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# Criteria 3

## Research, Innovations and Extension

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|---|---|
| **Metric 3.4.5** | Number of research papers per teacher in the Journals notified on UGC website during the last five years |
| 3.4.5.1 | Number of research papers in the Journals notified on UGC website during the last five years |

# Supporting Documents

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|---|---|
| 1 | List of research papers by title, author, department, name and year of publication **(Year : 2018)** |

# Faculty of Technology & Engineering

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# Experimental investigation of heat transfer potential of $Al_2O_3$/Water-Mono Ethylene Glycol nanofluids as a car radiator coolant

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ABSTRACT

In this research, the heat transfer potential of $Al_2O_3$/Water-Mono Ethylene Glycol nanofluids is investigated experimentally as a coolant for car radiators. The base fluid was the mixture of water and mono ethylene glycol with 50:50 proportions by volume. The stable nanofluids obtained by ultra-sonication are used in all experiments. In this study nanoparticle volume fraction, coolant flow rate, inlet temperature used in the ranges of 0.2–0.8%, 4–9 l per minute and 65–85 °C. The results show that the heat transfer performance of radiator is enhanced by using nanofluids compared to conventional coolant. Nanofluid with lowest 0.2% volume fraction 30% rise in heat transfer is observed. Also the estimation of reduction in frontal area of radiator if base fluid is replaced by Nanofluid is done which will make lighter cooling system, produce less drag and save the fuel cost.

## 1. Introduction

Day today the people's needs own automotive vehicle to make their work faster and simpler. So by seeing the increasing demand of vehicle, automotive industries continuously doing development for making high efficient and economical engines which consumes less fuel to attract the customers. There are various ways to increase the efficiency of engine like by using optimized design of engine which reduce the weight of automotive and efficient engine cooling system which will increase the performance of vehicle. Use of optimized designed fins and micro size tube is most conventional way to increase the performance of radiator is now reached to its limit. Another way of enhance the cooling effect is use of efficient coolant in the vehicle radiator. As conventional coolant is the mixture of water and ethylene glycol as anti-freeze agent to increase the boiling point and reduce the freezing point of water. By adding the anti-freeze in water make it possible to use water for wide range of temperature but for that we have to compromise the heat transfer performance of the radiator as the heat capacity of mixture is less that of water.

Solid particles having size less than 100 nm has different thermal properties than the conventional solid particles. As nanometer size particles has large surface area as compare to micro size powder which enhance heat transfer rate. Choi [1] proposed the concept of adding the nanometer sized solid particles in conventional heat transfer fluid and by preparing stable fluid can enhance the heat transfer characteristics which he named as Nanofluids at Argonne National Laboratory of USA. Enhancement in thermal properties is depends on the method of preparation, particle size, type of particle etc. Now a days researchers also starts investigating the potential in hybrid Nanofluid to get more benefit in heat transfer rate. Che Sidik [2,3] has discussed the challenges to preparation of stable hybrid Nanofluid and enhancement in the thermal properties. Subhedar and Ramani [4] also observed that thermal conductivity of

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# Design and Analysis of Solar Vapour Absorption Refrigeration System for 1 TR Capacity

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## ABSTRACT:

This paper presents the design of vapor absorption refrigerating system of capacity 1 tonne based on the basic concepts of thermodynamic principles. In design the area of all the major components of the system is calculated on the basis of enthalpy parameters at different points in the system. The data is analyzed using the first and second laws of thermodynamics to determine the refrigerating effect, the net heat required to run the system and the coefficient of performance (COP). Refrigerant used in the system is Ammonia (R717) and water is used as Absorbent. Solar energy is utilized as heat input in absorber.

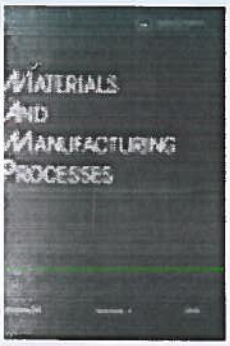
**KEYWORDS** Absorption, absorber, R717 (Ammonia), Coefficient of Performance.

## INTRODUCTION

VARS belong to the class of vapour cycles similar to vapour compression refrigeration systems. However, unlike vapour compression refrigeration systems, the required input to absorption systems is in the form of heat. Hence these systems are also called as heat operated or thermal energy driven systems.

This cycle is operated with help of heat supply from generator by thermal energy collected from the sun without e need to convert this energy into mechanical and for circulation of refrigerant and absorber solution a pump is needed which can be operated from battery or engine shaft and it requires much less work than compression work in vapor compression cycle so this cycle can be used.

Hourz et al.[1] performed a thermodynamic analyses for different working fluid pairs. A computer simulation model has been developed to predict the performance of solar absorption refrigeration system using different working fluid. Detailed thermodynamic properties for ammonia- water, ammonia-lithium nitrate and ammonia-sodium thiocyanate are expressed in polynomial equations and used in cycle simulation. The performances of these three cycles against various generator, evaporator, and condenser temperatures are compared. The results show that the ammonia-lithium nitrate and ammonia-sodium thiocyanate cycles give better performance than the ammonia-water cycle.



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# Investigations on drilling of hemp/glass hybrid composites

Kundan Patel, Piyush P. Gohil & Vijaykumar Chaudhary

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# Study the Effect of Nitrogen Flow Rate on Tribological Properties of Tantalum Nitride Based Coatings

Dharmesh B. Chauhan [1,a)], Kamlesh V. Chauhan[1,b)], Akshay L. Sonera [1,], Nishant S. Makwana[1,], Divyeshkumar P. Dave[2,], Sushant K. Rawal[3,c)]

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**Abstract.** Tantalum Nitride (TaN) based coatings are well-known for their high temperature stability and chemical inertness. We have studied the effect of nitrogen flow rate variation on the structural and tribological properties of TaN based coating deposited by RF magnetron sputtering process. The nitrogen flow rate was varied from 5 to 30 sccm. X-ray diffractometer (XRD) and Atomic Force Microscopy (AFM) were used to determine structure and surface topography of coating. Pin on disc tribometer was used to determine tribological properties of coating. TaN coated brass and mild steel substrates shows higher wear resistance compared to uncoated substrates of brass and mild steel.

**Keywords:** Tantalum Nitride; Sputtering; $N_2$ flow rate variation; XRD; AFM; Tribology.

## INTRODUCTION

Tantalum and tantalum nitride thin films are well-known for their extreme temperature stability and chemical inertness. They are used as diffusion barriers and adhesion promoters within the microelectronics industry. TaN thin film have additionally become technologically necessary as wear resistant coatings, and functionalized optical coatings [1]. Tantalum nitride thin films have promising properties such as good resistance to wear and oxidative corrosion, super hardness, high melting point, high strength and toughness even at elevated temperature, high thermal stability and superior thermal conductivity [2, 3]. The main objective of present work is to synthesize tantalum nitride based coating on glass, silicon, brass and mild steel pins substrates by using RF magnetron sputtering process. A metallic target of tantalum is used and TaN coatings were deposited by introducing nitrogen ($N_2$) as a reactive gas along with argon (Ar) and argon is used as an inert gas in the vacuum chamber for creating plasma in it. The effect of nitrogen flow rate variation on the structural and tribological properties of TaN based coating was investigated.

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# Tribological Characterization of TiN Coatings prepared by Magnetron Sputtering

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**Abstract.** Titanium nitride (TiN) coating deposited on aluminium and brass pin substrates using RF reactive magnetron sputtering. The structural properties and surface morphology were characterized by X-ray diffraction (XRD), atomic force microscope (AFM) and field emission scanning electron microscope (FE-SEM). There was formation of (101) $Ti_2N$, (110) $TiN_2$ and (102) $TiN_{0.30}$ peaks at 3.5Pa, 2Pa and 1.25Pa sputtering pressure respectively. The tribological properties of coating were inspected using pin on disc tribometer equipment. It was observed that TiN coated aluminium and brass pins demonstrated improved wear resistance than uncoated aluminium and brass pins.

**KEY WORDS:** Titanium Nitride; RF Magnetron Sputtering; Tribology.

## INTRODUCTION

Titanium Nitride (TiN) coating is one of the most known and studied transition metal mononitrides [1].It becomes an important film material in engineering application [2]. TiN coatings precipitated by physical vapour deposition on cutting tools and other material surfaces liable for wear help expanding life and range of the operating situation [3]. The coating has high melting point, utmost hardness and brittleness, desirable thermal and chemical durability, corrosion resistance, low electrical resistivity, good wear resistance, low COF and golden colour [4-10]. TiN coatings have found in large-scale applications in the last three decades [11]. Due to the above properties TiN coatings have wide range of applications in cutting tools, MEMS, solar reflectors [12], artificial jewellery [13], diffusion barrier, semiconductor [1], protective coating and decorative coating on watch cases and eyeglass flames [8]. Titanium nitride basically used in hard wear protective coating which has magnificent combination of satisfactory performance at room temperature and improved appearance [14]. It also treated as electrical interconnects and surface layer in orthopedic prostheses, cardiac valves and other biomedical devices due to the inherent biocompatibility and homocompatability [10, 15]. At the point when a sputtering procedure is utilized for generating TiN films, the film properties were broadly moved by changing in the sputtering conditions, for example, reactive gas flow rate, sputtering pressure, time of deposition, substrate temperature and so on. In this manner, it is essential to think about the results of the deposition parameters on the thin films. [16]. Based on the literature reviews it was observed that the majority of the studies are done on investigating mechanical and electrical

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# Effect of sputtering pressure on molybdenum oxide thin films prepared by Rf magnetron sputtering

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**Abstract.** The aim of this paper is to investigate the effect of sputtering pressure variation on Molybdenum oxide thin films were deposited by RF reactive magnetron sputtering. The effect of sputtering pressure on structural and wettability properties of molybdenum oxide films was studied. The decrease of sputtering pressure from 4.5Pa to 1.5Pa which led to evolution of (540), (001) and (015) textures of molybdenum oxide. The XRD results show increment of preferred orientation along with (001) plane for deposited molybdenum oxide films. The average crystallite size is within range 10.09nm-27.39nm with decrease of sputtering pressure from 4.5Pa to 1.5Pa.The static contact angle formed by water and surface energy varies as a function of sputtering pressure. The surface roughness increases from 16.886 to 30.16 nm with decrease in sputtering pressure from 4.5Pa to 1.5Pa.

**Keywords:** Molybdenum oxide; Sputtering; Pressure variation; XRD; AFM;Wettability.

## INTRODUCTION

Molybdenum oxide has become an attractive coating material due to its good mechanical, electrical and optical properties.Molybdenum has good lubricating and corrosion resisting properties. Its oxides are well known from catalysis field investigation for oxidation reactions for alcohol and hydrocarbons. The $MoO_3$ is n type semiconductor. Molybdenum oxide used in various applications like lithium batteries, diffusion barriers, in ultraviolet photographs, in gas sensor application and also used as contact material for high efficiency solar cells [1-4].

The Molybdenum films having thickness of 2–3μm are used for nuclear energy applications. This thin films were also used in missile and aircraft components [5]. Molybdenum has better lubricating and corrosion resistance properties [6]. $MoO_x$has wide selection of applications.The main purpose of this experimental study is to deposit the thin films by utilizing molybdenum target.The film deposition process carried out in RF magnetron sputtering. The argon gas utilized as idle gas while oxygen gas utilized as reactive gas that may prompt development of individual molybdenum oxide thin films. In this experimental investigation the effect of sputtering pressure variation on structural and wettability properties of deposited molybdenum oxide thin films is researched.

## EXPERIMENTAL DETAILS

To prepare molybdenum oxide thin films a custom designed cylindrical chamber (made by Excel Instruments, India) in radio frequency (RF) magnetron sputtering was used. A molybdenum (99.99% purity) target with dimensions

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# Tribological and Physical Characterization of Citrus-Limetta Peel Reinforced Polyester Composites

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**Abstract**

Objective: To examine tribological properties of citrus-limetta peel reinforced polyester composites (CLPRPC) by varying weight fraction of citrus-limetta peel and testing parameters. Physical behavior is also studied for CLPRPC. Method/Analysis: CLPRPC was fabricated by varying weight fraction of peel in the range of 20%, 30% and 35 %. The testing was carried out using a pin-on-disc machine by changing the parameters as sliding distances, sliding speeds and applied load to study wear and friction behavior and also the empirical model is proposed for CLPRPC. The physical property is examined through the SEM (Scanning Electron Microscope). Findings: Citrus-limetta peel particles added to polymer composite for improving wear and friction properties. Tribological properties of CLPRPC seems batter than basic matrix composite. Analysis of variance (ANOVA) is performed on CLPRPC to know the effect of parameters on response. From ANOVA of CLPRPC disclosed that at 20 %, 30% and 35% weight fraction of CLPRPC, the highest influencing parameter for coefficient of friction is load, speed and load respectively, for wear is speed, sliding distance and sliding distance respectively. The regression equations also suggested to find wear and co-efficient of friction of CLPRPC and the worn-out surfaces are examined by Scanning Electron Microscopic (SEM).

**Keywords:** Citrus-limetta peel/polyester Composites, Wear & Friction, Pin on disc (POD), Mathematical Modeling, Taguchi approach, SEM (Scanning Electron Microscope).

## INTRODUCTION

The acceptance and expansion in natural awareness toward the usage of unsustainable materials, encouraged thinking for the utilization of ecofriendly materials. Natural fibers are the ecofriendly materials which have great properties compared to synthetic fibers [1].The research carried out on industry show the fact that the industry sector concern with natural fiber reinforced polymer composites reached U$2.1 billion worldwide in 2010. Current scenario show that interest in natural fiber reinforced composites (NFPCs) industry around the world will grow quickly. An evaluation says that in last five years (2011–2016), the NFPCs industry is estimated to grow 10% worldwide [2].

Natural fibers in simple definition are fibers extract from plants or animals that are not synthetic or manmade [3]. The use of natural fiber such as jute, sisal, flax and oil palm for the production of composite materials, gets importance in the last decades, so far. The plants, which produce cellulose fibers can be classified into seed fibers (coir, kapok and cotton), bast fibers (hemp, kenaf, jute, flax and ranie), grass and reed fibers (corn, rice and wheat), core fibers (hemp, jute and kenaf), leaf fibers (pineapple, abaca and sisal) and all other kinds (wood and roots) [4]. The most widely recognized natural fibers in the world and world production have been shown in Table 1.

**Table 1.** Natural fibers in the world and their world production [4-5]

| Fiber source | World production ($10^3$ tons) | Region |
|---|---|---|
| Cotton | 18450 | E, W |
| Jute | 2300 | W |
| Kenaf | 970 | E, W |
| Flax | 830 | UK, E, W |
| Sisal | 378 | W |
| Hemp | 214 | UK, E, W |
| Coir | 100 | W |
| Ramie | 100 | W |
| Abaca | 70 | W |
| Bamboo | 10 | W |

UK = United Kingdom, W= Rest of the World, E = Europe.

Application wise the use of NFPCs increases because of the superior advantages over synthetic fibers in terms of its biodegradability, processing flexibility, relatively low cost, low weight good relative mechanical properties, improved surface finish of molded parts composite [6].Adding of natural fiber into polymer (thermoplastic and thermoset) improve high specific stiffness and strength of NFPC [7].

On The other hand, the use of natural fibers as reinforce material is not easy because of having notable deficits in properties. The natural fibers permits moisture absorption

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# Study of Effect of Process Parameters of Welding during TIG welding of AA 7075 and its optimization

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**Abstract**

Aluminium has very unique properties of light weight and corrosion resistance and due to this it becomes very interesting metal in the field of engineering. Mainly this paper deals with effect and optimization of certain range of values of process parameters during TIG welding of aluminium alloy 7075.

In the first cycle of experiment the effect of values (in wide range) of gas flow rate and welding current during TIG welding of Aluminium alloy 7075 has been found out on its mechanical properties such as ultimate tensile strength and hardness. Visual inspection and dye penetrate test also has been performed for every sample of welding.

From the results for ultimate tensile strength obtained in first cycle of experiment, a try has been made to optimize process parameters in second cycle of experiment by narrowing the range of values of gas flow rate and welding current. Finally the near optimal values of gas flow rate and welding current has been found to get maximum UTS.

**Keywords:** TIG welding, gas flow rate, welding current, AA 7075, optimization of process parameters.

## INTRODUCTION

Aluminium and its alloy offer a wide range of capability and applicability, with a unique combination of advantages that make it the material of choice for numerous products and markets.

**Ahmed Khalid Hussain et al., [1]** have done TIG welding on AA6351 with Dimensions of the sheet as (4*50*200) $mm^3$. The Filler used is ER 6063. Experiments are conducted on specimens of single v butt joint having different bevel angle and bevel height. The Process Parameters are welding speed, bevel angle, bevel height. The depth of penetration of weld bead decreases with increase in bevel height of V butt joint. Tensile strength is higher with lower weld speed. This indicates that lower range of weld speed is suitable for achieving maximum tensile strength. Bevel angle of the weld joint has profound effect on the tensile strength of weldments. Bevel angles between 300- 450 are suitable for maximum strength. The heat affected zone, strength increased with decreasing heat input rate.

**A. Raveendra et al. [2],** have carried out TIG welding for AA5052.The Dimensions of sheet are (100*50*2.5) $mm^3$. The filler used is ER 4053.The parameters are arc voltage, welding current, speed of welding, gas flow rate, heat input and depth of penetration. Increasing the speed of travel and maintaining constant arc voltage and current increases penetration until an optimum speed is reached at which penetration is maximum. Increasing gas flow rate, the depth of penetration increases until an optimum value which gives maximum depth of penetration. Depth of Penetration increases linearly by increasing welding speed. It can be concluded that as the welding speed increases at constant current and voltage, the depth of penetration will increase until an optimum value which shows maximum penetration. The depth of penetration will decrease when welding speed increases beyond the optimum value.

**B. Ravindar et al. [3],** have done TIG welding on AA5083 with the dimensions of sheet as (100*100*4) $mm^3$. The Filler used is ER5356.The parameters are welding current, gas flow rate and different filler diameters. The effect of welding process parameters is analyzed by conducting of micro hardness, and Impact tests on weld joint. Micro hardness value of the welded zone was measured for all the welded specimens at the cross section to understand the change in mechanical property of the welded zone. In this paper the effect of micro hardness and Vickers hardness test with changes of welding current, gas flow rate and filler rod diameters by using pulsed tungsten inert gas welding technique is investigated. The welding current weaves periodically between a high (pulse current) and low (basic current) values. In the basic current phase, the low temperature causes a decrease in the volume of the molten pool. Hardness value of the weld zone changes with the distance from weld centre due to change of microstructure. At low welding current vickers hardness value is very low due to lack of fusion. With increase in current hardness values are almost near to the base values.

**J. Tusek, and D. Klobcar [4],** have done TIG welding of AA 7075-T6 in the butt joint with single-V edge preparation with Dimensions of (100*75*20) $mm^3$ and Filler wire AA 5183. The Parameters are Preheating temperature, microstructure, tensile test. At welding at low temperature, the hot crack was deeper than at welding at high temperature. The area of the material which breaks during the tensile test indicates the tensile strength of the samples was low due big area of hot crack. The optimal preheating and interpose temperature is 200 degree Celsius. The work piece should be cooled during

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# Experimental Investigations on Flexural Properties of Longitudinally and Transversely Placed Fiber Reinforced Polymeric Composites

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**Abstract**

In present study, an experimental investigation is carried out to evaluate flexural properties of longitudinally and transversely placed fiber reinforced polymeric composites. For this purpose, fabrication of composites is carried out by using mould and punch setup and following hand layup technique. Natural fiber yarn: bamboo fiber yarn, jute fiber yarn & flax fiber yarn and synthetic fiber yarn: kevlar fiber yarn, carbon fiber yarn & glass fiber yarn are selected as a reinforcement. Polyester resin is selected as a matrix. The flexural testing of composites is carried out on the universal testing machine as per ASTM D790-10 and evaluates the flexural properties of composites. The paper signifies the outcome as, flexural strength and flexural modulus are dependent on weight fraction of fiber and increases with increase in weight fraction of fiber in longitudinally placed fiber reinforced composites; flexural strength and flexural modulus are dependent on the interphase and its adhesion phenomenon in transversely placed fiber reinforced composites; flexural strength and flexural modulus are higher in longitudinally placed reinforced composites compared to transversely placed reinforced composites.

**Keywords:** Natural Fiber Composites, Synthetic Fiber Composites, Fabrication of Composites, Flexural Testing, Flexural Strength, Flexural Modulus.

## INTRODUCTION

The composite material is fetching an inherent part of in the field of engineering materials because of their advantages as shown in fig.1. Due to this advantages of composites over a conventional material, composites rises the interest of the researchers all over the world. (Kaw, 2006). Here in present study, the composite material is selected as a part of study due to its several advantages and wide usage in today's world.

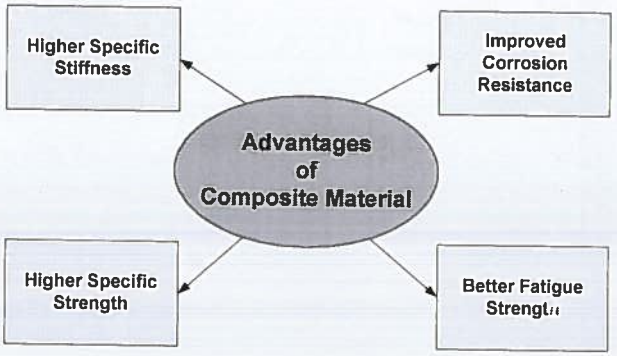


**Figure 1.** Advantages of composite material over a conventional material

Bax and Mussig (2008); Bledzki and Jaszkiewicz (2010); Coroller et al. (2013); Hojo et al. (2014); Lebrun et al. (2013); Okubo et al. (2004) studied only tensile properties of composites. Biswas et al. (2015); Chokshi et al. (2017); Couture et al. (2016); Khan (2016); Kumar and Boopathy (2014); Liu et al. (2014); Mishra and Biswas (2013); Porras et al. (2010); Saba et al. (2015); Yan et al. (2014); Zhi et al. (2001) studied the tensile and flexural properties of composites. Many of the researchers focused on tensile and flexural properties investigation of unidirectional and bidirectional composites. A very few researchers concentrated on the investigation on properties of composites by varying the fiber direction in longitudinal and transverse conditions. Gohil and Saikh (2010a) endeavored an effort in this direction and investigated the tensile properties of longitudinally placed reinforced cotton/polyester composites and evaluated that the tensile properties: tensile strength and elastic modulus increase with increase in volume fraction of fiber. Gohil and Saikh (2010b) also developed the model to evaluate the elastic modulus of transversally placed unidirectional fiber reinforced composites. Hence, this work is focused on investigation of flexural properties by varying the fiber direction and placing a longitudinal and transverse arrangement of fiber yarn in polymeric composites. Flexural properties are selected as a study due to it is widely usage in the application of automobiles, aircraft etc. For the accurate forecast of flexural properties, the natural fiber yarn and synthetic fiber yarn, both are taken as a part of the study. Flexural properties like

# Metal Matrix Composites Fabrication Difficulties and Remedies - Research and Review

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***Abstract*—** while fabricating a Metal Matrix Composite (MMC), there are several difficulties encountered which should be overcome to make a successful product as outcome. To achieve desired properties of MMC composites, fabrication process should be errorless and proper. This paper includes the difficulties encountered during the fabrication process of MMCs and remedies found by the researches.

***Keywords*—** Wettability, bonding, coupling agent, stir casting, compo casting

## I. INTRODUCTION

A composite is a material that consists of two or more chemically different constituents that are combined at a macroscopic level and are not soluble in each other to yield a useful material and properties. One constituent is called the reinforcing element and the one in which it is embedded is called the matrix material. The reinforcing element material may be in the form of fibres, particles or flakes. The matrix materials are generally continuous. Examples of composite systems include concrete reinforced with steel, epoxy reinforced with graphite fibres, epoxy reinforced with cotton fibres, aluminium reinforced with silicon carbide particles, etc.

Metal matrix composites (MMC) are essential part of todays engineered materials world. To make a successful composite of metal matrix, few difficulties while fabricating it should be overcome to achieve the desired outcome and properties. This paper includes some experimental work to show the general difficulties encountered while fabricating a MMC and remedies found by some researchers.

## II. WETTING AND BONDING

### A. *Wettability*

Wettability means interaction between fluid and solid phases. Wettability is defined by the contact angle of the fluid with the solid phase as shown in figure 1.

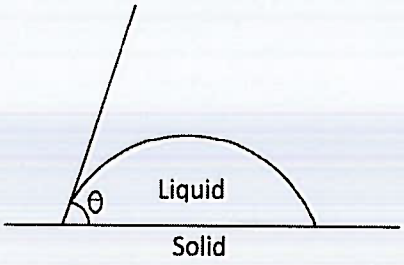


Fig. 1 Contact angle of the fluid with the solid phase

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# A Review on - Materials For Additive Manufacturing

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**Abstract: In today's modern technology, additive manufacturing has advanced over the year that usually known as 3D printing. Currently, additive manufacturing applied in various industries such as in particular aerospace, medical, transportation, energy and other consumer products. The most common additive manufacturing technologies such as fused deposition modelling (FDM), poly-jet, inkjet printing, selective laser sintering (SLS), and electron beam melting (EBM) used to fulfil manufacturing industries requirement. In addition, it is important and efficient to look at the materials for the manufacturing process to produce high quality and durable products. The most commonly materials, polymers, metals, ceramics and composites used for additive manufacturing, and mostly available in the form of wire feedstock, powder and liquid. In circumstance, it is essential to have better understanding of available materials, which can be suitable for AM applications; the current review gives the broad ideas on the novel materials with present and future material can be applicable in 3D printing technologies. Emerging pathway of materials from large sizes to Nano sizes in the various forms including larger productivities and high quality performance, with maintaining mechanical performance and geometrical flexibilities scale up the additive manufacturing. The main focus of this article to introduce newly upcoming materials such as graphene, graphite, carbon fiber, and glass, concrete, bioactive drugs, cells, and proteins even food can utilized in 3D printing technologies.**

*Keywords: 3-D printing, Additive Manufacturing, Novel Materials, Metals, Ceramics, Polymer, Bio ink, Food materials.*

## I. INTRODUCTION

Additive manufacturing (AM), also known as direct digital manufacturing (DDM) is the collaborative transformation of manufacturing through the exploitation of advances in ICT [1]. The ability to design a part and manufacture it anywhere in the world using 3D printing techniques interpreted as the realization of that has the full potential to revolutionize manufacturing technology [2].The focus of this review to use of high tech-smart-novel materials in manufacturing, In addition plastics, ceramics, metals, and composites most common materials used for manufacturing. Todays need that, it is very critical to select appropriate materials for additive manufacturing (AM) [3]. A better understanding of process parameters and materials behavior facilitates the design of new materials that can meet future requirements [4]. Materials necessities for AM contain the capability to produce the raw material in a form responsive to the specific AM process, appropriate processing of the material by AM, ability to be adequately post-processed to enrich geometry and properties, and appearance of essential performance characteristics in service. As AM has matured, specific classes of material have become related with specific AM practices and applications. Microstructural features affecting AM part properties listed. Service properties of AM parts termed, containing physical, mechanical, optical, thermal and electrical properties [5]. The metal-based materials as 3D printing of metals is mostly challenging due to a build of microstructural alterations that marks, specifically when the metals and alloys are bare to high temperatures. Researchers for diverse types of metals are still discovering mechanism for the dimensional precision and end properties and alloys as the outcomes of some compositional structure cannot shifted to a different compositional structure [6].3D Printing materials for food: Ice cream, magic candy, pasta, molecules for medicine, even human cells. The categories of materials are used in 3D printing matures longer and a lot better exciting by the current scenario. In addition, expanding it is a multibillion-dollar material battle nowadays. As per the recently released 3D-printing market survey, forecasting the technological expansion will drive the 3D-printing market value from its 2017 level of $6.98 billion to $12 billion by the end of 2018. That means a huge requirement of the materials for those machines use. Even that the plastic still most favorable in the 3D-printing materials world. Rendering to a SmarTech Markets report, 3D printing projected to generate $1.4 billion in plastics sales by 2019. This is not just "ordinary" plastic. The industries extensively experimenting with new, novel methods, such as bio-based resins made from corn and soybean oil [7].

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# INVESTIGATION ON HEAT TRANSFER COEFFICIENT AT METAL-SAND MOULD INTERFACE IN SAND CASTING PROCESS - A REVIEW

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***Abstract – To simulate the casting process and estimate casing defects, interface heat transfer coefficient is a necessary step towards it. For accurate simulation of any casting process the interfacial heat transfer coefficient (IHTC) or heat flux is required. IHTC value or Heat Flux value is vary essential which indicates the heat transfer at casting and mold surface interface. In any casting process, there are large number of factors which affects heat transfer and decreases quantification by theoretical means a challenge. Similarly, Experimental methods applied directly to temperature data collected from castings are also a challenge to interpret because of transient nature of many casting processes. Many researchers have applied inverse methods to estimate interfacial heat transfer coefficient at metal-mold interface in sand casting process.***

***Keywords- Metal-Sand Mould Interface, Sand Casting, Heat Transfer Coefficient (HTC), Heat Flux.***

## I. INTRODUCTION

The success of simulation-based process design of castings to predict accurately the thermal history and to locate hot spots inside the casting depends to a large extent on a reliable data base on the heat transfer boundary conditions specified at the casting/mould interface. Further, when the metal and the mould have good rates of conductance, the boundary between the two becomes the region of dominant resistance. When the molten metal is poured into a mould, the rate at which it can lose heat is controlled to a significant extent by the heat transfer at metal/mould interface. During the last two decades the use of solidification simulation software for both design of casting processes and their optimization from quality stand point has greatly increased with improvements in the computational technology. It is then essential to determine the Heat Transfer Coefficient (HTC) on metal-sand mould boundaries exactly. The computer simulation of solidification of castings offers a basis for predicting the solidification patterns and casting defects with accuracy.

During the filling process of an alloy, an interface layer between melt and mold unavoidably forms as different thermal response to temperature variation and coating effect. Meanwhile, the heat transfer of interface layer has an important influence on the solidification process. Hence, it is important to investigate the heat transfer of the interface layer, which leads to a problem of calculation of interfacial heat transfer coefficient (IHTC) between the metal/mold interfaces. Many researchers have contributed to the understanding of heat transfer at metal-mold interface, which can be characterized either by interfacial heat flux ($q$) or interfacial heat transfer coefficient ($h$). Modelling of the casting/mould interfacial heat transfer is one of the critical problems in numerical simulation of casting solidification as it is influenced by casting parameters like the type of alloy, super heat, latent heat of fusion and mould variables that include the roughness of the mould surface in contact with the solidifying alloy, thermophysical properties of the mould, preheat temperature etc.

## II. LITERATURE REVIEW

Since past few decades' solidification simulation, particularly interfacial Heat Transfer Coefficient have been a foremost topic of research. Here, a review has been carried out on the history of solidification simulation for metal-mould interface, importance of IHTC in solidification simulation, methods available for the determination of IHTC and influencing parameters on IHTC. The present review includes solidification simulation, various aspects in solidification modelling, estimation of IHTC at metal/mould interface by inverse method and effect various parameters on heat transfer coefficient and heat flux.

A. ZHANG [1], et.al. have determined the interfacial heat transfer coefficient (IHTC) at the metal-sand mould interface by applying a nonlinear inverse estimation method during the low-pressure sand casting (LPSC) process. Experiments were conducted using plate shape castings with different thicknesses for both ZL205A and ZL114A aluminum alloys. To estimate interfacial heat transfer coefficient, a specific temperature sensor unit was developed to measure accurate temperature at predefined location inside the sand mould and cast metal. From their investigation they revealed that the time-dependent

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PAPER

# Predicting the thermal sensitivity of MR damper performance based on thermo-rheological properties

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Keywords: magnetorheological fluid, thermo-sensitivity, MR-damper, MR-effect

## Abstract

One factor which needs to be addressed in magnetorheological (MR) fluid device is operational stability under a given environmental condition and/or localized viscous heating within a device. So, one need to study thermal effects on MR fluids and its influence on performance of MR fluid devices. The aim the present paper is to predict the thermal stability of MR fluid device performance, based on the thermo-rheological properties. The MR fluid is synthesized using flake shape iron particles and its rheological study is carried out in the absence and presence of field using a magneto—rheometer. The thermo-rheology was studied and sensitivity was derived. This fluid is tested for its damper performance in the designed and fabricated flow mode damper. The thermo-sensitivity of the damper is studied and compared with rheological properties. It is suggested that one can predict the damper temperature dependent performance based on the thermo-rheological results.

## 1. Introduction

Magnetorheological fluids (MR fluid) are non-colloidal suspension of magnetizable particles having tunable and reversible magnetic and rheological properties under the influence of magnetic field [1–6]. MR fluid has become a prime component for use in controllable structure and system. Over the past few years, MR fluid based technologies have grown extensively in automobile industries [7–15]. In addition, use of MR fluid devices and actuators in many other applications like; prosthetic knee, advance polishing applications, bearing and oil, gas exploration, recoil and productivity [16–23] have grown extensively. In all these applications, properties of MR fluid related to yield strength and settling stability are very important [24–26], but other factors such as 'off-state viscosity' and durability are equally important. These demand syntheses of MR fluids so as to meet specific application demands. One element which asks to be addressed in MR fluid device is operational stability under a given environmental condition and/or localized viscous heating within a device. So, one need to study thermal effects on MR fluids and its influence on performance in MR fluid devices. This is the primary motivation for the present study on predicting the thermal stability of MR fluid device performance incorporating magneto-rheological properties.

The major components in MR fluid are carrier liquid, which takes around 60 to 80% of total volume, micron-sized magnetic iron particles (having loading from 20 to 40% by volume) and few additives to keep MR fluid stable and re-dispersible. Properties which are thermal dependent are density, viscosity and magnetization of iron particles. The change in properties eventually influences the damper performance. The applied magnetic field generates interparticle interactions and leads to formation of chain like columnar structure in MR fluid. This field induced structure introduces anisotropic magnetic and rheological properties. Previous experimental studies on MR fluid have reported reduction in yield stress with increasing temperature [27–32]. This reduction is greater than variation in the individual physical properties of the constituents, indicating synergistic effect. This decrease in yield stress is imparted as an average normalized sensitivity by the following relation

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# Process Identification for Dismantling of Commercial Lens Assembly and Feasibility Study towards Earth Observation

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**Abstract**

Earth imaging is the unique feature of any satellite mission for technological advancements. This covers variety of applications like agriculture, forestry, fishering, weather forecasting and many more. For any Earth observation satellite mission, optics is playing very important role as it behaves transmissive media for focusing or dispersion of light beam by means of refraction characteristics for capturing high quality information through converting them into pixel frame. In current modernization scenario, commercial optics having enough characteristics and capabilities to suit run time applications which enables to use them in the direction of earth observation system. This feature of commercially of the shelf (COTS) optics leads to minimize the lead time, for predominantly during material selection, optics design, fabrication and testing required to suit space qualification. The main objective of this article is to identify step by step procedure for dismantling of COTS optics followed by accurate inter separation measurement and feasibility study to be utilized for space application. As a result of the identified procedure, various quantitative and qualitative information can be extracted such as pre performance test, geometrical features, dimensional features, weight measurement of each optical element, which provides foundation towards development of barrel housing consisting of all optical elements.

**Keywords:** Refraction, Dismantling, Lens elements, COTS

## INTRODUCTION

The quality of the image from camera essentially depends on the imaging optics, detector and associated electronics. The preliminary function of imaging optics is to transfer the radiance from the object space to image plane which means ability to maintain the shape, orientation, relative dimension, and relative radiance values as in the object space. The selection of a specific imaging optics for a satellite mission primarily depends on (1) the spectral range to be covered, (2) total field of view (FOV), and (3) aperture size [1].

Optical system to be used in the earth observatory design, should have capacity to withstand wide range of environmental loads encountered fabrication, launch, and during functioning in space. These include mechanical and thermal stresses, and the radiation environment. Therefore, it is required to pay utmost attention to opto-mechanical design to ensure that the shape and position of the optical elements of the system are unaffected under these loads, so that the system performance requirements are satisfied [1-5].

In order to achieve the requirements of realizing of the camera within a short span of time and achieving miniaturization in terms of size and weight to the extent possible, it is advisable to use readily available off the shelf optics with the consideration that these optical elements would be used in earth observation. This gives an adequate opportunity for miniaturization of this lens assembly through dismantling of its lens elements from the present housing and a subsequent reassembly into a newly designed miniaturized housing for achieving the initial performance.

This article provides the complete top down approach stating optical performance measurement, dismantling of the lenses from the lens housing and the subsequent cleaning procedures.

## Commercial Optics Description

Figure 1 depicts optical layout of the COTS lens assembly. As per the datasheet specifications, the lens assembly includes six spherical lens elements (L1 to L6) with built in rear glass plate for dust protection. The lens assembly has a focal length of 105 mm and a large maximum aperture at f/2 shooting in dim light with adjustable f-numbers at f/2.8, f/4.0, f/5.6, f/8.0, f/11 and f/16. The minimum focusing distance is 0.9 m and ranges up to infinity.

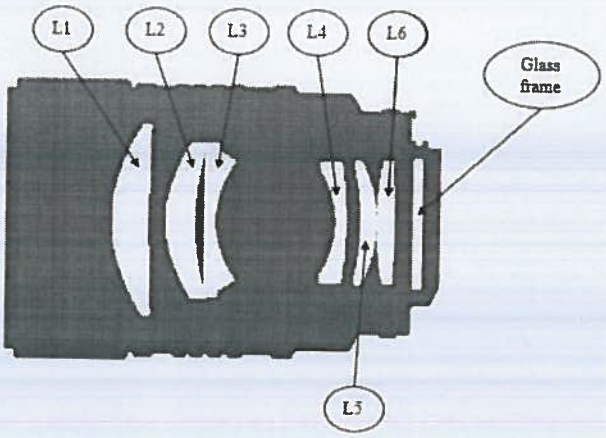


**Figure 1:** COTS Lens Assembly Layout [6].

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# INVESTIGATIONS ON DRILLING OF UNIDIRECTIONAL HEMP-POLYESTER COMPOSITES

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## ABSTRACT

*The natural fiber reinforced composites are emerging as a potential replacement to synthetic fiber composite for lowering down the cost of applications and they are used in interior of automobile, chassis of cellular phone, building construction, etc. Drilling operation is the most important machining process for assembly of different components. Delamination phenomenon occurs during drilling operation on composites which lay-down the structural reliability of component. The present work focused to carry out experimental studies of thrust force and delamination on drilling of unidirectional hemp fiber reinforced composite. The drilling was carried out by varying tool geometry (end mill, Centre drill, parabolic drill), feed rate (0.07, 0.17, 0.27 mm/rev) and spindle speed (800, 2800, 4800 rpm). Digital image analysis was used to determine the delamination factor. ANOVA has been used to determine the contribution of factors. Multivariable regression analysis has been also used to determine empirical model between parameters.*

**Keywords**: Hemp, Drilling, Delamination, Thrust Force, Image Analysis, ANOVA, Regression

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# TRIBOLOGICAL CHARACTERISTIZATION OF CHOPPED CARBON/POLYSETER COMPOSITE MATERIAL

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## ABSTRACT

*In this paper, the study of wear and friction characteristics of chopped carbon fiber composites is carried out. In this study, chopped carbon is considered as a reinforcement and polyester resin is considered as a matrix. Compression molding technique is used for fabrication of the composites. Pin on disc machine is used for testing the composite material. Taguchi method is used for optimized and testing with different parameters like load, sliding distance, disc speed. This study signifies outcome as wear is minimum at 5% weight fraction of chopped carbon fiber and friction is minimum at 10% weight fraction of chopped carbon fiber.*

**Key words:** Chopped carbon fiber, Fabrication of composites, testing of composites, Wear, Friction.

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## 1. INTRODUCTION

Polymer composites are widely used as structural materials for automotive, aerospace, defense, marine and housing application in the past [1].The carbon nanotube composite showed significantly improved the mechanical and electrical properties with young modulus up to 20.4Gpa and tensile strength up to 231.5Mpa [2].The amount of sizing was affected by the friction force [3].The sliding direction gave more wear resistance and a lower coefficient of friction [4].The initial coefficient of friction was 0.65 and the peak coefficient is 0.74 slow wear of the matrix on the original surface and cracking of the fiber matrix [5].Sliding speed was

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# Testing and Evaluation of Linear Shear Mode Magnetorheological (MR) Damper Based on Rheological Properties of MR Fluid

**Reference**

Patel, D. M. and Upadhyay, R. V., "Testing and Evaluation of Linear Shear Mode Magnetorheological (MR) Damper Based on Rheological Properties of MR Fluid," *Journal of Testing and Evaluation* https://doi.org/10.1520/JTE20180030. ISSN 0090-3973

**ABSTRACT**

Magnetorheological (MR) fluid exhibits variable yield stress and viscosity with the magnetic field, which is why it is classified under smart materials. Because of its controllable properties, MR fluid has many applications. The most common application of MR fluid is MR fluid damper. According to the flow of MR fluid, three types of dampers are possible; flow mode, squeeze mode, and shear mode. In this article, rheological properties of MR fluid, which has a high Bingham number (ratio of MR force on-state to off-state), are synthesized and the MR properties are studied. Based on these properties, a linear shear mode MR damper is designed and evaluated for its performance. A unique model is adopted to evaluate the performance of MR damper. In this model, the dimensionless Mason number is applied to establish the relation between test data of damper and rheological properties of MR fluid. This is verified for two different volume fractions of magnetic particles in MR fluid.

**Keywords**

magnetorheological fluid, Mason number, damper

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## Introduction

The tunable rheological properties of magnetorheological (MR) fluids under a magnetic field has winded its potential applications in vibrational control devices and vehicle suspensions as MR damper [1–5]. The MR fluid—a suspension of magnetic particles dispersed in a carrier liquid—develops a field-controllable yield stress and apparent viscosity.

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# Comparative studies between Indian Standard codes IS 802 (Part 1/ Sec 1):2015 & IS 802 (Part 1/ Sec 1):1995 used for overhead transmission line towers

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**Transmission line towers are steel lattice structures and were generally analyzed and designed as per Indian Standards code IS 802 (Part 1):1995. A revised code IS 802 (Part 1/ Sec 1):2015 is introduced recently for transmission line towers with modified load combinations and material input provisions. So far no attempts have been made to compare the previous code with the revised code in terms of design, analysis efficiency and economy. The present study is aimed to compare the loading, axial forces, deflection and weight of the tower using the analysis and design procedure of previous and revised codes. Two transmission line towers of same geometry were analyzed and designed using STAAD. Pro V8i software using provisions of previous and revised codes. The conclusions drawn from the comparison shows that the axial forces at critical points as per IS 802 (Part 1/ Sec 1):2015 design is 25 to 40 %, 15 to 25% and 18 to 30% for 132kV, 400kV and 765 kV respectively less than design based on IS 802 (Part 1/ Sec 1): 1995. The difference in total weight of the tower material as per IS 802-2015 design is 6.24%, 5.92% and 5.72% for 132kV, 400kV and 765 kV respectively lesser in comparison to IS 802:1995 lesser in comparison to IS 802 (Part 1/ Sec 1): 1995 design.**

**KEYWORDS**: Transmission line tower; IS 802 (Part 1/ Sec 1):2015; IS 802 (Part 1/ Sec 1):1995; STAAD.Pro. V8i; axial forces; deflection; economy; efficiency.

The electrical power generated from thermal & nuclear power plants are distributed wide and far by a network of transmission lines. Transmission line towers major components which transmit the electrical energy are conductors and ground wire or optical ground wire (OPGW). Transmission line towers require more efficient and accurate method of analysis and design. For analysis, design, fabrication, testing and inspection of transmission line towers special code IS 802:1995 is used. As transmission line towers are light and tall structures, they are designed for maximum wind load as per IS 802 (Part 1/Sec 2):1992.

Rao (1995) studied method for nonlinear optimization and concluded that the weight of the tower is reduced due to optimization[6]. Trivedi (2011) observed that the vertical configuration of tower with quad bracing and material high tensile steel shows lowest weight as compared to simple bracing and material mild steel[7]. Raghavendra (2012) optimized the transmission line tower with respect to configuration and different materials as variable parameter. Results obtained by increasing the base width of the tower and by decreasing the bracing patterns below the waist of the tower[8]. Preeti and Mohan (2013) made an attempt to make the transmission line tower more cost effective by changing the geometry (shape) and behavior (type) of transmission line structure. The conclusions made that using triangular self-supporting tower saving in weight of the steel[9] is 9.23%. Ghugal and Salunkhe (2013) analyzed and designed transmission line tower using angle and tube sections and concluded that tower with tube section were efficient by saving in 20.6% weight in steel using tube section compared to angle section[10]. Punse (2014) analyzed and designed transmission line tower keeping in view to supply optimum utilization of electric supply with available Right of way and

Climate Dynamics
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# Future urban rainfall projections considering the impacts of climate change and urbanization with statistical–dynamical integrated approach

Hiteshri Shastri[1,2] · Subimal Ghosh[1,3] · Supantha Paul[1] · Hossein Shafizadeh-Moghadam[4] · Marco Helbich[5] · Subhankar Karmakar[1,6]

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## Abstract

Impacts of global warming and local scale urbanization on precipitation are evident from observations; hence both must be considered in future projections of urban precipitation. Dynamic regional models at a fine spatial resolution can capture the signature of urbanization on precipitation, however simulations for multiple decades are computationally expensive. In contrast, statistical regional models are computationally inexpensive but incapable of assessing the impacts of urbanization due to the stationary relationship between predictors and predictand. This paper aims to develop a unique modelling framework with a demonstration for Mumbai, India, where future urbanization is projected using a Markov Chain Cellular Automata approach, long term projections with climate change impacts are performed using statistical downscaling and urban impacts are simulated with a dynamic regional model for limited number of years covering different precipitation characteristics. The evaluation of the statistical downscaling methodology over historical time period reveals large underestimation of the extreme rainfall, which is improved effectively by applying another regression model, for extreme days. The limited runs of dynamic downscaling models with different stages of urbanization for Mumbai, India, reveal spatially non uniform changes in precipitation, occurring primarily at the higher quantiles. The statistical and dynamical outputs are further integrated using quantile transformation for precipitation projection in Mumbai during 2050s. The projections show dominant impacts of urbanization compared to those from large scale changing patterns. The uniqueness of this computationally efficient framework lies in an integration of global and local factors for precipitation projections through a conjugal statistical–dynamical approach.

**Keywords** Precipitation downscaling · Extreme precipitation · Urbanization · Mumbai · India

## 1 Introduction

Characteristics of precipitation at global, sub-continental, regional and at a local scale has been affected, is being affected and will be affected by both global factors such as climate change (Milly et al. 2005; Zhang et al. 2007; Trenberth 2011) and local factors such as changes in Land Use

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# Biodegradation of a Real Dye Wastewater Containing High Concentration of Total Dissolved Inorganic Salts (TDIS) in a Lab-Scale Activated Sludge Unit

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Biodegradation studies on Dye wastewater (DW) are normally conducted on simulated wastewaters or aqueous dyes solutions supported by growth medium, and often, an easy carbon source such as glucose. This rarely resembles actual DW which is characterized by the presence of complex organic compounds, and a high concentration of Total Dissolved Inorganic Salts (TDIS). Biodegradation of real Direct Dyes Wastewater (DDW), and a mixed-waste stream (MWS) consisting of equal volumes of Direct and Acid dyes wastewaters, was carried out using a lab-scale activated sludge unit. The DDW and MWS had TDIS and COD concentrations of 105 and 4.5 g/L, and 54 and 4.1 g/L, respectively. After acclimatization process of 70 days, 67% COD removal was achieved at influent TDIS and COD concentrations of 79.6 g/L and 4320 mg/L, respectively, for the DDW at HRT of 3 days and MLVSS concentration of 2000 mg/L. Although no sludge wastage was done, initially increased concentration of MLVSS ( 2400 mg/L) decreased to 1700 mg/L with increase in TDIS. Using the biomass acclimatized for DDW for treatment of MWS, consistent COD removal of 70% was achieved at HRT of 4.3 days and an MLVSS concentration of 1600 mg/L. Results suggest that significant COD removal can be achieved in real DW if biomass is gradually acclimatized to increasing TDIS concentrations.

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# A Known in Advance, What Ontologies to Integrate? For Effective Ontology Merging Using K-means Clustering

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**Abstract:** A significant aspect of any system is how we present the knowledge. Ontology is one of the methods to present shared knowledge of the particular domain. Ontology can be designed and developed on specific domain or subdomain by many groups and researchers, which will create heterogeneity. To solve this problem ontology integration is necessary. To integrate shared knowledge, we require calculating the similarity between two ontologies, selected from a corpus using ontology matching techniques. Here we define a procedure to create a group of ontologies. Ontology comparison can be made using tools to find similar classes. As a similarity measure, Jaccard Similarity Index (JSI) is used create a group of ontology by an algorithm named k means. For each cluster, we generate buckets of ontologies, and from the bucket, all ontologies are grouped in one ontology reducing the attempt of exploring in enquiring understanding in multiple ontologies. Here we have check performance of ontology matching; clustering and merging algorithms script using standard benchmarking techniques of agriculture domain and conference track. Also, compare response time performance of SPARQL (SPARQL Protocol and RDF Query Language) query on merged ontology using this method. For experimentation, we have selected ontology corpus from agriculture domain and conference tack domain of OAEI (Ontology Alignment Evaluation Initiative). At the end of experimentation through our proposed approach we could achieve improvement in average loading and match time in ontology matching process compare to an existing tool. Also, we could achieve significance result in ontology merging process though benchmark parameter of coverage, compactness, and average merge time of two ontologies. Finally, in SPARQL query experimentation, we got success in improvement in reducing search space and response time of the query.

**Keywords:** Ontology, Knowledge reuse, Knowledge merging, Ontology matching, Semantic web, Clustering.

## 1. Introduction

Ontologies help to understand the similar domains in semantic web-based applications [1, 2]. In last decades ontologies is widely used as a knowledge representation in various domain and applications like semantic web, education, agriculture, healthcare, biological sciences, etc. There is a requirement of query answering machine to process complex queries of the user on a domain like agriculture, university and research conferences. Usually, this application is using SPARQL [1] query by the user. SPARQL (SPARQL Protocol and RDF Query Language) is an RDF query language, that is, a semantic query language for databases, able to retrieve and manipulate data stored in Resource Description Framework (RDF) format. To search knowledge from this multiple ontologies using SPARQL [2] queries required much time by sequentially applying these queries one by one on each ontology. For reduction in response time of the query, it is required to merge similar domain ontology into one through a reduction in search space.

An ontology [3, 4] is sharing the perception of knowledge depiction. Ontologies express a solid domain knowledge and provide a simple understanding of the same. With regards to the usage and situations, individuals or group of people

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# Feature Descriptor Based Identity Retention and Tracking of Players Under Intense Occlusion in Soccer Videos

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**Abstract:** Tracking plays an important role to analyze the action of players, i.e movement of players and path corresponding to this movement. In recent years, the number of approaches to detecting players throughout the monocular image sequences has grown steadily. Severe occlusion makes this tracking challenging and standard algorithm fails to retain the identity of players. In soccer sequences, it is even more challenging due to erratic movement of players as well as players having clothes of the same color. Feature Descriptors do not require prior training to hold player's size, shape or color. Thus, this paper proposes feature descriptor based object tracking algorithm to tackle severe spatially extended and temporally short and long-term occlusions. The objective is to detect players and maintain their identities over the time even under the situation of intense occlusion. Gaussian Mixture Model (GMM) and Hungarian Assignment (HA) are used for player detection and association respectively. In the proposed approach, the feature descriptors are pre-calculated for the players having a reliable blob. In the case of demerge, these reliable feature descriptors are used to retain player identities. The proposed approach is evaluated on ISSIA Soccer dataset having six sequences having 25 frames per second (fps) for the image size of 1080 x 1920. The proposed method outperforms state of the art trackers by achieving 80% accuracy and 64% precision on ISSIA dataset.

**Keywords:** Occlusion and demerging, Player detection and tracking, Soccer video, GMM, HA.

## 1. Introduction

In the field of computer vision, human action recognition is one of the major challenges. It has various applications like sports video analysis [1, 2], surveillance scenarios [2 - 4], robots navigation [5, 6], human-robot interaction [7, 8]. In sport sequences, players are tracked to analyze player's strength, team strength and mining their movements to provide required guidelines to other players.

Tracking of players and their movements is essential to understand the tactic of the game along with automatically mining the player's movement, speed, strength and ability to instruct other players in specific situations. Significant work has been carried out to track players. For example, people can be tracked by searching in the neighborhood from last frame as proposed by S. Denman et al. [9], using model matching proposed by M. Andriluka et al. [10], using joint probabilistic methods proposed by D. Schulz [11, 12].

Occlusion limits the continuity of player to be tracked. The occlusion defines the effect of one player blocking another player in the 3D Space from captured view. This occlusion can be classified as self-occlusion, inter-player occlusion and occlusion by background. Self-occlusion mostly arises while tracking articulated players (when one part of the player's body occludes another part of the same player). Inter-player occlusion occurs when two players being tracked, occlude each other. Occlusion by the background occurs when a structure in the background occludes the tracked players. In sports,

# Identity Retention of Multiple Objects under Extreme Occlusion Scenarios using Feature Descriptors

Dippal Israni and Hiren Mewada

***Abstract*— Identity assignment and retention needs multiple object detection and tracking. It plays a vital role in behavior analysis and gait recognition. The objective of Multiple Object Tracking (MOT) is to detect, track and retain identities from an image sequence. An occlusion is a major resistance in identity retention. It is a challenging task to handle occlusion while tracking varying number of person in the complex scene using a monocular camera. In MOT, occlusion remains a challenging task in real world applications. This paper uses Gaussian Mixture Model (GMM) and Hungarian Assignment (HA) for person detection and tracking. We propose an identity retention algorithm using Rotation Scale and Translation (RST) invariant feature descriptors. In addition, a segmentation based optimum demerge handling algorithm is proposed to retain proper identities under occlusion. The proposed approach is evaluated on a standard surveillance dataset sequences and it achieves 97 % object detection accuracy and 85% tracking accuracy for PETS-S2.L1 sequence and 69.7% accuracy as well as 72.3% precision for Town Centre Sequence.**

***Index Terms*— Occlusion and demerging; Detection and Tracking; Person tracking; Surveillance video; Identity Retention.**

## I. Introduction

Multiple object tracking is the primary step in video sequence analysis. As an example, player tracking in sports video [1]-[3], person tracking in surveillance video [4], [5], group of animals (ants [6], birds [7], fish [8], [9], bats [10]), etc. Other application includes action recognition [11], pose estimation [12], behavior analysis [13], human-computer interaction [14], visual surveillance [15] and virtual reality [16]. Despite of a large number of algorithms been developed for video analytics, major constraints to successful MOT are illumination changes, initialization and termination of tracklets, occlusion, distortion and/or similar appearance, interaction amongst multiple objects, changes in the size of the object.

This paper primarily focuses on pedestrian tracking. Three main reasons for this selection are: (i) pedestrians are the most non-rigid objects as they suffer deformations (changing its appearance along the time. (ii) a lot of practical applications of pedestrians results in a great commercial potential. (iii) 70% of research in the field of object tracking is focused on pedestrians [17].

In computer vision, occlusion defines the effect of one person blocking another person in the 3D Space from captured view. L. Yong et al. categorizes occlusion as partial occlusion, full occlusion, non-occlusion and long term occlusion. Object tracking is primarily grouped into detection based tracking and detection free tracking. In former tracking method, the algorithm detects object and links into trajectories [19], [20]. In later tracking method manual initialization is done in the first frame of some fixed objects, and then localizes these objects in subsequent frames [21]-[23]. Tracking can also be classified as an online tracking or offline tracking. Online tracking also known as sequential tracking handles the image sequence in a stepwise manner [22]-[25]. However, in offline tracking observation from all the frames are utilized and analyzed to estimate trajectories [5], [26]-[29].

This paper emphasizes on the usage of detection based tracking referred to as 'Tracking-by-Detection'. Further, this paper uses an online tracking method to extend the existing trajectories with current observations. This paper contributes a novel and efficient identity retention method. It proposes a multiple object demerge handling method that segments multiple object precisely. The proposed method is evaluated on standard datasets and it outperforms state of the art trackers.

The rest of this work is organized as follows. A review on non-rigid MOT for pedestrian video is described in section 2. The proposed method is described in section 3. Section 4 showcases the performance of the proposed approach on standard datasets evaluated it by comparing it with other competitive methods. Section 5 contains a conclusion.

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# An Efficient Satellite Image Super Resolution Technique for Shift-Variant Images using Improved New Edge Directed Interpolation

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**Abstract** Super resolution is a method that reconstructs a higher resolution image from single captured image or set of captured low resolution images. Super resolution imaging is used for several image processing applications like medical imaging, earth observation systems and surveillance systems. Image interpolation is one of conventional methods used to enhance resolution of image. Basic linear interpolation methods like bilinear, bicubic give blurred image as a result. Non-linear interpolation methods like New Edge Directed Interpolation (NEDI), Curvature based interpolation, neural network based interpolation enhance image but has limitations like several artifacts. In this paper, a novel innovative approach is proposed in which using dual tree complex wavelet transform (DT-CWT), low and high frequency sub bands are generated. High frequency sub band images are interpolated using improved NEDI which is NEDI with circular window and dynamic window. Improved NEDI (INEDI) algorithm proposed in the paper gives better results on high frequency components which lead to high resolution image without artifacts. Inverse DT-CWT is applied on interpolated sub bands to reconstruct high resolution image. Registration is applied on both images and shift adaptable bilinear interpolation is applied which reconstructs image into 4 interpolation factor. The proposed approach is verified for different interpolation factors and for different satellite images. The accuracy of proposed approach is verified by several contrast features. The algorithm proposed in this paper outperforms in comparison to state of the art algorithms.

**Keywords** Dual Tree Complex Wavelet Transform (DT-CWT), Sub pixel shift, Resolution enhancement, Improved NEDI

**AMS 2010 subject classifications** 94A08, 68U10

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## 1. Introduction

In various fields like medical imaging, remote sensing, recognition and computer graphics, high resolution image is desirable. There is high requirement of a high resolution image that provides better visualization and additional information details. In remote sensing, a higher resolution image is advantageous to attain better classification of areas[1, 2, 3, 45, 5]. High resolution image is helpful in medical imaging to make correct diagnosis and treatment[6, 7, 8, 9, 10]. In video observation system, high resolution videos are useful in identifying object or person of concern[11, 12, 13, 14].

One major way for acquiring high resolution image is to ameliorate image acquisition device by increasing pixel density of the sensor. There is a constraint in decreasing pixel size of sensor. The captured image quality will be naturally reduced as the pixel size of sensor becomes too small[15]. As pixel size of sensor reduces, the power of signal also decreases. This fact affects the quality of image. Moreover,a higher value is needed to improve chip size. On base of above stated, the Super Resolution imaging turns out to be good option. Super Resolution imaging research has emerged really fast after initially described by Tsai and Huang [16] in 1984.

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# High speed multi-channel data acquisition technique for efficient hardware utilization using quad data rate approach

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**Abstract**

Data acquisition is the most demanding application for the acquisition and monitoring of various sensor signals. The data received are processed in real-time environment. This paper proposes a novel Data Acquisition (DAQ) technique for better resource utilization with less power consumption. Present work has designed and compared advanced Quad Data Rate (QDR) technique with traditional Dual Data Rate (DDR) technique in terms of resource utilization and power consumption of Field Programmable Gate Array (FPGA) hardware. Xilinx ISE is used to verify results of FPGA resource utilization by QDR with state of the art DDR approach. The paper ratiocinates that QDR technique outperforms traditional DDR technique in terms of FPGA resource utilization.

***Keywords***: *Data Acquisition System (DAQs); Dual Data Rate (DDR); FPGA; Multi-Channel; Quad Data Rate (QDR).*

## 1. Introduction

There are certain areas like high speed digital signal processing system, high speed image information conversion, real time processing system as well as radar, communications, chemical, military and medical industry which often requires number of analog signal to be synchronously sampled, so the collected data not only contains simulation signal frequency range of features but also keep the appropriate phase difference between different analog signals [1].To fulfill the requirement of higher and higher accuracy and data rate, data acquisition systems have been developed [2]. Single channel or multichannel signals can be acquired by current data acquisition system. Nowadays, there are a lot of data acquisition systems, some are high-accuracy but not high-speed; some are high-speed but not high-accuracy [3].

This paper proposes a Quad Data Rate (QDR) technique for efficient data acquisition. The QDR effect is advantageous to deliver four bits of data per signal line per clock cycle. QDR is a communication technique where data are transmitted at four points (Two on the rising and falling edges and at two intermediate points between them) in the clock cycle. This intermediate points are defined by a second clock. The second clock is 90° out of phase from the first.

In a quad data rate system, the data lines operate at twice the frequency of the clock signal. This is in contrast to double data rate systems, in which the clock and data lines operate at the same frequency.

This paper is further organized as follows: The next section gives some brief background of researches related to the proposed technique. Section 3 describes the proposed methodology for QDR. The experimental results and discussions of the proposed approach are depicted in Section 4. Finally, conclusions are summarized in Section 5.

## 2. Literature analysis

Presently, various models are proposed targeting acquisition of data with objective of proper resource utilization of hardware.

### 2.1. DAQ methods

Data acquisition can be classified as Computer based, Microcontroller based and FPGA based. The computer based data acquisition system uses microprocessor for processing, storing and manipulating the data [1] [2] [4]. The method of embedded microcontroller system has advantages like cheaper cost, better performance and mobility; however fixed architecture is its biggest disadvantage. If any change is required in the system than whole system need to be changed [1] [2] [5] [6]. Last is reconfigurable FPGA. It can be easily understood from its name that it is reconfigurable onboard system. It becomes first choice for any developer because of its high performance and high capacity. It also fulfills all the requirement of data acquisition system like I/O, processing and storage capability [1] [2] [7] [8].

### 2.2. DAQ protocols

This section describes various protocols used in DAQ system like Universal Asynchronous Receiver Transmitter (UART), Serial Peripheral Interface (SPI) and Inter-Integrated Circuit ($I^2C$): UART is a universal asynchronous receive or transmit protocol [1] [9]. To set the synchronized clock information into data stream,

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Original Research Paper

# A Better Approach to Ontology Integration using Clustering Through Global Similarity Measure

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**Abstract:** Knowledge representation is a crucial area of work in the intelligent system, especially in query answering system development. Ontology is used to represent shared knowledge of a particular domain for query answering system. Domain-specific ontology can be designed and developed by many groups and researchers, because of which there is heterogeneity in the knowledgebase. Ontology integration or merging is necessary in order to solve this problem of mixed knowledge. Finding similarity between two ontologies is crucial to achieve integration or merging of ontology. In this study, we present a method to generate a cluster of ontologies using global similarity measure of two ontologies. Ontology matching tools are used to find matched classes between two ontologies. Output of ontology matching tool is mapping between two ontologies and is used for generating clusters of ontology. We use Jaccard Similarity Index as a global similarity measure for clustering. Based on this measure, the popular k-means clustering algorithm is used to perform clustering of ontologies. Bins of ontologies are generated from each cluster. From each bin, all ontologies are finally merged into a single ontology, which helps us in reducing search effort in querying knowledge in query processing. The outcome of this research paper to provide better solution for merging ontology. Here, we use agriculture domain ontology corpus from the standard dataset for experimentation.

**Keywords:** Ontology, Knowledge Reuse, Knowledge Merging, Ontology Matching, Semantic Web, Clustering

## Introduction

For developing semantic web-based applications (Hitzler *et al*., 2011; Fensel *et al*., 2005) ontologies are widely accepted as a means for providing a shared understanding of common domains. For such semantic web applications, there is a requirement of reasoner and query answering machines to process complex queries of the user on a particular domain.

Ontologies (Gruber, 1993) capture fixed domain knowledge and give an ordinary meaning of a domain, which can be reused and shared across systems and groups. Ontology (Chandrasekaran *et al*., 1999) shares conceptualization of knowledge representation in different forms and formats and can be represented by many people or groups, either for the same domain or different domains. Searching or querying this knowledge from one or more ontologies requires a query answering system.

Ontology (Fensel *et al*., 2005; Chandrasekaran *et al*., 1999) provides a vocabulary of a specific domain and for a particular domain, many people and groups have generated their ontologies. Ontologies are designed and developed by different people or groups with different context and usage. This creates heterogeneity in knowledge represented by ontologies about the same domain. Also, many concepts are common to different domains, which creates heterogeneity in concept presentation. Thus, there is a demand for ontology matching (Euzenat and Shvaiko, 2007) to generate a total number of matching concepts among ontologies.

Multiple ontologies need to be merged on a standard platform. Random merging of ontologies poses a challenge to any query answering system. Systematic and logical merging of ontologies is required for solving problem of radom merging followed by creating clusters of those ontologies, which results in a standard to

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# Hybrid Group Recommendation Using Modified Termite Colony Algorithm: A Context Towards Big Data

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**Abstract.** Since the introduction of Web 2.0, group recommendation systems become an effective tool for consulting and recommending items according to the choices of group of likeminded users. However, the population of dataset consisting of the large number of choices increases the size of storage. As a result, identification of the combination for specific recommendation becomes complex. Hence, the existing group recommendation system should support methodology for handling large data volume with varsity. In this paper, we propose a *content-boosted modified termite colony optimisation-based rating prediction algorithm* (CMTRP) for group recommendation system. CMTRP employs a hybrid recommendation framework with respect to the big data paradigm to deal with the trend of large data. The framework utilises the communal ratings that help to overcome the scalability problem. The experimental results reveal that CMTRP provides less error in the rating prediction and higher recommendation precision compared with the existing algorithms.

*Keywords*: Big data; content-boosted modified termite colony optimisation-based rating prediction algorithm; group recommendation; hybrid recommendation; non-deterministic content-boosted modified termite colony optimisation-based rating prediction algorithm.

# A Data Mining Approach to Identify the Factors Affecting the Academic Success of Tertiary Students in Sri Lanka

**K. T. Sanvitha Kasthuriarachchi, S. R. Liyanage and Chintan M. Bhatt**

**Abstract** Educational Data Mining has become a very popular and highly important area in the domain of Data mining. Application of data mining to education arena arises as a paradigm oriented to design models, methods, tasks and algorithms for discovering data from educational domain. It attempts to uncover data patterns, structure association rules, establish information of unseen relationships with educational data and many more operations that cannot be performed using traditional computer based information systems. It grows and adopts statistical methods, data mining methods and machine-learning to study educational data produced mostly by students, educators, educational management policy makers and instructors. The main objective of applying data mining in education is primarily to advance learning by enabling data oriented decision making to improve existing educational practices and learning materials. This study focuses on finding the key factors affecting the performance of the students enrolled for technology related degree programs in Sri Lanka. The findings of this study will positively affect the future decisions about the progress of the students' performance, quality of the education process and the future of the education provider.

**Keywords** Data mining · Educational data mining · Classification
Knowledge discovery · Feature extraction

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# An Indexing Technique for Fuzzy Object Oriented Database using R Tree Index

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**Abstract-Object Oriented Database (OOD) is one of the emerging technologies which replace relational databases as relational databases are not designed to support multimedia data. As there is need to move towards the age of internet, thus dealing with multimedia data is the issue which is solved by Object Oriented Databases. Generally, the data available to us is highly imprecise or uncertain. Thus, there is the need of Fuzziness in databases to deal with uncertainties in data. The extension towards OOD model is Fuzzy OOD which is used to model various Object Oriented features with the representation of uncertainty or impreciseness in data. The Proposed work includes the OOD model which handles fuzziness in data and to enhance performance of the proposed model, an indexing technique using R tree is introduced. Query Processing in proposed model is compared with the Normal Query Processing with respect to time. The results show that the performance of Query Processing in Proposed ITFOOD is better than the normal query processing without Indexing.**

***Keywords- FOOD, R Tree, Objects, Fuzzy, indexing, relational.***

## I. INTRODUCTION

Object Oriented Databases allows composite database applications which are complex to handle by relational databases including 3 dimensional structures, computer aided design, automation systems, telecommunications etc. In such complex applications, data available is imprecise or uncertain, and users of the database may request for Fuzzy queries [20]. Thus, such complex applications require the model to handle this fuzziness in data. The Comparison of OOD and Relation Database is given in the Table 1.

Generally, it's an illusion that the information available to us is certain or precise. But this is not true. These complex objects can have uncertain information which can be considered by the OOD model. For Example, an eye witness might see the person committing the crime but cannot describe the criminal accurately. More practical example for fuzzy data is, if we want to divide the data into groups, but we are unable to identify the exact group in which it may fall. But we can probably specify the percentage of similarity factor of the data in various groups. In other words, it can be said the information available to us is Fuzzy i.e. cannot be specified exactly and only probable estimation can be given in percentage. Considering Fuzzy Information of the complex objects in Object Oriented Database gives Fuzzy OOD model i.e. FOOD model. The basis of this FOOD model is to replace equality with similarity relations. Similarity matrices are used here for fuzzy attributes to represent the similar relation between their values [20].

Table 1: Comparison of OOD with Relational Database.

| Sr. No. | Object Oriented Database | Relational Database |
|---|---|---|
| 1 | It provides class hierarchy which results in efficient navigation in database. | Does not support class hierarchy. |
| 2 | No Impedance Mismatch | Impedance mismatch occurs as Relations in Relational Database are to be mapped with the objects of programming language |
| 3 | Less programming effort because of inheritance, reliability and extensibility of code. | Does not support Reusability. |
| 4 | Complexity is high due to complex queries | Simple to understand and implement. |
| 5 | Object Identifier (OID) is used by the system to identify the objects in the database. | Primary key is used for identification which is not used by the system. |
| 6 | The structure of data may be complex, involving various types of data. | Users perceive data as columns, rows/tuples and tables. |
| 7 | Standard model is not available | Various standard models are available. |

To increase the performance of the model, we need indexing techniques to increase the performance of queries and to retrieve the results fast. As Object Oriented Databases are specially used for the complex applications containing multimedia data, geometric data, Computer Aided Design(CAD) etc. Therefore, an indexing technique which can retrieve and search such data in short duration should be applied to enhance the performance of the queries in FOOD model. For indexing, R Tree index structure is used. R Tree index structure along with Fuzzy OOD model gives ITFOOD.

## II. LITERATURE REVIEW

There are various techniques available for indexing OOD models. This includes Path Index [2], Nested Inherited index [1] & [11], enhanced version of Nested Inherited index [1] & [11], and various other [3], [10] & [11]. These techniques of indexing available for OOD models are either *structural* [1], [3], [10], [11], [15] or *behavioural* [4]. But all these techniques have limitations. The indexing techniques for Object Oriented Database which are discussed above do not support uncertainty in Object Oriented Databases i.e. fuzzy querying. None of these indexing techniques for Object Oriented Database support multidimensionality.

Very Few indexing techniques and access methods are

# A Chaff-Point Based Approach for Cancelable Template Generation of Fingerprint Data

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**Abstract.** In the recent biometric community security of biometric information has accepted basic significance. Cancelable biometrics is the one technique to do this, which manage before biometric information putting away in the database transforming the biometric information, in a manner that relative minutiae data is not defiled in the transformed template. This paper shows an investigation of few methods of generating cancelable biometric templates. The security level of current biometric framework is upgraded by the structure of fuzzy vault as far as concealing secret key and ensuring the template, by applying a binding strategy on biometric template and cryptographic key. Apply cyclic redundant code(CRC) to distinguish a real polynomial from an arrangement of competitors in light of its straightforwardness. In CRC based fuzzy vault scheme to overcome issue of blend substitution attack two new module is proposed chaff point verifier along with generator. The systems dispense with a blend substitution assault to enhance general security and, subsequently it can distinguish any alteration in vault.

**Keywords:** Cancelable template · Template transformation · Biometric cryptosystem · Fingerprint

## 1 Introduction

As a matter of first important thing is that, what is biometrics, "Biometrics are robotized techniques for perceiving a man in light of a physiological or behavioral trademark". Biometrics are used to distinguish a person on the basis of its characteristic. The main goal of utilizing biometric system is to give nonreputable validation. Verification implies that (I) only legitimate assets secured by the biometric system or legitimate approved clients can get to the physical and (II) pretenders are kept against getting to the ensured assets. A person who gets to specific assets later can't deny to utilizing it that guarantee by nonrepudiation [6].

There are began new challenges by expanding utilization of biometrics in various environments. Import thing is that, biometric information is imperative. Accordingly, biometric template database involves critical security dangers

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# An Approach to Analyze Data Corruption and Identify Misbehaving Server

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**Abstract.** Many studies have derived multiple ways to achieve security in the server and integrating the data in multiple servers by detecting the misbehavior in the server. The data is secured on server using encryption techniques before dividing into fragments before storing on virtual cloud. This study focuses different perspective of storing data on virtual cloud to maintain integrity by storing the fragments of address of data. Hence, the data remains secure and only the address of the data is transmitted when divided in fragments and data is secured with encryption, so it would be difficult for third party to decrypt and access on server. Thus, security level has been increased on cloud platform though data stored on server is more secure and integrity is maintained throughout the cloud platform.

**Keywords:** Cloud data storage · Data corruption · Misbehaving server · Data security · AES encryption

## 1 Introduction

In today's era Cloud computing is a new and Internet based technology which provides a services like infrastructure as a service, Platform as a Service and Software as a Service [1–5]. Cloud Computing provides a facility to end user for on demand accessing resources which is virtualized on the cloud by Anytime Anywhere [6]. In this technology Cloud data storage is used for storage of data which offers an on demand data outsourcing as a service [7–10]. The main use of Cloud data storage is data written once by the user and rarely read by the user so it is necessary to ensure its integrity of data. So, the cloud computing is beneficial due to low cost and high efficiency [10–15]. But the Security is a major issue of Cloud data storage which contains the some sensitive data. In this paper, the research work goal is to design a single approach which uses, an encryption algorithm, Using standard encryption algorithm where we encrypt users data and convert into cipher text so no other malicious user can decrypt it, a fragmentation which is used for data fragmentation, an addressing scheme to provide a higher security of data and allocate an address to each fragmented

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# A Novel Machine Learning Based Approach for Rainfall Prediction

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**Abstract.** The climate changes effortlessly nowadays, prediction of climate is very hard. However, the forecasting mechanism is the vital process. It is also a valuable thing as it is the important part of the human life. Accordingly to the research, the weather forecast of rainfall intensity conducted. The remarkable commitment of this proposal is in the implementation of a hybrid intelligent system data mining technique for solving novel practical problems, Hybrid Intelligent system data mining consists of the combination of Artificial Neural Network and the proper usage of Genetic Algorithm. In this research, Genetic algorithm is utilized the type of inputs, the connection structure between the inputs and the output layers and make the training of neural network more efficient. In ANN, Multi-layer Perceptron (MLP) serves as the center data mining (DM) engine in performing forecast tasks. Back Propagation algorithm used for the trained the neural network. During the training phase of the proposed approach, it gains the optimal values of the connection weights which, in fact, utilized as the part of the testing phase of the MLP. Here, the testing phase is used to bring about the rainfall prediction accuracy. It may be noted that the information/data is used to cover the information from the variables namely temperature, cloud fraction, wind, humidity, and rainfall.

**Keywords:** Rainfall prediction · Genetic algorithm · Artificial neural network

## 1 Introduction

Machine learning is an advanced mechanism for analysis is various data (i.e. data sets) that computerises explanatory which are use to build the models. The knowledge/information gain by the various calculations which are performed based on the information, the Machine Learning (ML) allows the systems to find out the hidden bits (i.e. information) of knowledge without applying alternative solutions [1–10].

There are various utilizations of machine learning. It's quite to acknowledge how much machine learning has accomplished in real world applications.

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# Data Security in Recommendation System Using Homomorphic Encryption

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**Abstract.** Cloud computing is like a daily routine now a day. Even though it has numbers of advantages in technical and business view, still there are some challenges there like data storage security, confidentiality and integrity. Main risk in cloud data is about to trust on cloud owner. Encrypted data is not useful for any computational process, so we cannot store as encrypted data. In recommendation system cloud plays very important role. Using homomorphic encryption, we can perform cloud data analyzation. This paper discusses about different homomorphic encryption technique and solution to recommendation system.

**Keywords:** Cloud data storage · Homomorphic encryption · Data security · Data confidentiality · Data integrity · Recommendation system · Collaborative filtering

## 1 Introduction

Cloud computing is a most popular architectural model in the field of Information Technology. It is combination of Distributed Computing, Parallel Computing and Grid Computing Architectures. It provides following kinds of services: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS). Basic Computing Resources and Storage Network Services can be categorized under IaaS. PaaS provide service to develop and run application without any worry about its complexity and maintenance. SaaS is a service in which we can provide features like subscribe and software licensing. For all these services, there is no need for users to manage or control the cloud infrastructure, including network, server, operating system (OS), storage and even the functions of applications [1, 2]. In other words, we can say cloud computing is a third-party service which can be used for delivery of the applications [3]. Some well-known service providers like Rack space, Microsoft, IBM. The buzz 'cloud computing' word way back in 2006 with the launch of Amazon EC2, gained traction in 2007 [11–29].

The research paper is divided into various sections. Section 2 introduce Recommendation system & literature review followed by Collaborative filtering and Homomorphic encryption in Sect. 3. Section 4 contains the proposed work and in last we will try to conclude the study and its future scope.

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# Message Delivery Guarantee and Status Update of Clients Based on IoT-AMQP

**Purvi Bhimani and Gaurang Panchal**

**Abstract** Advanced Message Queue Protocol (AMQP) is an open-standard application layer protocol for IoT focusing on message-oriented middleware. It provides asynchronous publish/subscribe communication with messaging. It is store-and-forward feature that ensures reliability even after network disruptions, which is its main advantage. When compared all other IoT protocols with AMQP protocol, it gives better performance. In this paper, we provide features for some cases or situations like when any client disconnected ungracefully or when any client connected and subscribed for a particular topic which it is interested in. This is because these features are used to notify other client(s) about disconnected client and help newly subscribed clients to get a status update immediately after subscribing and do not have to wait until the publishing clients send the new update. So AMQP protocol provides the guarantee of message delivery and provides reliable communication even after a network failure.

**Keywords** AMQP · Status update · Publish/subscribe
Message delivery guarantee

## 1 Introduction

A ubiquitous network enables monitoring and control of the physical environment by collecting, processing and analysing of data, which are generated by sensors, actuators or smart objects referred as an Internet of things (IoT) [1–3]. It should be capable of interconnection through the Internet that connects billions and trillions of objects. There are three main parts of IoT: first is a network terminal part that includes sensors, second is the transmission network that refers to information

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# An IoT-Based Portable Smart Meeting Space with Real-Time Room Occupancy

**Jaimin Patel and Gaurang Panchal**

**Abstract** The collaboration is the main aspect of very large organizations. Meeting rooms are the main enablers of collaboration. However, most organizations face challenges in using their meeting rooms effectively due to lack of efficient and affordable systems. All the traditional purely software-based solutions are not enough to meet the demands of today's organization. So our aim is to incorporate the latest Internet of Things (IoT) technologies into the meeting rooms based on many different types of research. Our proposed system will help every organization those who want to convert their traditional meeting spaces into a smart meeting space without spending too much money and space. Our proposed system is based on sensors, microcontrollers and minicomputers. We have selected best of available devices keeping the price and portability in mind. This proposed system will be capable enough to display real-time room occupancy status, room booking and management, generate notifications and the control of room environment from a remote location.

**Keywords** IoT · Smart meeting space · Room occupancy · PIR sensor

## 1 Introduction

If any organization want to hold more effective meetings, they have to invest in them [1–3]. Over the last few decades, corporations have invested heavily in technology designed to increase individual employee efficiency. But, fewer companies have extended this investment into the meeting rooms/spaces. Plush leather chairs and polished boardroom tables are no longer enough to furnish a meeting room, tools are essential to creating a fully functional workspace [3–6]. A smart meeting room uses various sensors to detect and sense activity and room environment of meeting

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# Migration and Cooling Aware Approach for Virtual Machine Spreading in Data Centers

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***Abstract* — Server virtualization is a way to utilize efficient resources of the data center. One of the challenges faced by data centers is to decide when, how and which Virtual Machine to migrate. In principle, VMs will migrate from one physical host to a different host without inflicting a significant impact on the application running within them. VM selection decision opens up a huge area for researchers. VM migration cost plays a very important role in the VM selection because it directly depends upon VM performance. R. Ayoub et al. have proposed GentelCool algorithm. The proposed a policy based on GentelCool algorithm which includes VM migration cost. The proposed policy for VM Level spreading considers the migration cost and cooling cost. From the simulation results of existing and proposed VM Level spreading policy conclude that proposed VM level spreading policy provides a higher lead to terms of SLATAH, PDM and SLAV. The improvement in SLTAH is because of swapping of hot VM with colder VM, whereas the improvement in PDM is because of consideration of migration cost with cooling cost.**

***Keywords*—** *Cloud Computing, Virtualization, Virtual Machine (VM), Service Level Agreement (SLA), GentleCool*

## I. INTRODUCTION

Cloud computing can be defined as active processing (software & hardware) that is transmitted within the form of administration by a system (usually the Internet). Cloud computing is based on top of the server virtualization technology, which permits different occurrences of Virtual Machines (VMs) running on a solitary physical server. Nowadays cost aware VM migrations are important research issues. There are different costs aware VM migration techniques available such as workload-aware, power cost aware, migration cost aware and so on, yet most existing schemes have centered Service-Level Agreement (SLA) and VM migration cost for VM migration. SLA and VM migration cost aware VM migration utilizes distinctive VM and host selection policies. Recently, Gentlecool [3] algorithm has been proposed which gives cooling aware VM level spreading policy for VM migration. In this algorithm, VM level spreading policy considers just cooling cost in VM selection approach. In work on, considering just cooling cost or VM migration cost is insufficient for VM migration. Thus, we proposed an algorithm which considers cooling cost and VM migration cost for VM selection and assesses the execution of SLA violation(SLAV), for giving better services to the client. Gentlecool VM level spreading algorithm considers just cooling cost for a VM migration purpose. It is paramount to evaluate the performance of the VM spreading algorithm in a situation where VM migration cost, likewise impact for a VM selection purpose.

The rest of the paper is composed as takes after. Section II, relates with associated work. Sections III is about Gentlecool algorithm and its limitations. Section IV is proposed VM level spreading policy and calculated cost model. Section V contains performance evaluation and discusses simulation result. Section VI concludes the paper.

## II. RELATED WORK

In context of power management in the virtualized data centers, Verma et al. [4] have developed the matter of dynamic power-aware placement of VMs in hetero-virtual system to boost in the algorithm for collocation of virtual machines. As a result, they optimized to reduce the power consumption and maximize efficiency. Anton et al. have projected efficient adaptive heuristics for dynamic consolidation of virtual machines (VMs) within the use of live migration and change of inactive nodes in sleep mode and thereby minimizing power consumption. They have proposed different VM selection and Host overload/underload detection policies which offer a big reduction in energy consumption, whereas guaranteeing a high level of compliance with the SLA. For VM selection they have used different policies such as Minimum Migration Time, The Random Choice, and The Maximum Correlation. Justin Moore et al. [5], they studied solution-level systems to manage heat generation by setting the temperature of the aware work. Raid Ayoub et al. [3] they have planned to spread VMs using GentleCool approach supported a multi-tier proactive approach.

## III. GENTLECOOL ALGORITHM

The Gentlecool algorithm reallocates the work on the virtual machines (VMs) and on the CPU socket. This algorithm has 2 stages, spreading and refinement. The spreading stage keeps

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# Extended BB84 Protocol Using Lucas Series and Identity Based Encryption

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**Abstract.** In 1984 Bennett and Brassard proposed a Quantum Key Distribution (QKD) protocol known as BB84 protocol to distribute a random and frequently changed key using quantum mechanism. A major problem in this Protocol is to prove authentication. One of a solution of this problem has already been proposed in [4]. But in presence of Hardware Fault or Interception, above protocol is not applicable. In This paper Proposed System, Key Distillation has been added to overcome Hardware Fault or Interception with minor changes were not available in [4] and was available in original algorithm. It may increase performance of the Proposed System.

**Keywords:** Quantum key distribution (QKD) · BB84 · Identity key · Hybrid key

## 1 Introduction

BB84 Protocol is having mainly three steps: Raw Key Exchange, Key Shifting and Key Distillation. In Raw key exchange, Alice chooses randomly selected bit value with randomly selected bases from rectilinear or diagonal bases which results in four quantum states which are exchanged with Bob through quantum channel. The only way for Bob to derive any information from the incoming quantum states is to measure them against a randomly selected sequence of bases of his own. In Key Shifting if Alice/Bob selects the same base, which was used for decoding/encoding, then the result is determined to be correct. When the bases are different, then the result of this measurement is in deterministic [6]. After Key Shifting, key should be free of errors but it is possible only if no interception or no Hardware Fault is there. Key Distillation is consists of two steps. The first step corrects all the errors in the key, by using a Classical Error Correction protocol to precisely estimate the actual error rate. With this error rate, it is possible to accurately calculate the amount of information the eavesdropper may have on the key. The second step is called privacy amplification which compresses the key by an appropriate factor to reduce the information of the eavesdropper. The compression factor depends on the error rate. The higher the error rate, the more information an

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# File Distribution Preparation with File Retrieval and Error Recovery in Cloud Environment

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**Abstract.** Many studies have derived multiple ways to achieve security in the server and integrating the data in multiple servers by detecting the misbehavior in the server. The data is secured on server using encryption techniques before dividing into fragments before storing on virtual cloud. The fragments in which data is divided could be big or small. For encryption technique I had used Reed Solomon codes to encrypt fragmented data. After using encryption they are stored into different servers. Whenever user will challenge for its particular file, Cloud Service Provider will provide that file in original form. If that data chunk from particular file or file is corrupted on any server so using Reed Solomon Code we can repair our corrupted data or file. So, whenever attacker might attack on the server he might get small portion of that file in encrypted form which is not useful for him. He did not get original file from one server because that particular file fragments are dispersed on different servers. This ensures data security to cloud servers, cloud customers important information. It will also provide security from cloud service provider. And if any misbehavior of server is occurred or any file fragment is corrupted can be detected with automated tools and it can be also traced that on which server the file fragment is corrupted. Hence, in any way the data stored on server is more secure on cloud platform.

**Keywords:** Cloud computing · Error localization · Distributed storage · Reed-Solomon code

## 1 Introduction

In today's era Cloud computing is a new and Internet based technology which provides a services like infrastructure as a service, Platform as a Service and Software as a Service [1,5–8]. Cloud Computing provides a facility to end user for on demand accessing resources which is virtualized on the cloud by Anytime Anywhere [5–10]. In this technology Cloud data storage is used for storage of data which offers an on demand data outsourcing as a service. The main use of Cloud data storage is data written once by the user and rarely read by the user so it is must necessary to ensure its integrity of data. So the cloud computing

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# A Recent Trends and Analysis of Various Techniques of False Minutiae Removal for Fingerprint Image

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***Abstract*—This In the field of Biometrics, Fingerprint is among the most used and well accepted biometric traits. The fingerprint recognition has higher accuracy, reliability and simplicity as compared to other biometric traits. Fingerprint is obtained by a live scan or an offline scan by the biometric System. These systems differentiate stored fingerprint with the obtained fingerprint by comparing their minutiae points. Minutiae are major features of a fingerprint, arising from local ridge discontinuities: ridge endings and ridge bifurcations. Therefore, extraction of true minutiae points in addition to the removal of false minutiae by enhancement of fingerprint image is important. Such research challenge is impacting on complete applications based on fingerprint systems. The scope this paper is presents a survey on different methods of enhancing of fingerprint image as well as the different methods for detection and removal of false minutiae from the fingerprint image**

***Keywords—Fingerprint; Minutiae; False Minutiae Removal; Minutiae Filtering; Fingerprint Image Enhancement;***

## I. INTRODUCTION

Biometrics is no longer considered as a quickly developing innovation which recognizes individuals in view of their physiological or behavioral traits [14]. Today, the biometric system is more common than anything as a fundamental piece for providing security to various systems using fingerprints. Among accessible biometric qualities fingerprints are a standout amongst the most looked into, develop and exact strategy for authentication [7]. Fingerprint matching is done via identifying and matching minutiae point of a fingerprint image[18]. Minutiae are major features [20] of a fingerprint, arising from local ridge discontinuities: ridge endings and ridge bifurcations [3]. Various types of Minutiae [7] are shown in Fig. 1.

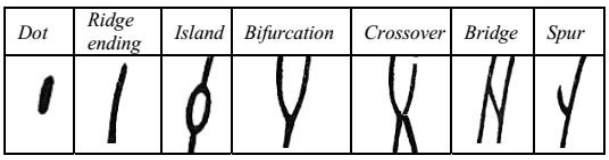


Fig. 1: Various Types of Minutiae

While in extraction phase there exists some false minutiae, which are obtained with true minutiae points. So, identifying and removing untrue minutia is critically important as it affects the overall performance of the recognition system. False acceptance Rate (FAR) and False Rejection Rate (FRR) are increased in fingerprint recognition due to false minutiae. Therefore, fingerprint image enhancement, extraction of features [17] and key generation is critically important. Removal of the false minutiae from fingerprint image is an important part of the system [2] as well the key generation [19]. Types of False Minutiae Structures are: Broken Ridge, Hole, Bridge, Triangle, short ridge. These Structures of false minutiae must be removed in order to improve the performance of the whole system. After that a biometric template [16] is generated which is stored in database for matching.

## II. LITERATURE SURVEY

S. Kim *et al.* [1] presented an efficient minutia post processing algorithm which is based on minutiae distance, connectivity of ridges as the key factor. After applying pre-processing procedures such as local ridge orientation calculation, image enhancement and thinning, minutiae points are extracted [20] and template is generated. Still the minutiae points extracted contain many false minutiae points which degrades fingerprint identification execution by expanding FRR and FAR.
Numerous Untrue minutiae constructions are broken ridge, Bridges, Short ridges, Holes and triangle. So, to remove false minutiae while holding true minutiae points, the proposed method consists of steps such as (i) Discovery of broken ridge structure (ii) Discovery of Bridge Structure (iii) Discovery of Short Ridge Structure (iv) Discovery of Hole structure (v) Threshold and False Minutiae Removal. So, selection of minutiae points [18] is crucial to remove fictitious minutiae even though holding real minutiae, incorrect minutiae are perceived as well as removed in precise directive are: (i) broken ridge (ii) bridge (iii) Short Ridge and lastly (iv) Hole. The Experimental results of this paper have concluded improved the performance of the fingerprint matching while eradicating false minutiae and retaining true minutiae.

M. Bandur *et al.* [2] proposed an improved extraction technique for minutiae by enhancing fingerprint images; they portrayed carefully the skeleton based algorithm. The obtained recognizing qualities are utilized together in the manual and programmed fingerprint matching method for identification tenacities. Proposed upgrade algorithm, using multi scale

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# Comparative Analysis on different Region of Interest (RoI) Extraction Mechanisms for Fingerprint

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***Abstract*— Fingerprint is one of the most well-known biometrics due to its uniqueness, better security and better accountability. Finger impression had been broadly used and connected with criminal examination, yet presently it has turned out to be more popular in different areas, for example, common applications (access control, money related security, etc.) as well. In practice, the position of finger on the scanner for authentication isn't finished with the most extreme care as when placed during the enrollment and that result in genuine user rejection. Also, genuine acceptance rate (GAR) is decreased due to user behavior and environmental conditions. To overcome this limitation, Region of Interest (ROI) is extracted for fingerprint matching which is focus on desired/subset of the fingerprint impression.**

***Keywords*— Region of Interest (ROI); Fingerprint; Orientation Detection; Segmentation***

## I. INTRODUCTION

Biometrics is robotized techniques for perceiving a man in light of a physiological or behavioral trademark [3]. For person recognition biometrics systems are more reliable than traditional token (e.g., ID cards) and knowledge (e.g., Password) based methods because of their identifiers cannot be shared, misplaced or forged easily [7]. Biometric system main goal is to provide non-reputable authentication. Authentication means that i) Only legitimate or authorized users are able to access the physical or logical resources protected by the biometric system and ii) impostors are prevented from accessing the protected resources. Non- repudiation ensure that an individual who access certain resources later cannot deny to using it [13].

Biometrics one of the most researched topic is Fingerprint and it applied to application like security to electronic devices, boarder security and finance [12]. Fingerprint uniqueness can be identified by the characteristics and relationships of ending and bifurcations [8] in the valleys or ridges. Due to noise, image deficiency and deformation detection of reliable minutiae [18] is very difficult. For effective fingerprint recognition system, segmentation [9] of the **Region of Interest (ROI)** [1-5] is taken into consideration (see Fig. 1). ROI is subset of the image which is used for accurate and easy fingerprint matching system. ROI is extracted based on some criteria and there are various methods available [13].

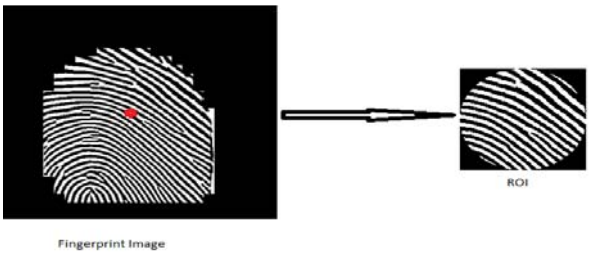


Fig. 1: Extract ROI from Fingerprint Image

## II. LITERATURE SURVEY

N. Bhattacharjee *et al*. [1] proposed Region-based approach for partial fingerprint alignment and matching. In their system, new partial fingerprint recognition method was proposed and deals with two main challenges that are alignment of partial fingerprint and computing matching/similarity score were addressed. Alignment and computation of similarity score both uses fingerprint texture information. In partial fingerprint alignment: i) divide query image into sub-region, ii) calculate correlation value at each degree step, iii) Identify available regions, iv) Identify consistent region for each angle according to their distance and direction, v) Assign new ranked values to each region as per similarity value, vi) Considering location consistency index which gives highest correlation value with its corresponding angle as the rotation difference of two images and repeat this step for all regions which have different rotational angle and size, vii) Use the location of cropped region on query image and the corresponding location on register image as off-set for common region extraction (see Fig. 2).

Similarity score computed using Local similarity score and global similarity score. Local similarities calculated based on Normalized Cross Correlation (NCC) [11] between each pair of corresponding regions. NCC is not as sensitive as minutiae-based methods when it comes to image quality but it takes into account all the available information (and attributes) of the fingerprint. Computation of NCC is not dependent on image size and any particular feature that may or may not exist in the partial fingerprint. For Global Similarity calculation: i) Apply Local similarity sort (LSS) to sorts all Local Similarities and select highest similarities as per quality of sub-region, ii)

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# Quick Response Codes Decodability Improvements using Error Correction Levels

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***Abstract*—In today's era usage of QR Codes (Quick Responsive codes) has become very common. The problem arise with the poor quality of QR Code. Due to this its decodability must need to be focused. As the reproduction (i.e. printing process) of QR Code for different image formats may include compressions and transformations, there are the major cause of distortion and noise which majorly affects the quality of the QR Codes and so apparently the decodability of QR Codes will get affected. In this approach we have discussed about the vital point of QR Codes called Error Correction levels L, M, Q, and H. For the different image formats (such as bmp, jpg, png etc.) the MSE (Mean Squared Error) and PSNR (Peak Signal Noise Ratio) values will be calculated to carry out better quality for the QR Codes by reducing the distortion and noise. The improvement will help to give better results to make QR Codes more useful in every way such as, for commercial purpose, for the education purpose, to store the information, to store the URL.**

***Keywords—QR Code; error correction levels; barcode quality; decodability; mean squared error;***

## I. INTRODUCTION

The two-dimensional barcode basically made of black arranged squared grids with white backgrounds having the capability to store the information by encoding numerical, alphanumerical values, bytes, binary, and kanji characters [8]. This QR Codes can be decoded by imaging devices to retrieve the stored information [8]. The two dimensional barcode is the type of trademark abbreviated as QR Code [8]. The usage of QR Code has widely increased now a days but the problem arise when there are less availability to decode that embedded information from inside. This problem occurs due to the poor quality of QR Code and more amount of noise and distortion present in QR Code [1-7].The production process of QR Code uses the different image formats such as .bmp, .jpeg, .png etc. The image might sometimes need to be transformed from one file format to another file format. Also there are the cases where the QR Codes are being sent from the web. This will distort the QR Codes and become the reason of noisy QR Code. And so the decodability of the QR Code can be affected [1-2]. To overcome this we have used an approach of calculating PSNR and MSE values for different image file formats for the different error correction level used in QR Code [1-3]. The following figure.1 shows the flow of the approach

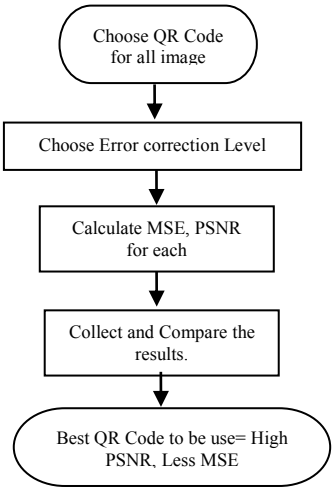


Fig.1.Flow diagram to check improvements on QR Code decodability

To determine four error correction levels Reed-Solomon error correction algorithm used [8]. The higher error correction level depicts lesser storage capabilities. Below mentioned data in Table I. depicts the different available error correction levels and there capability to restore the data. The PSNR [13] value depicted by the ratio between the maximum possible power of signal and maximum possible power of corrupting noise which affects the representation. And the MSE [12] value is the measure of the quality of an estimator.

TABLE I. ERROR CORRECTION LEVELS

| **Error Correction Levels** | ***Statistics (In %age)*** |
|---|---|
| Level L (Low) | restoration capability : 7% |
| Level M (Medium) | restoration capability : 15% |
| Level Q (Quartile) | restoration capability : 25% |
| Level H (High) | restoration capability : 30% |

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# *Survey on Developing Data Acquisition System using ZYNQ Architecture*

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***Abstract*—Design of Data Acquisition (DAQ) system is always remains topic of research and development for custom requirements from the environments. This paper represents exploratory analysis of the various system components and their performance parameters. The baseline performance parameters are power requirement, computing capabilities, interface data rates, miniaturization requirements and others. Based on the baseline performance requirements of DAQ system, major system components are quantified and proposed design has adopted Xilinx Zynq 7000 based System on Chip(SoC) which consists of dual-Cortex A9 CPU and an Artix-7 family Field Programmable Gate Arrays(FPGA). At the end of paper, the design of compact instrument based on Zynq7000 SoC is finalized, which satisfies the functional needs and specifications of data acquisition, storage, processing and communication for high speed data acquisition system in a compact package.**

***Keywords—Data Acquisition System; Processor + FPGA Hybrid Design; DAQ Computing Platform; DAQ Software Interface; Hardware-software Co-Design***

## I. INTRODUCTION

**What is Data Acquisition?**

Data acquisition (DAQ) is the way toward measuring an electrical or physical phenomenon such as voltage, current, temperature, pressure, or sound with a PC. A DAQ system consists of sensors, DAQ estimation hardware, and a computer with programmable software. Contrasted to conventional estimation systems, PC-based DAQ systems misuse the processing power, productivity, display, and connectivity capabilities of industry-standard PCs providing a more powerful, flexible, and cost-effective measurement solution.[3]

**Types of DAQ Application**

- Research and Analysis
- Design Validation and Verification
- Manufacturing and Quality test
- Asset Condition Monitoring
- PC-Based Control and Automation

## II. MAJOR CHALLENGES IN COMPACT DAQ SYSTEM DESIGN

### *A. Power Optimization*

In the design of data acquisition system, scale of the system can be single channel data channel operating @ 1Hz > 1000 channels at more than 1 GHz along with 8-14 bit data samples. As the volume of data is increase the corresponding power consumption is also increase for computing and communication. The signal driving components require to accommodate variable scale powering scheme. The system can be powered by Solar Cells, Electro-Chemical batteries or regulated power supply unit without any constraints. Selection of DAQ system platform is always introduces the power issue when the power availability is constrained (e.g. Spacecraft Systems, Sensor Networks deployed in remote places, etc). In the designing of system, major power requirement is compel by sensing, acquisition and computing and communication need. [3][5][9].

### *B. Miniaturization Constraints: Volume and Weight*

Mechanical Packaging of DAQ Electronics packages puts the design constraints of physical parameters. When the system is designed for compact, constrained by mission specific needs like lower volume, lower weight and size. The instrument packaging also enforces the constraints on interface ports and orientation.

### *C. Data Handling and Computing Capabilities*

Digital data generated by diverse range of sensors at variable rates (at regular intervals or on the event) stimulates the major requirement of data handling and processing capabilities. These prerequisite also enforces interface selection, storage memory selection and computing platform selection among the many system components alternatives for DAQ systems.

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# *SMOOTH VIDEO STREAMING IN BANDWIDTH FLUCTUATING ENVIRONMENT*

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***Abstract*— Due to evolution of technology, internet, smart phones, tablets, the demand of VOD (Video on Demand) services are booming among internet users. One of the statistics given by Cisco that until the year of 2018, 78% portion of whole IP traffic is consumed by video traffic itself. This services are based on client-server model and network bandwidth between client-server plays a crucial role in order to provide smooth video streaming at client side. If available bandwidth is high enough to play high quality video then video is never going to be paused. It is the fact that bandwidth hardly remain constant so it is needed to find solution which enable the server to deliver constant video streaming even in bandwidth fluctuating environment. If we develop algorithm at client-server side which can detect available bandwidth of the connection after predefine interval then server deliver the quality of the video according to ABW (Available Bandwidth). For the bandwidth estimation, it is not appropriate to use dummy packets as they increase overhead or become reason of congestion in the network. Our approach is very straight forward as for the first few seconds we send video-data itself at varying bandwidth, first start with lower bandwidth and increase it gradually. Our algorithm backtrack when packet loss and packet delay value surpassing the predefine threshold value of packet loss and packet delay. Our bandwidth measurement approach is continuous as when again same event confronted then same process will repeat again.**

***Keywords*—** available bandwidth prediction; packet loss; packet delay; video data rate; quality of service; adaptive video streaming.

## I. INTRODUCTION

VOD service users can watch video over internet anytime from anywhere, the only thing require is internet. The popular VOD providers are YouTube, Hot star, Voot and others. Subscriber of this VOD services can watch video in any video quality as they are generally available in 144p, 240p, 360p, 480p, 1080p. As pixel decreases the quality of the video is also compromised. Service consumer can watch video thoroughly if available network bandwidth of client-server connection is enough to play user selected video quality. ABW (Available Bandwidth) may increase, decrease or remain constant. Major reasons behind this kind of fluctuation are mobility of user, other tasks are running simultaneously at client node which also consume network bandwidth [1].

First, it is necessary to acknowledge the whole flaw of video transfer process between client and server. The whole process start with activation of server as it must be in listening mode in order to receive request from the client [1]. It is the fact that the entire original video is never going to be transfer at client side. Video is encoded by particular encoder and divided into small chunks. These chunks are encapsulated in IP packets and IP packets are transferred through network to the client. At client side, the exactly reverse process is done as de-capsulation and decoding and finally video will be run on media player of client [2-3].

We try to solve the biggest issue face by the VOD service consumer that video pauses for few seconds while it is playing [3]. It is the fact that network bandwidth is fluctuating as it hardly remain constant. If network bandwidth between client and server decreases rapidly then as a result video freezes or pause and it is irritating for the service consumers [4-5]. The best and the easiest solution is to deliver video quality according to available bandwidth of network connection. Dynamic bandwidth measurement algorithm is needed to be develop at server side [6].

Available Bandwidth is a crucial network parameter, by analyzing it server can decide video data rate. ABW may increase, decrease or remain constant. ABW decreases due to various reasons like network availability changes as from 4g to 3g, some other tasks are running simultaneously like other applications are updating in background [6].

Bundle of techniques are available to evaluate network performance and they are majorly classified in Active and Passive. Active methods are those in which dummy packets are transferred between client and server in order to measure some network parameters like packet loss, packet delay, jitter and others [6-7]. However, for multimedia streaming, use of dummy packets sometime become reason for congestion in the network. In passive measurement technique, intelligence is added at the devices and information is gathered like packet rates without using any unusual packet stream [8].

# Revolution in Networks of Smart Objects: Social Internet of Things

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***Abstract*— Nowadays Internet of Things gives a high comfort level to human life by providing connectivity between objects with a human being. People are also connected with each other via Social Network. There are many researches are being conducted on an integration of Social Network with Internet of Things. This new paradigm knows as "Social Internet of Things". Internet of Things has many limitations so to overcome it Social IoT can be used. Social IoT provides network of objects with security, navigability and scalability by converting "Smart" objects to "Social" object. Social IoT provides all social network services and best comfort level using IoT. In this way, Social IoT has two separate layers as a network of people and network of smart objects and still, Social IoT paradigm can be represented as a field of state of art in IoT and Social Network and simulations. In this paper, we have contributed the implementation of Social IoT with history of Intranet of Things to Social IoT, Social IoT architectures, various relationships of Smart objects with each other, different policies, challenges and applications etc.**

***Keywords— Social Network; Relationship; Scalability; Navigability; Internet of Things; Security***

## I. Introduction To Internet of Things

In coming era of technologies the Internet of Things (IoT) is coming on the peak of hype cycle [15] of Gartner as emerging technology. It is used in industry, engineering, energy management and health care etc. IoT consists of various networks, lightweight protocols such as CoAP, MQTT. Still in IoT there are many challenges like security, privacy and technical interoperability with each device those are part of IoT environment. Every IoT devices needs to be connected to the power supply and internet continuously, round the clock, hence the energy efficiency of the sensing is also a primary concern. It is also used to make better delivery of healthcare services by creating various wearable devices for fitness; health monitoring and network enabled medical devices which are helpful for people with disabilities and aged, by providing independent life style with realistic cost. IoT can be defined as: "It is a global network infrastructure where in the physical and virtual objects are all made equipped with data capture and communication capabilities so that they can use the ubiquitous internet to transmit data and other controlling purposes. [16]"

From definition it can be interpreted as all physical objects can be connected and create seamless network. By integration, people can achieve data capturing, data monitoring and event controlling. Captured data can be used for further processing such as manipulation, control. In IoT, each device has one unique identity and each have enough ability that can transfer a data over network without intervention of human-to-human and human-to-machine as well.

## II. Limitations of Internet of Things

When large numbers of heterogeneous and "Smart" devices are placed in physical world, they continuously generate useful information using sensors and actuators. It is also becomes possible to exchange data between disparate fields like hospital management to traffic monitoring, city management to energy management, house management. Hence, in near future of IoT, devices will get request from thousands of devices at single time, increasing the network traffic in terms of number of access to device and number of queries received by the search engines. Information can be accessible from multiple domains and it is not possible to manage this issue on existing system efficiently. Basically there are two interaction models in IoT:

1. Human-to-Machine
2. Machine-to-Machine

Nowadays people are looking for information provided by "Smart" object but in future there will be negligible human-to-machine interaction where object will look for other to provide better services to human being by increasing interaction complexity [3]. It is called scalability issue, which occurs when one object searches for appropriate service provider object. IoT search engines are not scalable with respect to number of devices and number of queries received. This issue can be solved by new paradigm SIoT as integration of social network and IoT. Same as social network, SIoT where object can make any number of friends as right object to get right service by using relationships querying their friends or search for friends or friends. Thus SIoT will give guaranteed efficient and scalable discovery of objects and services by following principle of human social network. According to sciologist Stanley Milgram [11] the object will able to find the right object for the service through the shortest path in the network using navigability feature.

In IoT network there may be fake objects from which people can't get right service and objects may work as virus to hack the data of other objects in network. e.g. Attacker nodes

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# Existing and Relevant Methodologies for Energy Efficient Cloud Data centers

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***Abstract*—Cloud computing is a novel paradigm which defines a new style of deploying systems. It realizes the vision of delivering Computing as a Utility. The demand for Cloud infrastructure has expanded with rapid growth of computing applications and data thereby amplifying energy-consumption. These results in heightened cost of ownership, reduced return on investment, narrowed profit margin, decreased reliability and availability of datacenter resources, and above all it adversely affects the environment by increases carbon footprint. Hence there is need for green computing and for energy-efficient management of cloud datacenter resources besides meeting the QoS constraints. Within a datacenter, maximum energy is consumed by cooling systems and ICT Infrastructure, particularly, the servers. So it is of utmost importance to optimize energy utilization in datacenter servers. In order to achieve this, we can leverage the power of virtualization which is intrinsic in Cloud Computing. Virtualization opens the doors for VM consolidation by allowing dynamic migration of virtual machines across physical machines. In this paper, give the detailed explanation of existing and relevant methodologies for energy efficient cloud data centers. Also explain limitations of existing methodologies and techniques.**

***Index Terms*—Cloud computing, Green Computing, Green IT, VM consolidation, VM Placement, VM Selection, Host Underload Detection, Host Overload Detection**

## 1. Introduction

Several methods and methodologies have slowly evolved for consolidation of VM for Heterogeneous work methods in cloud computing atmosphere. Its embrace completely different reasonably work, it's having completely different parameters like numbers of CPUs needed, buffer size of input and output files and length. To manage heterogeneous work there square measure varied type of methods describe below [1] [2]:

- **Dynamically modify Heterogeneous workload on same physical h/w:** In this section how to manage heterogenous workloads in various virtualized data centers has been explored. To compare the performance of different workloads the various utility functions used in this method. To improve the performance of heterogenous workloads these methods used.
- **Cooperative resource provision and management policies:**In the same organization to manage heterogenous workload Zhan et al.[1] proposed Phoenix cloud. These methods result in increased number of completed jobs which is run using various simulation kit. In this methods provide cooperative management and resource provision policies has been introducing.
- **Map Reduce model to manage the Heterogeneous workload:** For managing heterogeneous workloads Tiant al. [2] proposed new model which is directly working with map reduce. As per map reduce model the workload divide into three main parts like I/O bound, CPU-bound without shuffle and CPU-bound. As per methods, simulation results it has been proved by using triple queue scheduler mechanism the throughput of Hadoop by 30%.
- **Automatically manages the data centers using real and simulation:** To manages the datacenters running the heterogeneous workloads automatically Steinder et al. [1] have been introducing the new method. By using this method the heterogeneous workloads on any server collocate, using resource allocation the high-performance goal achieves and Without heterogeneous workload its has been achieved. In this methods, implementation author has used both methods like real-time environments and simulation methods.
- **Scheduling methods for HPC jobs and web-based applications:** To manage heterogeneous workloads like web-based application and HPC jobs on the virtualized datacenters methods has been proposed by Goiri et al. [2], which gain maximum benefits to the cloud providers. The main aim is to provide energy efficiency to the clients or consumers, SLA violation penalties, and fault tolerance. In this techniques, the simulation results show the improved performance

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DOI: 10.6688/JISE.201809_34(5).0008

# Robust Facial Expression Recognition using Local Haar Mean Binary Pattern

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In this paper, we propose a hybrid statistical feature extractor, Local Haar Mean Binary Pattern (LHMBP). It extracts level-1 haar approximation coefficients and computes Local Mean Binary Pattern (LMBP) of it. LMBP code of pixel is obtained by weighting the thresholded neighbor value of 3×3 patch on its mean. LHMBP produces highly discriminative code compared to other state of the art methods. To localize appearance features, approximation subband is divided into $M \times N$ regions. LHMBP feature descriptor is derived by concatenating LMBP distribution of each region. We also propose a novel template matching strategy called Histogram Normalized Absolute Difference (HNAD) for histogram based feature comparison. Experiments prove the superiority of HNAD over well-known template matching techniques such as L2 norm and Chi-Square. We also investigated LHMBP for expression recognition in low resolution. The performance of the proposed approach is tested on well-known CK, JAFFE, and SFEW facial expression datasets in diverse situations.

***Keywords:*** affective computing, appearance based feature, local binary pattern, Gabor filter, support vector machine

## 1. INTRODUCTION

Facial Expression Recognition (FER) plays a vital role in social communication and in conveying emotions [1]. In the earlier development stage, the scope of FER was confined to psychological studies only, but nowadays it covers a broad range of applications including human-computer interfaces (HCI), industrial automation, surveillance systems, sentiment identification, *etc.* Precise recognition of facial expressions can become a driving force for the future automation interfaces like car driving, robotics, driver alert systems, *etc.*

According to input, expression recognition systems can be classified as static or dynamic. In static approaches, features are computed from still image. Whereas in dynamic approaches temporal relationships between features over the image sequence is extracted. In last decade, many video-based methods have been studied [2]. Research is also focused on detecting micro-expressions [2-5], recognition of spontaneous expressions [6], analysis of multi-views or profile views [7] and fusion of geometric and appearance features [8-10]. Nowadays, deep learning based approaches also getting significant attention [2, 11-13].

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# Study and Analysis of Decision Tree Based Classification Algorithms

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***Abstract*—** Machine learning is to learn machine on the basis of various training and testing data and determines the results in every condition without explicit programmed. One of the techniques of machine learning is Decision Tree. Different fields used Decision Tree algorithms and used it in their respective application. These algorithms can be used as to find data in replacement statistical procedures, to extract text, medical certified fields and also in search engines. Different Decision tree algorithms have been built according to their accuracy and cost of effectiveness. To use the best algorithm in every situations of decision making is very important for us to know. This paper includes three different algorithms of Decision Tree which are ID3, C4.5 and CART.

***Keywords*—** Machine Learning, Decision Tree (DT), WEKA tool.

## I. INTRODUCTION TO DECISION TREE

Classification is the task of giving objects to categories which have many diverse applications.

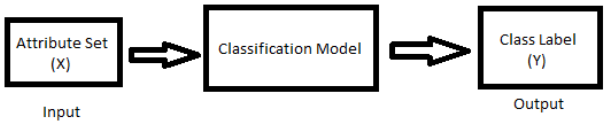


Fig. 1: Classification of mapping attribute set (X) to its class label (Y)

### Decision Tree

A normal tree includes root, branches and leaves. The same structure is followed in Decision Tree. It contains root node, branches, and leaf nodes. Testing an attribute is on every internal node, the outcome of the test is on branch and class label as a result is on leaf node [3, 4]. A root node is parent of all nodes and as the name suggests it is the topmost node in Tree. A decision tree is a tree where each node shows a feature (attribute), each link (branch) shows a decision (rule) and each leaf shows an outcome (categorical or continues value) [4]. As decision trees mimic the human level thinking so it's so simple to grab the data and make some good interpretations. The whole idea is to create a tree like this for the entire data and process a single outcome at every leaf.

## II. RELATED WORK ON DECISION TREE

Decision Tree is similar to the human decision-making process and so that it is easy to understand. It can solve in both situations whether one has discrete or continuous data as input. The example of Decision Tree is as follow [15].

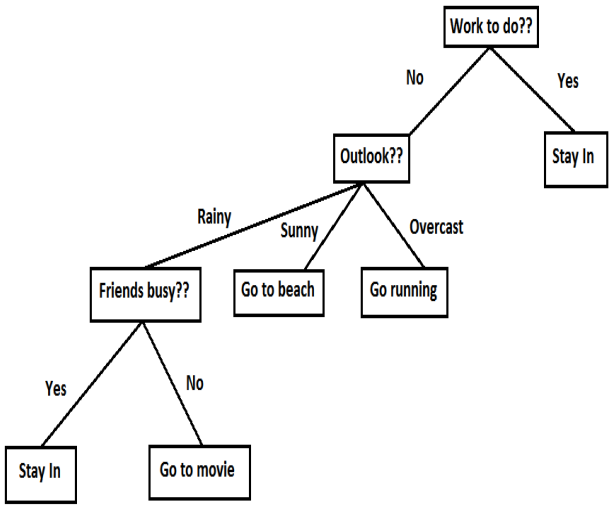


Fig. 2: Example of Decision Tree on what to do when different situations occur in weather.

When data does not offer benefits while splitting, it directly stops the execution. Try to find one test at a time rather than optimize the whole tree together.

Talking about the characteristics of Decision Tree, the ID3 algorithm is simulated only on WEKA tool and the data type of data set is only categorical. ID3 can not take continuous data set for simulation. Similarly, CART and C4.5 have same

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***Research paper***

# Deep Learning Approaches for Protein Structure Prediction

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**Abstract**

In recent years, Machine Learning techniques that are based on Deep Learning networks that show a great promise in research communities.Successful methods for deep learning involve Artificial Neural Networks and Machine Learning. Deep Learning solves severa problems in bioinformatics. Protein Structure Prediction is one of the most important fields that can be solving using Deep Learning approaches.These protein are categorized on basis of occurrence of amino acid patterns occur to extract the feature. In these paper aimed to review work based on protein structure prediction solve using Deep Learning Networks. Objective is to review motivate and facilitatethese deep learn the network for predicting protein sequences using Deep Learning.

***Keywords***: *Bioinformatics, Protein Contact Mapping, Protein-Protein Interactions, Protein Structure Prediction, Protein Docking, Protein Folding, DeepLearning*

## 1. Introduction

Protein Structure Prediction for secondary structure is one of themost important for studying protein structure and function of protein.Understanding of protein secondary structure beyond yields that give benefits to understand human disease and developing thetherapeutic drugs and enzymes. Several attempts at Ab initio secondary structure prediction utilize statistical approaches for employing the data collection from protein with known protein secondary structure of proteins, these methods could not often archive accuracy around 65%[1][2][3]. But recently a novel approach for Ab-Inito approach for protein tertiary structure prediction by Matt spancer et.[1] improve the accuracy around 80.7%. When this sequence (profile) information used for input features, currently the best prediction can be obtained around 80% that improve over past decades. Achieving higher accuracy around 80% is one of the most challenging tasks for researcher.

By using these Neural Network that have effectively used in various variety of classification as well as predicting algorithm including character recognition, speech recognition, weather recognition, face recognition as well for several bioinformatics fields also like Protein Structure Prediction, Protein Docking, Protein Folding, Protein-Protein Interactions etc. These types of network that mainly allows to do prediction for recognizing a complex relationships, as well as if knowledge of these relationship is also more complex which is not known to us. Weights are assigns to these nodes of hidden layers. During the training procedure it will adjust these weights to make output; these output layers is more likely to be reflect the result which is derived from such examples. When

these weights are sets, these information from unknown target input uses as input, allowing these network to predict form unknown properties. Using these multiple hidden units to train these supervised as well unsupervised learning using these Deep Neural Network Architectures[4].

Several Researchers are working of Neural Network based on applied techniques for experimenting such novel Deep learning techniques to stimulate the progress of neural network plays an important role for secondary structure prediction. Using these Conventional Machine Learning techniques- Naïve Bayesian, Logistic Regression, Random Forest, K-Nearest Neighbors (KNN), Support Vector Machine(SVM) and with the use of single hidden layer neural network that have limited in complexity of such function ,these neural network are not efficiently learn. Methods require extracting the hidden features as well complex pattern to be taken out to learn the network. This ability is provided to learn features that learn automatically for such protein. This paper attempt to review and overview of such Deep Learning that contribute to advancement of this fields.

Deep learning or Machine Learning approaches involve several deep learning architectures that learn using high level representation of data[5]. Deep neural network(DNN) is an artificial neural networks having multiple layers of units between input and output layers [6]. To shallow these artificial Neural Networks, Deep Neural Networks model have complex non linear relationshipamong these architectures. DNN architectures have a complex model for object expression as a layer composition.

For observation that can be represented in many ways (for images)such as vector of intensity for each pixel, more abstract way for detection of edges, regions of different shapes etc. several representation are much more easier to learn the model. One of the promising handcrafted features in deep learning is to extract the features algorithm for supervised learning, unsupervised learning, semi-supervised learning also for hierarchical feature extraction[7]. Deep Learning architectures that give best performance in several domains like image processing, face recognition, text recognition also for domains for bioinformatics.

Fields of bioinformatics solve using deep Learning architecturesProtein Structure Prediction, Protein Function Prediction, Protein

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# ANDROID MOBILE PHONE TRACKING USING WEB APPLICATION

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***Abstract:*** The widespread adoption of various technologies by today's teenager has added a modern wrinkle to challenge of parenthood. We are moving closer to world where in which parental scrutiny becomes opt out of opt in. now a parents are concern about behaviors teen engage in online, the people whom they interact and personal information they make available. Most parents check what their teenager does online on social media. In this technical world, many IT industry and business organizations have many employees with their phones. In each and every company confidentiality must be kept by all the employees of the company. There are many organizations have their own rules and regulation. So the company has their most important work to track employee's phones to check whether any of their secret data is leaking or not. So taking this into account, we executed the system called "Android mobile phone tracking using web-application". All the information in the android phone like the call, contacts, location, SMS and other applications will be tracked by the invisible android application and send to the server and administrator can monitor data through a web application. The main purpose of this system is to maintain security of the confidential data and to monitor your young ones.

This system subsists live panel so we can monitor them live. We can access their phones' front, the rare camera as well as a microphone. And the manager can take their location. So that manager can listen to the talk of the employee who is in some meeting for the company. This is a very helpful system for parents they can also see the location of the child.

***IndexTerms*** **- Smartphone, SMS, Google Map, API, GPS, JSP**

## I. INTRODUCTION

In the technical world approximately 68 percentage urban people have their own Android phone. In future, this number will be increased. Many employees are performing more activities on their phone for managing the policies of the company, this is very important to track their phone. The information will be a track like a call (type, name number, duration, recording), SMS (type, name, message, number), location, photos live panel (front camera, rare camera, microphone) WhatsApp, Instagram by the application which will be installed in the Android phone. After installing the application this will disappear so that the person will have no idea about where he is been tracked or not. Not a single notification will be sent to the android phone. On the other hand, admin have to login into the web application for monitoring the person. All the system needs the active internet connection. Android phone will track the information without the internet and when we connect a phone to the internet it will send data to the server. Server stores all the data and when administer login web application will retrieve data from the server. [1, 9, 10]

The administrator can access the data at any time and location with the help of web application. For the live location tracking android phone will send latitude and longitude to the server so that they can track the exact location of the phone.

This system will improve the productivity of the workers and also child have the fear of being tracked so that they will think twice before doing any wrong things. This system will provide high-level security to the organization. [11]

This system is not only for the employee but also tracking dupe's location, monitoring kids performing an unwanted activity on phones also students in the classroom and also many agencies to prevent the data leakage.

## II. FEATURES AND SYSTEM REQUIREMENTS

There should be one User-friendly web application. One can monitor the person through live panel an instant location. Maintenance and installation should not be very costly. It must be provide security and confidentiality. To fulfill this all the parameters "Android mobile phone tracking using web-application" is suggested.

As per mentioned in above parameter.

Android is a mobile OS which offers unite approach to mobile application development. Developed application can run on numerous different devices and also devices are powered using android [13].

JSP (JAVA): For web application development, we use JSP. JSP pages easily combine static templates like HTML. It is easy to query the database and to throw the results up on a web page [14].

SQL: For store database in this system SQL is used. It is very convenient to send and retrieve data from this database.

# Casper: Modification of Bitcoin Using Proof of Stake

**Nakul Sheth, Priteshkumar Prajapati, Ayesha Shaikh and Parth Shah**

**Abstract** Proof of Work is a Bitcoin mining algorithm in which miners used to solve cryptographic puzzle using lots of electricity and computational power. Some amount of bitcoins will be rewarded to the first miner who solved this puzzle and generates a new block in the blockchain. But using proof of stake, this mining process may not require huge amount of computational power and electricity consumption from the miner. So, proof of stake may be the most promising mining algorithm for cryptocurrency. In proof of work, the validation of a transaction is based on the amount of computational power provided by a miner in the blockchain to solve the cryptographic puzzle but proof of stake is a consensus mining algorithm of blockchain that depends upon the amount of stake deposited by a validator into the network. Proof of stake reduces the risk of centralization and energy efficiency from the blockchain.

**Keywords** Proof of work · Proof of stake · Blockchain · Block Bitcoin · Cryptocurrency · Casper

## 1 Introduction

The first decentralized cryptocurrency bitcoin was introduced by Satoshi Nakamoto in 2009 [1]. It is represented by "BTC" in cryptocurrency market [1]. Bitcoin can be created and stored electronically in a public ledger so it cannot be printed on paper like other traditional currencies [2]. Bitcoin uses proof of work mining algorithm for generation of a new bitcoin. Proof of work is a cryptographic puzzle which can be solved by miners by providing computational power in blockchain, and the

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# Provable Data Possession Using Identity-Based Encryption

**Smit Kadvani, Aditya Patel, Mansi Tilala, Priteshkumar Prajapati and Parth Shah**

**Abstract** Nowadays, we have many remote data storage systems available which allow clients to store their data on remote server. But these systems possess many security problems like integrity, availability, and privacy. Unauthorized modification of files must not be possible, but this problem should be resolved. For this, one existing solution called Provable Data Possession (PDP) is available to eliminate integrity problem. This PDP works on public key infrastructure (PKI) and it generates large size keys and requires public key certificates to publish public keys. These characteristics of PDP introduce computation and management overhead on devices having limited computation power. A possible solution to these problems could be usage of Identity-based encryption instead of typical PKI. This solution will generate small-size public keys and eliminate the requirement of public key certificates to publish them.

**Keywords** Remote storage · Identity-based encryption · Provable data possession

## 1 Introduction

Remote Storage System, abbreviated as (RSS), a system or device that basically helps the user to store their files and folders at a secured cloud backup service which are also termed as backup as a service in order to provide the user the facility of summing up more external disk space on their server without adding more hard

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# Machine Learning Techniques to Detect Anomalies in Surveillance Videos: Review

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***Abstract:*** Intrusion location is such a great amount of well-known problem since the most recent two decades where interruption is endeavoured to break into or abuse the framework. It is for the most part of two sorts in view of the interruptions, first is Misuse or signature based discovery and the other is to identify Anomaly in it. In this paper Machine learning based strategies are examined and these are one of the sorts of Anomaly localization methods.

***Index-Terms*** **- Computer vision, Video surveillance system, Behavior representation, Behavior modelling, Anomaly Detection Techniques.**

## I. INTRODUCTION

Intruders might be from outside the host or the system or real clients of the system. Interruption identification is the way toward observing the occasions that are happening in the frameworks or arranges and examining them for indications of conceivable occurrences, which are infringement or dangers to PC security approaches, adequate utilize strategies, or standard security hones [1]. That framework which identifies the interruption in the framework is known as IDS (Intrusion Detection System). This idea has been around for two decades yet as of late observed an emotional ascent in the notoriety and consolidation into the general data security framework [1]. In this way the interruption can be discovered fundamentally utilizing two arrangement systems: Misuse or mark based identification and the other is Anomaly Detection.

## II. RELATED WORKS:

Influence characterization utilizing the wavelet change has been broadly researched in the writing [2]-[5]. In [6], the creators utilized the wavelet change and bolster vector machine (SVM) for highlight portrayal and grouping of intensity quality occasions and aggravations. Masoum et al. proposed a novel methodology for discovery and characterization of unsettling influences in control frameworks [7]. The mutilated flag is first denoised utilizing the discrete wavelet change (DWT), and the overwhelming highlights are then bolstered to a wavelet arrange classifier. A wavelet-based neural system strategy for recognition and order of intensity quality unsettling influences in control frameworks was proposed in [8]. All in all, DWT-based strategies are a compelling method for dimensionality decrease. They lessen the computational time while protecting the exactness. The multi-goals investigation utilized in DWT is an advantageous device for accomplishing faster information mining and decreasing information stockpiling. In any case, contrasted with different techniques, DWT based strategies don't perform well within the sight of clamor.

There are a few different techniques for the arrangement of intensity quality unsettling influence. A few creators have contemplated the location and grouping of intensity quality unsettling influences utilizing SVM [9]-[12]. In [13], two diverse order strategies are thought about. The primary technique speaks to highlights utilizing foremost segment examination (PCA). The portrayal is the contribution to a multi-class SVM. In the second technique, include portrayal and order utilize the autoencoders and softmax classifiers, individually. Despite the fact that the SVM can deal with high dimensional information well, it requires a legitimate decision of the bit capacity and experiences overfitting. What's more, their computational intricacy increments radically with the span of the preparation set.

Fuzzy based techniques for the characterization of intensity quality aggravations were examined in [14]-[17]. Manikandan et al. proposed another strategy in view of an inadequate flag disintegration calculation on mixture word references for discovery and characterization of intensity quality aggravations [18]. Fuzzy techniques are especially helpful for pre and post information examination. In any case, their disadvantage is the high asset utilization included [19].

Peculiarity arrangement is a huge assignment that has been broadly examined inside different research zones in the writing. Change has been generally contemplated in [20]-[23]. The occasion order in light of S-change and probabilistic neural system (PNN) needs less highlights contrasted with the wavelet-based technique and beats the feedforward multilayer (FFML) and learning vector quantization (LVQ) strategies [20]. Not at all like the wavelet change, the highlights acquired from the S-change have physical criticalness and can evaluate the aggravations. The time-recurrence goals of S-change makes it a decent contender for occasion arrangement. Also, it results in better exactness within the sight of clamor. Utilizing the secluded neural system yields better exactness and less preparing time, contrasted with a solitary NN [23].

# Google Page Rank Algorithm and It's Updates

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***ABSTRACT***

*Google's search engine i.e Google's PageRank is one of the biggest search engines with 67% market worldwide but its algorithm is unknown. Though, Bing, Yahoo also holds good amount in search engine market but are far behind Google. Similarly, in China Baidu holds 59% of search engine market. There are billions of websites on internet while millions of websites add up every day. But in this huge dump yard of websites, every website wants to rank up in search engines search result. Question remains same as how to score up in any search result query. So, all search engines more or less have similar algorithm, but in this paper, we'll be focusing on Google's Page Rank algorithm. Google being prominent player in search engine holds a prime role for affecting your quality of website. Content can be in any form on web like email, talk, private stuffs, messages, blogs, images etc. So, there are smart crawlers which are bots or algorithm who fetch data from web and are added to databases in pretty formatted manner. On, later stage link is identified and a tree like structures are made which then describes a page or domain strength on web.*

***Keywords: Google, Search Engine, PageRank, Domain Authority, Page Rank Algorithm, Search Result, Page Ranking, Google Search Engine, Web Page, Keyword Stuffing, Update Google, Search Query, Exact Match, Web Site, Keyword Occurrence.***

## INTRODUCTION&OTHER HEADINGS

With the increase in the use of search engines, it becomes more important for web developers and SEO marketers to have their website score well in rankings in these various search engines in order to reach to their desired audiences. To optimize websites and webpages for search engines, such as Google or Bing, knowledge about the page ranking algorithms is essential. For instance, if a search engine considers how often search terms occur on a webs full text, web content should use the most relevant keywords in their web pages whenever possible to get their webpage in a top position.

For users of search engines, data regarding ranking algorithms is additionally essential so as to judge the hardiness of the results. As noticed, web site house owners do have Associate in nursing interest in having their web site displayed in high positions by search engines. Consequently, users ought to understand the algorithms so as to estimate the hardiness and so the trustiness of the search engines' results.

Understanding of any ranking algorithm will help web owners in estimating the utility of results in case of their search motive. For any instance, user trying to search for the latest match score should be showed result in preference to date while any user searching for weather forecast should be shown result based on nearby locations and not random locations. Similarly, any user searching for a product should get a result relevant to him,

# Survey on Network Simulators

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## ABSTRACT
Simulation software plays a vital role in real-world implementation. Practically hardware setup of network topologies is very costly and strenuous to modify often. Hence various simulators act as the prototype of the real system. These days a wide range of network simulators are accessible, some of them are committed to the wired network, some of them to the wireless network or some dedicated to both type of networks. There are many simulators available such as Ns-2, Ns-3, OMNeT++, NetSim, J-SIM, REAL, OPNET, OMNEST, QualNet, GloMoSim, TOSSIM, DRMSim, TraNS, NTCUns etc. Out of these varieties of simulators, it is difficult for one to select network simulator based on the requirement for a specific job. The following paper provides comparison based analysis of various network simulators. Simulators taken into consideration are Ns-2, Ns-3, OMNeT++, NetSim, REAL, OPNET and QualNet. Information about simulators such as features, advantages, disadvantages, backend environment, the supporting operating system, and minimum hardware requirement is discussed in the following paper. So based on above-mentioned information and analysis, one can make choice of an appropriate network simulator based on the requirements.

## Keywords
Simulation, Network Simulator, Simulators comparison, OMNeT++, Ns-2, Ns-3, REAL, NetSim, OPNET, QualNet, Event driven, GUI support.

## 1. INTRODUCTION
In computer networking, network simulation is a technique in which software program analyzes the behavior of a network by computing the association between different network devices/entity such as the hub, switch, router, access points, links etc. Network simulator provides visualization, animation of flow of packets, the performance of the network and cost-effective technique to design network. There are two types of simulators available, commercial and open source. The following paper presents both type of simulators and some comparative study between them. The following paper discusses various simulators such as Ns-2, Ns-3, OMNeT++, NetSim, REAL, OPNET and QualNet. Out of these varieties of simulators, it is difficult for one to select network simulator based on the requirement for a specific job. For each simulators mention above, the brief introduction, advantages, disadvantages, backend environment, the supporting operating system, minimum hardware requirement and comparison with other simulator is discussed. So based on above-mentioned information and analysis, one can make choice of an appropriate network simulator based on the requirements.

## 2. SIMULATORS
### 2.1 Ns-2
Ns-2 is a network simulator, which is object-oriented and it was essentially created at the University of California-Berkeley. Ns-2 is a various case simulator intend on art network research, exceedingly concentrate on modeling protocols alike wired, wireless, satellite, TCP, UDP, multicast, unicast, telnet, FTP and web. Ns-2 is naturally an event driven simulation software advantageous in studying communication networks. Ns-2 gives the distinctive method for deciding system protocol and simulating their analogous conduct. The burgeoning maturity of the tool is marked ever since certain revolutions and improvements have been implemented. Now, Ns-2 has developed into the most extensive network simulator, and one of the most universally utilized open source network simulator [1].

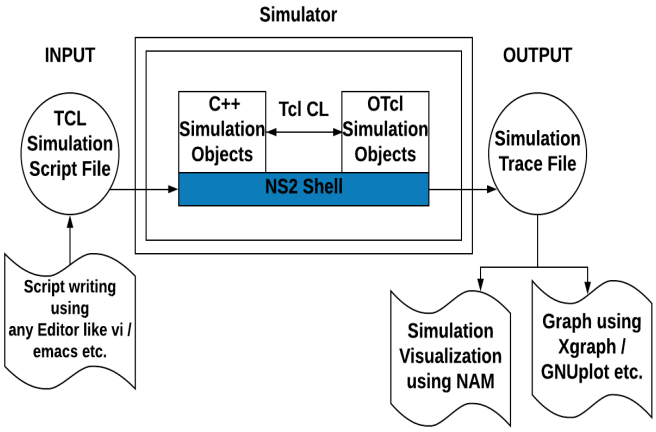


**Fig 1: Ns-2 Architecture [1]**

Developer: Defense Advanced Research Projects (DARPA) through the Virtual Internetwork Testbed (VINT) project at Lawrence Berkeley National Laboratory (LBL), Xerox PARC, UCB, and USC/ISI (Information Science Institute).

License: Open source.

Language: OTCL (Object-Oriented Tool Command Language) and C++.

Operating system supported by Ns-2: Windows (Windows XP, Vista, 7, 10), FreeBSD, GNU/Linux and Mac OS X.

Minimum hardware requirement: 5 GB disk space and 256 MB RAM.

#### *2.1.1 Features*
- Ns-2 isolate control path implementation from the data path implementation.
- To chop down packet and event processing time essential network component objects in the data path are composed and incorporated utilizing C++.

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# Empirical Analysis on Stream Classification & Clustering with Concept Drift in MOA

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***Abstract***— Stream data processing is the next 'big thing' in big data which is one of the most propagating fields in computer science. The stream data analytics is an important aspect while dealing with data stream mining. While dealing with the classification of stream data, concept drift and its effect are required to be considered. Massive online analysis (MOA) is one of the most popular tools to perform analytics on stream data. We primarily deal with three features which are provided by moa namely classification, clustering & concept drift. The key emphasis is on experimental analysis on the combination of different procedures and learner algorithm which are suited for training the model so it can be used for the prediction purpose. Besides that, we have also tried to identify drift (change) in data and its effect on performance. So conceptually after taking proper measures about the noise and drifts, we can construct a model which is persistent to all the changes it faces. Stream analytics also required exploring the different clustering techniques which have a wide number of applications. We have presented all the empirical analysis carried out on classification and clustering techniques in a tool called MOA.

***Keywords***— Stream Processing, Concept Drift, classification, Clustering, MOA.

## I. INTRODUCTION

Massive Online Analysis (MOA) is a software environment for implementing algorithms and running experiments for online learning from evolving data streams [1].MOA (Massive online analysis) can be said as an open-source framework software which allows to build and run experiments of machine learning or data mining on evolving data streams . The Classification techniques commonly build models that are used to predict future data trends [11].

MOA consists of different learner algorithms and also different stream generators which can be encountered from the graphical user interface or command line version. MOA is built on experience with both WEKA and VFML [3]. we deal with three features of MOA Tool namely Classification, Concept Drift, and Clustering. The in-depth descriptions of all the features are described in the following section. Data mining also called information mining or certainly finding is the term which is utilized for removing or finding helpful data from the information that is available in vast databases [22]. Following section includes stream processing with its algorithms which is followed by comparison of different classifiers and experiments of concept drift.

## II. STREAM PROCESSING

Stream processing is a kind of technology that will allow a user to do processing or the execution of a query on the continuous data stream and this will help in detection or the prediction of the conditions in a small span of time after the data is received. It does not provide any option for storage; the incoming data is directly processed as soon as it arrives. The time period for this may range from milliseconds to seconds. Let us consider an example where we want to perform query or operations on the data stream which is arriving from the satellites for the weather prediction, so we can develop a model with help of tool which can predict the weather from the testing on our trained model. This Stream processing is also called real-time streaming analytics, complex event processing.

## III. LEARNER ALGORITHM

**Table 1: Algorithms description**

| Algorithm Name | Description |
|---|---|
| Naïve Bayes | When one has hundreds of thousands of data points and few variables in one's training dataset. If time is the main factor for one's situation then Naive Bayes is one of the fastest classification algorithms. It works on the principles of Bayes theorem to predict the class of unidentified dataset [4]. It is a classification technique based on the principles of Bayes Theorem with an assumption of independence among predictors [4]. In simple language, the Naive Bayes Classifier assumes that the presence of one feature is independent of any other features of the class. The principal disadvantage of this algorithm is that can't support Concept drift, the algorithm is not retrained over the time [15]. |
| Hoeffding Tree | Hoeffding trees were introduced by Domingos and Hulten in the paper "Mining High-Speed Data Streams" [10]. The Hoeffding tree induction algorithm implies a decision tree from a data stream incrementally, briefly checking each |

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# Comparative Study of Web Page Classification Approaches

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## ABSTRACT
Classification of Web pages is one of the challenging and important task as there is an increase in web pages in day to day life provided by internet. There are many ways of classifying web pages based on different approach and features. This paper explains some of the approaches and algorithms used for the classification of webpages. Web pages are allocated to pre-determined categories which is done mainly according to their content in Web page classification. The important technique for web mining is web page classification because classifying the web pages of interesting class is the initial step of data mining. The agenda of this paper is first to introduce the concepts related to web mining and then to provide a comprehensive review of different classification techniques.

## Keywords
Web page classification, Web Mining, Data Mining, uniform resource locator (URL), SVM (Support Vector Machine), KNN (K-Nearest Neighbor), Naïve Bayes, Artificial Neural Network.

## 1. INTRODUCTION
World Wide Web (WWW) is a widespread and collaborating medium with excellent growth of amount. World Wide Web has made it essential for users to operate automated tools in finding the desired information resources [2]. The World Wide Web is the collection of text files, documents, images, and other forms of data in unstructured, semi structured and structured form [11]. The Web is the largest data source in the world [10]. Classification plays a vigorous role in many information management tasks and reclamation tasks [4].

Classification of the Web pages have been considered largely since the Internet has become a huge source of information, in terms of variance and volume [1,17]. Classification being considered a supervised learning problem in which a set of labelled data is used to train a classifier which can be applied to label upcoming instances [3]. There are mainly two types of classification, one is Binary classification and the other is multi-class classification. The issue of classification has been broadly considered in the data mining, database, and information retrieval communities [12].

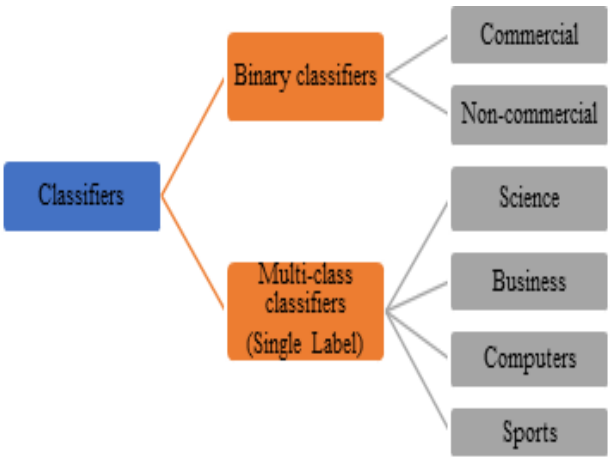


**Fig 1: Types of Classification with its example.**

Web mining can be generally stated as the analysis and discovery of valuable information from the World Wide Web by the mining of stimulating and convenient patterns and implied information from activity related to the World Wide Web [2].

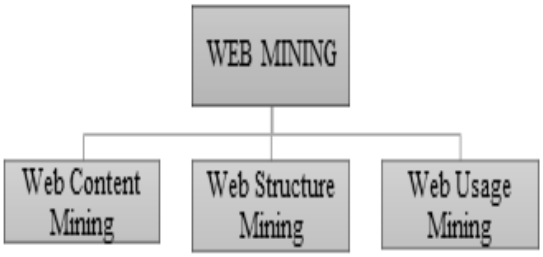


**Fig 2: Types of Web Mining**

Web content mining, it is the method of data mining from the content of documents or their brief descriptions, which includes Text, Audio, Images, Video and Structure Record. Web structure mining, it is the process of concluding knowledge from the World Wide Web organization and also from the links between references in the Web and it includes Hyperlink and Document structure. A Web usage mining, it is the process of extracting fascinating patterns in web access logs and it includes web server logs, Application Level logs and Application Server logs [13]. From a point of view of data mining, Web mining, has three parts of concentration: clustering (finding natural groupings of pages, users etc.), associations (which URLs tend to be demanded together), and classification (characterization of documents) [2].

Web page classification, it is the method of allocating a Web page to one or more predetermined category labels [4]. It is an

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# A Review on a Emotion Detection and Recognization from Text Using Natural Language Processing

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**Abstract**

In today's world communication is done on vast area along with growth of Internet. Communication and human interaction is carried out using social sites, applications etc. in textual form. Emotion plays a vital role in human day-to-day life conveying their feelings and situation in their life. Emotions can be expressed using speech, gestures facial expression, or text. The Ekman model includes happy or joy, sad, disgust, anger, fear and surprise as basic emotion. Emotion Detection from textual source can be done using concepts of Natural Language Processing. In this paper emotion detection using NLP and its naive algorithm are described.

**Keywords:** Emotion Recognition; Natural Language Processing; Key-word based detection; Text Processing, Sentimental measures.

## INTRODUCTION

**Emotion Detection:** Sentiment Analysis is a recent field of research that is closely related to emotion detection and recognition from text. There are two types of analysis available to detect emotion. 1. Sentiment analysis 2. Emotion analysis. [37] In sentiment analysis we can detect [4] positive, negative or neutral feelings from the given user input text. In emotion analysis we can detect types of feelings such as happy, sad, anger, disgust, fear and surprise from the given user input text.

In this approach, first analyzing the given input text and then detect emotion's type of that particular given text. Detecting emotion's type from the text is quite challenging because it can't give 100% perfect result. Face expression give better result compare to the textual expression. For the human-computer interaction, detect and recognize the emotion of the given input text plays a key role. [1] Emotions may be articulated by a human's speech, face expression and written text known as speech, facial and text based emotion respectively. Most of work has been done by speech and facial emotion detection and recognition but text based emotion detection system is also very attractive for research side because now-a-days most of people write their own expression on their personal's blogs, product reviews/journals, comments etc.

[37] Emotion detection and analysis has been widely researched in psychology, finding happy planet index of the particular country and emotion marketing. By using Emotion Detection, we can generate Happy Planet Index according to level of Happiness and Healthy life style of the people among the other countries, and also give rank of the countries according to their Happy Planet Index. Emotion Detection also used in Emotion Marketing. By using Emotional Marketing we can identify that which type of people buy which type of products. Emotionally rich text can be found on product reviews, personal blogs/journals, social network websites etc.

Recognizing textual [2] emotions is a major challenge for both humans and machines, because people may not be able to recognize or state their own emotions at certain times or machines need to have proper position for emotion modeling, and also need advanced natural language processing for developing the emotion models. For this reason, we decided to develop a survey about emotion detection systems from text using natural language processing. Here in this Research paper we use natural language processing based on knowledge approach to identify the emotion type of that particular text.

## LITERATURE SURVEY

**[1] Shivhare, Shiv Naresh, and Saritha Khethawat (2012)** developed a system that can be used to detect emotion from text. In this paper, discussed about [1] Keyword spotting technique, Lexical Affinity Method, Learning-based Methods, Hybrid Methods in step by step manner. Also discuss its limitation due to detect emotion detection.

**[2] Shaheen, Shadi, Wassim El-Hajj, Hazem Hajj, and Shady Elbassuoni (2014)** proposed a [2] new approach for classifying emotion from textual data based on fine grained level. Performs semantic and syntactic analysis for making system context sensitive and uses WordNet and ConecptNet for covering emotion rules to generalize training set. The model shows that relation between words could lead to better accuracy than assigning value to each word. Also it performs better than EmoHeart.

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# Android News App

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**Abstract**

As world's technology is rapidly growing we has fast connection and network to instantly connect to other person. Day to day use in mobile, tablets and laptop is increasing, most of the people already have this facilities. In this fast and information oriented world we need to stay updated with every incidents and news too. This News app is android mobile application where user have access to latest news from 120+ newspapers from 50+ countries. The main focus of this application is to connect news articles from all around the world and deliver it to user as fast as possible in best visualize way.

## INTRODUCTION

Android provides simple application structure and requires Java and Mark-up languages knowledge to work with. Such as, an discrete movement delivers a solitary screen for a user interface and a service whole completes work in the contextual [1]. We can work on different module separately and can combine at the end, we can also add future modules easily afterwards.

API (Application Programming Interface) which is an intermediate interface between different applications. It provides automation, immediacy, adaption and personalization. **News API** provides us the source of news articles from many different sources at one place and updates it. To expand the sources old fashioned **Admin panel** can be used where writers will fill the gap of API.

In 2014, a design language has been created by google named Material Design which is based on "cards" uses grind based layouts, responsive animation, padding and depth effects like shadow to create an responsive, attractive and easy user interface. With the use of different libraries and material design it is possible to use attractive UI.

## RELATED WORK

Native news apps are expensive and difficult to maintain. Native Publishers like BBC News or NY Times uses their own writers to manage articles and manage it. Many native newspaper are divided because of this which causes in lack of resources from one side. Android structure provides great capability with frameworks, libraries and APIs, with the help of it we can provide better user experience and combine this sources at one place while maintaining integrity of its owner.

"Newsapi" provides API that returns JSON (JavaScript Object Notation) metadata for headlines and articles live all around the world at any time [2]. In this app we will be using this API for our better experience. Even after using this API it is possible that we can't reach maximum output of resources for that we can use Admin panel where admin or writers can add news of their own, manage and delete it. This contain will have separate database and access bar which will be labelled as "local news". A module can be implemented where user will have different local news based on his location.

## SYSTEM MODEL

**Use Case Diagram:**

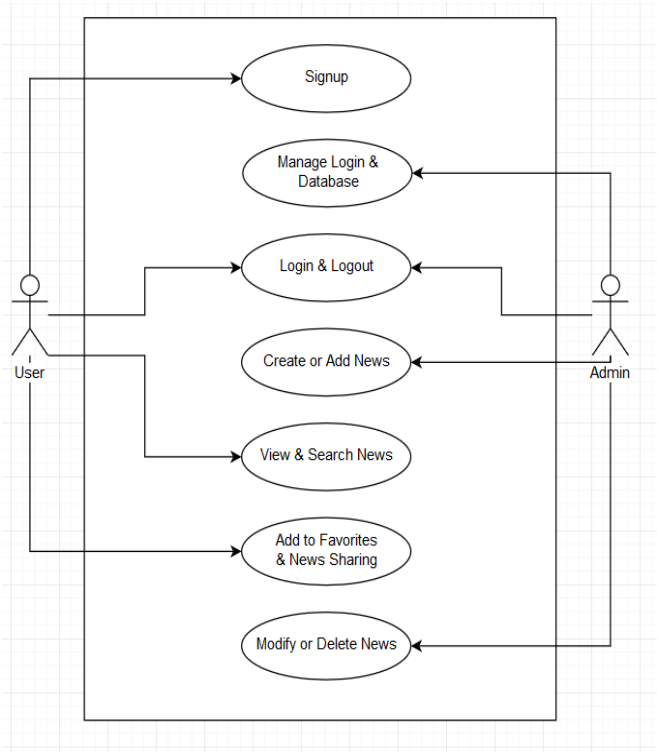


**Figure 1:** Use Case Diagram

Use Case Diagrams referred as behaviour diagram which describes the commutation between actors or participations and set of actions. This is set of actions or use cases will be enclosed by system boundary and can also have relation with each other. Division among tupelos will based on the information gain computed for each attribute.

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# A Review of Advanced Techniques and Technology to Detecting Fingerprint

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***Abstract*—** the human fingerprint have been key biometric technology providing authentication and security for last decades. Currently fingerprint detection technology used in almost every Smartphone and laptop manufacturing company also considering implementing fingerprints detection technology in laptop. It is preferred by the most of people due to its accuracy, reliability, distinctiveness, feasibility and acceptability. There is several technologies available in the market for scanning the image which works on different principle viz. optical unique fingers impression in which Optical fingers impression sensor works by catching a high definition image of the fingertip through light source. This sort of sensor has a specific kind of high resolution advanced camera. The upper layer of the sensor, where the finger is put, is known as the touch surface. After this layer is a light-producing phosphor layer which illuminates the surface of the finger. The light reflected from the edges and valleys of the finger and goes through that layer which catches a picture of the fingertip. Semiconductor likewise called capacitance unique mark sensors, this sensor additionally produces a picture of the edges and valleys of fingertip yet as opposed to detecting the example utilizing light, and it utilizes electrical current. Ultrasonic unique mark sensors, this sensor influences utilization of the standards of ultrasonography keeping in mind the end goal to make visual picture of the unique mark. Ultrasonic sensor utilizes high recurrence sound waves to create the example of fingertip. Here it measures the reflected sound wave to generate pattern.

***Keywords***— Minutiae point, Fingerprint patterns, Imaging Technology, Techniques for extraction, Binarization, Thinning, Crossing Number Algorithm.

## I. INTRODUCTION

The big term Biometrics is short for biological measurable characteristics. There are many physical human traits like eyes, face, figure, palm, hand, are measurable can be termed as a biometrics. To detect, identify and classify the one to one or one to many class one can use three mention trait. These traits are unique for every individual. Biometric authentication is simply authentication driven by biometrics. The application of biometrics are criminal examination, Security and Educational regions, and many more. Iris, palm-print, voice and unique finger impression acknowledgment are generally utilized biometric strategies. Among these systems, unique mark acknowledgment is the outstanding and exact technique. To perceive a man character it is important to coordinate his unique finger impression with the layouts put away in the database. Coordinating depends on the data incorporated into the unique mark picture. The unique finger impression picture contains details focuses, center focuses, edges and valleys, foundation region, forefront zones, neighborhood highlights and worldwide highlights. Details focuses are the little lines in unique mark picture. Center point is the focal zone of unique finger impression picture. It is the most upper purpose of the deepest territory. Edges are the dark lines of unique mark picture and valleys are the white lines of finger impression picture.

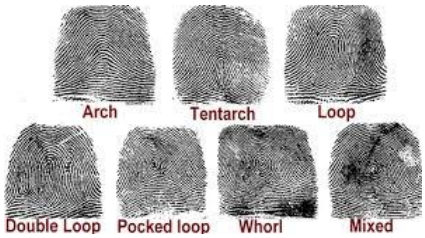


**Figure 1 Fingertip Patterns**

Biometrics is the growing region of bioengineering; it is robotized system of distinguishing individual in view of a physiology. There are a few biometric frameworks currently used, for example, fingerprints, voice, iris, retina, hand geometry, ear geometry, and face. Fingerprint is one forms of biometrics used to provide authenticity and security. Because of their uniqueness and consistency over other technology it has been used for over century. Fingerprint mark is the

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# Comparative Analysis of Search Algorithms

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## ABSTRACT
Nowadays many artificial intelligence search algorithms are available to figure out the problem of shortest path finding. The paper presents the detailed study of informed search and uninformed search techniques. The paper focuses more towards uninformed search strategies such as BFS, DFS, and UCS and informed search strategies like A*, and Best First Search. The paper includes working of search techniques, their merits, and demerits, where these algorithms are applicable, also open and closed list for each algorithm are shown. At last comparison of search techniques based on complexity, optimality and completeness are presented in tabular form.

## Keywords
Artificial intelligence**,** informed search, search algorithms, shortest path algorithms, uninformed search.

## 1. INTRODUCTION
Artificial Intelligence is a study of "How to make computer to think like a human". Artificial Intelligence is a broad area of research. As shown in Figure 1 Artificial Intelligence has sub areas like Machine learning and Deep learning. The fields such as Artificial intelligence, Machine Learning, Deep Learning, and Data Science are inter-related with each other.

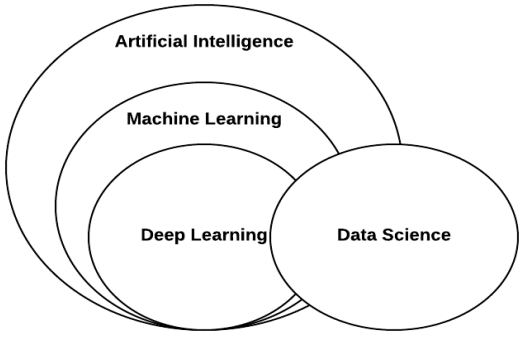


**Fig 1: Co-relation of artificial intelligence with other fields**

Artificial intelligence includes Problem Solving (Search techniques), Knowledge and Reasoning (Resolution, Knowledge Representation, Fuzzy Logic), Adversarial Search: Game Playing (Minimax Algorithm, Alpha-Beta Pruning), Uncertain Knowledge and Reasoning (Uncertainty, Probabilities, Bayesian Networks), and Expert system. The following paper presents more about problem-solving techniques in artificial intelligence. There are two problem-solving techniques in artificial intelligence, uninformed search, and informed search. The paper focuses more on BFS, DFS, UCS, A*, and Best First Search.

## 2. SEARCH ALGORITHM APPROACHES
### 2.1 Uninformed search
Uninformed Search is a blind search or brute force search which includes search techniques such as Breadth First Search, Depth First Search, Uniform Cost Search, Iterative Deepening, and Bidirectional Search. Uninformed search does not contain any information about the number of steps to reach from current state to goal state. The uniformed search will consider the path which is most promising at that moment, it will not consider the optimum path to reach the goal.

### 2.2 Informed search
Informed search is Heuristic search which uses heuristic function (To estimate how close a given state is from goal state) to solve a problem. Informed search uses generate and test approach. It includes hill climbing, steepest hill climbing, A*, AO*, and Best First Search algorithms. Informed search is more efficient than uninformed search. In informed search heuristic function is used as a model that will lead us to the goal state. The informed search will not traverse search tree blindly. It will consider the next node to traverse based on some evaluation function (Heuristic Function) to reach the goal state from current state.

## 3. WORKING OF SEARCH TECHNIQUES
### 3.1 BFS (Breadth first search)
In Breadth First Search all nodes are expanded level by level. It first expands all the nodes at first level in the search tree, then expands all the nodes of the second level and this way it reaches the goal. In Breadth First Search the frontier is actualized as a queue which works as First In First Out (FIFO). It is a poor strategy when all solution has a long way length or then again there is some heuristic information accessible [1]. It is not utilized when memory requirement is high. Time complexity is $O(b^d)$ and space complexity is $O(b^d)$, where b is branching factor and d is solution depth. For example, consider a graph (Figure 2). Table 1 shows open list and closed list for BFS. The open list is set of nodes yet to explore and closed list is set of nodes already been explored. At level 0 node 1 is expanded first. Children of node 1-2, 3, and 4 are added to the queue. Then according to First In First Out approach node 2 is expanded and child of node 2-6 is added to the queue. This way search reaches the goal state.

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# Smart Farming using Internet of Things

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**Abstract**

Over the last decade, there has been an immense progress in science and technology. This has poured a great interest among scientists and researchers about designing smart farming system. The smart farming system can benefit us in various ways such as an increase in production, water conservation, real-time data and production insight, lowered operation costs, increase in quality of production, accurate farm and field evaluation, remote monitoring, equipment monitoring etc. Internet of Things has provided farmer better ways to install various sensors and are also provided with numerous data. But as these technologies are unable to reach the majority of the farmers, they are unaware of these useful and efficient techniques for farming. In this paper, a smart farming model is constructed which is based on Internet of Things (IoT). This proposed model is equipped with various sensors for measuring environmental parameters required for the crops. It includes node MCU and various sensors for executing the whole process. The various features of this system are to collect all the environmental data and give to the farmers so that they can take an accurate decision about farming. The system will execute the tasks such as soil moisture sensing, temperature, and humidity sensing, indicating water level, detecting an intruder in the field and switching an electric motor on/off manually and automation is also provided. The system which is proposed has been tested, readings have been monitored and obtained satisfying results will enable this system to be very useful in smart farming.

**Keywords:** IoT, Zigbee, Node MCU, Soil Moisture, Water-Level, Humidity, Sensors, Website, and Data.

## INTRODUCTION

In most of the countries, agriculture has played a vital part in the economic development. In the developed countries farmers have been provided with various technology to increase the production. While in the under-developed countries farmers don't have enough knowledge about those technologies and so farmers are still relying on old techniques. They do not know about the power of emerging latest technologies which can drastically increase the crop production. Various factors contribute to the yield of crops such as proper soil preparation, different varieties of crops and respective techniques for production, chemical fertilizer's volume added to the soil, various natural hazards occurring in the cultivated place, number of seeds added in the related area, proportion of moisture in the fields, plant disease detection, adoption of modern technologies etc. Farmers lose a huge amount of money because of usage of wrong irrigation mechanisms, insect pests and attack of plant diseases, usage of the uncalculated amount of pesticides and insecticides, and inaccurate prediction of weather. Smart farming techniques enable the farmer to use latest technologies and increase the crop yield by eliminating various risk factors involved in the farming. The farming systems which are used currently is helping the farmers up to some extent by reducing labor costs but somehow these systems are unable to consider and predict the weather conditions suitable for the crop. Thus, the yield of crops is limited while we can still increase it. On the other hand, not every farmer uses this system as they are very expensive. Thus, there is a need of currently available wireless technologies and automation in farming which is not much expensive and every other farmer can use it. Various sensors such as water level indicator, soil moisture detection, temperature and humidity sensing, PIR (Passive Infrared sensor), LDR (Light dependent resistor) etc. can be used to collect various environmental data for accurate future decision making and replacing the labor work by automation. This will improve crop yield significantly. The most advanced technology which can be used in the farming is IoT (Internet of Things) which has revolutionized all major sectors such as industries and business across the world. Using IoT one can interact many things with each other to produce required information. It is used to determine the working status of the implemented system remotely from anywhere around the world. There are mainly four benefits that farmers get from IoT application in agriculture. First one is, increase in the yielding by making a better decision from the accurate data, the second benefit is the cost of production is

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***Research paper***

# Modeling Transport Layer Protocol Behaviour to Improve Data Center Network Performance

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**Abstract**

Today, there is a generalized standard usage of internet for all.The devices via multiple technologies that facilitates to provide few communication methods to scholars to work with. By forming multiple paths in the data center network, latest generation data centers offer maximum bandwidth with robustness. To utilize this bandwidth, it is necessary that different data flows take separate paths. In brief, a single-path transport seems inappropriate for such networks. By using Multipath TCP, we must reconsider data center networks, with a diverse approach as to the association between topology, transport protocols, routing. Multipath TCP allows certain topologies that single path TCP cannot use. In newer generation data centers, Multipath TCP is already deployable using extensively deployed technologies such as Equal-cost multipath routing. But, major benefits will come when data centers are specifically designed for multipath transports. Due to manifold of technologies like Cloud computing, social networking, and information networks there is a need to deploy the number of large data centers. While Transport Control Protocol is the leading Layer-3 transport protocol in data center networks, the operating conditions like high bandwidth, small-buffered switches, and traffic patterns causes poor performance of TCP. Data Center TCP algorithm has newly been anticipated as a TCP option for data centers which address these limitations. It is worth noting that traditional TCP protocol.

***Keywords***: *Data Center Network, Transport Protocol, Multipath Transport, Data Center TCP, Multipath TCP.*

## 1. Introduction

TCP is the leading protocol on the Internet and has demonstrated its scalability to operating conditions of the network. TCP is leading Layer-3 transport protocol in the data centre situation, particularly in cloud computing data centres. However, its performance in the data centre is of poor, and the prime reason is the small-buffered and high-speed switches used in the data centre. Also, the types of traffic of applications in data centers are quite different from WAN; data centre applications produce a mixture of burst traffic, short Messages, and often have firm deadlines for the completion of those data traffic In the last decade, data centres have dominated the computing market. Nowadays, large data centres have thousands of servers which performs distributed applications that distribute computation and storage to thousands of machines. It is unfeasible to manually allocate tasks to machines when there are so many hosts. Though we can write applications to take benefit of locality in the data centre, huge distributed calculations are distributed across many racks of machines, with the adverse result creating bottleneck networks.

Such topologies creating bottleneck networks are in progress to be conveyed; Amazon Web Service's most recent EC2 server farm has a repetitive structure - between a few hosts, there are multi-path accessible. Regularly switches run a variation of Equal-cost multipath routing, casually hashing streams to meet cost ways to adjust the heap over the topology.

Nonetheless, with most such topologies it takes numerous synchronous TCP associations per host to produce adequate streams to verge on adjusting activity.

With more regular load levels, utilizing ECMP on these multi-arrange topologies causes flows to collide on at least one link with high probability.

The techniques used by Data Center Transport Protocol are a queue management scheme called as active queue management at the switch, based on Explicit Congestion Notification and a sender/receiver window control scheme at the source end device, which reacts to Explicit Congestion Notification marks by reducing the window size in proportion to the fraction of packets that are marked with special characteristics used for marking congestion in the packet. The performance of Data Center TCP relies on two important parameters associated with Data Center TCP protocol : (1) K, the threshold on the queue at the switch above which packets are marked with special characteristics used for marking congestion and (2) g, the weight parameter used for exponentially averaging explicit congestion notification mark values at the sender end node [01].

It has been observed that modern data center has different traffic requirements. If we classify the data center based on the type of traffic handled by the data center, then network traffic is broadly classified as under following.

Data center which handles query traffic (inflows and outflows) (very short length traffic like Google search query). Data center which handles medium range traffic (inflows and outflows) (like e commerce traffic consist of images and other relevant information).

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## REFERENCES

[1] Lee TH, Wong SS. CMOS RF integrated circuits at 5 GHz and beyond. *Proc IEEE.* 2000;88(10):1560–1571.

[2] Aoki I, Kee SD, Rutledge DB, Hajimiri A. Distributed active transformer-a new power-combining and impedance-transformation technique. *IEEE Trans Microwave Theory Tech.* 2002;50(1):316–331.

[3] Jin B, Han K, Choi J, Kang D, Kim B. The fully-integrated CMOS RF power amplifier using the semilumped transformer. *Microwave Opt Technol Lett.* 2008;50(11):2857–2860.

[4] Lin K-C, Chiou H-K, Wu P-C, Tsai H-H, Juang Y-Z. 5-GHz SiGe linearity power amplifier using integrated feedforward architecture for WLAN applications, Proceeding of IEEE International Symposium on Circuits and Systems 2014, 1508–1511.

[5] Yue CP, Wong SS. On-chip spiral inductors with patterned ground shields for Si-based RF IC's. *IEEE J Solid State Circuits.* 1998;33(5):743–752.

[6] Dickson TO, LaCroix M-A, Boret S, Gloria D, Beerkens R, Voinigescu SP. 30–100-GHz inductors and transformers for millimeter-wave (Bi)CMOS integrated circuits. *IEEE Trans Microwave Theory Tech.* 2005;53(1):123–133.

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# Highly selective bandpass filter using substrate integrated waveguide technology for FMCW radar application

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## Abstract

A bandpass filter using substrate integrated waveguide technology is proposed in this paper for ISM band frequency (5.7–5.9 GHz) application. Metallic inductive posts are used for the realization of the filter. The proposed structure provides pass band from the frequency range of 5.72 GHz to 5.84 GHz with the insertion loss of 0.7 dB and return loss more than 25 dB. Frequency tuning is carried out from the frequency range of 5.65 GHz to 6.06 GHz with the variation of pass band bandwidth from 88 MHz to 222 MHz. All the simulations are carried out by high frequency structure simulator based on FEM method software. Proposed bandpass filter is fabricated and measured result indicates better performance. It will be utilized in the system developed at CSRTC for the suppression of higher order harmonics in frequency modulated continuous wave radar at the frequency from 5.725 GHz to 5.875 GHz.

**KEYWORDS**

band pass filter (BPF), frequency modulated continuous wave (FMCW), high frequency structure simulator (HFSS), insertion loss, return loss, substrate integrated waveguide (SIW)

## 1 | INTRODUCTION

Emerging field in RF and Microwave continuously challenge to develop components which provides greater performance in terms of efficiency, size, and cost. In recent days SIW structure finds number of application at microwave and millimeter wave frequency because of its superior performance similar to conventional waveguide in a planar form.[1,2] Compare with conventional metallic waveguide it comes with light weight as well as integration of active and passive elements are possible with the structure.[3] SIW is a waveguide like structure created by insertion of metallic vias in dielectric material in a way that it connects top and bottom metallic plate as shown in Figure 1.[1–4]

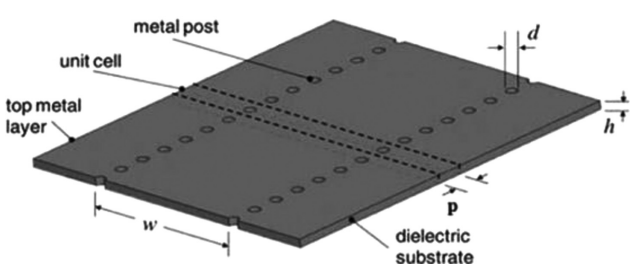


**FIGURE 1** Basic structure of SIW

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# A low-cost and efficient cloud monitoring camera system design for imaging satellites

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**ABSTRACT**

Design and development of a cloud monitoring camera (CMC) as a secondary camera for imaging/remote-sensing satellites is proposed here. It is well known that presence of clouds alters the earth-atmospheree energy budget by scattering and absorbing the shortwave radiation and absorbing and re-emitting the infrared radiation. Detection of clouds at precise positions, prior to the initiation of the imaging session of the primary (super resolution) camera can aid in saving power as well as memory storage of the satellite. Key feature of the proposed system is the implementation of an onboard cloud detection system in the visible band. The proposed system is miniature in size and cost-effective when compared to the existing integrated visible and infrared band detection system. It primarily consists of lens assembly, detector head assembly, field programmable gate array (FPGA)-based camera electronics system with supporting proximity electronics. Cloud detection algorithm for the visible band images is derived and simulated with the help of Laboratory Virtual Instrument Engineering Workbench software. The verification and hardware realization of the algorithm is achieved by implementing it on a FPGA-based system. Overall simulated and measured efficiency of more than 94% was achieved. The volume of the system is 85 mm × 85 mm × 25 mm and weighs approximately 2 kg, making it suitable for satellite mounting.

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## 1. Introduction

Remote sensing is extensively used in the field of scientific and research activities. It offers the data containing images taken from satellites in Narayana (1999), Henderson and Lewis (2012), Vivone et al. (2014). It is prerequisite that images captured by satellites are clean and informative. Images contaminated by clouds confine the derivation of atmospheric and surface parameters. Hence, cloud detection is an important and pre-processing task for satellite imaging system. Moreover, automatic cloud detection can be beneficial for various applications such as hazard assessment, oceanography, geology, weather and climate studies, etc.. In case of

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# Millimeter-wave $TE_{01}$–$TE_{11}$–$HE_{11}$ mode converter using overmoded circular waveguide

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**ABSTRACT**

The paper presents overmoded circular waveguide mode converters ($TE_{01}$ into $HE_{11}$ with $TE_{11}$ as an intermediate mode) used in a 42 ± 0.2 GHz, 200 kW gyrotron transmission line system for plasma heating in electron cyclotron resonance heating application. To convert mode from $TE_{01}$ to $TE_{11}$, we have used wriggle converter method with a deformation in the converter axis and for $TE_{11}$ to $HE_{11}$ mode converter the depth of corrugation decreases gradually from $\frac{\lambda}{2}$ to $\frac{\lambda}{4}$. Both the converters are optimized in terms of design parameters using mode field matching technique. The $TE_{01}$ to $TE_{11}$ mode converter showed a conversion efficiency of 95% (predicted 99%) for a length of 1205 mm, while $TE_{11}$ to $HE_{11}$ mode converter gave conversion efficiency of 99% (predicted 99.98%) for a diameter of 32 mm. Cross-polarization isolation of 31.7 dB is obtained in $TE_{11}$ to $HE_{11}$ mode converter. Convergence of the theoretical values and the simulated results indicates that the converters meet the system requirements.

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**KEYWORDS**
Overmoded circular waveguide; mode converters; coupled wave theory; periodic perturbation; mode conversion efficiency; radiation pattern; ECRH (electron cyclotron resonance heating)

## 1. Introduction

In electron cyclotron resonance heating (ECRH) application, high-power millimeter-wave in $TE_{0m}$ mode is generated from the gyrotron and is used for plasma heating [1,2]. The performance parameters of gyrotron are given in terms of its frequency, output power, and mode purity [3]. The transmission of this power is majorly done using highly oversized circular waveguides that produce low transmission losses (as the damping rate of $TE_{01}$ mode and length of $TE_{0m}$–$TE_{0m-1}$ mode converters decrease with an increase in the waveguide radius) [4]. However, mode generated from the available gyrotron is $TE_{0m}$ (unpolarized) mode and an efficient heating of plasma requires axis-symmetric linearly polarized narrow pencil gaussian beam [5]. Hence, it is required to convert the generated $TE_{0m}$ mode into a linearly polarized $HE_{11}$ mode. There are two possible schemes to produce $HE_{11}$ mode from $TE_{0m}$ mode [5]:

(i) $TE_{0m}$–$TE_{01}$–$TM_{11}$–$HE_{11}$;
(ii) $TE_{0m}$–$TE_{01}$–$TE_{11}$–$HE_{11}$.

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# Wideband High Gain Fractal Antenna for Wireless Applications

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**Abstract**—The paper focuses on design and analysis of hexagon inspired fractal geometry and defected ground plane to evaluate the performance of patch antenna for wireless applications. It also emphasizes increasing the antenna bandwidth by incorporating novel rectangular Defected Ground Surface (DGS) structure with CPW feed. In the proposed work, antenna is simulated and fabricated for wireless applications using FR4 as the substrate, and it covers wide band with high gain. The antenna resonates at frequencies of 3.79 GHz and 5.5 GHz with measured return losses of −25.02 dB and −26.03 dB, respectively, making the proposed antenna suitable for Wi-Fi, cordless phone, wireless devices and wireless sensor networks applications.

## 1. INTRODUCTION

Antennas are most important part of any communication systems. In modern wireless communication, it is required to have small size, high gain, high directivity, wide/multi-band and low cost antennas. This research focuses on the design of ultra-wide and multi-band antennas with high values of gain. A wide-band antenna has its own advantages such as low transmission power, high data rate, high performance in multipath channel, and resistance to jamming which can be satisfied using fractal antenna geometry [1]. Antenna is a transducer employed to transmit or receive electromagnetic waves and is a transitional structure used between free space and energy guiding device. Modern technology has put special importance on small size and reliability, internetworking across the globe making technology to be more intelligent and sophisticated to provide all time communication which should be cost effective, noise free and robust. Compact microstrip patch antennas are increasing in popularity for use in communication systems due to their miniaturized size and cost effectiveness [2–4]. They offer good compatibility for embedded antennas in hand-held devices. The basic form of a patch antenna consists of a conducting patch printed on a ground plane which radiates only at the desired frequency band. Microstrip patch antennas have some disadvantages such as inherently narrow impedance bandwidth, low gain and poor radiation efficiency [5]. Some design techniques have been developed to overcome the disadvantages and design antennas with different properties that can fulfill the requirements in different applications. Wideband technology has attracted much attention recently because the communication systems promise high bandwidth, reduced fading from multipath propagation and low power requirements. Fractals were first introduced by Mandelbrot in 1977 as a way of ordering structures whose sizes were not whole numbers. Fractal has unique geometrical features in nature [6]. To overcome the disadvantage of microstrip patch antenna and for multiband applications, fractal antenna geometry is useful [7, 8]. Main advantage of fractal is compact size, multiband, and high gain [9, 10]. It can be used in the form of branching of tree leaves, plants, rough terrain, jaggedness of coastline, and many more examples in nature [11, 12]. Fractals have been applied in various fields such as image compression, study of high altitude lightning phenomena, and

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RESEARCH ARTICLE

# Compact wideband transparent antenna for 5G communication systems

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## Abstract

A compact wideband transparent antenna designed on plexiglass substrate ($10 \times 12 \times 1.48$ mm$^3$) is presented. The optically transparent antenna consists of a radiation patch and a ground plane fabricated using AgHT-8. The antenna design comprises of rectangular shaped branches optimized to attain the wideband characteristics. The proposed antenna design has impedance bandwidth of 58.71% covering the frequency range of 23.92-43.8 GHz. The radiation pattern of the proposed antenna shows directional radiation pattern with electrical tilt. All calculated and measured results show that proposed compact transparent antenna is an excellent candidate for 5G communication systems and wideband code division multiple access applications.

KEYWORDS

5G, AgHT-8, compact, transparent, wideband

## 1 | INTRODUCTION

The world is moving towards the era where people are demanding for smart gadgets which work faster than ever, having seamless connectivity. The ever-increasing demand for greater data rates due to the adoption of mobile handsets for video streaming needs continuous evolution in the technology being used by the devices. 5G technology is taking over 4G technologies to fulfill the user demands. Such systems provide high-speed connectivity for multimedia applications.[1–3] Internet of Things is also a reality now through which billions of devices will be connected in near future.[4] Antenna design to fulfill the requirement of high-speed networks is a challenging task for antenna designers. The antennas for 5G systems demand wideband antennas covering the mobile applications and which also helps in miniaturization of devices.[5] The device miniaturization can be achieved using flexible antennas or transparent antennas where transparent antennas have an upper hand in terms of maintaining the aesthetics of the devices while avoiding bending losses.[6] Transparent antennas mainly use conductive oxides doped with Indium, a combination of silver and tin, fluorine, zinc, and aluminum. Indium being a rare earth metal is on the verge of extinction so it is not much used. Aluminum doped zinc oxide is still not commercialized however tin oxide is widely been accepted for its use as a useful material for fabrication of antennas. The combination of silver and tin oxide is used for making Silver Tin Oxide AgHT sheets which is available in 2 variants namely AgHT-4 and AgHT-8 where the number indicates the surface resistance in Ω-m. A 4 Ω-m has a conductivity of 250 000 Siemens/m and 8 Ω-m has conductivity of 125 000 Siemens/m. As the surface resistance increases, an optical transparency increases which show that AgHT-8 has a higher optical transparency while lower conductivity over AgHT-4.[7]

Wideband antennas systems are very encouraging due to its use for communications in short range with a high value of data rate, less power consumption, and wide bandwidth. Various transparent antennas are proposed in the literature for dual-band[8,9] and ultra-wideband[10–13] characteristics but very few covers the millimeter wave applications. Researchers have proposed various nontransparent antennas using array structures for 5G applications[14,15] and mobile communication networks.[16] Few more antennas useful for 5G smartphone applications are proposed in Refs. [17,18]. Semi-transparent flexible antenna working in the range of 7-13 GHz is proposed for 5G applications using Polyethylene terephthalate PET and silver nanoparticle ink.[19] Transparent antenna interfaced with Solar cells working at 28 GHz is proposed in Ref. [20] where analysis of the antenna is carried out by using various transparent conductive sheets over a glass substrate. A wideband antenna made up of fabric tissue having transparent and conductive characteristics integrated with flexible PDMS substrate is proposed inRef. [21] which is analyzed for 5, 10, 15, and 18 GHz in terms of efficiency and gain. A flexible antenna operating at 28 GHz

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RESEARCH ARTICLE

# Dual band slotted transparent resonator for wireless local area network applications

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**Abstract**

In this paper, a transparent dual-band antenna having a size of $\lambda/4 \times \lambda/4$ mm$^2$ at the lower resonance frequency of 2.4 GHz is proposed. Antenna operates at the frequency band of 2.47 GHz and 5.32 GHz, respectively. The resonator geometry is in the form of a modified slotted split ring resonator with the extended slot line sections at the split ends. AgHT-8 conductive oxide material is used for the radiating element and ground plane of the antenna. Optically transparent borosilicate glass having a dielectric constant of 7.75 with 2 mm thickness is used as the substrate material to achieve the optical transparency. The impedance bandwidth of the proposed antenna in the lower and higher frequency bands is 8.3% (2.34 GHz-2.54 GHz) and 2.4% (5.26 GHz-5.4 GHz), making the proposed transparent antenna suitable for dual-band WLAN applications.

**KEYWORDS**

AgHT-8, dual band, glass substrate, transparent conductive oxide, WLAN antennas

## 1 | INTRODUCTION

Wireless local area network (WLAN) is emerging as a strong access technology for business enterprises as well as consumers. With the accelerating increment in the total number of devices using Wi-Fi and due to the restricted accessibility of 3G/4G bandwidth, it is important to provide seamless connectivity and uninterrupted streaming at locations like airport, restaurants and offices in a decentralized manner.[1] The network devices to be used for providing WLAN services need the efficient antennas, which have to be mounted externally or internally on the Wi-Fi enabled devices and/or access points.[2,3] With the current trend of geometrical miniaturization of wireless devices, the researchers are working towards making the antenna size smaller while maintaining the antenna efficiency and gain as high as possible.[4] Since the late 1970s, many researchers have validated the research on microstrip antenna, which offers many advantages like low profile geometric size, ease of integration and compatibility with various circuit boards.[5–7] The research results have backed to the success of patch antennas in various areas of communication, defense, and remote sensing.[8–10] In the early 1990s, Ito and Wu[11] published the work in the field of transparent antennas after which Simons and Lee[12] introduced initial work on optically transparent antenna by using AgHT-8 as the conductive oxide material on PET (polyethylene terephthalate) sheet covering 2.3 GHz and 9.5 GHz. Research work on the transparent antenna re-emerged in 2000 when Mias et al.[13] published the work regarding the feasibility study on the antenna performance using transparent oxides. Nessel et al.,[14] a NASA engineer revealed wideband, high gain, multilayer Yagi antenna for X band using AgHT-8. Guan et al.[15] designed PIFA and monopole antenna for WLAN applications. Transparent conductive oxide material AgHT-4 had been used by Katsounaros et al.[16] for making UWB antenna followed by designing the transparent antenna for RFID applications.[17] Other researchers using micro metal mesh (MMMC), indium tin oxide (ITO), and fluorine-doped tin oxide (FTO) have represented similar work for the antenna developments in various wireless applications.[18]

As the transparent antennas are capable of being artistically designed for the use as a camouflage, they can be implemented in an array form on the surfaces for the use in various applications[19–21] without causing uneasiness to the people in the vicinity. Transparent conductive materials, which can be used as the conducting material in antenna design, are mainly made up of oxides like tin oxide (indium), zinc oxides (fluorine, aluminum), and silver coated polyester (AgHT) maintaining optical transparency in modest patch antennas.[22] Due to the optical transparency of the

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RESEARCH ARTICLE

# Transparent dual band antenna with μ-negative material loading for smart devices

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**Abstract**

A dual-band optically transparent antenna having two slotted circular rings with partial ground plane is proposed for smart applications. The antenna has circular split ring resonators (SRRs) array which offers negative refractive index properties to the resonator. The antenna is fed using microstrip feed line which is matched at 50 Ω. The conducting patch, partial ground plane and two circular SRRs are made up of transparent conducting thin film AgHT-8 having transparency of above 80%. Substrate in the form of Plexiglas is used for making the antenna structure completely transparent. Metamaterial is incorporated for achieving acceptable values of antenna gain. The patch design is engineered for antenna operation in IEEE a/b/g/n frequency bands working at 2.4 GHz and 5.5 GHz, respectively. The size of the proposed transparent antenna is 35 × 35 × 1.84 $mm^3$ with measured impedance bandwidth of 13.27% and 5.28% achieved for lower frequency band of 2.4 GHz and the upper frequency band of 5.5 GHz, respectively. The proposed antenna is useful for smart devices communicating over WLAN frequency bands without need of extra board space due to the optical transparency of antenna.

**KEYWORDS**

AgHT-8, smart devices, transparent antenna, WLAN application, μ-Negative material

## 1 | INTRODUCTION

Smart systems can be broadly classified as miniaturized and intellectual devices which are ubiquitously connected. These systems integrate functionalities like automation, sensing, and controlling.[1,2] Sophisticated and varied advanced components are needed to fulfill the requirements for smart applications. The devices should be capable of communicating with other devices in the environment over RF and Wireless medium which needs efficient antennas to be called as a smart device. Smart devices needs internet connectivity to work efficiently which can be provided through mobile internet, WLAN, or WiMAX networks.[3] WLAN however has many advantages over other technology owing to its robustness and ease of availability with low cost rates.[4]

The antennas which can be used for smart applications should be low profile and easy to integrate on display screens of the devices.[5] If the antenna construction is such that the antenna is optically invisible then it can be directly integrated on any screens of the smart devices.[6,7] Transparent antennas are recently luring lot of attention of researchers due to its optical transparent properties along with good value of conductivity which makes them a good candidate for its use in display glass,[8] solar panels,[9] windows, and glass buildings.[10] However, antennas made up of transparent antennas suffer from low gain as they are made up of AgHT-8 (silver layer sandwiched between two layers of tin) with conductivity value of 125 000 Siemens/m which is very much less as compared to the copper which has a conductivity value of $5.96 \times 10^7$ Siemens/m.[11,12] It is difficult to improve the gain of transparent antennas as the conductive material properties of AgHT need to be changed for increasing the electron mobility for improving the gain which is not in our hand.[13–15] A technique for increasing the efficiency by the means of soldering where silver was embodied to increase the efficiency by 20% has been proposed in literature.[16] However, the gain improvement is of great demand by the researchers for its commercial viability. Few more techniques including multilayer antenna,[17] gold nano-layer deposition.[18] metamaterial incorporation[19] and slotted structures[20] are proposed. One more technique of increasing the gain is proposed by application of a conductive coating in the form of fine strips near high current density areas of antenna but this leads to decrease in the overall transparency.[21]

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# Comparative Research on Region based Image Segmentation Algorithms

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***Abstract:*** ***Image segmentation is crucial part of image processing. This paper reviews various region based digital image segmentation algorithms .After basic introduction, we have also discuss comparison of such type of algorithms. A central problem, called segmentation, is to distinguish objects from background. For intensity images four popular approaches are: threshold techniques, edge-based methods, region-based techniques and connectivity-preserving relaxation methods.Threshold techniques, which make decisions based on local pixel information, are effective when the intensity levels of the objects fall squarely outside the range of levels in the background. Because spatial information is ignored, however, blurred region boundaries can create havoc.A region-based method usually proceeds as follows: the image is partitioned into connected regions by grouping neighboring pixels of similar intensity levels. Adjacent regions are then merged under some predefined criterion involving homogeneity or sharpness of region boundaries.***

***Keywords—*** : ***image processing, image segmentation ,region based segmentation, Thresholding.***

**Introduction**

Image segmentation is basically understood as part of image processing in which it divides a digital image into its continuous, disconnect and nonempty subset, which gives suitability to removal of attribute. Almost all segmentation algorithms are based on discontinuity around edges and similarity in same region[1],[3].In image segmentation ,we divide main image into various parts for the sack of our understanding or depending upon the application that we are using .Ideally, before start of actual image processing noise in the image should be eliminated. Image segmentation should be stopped when we get better visual results.Before actual start of image processing, color spaces should be changed into given color space. then for reducing the noise different filtering techniques might be used.Image segmentation algorithms decide segmentation results, so for that we have to choose proper algorithm.In this paper region based image segmentation algorithms are classified and reviewed .then they are discussed in depth.

$f(x,y)$

$f_1, f_2, f_3, \ldots, f_n$

## I. CLASSIFICATION OF REGION BASED IMAGE SEGMENTATION ALGORITHMS

### A. Thresholding methods

Thresholding techniques made decision on local pixel information.

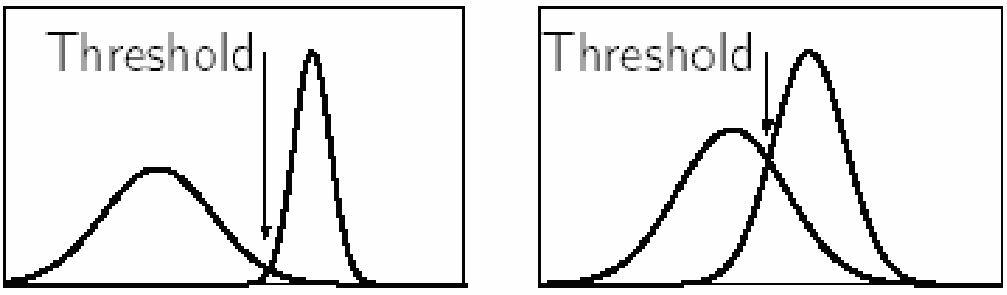


Fig-1.1 Threshold Selection

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# CMOS Active Inductor: A Technical Review

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**Abstract:** The demand of configurable and compact RF integrated circuit is ever increasing since the inception of CMOS technology. The inductor has been an essential component in RF system design blocks such as voltage controlled oscillator, low noise amplifier, matching network, filter, power divider, power supply noise reduction etc. The gyrator-C based CMOS active inductor is recent research topic because of its tunability, compactness and high quality factor. This paper presents the detailed review of gyrator-C based CMOS active inductor and several techniques to enhance its performance.

**Keywords:** Active Inductor (AI), Complementary Metal Oxide Semiconductor (CMOS), Gallium Arsenide (GaAs), Gyrator, Noise, Metal–semiconductor field-effect transistor (MESFET), Radio frequency (RF), Transconductors, Quality factor (Q).

## INTRODUCTION

Inductors are prominent element in RF circuit design [1]. Fig. 1 illustrates LC-voltage controlled oscillator where spiral inductors consume the dominant chip area. The other drawbacks of spiral inductor are fix inductance value and weak quality factor, which are the main constraints in RF integrated circuit design [2]. Over that, advantages of active inductors are small chip area, high quality factor, wide inductive bandwidth and low voltage operation [3]. The most vital advantage of active inductor over passive counterpart is its tunability. Nevertheless, active inductor has certain drawbacks as power consumption, noise, poor linearity - all these are inherent in active inductor circuit [4]. The Gallium Arsenide (GaAs), Metal Semiconductor Field-Effect Transistor (MESFET) and bipolar technologies are the alternative techniques to realize an active inductor. But the CMOS active inductor has proven the greatest achievement towards the inexpensive chip design [5].

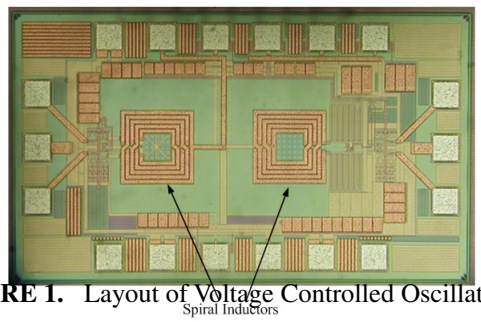


**FIGURE 1.** Layout of Voltage Controlled Oscillator [6].

The organization of paper is as follows. The basic active inductor topology is described in Section 2. The various active inductor architectures are presented in Section 3. Finally, Section 4 summarizes the technical review.

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# Improved VBLAST MAP: A Novel Point-to-Point Symbol Detection Algorithm for MIMO Wireless Communication Systems

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**Abstract**—A novel point-to-point symbol detection algorithm in multiple input multiple output (MIMO) system is proposed. This algorithm is an augmentation of two popular algorithms, namely, vertical Bell laboratories layered space-time (VBLAST) and maximum a posteriori probability (MAP). Here, layers are distinguished or ordered based on the a posteriori probabilities of output symbols and not on signal-to-noise ratio (SNR). For each layer, a set of a posteriori probabilities is computed for all output symbols using all possible signal constellations. The layer corresponding to the output symbol having minimum a posteriori probability is selected first from the set of a posteriori probabilities for detection by doing the comprehensive search over all the possible signal constellations. Then, the remaining layers are detected by the conventional VBLAST MAP technique. The relationship of MIMO symbol error rate (MIMO SER) versus MIMO symbol SNR is presented using simulations for 16×16 MIMO systems and 16-QAM constellation. The results show that the proposed algorithm outperforms conventional VBLAST MAP and improved VBLAST algorithms.

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## 1. INTRODUCTION

The current demand of high data-rate in wireless communications is fulfilled by using spatial multiplexing in multiple input multiple output (MIMO) systems [1]. Spatial multiplexing can be implemented by using the channel state information available at the transmitter. However, it needs dedicated feedback link, which increases complexity of the overall system. Therefore, to avoid the feedback link, maximum likelihood (ML) detection or sphere decoder (SD) is used. However, it substantially increases the complexity of the receiver, when we increase the number of antennas or use higher order modulation schemes [2–4].

The vertical Bell laboratories layered space-time (VBLAST) architecture is a nonlinear detector in spatial multiplexing with reasonable practical implementation [5]. To improve the performance of VBLAST, the VBLAST MAP algorithm was proposed [6]. However VBLAST MAP was unable to achieve a significant improvement in the performance, because VBLAST MAP uses layered structure of VBLAST and the bottleneck in the performance of VBLAST detection is the reliability of detection of the symbol in the layer having the lowest postdetection SNR (i.e. the weakest layer) [7]. Therefore, further modification was done in VBLAST and the improved VBLAST algorithm was proposed [8], which was able to achieve a significant improvement in the performance.

The scheme proposed in [8] considered spatially uncorrelated channels and $n_R = n_T$, while paper [9] shows that if $n_R > n_T$ for spatially uncorrelated channels, then the performances of VBLAST MAP [6] and improved VBLAST [8] are similar, where $n_R$ denotes the number of receive antennas and $n_T$ denotes the number of transmit antennas. This paper proposes a new layered symbol detection algorithm, which is an augmentation of VBLAST and MAP. Simulation results show that the proposed detection algorithm is having a better error rate performance as compared to all previously proposed detection algorithms.

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# Design of textile based microstrip low pass filter

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***Abstract*— The design of textile microstrip low pass filter is discussed in this paper. The filter is designed at 1GHz frequency. The lumped circuit model is simulated in student version of ansoft designer. The transmission line model of the filter is simulated in high frequency structure simulator. Jeans is used as dielectric substrate and copper adhesive tape is used to make conductive parts. The filter is fabricated and tested in network analyzer. There is little change in simulated and measured results that may be due to fabrication errors.**

*Keywords*—***lumped-element network, Microstrip low pass filter, Jeans, , High frequency structure simulator.***

## I. INTRODUCTION

Recently lot of research work is going on wearable electronic devices. This application has led to the necessity of electronic devices to be integrated with cloths, for which they have to be low profile and flexible. It is big challenge to make them flexible, its parameters have to be at acceptable levels in normal condition and environment. In [4-9], the microstrip filters are designed using dielectric material substrate like FR4 [5,7]. The design of microstrip filters using wearable substrate such as jeans are discussed in [1,2].

In this paper chebyshev low pass filter is designed using Jeans as substrate. The filter is fabricated and tested.

## II. DESIGN OF MICROSTRIP LOW PASS FILTER

The design of low pass filter at 1 GHz is presented in this paper. The filter is designed using third ordered chebyshev approximation. The lumped circuit model is designed and simulated using ansoft designer. The lumped parameters are converted into microstrip line using richard transformation method [10]. The designed microstrip line model is simulated in high frequency structure simulator.

Third order low pass filter have been designed in microstrip configuration with the following specification.

Dielectric constant =1.6 (Jeans)[3]

Pass band Ripple = 1dB

Cut off frequency = 1 GHz

Substrate thickness, h =2.4 mm

Lowest Line impedance = 20 Ω

Characteristic impedance = 50 Ω

Highest Line impedance = 86 Ω

Design of Lumped-Element low pass filter

For pass-band ripple characteristic having 1 dB ripple the element values for the third ordered filter are given below [10].

g1=2.0237,g2=0.9941,g3=2.0237

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# Flexible Circular shaped dipole antenna on paper substrate

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***Abstract*— The paper material is attractive material because of low cost, nature friendly and its flexibility. It is well-suited with direct write, inkjet printing and copper lamination technologies. The paper is natural, easily and broadly accessible. The circular shaped half wave dipole is presented in this paper. The proposed antenna works on 2.35 GHz to 2.77GHz frequency. The antenna is simulated in high frequency structure simulator. The prototype antenna is fabricated and tested using network analyzer. There is good matching observed in simulated and measured results. This prototype provide flexibility. The flexibility test is carried out and it is discussed in the paper.***

***Keywords— printed dipole antenna, circular shaped dipole, paper substrate, High frequency structure simulator.***

## I. INTRODUCTION

The paper material is light in weight, low cost, conformable, nature friendly and easily and widely available. It is compatible with direct-write, inkjet printing technologies. Because of these advantages paper become attractive choice for antenna and microwave designer. The paper material is used in many recent application like RFID tags[7], Microwave filters[10],wearable device[9], flexible display[11], wireless sensor networks[4], antennas[13,14] etc.

In [2], a star shaped patch antenna is designed on paper substrate at 2.4GHz. In [3], the Z shape antenna is designed on glossy paper.

In [4], radiating structure was formed by zigzag arrangement of 5 square patches which operates on 2.4GHz and 5.4GHz. In [5], UWB antenna is designed on paper substrate. In [6], U slot monopole antenna is designed using paper substrate which works on 1.57GHz, 3.2GHz and 5GHz.In [7], RFID tag antenna on paper substrate is presented at 915MHz. In [10], inverted-F-antenna (IFA) is designed on a paper substrate at 2.45GHz. In [12], a slot is created in radiator and one additional radiator is added to have frequency operation at 2.4GHz,3.4GHz and 5GHz.

In this paper CPW fed circular shaped dipole antenna using paper substrate is designed at 2.45GHz. The antenna is fabricated and tested. There is good agreement between measured and simulated results. The paper is flexible material. In order to check the effect of bending on antenna performance , flexibility test is carried out. The measured results are slightly shifted to lower side under bend condition.

## II. DESIGN

The proposed antenna is CPW fed dipole antenna. The antenna is designed at 2.45 GHz. The dielectric material used for the design is photo paper with dielectric constant of 3.45 [15]. The loss tangent of paper is 0.065 [15]. The thickness of the substrate is 0.1718mm. The radius of circular dipole is 0.55 λ. The width of ground plane 27mm is and length of ground plane is 20 mm. The feed line length is 24.25mm and feed line width is 1.5mm. The gap g is 1mm. The proposed antenna model in high frequency structure simulator is shown in Fig 1(a). Fig 1(b) shows photograph of fabricated antenna.

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# Patch Antenna Array using Paper as Substrate

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***Abstract*- Paper is low cost, environment friendly and flexible material. The paper as substrate is compatible with direct write, inkjet and copper lamination technologies. The paper is organic and widely available. Because of these advantages, it has attracted researchers of antenna and microwave community since several years. In this paper, single patch antenna and 1×2 patch antenna array are designed and fabricated on paper as substrate. The antennas are designed at 2.4GHz. The simulated peak gain of the single patch antenna is 1.0067dB. The simulated peak gain of 1×2 patch antenna array is 3.04dB. The prototype antennas are fabricated and tested using a network analyzer. There is small discrepancy seen in simulated and measured result that may be due to fabrication related errors.**

***Index Terms*- Microstrip patch antenna, patch antenna array, High frequency structure simulator**

## I. INTRODUCTION

The microstrip patch antennas are light weight, low gain and low profile antenna. The patch antennas are easy to fabricate and they can be easily integrated with circuits because of its planar structure. One of the drawbacks of patch antenna is its low gain. There are various methods to improve the gain of the antenna. One of the methods to improve the gain is by using an array of antenna. The radiation pattern can also be changed with the help of the antenna array.

Paper is biodegradable and friendly to the environment, a material that is also organic and flexible. As a substrate, it is compatible with additive direct-write, inkjet, and copper lamination technologies. It is also suitable for wearable devices and sensors due to its low profile that makes it an attractive substrate for modern RF applications including RFID tags [7,8], antennas [7,8], microwave filters [10], wearable devices [9], wireless sensor networks [4], and flexible display [11]. Moreover, the paper is an organic based substrate and is widely available; the high demand and the mass production of paper make it the cheapest material ever made.

In [2], a star shaped patch antenna is designed on paper substrate whose gain is 1.8dBi at 2.4GHz. In [3], the Z shape antenna is designed on glossy paper. In [4], radiating structure was formed by zigzag arrangement of 5 square patches which operates on 2.4GHz (gain 2.1dBi) and 5.4GHz. In [5], UWB antenna is designed on paper substrate. In [6], U slot monopole antenna is designed using paper substrate which works on 1.57GHz, 3.2GHz and 5GHz.The maximum obtained gain range is 2 dBi at 5GHz. In [7], RFID tag antenna on paper substrate is presented at 915MHz whose gain is 1.8dBi. In [10], inverted-F-antenna (IFA) is designed on a paper substrate which has a gain of 1.2dBi at 2.45GHz. In [12], a slot is created in radiator and one additional radiator is added. The gain of antenna [12] at 2.4 GHz is 0.2 dBi, at 3.4GHz is 2.45 dBi and at 5 GHz is 2.36 dBi.

Because paper is lossy material, the gain obtained in the above mentioned paper is low. One of the methods to improve gain is by using an array of antennas. In this paper, the design and simulation of single patch antenna and 1×2 patch antenna array on paper substrate at 2.4GHz are discussed. The simulated peak gain of the single patch antenna is 1.00dB. The simulated peak gain of 1×2 patch antenna array antenna is 3.04dB.

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# Implementation of Image Processing Techniques for Identifying Different Stages of Lung Cancer

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**Abstract**

Lung cancer is the most dangerous & widespread disease in the world. Lung cancer is the most common cause of the death. 90% of lung cancers are arising due to the consumption of the long time tobacco, cigarette smoking. About 10 to 15% of causes occur who have never smoked. Worldwide in 2012, lung cancer occurred in 1.8 million people and resulted in 1.6 million deaths. The lung cancer can be minimized, if the disease is to detect in initial stage. Although the process of detection of the cancer takes too much time, Hence lung cancer detection system using several image processing techniques to detect whether tumor is present or not and also shows that, in which stage the cancer is present in nodes of the lungs in CT-scan(Computed tomography) image. In this study the software MATLAB is used. Here, we discussed about which techniques are used to detect the tumor and the staging of the cancer and results of that.

**Keywords:** MATLAB, Image Pre-Processing, Image Enhancement, Binary Image Processing, Feature Extraction, Lung Cancer

## INTRODUCTION

Lung cancer is also called lung carcinoma. It is an uncontrolled cell growth tumor in the tissues of the lungs. There are two types of lung cancer: 1.Small Cell Lung cancer (SCLC). 2. Non-Small Cell Lung Cancer (NSCLS) [10]. The size of tumor shows the staging of the cancer in the lung nodes. There are total four stages of the lung cancer in which, if the tumor is in the first or in the second stage, it can be recovered. If the tumor is in the third stage of the cancer it is difficult to recover. Very dangerous stage is fourth stage, in which there is no any chances to remove the lung tumor because the cells of the cancer are spread all the part of the body which is very difficult to recover. As a treatment of the lung cancer, CT(Computed tomogram)-scan, biopsy, radiotherapy, surgery, chemotherapy processes should be done. So In this case Image processing techniques are very useful to detect the tumor or the staging of the cancer and hence we can give the best solution to recover the lung tumor immediately. In our work the whole process is shows to detect the lung tumor and the stages of the tumor. Overall total four processes are used to detect the tumor. Here the methodology section shows that, which processes are used in our entire work. Image pre-processing, Image enhancement, Binary image processing, Feature extractions are the main processes. Image pre-processing consists resizing the image & grayscale image. For Image enhancement we use Median filter & Morphology methods. In feature extraction we show the Extracted tumor, Boundary detection, Circularity of the tumor, Diameter of the tumor & Stage of the tumor. Results section represents the Experimental results and analysis of whole work, which shows the image of lung cancer, is passes on different processes and also shows the stage of the tumor and different images in different stage. At last the conclusion and references of this work is shown. [1-25]

There are different stages of the lung cancer which are,

**Stage I**: The cells of cancer are present only in the lungs and have not spread to any lymph nodes. The size of tumor is < 3 cm.

**Stage II**: The cells of cancer are presents in the lung and nearby lymph nodes. The size of tumor in this stage is between 3 cm to 7 cm.

**Stage III**: In this stage, cancer cells are occurred in the lung and in the lymph nodes in the middle of the chest. In this stage, the size of tumor is > 7 cm.

**Stage IV**: This stage of cancer is very dangerous and impossible to recover. In this stage, cancer cells are spread into both lungs or to another part of the body, such as the liver or other organs [11].

## METHODS

The whole process of lung cancer detection is divided into four parts:

Figure-1 shows the flow diagram to detect the lung tumor.

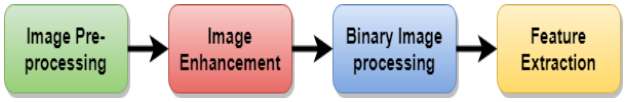


**Figure 1:** Lung cancer detection diagram

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# Implementation and Evaluation of OFDM and FBMC Systems

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**Abstract**

In today's world, the growth of communication systems is at the speed of light. Every day, the number of people using communication system is increasing rapidly. In this modern generation of 4G, Orthogonal Frequency Division Multiplexing (OFDM) is the latest modulation technique which is used to achieve high data rate and it is also used to transmit data without Inter-Symbol Interference (ISI) and Inter-Carrier Interference (ICI). The concept of OFDM is difficult to understand as it is a modern 4G wireless technique and various problems such as Peak-to-Average Power Ratio (PAPR) also takes place. In this paper, discussion of the various parameters of OFDM behaviors such as Carrier Frequency Offset (CFO) estimation, Cyclic Prefix and Bit Error Rate (BER) is done. OFDM is also used in a number of applications which is also described in this paper.

**Keywords**: **:** Orthogonal Frequency Division Multiplexing (OFDM), FBMC (Frequency Band Multi Carrier), Inter-Symbol Interference (ISI),Inter-Carrier Interference (ICI), Peak-to-Average Power Ratio(PAPR), Carrier Frequency Offset (CFO), Cyclic Prefix(CP), Bit Error Rate(BER).

## INTRODUCTION

High speed data rate transmission is needed in order to meet the requirements of the tremendous growth in the communications. Apart from the high data rate, future communication system will also support the high rate of voice, video as well as wireless communication links [1]. Orthogonal Frequency Division Multiplexing (OFDM) has considerably achieved a success in providing high data rate transmission. OFDM modulation techniques include multicarrier modulation techniques [2] and high capacity transmission. As OFDM is having high bit rate as well as multicarrier modulation technique, Digital Audio Broadcasting (DAB), Digital Symmetric Lines (DSL) and Digital Video Broadcasting (DVB) uses OFDM technique.

The Development of OFDM started in 1960's with the progress of the development of Multi Carrier Modulation Technique (MCM) [3]. The structure of OFDM was patented by Chang in 1966[4] and overlapping of multiple signals was published. Weinstein and Ebert [5] proposed Discrete Fourier Transform (DFT) for the OFDM modulation. Digital Signal Processing (DSP) is also used in OFDM implementations by which FFT [6] algorithm can be implemented. Use of OFDM at the commercial level started in 1980's [7]. Peled and Ruiz implemented the use of Cyclic extension and Cyclic Prefix (CP) [8].

## BASIC PRINCIPLE OF OFDM SYSTEM

The basic principle of OFDM modulation technique is to split the high data stream into a number of lower rate data streams. These data streams are transmitted over a number of subcarriers. But whenever high data rate is there, there is always a problem of noise and other interferences. Peak-to-Average Power Ratio (PAPR) is also one of it.PAPR is the ratio of instantaneous maximum power to the average power given by a signal. The transmission rate can be increased by overlapping sub channels in frequency domain. Different modulation techniques such as Fast Fourier Transform (FFT) [23]and Inverse Fast Fourier Transform(IFFT)[24] are used to for modulation as well as demodulation of filters at the transmitter and receivers.OFDM has been widely used in today's high speed digital communication such as 4G,5G and LTE systems.OFDM combines a large number of low data rate carriers to construct a composite high data rate communication system.Orthogonality is used to give the carrier a valid reason to a closely spaced, even overlapped without inter-carrier interference. The high data is modulated over a single carrier frequency and bandwidth is occupied by each signal. Thus in these case of frequency selection, Inter-symbol Interference (ISI) and Inter Carrier Interference (ICI)[22] occurs. Flat fading occurs in OFDM because the total bandwidth is divided into number of subcarriers and the channel spectrum into number of orthogonal sub channels. Several modulation techniques such as FDMA, CDMA, TDMA are used over a number of years, the problem such as multipath fading, less spectral efficiency, Bit-Error Rate (BER) etc. still occurs. High spectral efficiency, Flat fading of channels are the main advantages of OFDM.OFDM signal spectrum is shown in Figure 1.

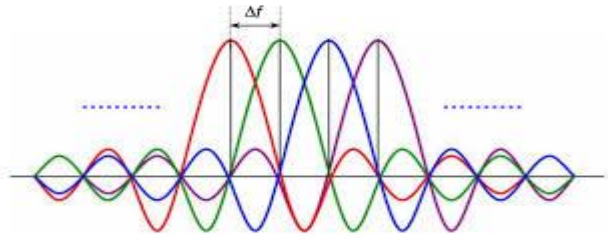


**Figure 1.** OFDM signal spectrum

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# Design and Implementation of Image Processing Techniques for Plant Disease Detection

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## ABSTRACT

The disease identification on the plant by the old method of checking and observing diseases in plants is through only visualization which is not so suitable in detecting the diseases associated with plants. The leaf shows the symptoms by changing their color, showing the spots on the leaf like yellow spots or Black spots or chocolate brown spots. Some leaves are having mildew such as Powdery Mildew, Downey Mildew. This identification of the disease is done by manual observation and pathogen detection which is more time consuming and somehow costly with a lower accuracy. So there is a better option which is fast and accurate detection by using image processing techniques which can be more reliable than some other old traditional techniques. The symptoms can be observed on the parts of the plants in the parts like it's fruit or leaf or stems or lesions. The aim is to identify and classify the disease accurately from the leaf images. The steps required in the process are Image Pre- processing, Segmentation, Feature Extraction and Identification. The disease considered are bacterial, viral fungal or disease by insects and by weather. Here, we are going to detect the disease of plant leaf. For identification of disease features of Leaf such as their axis including major axis, minor axis etc. are extracted from leaf and by different classification techniques, we can diagnosis the disease**.**

**Keywords:** MATLAB, Leaf Disease, Disease Detection, Image processing

## INTRODUCTION

In this modern age a new concept of smart farming has been introduced where the field conditions are controlled and monitored using the self-operating systems instead of using the traditional methods such as different image processing techniques. By using these techniques information about the Disease occurrence could be quickly and accurately provided to the farmers, researchers and experts. This in turn reduces the monitoring of large field by human being as this may be less accurate and more time consuming. In Disease recognition from image the steps are to extract the characteristic feature of the diseased region. The features may vary according to the Disease of plant Leaf. The features that are extracted from the image are color, shape, position, edges, texture and the regions. Identification of the diseases is very important in any field to preventing the losses. For sustainable agriculture health monitoring and disease detection on plant is very critical. The studies of the leaf diseases mean the studies of visually observable patterns seen on the leaf. Leaf Disease detection requires huge amount of work, knowledge in the plant diseases, and also require the more processing time. Now a day's in all fields technology plays vital role but till today we are using some old methodologies in agriculture. If disease is wrongly detected it will leads to a loss of yield, time, production and money. For identification of diseases we can use Image Processing techniques for more accuracy, less time requirement and better performance.[1-25]

## LITERATURE REVIEW

Here, some papers review are describing to detecting leaf disease using different techniques as illustrated and discussed under. The approach discussed by authors was only for apple fruit it cannot be extended to other fruits or plants. They proposed approach [2-4] that is combination of three steps such as image segmentation, feature extraction and classification. For the image segmentation, they used K-mean clustering technique. Authors developed [5] genetic algorithm based on system whose disease detection efficiency is about 93%. Cotton leaves were used for experimentation. They proposed an algorithm for Disease spot segmentation using K mean image processing and support vector machine.

Authors [7] introduced fuzzy curves and fuzzy surfaces in the paper. The features which are extracted from fuzzy selection approach are used for diagnosing and identifying diseases, it removes the dependent features of image so as to reduce the number of features for classification.

As per authors[9] the artificial neural network (ANN) technique is used for training the image database and classified their performance to the respective Disease categories, which may be viral , bacterial, fungal or other plant Leaf Disease. The experimental results express the type of disease can be affected in the fruit and leaf.

This paper [15] has two techniques for feature extraction and comparison of two techniques. Otsu Threshold: Otsu-threshold creates Binary image from Gray level by turning all pixels below some threshold to zero and all pixels about that threshold to one. Using K-means clustering segmented Disease portion is obtained.

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# An Efficacious Graphical User Interface Implementation for Automatic Classification of Brain Tumor from Magnetic Resonance Imaging Images Using Image Processing

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***Abstract:*** ***Biomedical image processing is an emerging field, and is very useful for automatic disease diagnosis. Brain tumor classification is performed using image processing toolbox of MATLAB over here. For tumor classification: Image Preprocessing, Segmentation and feature Analysis are essential steps, these steps are described in the paper. First of all, images were filtered by Gaussian filter, then tumor part i.e. regions having high intensity are enhanced using power low transform in order to neglect insufficient data from image. Then enhanced part was extracted and denoising was performed to get tumor region only at output. By the method we have got only tumor part having high intensity and all other part of brain considered as background. After tumor segmentation, feature analysis has been made by which we can get idea that how they differs into normal and benign or malignant tumors. Then classified based on feature analysis of tumor region, all the processes have been done over dataset of 45 Brain Tumor images. Here overall Accuracy of correct classification is got to be 97.78%, where normal brain is classified with 100%, benign with 95% and malignant with 100% accuracy. A Graphical User Interface (GUI) is developed in MATLAB to perform all the task and to test proposed work. In future, everything would be going to be computer assisted. This is a step toward automatic disease diagnosis using Computer Aided Design (CAD).***
***Keywords: Classification, Feature Extraction, GUI, Image Processing, Segmentation, Tumor.***

## I. INTRODUCTION

Automatic brain tumor segmentation and classification is emerging area of research, now days. Simplest and efficient method is described here, which do not require training and testing phase. Unsupervised classification is done after feature Analysis, and hence the proposed method is fast in computational complexity and accurate method. Nandpuru H.B. et al. have classified brain tumor using SVM, where they have first converted RGB to gray, then applied median filtering and skull masking using morphological opening, region filling and power law transform. Then extracted features and after that classified using SVM [1].Siva Sankari S., et al. have Segmented tumor part using k-mean clustering, and extracted features using GLCM and Gabor filter, where Analysis is done over 45 images[2].Ehab F. Badran, Esraa Galal Mahmoud, and Nadder Hamdy [3] have constructed GUI using MATLAB to test their proposed work. The methods proposed by them are: preprocessing by image edge expansion; segmentation using canny edge detection or adaptive thresholding; feature extraction using Harris method; classification using neural network. Chavan, Nikita V., B. D. Jadhav, and P. M. Patil [4] have preprocessed image with Gaussian filter, and enhancement has performed using histogram equalization, binarization is performed for image segmentation and GLCM features have extracted and finally classification is done using kNN classifier. They have classified brain MRI images in two classes, whether tumor is present or not i.e. brain is normal or abnormal. In this paper, proposed methods are: Image preprocessing, power law transform, segmentation, feature extraction and selection, Classification as shown in figure 1.

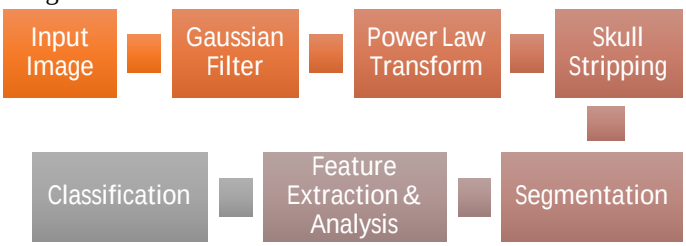

FIGURE 1.Process flow diagram

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# Research Article
# Dictionary Properties for Sparse Representation: Implementation and Analysis

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## Abstract

**Background and Objective:** Linear inverse problems emerge throughout the engineering and the mathematical sciences. Over the last two decades, sparsity constraints have emerged as a fundamental type of regularizer. This paper implements and assesses the role of dictionary miscellany in sparse representation for image processing prospective. **Materials and Methods:** A dictionary is formed by a linear basis using a mathematical model from the set of images referred as analytic dictionary or using a set of realizations of the images referred as trained dictionary. This study considers the problem of true sparsity formation and analyzes the two most commonly used algorithms-the Matching Pursuit (MP) and Orthogonal Matching Pursuit (OMP) using analytical dictionaries. These methods were compared using diverse dictionaries formation for image restoration applications. **Results:** The results were validated using peak signal to noise ratio and mean square error of the sparse approximation for the images. The different dictionaries like-discrete wavelet dictionary, Discrete Cosine Transform and Kronecker Delta dictionary and Haar Wavelet Packets and DCT dictionary had been used for implementation of these two algorithms. **Conclusion:** This experiment showed that the discrete wavelet based dictionary performs best with orthogonal matching pursuit algorithm in terms of MSE and PSNR performances. The result also shows the out performance of OMP in comparison with MP. From the experiments, it has been observed that high number of iterations and small patch size proves to be advantageous.

Key words: Dictionary learning, greedy algorithms, matching pursuit, orthogonal matching pursuit, sparse approximation

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

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# Analysis of Machine Learning Based Scene Classification Algorithms and Quantitative Evaluation

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**Abstract**

Scene classification plays an important role in automated surveillance applications including pedestrian detection, indoor positioning, categorizing in semantic classes etc. The capability of machine learning to process big data with high speed make it suitable algorithm for supervised and unsupervised image/video processing applications. The scene classification processes large set of images to categorized it and hence weight-age is given to machine learning including in this paper. This paper provides in-depth analysis of various machine learning based scene classification techniques including Sparse representation, Support Vectors Machine (SVM), Artificial Neural Networks (ANN), Convoluational Neural Networks(CNN), Spatial Pyramid Matching (SPM). The quantitative comparison of all algorithms with reference to type of datasets and corresponding accuracy are presented in the paper. The paper concludes that Caltech dataset has been used widely for performance testing and ResFeat algorithm achieves highest accuracy amongst all algorithms.

**Keywords:** Scene Classification, Sparse representation, Support Vectors Machine (SVM), Artificial Neural Networks (ANN), Convoluational Neural Networks (CNN), Spatial Pyramid Matching (SPM)

## INTRODUCTION

Understanding the world in a solitary look is a standout amongst the most proficient accomplishments of the human mind [1]. It will take few microsecond time to recognize the object category using feedforward proceesing in visual ordinary recognition. Scene Classfication is a core problem in image understading. In past, there were various automatic techniques for associating scenes with semantic labels which can improve the computer vision applications like browsing, retrieval, ojbect recognition [2]. The object recognition and scene classification are particular piece of computer vision which has numerous different genuine applications, going from computer games to self driving autos. But, due to our limitation to learn and remember diverser scene and its category, this is not efficient system. Two steps are necessory for accurate scene classification. The first step involve how to extract effective representation from given visula input. Here, The main requirment is to develop highly robust features with less computational complexity [3]. The second step includes algorithms and classifiers which actually process representations.

With the machine learning, It is possible to fastly and automatically produce models which can analyze complex, bigger data and generate accurate, quick result on very large scale.

The section 2 explain various algorithms of machine learnirng for scene classifications. The different image dataset was discussed in section 3. The section 4 covers various method used for scene classifications. The comparision of accuracy analysis for various dataset and methods were covered in section 5. The section 6 discuss merits and demerits of various methods.

## Types of Machine Learning Algorithms for Scene classifications

The Fig. 1 shows the various types of machine learning for scene classification.

The Naive Bayes is a classification technique based on Bayes' Theorem with a presumption of freedom among indicators. This classifier is working with assumation that presence of feautre in one class is non related with presence of other feature. The decision tree has tree like flow chart structure. The node indicate a test on the attribute, while the branch indicate the output of test. The leaf nodes represent classes or class distributions. K-nearest neighbors is a simple algorithm that stores all available cases and classifies new cases based on a similarity measure. For simple linear regression, the single independent variable is used to decide the value of dependent variable. For multiple linear regression, two or more variable used then single independent variable. Bootstrap aggregating is a machine learning ensemble meta-algorithm designed to improve the stability and accuracy algorithms.

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# Internet of Things Based Smart Home Automation System

***Himanshu Patel*, Hardik Modi***
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***Abstract***

*The internet has been associating individuals and making life less complex by furnishing a wide range of data with the button click. The next enormous wave in this space is the web of things which will empower physical items utilized as a part of everyday life to interface with the web and trade information. With regards to our home, this idea can be apropos joined to make it more brilliant, more secure and robotized. This paper demonstrates the IOT based project focuses on building a smart home security system. It sends alerts to the authorized person and also controls various devices like bulb, fan and any other home appliance. These things are done using the controller Nodemcu and relays which are interfacing with the same. Besides, the same can also be utilized for home automation by making use of the same set of sensors. In this project, the various instruments are controlled remotely using webpage through internet.*

***Keywords:*** *Internet Of Things (IOT), Nodemcu, relay, internet, fuzzy system, home automation*

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## INTRODUCTION

Home Automation is the building automation for a home, called a smart home or smart house [1–4]. It includes the control and mechanization of lighting, warming, (for example, indoor regulators), ventilation, aerating and cooling and security, and also home machines, for example, washer/dryers, stoves or fridges/coolers. Wi-Fi is frequently utilized for remote checking and control. Home gadgets, when remotely checked and controlled by means of the internet, are an essential constituent of the internet of things. Present day frameworks for the most part comprise of switches and sensors associated with a focal center now and again called a "gateway". With the advancement of wireless technologies such as Wi-Fi, cloud networks in the recent past, wireless systems are used every day and everywhere [5].

### History

Early home robotization started with work sparing machines. Independent electric or gas controlled home apparatuses ended up suitable in the 1900s with the presentation of electric power distribution and led to the introduction of washing machines (1904), water heaters (1889), refrigerators, sewing machines, dishwashers, and cloth dryers. In 1975, the primary broadly useful home robotization arranges innovation, X10, was produced. It is a correspondence convention for electronic gadgets. It fundamentally utilizes electric power transmission wiring for flagging and control, where the signs include brief radio recurrence, blasts of advanced information, and remains the most generally accessible. By 1978, X10 items incorporated a 16 channel summon comfort, a light module, and an apparatus module. Not long after came the divider switch module and the primary X10 clock. By 2012, in the United States, as indicated by ABI Research, 1.5 million home mechanization frameworks were introduced.

### Advantages of Home Automation Systems

Lately, remote frameworks like Wi-Fi have turned out to be increasingly basic in home systems administration. Additionally in home and building computerization frameworks, the utilization of remote innovations gives a few points of interest that could not be accomplished utilizing a wired system as it were [6].

1) Reduced installation costs: As a matter of first importance, establishment costs are altogether diminished since no cabling is vital. Wired arrangements require cabling, where material and also the expert laying of links, (e.g., into dividers) is costly [5, 7].

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# Concurrent design of active contour for image segmentation using Zynq ZC702☆

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ABSTRACT

Image segmentation is the fundamental step in various video processing applications like object tracking, pattern recognition, industrial automation, object classification etc. Earlier, low-level curve gradient methods were used for the real time image segmentation where images were processed pixel by pixel. However, the gradient models provide discontinuous edges and are highly sensitive to the noise in the image. High level Mumford–Shah based Active Contour Model (ACM) provides continuous edges and is less sensitive to noise but the complexity in the algorithm and its iterative implementation makes it challenging for the real time applications. This paper investigates the computational complexity and proposes optimum approximation of segmentation with removal of contour initialization. The proposed algorithm is implemented on Xilinx's Zynq ZC702 FPGA board. The removal of contour initialization increased the speed by 10% in software and fixed point implementation on Xilinx provided 80% segmentation accuracy with very low latency of 7.3270 ns per iteration.

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## 1. Introduction

Human mind is considered the powerful and the most advanced processor for the real time applications. However, due to limited perceivability of the human, results for such applications vary with human to human. Applications like surveillance system, on-line human activity monitoring, various satellite image classification, object identification, pattern recognition and industrial automation system demand on-board and real-time implementation of various image and video processing steps. Image segmentation plays fundamental role in all these applications. Numerous algorithms are available to perform image segmentation. Examples include thresholding the image intensity values within defined ranges, by using low-level edge detection kernels like Robert, Prewitt and Sobel, region grow model where pixel is selected and it forms cluster according to the connectivity theory, feature based segmentation and hybrid approaches which combines all above said algorithms. Early hardware realization of image segmentation algorithms focused on low level models where image is processed pixel by pixel. They offer low computational complexity, require less memory and is a less time. The major drawbacks of these models are that they provide discontinuous edges and are very sensitive to the noise.

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# Design & Development of Smart Attendance Logger System

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***Abstract: Attendance management system in form of the attendance logging is one of the important requirements in any academic organization. The traditional attendance management system in which mentor has to take attendance manually and keep the record for the same manually. Some of the traditional attendance management system is based on the RFID, in which RFID tag is required which is not cost effective. The proposed system is smart attendance logging system in which system can mark the presence and absence of the person and keep the record for the same. The suggested system is also consist of real time clock device which also update the time in form of day, month, year and hour, minute and second. The system can also keep the record of the attendance as a backup of about one month. The system can store the presence of about more than one twenty users. The suggested system is handheld device which is portable with battery backup feature, so it will not consume much time to take attendance one by one. The whole system is design on the arduino platform along with fingerprint sensor, real time clock device, LCD and external memory as EEPROM. The system is compatible with the Microsoft Excel for logging the record of presence.***

***Keywords: Attendance Logger, PLX-DAQ, Fingerprint Sensor, Real Time Clock***

## 1. Introduction

Traditional attendance system is the system in which the person submitting their attendance either manually or in form signature on paper. This type of system is excessive time consuming and there are the chances of human mistakes and malfunctioning. In such type of system person needs maintain the attendance in form of the soft copy from the hard copy. After preparing the soft copy, it requires to analyse the same for preparing attendance report. This task is very tedious and it requires so much accuracy. Biometric attendance method has many advantages over traditional time tracking system used in real time. Biometric system is very user friendly as person has to scan either his/her finger, face or eyes and system will extract all the details of specific person. In this manner biometric system is saves lots of time and save the records very accurately. It also provides better security.

Figure1. Biometric System

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# Implementation of Internet Of Things Based Home Automation System Using Node MCU

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**Abstract:** With headway of Automation innovation, life is getting more easier in all angles. In this day and age Automatic frameworks are being favoured over manual framework.. With the quick innovations in the quantity of clients of web over the previous decade has made Internet an integral part of life, and IoT is the most recent and rising web innovation. Web of things is a developing system of regular question from modern machine to shopper merchandise that can share data and finish assignments while you are occupied with different exercises. Remote Home Automation system (RHAS) utilizing IoT is a framework that utilizations PCs or cell phones to control essential home capacities and highlights consequently through web from anyplace around the globe, a computerized home is some of the time called a brilliant home. The home computerization framework varies from other framework by enabling the client to work the framework from anyplace around the globe through web association. In this paper, I proposed Home automation system using Internet of Things and Node MCU. In which home appliances can be controlled by IP based HTML webpage from anywhere around the globe.

**Keywords: Automation ,Remote Home Automation System, Internet of Things, Web of Things.**

## I. INTRODUCTION

Homes of the 21st century will turn out to be increasingly self-controlled and mechanized because of the solace it gives, particularly when utilized in a private home. A home computerization framework is an implies that enable clients to control electric machines of fluctuating kind.

Numerous current, settled home computerization frameworks depend on wired correspondence. This does not represent an issue until the point that the framework is arranged well ahead of time and introduced amid the physical development of the building. Be that as it may, for effectively existing structures the usage cost goes high. With the progression of remote advancements, for example, Wi-Fi, cloud arranges in the current past, remote frameworks are utilized each day and all overAs of late, remote frameworks like Wi-Fi have turned out to be increasingly regular in home systems administration. Additionally in home and building robotization frameworks, the utilization of remote advances gives a few focal points that couldn't be accomplished utilizing a wired system as it were[1].

- Reduced establishment costs: First and premier, establishment costs are fundamentally diminished since no cabling is essential. Wired arrangements require cabling, where material and in addition the expert laying of links (e.g. into dividers) is costly.

- System adaptability and simple expansion: Deploying a remote system is particularly beneficial when, because of new or changed prerequisites, augmentation of the system is fundamental. As opposed to wired establishments, in which cabling expansion is repetitive. This makes remote establishments an original venture.

- Aesthetical advantages: Apart from covering a bigger zone, this ascribe fulls aesthetical necessities too. Illustrations incorporate agent structures with all-glass engineering and verifiable structures where plan or center reasons don't permit laying of links.

- Integration of cell phones: With remote systems, partner cell phones, for example, PDAs and Smart phones with the computerization framework winds up conceivable all over the place and whenever, as a gadget's correct physical area is never again essential for an association (as long as the gadget is in reach of the system). For every one of these reasons, remote innovation isn't just an alluring decision in redesign and restoration, yet additionally for new establishments.

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# A Review Paper on Digital Mammography for Detection of Breast Cancer

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**Abstract-** Breast cancer is the second-most common and important cause of cancer death among women. It has become a major health problem in the world over the past 40-50 years, and its incidence has increased in recent years. Mammography is the best diagnosis technique for tumor detection. In this paper we define different techniques for early detection of breast cancer and also define analysis of classification of different method for detection of normal and abnormal tissue. This type of analysis is help to radiologists for better and early detection of cancer. So, we can reduce the mortality and also used for health care system.

**Key Word : Digital Mammography, Breast Cancer**

## 1. INTRODUCTION

In worldwide the automation system is used for different area for development and developing country. Breast cancer is the most general cancer among women. and in addition to detect finding high humanity rate. However there is unable to distinguish with certainty each and every year. Computer aided detection is used for finding detail analysis for mammogram.
Computerized detection of micro calcification on mammograms has very high accuracy. but on the other hand for finding malignant and benign using computerized method need some more accuracy.

## 2. TYPE OF BREAST CANCER

There are two types of breast cancer:

### *2.1. Invasive Breast Cancer*

The cancer having abnormality in cell which have power to augment other part of body. It start from lobes or milk duct to with this the breast tissue. Malignant is the invasive type breast cancer which spread other part of body.

### *2.2 Non Invasive Breast Cancer*

The cancer having abnormality in cells lives in breast lobes or duct. Benign is a non invasive breast cancer which cannot spread out side breast but in breast lobes of ducts.

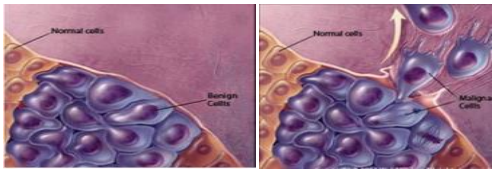
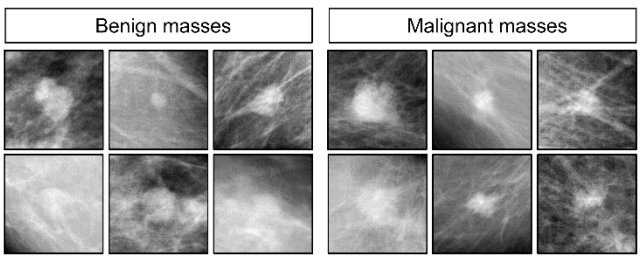


Fig. 1 Example for Benign cells and Malignant cells

Table 1. Comparision of Bening and Malignant Tomor

| Sr. No. | Characristics | Bening | Malignant |
|---|---|---|---|
| 1 | Histology | Typical tissue of origin, Well diferentiation with no anaplasia | Poorly differentiate , Abnormal Cell Size and Shape |
| 2 | Growth | Slow | Rapid |
| 3 | Prognosis | Good | Poor |
| 4 | Metastasis | No | Yes |
| 5 | Recurrence | Rare | Common |

In this review paper we defied different techniques for early detection of breast cancer and also give us the importance of momoghraphy. Using mammography techniques we define analysis for masses, this type of masses we categaraized in benign and malignant.



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# Design & Development of Smart Digital Notice Board based on IoT Platform

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***Abstract*— Smart Digital Notice board is primary requirement in any institution, organization or public sectors like airport, bus station, railway stations, schools, colleges etc. The traditional method of sticking notices day to day on the notice board is a difficult process. In order to provide a better communication which is easy to use and which is based on the advance technology, the proposed system is IoT based smart digital notice board system is presented here. The whole system is designed using the known as NodeMcu which is also easily connected with the cloud. The designed webpage is used to send the message which will be displayed on to the notice board. The message which is send from the webpage is received by the IoT device. The will push this message on to the remote LCD. To send the message onto the remote LCD, the user have must login to the webpage, type the message which is sent to the remote LCD and publish that message through the submit button. At another side NodeMcu will subscribe the message and push it on the remote LCD.**

*Index Terms — Smart Notice Board, NodeMCU, IoT, LCD*

## I. INTRODUCTION

A notice board is a traditional way of communication in any Institute, Organization or public sector which is used to notify the message to the respective person or group of persons. In conventional notice board the messages are to be pinned up and the message has to be physically changed whenever required. It also required so many resources like wooden / standby notice board, paper, ink, pin etc. In addition to this traditional system, it requires human resource whenever it wants to add the notice paper or remove the notice paper from notice board.

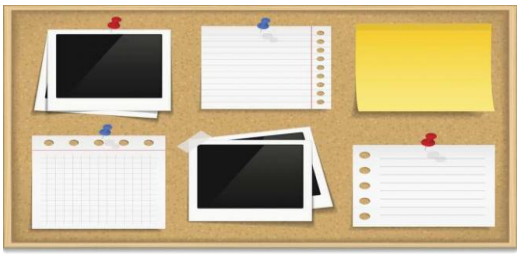

Fig. 1 Traditional Notice Board

To overcome the cones of existing system, the smart digital notice board is required which is operated remotely. The proposed system is IoT based smart digital notice board in which user who want to send the notice message has to login on the official page of the system. After login on to the page, user has to write the notice message and publish that notice message from the cloud. On another side, the i.e. NodeMcu will subscribe that message and send the message to one of its peripheral i.e. 16 * 2 LCD to display that message. For creating the official page along with the login system and publish the notice message from the cloud, here HTTP protocol is used. Message will be subscribed through the NodeMcu using the MQTT protocol and then it will be display on LCD. The whole system is build up on the cloud, so anyone can remotely send or remove or update the noticed message. At the subscribe side, the updated notice message can be received via and it will be displayed on LCD. The moment, at which the notice message is updated at the cloud, simultaneously it will be updated on the display also.

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# Machine Learning in Wireless Sensor Networks: A survey

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***Abstract*— Wireless Sensor Network (WSN) is a network which consists of multiple sensors which are small in size, autonomous, low power and low cost. Main objective of WSN is to measure or sense change in environmental or physical conditions overtime. WSN are often used in applications where remote data collection is required such as military applications, health monitoring, smart homes, environment monitoring etc. Often WSNs is use to monitor dynamic change in environment parameters which occur over period time. The source of this dynamic behavior is either initiated by system designers or caused by external factors. To comply with such critical conditions, WSN often uses Machine Learning algorithms to avoid the need of unnecessary redesign or restructure. Many practical solutions which enhance the lifespan of the network and maximize resource utilization can be achieved using Machine Learning algorithms. In this paper, we present and literature review of Machine Learning methods that were used to address in general problems in WSN. The advantages and disadvantages of each algorithm are evaluated.**

***Keywords-component; formatting; Wireless sensor networks; machine learning; clustering; security; data aggregation; localization; event detection; query processing.***

## I. INTRODUCTION

Wireless Sensor Network (WSN) is a network which consists of multiple sensors which are small in size, autonomous, low power and low cost. Generally WSN is having distributed autonomous devices for the purpose of to sense or monitor physical or environmental parameters cooperatively [1]. There are various applications such as military applications, health monitoring, smart homes, environment monitoring, habitat monitoring, prediction and detection of natural calamities [2] where WSNs are used. WSN composed of thousands of tiny, inexpensive, disposable and autonomous sensor nodes which are arranged using ad hoc manner in any hostile terrain. These nodes senses data of their environment and these collaborative data are to be forwarded to centralized units which are called as Base Station (BS) or sink node for further data processing. The sensor nodes are equipped with different types of sensors, transceiver or other wireless devices, a small micro controller, limited energy sources usually a battery. WSN have enormous potential to build powerful applications. For WSN it is always challenging task to design efficient protocols which are suitable for various application. WSN protocol designers have to face common problems related to data aggregation, localization, data reliability, node clustering, events scheduling, energy aware routing.

Machine learning (ML) was introduced as a technique for artificial intelligence (AI) in the late 1950's [3]. Over time, Machine Learning algorithms are shifted to algorithms which are robust and viable in terms of computation. Task like classification, regression and density estimation were major domain in which machine learning techniques have been used broadly during last decade. In these domains, machine learning techniques are improving performance of applications such as fraud detection, speech recognition, computer vision, bioinformatics, and spam detection. There are two classical definitions of machine learning as follow:

1) "The development of computer models for learning processes that provide solutions to the problem of knowledge acquisition and enhance the performance of developed systems" [4].
2) "The adoption of computational methods for improving machine performance by detecting and describing consistencies and patterns in training data" [5].

Based on these definitions, machine learning can be applicable to historical data to achieve performance enhancement of WSN for specific function without the requirement of re-programming. In addition, machine learning is very useful in the domain of WSN because of following main reasons:

- Main objective of WSN is to measure dynamic environments that change quickly after some time. For example, due to soil disintegration or ocean turbulence a node's position may differ. For such applications it is convenient to design sensor networks so that network can modify and perform efficiently in such unpredictable environments.
- Another application of WSNs is to be used for collection of new data of unreachable, dangerous locations [6] (e.g., hostile environment, volcano eruption and waste water monitoring). Because of the abrupt behaviour of such environment, system designers needs design machine learning algorithms which are robust and self-adaptive in nature and these

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RESEARCH ARTICLE

# Substrate Integrated Waveguide based dual-band bandpass filter using split ring resonator and defected ground structure for SFCW Radar applications

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**Abstract**

In this paper, we present a novel dual-band highly selective bandpass filter using Substrate Integrated Waveguide (SIW) technology. Designed bandpass filter is a combination of SIW structure with high-pass characteristic, single rectangular split ring resonators (SRRs) as parallel LC resonator & dumbbell- shaped defected ground structure (DGS) with band rejection characteristic. Here, designed filter has pass band with high rejection values of −15.24 dB and − 18.43 dB and the insertion loss of 0.250 dB and 0.361 dB at 6 GHz and 8.55 GHz respectively. Designed SIW based dual-band bandpass filter has 3-dB fractional bandwidth (FBW) of 2.85% and 2.22% at 6GHz and 8.55 GHz respectively. The physical dimension of proposed structure is of 42 mm x 21 mm (1.77 $\lambda_g$ x 0.88 $\lambda_g$). All the simulations and optimizations of the proposed structure are carried out in the Ansoft HFSS (high frequency structure simulator) software based on the finite element method. In order to verify the functionality of the proposed filter, structure is fabricated and tested.

**KEYWORDS**

defected ground structure (DGS), insertion loss, quality factor, Split ring resonator (SRR), stepped frequency continuous wave (SFCW), Substrate integrated waveguide (SIW)

## 1 | INTRODUCTION

Radio detection and ranging (RADAR) is basically uses radio signals to determine the distance, speed and position of an object. In 1982, Brown, Bryce K., et al.[1] proposed traffic RADAR, which can measure the speed of the target vehicle, by finding out the difference between the doppler signal and reference signal. Nowadays, police uses similar kind of system for the detection of the speed of the target vehicle using X, Ku, K and Ka band frequencies.[2] Block diagram of the RADAR system is shown in the Figure 1. In the proposed design, bandpass filter is designed for the stepped frequency continuous wave (SFCW) K & Ka-band radar application, which is operating at two different center frequencies 24.15 GHz and 34.20 GHz highlighted by red dotted square in the Figure 1. In the transmitter sub-system Microwave Wideband Synthesizer with Integrated voltage-controlled oscillator (VCO) is utilized for the generation of the frequency in the range of 5 to 10 GHz, which is further given to the frequency multipliers to achieve the desired frequencies 24.15 GHz and 34.20 GHz. A VCO is an electronics oscillator whose frequency is controlled by input voltage. Here, VCO is operating at two center frequencies 6 GHz and 8.55 GHz under high nonlinearity, and therefore it generates harmonics. The harmonics generated from VCO can be removed by using band pass filter (BPF). A novel dual-band highly selective bandpass filter using Substrate Integrated Waveguide (SIW) technology is presented in this paper.

Recently, SIW technology creates a center of attention for the researchers in the field of Radio Frequency (RF) and

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International Journal of Scientific Research and Reviews

# Designing of Monostable Multivibrator Circuit Using Conducting Properties of Synthetic Plasma

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## ABSTRACT:

Since last decade, biotechnology domain has offered many open research issues. This led to significant developments all over the world. High quantum of work has been proposed for solid state electronic circuits. Electronic circuit realization using conductivity of liquid medium is the key issue now a day. The research has been focused to get the stable result from the aforesaid circuit using different feasible apporoaches. One of the feasible approache has been aaplied here to demonstrate the basic monostable multivibrator circuit. The result shows strong possiblility to develop liquid electronic circuit. Here, the author has systamatically replace each solid component using liquid medium and finally designed liquid circuit. The syntheic plasma has been formed in the laboratories to be used as conducting liquid. Power supply and analog input signal has been applied to the circuit by conventional power supply generator and function generator respectively. The response from the circuit has been observed in cathore ray ossilloscope. Similar kind of circuit could be investigated using human implantable material.The presented biological electroic circuit has a potential to work as an implantable circuit for humanbody. These kind of circuits are effectvely utilised for cyborg implants/engineering, man-machine interface, human disease detection and healing, artificial brain evolution in biotechnology domain.

**KEY WORDS:** Liquid medium, synthetic plasma

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International Journal of Scientific Research and Reviews

# An electronic circuit development usingconducting botanical material (Plant Leaf) – A visionary concept

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## ABSTRACT

A lot of research has been done on solid state electronics. On the other side, botanical research has been reached to a level where only limited scope is remaining. The upcoming reseach could be visualised which fills the gap between pure electronics and biology. Biotechnology provides a platform to apply the fundamentals of electronics on the biological conducting medium. Here, in this paper, the author has utilised conductng properties of plant leaf and tried to develop diffrential amplifier circuit.The response meets the desire output, which shows it is feasible to develop electronic circuits from different conducting botanical material.

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# A REVIEW AND VISIONARY CONCEPT OF HUMAN TISSUE SKIN BASED ELECTRONIC CIRCUIT AND SYSTEMS FOR ABO BLOOD GROUP IDENTIFICATION

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## ABSTRACT

*This article presents a concept of Bio-Electronics with reference and review of research and development in the area of electronic circuits made on the basis of human tissues. In medical healthcare science, bio-material human tissue based electronic circuits are an innovative area of research. A multiple no of applications can be found based on such electronics in cyborg implant engineering, man-machine interface, human disease detection and healing and artificial body parts development. From long time, electronics has made an undeniable and valuable contribution in the field of medical instrumentation. Upcoming and recent new medical electronic devices are based on available medical or biological knowledge combined with technologies available in the electronics field. Electronics in medical area has a wide range of applications, from diagnostics to therapy, always aiming to provide new tools to improve the well-being of the population. Basically, fundamental electronic components diode and transistor made of skin is discussed here broadly. A visionary concept is presented at the end with conclusive remarks based on this research.*

**Keywords:** Bioelectronics, ABO Blood group system, Biological signal analysis, disease detection and healing.

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# Design & Implementation of Data Acquisition & Controlling System Based on Free RTOS Platform

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**ABSTRACT**

**Data acquisition and controlling (DAC) system refers to provide solution which is capable of making measurement and controlling external processes using variety of hardware and software. The proposed design and its implementation of DAC system based on the freeRTOS platform. The suggested system is used to monitor and control industrial applications. The proposed system is design on open source hardware Arduino platform in which freeRTOS Application programming Interfaces (APIs) is installed and configured. As part of the hardware, here three basic sensors are used as temperature sensor for measuring temperature, flame sensor as measuring the flame and ultrasonic sensor as measuring the water level in the tank. Buzzer and LEDs are used as the controlling devices for flame sensor, whereas motor is used as the controlling device for ultrasonic sensor. Here temperature sensor is used as monitoring device. The proposed system can justify the remote monitoring and controlling task through the network using the web browser. The proposed system continuously monitors the sensor values and displays it onto the web browser. If the sensor value is exceeds from the threshold values, it will take necessary controlling actions.**

Keywords - **Data Acquisition & Controlling, freeRTOS**

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## 1. INTRODUCTION

In today's era of Industry, there will be a crucial requirement of measuring various parameters and also require monitoring and controlling those parameters for getting good quality of result. These essential parameters could be anything like temperature, distance, flow of liquid, pressure, quality and quantity of liquid, fire detection etc. All these parameters can be sensed by the different type of sensors which are connected with the main system. Sometimes it is required to keeping log and doing analysis of these parameters and has to take some necessary control action according to the specific behavior of this measured value. All these things can be happened if the system is associated very good quality of Data Acquisition & Controlling System. The DAC system should be fast enough & responsive. The suggested system is based on the freeRTOS platform. The reason to design the system based on the freeRTOS is as the number of sensors can be behave like a separate task and all these sensors can handle in form of multiple task at one particular time. The advantage of the system is it can utilize all the resources of the operating system. The system can be consider as reliable as particular task can be deleted or inserted in the run time of the system as system is working on the freeRTOS platform. In the proposed system one dedicated task is constantly running which is creating the webpage for getting the record of each and every sensor values. Webpage generating task will create two more tasks in which in one task, both the ultrasonic sensors constantly measure the level of the water in both the tanks and display the measured value on to the webpage. Whereas in another task temperature sensor continuously measures the temperature value and display measured value on to the page. One more task which is fire sensor task is behaved as an interrupt task i.e. this task is executing at any moment of time. This task has the highest priority. As the interrupt task is executed, it will directly give the notification in form of blinking the led and activating the buzzer. The proposed system block diagram of the system is shown in the Fig.1.

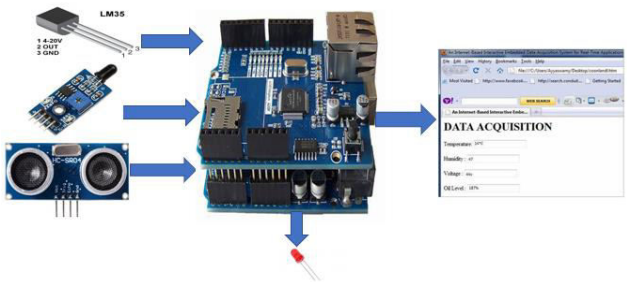


Fig. 1 Proposed System Block Diagram

The proposed paper is organized in the given form. Paper starts with the Introduction as Section I; the objective of the system is described in Section II. System requirements are described in Section III. Literature review is described in Section IV. Software Environment is shown in form of the flow diagram in Section V. Section VI described Experimental Setup of suggested system. Test Results are discussed in Section VII. Conclusion is mentioned in Section VIII. Paper is concluded with the references.

# CIRCULAR MICROSTRIP PATCH ARRAY WITH SMALL CIRCULAR SLOTS LEADING TO MULTIBAND OPERATION FOR WLAN APPLICATIONS

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**Abstract: This paper presents the novel design of 4 × 2 circular microstrip patch array antenna centered at 2.4 GHz. Small circular slots are subtracted from the circular patch in order to obtain the multiband operation. The goal of this paper was to obtain multiband operation, reasonable gain and SWR performance for WLAN applications. The proposed design resonates at 2.4 GHz, 3.4 GHz, 3.8 GHz, 5.45 GHz and 6.05 GHz. The size of the antenna is 24 cm × 12 cm. The proposed design includes eight circular patches of identical dimensions with equal spacing between them. Full wave simulation software was used to design and analyze the novel design presented in this paper. The results obtained of Gain, SWR and return loss are depicted in this paper.**

***Keywords:*** *Circular microstrip patch, Patch array, WLAN antenna, Antenna, Mutiband.*

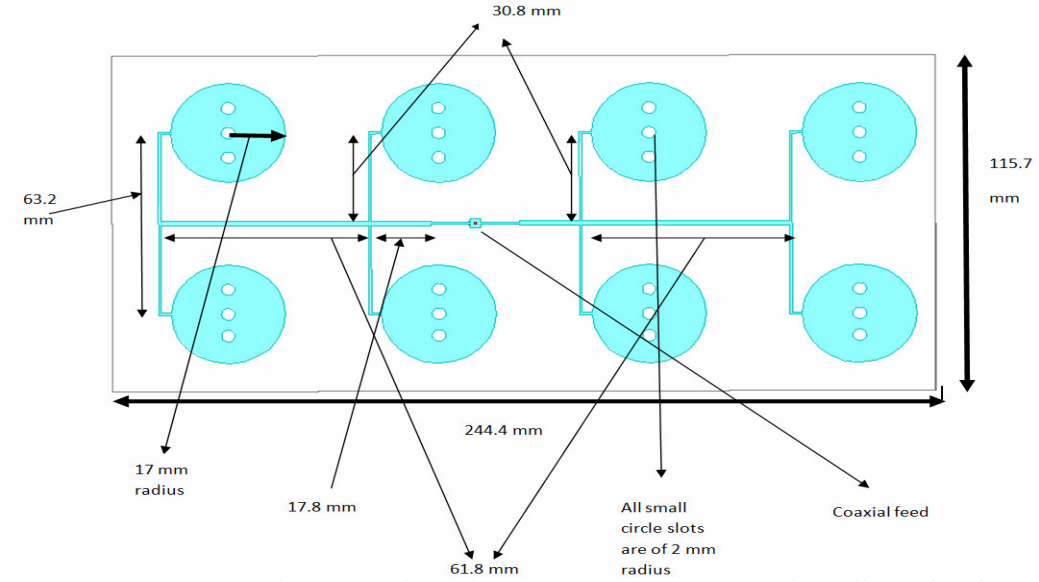


*Figure 1: Top view of the proposed circular microstrip patch array with small circular slots*

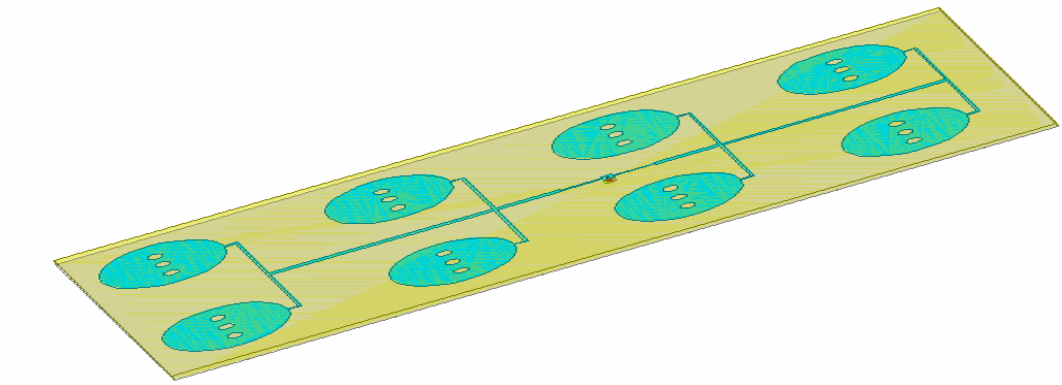

*Figure 2: Actual 3D image of the proposed design in HFSS 15*

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# Dual Band High gain Slotted hexagonal shaped Microstrip patch flexible antenna

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***Abstract— This paper presents the novel design of slotted hexagonal shaped microstrip patch flexible antenna. The design was done using high frequency simulation software. This novel design has dual band resonance at 2.5 GHz and 4.1 GHz. The goal of the paper was to see the effect of rectangular slots on the hexagonal patch, the size of each segment of hexagon taken is 19 mm. The dimension of the substrate on which the patch has been designed is taken to be 80 x 40mm.The parametric analysis has been shown by changing the length of the symmetrical rectangular slot. The hexagonal patch and slotted hexagonal patch has been compared based on different performance parameters. The comparative analysis of different antenna parameters such as return loss, VSWR, radiation pattern has been presented.***

***Keywords— Hexagonal shaped microstrip patch, circular slots, Antenna, flexible antenna, WLAN Antenna***

## I. INTRODUCTION

Recently the flexible antenna has drawn attention of research community toward it due to the many advantages it has specifically in Body area network application. The fundamental advantages that body area network provide is in medical emergency situations. The single band design for wearable antennas has been proposed in [1-2]. The dual band design for wearable antennas can be found in [3].The multiband antennas design for automative applications is proposed in [4]. A plethora of designs with patch antennas[5] or printed inverted F antennas[6] as base can be found in the literature. It is the area of research which is tremendously growing due to its immense potential applications.The analysis done by varying the properties of the UHF antennas which can be worn is discussed in [7-10] .The major obstacles was obtain the omni-directional radiation pattern and flexibility near the body. These problems are being addressed by changing the material properties and different meandering techniques [11-15]. Various techniques to obtain multiband operation in microstrip antennas with metamaterials have been proposed in [16].The antennas for wideband applications using negative refractive index material is been proposed in [17].

## II. PROPOSED MODEL AND DESIGN

The design of the proposed flexible hexagonal shaped microstrip patch antenna with symmetrical rectangular slots is shown in the figure 1.Full wave simulation software was used to simulate the proposed design and to gather the results of analysis. The patch is fed using inset feed method. The feed line length and width were optimized in order to obtain the desired results. Firstly the traditional hexagonal patch antenna was designed by taking jeans as the substrate. The dielectric constant of the jeans was taken as 1.6.Then the rectangular symmetrical slots of 14 mm length.Table 1 show the material used to design the antenna. Copper of thickness 0.035 was assigned to patch while jeans was used as the substrate on which the patch was placed. The reason for choosing the jeans was to create a flexible antenna also known generally as textile antenna. The Thickness of Jeans was taken as 1.6 mm. The copper again of thickness 0.035 thickness was placed at the bottom of the substrate and it is acting as the ground.

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# Design and Fabrication of Microstrip Patch Antenna at 2.4 GHz for WLAN applications

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***Abstract*: In this paper, a rectangular microstrip patch antenna is designed using HFSS software. The designed antenna has a resonating frequency of 2.4 GHz which is applicable to Wireless Local Area Network (WLAN). This paper shows the design considerations of the proposed antenna as well as the simulated and measured results of the same. The design is made on FR-4 Epoxy material used as a dielectric material with its dielectric constant = 4.4 and thickness of 1.6mm. The simple structured configuration and low profile of the proposed antenna makes the fabrication process easy and also suitable for the application in the WLAN. Gain and Return loss are measured at this frequency.***

***Keywords*: Microstrip patch, WLAN, HFSS**

## I.INTRODUCTION

Wireless communication system requires low profile, light weight, high gain, and simple structure antennas to assure reliability, mobility, and high efficiency characteristics And the main advantage of these antennas is that they can be produced in mass with very nominal cost. One of the main disadvantage of these antennas is having narrow bandwidth and large size. Many advances in electronic field such as smart phones, smart watch and wearable gadgets have increased the demand for the small conformal antennas. MSAs are widely used in Radio-Frequency Identification (RFID), Broadcast radio, mobile systems, Global Positioning System (GPS), satellite communication, television systems, multiple-input multiple output (MIMO) systems, vehicle collision avoidance system, surveillance system, direction founding, radar systems, remote sensing, missile guidance, and so on [1]-[2].Various configurations can be used to design microstrip antenna for WLAN applications. In [3] U shaped microstrip patch is designed at 2.4 GHz. In [4] patch antenna is designed having thickness of 1.5mm at 2.4 GHz.

## I. DESIGN EQUATION AND PROPOSED ANTENNA

This section introduces the design of the proposed antenna. First the rectangular patch antenna is designed based on the design equation. The antenna is fed with inset feed transmission line. Material used for proposed antenna is FR4 having thickness 1.6 mm and dielectric constant of 4.4 [5]-[6].

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# Design and Fabrication of CPW fed Dual band antenna for WiMAX and WLAN applications

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***Abstract*: A Coplanar Waveguide (CPW) fed patch antenna is proposed for dual band operation. The 50 Ω CPW transmission line of width 3mm is used to excite patch. The ground plane, fed line and radiating patch are on one side of FR4 substrate. The dielectric constant and thickness of FR4 substrate are 4.4 and 1.6mm respectively. The proposed antenna has dimensions of 50x50mm$^2$.The proposed antenna generates two frequency bands one in 3.28GHz -3.73GHz with bandwidth of 450 MHz and second band in 5.54GHz – 5.94GHz with bandwidth of 400 MHz . The first frequency band is suitable for WiMAX (Worldwide Interoperability for microwave access) and second frequency band is suitable for WLAN (wireless local area network).The proposed antenna generates same frequency bands with improved return loss when triangular slot is created in patch. The proposed antenna is simulated using High Frequency structure Simulator (HFSS).Simulated and measured results shows good agreement with each other.***

***Keywords*: Coplanar Waveguide, Dual band, WLAN, WiMAX, HFSS***

## I. INTRODUCTION

Recently antenna with multiband operation is very popular to support various modern wireless communication systems [1].For these reason multiband antennas are designed with various configurations [2].Many applications in wireless communication, such as WLAN (Wireless Local Area Network), require dual or multi-frequency operation that meets the standards of 2.4GHz/5.2GHz/5.8GHz [3] and the World Interoperability for Microwave Access (WiMax) operating at 3.5GHz WiMAX IEEE 802.16 (3.4–3.6 GHz) [4].Many techniques have been developed to achieve dual band operations. In [5] dual band operation is achieved by including U slot and fork like structure. Dual band can be obtained with patch having S shape slot [6], CPW fed rectangular patch with two slots [7], circular ring patch [8], circular patch with shorting pin [9].

The proposed antenna comprises of rectangular patch with two vertical slots on both sides of patch which gives dual band operation. The substrate used is FR4 having dielectric constant of 4.4 and thickness of 1.6mm. The proposed antenna is fed by coplanar waveguide. There is a triangular slot in patch to improve return loss of dual band operation. Simple structure, light weight and low cost are main advantages of proposed antenna. The proposed CPW fed dual band antenna generates two frequency bands one is 3.28GHz -3.73GHz and second is 5.54GHz – 5.94GHz. The proposed antenna has percentage impedance bandwidth of 45% for first band and 40% for second band.

## II. ANTENNA DESIGN

This section introduces the design of the proposed antenna. First the rectangular patch antenna is designed based on the design equation. The antenna is fed with inset feed transmission line. Material used for proposed antenna is FR4 having thickness 1.6 mm and dielectric constant of 4.4 [5]-[6]. Figure 1 shows the simulated and fabricated CPW fed dual band antenna structure. The proposed antenna is designed on commercially available FR4 substrate. Substrate has length and width of 50x50mm$^2$ with thickness of 1.6mm, loss tangent 0.025 and dielectric constant 4.4. Pentagonal cut is created in ground plane. Rectangular patch is placed over pentagonal cut.

[5] Yu J, Lai F. Design and fabrication of the micro-accelerometer using piezoelectric thin films. *Ferroelectrics*. 2011;263(1):101-106.

[6] Denghua L, Xiangyu G, Zhixin Z, Feng Z. Research on temperature property of piezoelectric vibration accelerometer based on cymbal transducer. *Ferroelectrics*. 2010;405(1):126-132.

[7] Lumentut MF, the KK, Howard I. Computational FEA model of a coupled piezoelectric sensor and plate structure for energy harvesting. *Austr J Mech Eng*. 2015;5(2):199-208.

[8] Hewa-Kasakarage NN, Kim D, Kuntzman ML, Hall NA. Micromachined piezoelectric accelerometers via epitaxial silicon cantilevers and bulk silicon proof masses. *J Microelectromech Syst*. 2013;22(6):1438-1446.

[9] Lv H, Qin L, Liu J. Principle research on a single mass six-degree-of freedom accelerometer with six groups of piezoelectric sensing elements. *IEEE Sensors J*. 2015;15(6):3301-3309.

[10] Han R, Wang J, Xu M, Guo H. Design of a tri-axial micro piezoelectric accelerometer 2016 Symposium on Piezoelectricity, Acoustic waves, and Device Applications, 21–24 Oct. 2016, Xi'an, Shaanxi, China

[11] Xu M, Wang J, Han R, Zhou H, Guo H. Analytical and finite element analysis of a new Tri-axial piezoelectric accelerometer. 2016 Symposium on Piezoelectricity, Acoustic waves, and Device Applications, Oct. 21–24, Xi'an, Shaanxi, China.

[12] Yin S, Niu G, Vilquin B, et al. Epitaxial growth and electrical measurement of single crystalline Pb(Zr0.52Ti0.48)O3 thin film on Si(001) for micro-electromechanical systems. *Thin Solid Films*. 2012;520(14):4572-4575.

[13] Lebrun A. Modélisation et conception d'un capteur de vibrations à fibre optique par analyse par analyse polarimétrie: application à la sismologie » Thèse de doctorat, Institut d'électronique du solide et des systèmes, université de Strasbourg, France; 2011.

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# Capacitive couplings compact antenna for LTE/WiMAX/WLAN application

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## Abstract

A Compact antenna applicable for wireless communication fields like Long Term Evolution (LTE) frequency division duplex (FDD) Downlink Communication (1850-1910 MHz Canada, Latin America), Worldwide Interoperability for Microwave Access (WiMAX) and Wireless local area network (WLAN) is proposed. The antenna structure is based on 1 outer ring resonators. Here, directly fed through the patch the stepped impedance transmission line with an optimized electromagnetic coupling outer ring. The proposed design operates in the lower frequency band from 1.79 to 1.94 GHz with 1.86 GHz center frequency and in the higher frequency band form 4.69 to 5.27 GHz. The compact antenna return loss is good agreement between simulated and measured results. The antenna gain value are 0.8 dBi at 1.86 GHz, 1.1 dBi at 4.75 GHz, 3.84 dBi at 4.97 GHz, and 2.64 dBi at 5.19 GHz. Moreover multi-directional radiation to unidirectional radiation flow at the horizontal plane and vertical plane. A unidirectional radiation patterns based compact antenna utilized for wireless communication applications.

**KEYWORDS**

dual broadband, planar antenna, single ring resonator, wireless communication

## 1 | INTRODUCTION

Now a days utilization of different types of wireless applications using wireless local area network such as wireless sensor, high speed computer network with self-governing network access point, and so on is significantly increasing. IEEE 802.11 have some levels of standardization in form of wireless utilization range, transmission and receiving range, uplink and downlink rate and power consumption levels. Market requirement in day-to-day life cycle demands resonator structures with low profile, low fabrication cost, easy to mount on the Wireless local area network (WLAN) equipment having limited available space. Number of different types of antenna structure is designed to meet the requirements like squiggle, square, rectangular shaped, different types of symbols[1] and different complementary slotted geometries such as L and U, M, T, and so on.[2] Bow tie shape as right and left side complementary structure is also proposed for construction of patch for WLAN applications.[3] Fork-shaped planar structure, E- and H-shaped dual radiators base with Y-shaped combinations of feeding lines is proposed for WLAN and Worldwide Interoperability for

smartphone applications. *IEEE Trans Antennas Propag*. 2015;63: 48-58.

**How to cite this article:** Wong K-L, Chen Y-H, Li W-Y. Decoupled compact ultra-wideband MIMO antennas covering 3300∼6000 MHz for the fifth-generation mobile and 5GHz-WLAN operations in the future smartphone. *Microw Opt Technol Lett*. 2018;60:2345–2351. https://doi.org/10.1002/mop.31400

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# Electrically small inverted L planar patch antenna for wireless application

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## Abstract

This paper presents a miniature structure using a printed board facilitating single band operation for WLAN application. The two inverted L groove structures are used as additional resonators to produce a single band operation for covering the WLAN frequency band of 2.4 GHz (2.4-2.484 GHz) and peak gain is 10.42 dbi. Presented return loss and radiation pattern of proposed antenna with comparisons simulated and measured results by fabricating the antenna.

**KEYWORDS**

bandwidth, electrically small antenna, gain, return loss, WLAN

**Abbreviations:** *ESA*, Electrically small antenna; *GHz*, Gigahertz; *HFSS*, High Frequency Structure Simulator; *hs*, Height of substrate; *mm*, millimeter; *WiMAX*, Worldwide Interoperability for Microwave Access; *WLAN*, wireless local area network.

## 1 | INTRODUCTION

Electrically small single band antenna for wireless application is designed having advantages like low profile, low manufacturing costs, and ease of integration.[1,2] Furthermore, compact antenna, dipole antenna, monopole antenna, and planar antenna configuration have been reported for broadband and multiband applications.[3] In last decade, few interesting slot antenna designs with different geometric configurations for bandwidth enhancement and the size reduction function has been extensively studied.[4,5] These tenable antennas are based on slot design and antenna fabrication has been developed to achieve a wide impedance bandwidth and small size.[6–8] Structure of slot antenna with microstrip line feeds has been developed to integrate circuit boards in a single band and wide bandwidth of the operating frequency band.

Recently wireless device is requited for the wide bandwidth and good resistance radiation gain property for full operating band, other part low cost, light weight and good range performance, the antennas are microstrip promising candidate in such wireless communication systems.[22–28] Here, Table 1 comparisons of single band antenna with proposed antenna in Table 1, also total area of antenna is small size.

ESA antenna first work done by wheeler in 1947; he addressed the fundamental limitation of electrically small antenna and says the maximum dimension of any antenna is less than $\frac{\lambda}{2\pi}$.

The relation of maximum dimension is[1]:

$$Ka < 1$$

$k\ \frac{2\pi}{\lambda}$ (radians/ m)

$\lambda$ Free space wavelength (meters)

$a$ Maximum dimension of the antenna

Than after in 1987 Fujimoto, Henderson, Hirasawa and James summarized the ESA approaches and theoretical

**TABLE 1** Comparisons of single band antenna with proposed antenna

| Published literature | Antenna dimension ($MM^2$) | Total area | Frequency range |
|---|---|---|---|
| [9] | **16 × 32** | 512 | 2.4/5.2 GHz |
| [10] | **50 × 20** | 1000 | 2.4 GHz |
| [11] | **50 × 35** | 1750 | 2.4/5.8 GHz |
| [12] | **156 × 156** | 24 336 | 2.4 GHz |
| 13] | **60 × 10** | 600 | 2.4 GHz |
| [14] | **35.21 × 27.75** | 977.07 | 2.4 GHz |
| 15] | **66 × 41** | 2706 | 2.4 GHz |
| [16] | **200 × 200** | 40 000 | 2.4 GHz |
| 17] | **60 × 60** | 3600 | 2.4 GHz |
| [18] | **57 × 20** | 1140 | 2.4 GHz |
| 19] | **62.5 × 55** | 3437.5 | 2.4 GHz |
| [20] | **100 × 45** | 4500 | 2.4 GHz |
| [21] | **90 × 25** | 2250 | 2.4 GHz |
| **PROPOSED ANTENNA** | **20 × 10** | **200** | **2.4 GHz** |

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# An electrically small antenna for nearfield biomedical applications

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**Abstract**

The size of electrically small antennas is quite lesser than wavelength, typically in range of λ/10 or lesser. These antennas offer vital application in space constraint environment such as small biomedical equipment or passive radio frequency identification applications. The antenna having size of 20 mm × 15 mm (0.16λ × 0.125λ) is proposed. Slots on the patch are engineered for target resonance and bandwidth enhancement. The antenna offers bandwidth in order of 7.6% and product *ka* in order of 0.62. The prototype is fabricated and measured results are presented, which are well suited for ISM band applications.

**KEYWORDS**

biomedical applications, electrically small antenna, quasi-isotropic antenna, nearfield antenna

## 1 | INTRODUCTION

As demand of wireless biomedical devices is becoming extremely high, there is a huge requirement of Industrial, Scientific, and Medical (ISM) band antennas which are compact in size, surface mountable, and easy to integrate on circuit. The strip fed microstrip antennas are highly focused by antenna research community due to their advantages of low profile, easy to manufacture and typically of low cost. Further, medical equipments are usually small in size, which significantly increases the demand of electrically small antennas (ESA).[1,2] However, ESA suffers in terms of low gain and typically offers narrow bandwidth.[3–7] Most of the researchers have been working to improve the bandwidth and gain simultaneously of electrically small patch antenna by varied techniques proposed in the literature.[8–11] Addition of superstrate to the antenna is one of the techniques to improve the bandwidth and gain. Implementation of superstrate with finite air gap decreases effective relative permittivity causing gain to increase. In addition, increased thickness of antenna substrate because of presence of air gap increases bandwidth of the antenna. Although, this technique is widely utilized in many wireless applications, the multilayer structure increases the electrical size of the antenna. Moreover, electromagnetic bandgap structures and negative refractive index materials are also used to increase the effective antenna performance.[12–17] Bandgap and metamaterials structures are having very less dimensions compared to wavelength typically in order of λ/20 or even lesser. Hence, they need precise fabrication mechanism and offers low manufacturing tolerance. Minor variations in fabrication can cause significant modifications in results. The proposed antenna uses partial ground plane to increase the antenna bandwidth. The target gain of proposed antenna is achieved by using very low lossy material as a substrate to match end application requirement.

Being ESA there are potentially few options to meet application specification requirements. Fractal antennas have been presented in literature to increase the antenna bandwidth, however, they are classically contributory after second or third iterations.[18–20] One of the traditional methods to vary the resonance of planar antenna is use of slots in the patch. The proposed antenna is exploiting the variation in the resonator to tune the antenna to target frequency of 2.45 GHz. The surface current distribution is varied by modifying the ground plane of antenna. Partial ground plane notably increase the bandwidth of the antenna.

## 2 | LITERATURE REVIEW

In broad sense, after effective experiments carried out by Hertz between 1886 and 1888 and further explorations in small antennas, Chu-Wheeler-Harrington identified the fundamental limitations on Q-factor for small antenna between 1948 and 1960.[21] Wheeler has indicated the effect of dielectric loading on radiation power for small capacitor antenna.[21] Chu provided fundamental restrictions on dimensions of ESA in 1948 presuming a fictitious sphere. Brown's work was extended by Belrose (1953); which primarily associated near-ground antennas on moving vehicles.[21] Ten years later, Harrison (1963) used the King-Middleton theory to analyze an inductively loaded dipole using a superposition of asymmetrically excited dipoles.[21] Simulation of the antenna by the method of a piecewise sinusoidal moment made it possible to accurately determine the efficiency, the input resistance and the ratio of the reactive load resistance to the antenna resistance. Subsequently, Hansen and Colleen

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# An Electrically Small Antenna Using Defected Ground Structure for RFID, GPS and IEEE 802.11 a/b/g/s Applications

**Riki Patel*, Arpan Desai, and Trushit Upadhyaya**

**Abstract**—A compact size ($20 \times 21\,\text{mm}^2$) planar tri-band electrically small antenna is presented for Wireless ISM, RFID application resonating at 1.57 GHz, 2.47 GHz and 926 MHz. The Proposed structure consists of a dual-slot radiating patch and two split ring structures made using combination of L and U shapes forming a defected ground structure (DGS). Length and width of the planar slot is optimized to get the required frequency bands whereas incorporation of DGS leads to increase in impedance bandwidth. The simulated and measured return losses ($S_{11}$) of all three frequency bands are greater than 10 dB. Impedance bandwidths of 20 MHz (913–934 MHz), 90 MHz (1.5–1.59 GHz) and 70 MHz (2.43–2.50 GHz) are achieved for the proposed range. The electrically small antenna radiation pattern is omnidirectional, and gains of 0.32 dBi, 1.2 dBi and 1.5 dBi are achieved which make the antenna suitable for RFID, GPS and WLAN applications.

## 1. INTRODUCTION

Electrically small antennas (ESAs) are attracting researchers due to their small size, ease of integration on chipset and multiband characteristics [1]. In wireless communication systems, the need for compact size multiband resonating antennas is increasing day to day. Researchers have proposed many electrically small antennas for various applications using different techniques. There are various single band electrically small antennas proposed in the literature. The authors have proposed an electrically small antenna with semi ground plane for biomedical applications working at 2.45 GHz [2]. ESA' in the form of active antennas using superconductive serial arrays is presented in [3] which is applicable to 200 MHz. An electrically small slotted antenna for MIMO application where the structure uses meander line combination with semi ground plane antenna is illustrated in [4]. Trident shape with a meandered line electrically small antenna is proposed for single band 2.45 GHz application [5]. Electrically small scalable antenna fabricated on a thin circuit board working at 2.4 GHZ frequency is presented in [6]. A compact size antenna using metamaterial based Taconic TLY-5 conducting material having high gain and circular polarization applicable for WiMAX application is proposed in [7]. With increase in complexity of devices, the demand for multiband antennas is very high, and as a result, various types of dual-band and tri-band antennas for various applications have been reported. Planar inverted F shaped dual-band ESA working at 100 MHz and 500 MHz applicable to handheld application is proposed in [8]. A dual-band circularly polarized four short stub loaded microstrip patch antenna useful for wireless applications is proposed in [9] which is not categorized as compact antenna due to its dimensions. Another antenna using carbon composite as conductive adhesive is proposed for UWB applications having dimensions of $41 \times 41\,\text{mm}^2$ [10]. There are various techniques to achieve multiband characteristics such as slot/notch loading, lumped element loading, short circuit microstrip antennas, fractals, artificial magnetic conductors, electromagnetic bandgap (EBG) structures, Split Ring Resonators (SRRs)/Complementary SRRs (CRRs), frequency selective surfaces (FSS) and defected

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# Wireless Sensor Network for Monitoring & Control of Environmental Factors using Arduino

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**Abstract—**Today there is demand to monitor environmental factors almost in all research institutes, industries and even for domestic purpose. The analog data measurement requires manual effort to note readings and there may be a possibility of human error. Such type of systems fails to provide and store precise values of parameters with high accuracy. Analog systems are also having a drawback of storage/memory. Therefore, there is an increasing demand of a smart system which is fully automated, accurate and capable enough to monitor all the environmental parameters with utmost possible accuracy. In this paper a Wireless Temperature and Humidity Monitoring and Control system is presented which continuously scans the temperature and humidity conditions of surroundings and controls the same by triggering a cooling system. This system is interfaced with the GSM module which captures the undesired change in temperature through sensor and sends a warning message to the user acknowledging about the accurate and real-time remote temperature change and at the same time it triggers the cooling system to make the temperature condition to desirable one. This system is convenient to use with a good interface and operates intuitively for shorter ranges.

**Keywords—**Wireless; Arduino; temperature; humidity; GSM

## 1 Introduction

Field of monitoring and remote sensing has been revolutionized by wireless sensor network [1]. Wireless sensor networks can collect data from different sensors such as temperature, humidity, voltage, current etc. from remote locations and co-operatively pass the data through the network to the control station (or where data analysis is needed). Hence, wireless sensor networks can be used for monitoring of power data even from remote locations [2-3]. Continuous monitoring of these physical quantities online from remote control station helps to co-ordinate the uninterrupted operation in the process plants, industries and even in domestic utilities [4-5]. Keeping these situations in view, an attempt has been made in this project to monitor data through wireless sensor network for measurement of temperature and humidity [6-7]. All the measured data is transmitted from the site to the mobile device (control station)

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# Design and Implementation of Custom Logic for utilizing DDR 2 Memory Controller on FPGA for High Speed Data Storage Application

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***Abstract— In the recent development semiconductor technology and availability of microprocessors with rich instruction sets, FPGAs and other such computing platforms, many complex processing tasks becomes more easy, faster and accurate. With rich processing capabilities, it requires to have platform where large amount of data can be buffered for faster processing by high performance computing platforms. For optimized High performance, computing platform requires compatible memory interface, which enables the processing unit (microprocessor / FPGA) to communicate for data readout and write back at relatively faster speed which matches the processing speed. For storage, many different storage options are available like SRAM, DDR RAM, SDCARD, Flash Memory etc. Each one them has their own throughput for reading-writing. In this paper, A DDR2 memory controller is custom configured for High-speed data storage using Xilinx ISE tool and Virtex 5 FPGA as a computing platform. Detailed results are discussed in paper.***

***Keywords— FPGA, DDR2, Memory Controller, High Speed Data, RS232 protocol.***

## I. INTRODUCTION

In the modern computing era, to address the end-user demands for diverse nature of applications, scalable computing platforms have became prime focus to meet custom requirements and specification. These includes issues to be addressed are like power consumption, computing capabilities using FPU and SIMD instruction sets, support for memory interfaces, and programming interface etc. With considering all diverse set of design requirements and constraints, system designer has to select specific device and design based on the application specific performance requirements. In the recent times, due development of advanced processors with rich instruction set and other computing systems along support of high-speed interfaces for data communication and storage, new range of applications has emerged, which is being on prime focus and are being developed and deployed. In the span of recent years, there has been increased clock frequency of the processor but the memory operating clock frequency has not increased at same rate as microprocessor This scenario provides the bottleneck for the range of applications which are data centric (The applications which are heavily dependent on the data read write transactions for processing data items for specific algorithm, where the computer architecture could not accelerate the performance beyond certain limits due to timing and synchronization). These bottlenecks serve the research opportunity for the developing designs for optimized performance. For storing data at the computing platform, various options of memory modules are available to provide suitable selection of memory. Based on the performance qualification criteria (memory throughput, size, data transfer unit, memory response time, etc) designer can suitable memory. For high speed storage on-chip memory serves as one of the best option as in case of processor and internal flash memory or RAM in case of FPGA, which could be Block memory or Distributed memory. However on-chip memories are not available in large size due to high cost (semiconductor design and fabrication). For large volume of data, COTS (commercially off the self) external memories available are SRAM, SDRAM, PROM, Compact flash, DDR Memory (DDR2, DDR3, DDR4, LPDDR, LPDDR2 [1] etc).

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# Proficient Design Space Exploration of ZYNQ SoC using VIVADO Design Suite: Custom Design of High Performance AXI Interface for High speed data transfer between PL and DDR Memory using Hardware-Software Co-Design

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**Abstract**

In the recent era of Massive scale computing, the new trend of deploying application design in which, not only utilizing the software but also integrate and utilization of custom logic design on dedicated Hardware platform is gaining the focus. This design approach allows to fuse the features of software and hardware based systems in a single package. This paper discusses the design of High Speed Data Acquisition System (DAQ) based on Hardware-Software(HW-SW) Co-Design methodology and its experiments on ZYNQ-7000 SoC(System on Chip) based platform (Avnet ZED Board). This novel experimental setup incorporate the design and development of Custom VIVADO Design for ZYNQ-FPGA(Programmable Logic-PL) and move the data to the Onboard DDR3 Memory using AXI4(Advanced Extensible Interface Ver. 4). Detailed design and results are discussed in this paper.

**Keywords**: VIVADO, ZYNQ SoC, Hardware-Software Co-Design, PS-PL Interface, First in first out (FIFO), AXI4

## INTRODUCTION

The objective of the system is to design custom AXI based interface which controls the data transfer between PL-PS in ZYNQ SoC Architecture by providing control and data bus signals. This system is to be used as a Data Acquisition System (DAQS) which acquires data from multiple external sources/lines by sampling using clock signal and it utilizes the bandwidth of DAQ system. To handle the signals with variable data rates (Kbps to Mbps to Gbps), Asynchronous & Synchronous data, and multiple channels (1-n), with configurability in accommodating in a single system design. The constraints in designing configurable DAQS are imposed by underlying Hardware usage in I/O Speed, Synchronizers, Buffers, Memory Modules, FPGA Logical components, etc. In DAQS, the basic problem is to accurately sample the asynchronous/synchronous high speed data lines from multiple channels at the input interface of the system. The proposed system is designed to have configurability using reconfigurable software and hardware components, which allows flexibility of software with the high performance hardware using high speed computing fabrics. For satisfying both the requirements of handling high speed data with reconfigurable computing, a computing architecture with FPGA and Microprocessor is preferred over the conventional processors and Flexible computing architecture over the Application Specific Integrated Circuits.

In traditional systems, high frequency parallel acquisition tasks with reliability are achieved by using Programmable FPGAs as a front-end part in data acquisition systems, while the processor is used for controlling the data movement with standard interfaces like SPI, SDIO, UART, Ethernet or USB among memory components. Using open source device driver, one can easily program interface using ‘C’ and other high level languages. For onboard data storage, memories of various sizes ( Few KB to Few GBs) with variable speed grade is available i.e. SRAM, DDR RAM, FLASH memories and others.

The design of low cost real time DAQ systems are well discussed in various articles [Mehmet et.al., 2008 , B. Nkom et al., 2009, Jason Bank et al., 2012]. Data acquisition process starts with measurement of physical phenomenon. This physical phenomenon could be the room temperature wind flow parameters, light source intensity, stresses and strain, the pressure in a chamber, force applied to an object, or many others. In earlier times, data acquisition system were based on microcontroller unit, but now due to rise of tremendous demand of samples, resolution, and development of semiconductor technology, it is possible to design High performance digital systems which can fuse the available modern processors, digital signal processors(DSP) and FPGAs as a processing unit in the advanced data acquisition system. The all three computing blocks have their own pros and cons in their operational application fields as an individual [Anju P. Raju et al.,2012, Jan Dolinay et al., 2011].

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# Novel LTE-A High Rate and Full Diversity Space Time Block Code for Two Transmit Antenna and Three Time Slot

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***Abstract—In long term evaluation- advanced (LTE-A), there is odd time slot available for data transmission in space time block code wireless communication system. But, higher code rate space time block code offer better data rate in long term evaluation- advanced (LTE-A) where odd number of time slot is available for transmission. In this paper, two new higher code rate space time block code have been proposed for two transmit antenna and one receive antenna using three time slot. Proposed space time block code BER performance outperform over alamouti space time block code. It also outperform in terms of code rate as well. Simulation results show that all proposed schemes give better performance in higher signal to noise ratio for given modulation order. This schemes offer higher code rate i.e.1.33 than alamouti full rate (code rate-1) scheme. At lower signal to noise ratio, the BER performance of proposed- 1 space time block code scheme offers better response than proposed- 2 space time block code scheme. At higher signal to noise ratio, proposed-1 and proposed-2 space time block code schemes have better alamouti BER performance.***

***Keywords—Long term evaluation- advanced (LTE-A) Space Time Block Coding (STBC), Code rate, High rate, Full diversity, Two transmit antenna, Three time slot.***

## I. INTRODUCTION

[1] is a pioneer who brings out basic concept of full code rate and full diversity space time block code. [2] has given fundamental theory of space time block code based on orthogonal design for any number of transmit and receive antennas which offered full diversity, easy maximum likelihood detection and partial code rate. Due to code rate issue in orthogonal transmission, there were many quasi orthogonal space time block codes have been proposed [3]-[10]. These offer full code rate, linear maximum likelihood detection and partial diversity.

In recent times, long term evaluation- advanced (LTE-A) have provision of odd time slot for data transmission in next generation wireless communication system [4].

3rd generation partnership project (3GPP) standard committee finalized cellular system standard across the globe [4]-[6]. Though, there is extremely complex to utilize orthogonal space time block code in the frame structure of long term evaluation- advanced (LTE-A) due to odd transmission time slots available for data transmission. Due to this constraint, researchers are emphases on two transmit antenna and three time slot in space time block code. In recent times, couples of novel space time block codes have been proposed in literature.

Hybrid space time block code has been presented in [6] for two transmit antenna and three time slot. The constraint in this scheme is diversity. It has full code rate however not full diversity. So, full diversity as well as full rate has been presented in [7]. When modulation order increases its minimum determinant value (MDV) evaporate. This will take towards poor performance. In [8], group decodable space time block code (GSTBC) was presented with random code measurements, with use of odd number of time slots. It fulfilled the requirement of three time slot transmit diversity matter which was initiated by 3rd Generation Partnership Project (3GPP). In recent times [9], novel STBC has been presented which make use of two antennas and three time slots with given aspects i) full diversity and code rate one ii) three symbol joint maximum likelihood (ML) detection iii) With expansion of signal constellation minimum determinant value (MDV) does not evaporate iv) single antenna transmission compatible mode. In [10], it improves all drawbacks of [9] including BER performance but still code rate remain one. This focus to increase code rate more than one.

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# Spatial Modulation- A High Spectral Efficient Technique

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***Abstract*— Spatial modulation scheme introduced in present times has proved advantageous in context of wireless MIMO communication systems. Furthermore, it also increased spectral efficiency and throughput. In this paper we have presented the simulation results of a SISO wireless communication** $(N_t = 2, N_a = 1, N_r = 1)$ ***with quadrature phase shift keying (QPSK). The performance is shown in the graphical form of BER (bit error rate) vs SNR (signal to noise ratio).***

***Keywords*—** *Spatial Modulation, QPSK (Quadrature Phase Shift Keying), Single Input Single Output.*

## I. INTRODUCTION

To achieve high data rate in wireless communication domain, many modulation schemes and adaptive coding techniques are proposed like STCs, spatial modulation, PSKs and etc[1]-[9]. In the present antenna diversity's MIMO, spatial Modulation is widely used approach in which antenna indexing is used. Power consumption in wireless networks has been a major issue. But, spatial modulation technique has low power consumption compared to other schemes. At the receiver side there is only one unit, reducing the complexity at receiver side [2], [5]. Hence, due to the high energy efficiency and low detection complexity, spatial modulation is regarded as a candidate technique for future wireless communication systems, especially for large-scale MIMO [6], [8].

Increasing the order of modulation increases the bits to be transmitted. In QPSK system, at a time 2 bits are modulated on the basis of its constellation diagram.

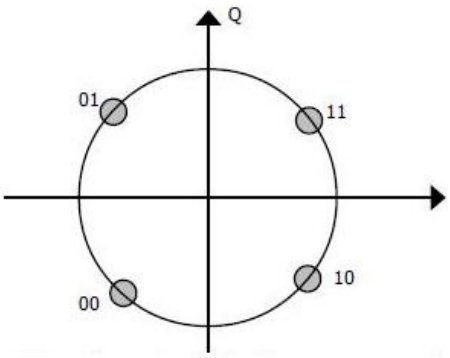


Fig.1 Constellation diagram of QPSK

Each adjacent symbol only differs by one bit, sometimes known as quaternary or quadrature PSK or 4-PSK, or 4-QAM [7].QPSK uses four points on the constellation diagram, equi-spaced around a circle. With four phases, QPSK can encode two bits per symbol shown in the diagram to minimize the BER- twice the rate of BPSK. Analysis shows that this may be used either to double the data rate compared to a BPSK system while maintaining the bandwidth of the signal or to maintain the data rate of BPSK but half the bandwidth needed [10][11].

At the receiver, the detection algorithm needs to find out the modulated symbol and index of selected antenna by a joint exhaustive search for recovering the information data. The most obvious and efficient way to reduce complexity is to restrict maximum-likelihood (ML) search space [10].

In Further sections, the system model, simulation results and finally the paper is concluded in last section.

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# Near Optimal Receive Antenna Selection Scheme for MIMO System under Spatially Correlated Channel

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**ABSTRACT**

Spatial correlation is a critical impairment for practical Multiple Input Multiple Output (MIMO) wireless communication systems. To overcome from this issue, one of the solutions is receive antenna selection. Receive antenna selection is a low-cost, low-complexity and no requirement of feedback bit alternative option to capture many of the advantages of MIMO systems. In this paper, symbol error rate (SER) versus signal to noise ratio (SNR) performance comparasion of proposed receive antenna selection scheme for full rate non-orthogonal Space Time Block Code (STBC) is obtained using simulations in MIMO systems under spatially correlated channel at transmit and receive antenna compare with several existing receive antenna selection schemes. The performance of proposed receive antenna selection scheme is same as conventional scheme and beat all other existing schemes.

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## 1. INTRODUCTION

Wireless communication in a fading channel is very challenging. Performance of wireless communication systems can be improved by using several diversity techniques using multiple antennas at the transmitter or at the receiver or at both the ends. In general, this is popularly known as multiple input multiple output (MIMO) in standards such as Long Term Evolution (LTE), Wideband Code Division Multiple Access (WCDMA) and Worldwide Interoperability for Microwave Access (WiMAX). In MIMO systems, at the transmitter, space time block coding (STBC) is used to exploit diversity gain. However, adverse effect of STBC is there on the code rate. A special case of Orthogonal STBC, the Alamouti space time code [1], which has been proposed for two transmit antennas, can offer full diversity gain and rate as well i.e. one. For more than two transmit antennas, the code rate is below one [2].

Recently, some non-orthogonal STBC have been proposed with reasonable decoding complexity with a motivation to gain full diversity without loss of code rate [3], [4]. In [4], three and four transmit antennas are used and SER performance was presented using simulations assuming spatially uncorrelated channels.

However, it is hardly possible to assume spatially uncorrelated channels [5], [6]. Therefore, in this paper a real time scenario is considered assuming spatially correlated channels in MIMO system at both the ends with receive antenna selection [7]-[11]. Assuming coherent detection of QPSK modulation with quasi-static rayleigh fading channels, we present SER performance of this system and shows that effect of spatial correlation at the transmit and receive antennas to be nullify and improved with proposed receive antenna selection scheme. The reason behind choosing receive antenna selection are a) No hardware complexity b) No more RF (radio frequency) chain required c) incereses channel capacity d) do not require feedback bit.

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# Performance Analysis of fibre Channel Dispersion and its effect on Optical Communication

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***Abstract—the bandwidth that an optical fiber can support is limited by the dispersion in an optical fiber. As the demand of bandwidth increases, the spacing between successive pulses and the pulse duration of the signals have to decrease to meet the demand. However, the short optical pulses used may not necessarily be monochromatic, in another words they often contain more than one frequency components. In this case, chromatic dispersion in the optical fibre is the dominant factor limiting the transmission rate of nowadays telecommunication systems. Dispersion limits the length of fibre and effect on inter symbol interference (ISI) of the signal. The primary dispersion in a multi-mode step index fiber is the intermodal dispersion caused by different modes in the fiber traveling different distances to reach from one point to another a narrow pulse at the input divides its energy into different modes which now take different lengths of time to reach the detector. The result is a broadening of the pulse. In the graded index fiber, the intermodal dispersion is greatly reduced and is eliminated in a single mode fiber. The pulse broadening may cause overlapping of neighboring pulses. To avoid this, dispersion compensation techniques are used to make sure long and error free transmission. In this paper the effect of dispersion and the method to compensate it using MATLAB coding and SIMULINK modeling of the optical communication system are shown***.

***Keywords—*** *Dispersion, Inter symbol Interference, Chromatic Dispersion, Polarization Mode dispersion, optical fibre*

## Introduction

The demand for the bandwidth of nowadays telecommunications grows exponentially each year. For high speed communications, data (bits) are converted to optical pulses and sent through optical fibres. Single-mode optical fibres have been laid underground and on the ocean floor to provide high speed telecommunication pathways throughout the globe. As the demand of bandwidth increases, the spacing between successive pulses and the pulse duration of the signals have to decrease to meet the demand. However, the short optical pulses used may not necessarily be monochromatic, in another words they often contain more than one frequency components. In this case, chromatic dispersion in the optical fibre is the dominant factor limiting the transmission rate of nowadays telecommunication systems. Dispersion defined as the signal broadening or spreading while it is propagates inside the fibre. It is most often described in light waves, but it may happen to any kind of wave that interacts with a medium or can be confined to a waveguide, such as sound waves. As a pulse of light proceeds through the fibre, it widens in the time domain. This spreading is caused by dispersion [1]

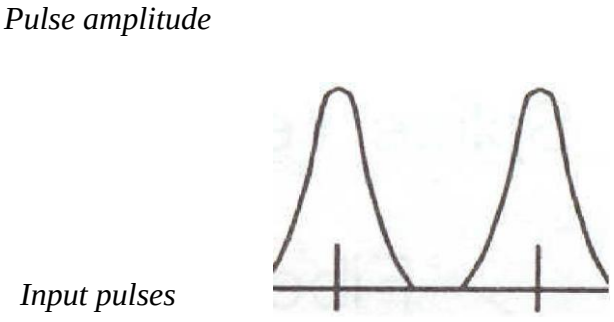


*Figure 1(a) Well-resolved pulses at input*

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# Analysis of Pulse Dispersion and effects of differential group delay and length of optical fibre

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**ABSTRACT** *In current era, Optical fibre communication is used to transmit data with high speed and for requirement of high data rate. In optical communication we can transmit data in terabit range. Data accuracy is very important in case of optical communication. Signal distortion due to pulse broadening is leads inter symbol interference of the optical signal which is called pulse dispersion. Analysis and compensation of pulse diapersion is necessary. In today's optical communication pulse dispersion will be managed by using some advanced optical amplifiers and wavelength division multiplexing technique. In this paper we analyse the difference types of pulse dispersion like polarization mode dispersion and chromatic dispersion. We have also proved in this paper that the differential group delay effects on ISI of the signal and Signal ISI limits the length of optical fibre. In this paper we analyse the effect of pulse dispersion in form of DGD and fibre length because of pulse dispersion.*

***Keywords:*** *Pulse dispersion, Differential Group delay, optical fibre, Group velocity dispersion.*

## 1. INTRODUCTION

The total dispersion of single-mode fibres is the combination of material and waveguide dispersion[1]. It can be taken into account mathematically by using the Taylor series expansion about the centre frequency $\omega_0$ of the mode-propagation constant $\beta(\omega)$

$$\beta(\omega) = \beta_0 + \beta_1(\omega - \omega_0)\frac{\beta_0}{2!}(\omega - \omega_0)^2 + \ldots\ldots \quad (1)$$

Where,
$$\beta_m = \frac{d^m \beta}{d\omega^m}_{\omega=\omega_0} \quad (2)$$

The parameter $\beta_1$ is the reciprocal of the group velocity vg and is related to the group index ng, where the group velocity represents the velocity of the envelope of the optical pulse[2]

$$\beta_1 = \frac{1}{v_g} = \frac{n_g}{c} \quad (3)$$

On the other hand, $\beta_2$ represents the change in group velocity of the envelope as a function of frequency and is the main factor that is responsible for pulse broadening effects.

$$\beta_2 = \frac{d\beta_1}{d\omega} = \frac{d}{d\omega}\frac{1}{v_g} = -\frac{1}{v_g^2}\frac{dv_g}{d\omega} \quad (4)$$

The pulse broadening effect is called the group-velocity dispersion (GVD), and $\beta_2$ is generally referred to as the GVD parameter which is the most interesting parameter in this paper.

The unit of $\beta_2$ is ps2/km which is equivalent to ps/ (THz·km), and it can be easily understood as if there are two pulses separated by 1THz entering a 1km fiber with $\beta_2$ = 20ps2/km, they will have a 20ps delay between them when they exit at the other end. The dispersion parameter D is commonly used in engineering literature in place of $\beta_2$ and it has the units of ps/(nm· km), which has the same meaning of the $\beta_2$ parameter but the unit of the pulse separation is in wavelength (nm). It is related to $\beta_2$ by the relation

$$D = -\frac{2\pi c}{\lambda^2}\beta_2 \quad (5)$$

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# Measurement of Material Dispersion for 850nm wavelength using FiberSim Simulator

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***Abstract*—Dispersion in the optical fibre is critical issue in case of optical fibre communication. Dispersion is broadening of the pulse which affect the inter symbol interference of the pulse. This ISI effect limits the length of fibre, data rate of transmission and strength of the signal in optical fibre. Basically there are three types of dispersions material dispersion, waveguide dispersion and polarisation mode dispersion. Dispersion depends on types of optical source, spectral width of the optical source and type of fibre. Study of measurement and compensation of dispersion is very necessary to improve the quality of optical communication. In this paper study of dispersion is completed. We have been measured material dispersion for 850nm wavelength signal of Light Emitting Diode (LED) source. We have taken 20nm width of the pulse and measured dispersion at different distances. Results show that the data rate and broadening of the pulse at various length of optical fibre***.

***Keywords*—** *Dispersion, Inter symbol Interference, Material Dispersion, Optical communication*

## Introduction

The high bandwidth of today's communication increases exponentially every year. For high speed communications, we can optical communication which supports terabits bandwidth and high data rate transmission. As the ultimatum of bandwidth rises, the spacing between successive pulses and ISI effect of the pulse should be minimum. Any signal in optical contain more number of frequencies or wavelength,. As we know these different components travels with different speed in optical channel and they arrives at different time at the receiver. Due to delay between these different components pulse broadening occurs which is called dispersion[1]. Dispersion depends on the source type, spectral width of the source, material utilized in optical etc. Dispersion is very important parameter which degrades quality of optical communication system. LASER optical source having the narrow spectral width compared to the LED so it create less dispersion compared to LED source. In multi-mode fiber effect of dispersion is more compared to single mode fibre. Different mode having different velocity of pulse in multimode fibre so delay occurs on output and dispersion occurs which is called intermodal dispersion. Intermodal dispersion occurs only in multimode fibre. In single mode fibre dispersion occurs because of material or reflective index of material which is called material dispersion [2]. In this paper we have studied material dispersion and measured it at 850nm wavelength signal by using Fibre Sim simulator.. As a pulse of light proceeds through the fibre, it widens in the time domain. This spreading is caused by dispersion. To improve the optical communication we should study some dispersion compensation techniques [3].

## I. Material Dispersion

Material dispersion is produced by the speed of light existence a utility of wavelength. If the wavelength of the signal is higher, the signal arrives faster than the lower wavelength optical signal so that pulse is broadened. This happens in same material fibre this is called material dispersion. This broadening of the pulse is expressed by following equations [4]

$$T = \frac{L}{V_g} \qquad (1)$$

Where $V_g$ is the group velocity of fiber given by,

$$V_g = 1/(\frac{d\beta}{d\omega}) \qquad (2)$$

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# Design of Printed Monopole Antenna for Wireless Energy Meter and Smart Applications

**Trushit Upadhyaya*, Arpan Desai, and Riki Patel**

**Abstract**—European smart energy meter applications operate over a smart grid network. These applications operate over ISM frequency bands. The proposed dual-band printed monopole antenna provides a solution to smart energy meter applications. The surface dimension of the planar monopole antenna is $45 \times 17\,\text{mm}^2$. The antenna has strips fabricated on a standard cost-effective FR-4 substrate of thickness 1.6 mm for achieving dual-mode resonance at 868 MHz and 2.4 GHz. The proposed monopole antenna has operating impedance bandwidth of 2.89% and 2.78% for the first and second resonances, respectively. The gain of the presented antenna is in order of 1.18 dBi for lower resonant mode and 2.1 dBi for the higher resonant mode. The antenna resonates in the frequency range which is also useful in smart RFID tags for device identification operating over smart grid. In addition, the antenna can be utilized for the devices functional in Low Rate Wireless Personal Area Networks (LR-WPAN) and WiFi-based smart applications.

## 1. INTRODUCTION

The wireless communication technology has seen extremely rapid growth, and wireless networks play a crucial role for wireless handheld devices. The integrated antennas in such devices should be able to cater the need for acceptable gain and impedance bandwidth. Through Joint Research Center (JRC) reference report, European commission provided guidelines for conducting a cost-benefit analysis of smart grid projects. The report has convincingly argued the economic potential of the smart grid systems [1]. LR-WPAN, IEEE 802.15.4 protocol, can provide high energy efficiency and higher node-living time due to optional beacon-enable mode. Unlike Wireless LAN standard, LR-WPAN standard needs very little or negligible infrastructure for connections. There is no need of connectivity beyond the communication link established between two devices. The LR-WPAN has higher efficiency due to lower latency rates and higher node-living time. Hence, LR-WPAN offers power efficient and low cost solutions [2]. The Industrial, Scientific, and Medical (ISM) band in European countries covers a range of Low Rate Wireless Personal Area Network applications at 868.3 MHz. LR-WPAN communication applications are able to support smart grid networks with higher accuracy, lower latency and high node-living time. In addition, LR-WPAN configured for wireless sensor networks has higher power efficiency than simple sensor nets [3]. Printed monopole antennas are being extensively utilized for handheld communication devices such as tablet, laptops and mobile phones [4–8]. The printed monopole antenna operational at multiple resonant modes is being excessively utilized as embedded antennas in handheld devices for end-user applications. The antennas can be tuned for target applications without major modifications in substrate dimensions or effective antenna size. The resonant modes can be excited by modification or addition of monopole branches. The electrical size of such an antenna is always of great concern. The loop antennas etched on substrate or base of handheld devices offer an

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RESEARCH ARTICLE

# Design of wide band printed monopole antenna for low rate wireless personal area networks

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**Abstract**

A dual-band printed monopole antenna useful in low-rate wireless personal area networks (LR-PAN) and GPS operation for tablet devices is presented. Antenna has monopole strips arranged in planar configuration on substrate suitable to match standard tablet computer display size. The overall antenna dimension is 150 × 50 × 1.6 $mm^3$. The long and short strips of monopole are separated by notch to increase the bandwidth of antenna. The operating impedance bandwidths of 14.97% and 5.09% are obtained across LR-PAN band and GPS band, respectively. The presented monopole antenna provides significant gain in order of 4.48 dBi for lower resonant mode and 3.26 dBi for higher resonant mode. The antenna covers LR-WPAN frequency bands of 868.3 MHz, 915/920 MHz, GSM 850, UMTS/LTE 850, 1.57 GHz GPS bands.

KEYWORDS

automatic meter reading, low data rate wireless personal area network, mesh networks, monopole antenna, SOHO networks

## 1 | INTRODUCTION

The wireless networking plays an important role for wireless handheld devices with rapid increase in wireless communication technologies. The embedded antenna in such devices should be able to provide sufficient operational bandwidth and gain for range of wireless applications. Low-data rate wireless personal area network (LR-WPAN) provides wide coverage of facilities for short range wireless communication protocols based applications. LR-WPAN is popular in wireless sensor network and it offers lesser challenges in terms of power consumption, cost and complexity compared to simple sensor nets.[1] LR-WPAN communication can support mesh networks to efficiently gather the network data with high accuracy, lower delay, and larger node-living time. One of such important utilization of mesh network is automatic smart meter reading. The proposed antenna is primarily designed to address this application.

Printed monopole antennas have been broadly found their applications in tablets, laptops, and mobile phones.[2–7] The multifrequency monopole antennas are providing most promising way of integration with handheld devices for commercial applications. The mode excitation in printed monopole antennas can be governed by modifications in physical dimension of associated branches without any significant changes in substrate dimensions. In addition to the monopole antennas, loop antennas printed on the top of substrate are another popular type of PCB antennas for tablet and mobile phones.[8–12] Also, uniplanar PIFA antennas have presented its potential applicability for mobile and tablet devices.[13–15] The conventional PIFA offers issues related to design complexity, physical space, and strong interbranch coupling. Compact antennas are presented in literature for utilization in tablet, laptop, and hand held devices;[16–18] however, this type of antenna has limited gain which makes them less functional for target wireless applications. Reconfigurable antennas have also been addressed in literature for compact handheld designs.[19–21] Additionally, the compactness of antenna can be achieved by introducing lumped circuit elements; however, such antennas suffers with fabrication complexity.[22,23]

The proposed antenna is primarily designed to support IEEE 802.15.4 LR-WPAN switching bands of 868 MHz and 915/920 MHz for smart grids and additional bands of GSM850 MHz, UMTS 824-894 MHz, LTE 850 MHz (North America Region), and GPS 1575 MHz. The IEEE 802.15.4 standard provides the following RF link specifications for operation (a) 1 channel at 868.3 MHz frequency having 600 kHz of bandwidth (b) 10 channels within 902-928 MHz band each having around 2 MHz bandwidth. First and second RF links are unlicensed for Europe region and North America region, respectively. The proposed antenna resonates at dual-band frequencies covering

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# Investigation on Radiation Characteristics of $\mu$- Negative Material Array Loaded Planar Resonator

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***Abstract*- In this article, a radiation characteristic of μ-negative material loaded planar microstrip resonator is examined. This antenna resonates at 3.5 GHz and 5.8 GHz frequencies with return loss of 38.12 dB and 15.83dB respectively. The substrate dimension of proposed resonator is 0.505λ x 0.6λ at lower frequency and 0.84λ x 1.0λ at higher frequency. An engineered partial ground plane is utilized to improve impedance bandwidth of the resonator. The design incorporates homogenous square shaped Split Ring Resonator (SRR) array, which possesses μ-negative characteristics, are loaded on the back side of planar resonator. Enhancement of gain at antenna bore sight and radiation efficiency of antenna is achieved using Split Ring Resonators. A cost effective FR-4 substrate has been selected for design. The resonator prototype has been fabricated and measured results are presented. Measured results have good agreement with simulated results. The proposed design presents optimized dimensions for target resonance frequencies for fair value of bandwidth and gain compared to other antennas proposed in literature.**

***Index Terms*- μ-negative materials, efficiency improvement, gain improvement, homogenous split ring resonators array, partial ground plane**

## I. INTRODUCTION

Wireless services have been extremely popular in the modern era of communication technologies across the globe. In recent years, Worldwide Interoperability for Microwave Access (WiMAX) is one the most in-demand broadband wireless technology. WiMAX provides good alternative to Digital Subscriber Line (DSL) and other cable connections. The WiMAX technology furnishes last-mile internet access and installation of its network is also cost effective [1]. The extremely high demand of wireless users is catered by microwave links. The antennas are crucial element of wireless communication. The demand of planar antenna for commercial wireless applications is ever increasing and plenty of research is being carried out in planar antenna design and its optimization [2-3]. Planar antenna provides feasibility of surface mounting and offers less volume. Microstrip resonators are typically of planar structure, low profile and provide higher radiation efficiency. Due to such advantages microstrip patch antennas are widely utilized in many wireless applications [4-6]. Patch antennas suffer from narrow bandwidth. Many techniques have been proposed in literature to improve bandwidth of patch antenna; however, partial ground provides very high bandwidth improvement in planar resonator [7-8]. The cut within patch at top layer of antenna can be created for bandwidth enhancement. Two notches are added in the presented design for bandwidth enhancement and fine antenna tuning to resonate at target frequencies [9].

One of the techniques to improve antenna radiation is to use artificial left-handed material also known as metamaterials. These materials are not readily available in nature. Left handed materials (LHMs) are artificial materials that have negative electrical permittivity, negative magnetic permeability [10-11], and negative index of refraction across a common frequency band also referred as Negative Index Materials (NIMs) [12]. To investigate the electromagnetic properties of such a medium, it was first studied how the electromagnetic wave behaves when $\varepsilon < 0$ and $\mu < 0$. According to Pendry and Veselago [4-5], an artificial μ-negative permeability

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# Design and Analysis of Periodic Split Ring Resonator Array Inspired Defected Ground Plane Antenna

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***Abstract*- In this paper, a radiation characteristic of μ-negative material inspired defected ground plane microstrip antenna is examined. Defected ground plane structure (DGS) is the prominent technique to improve bandwidth and gain of the antenna whereas negative refractive index materials have shown extraordinary electromagnetic properties. The overall size of proposed antenna is kept fixed, while homogenous array of split ring resonators are implemented as defected ground structures. The antenna size is 51mm x 43mm which makes it electrically compact being operated in IEEE S-band. Standard low loss FR-4 laminates of 1.6 mm thickness were used for the design. The antenna resonates at multiple frequencies in IEEE S-band and it can be utilized for specific wireless applications, however, key important focus of the paper is to analyze the antenna radiation properties for varied periodic defects in ground plane. The resonance modes, impedance bandwidth and gain are presented in the paper. Antennas were fabricated to verify the simulated results which show good agreement with measured results.**

***Index Terms*- Defected ground plane, μ-negative material, split ring resonators, Gain and bandwidth improvement**

## I. INTRODUCTION

An antenna acting as a transducer is an essential component of wireless communication. The antenna has its typical gain and bandwidth requirement for optimal performance along with low manufacturing cost. Conventional microstrip planar antennas are very widely utilized antennas for wireless applications. A traditional microstrip patch antenna suffers from issues such as single resonance frequency, lower gain, lower impedance bandwidth and linear polarization [1]. There are numerous techniques available for radiation characteristics enhancement of antenna. Out of several well-known methods, defective ground plane technique has gained significant popularity due to its structural design and ease in fabrication [2-4]. DGS offers extra freedom of tuning and opens up additional dimensions in terms of variation of characteristics impedance of antenna.

The defected ground structures are either unit cells or strategically cascaded periodic and/or non-periodic structures etched out in ground plane [5]. Symmetric or asymmetric slits and cuts are introduced on ordinary ground plane to make it defected ground plane. This perturbs the surface currents flowing in antenna due to introduction of slit resistance, capacitance and inductance [6]. This in turn alters equivalent circuit parameters and hence antenna resonance. In addition, effective parameter extraction and fabrication is easier compared to photonic band gaps (PBG) and Electromagnetic band gaps (EBG) inspired antennas [7]

Defected Ground Structure (DGS) and split ring resonator (SRR) based antennas has wide utilization in both active and passive microwave components and devices. They have found great applications for miniaturization of antennas [8], antenna bandwidth enhancement [9-10], antenna gain enhancements [11-12], harmonic suppression [13], and antenna cross polarization suppression [14], reduction of mutual coupling in antenna array [15-16] and enhancement of filter characteristics [17]. In the proposed article, split ring resonator based periodic defected ground plane is examined. The study of antenna radiation characteristics with increase in periodic SRR defects in ground plane is presented.

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# Experimental Study and Implementation of Industrial or Home Automation

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***ABSTRACT***

***A telephone circuit which enables switching ON and OFF of appliances through telephone lines. It can be used to switch on or off the appliances from any distance, overcoming the limited range of infrared and radio remote controls. The DTMF signals in telephone instruments are used as control signals. The digit # in DTMF mode is used to toggle between the appliance mode and normal telephone operation mode. Thus the telephone can be used to switch on or switch off the appliances also while being used for normal conversation. In order to build a telephone operated remote switch, first DTMF signal is converted into BCD form with the help of IC MT8870. The DTMF signal in telephone instruments used as the control the digit # in DTMF mode is used to toggle between the appliances mode and normal telephone mode with the help of IC 74LS154 decoder and according data is stored in D-latch. In similar fashion, the relay is operated which causes the appliances turn ON or OFF. Before going to telephone operated remote switch let's consider function and operation of each block.***

## INTRODUCTION

To control the electronic devices at industry and home using telephone operated remote switch."Electronics dominate the world today and many of the people in it. Within the past twenty years or so, so many improvements and advancements in technology have created a world which relies on electronic services and communication. The main objective here is to remotely control devices/appliances at home or industries so we don't need to be at that place. It can solve many problems of industry and it's very useful. It is very useful at home and industries such as agriculture, hospital automation, power plant, ship loading etc.Generally, mechanical switches are used, but they can't remotely control. So telephone operated switch control devices far away from distance. Currently some appliance manufacturer provides facility to control that appliance through telephone. Using this remote control switch we can operate more than one appliance.

In this paper, telephone operated remote switch using DTMF (Dual Tone Multi-frequency Signalling) and micro-controller [1] is used. We will understand operation of components such as DTMF, Micro-controller, relay etc. Then we will learn how to interface this component with micro-controller. We will make and compile algorithms for micro-controller and in last we will implement hardware after debugging and troubleshooting. It should also sense if the connected «consumer» is turned-on or off and report to the administrator at the other end of the phone line

Our main objective here is to remotely control devices/appliances at home or industries so we don't need to be at that place [2,3]. It can solve many problems of industry and it's very useful. It is very useful at home and industries such as agriculture, hospital automation, power plant, ship loading etc. In this project we will implement the telephone operated remote switch using DTMF (dual tone multi-frequency signalling) and micro-controller. Tone and pulse dialing are two ways of communicating with the central telephone relay to indicate the telephone number that you wish to call. Pulse dialing indicates each digit in the phone number by a series of clicks that corresponds only to that digit. It would then need a short pause in order to clearly identify one digit from the next. [4,5]

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# Energy Harvesting using Novel Technique: Walk & Charge

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***Abstract***— Increase in energy consumption of portable electronic devices and the concept of harvesting renewable energy in human surrounding arouse a renewed interest. This technical paper focuses on one such advanced method of energy harvesting using piezoelectric material. Piezoelectric materials can be used as mechanisms to transfer mechanical energy, usually ambient vibration, into electrical energy that can be stored and used to power other devices. A piezoelectric substance is one that produces an electric charge when a mechanical stress is applied. Conversely, a mechanical deformation is produced when an electric field is applied. Piezo-film can generate enough electrical density that can be stored in a rechargeable battery for later use. Piezoelectric materials have a vast application in real fields. Some of the latest applications are mentioned below. Currently, there is a need to utilize alternative forms of energy at passenger terminals like airports and railways across the world. Cleaner, more sustainable forms of electrical power are needed in order to keep costs lower, to maintain positive and productive relationships with neighbors and to insure a healthier environment for future generations. The use of piezoelectric devices installed in terminals will enable the capturing of kinetic energy from foot traffic. This energy can then be used to offset some of the power coming from the main grid. Such a source of power can then be used to operate lighting systems. The increasing prevalence and portability of compact, low power electronics requires reliable power sources. Compared to batteries, ambient energy harvesting devices show much potential as power sources. A piezoelectric generator can be developed that harvests mechanical vibrations energy available on a bicycle. The electrical energy thus produced can be used to power devices aboard the bike, or other portable devices that the cyclist uses. Electrical energy can also be generated from traffic vibrations (vibrations in the road surface) using piezoelectric material.

**Keywords**: Energy Harvesting, Power consumption, Piezo electric material

## INTRODUCTION

### 1.1 Overview

In today's hectic lifestyle, health has been seriously hampered due to sedentary work. This project represents an idea of walking based wearable piezoelectric device that provides an alternate means for powering mobile phone batteries. Since, the mechanism of the device is based on walking; the device promotes human metabolism as well as physical fitness. Hence, it can be seen as an e-health gadget that encourages walking exercise as a means to charge mobile phone batteries. Walking is the best and common activity in day to day life. As per the study of Biomechanics, the ground reaction force, GRF is the force exerted by the ground on the body in contact with it. For example A person standing motionless on the ground exerts a contact on it which is equal to the person's weight and at the same time an equal and opposite GRF is exerted by the ground on the person .Thus, as the human starts walking, this GRF increases which generates power in greater amount, so why to waste this power?

The world's energy consumption is all the time high with the demand continuously increasing. With the advent use of portable machines in this technological world; it has become a major issue of power source. The situation brings up several challenges that need to be addressed. [1]

1.) Power supply.

2.) Battery discharging.

3.) Availability of power source.

Our project represents an idea of walking based wearable piezoelectric device that provides an alternate means for powering mobile phone batteries.

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# Research and Development of various Text to Speech synthesisers in Gujarati Language

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***Abstract— During last couple of years as the speech and language processing has provide it's significant in various fields. Text to speech conversion (Synthesiser) is very important aspect of speech and language processing field. Researcher has provided huge contribution to develop text to speech synthesiser in many foreign languages English, German etc. In India text to speech synthesiser is developed in many languages out of 22 official local Indian languages. This paper primary focus on various work done for text to speech synthesiser developed in Guajarati Language.***

***Keywords— Text to speech synthesiser, Indian Gujarati Language, Speech quality, Speech corpus***

## I. INTRODUCTION

The meaning and purpose of synthesiser of speech is to convert the text to the synthetic speech (TTS- Text to Speech) which is as close to real speech as possible in acquiescence with the pronunciation touchstone of special language [1]. The objective of TTS system is to read electronic texts in the form of a book, and generate synthesis speech as shown in figure-1. In the current era of fast paced technology development in the field of information and communication technology such synthesisers can be used in various applications like artificial intelligence, robotics, in information referral systems, it can also be useful to help blind people or who lost reading ability [2,3].

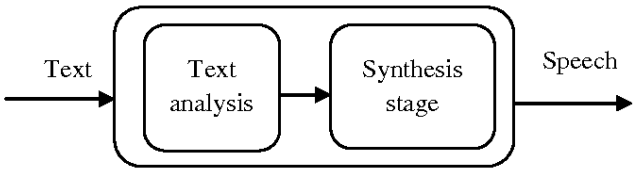


*Fig. 1 General Process of any TTS system*

Primary factors like its similarity to normal human speech (naturalness) and its intelligibility (ease of understanding by the listener) defines the quality of a speech synthesizer. Ideally, a speech synthesizer should be both natural and intelligible, and speech synthesis systems always attempt to maximize both the characteristics [4].

Further this Paper is organised as per 2) Requirement of TTS in Indian Languages, 3) Types of Synthesiser 4) Review of work done for Text to speech Synthesiser in Gujarati languages 5) Conclusion.

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# Construct a phonetic database and develop a phonetic transcription in Gujarati language

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***Abstract*—** Last few decades are witness of development of phonetic transcription as a part of linguistic research in various languages like American English, Spanish, and Japanese etc. Few amount of work has been done for Indian languages by researchers. So this paper particular focuses in Gujarati Language which is official regional Indian language. This research paper mainly contains two important parts as far as linguistic research is concern first one is creation of phonetic database and second is to develop a phonetic transcription in Guajarati language. For better analysis for bilingual and multilingual analysis phonetic transcription of Gujarati language has been compared with American English.

***Keywords*—** Phonetic database, Phonetic Transcription, Gujarati Language, International Phonetic Alphabet (IPA), PRAAT Software

## I. INTRODUCTION

Introduction Human do communication by various ways but best way of communication is speech and hence it is worth to say human could not become human except by language. With rapid development of human being language has become an integral part of any society, country and world by itself. Different flavours in language is purely depends on group of peoples, atmospheric conditions, physical structure of human being and so analysis of language is always an interesting topic. The scientific study of language is called as a phonetics and the way of writing phonetic is called phonetic transcription. [1, 2]

For example in English language two words Heart (muscular organ) / Heard (past tense of hear) spelt almost similar but pronounce differently phonetic transcription play vital role to understand this. Phonetic Transcription is discernible representation of sounds, other synonym are phonetic script or phonetic notation. Generally phonetic transcription is written based on though that any sounds are demarcation in to discrete words which are represented inform of symbols, commonly it is written using phonetic alphabet namely International phonetic alphabet (IPA)[3]. It help us to scrutinize distinction in pronunciation between dialects within a given language.

The other important aspects of creating and understanding the phonetic transcription is that it can be useful in other linguistic research area like to develop text to speech synthesiser (TTS) [4], implementation of phonetic engine, machine learning ,Speech recognition etc. [5].That's it is very important to have phonetic transcription for a every language.

In last decades lots of researcher has provide their contribution for various linguistic area in languages like English, German, Chinese, and Spanish etc. So, it is highly recommended to carry out some work in Indian regional languages because India is very strong in terms of number of languages and dialects of languages as mention below.

This paper has been organized as 1) Introduction 2) Related work in Gujarati Language 3) Methodology which includes Constructing a Database of Gujarati Characters for Speech Synthesis and Phonetic Transcription of Gujarati Language and finally results and analysis Phonetic Comparison between Gujarati and English language has been mention.

## II. RELATED WORK IN GUJARATI LANGUAGE

India is Asian country which holds second highest no. of languages, multicultural peoples and environmental differences study of languages is always an interesting. Gujarati is the one of the official language in India which is spoken in majority western part of India [6]. Author has prepared database at syllable level in Gujarati language which can be utilized for text to speech synthesizer using Concatenative synthesis approach and also highlights some issues regarding phonetic transcription Gujarati language.

Table-1 Consonants and vowels in Gujarati Language

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# Development of Emotion Recognition From A Speech In Various Regional Indian Languages: A Review

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***Abstract*—** Last few years have given witness of development in the field of emotion recognition from speech. Significance contribution has been provided by the researchers to detect emotions from a speech in various languages across world. India is country where second highest numbers of languages are spoken; in addition to that, same language is spoken with different dialects (flavors) with specified area. By considering this fact review of existing and latest work in emotion recognition and its development in Indian languages is useful for boosting further research. In this review paper enlargement of emotions detection, expansion of various speech databases, kinds of classifiers/ parameters/models used for detection in various Indian languages has been discussed. At last important issues has been presented. The purpose of this paper is to ignite the work in Indian Local languages.

***Keywords*—** *Emotion recognition, Regional Indian Languages, Simulated Indian emotional speech corpus, Prosodic features, Source features, Classifier*

## I. INTRODUCTION

There are several ways of communication and speech is the best mode of communication for human beings. Speech is a complex signal which holds information about language, speaker, message, and emotion. Last several decades researcher from psychology and neuroscience has proven that emotions are closely related to decision making and so it plays an important role in the rational actions of human. Emotions can be identified by speech and facial expression but identification from the speech is extremely difficult task. If emotion gets involve in a speech, human robot interaction can be possible in better and effective way [1, 2, 3]. Detail day to day application has been explained further in this paper.

An emotion is a complex psycho-physiological short-time experience resulting from the interaction of biochemical (internal) and environmental (external) factors. Decisions are highly affected by emotions. Recent research emanates that if events occurrence is happened along with emotions, it memorized and recalled with more clarity than without emotions [4].

According to Darwin's theory of evolution, emotions find their provenience in biology. Emotions classification can has been done in two ways approach one is discrete approach and another is continuous approach. According to discrete approach basic seven emotions are defined: happiness, sadness, anger, anxiety, boredom, disgust and neutral [5]. Further complex emotions can be classified by concoction of the basic ones. 40 discrete words for complex emotions were identified and classified in BEEV (Basic English Emotional Vocabulary) for automatic emotion recognition. In continuous approach each emotion can be manifested as a linear amalgam of valence (or evaluation), arousal (or activation) and potency (or power) for example, Thayer's valence-arousal representation and Plutchik's emotional wheel [6].

The paper is methodical as follows: 2. Applications of emotion recognition from speech, 3. Requirement of emotion recognition in India, 4. Available speech corpora for Indian Languages, 5. Development of emotion recognition in various local Indian languages, 6. Conclusion

## II. APPLICATIONS OF EMOTION RECOGNITION FROM SPEECH

Emotion recognition from speech has major impact on certain real time applications. Few of them are reviewed and mention as per below [3,7].

**Assign priority to customers in various call centres:** Call centre is a best real time application where customers with different emotions, different dialogues and different languages exist ultimately, vast variety of emotions based speech conversation can be found. In today's world failure in assignment of priority to customers may lead to failure or loss in business. By using linguistic information and paralinguistic cues, different emotions states can be evaluated at Medical emergency call centre [8]. Emergency cases may be analyzed if priority is assigned to various patients, which may lead to saving a life. By using acoustical variables and feature selection techniques, now a day's real time processing of customer's dialogues is possible through software like ER: Emotion Recognition Software which helps to handle the customer while he/she is speaking. From speech extracting the acoustic features and semantics of the conversation, Call back prioritization can be set effectively by using emotion recognition of customers at various call centers and it can be used in a decision support system for impelling voice messages and delegate a proper agent to respond the message [9].

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# LOW POWER AND HIGH PERFORMANCE MSML DESIGN FOR CAM USE OF MODIFIED XNOR CELL

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**Abstract--** *MSML design has been shown with the help of modified XNOR cell. Mainly this is used for low power and high performance. To perform the searching operations conventional design use only single match-lines and Master-Slave match line use single MMLs and multiple SMLs. Lower Power and high performances when MML share charge with mismatch SML. In this paper the simulations are obtained using Tanner EDA V-13 tool with 90nm CMOS technology. Match-delay of implementation of CAM design compare to conventional design in different bit-size condition.*

***Keywords-*** *Master-slave match line (MSML),Master-slave (MS), content- addressable memory (CAM), low power, match line (ML), match delay (MD), Master match-lines (MMLs), Slave match-lines (SMLs).*

## I. INTRODUCTION

A CAM memory comparing input searching data over a storing data and return addressed of match-data. CAM capable to use different type of execution which need high search speed. And those executions involve parametric curve extraction, Hough transform, Huffman coding-decoding and image coding [4],[5],[6]. CAM is good options to implement larger bit operation due to fastest search capability. As different type of memory, CAM store data in storage unit, provide searching data, after performing searching operation and last if any data will be match to the output data. In larger bit and larger word size bit design at that time large number of transistors and wires are used on every search that require more power consumption of CAM is significant. Each search will be a larger numbers of ML switching so matching and searching lines are main power consumers in CAM memory.

Most of the research will be interested in the ML power reduction and match-delay by different types of methods, including the ML segmentations, pipeline searching-scheme [7], [8]. In selective pre-charged techniques partitioned comparator and memory array in two part[7],[3].When ML needed to be pre-charged at that time main part will be active and smallest part of every comparison evaluation-phase done first. ML breaks in different part, pipeline search scheme [3], [8]. Every part evaluation-phase is continues. All these methods will be minimize power in good condition, to solve this type of problem other method is implemented is charged-share ML minimize the worst case power-consumptions. In charged–share ML recycled and transferred single ML charged to other ML charged [9]. The full ML separated in four segment and selected pre-charge to minimize power-consumption, in segments ML architecture (SMA) [10].Segment is divided in charge-share and pre-charge type. Before ML evaluations pre-charge segment charge and charge-share segment not pre-charge but shared charge to charge segments for evaluations of ML.

Improving the power-efficiency of shadow ML design suggest by current-recycle technique. These technique voltage-detector charged ML to define matching and mis-matching [11]. In mis-matching condition word circuit recognize fastest deactivate charging-path, in this shadow ML voltage detect schemes [12]. Here not only because of fast lookup table but also for minimize power-consumption effect in word-circuit, so voltage detectors and comparators are introduced. Best compact between ML power-consumptions and match-delay for CAM have continuously challenge point between the researches. The main focused in this paper is minimizing power-consumptions and high performances. Also compare conventional design with MSML design. So in this MSML design using XOR cell due to slow charging sharing problem some match-delay issue will be there, to overcome this type of problem modified XNOR CAM cell design. In XNOR cell high performances, low power consumptions and area also minimize to reduced number of transistor.

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# FLEXIBLE CHRISTMAS SHAPE DUAL BAND ANTENNA FOR WLAN APPLICATIONS

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**Abstract--** *A microstrip bio inspired compact dual-band Christmas tree shape antenna has been proposed for wireless local area network (WLAN) applications. The proposed antenna is designed and fabricated using flexible Polyethylene Terephthalate (PET) substrate, which can be mounted on any surface. Antenna parameters were optimized using High Frequency Simulation Software (HFSS) based on method of moments. The proposed antenna is then printed on PET substrate of size 70x60mm$^2$. The performance of the proposed antenna is simulated and measured in terms of return loss, VSWR (voltage standing wave ratio), gain and bandwidth. The proposed antenna is resonant the WLAN frequency bands at 2.4 GHz for IEEE 802.11b/g and 5 GHz for IEEE 802.11a, with return loss more than -10 dB. In all three configurations gain are more than 5 dB. Moreover they are giving ideal radiation pattern for dual-band WLAN applications and suitable for integrating in small size devices.*

***Keywords-*** *Bio-Inspired tree shape antenna, PET antenna, Flexible dual band antenna, WLAN.*

## I. INTRODUCTION

Flexible antennas can be used in many potential applications where antennas are integrated with wearable devices to provide wireless connectivity. Due to the recent advances in thin film materials being used as flexible substrates, printed antennas, such as a monopole or dipole, are fabricated on flexible substrates. Flexible substrates, such as Polyethylene Naphthalate (PEN) [1], Kapton Polyimide [2] and paper-based [3], have been widely used for flexible antennas. Coplanar waveguide (CPW) feeding techniques are recommended in ground plane are printed on one side of the substrate, which reduces the complexity of fabricating the antennas and also reduce the complexity of integrating active devices to flexible antennas [2]. With rapid advancement and recent developments in printing technologies, particularly the realization of large area printed electronics products utilizing traditional printing technology platforms.

Polyethylene terephthalate, commonly known as PET, is a thermoplastic polymer resin of the polyester family and is used in synthetic fibers; beverages, food and other liquid containers; thermoforming applications; and engineering resins often in combination with glass fiber [3]. Depending on its processing and thermal history, PET may exist both as an amorphous (transparent) and a semi-crystalline polymer. The semi-crystalline material might appear transparent (particle size < 500 nm) or opaque and white (particle size up to a few microns) depending on its crystal structure and particle size. Various types of antennas designs on PET film have been reported [3]-[5] including patch antennas, RFID dipole antennas and UWB monopole antennas.

In this paper, a flexible transparent modify dual band patch antenna is proposed. The proposed antenna was fabricated on PET film. It is designed at 5.2GHz and 5.8GHz for WLAN applications. Both simulation and measurement results will be present.

This paper is divided in the following sections: Section II represents the design and analysis for the proposed antenna. Simulated and measured results of the proposed antenna are presented and discussed in section III. Section IV represents antenna's hardware testing. Finally, conclusion of this proposed work is shown in section V.

## II. DESING AND ANALYSIS OF PROPOSED ANTENNA

The propose patch antenna design is based on basic shape of Christmas tree geometry are shown in Figure 1 & its dimensions are described in Table 1. The schematic structure of proposed antenna is fabricated on the PET film with 125$\mu m$ substrate thickness. We used PET film substrate with dielectric constant of $\varepsilon_r$=3.2 and loss tangent of tan$\delta$=0.02.

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# Wide-angle and polarisation-independent tri-band dual-layer microwave metamaterial absorber

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**Abstract:** In this study, a novel dual-layer wide-angle metamaterial absorber with polarisation independence has been presented at three distinct frequencies. The proposed structure consists of dual stacked metal-dielectric layers which are terminated by the metal ground panel. The unit cell of the presented structure consists of three concentric 8-point star rings on the top surface of both dielectric layers exhibiting three absorption peaks of 98.96%, 98.7% and 99.43% under normal incidence at 1.8 GHz, 2.14 GHz and 2.57 GHz, respectively. The polarisation independence of the design has been validated by numerical simulation and practically verified using waveguide measurement technique. The structure displays high absorption of about 84% for transverse electric polarisation and over 97% under transverse magnetic polarisation up to 60° of oblique incidence. Furthermore, the effects of variation in physical design parameters on absorption response are investigated. The measurement exhibits good agreement with the simulated outcome. The presented structure has a thickness of $0.0294\lambda_0$ with respect to the lower absorption band frequency.

## 1 Introduction

Veselago in 1968 [1] has introduced the concept of left handed materials (LHM) with experimental verification of negative indexed material performed by Shelby in 2001 [2] has gained tremendous interest in LHM or metamaterials (MTM). Many MTM-based applications such as antenna [3, 4], cloaking device [5], filters [6] and so on have been reported in the recent past. Among these applications, MTM-based absorbers (MMAs) have drawn significant interest among researchers from past decade. Since then many MMA exhibiting enhanced-bandwidth [7, 8], polarisation-insensitivity [9, 10], multiband [11–13], broadband [14, 15] and wide-angle [16, 17] properties have been reported from microwave to visible range [18]. Another significant property of MTM which has drawn attention in recent years is the compactness. Various ultra-thin compact MMA has been proposed and investigated lately exhibiting ultra-wideband as well as multi-band characteristic [19, 20]. Numerous closely-packed MMA composed of a multi-layers structure having either different geometries of frequency selective surfaces [21, 22] for stacked layers or same geometries [23] has been reported to achieve multi-band or wide-band absorption response.

In this paper, a novel tri-band dual-layer wide-angle metamaterial absorber with polarisation stability has been proposed. The unit cell of the structure consists of three concentric 8-point stars on the top plane of each dielectric substrate. Several triple-band absorbers based on concentric close rings resonator designs have been proposed in the recent past [24–28]. These structures are designed with the single metal-dielectric layer. The presented MMA unit cell design is composed of dual metal-dielectric layer terminated with metal ground plane exhibits three distinct absorption maxima of 98.96%, 98.75% and 99.43% at 1.8 GHz, 2.14 GHz and 2.57 GHz, respectively. Single layer structure attains absorption of 84.8%, 65.02% and 71.2% at 1.78 GHz, 2.11 GHz and 2.55 GHz, respectively. The stacking of dual layer raises the absorption with an increase in absorption bandwidth. The structure is numerically examined by using full-wave electromagnetic field high frequency structure simulator (HFSS) based on finite element method. Proposed MMA structure displays high absorption of about 84% for transverse electric (TE) polarisation and over 97% for transverse magnetic (TM) polarisation up to 60° of wide oblique incidence. Moreover, the polarisation independence of the design has been verified numerically and the practical verification is accomplished by waveguide measurement. Practically, the polarisation stability of the structure is verified by fabricating different MMA structures with various orientations of the unit cell [29]. The measured result shows good agreement with the numerically computed outcome thereby making proposed absorber a potential device for ensnaring ambient L-band and S-band signals in radar and RF energy harvester applications. Additionally, the absorption response of the structure is analysed for the effect of varying various physical design parameters.

The remaining of the paper is organised as follows: Section 2 presents the propose MMA unit cell geometries and numerically computed results. Section 3 describes the effect of variation in various physical design parameters on absorption response. In Section 4, measured results and discussions are presented. Eventually, the conclusion is drawn in Section 5.

## 2 Design and simulation results

The proposed MMA consists of the dual staked metal-dielectric layer with three concentric 8-point stars as shown in Fig. 1. 8-point star is imprinted on top of each 2.4 mm thick ($t_s$) FR4 dielectric substrate with relative dielectric constant ($\varepsilon_r$) and loss tangent ($\tan\delta$) of 4.4 and 0.02, respectively. 8-point star resonator and back metal plane are made of copper with a conductivity of $5.8 \times 10^7$ S/m and have a thickness ($t_c$) of 0.035 mm. The optimised geometries of the proposed MMA are (all dimensions in 'mm'): $a = 34.9$, $R_1 = 16.65$, $R_2 = 14.55$, $R_3 = 12.25$, $w_1 = 1.27$ and $w_2 = w_3 = 1.41$.

The numerical computation of the proposed MMA is performed by using HFSS with periodic boundary conditions imposed through Floquet port excitation. The incidence wave is applied along the $Z$-axis (normal to the MMA surface) while the electric field and magnetic field along the $X$-axis and $Y$-axis, respectively. The thickness of back metal plane is much greater than the skin depth to suppress any transmission through the absorber. Hence the absorption can be calculated as


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# Performance Evaluation of Wide-Angle Ultrathin Microwave Metamaterial Absorber with Polarization Independence

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## Abstract

A novel dual-band wide-angle ultra-thin absorber composed of dual closed-concentric ten-point stars with polarization independence is presented in this article. The ten-point stars formed resonators are engraved on low cost FR4 substrate. The EM absorber performance is studied in terms of electrical and physical parameters. The polarization independence is practically demonstrated using waveguide measurement method. The measured results are in good agreement with simulated results. The absorbance values of 99.37% and 97.18% are achieved at 2.13 GHz and 2.52 GHz, respectively. The presented absorber design is wide-angle RF absorber with high absorbance values of about 80% up to 60° under TE mode and 87% up to 75° of oblique incidence angle for TM mode excitations. The experimental results demonstrate the absorption effectiveness of the proposed design to be utilized in RF energy harvester modules for capturing ambient UMTS band signals and in RF absorber applications for S band radar systems. The presented absorber unit cell is ultrathin and compact with the thickness and size less than λ/56 mm and λ/5 mm, respectively, at lowest absorption frequency.

## 1. Introduction

Owing to the exceptional properties of metamaterials (MTM), introduced by Victor Veselego in 1968 [1], many researches based on MTM have been carried out in recent past. The most significant properties of MTMs are the negative permittivity, negative permeability and negative refractive index [2, 3] which can be adjusted to an optimized value by merely altering the geometrical parameters. Because of the compactness provided by MTMs, especially in RF domain, they are enormously utilized in the absorber structures. The first metamaterial absorber (MMA) was proposed and practically verified by N. I. Landy in 2008 [4] with the absorption value of 96% at 11.48 GHz and full width at half maximum (FWHM) of 4%. Subsequently, many MMAs have been reported and investigated with the distinct characteristics from microwave to infrared bands [5, 6]. MMAs of the following significant characteristics have been reported so far; dual-band [7, 8], triple-band [9, 10], quad-band [11, 12], penta-band [13], bandwidth-enhanced [14], wide-band [15, 16], wide-angle [17, 18] and polarization insensitivity [19, 20] to accomplish various RF applications. The bandwidth of MMAs can be increased extensively by using layered resonator structures and tuned to the specified value as reported in [21-23]. The drawback of layered structures is that they may not be suitable for ultra-thin broadband applications requiring the total thickness below $\lambda_0/4$ where $\lambda_0$ represents the absorption wavelength. Numerous ultra-thin compact MMAs have been reported having multiband/broadband response without using stacking of unit cells [24-26]. Some researchers outlined ultra-thin absorbers with the stacking technology achieving broadband absorption at terahertz region [27]. Thus there is still requirement of simple, compact polarization independent MMAs working in L-band and lower S-band.

In this article, a wide-angle microwave MMA with the polarization independence has been presented. RF absorption performance of the designed structure is evaluated by varying various electrical as well as physical parameters for the proper selection of unit cell design based on the requirement of bandwidth and frequency. The proposed MMA is numerically analysed by using finite element method (FEM) based 3D commercial full wave electromagnetic field high frequency structure simulator (HFSS) solver. Numerically computed absorption values of the suggested MMA are obtained as 99.37% and 97.18% at 2.13 GHz and 2.52 GHz, respectively. Proposed MMA structure has wide incidence angle of about 60° under TE mode excitation with the absorption of 80% and 75° for TM mode excitation with the absorption value of 87%. Furthermore, MMA design has been studied for the polarization independence and the experimental demonstration is performed by using waveguide measurement technique [28]. For the practical verification of the polarization independence, different MMA structures are fabricated in various orientation angles. A good agreement between the numerically computed results and measured results makes the proposed MMA structure a good candidate for capturing ambient UMTS band signals in the RF energy harvester modules and RF absorber in S-band radar system applications. In this paper, Section 2 describes the unit cell design with the brief details of the absorption principle. Section 3 presents the numerical computation and related discussion of results. In Section 4,

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RESEARCH ARTICLE

# Ultrathin dual-layer triple-band flexible microwave metamaterial absorber for energy harvesting applications

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**Abstract**

An ultrathin dual-layer flexible metamaterial absorber with triple-band for RF energy harvesting applications has been reported in this article. The sub-wavelength unit cell of the proposed absorber is composed of six distinct concentric annular having outer circumference of ring and octagonal inner circumference. The metallic resonators are constructed from copper foil self-adhesive tape which are affixed on flexible neoprene rubber sheet terminated by metal ground plate. The proposed absorber prototype is ultrathin and compact with the thickness less than $0.037\lambda_0$ and cell size less than $0.2\lambda_0$ at the lower absorption frequency of 1.75 GHz. Flexible dual-layer absorber exhibits triple absorption peaks of 96.91%, 96.41% and 90.12% at 1.75 GHz, 2.17 GHz and 2.6 GHz with full width at half maximum (FWHM) bandwidth of about ~6.5%. The RF performance of proposed absorber is numerically computed for different polarization and incidence angle variations. The absorption value is above 76% for the oblique incidence angle up to 45° in TE mode operation, whereas the absorption value is 94% for oblique incidence angle up to 60° in TM mode operation. The measured outcomes are in agreement with the numerically calculated results. The energy harvesting potential of the proposed absorber structure is numerically confirmed by the resulting improved RF absorption value in dependence to different resistive loading of the polarization insensitive unit cells.

**KEYWORDS**

energy harvesting, metamaterial, metamaterial absorber

## 1 | INTRODUCTION

In recent years, the exceptional properties of negative permittivity (ε),[1,2] negative permeability (μ),[2] negative refractive index,[3,4] and reverse Doppler effect[5] have made the metamaterials[6] (MTMs)-based microwave components tremendously popular in microwave community for the realization of versatile wireless communication systems. Several component-based systematic research works have been carried out to design MTM-based devices including antennas,[7–9] filters,[10,11] cloaking device,[12] bolometer,[13] and energy harvester.[14] Recently, MTM has immensely utilized for designing absorbers to achieve low-profile and frequency scalable structures in comparison to conventional thick (λ/4) absorbers, which are to be utilized in the implementation of RF energy harvesting systems. First MTM-based absorber has been experimentally verified by Landy[15] in 2008. Since then many multiband,[16] wideband,[17] polarization insensitivity,[18] wide angle,[19] compact-ultrathin[20] absorbers have been proposed with their practical verification. MTM absorbers can be conveniently designed to absorb freely available electromagnetic energy in the form of propagating electromagnetic radiation in the specific operation bands to be used for RF energy harvesting purposes. It is an important design criterion that the MTM absorbers utilized in the implementation of RF energy harvesting modules have to

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# Dual-Band Compact Metamaterial-Inspired Absorber with Wide Incidence Angle and Polarization Insensitivity for GSM and ISM Band Applications

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**Abstract.** *A dual-band metamaterial inspired microwave absorber composed of concentric two crossed double-arrow shaped resonators, ring resonator with four splits at the corners and square ring resonator is presented. The proposed RF absorber has the absorption feature of wide incidence angle. The sub-wavelength unit cell of the proposed absorber is structured on a metal backed epoxy glass (FR-4) substrate. The novel absorber has two distinct absorption peaks of 99.4% and 98.6% at the frequencies of 1.94 GHz and 2.4 GHz, respectively. The designed structure is polarization-insensitive with wide incidence angle of 60° and high absorption rate of 82% for transverse electric and 98% for transverse magnetic modes. Polarization insensitivity of the proposed design is investigated by the waveguide measurement technique with setting different orientation angles for the unit cells. The measured and simulated results have good agreement making the proposed absorber a potential candidate for energy harvesting applications in GSM and ISM band.*

## Keywords

Metamaterials, metamaterial absorber, ring resonators, polarization

## 1. Introduction

Metamaterials (MTMs) are artificial materials whose electric and magnetic responses can be altered according to the required application to exhibit exotic properties not usually available in nature [1], [2]. Among several MTM based RF component applications like antennas [3–5], filters [6], [7] and high frequency photodiode bias Tee circuits [8], metamaterial absorbers (MMA) [9] are extensively proposed and investigated due to the various properties exhibited in the form of multi-band [10], polarization independence [11], compact [12], broad-band [13], [14], and wide-oblique angle [15], [16]. These exotic characteristics of MMAs are achieved merely by altering the geometrical parameters of the sub-wavelength unit cells which are usually arranged in a periodic manner. The variation is done to achieve impedance matching between the impedance of the MMA structure and the free space impedance resulting in minimization of the electromagnetic (EM) reflection from the MMA surface.

In this article, a compact dual-band polarization insensitive MMA with wide incidence angle is designed and developed for trapping of ambient GSM and ISM band EM signals. The suggested absorber exhibits two distinct absorption peaks of 99.4% and 98.6% with the corresponding return losses of 22.35 dB and 18.43 dB at the frequencies of 1.94 GHz and 2.4 GHz, respectively. The FWHM (full width at half maxima) bandwidth of the both absorption bands are in the range of 4%. The narrow bandwidth can be increased by increasing the substrate height or utilizing more intercoupled resonators with the enhanced electric and magnetic coupling level. To the extent of author's knowledge, no microwave MMA has been reported so far for the aforementioned frequency band and the proposed absorber is also tested for the polarization insensitivity using waveguide measurement technique [13–15]. This is mainly because of the necessity of eliminating large sample size (~10λ) requirement for the selected frequency band in case of free-space measurement system [8]. Polarization angle and oblique angle variations for both TE (transverse electric) and TM (transverse magnetic) modes are illustrated to show that the proposed absorber is polarization insensitive with fairly high absorption of 82% and 98%, respectively, for wide oblique incidence angle of about 60°. The waveguide measurement results for polarization insensitivity of the suggested design are presented with good agreement with the numerical results. The proposed unit cell design is compact and ultrathin with size and thickness of $0.17\lambda_0$ and $0.015\lambda_0$, respectively, at the lowest frequency of absorption.

Dimension of MMA must be selected such that it is less or equal to λ/4 (λ is the operating wavelength wave-

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# A Brief Review on Bio-Medical Application of Radar

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***Abstract:*** *Since, The Radar Was Invented It Was Associated With The Military And Defenceapplications. The Revolution Ofradar Then Offered Medical And Industrial Application Which Ledto Intelligent Environment To Monitor And React On Our Dailyactivity. In This Paper We Present The Survey Of Possibility Ofradar Technology In Medical Application Without Instrumentingour Body. The Survey Explains The Vital Sign Monitoring Like Heartrate And Respiration Rate, Human Fall Detection, Radar Visionsensor For Blind People And Human Brain Stroke And Tumouridentification. Vital Sign Monitoring Exploits The Fact That Thereceived Signal Affected By Motion In Environment Due To Inhaling,Exhaling And Skin Vibration, Change In Speed Due To Fall Event,Distance Estimation By Change In Received Signal For Radar Visionsensor, And Change In Received Signal For Brain Tumour Detectiondue To Defected Tissue.*

***Keywords-****Microwave, Radar, Medical Application, Healthmonitoring.*

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## I. INTRODUCTIONAND MOTIVATION

General Radar System Is Used To Detect The Object In Far Field To Find The Location Of The Object And Corresponding Speed Of The Object. From The Time The Radar Was Invented To 1993 It Was Strongly Focused On Military Purpose [1]. It Was Not Intended To Use In Medical Field Until In 1996, Thomas E. Mcewan From University Of California Registered A Patent In United States [2]. Sincethen After The Interest Increased In Wireless Health Monitoring Or The Contact Less Human Body Examine In Compare To X-Ray Imaging. UWB Radar Are Working On Non-Ionized Electromagnetic Waves Which Are Harmless To Human Body [13]. In 14 February 2002, The Federal Communications Commission Allows To Use In Range Of 3.1ghz To10.6ghz Frequency Without License[3] While The Department Of Telecommunications Ministry Of Communications Information Technology Government Of India Authorize To Use 6ghz To 7.25ghz In National Frequency Allocation Plan 2011[4] With EIRP (Effective Isotopically Radiate Power) Of -41.3 Dbm /Mhz The Power Radiation Of UWB Band Is Strict And Thus It Effect As Noise For Other Equipment Unintended To Transmit Or Receive The Signal And Difficult To Detect By Unauthorized Device. By 1999 There Are Researches Of UWB Radar In Medical Use Like Respiration Rate Measurement, Heart Rate Measurement, Sudden Human Fall Detection, Breast Cancer Detection, Tumour Identification In Brain.

## II. TYPES OF RADAR

Based On Configuration, Scanning Pattern And Application, The Radar Is Classified As,

- Bistatic Radar
- Continuous-Wave Radar
- Doppler Radar
- FM-CW Radar
- Mono Pulse Radar
- Passive Radar
- Planar Array Radar
- Pulse-Doppler
- Synthetic Aperture Radar

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# COVERAGE BASED TEST_CASE GENERATION USING AUTOMATED TEST CASE GENERATING TOOL

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***ABSTRACT:-This paper presents a method for automatically generating test cases for different code coverage criteria of Function coverage, Statement Coverage, Brach Coverage and Condition Coverage to measure what percentage of code has been exercised by a test suite, Coverage criteria are usually defined as rules or requirements, which a test suite needs to satisfy.We show that how the Automated Test Case Generating Tool can be used to automatically generate complete test scenarios that will provide percentage coverage of test suit.***
***The purpose of producing the tool to help reduce the high cost of developing test cases for safety-critical avionics applications as well as to well as to save the time of deriving test cases manually.***

## INTRODUCTION

Software development for critical avionics control systems, such as the software controlling aeronautics applications like Aircraft Flight Control System, Engine Control System, Flight Management Control Systems are costly, time consuming, and error prone process. In such projects, the validation and verification phase (V&V) consume approximately 50%-70% of the software development resources. Thus, if the process of deriving test cases for V&V could be automated and provide requirements-based and code-based test suites that satisfy the most stringent standards (such as DO- 178C-the standard governing the development of flight-critical software for civil aviation , dramatic time and cost savings would be realized.[1]

This paper presents a method for automatically generating test cases for Statement Coverage, Brach Coverage and Condition Coverage of test suit. We show how a tool can be used to generate complete test cases that provide a predefined coverage of any software development artifact.

We provide a tool that is
(1) suitable for defining our test-case generation approach[1]
(2) defining how Statement Coverage, Brach Coverage and Condition Coverage criteria can be formalized in our framework and expressed

Random Testing Technique is used in this automatic test case generation tool which select values randomly from the input domain of the program input variables.[6]

### SCOPE
Test case and Test conditions generation of (switch case, if-else, while loop and for loop with different operators) of test suit.

### OUT OF SCOP
This tool will not take any other files except .C files as an input. So it cannot be used for testing any other source code file. It will not consider any other operations of C code out of these conditional statements.

### STRUCTURAL COVERAGE ANALYSIS (SCA)
In software testing structural coverage analysis is one of the most important part and here we are going to use this for generate test cases. Each requirement in application one or more tests which prove that it has been implemented correctly. Structural coverage proves that these tests exercise all of the code. According to DO-178B Structural coverage will be statement coverage, decision coverage and MC/DC coverage depending on the software level. DO-178B (like requirement based testing), which perform structural coverage has some key benefits: requirements are complete with respect to code, test cases are complete, no code is deployed that shouldn't be there, code for use in other configurations is clearly identified.
Structural coverage includes: Statement coverage, Decision coverage, MC/DC coverage.
Statement coverage measures whether each statement encountered. This is affected by computational statements than by decisions.

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# IOT Color Based Object Sorting Machine

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**Abstract**

There is a wide usage of many products in our day to day life, and manufacturing of this products are done in many large scale and small scale industries. Arranging makes quality consistency issue. Nowadays the main difficulty that is faced after the production is of sorting Arranging of items in an industry is a dull modern process, which is by and large done physically. Consistent manual the need of this type of machine in the industries will help in sorting the machine according to their weight, size, color, shape, etc. This paper gives a brief information about the sorting of objects according to their color using TCS3200 color sensor, Arduino UNO and servo motors. The identification of color is done frequency scaling of color detection.

**Keywords**: Internet of Things (IoT), Color Sensor, Arduino Uno, Global System for Mobile Communications (GSM) module etc.

## INTRODUCTION

The Internet of Things (IoT) will be a present correspondence model that envisions a not so aloof future, clinched alongside which those questions from claiming standard normal presence will be furnished for microcontrollers, handsets for electronic correspondence, Furthermore sensible gathering stacks that will make them prepared will talk with one another Also with the clients, turning under a vital bit of the web [1]. The IoT idea, consequently, goes for making the Internet considerably more immersive and inescapable. Besides, by empowering simple access and collaboration with a wide assortment of gadgets, for example, for example, home apparatuses, observation cameras, checking sensors, actuators, showcases, vehicles, et cetera, the IoT will cultivate the advancement of various applications that make utilization of the possibly huge sum and assortment of information produced by such questions give new administrations to subjects, organizations, and open organizations [2]. For closer future, the IoT is relied upon to have house and business utilizes, to add to the personal satisfaction. For instance, brilliant houses will empower their tenant to naturally open their carport when achieving home, set up their espresso, TVs and different employments. Keeping in mind the end goal to understand this potential development, rising advances and thoughts, and administration applications need to develop relatively to coordinate market requests and buyer's need. Besides, gadgets should be produced to fit client needs as far as accessibility anyplace and whenever. Additionally, new principles are required for correspondence similarity between fluctuated things.

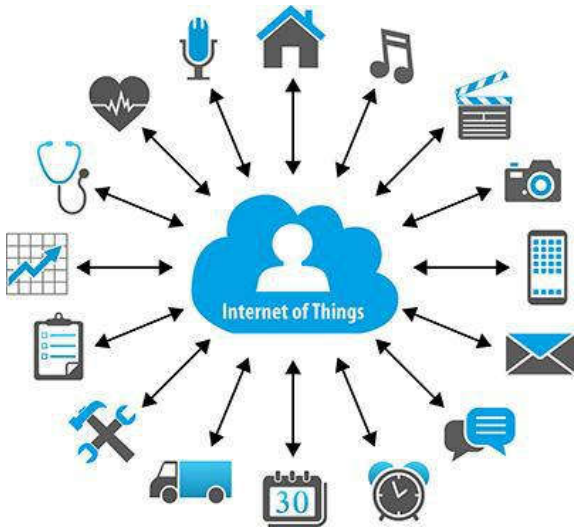


**Figure 1:** IOT Much bigger than we think [3]

The IoT enables physical things to look, listen, assume and perform businesses by having them "talk" together, to share information and to orchestrate choices. The IoT changes these articles from being conventional to shrewd by its basic advancements, for example, worldwide computing, embedded gadgets, correspondence advances. Shrewd questions alongside their appointed undertakings constitute space particular applications while universal registering and scientific administrations frame application area autonomous administrations Fig-2 shows the general idea of the IoT in which each area particular application is cooperating with autonomous administrations, while in every area sensors and actuators discuss specifically with each other [4].

# Plant Leaves Diseases Detection using Image Processing

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***Abstract :*** ***Plant leaves play most important role in growth of the plant. There are many research area in the agriculture field such as leaves, root, and fruit etc. This paper classify the six type of plant leaves diseases such as Bacterial blight, Alternaria leaf spot, Grey Mildew, Myrothecium leaf spot, Leaf curl and normal leaf. The classification of the diseases is done based on the GLCM texture features. Finally classified the diseases by using Multi SVM supervised machine learning technique. The classification accuracy is found to be 97 percent.***

***IndexTerms - Leaves Diseases,GLCM Texture features,Image processing ,Thresholding.***

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## I. INTRODUCTION

Image Processing in the Agriculture field has a lot of scope for researcher. There are different research areas in agriculture field such as leaf, root, fruit etc. A deep study is required to achieve the study and analysis in this field. The proposed work is research on the plant leaf diseases. The different type of plant leaf that is caused by the bacterial, viral diseases, and fungal disease. In the proposed work we classify the six type of diseases such as Bacterial bright, Leaf curl, Myrothecium leaf spot, Grey Mildew, Alternaria leaf spot and normal leaf. Generally in the image processing step for leaf diseases detection is image acquisition, image pre-processing, feature extraction and classification. Image acquisition is the process to capture the image using Digital camera, or mobile phone. In the image pre-processing step remove the noise from the image and in the feature extraction model extract the features from the leaf and finally use different machine learning technique to classify the diseases. The proposed work use Multi SVM supervised machine learning technique to classify the leaf diseases. In the literature paper there is some limitation for classification of the diseases such as less acquire and less number of image in the database. The accuracy of the process is more when compared with existing method. The reliability of the process is well optimum due to the limited number of the dataset is used. This paper divided into five sections. In section II describe the type of leaf diseases, Section III proposed system, Section IV result and Section V conclusion and future work.

## II. TYPE OF LEAF DISEASES

There are various type of Plant leaf diseases such as Bacterial blight, Leaf curl, Alternaria leaf diseases, Myrothecium leaf spot, Grey mildew etc.

**A. Bacterial Blight -** The disease appears on different parts of plant, both at seedling and mature plant stages. The disease first appears on the leaves in form of water soaked region, then turns into black and gets dried up. In some cotton plants, water soaked region gets enlarged into angular reddish spots of about 1 mm in diameter.

*Figure 1 Bacterial blight*

**B. Leaf Curl -** Initially swelling and darkening of leaf veins occur, it is followed by cupping of immature leaves and curling of leaf margins as shown in Figure 2. In some cases the growth extending from the veins on the lower side of the leaf can also occur to have the appearance of cup-shaped structure [1]

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# Dual-band perfect meta material absorber with polarization independence and wide incidence angle

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A dual-band perfect meta-material absorber based on closed ring resonator structures (CRRs) with polarization independence and wide incidence angle stability is designed, simulated and measured. The absorber unit cell is composed of FR4 dielectric substrate sandwiched between the CRR and ground metal plane. The optimized design is numerically simulated to obtain two absorption peaks of around 99.66% at 1.98 GHz and 99.05% at 2.59 GHz. The proposed absorber structure exhibits absorption of above 99% for all polarization angle variations. The effect of variations in oblique angle under TE and TM mode configuration and loss tangent on absorption efficiency is presented to support the efficacy of the design. The numerical computation of design with a different dielectric material is performed to provide comparative result. The absorber structure is tested using waveguide measurement method which could be utilized for the absorption of the ambient UMTS band frequencies. The experimental results show fair agreement with the numerically simulated results.

**Keywords:** Closed ring resonators, Meta material absorbers, Dual-Band absorber, Polarization

## 1 Introduction

The need of thin, small and multiband/broad absorber at microwave to infrared frequencies has initiated the research in the direction of meta material inspired absorbers. An electromagnetic (EM) absorber is a passive device, capable of restraining the incident EM reflection and transmission of an EM wave. The exotic properties of meta materials (MTMs) such as negative permittivity, negative permeability and negative refraction[1-3] have given rise to many metamaterial based potential applications some of them are super lens[4,5], antenna[6,7], cloaking device[8], sensors[9,10] and EM energy harvesting[11,12]. Meta material absorbers (MMAs) are usually devised by the periodic arrangement of the unit cells. The unit cell acts as atoms present in naturally existing materials and the dimensions of these unit cells must be less than one-fourth of the working wavelength ($\lambda/4$)[13] in order that metamaterial operates as natural materials. In absorbers, unit cell are composed of dielectric which is sandwich between resonators and metal ground plane. The shaped resonators either split ring resonators (SRRs)[15] or closed ring resonators (CRRs)[16] with bottom metal plate give rise to electric and magnetic responses simultaneously as the EM wave is incident on the MMA surface.

Absorption is maximized by reducing the reflection from and transmission through the absorber structure. By matching the impedance of the absorber structure to the free space impedance the reflection from the structure is minimized. This impedance matching takes place when the effective permittivity, $\varepsilon(\omega)$, of the structure becomes equal to its effective permeability, $\mu(\omega)$, and a large imaginary component of the effective refractive index ($n(\omega) = \sqrt{\varepsilon(\omega)\mu(\omega)}$) is obtained at certain resonance frequency. Under this condition the real component of the effective impedance ($Z(\omega) = \sqrt{\mu(\omega)/\varepsilon(\omega)}$) becomes nearly equal to unity while making imaginary component as near zero[14].

The first MMA was proposed in the year 2008 by N. I. Landy[15] and the design was based on split ring resonators (SRRs). Since then, many MMA designs have been proposed based on SRR as well as based on CRR. The MMAs design presented in this paper is based on two distinct concentric CRRs which is simulated using full wave High Frequency Structure Simulator (HFSS) software. The outer ring is an octagonal ring for the absorption of EM wave centered at 1.98 GHz and inner ring is a rotated

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# Ultrathin Wideband Polarization Independent Compact Metamaterial Microwave Absorber

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***Abstract*—In this article design, fabrication and analysis of a compact ultrathin polarization independent wideband metamaterial absorber at microwave frequency is presented. The unit cell of the proposed design constitute of a metallic 12-point star with center cavity and dual half slot at 45° imprinted on top of the grounded FR4 dielectric substrate. The numerical result exhibits full width at half maximum (FWHM) bandwidth of about 16.3% from 1.92 GHz to 2.26 GHz with absorption of above 80%. The absorption mechanism of the presented absorber has been analyzed through parametric variations, electric field distributions and surface current distributions. In addition, absorption of about 70% is achieved at wide angle of incidence up to 45°. The polarization independence is verified via waveguide method by setting distinct orientation angles for the unit cells. Measured results are in agreement with the simulated results. The designed absorber is compact and ultrathin with unit cell size and thickness of less than $0.25\lambda_0$ and $\lambda_0/45$ at center frequency of absorption.**

***Keywords—metamaterial absorber; polarization independence; wideband; compact; ultrathin***

## I. INTRODUCTION

Metamaterials (MTMs) [1] has recently gained an extensive interest among the researchers and scientist due their attractive characteristics of negative refractive index [2, 3], backward propagation [4], reverse Doppler effect [5] and perfect absorption [6] to name a few. Because of dependence of MTM properties on their physical dimensions rather than on their composition leads to enormous MTM inspired designs of filter [7, 8], antenna system [9-11], resonator [12, 13], sensor [14], perfect lens [15] and broadband photodiode bias tee [16] among others. Amid these applications metamaterial absorber (MMA) has gained popularity due to their features like perfect absorption [17, 18], frequency scaling [19, 20], ultrathin [21-23] and compactness [24, 25] in comparison to the conventional absorbers. First MMA has been proposed by Landy [6] in 2008 which comprises of split ring resonator and split-wire to achieve simulated absorption of 96% and experimental absorption of 88% at 11.5 GHz. Generally, MMA is composed of three layers: metal, dielectric and metal to attain multiband, wideband, wide-angle and polarization independent absorber structures for different frequency ranges. Most of the wideband absorbers reported are based on loading the absorber top surface with the lumped circuit components [26, 27]. However, the width of the absorption band depends on the geometric parameters like the thickness of the dielectric substrate, the total number of layers in the multiple layered unit cells, lumped circuit components value and position in the unit cell. In the proposed design, the wideband absorption behavior is achieved by using the thick dielectric substrate and without loading the absorber unit cells with lumped circuit components.

In this article a compact ultrathin wideband microwave absorber design based on metamaterial has been reported. The proposed MMA structure exhibits wide absorption band of about 80% with full width at half maximum (FWHM) bandwidth of around 16.3% from 1.92 GHz to 2.26 GHz. Dual absorption peaks of about 87.08% and 99.46% are observed at 1.985 GHz and 2.156 GHz. The unit cell of the proposed MMA structure is composed of metallic 12-point star with center cavity and dual half slot at 45° engraved on a grounded low cost FR4 dielectric substrate. The larger the electrical length of the structure, the lower is the absorption frequency. Hence, 12-point star shape is selected to achieve absorption at lower frequency of 1.985 GHz without any need to increase the unit cell dimension in addition to polarization stability due to 12-fold symmetry. The absorber mechanism of the structure is studied through electric field distributions and surface current distributions at various frequencies. Furthermore, the presented structure is investigated for various polarization angles under normal incidence and polarization independence is justified using waveguide method by setting distinct orientation angles for the unit cells. Simulated absorption of about 70% is achieved at wide angle of incidence up to 45°. The structure is compact and ultrathin with unit cell size and thickness less than $0.25\lambda_0$ and $\lambda_0/45$ at center absorption frequency. The effect of change in physical parameters on the absorption response is also presented. The optimized design is fabricated using standard printed circuit board (PCB) technique and the measured results are in good agreement with numerically simulated outcomes.

Springer Link

# A Color Transformation Approach to Retrieve Cloudy Pixels in Daytime Satellite Images

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## Abstract

Accurate cloud detection is a key focus area for several researchers to determine the parameters of earth's energy budget. It is a challenging task in the visible range due to resembling characteristics of thick clouds and snow/ice, difficulty in classifying faded texture soil and seasonal clouds (helpful for weather forecast), combined separation of vegetation and water against clouds. In this paper, a new color transformation approach is developed to classify thick clouds against three natural territories, i.e., water, vegetation, and soil. The proposed approach is implemented in two steps: preprocessing (includes color filter array interpolation method) and detection (a color transformation approach is introduced for classification). Extensive simulation studies are carried out on benchmark images collected from NOAA, VIRR, and MODIS databases. The superior performance of the proposed approach is demonstrated over the official cloud mask of VIRR database.

## Keywords

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Research paper

# SSR mitigation in power system with static synchronous series compensator

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**Abstract**

Series compensation in transmission line with fixed series capacitor may cause Subsynchronous Resonance (SSR) at certain compensation level. This paper presents the application of static synchronous series compensator (SSSC) to mitigate impact of SSR. For analysis of SSR, IEEE first benchmark model is used and SSSC is located in transmission line at generator end. The linearized state space equation of SMIB system without and with SSSC has been developed to carry out eigenvalue analysis to identify potential modes for SSR. The AVR and PSS in the generator control loop coordinated with SSSC can successfully mitigate SSR. Time domain simulation is also carried out to confirm the results obtained with eigenvalue analysis.

*Keywords*: *Subsynchronous Resonance; Simulation; Eigenvalues; Static Synchronous Series Compensator.*

## 1. Introduction

Series compensation of transmission line with fixed series capacitors has been used widely in long power transmission systems for enhancing power transfer capability and improving different stability limits [1]. But the different power system components such as generators, transformers, transmission lines and series capacitors experience an electrical resonance when series compensation reaches to a certain level [2-3].

In thermal power plants, the components of turbo-generator such as synchronous generator, different pressure stages of turbine are connected through different shaft sections which have been modeled as torsional springs with different stiffness coefficient depending upon shaft section diameter. Hence, such spring-mass model of turbo-generator has several modes of oscillations, known as torsional modes, when resonant frequency of electrical network becomes complementary to one of the torsional frequencies of turbo-generator mechanical system. This will result in either undamped or unstable oscillations which may endanger the turbo-generator and this phenomena is known as SSR [4-6].

The emergence of Flexible AC Transmission Systems (FACTS) has improved the steady state and dynamic performance of power system to a great extent. FACTS devices can control power flow in interconnected power system which may provide a number of benefits such as prevention of unwanted loop flows; transfer a power over intended path; enhancing transfer capability of line pushing towards their thermal limits [7-8]. In [9], small signal performance of the power system has been shown to be improved by controlling the damping characteristic of power system by controlling the operation mode and response time of FACTS controller. Hence, taking this advantage of FACTS controller, their capability to influence SSR mitigation has been assessed in [10].

This paper investigates the capability of SSSC to mitigate SSR. The mathematical model of IEEE FBM with synchronous generator model 2.2 equipped with AVR and PSS has been developed. The linearized state space equations have been formulated to carry out eigenvalue analysis along with SSSC to demonstrate their dynamic characteristic to control torsional modes of oscillations.

## 2. Analysis of SSR for IEEE FBM

IEEE First Benchmark Model (FBM) shown in Fig. 1 is adopted for SSR analysis [4]. The turbo-generator rated at 892.4 MVA is connected to 500 kV long transmission line through a step up transformer. The reactance of this transformer is denoted as $X_T$. The impedance of the line is represented by $R + j X_L$ whereas there are two options for series compensation. In case one, the series compensation is considered with fixed series capacitor and in other case fixed series capacitors are replaced with SSSC. The connecting reactance between transmission network and infinite bus is represented by $X_{SYS}$. The mechanical system of turbo-generator is represented by six lumped masses: a high pressure turbine (HP), an intermediate pressure turbine (IP), two low pressure turbines (LPA, LPB), the generator (GEN) and the exciter (EXC). These rotating masses are mechanically coupled by soft shaft sections. The parameters of the system shown in Fig. 1 are given in Appendix.

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# ENERGY CONSERVATION WITH COMPARISION OF DIFFERENT TYPES OF LAMP

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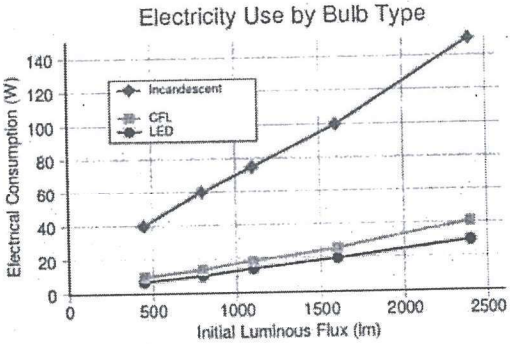
Abstract— With changes in day to day lifestyle & technology the demand of energy has increased tremendously and with increase in demand of energy the resources are becoming insufficient thereby growing energy cost. So, to overcome this problem and to improve the energy efficiency and optimize the energy cost, proper light sources such as Light Emitting Diode (LED), Compact fluorescent lamp (CFL), etc should be selected which consume minimum energy and having long life. This paper focuses on characteristics of different kind of lamps and also on the impact of LED's, CFL's and Incandescent light bulbs on energy conservation and on electric power network also on substitutes taken for different kind of lamps for high efficiency and technical issues related to different kind of lamps. An analysis performed on Light Emitting Diode (LED), Compact fluorescent (CFL) and incandescent light bulbs for different kind of loads to observe the variations in active power, reactive power and harmonic distortion in voltage. Also what are future possibilities and future advancements of different kind of lamps for conservation of energy.

Keywords: - Light Emitting Diode (LED), Compact fluorescent lamp (CFL), Incandescent light bulbs, Energy conservation .

## I. INTRODUCTION

Energy is an important measure for nations development. Energy is essential in every sector for both industrialization and urbanization. But as we know during last two decades due to increase in population the demand of electrical energy has increased significantly. And for the production of energy, the resources dealing with it are limited. As the resources are limited, to conserve energy and simultaneously fulfill the demand of energy, new advancements in luminaries and appliances should be used which consumes less energy. [1]

Almost two decades ago, we used incandescent bulb but because of high energy consumption an alternative was found which is compact fluorescent lamps (CFL). There was a massive increase in industrialization and urbanization over last five years. So to overcome the energy demands there was another alternative found in substitute of incandescent bulbs and CFL's which is Light emitting diode (LED).[3]




## II. ADVANTAGES AND DISADVANTAGES OF DIFFERENT LAMPS

### 1) Light emitting diode:

A). Advantages of Light emitting diode (LED)

- LED's are shock proof.
- LED' do not contain mercury like CFL.
- LED can be found of different colors for required purpose
- Many LED's have rated life up to 50,000 hours which is approx. 3 years if we operate it for full 24 hours.
- It lasts 50 times longer than a normal Incandescent bulb & 8-10 times longer than a normal CFL.
- LED's can be brightness and color can be controlled.
- With LED's we can direct the light where we want it, thus no light is wasted.

# SURVEY OF RENEWABLE ENERGY SOURCES IN INDIA

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*Abstract*— **With World rolling fast on its wheels there are many major changes we need to face one of such great change is change in Energy Generation Methods we have being using since decades. Production of Bulk electricity from naturally emerging energy resources is an emerging branch of research worldwide. The figures speak of its future scope, and country like India is very rich in this sector of natural energy sources for obvious reasons. In this paper we speak of various renewable energy resources, emphasizing mainly on Solar, Wind and Hydro Electricity. Paper also tends to show facts, graphs and figures regarding to present status of these sources in India. Not only this paper speak for their status but also for their respective technological advancements in India and their future scope. A detailed comparison between renewable sources and non-renewable sources is also discussed below. We also tend to show various eco-friendly energy conservation techniques using these sources. Not only the positive aspect but this paper also faces the hurdles that are going to come in the way before we completely change our harmful methods to eco-friendly methods and also tends to give a fruitful way to face or resolve them. Summing up we simply tend to collect and conclude facts on renewable energy methods in India.**

## I. INTRODUCTION

Electricity and the ways we generate it has changed the world in a manner no one could have imagined. Electricity has today become most basic need of the hour not only for people but also for whole nation, but this goal of our achieving this basic need is coming at a cost. Let's speak of our own nation India. Two major sections of electricity production are through [1]

(1) Non-Renewable Resources: These are those resources which do not renew themselves on time.

(2) Renewable Resources: These resources are natural and can renew themselves in sufficient time.

Electricity generation methods followed in India using Non-Renewable resources and Thermal power plants (Gas power plants, Diesel power plants, coal power station) and Nuclear power plants. Various energy generation methods using Renewable resources are Hydro power plant, Solar power plants, Wind power pants, Bio-mass power plant, Geo-thermal energy and Tidal power.

Presently in India until 31st March, 2018 total energy generation was about 344002 Megawatt (MW) out of which generation using Non-Renewable resources was about 229686 Megawatt (MW) and through Renewable resources was 114315 Megawatt (MW). Facts reveal our nation is majorly dependent on such method for energy generation which is going to harm us in long run. Problem with Non-Renewable is that they are not at all eco-friendly as well as not at all reliable in long run. According to U.S Energy Information Administration these resources may seem abundant to us in present but the fact we are missing here is they cannot replenish in short period of time. Not only this but energy production through such sources causes air and water pollution, damage to public health, loss of wildlife habitat, and also dose global warming emissions. Summing up it does more harm than good. On other hand National Geographic has revealed energy generation through Renewable resources is Eco-friendly as well as cast effective. Not only this but renewable resources are also and easier product to use. To the advantage of this our nation India is rich in Renewable resources as we have got them in abundant quantity and they also have the ability to replenish in short period of time. Recent (March 2017-18) Total energy generation ration in India is in "Fig 1".

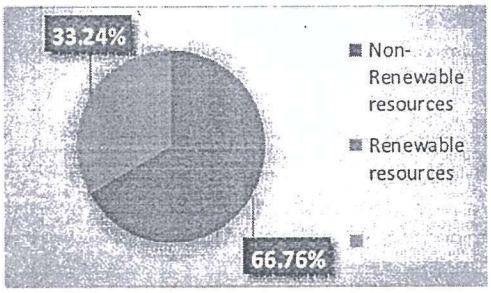


Fig 1: Ratio of renewable and non-renewable resources [3]

Graph clearly reveals that in spite of being rich in Renewable resources sector India develops only 33% of its

# Energy Audit: A Case Study

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*Abstract*— Energy Audit is the vital to a systematic approach for decision-making in the area of energy management. It endeavor to balance the total energy inputs with its use and serves to identify all the energy streams in a facility. With the advent of energy crisis and exponential hikes in the cost of different forms of energy, Energy Audit will help to understand more about the ways energy and fuel are used in any industry or any HT user area, and help in identifying the where waste can occur and where scope for improvement exists. This paper present the energy audit of Education Institute have 11 different departments with hostel in 9 buildings located in Gujarat. Also perform the one year bill analysis with load calculation in existing area. Corrective measures are given based on detail analysis in every aspect of energy saving. Audit performance gives the most likely areas for improvement for energy savings.Energy Audit is an effective tool in defining and pursuing comprehensive energy management program. In this field also, the basic functions of management like outlining, decision-making, organizing and controlling apply equally as in any other management subject. These functions can be effectively performed based on reliable information, which can be Audit techniques. Perform preliminary as well as detailed energy audit for all the area with all kind of load.

*Keywords—Energy Audit; Energy Savings; Energy Efficiency*

## I. Introduction

Energy is essential input for life comfort. With the increase in use of appliances, transportation and faster industrial growth, the energy resources consumption is increasing with very high demand. The natural resources being less, its import affects lot to the nation budget. The proper management of energy usage can help us in reducing overall consumption with same output. The energy needs to cover various human activities in agricultural, industrial and domestic field rising day by day. There is gap between availability and requirement, and we face power shortage. Many of our villages are still without electricity. Energy gap can be reduced by using efficient equipment and suppressing the wastage. A proper load management can also help in effective utilization. The energy conservation means to curtail the energy consumption without affecting quality and quantity of output by preventing the waste with efficient utilization. These will increase the resources utilization; otherwise it may lead to power shortage, dearth of water and other natural resources. The situation is knocking our door to do needful in this regard at an earliest, which may avoid hardships of generation to come. It is a need of time to create the awareness of the people about the seriousness of energy conservation.

There is wide scope of energy conservation applications in illumination, air conditioner, refrigeration, heat generation and transfer, electric traction, electric drive system, textile industries. More and more equipment is designed and fabricated to have higher efficiency, lower consumption and control leakage, well designed automation and instrumentation scheme can save energy. People must be trained for this battle. It is war against waste. A small step in right direction can help a great selection of appropriate ratings, switching off equipment not require and regular maintenance may have a amazingly. We can also think of electricity generation by the non-conventional resources like solar energy, tidal energy etc. Though the initial cost may be high, aright step in this direction will prove its worth. Necessary incentives are being announce in this regard and ministry of non-conventional energy sources is working and providing guidance in these fields. Energy audit is of a great importance because sometime costlier working thing may prove to be economical looking to their payback period.[1]

The demand side management will provide better utilization of available energy by improving load factor, diversity factor and plant use factor. Another emphasis must be given to subsidies and pilferage. Because of undue conversions the wastage increases to larger extend while power theft has made the consumers free from the worries of their energy bills. This must be prevented by heavy penalties culprits. It is a time to apply check on T & D losses and line outages. The combined effort by electricity authority power supply undertaking and awareness of consumer value will improve the scenario. This is a humble effort to give consideration to cover above topics in this course by experts of respective fields.

**"Energy audit" means examination of an electrical installation or electrical apparatus belonging to consumer, for the purpose of verifying whether there is leakage or wastage or inefficient use of an electrical energy, in operating the electrical installation or electrical apparatus.**

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RESEARCH ARTICLE

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# Utilization of DFIG-based wind model for robust damping of the low frequency oscillations in a single SG connected to an infinite bus

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**Summary**

In this study, a single synchronous generator connected to an infinite bus (SMIB), augmented by a DFIG, was assessed by studying a system model at various operating positions, wind speeds, and DFIG ratings. In addition, several tests were conducted to compare power systems with and without a connected DFIG. Following detailed analysis and residual configuring, we identified the optimal positioning of the DFIG rotor- and grid-side converter controllers for mitigating small oscillations. Three distinct signals were tested at the selected position to determine the most robust signal in terms of several key characteristics, namely, high average residue magnitude and average phase angle of residue. This was done to ensure system stability without reducing or destabilizing other system modes under a range of operating conditions. Based on the results of eigenvalue analysis, participation factor calibration, and time domain simulation, this study validated and demonstrated the effectiveness of the proposed modified system.

**KEYWORDS**

eigenvalue analysis, nonlinear simulation, residue, small signal stability

## 1 | INTRODUCTION

When connected to a power system, synchronous generators (SGs) are generally equipped with an automatic voltage regulator (AVR) to fulfill two major functions: maintaining the generator terminal voltage and voltage recovery following a severe disturbance, such as a three-phase short-circuit on a network isolated via a switchgear operation.[1] This AVR causes instability in a power system in the form of line reactance and generation increase,[2] which occur as a result of increases in generator loading conditions. This leads to increases in the rotor angle and, consequently, increases in the current and decreases in the voltage. The AVR attempts to maintain a constant voltage, thus introducing negative damping in the rotor, which makes the system unstable. A power system stabilizer (PSS) and FACTS devices are frequently used to damp these oscillations. A conventional PSS can improve the steady-state stability margin and increase system positive damping; however, these have a number of drawbacks, such as time-consuming tuning and non-optimal damping throughout the operating process.[3-5] FACTS-based approaches are expensive, and unless they use large energy storage systems, series converters can only inject a quadrature voltage, and shunt converters can only inject a quadrature current (reactive power).[6]


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IET Generation, Transmission & Distribution

Research Article

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# Optimal coordination of directional overcurrent relays using improved mathematical formulation

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**Abstract:** Achieving optimum coordination of directional overcurrent relays is a very complicated task in the large interconnected system including huge numbers of relays. In the literature, various objective functions (OFs) are reported to obtain minimum operating time of relays and minimum prescribed discrimination time between the operations of primary and backup (P/B) relays. In this paper, the performance of five well-established OFs is examined, and in addition, a new OF is proposed to improve the previously proposed OFs. The proposed OF (POF) minimises operating time of P/B relays together with discrimination time between their operations. Also, the coordination problem is formulated considering near and far-end faults and solved by using a genetic algorithm. In order to evaluate the effectiveness, the POF is implemented over the IEEE 14-bus and IEEE 30-bus distribution networks, and obtained results are compared with those obtained by using previously proposed OFs presented in the literature.

## 1 Introduction

Directional overcurrent relays (DOCRs) are widely used as a primary protection in sub-transmission and distribution networks, as well as a backup protection of distance relays in transmission networks [1]. The DOCRs can be required to obtain the fault zone discrimination in multi-looped, parallel feeder, double-end fed, and ring main systems. The coordination of DOCRs is the process of selecting the suitable relay settings, namely plug setting (PS) and time multiplier setting (TMS), in such a way that the primary relay responds faster than any other relays of the system. In case of the failure of primary relay or associated circuit breaker, backup relays have to operate after a prescribed time interval, ensuring the correct sequential operation of P/B relay pairs [2]. The perfect relay coordination can reduce the chances of equipment damage and improve the electrical power service to the consumers by isolating the least possible part of the system [3]. On the other hand, the overall relay coordination is a very complicated task, because a relay works as the primary relay for its primary protection zone and the same relay may serve as a backup of some other primary relays in the system. Even though the safeguards are taken for designing and setting of DOCRs-based protection scheme, mis-coordination may occur in the operation of P/B relay pairs. Therefore, the use of efficient approaches is essential for the accurate coordination of relays.

One of the most popular approaches in the literature is to find the optimal relay settings by using optimisation methods. Over the past decades, several optimisation methods have been used to solve the coordination problem. For the first time in 1988, the coordination of DOCRs is presented in the frame of the optimisation problem and solved by the linear programming (LP) method [4]. Afterwards, LP methods have gained good recognition to solve this problem due to their simplicity [5]. Owing to fixed value assumed for PS in LP techniques, the obtained solution may float away from optimal state. To optimise both PS and TMS simultaneously, the coordination problem is formulated as a non-linear programming (NLP) problem, and is solved by using the sequential quadratic programming method [6]. Subsequently, heuristic methods have become a tool to solve the relay coordination problem in the last few years. These methods include genetic algorithm (GA) [7–11], particle swarm optimisation (PSO) [12], seeker algorithm [13], enhanced backtracking search algorithm [14], ant colony algorithm [5], teaching learning-based optimisation [15], harmony search algorithm [3] etc. To improve the computational efficiency, the hybrid methods are also utilised to solve the coordination problem of DOCRs, including GA-LP [1], GA-NLP [2], biogeography-based optimisation algorithm-LP [16], and PSO-gravitational search algorithm [17].

Now, owing to the availability of numerous entrenched optimisation methods, it is a natural curiosity to step ahead for finding some other approaches for effective solution of optimal coordination of DOCRs. In this regard, some authors point towards the modification in the problem formulation of relay coordination. The most commonly utilised OF is the minimisation of weighted sum of the operating time of primary relays [1, 2]. However, in a larger interconnected system with huge numbers of relays and coordination constraints, the aforesaid method sometime leads to the larger discrimination time between P/B relay pairs. This is because the coordination constraints are not incorporated directly in the OF. To reduce the discrimination time, the coordination constraints are integrated as a part of the OF [7]. However, this method endures the problem of mis-coordination of P/B relay pairs. In [8, 9], the problem of mis-coordination associated with the previous method has been improved by adding a new term in the OF. Nevertheless, these methods have problems of large operating time of primary and backup (P/B) relays. To overcome the mentioned problem, a new OF is developed in [10, 11], which integrates operating times of both P/B relays with coordination constraints. By adding this new term, the improved solutions have been obtained, but still the problem of mis-coordination is subsisted.

In this paper, in order to obtain the optimal relay coordination, a novel OF based on GA is proposed to improve the earlier presented OFs. The main contribution of the proposed method is to reduce operating time of relays with preserving the discrimination time at a minimum prescribed value. In other words, the proposed method minimises the operating time of primary relays and maximises the operating time of backup relays in case of mis-coordination. In addition, the proposed method minimises operating time of backup relays in case of larger discrimination time between P/B relay pairs. In this way, the proposed method eliminates the problem of mis-coordination, and simultaneously reduces the operating time of relays by achieving the prescribed coordination between P/B relay pairs. Furthermore, if the relay coordination problem is solved by considering only near-end faults, there will be chances of violation


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# A hybrid improved harmony search algorithm-nonlinear programming approach for optimal coordination of directional overcurrent relays including characteristic selection

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**Abstract:** The objective of optimal coordination of directional overcurrent relays (DOCRs) is to search optimal relay settings. This leads to the minimum operating time of relays for faults in their primary protection zone under the coordination and boundary constraints. In this paper, relay settings are considered as pairs of – pickup current setting ($I_p$) and time multiplier setting (*TMS*), plug setting (*PS*) and *TMS* – for solving the coordination problem on 8-bus and 15-bus networks. Moreover, a new hybrid improved harmony search algorithm-nonlinear programming (IHSA-NLP) approach is proposed to solve the relay coordination problem. To demonstrate the superiority of IHSA-NLP method, obtained results are compared with the IHSA and existing methods presented in the literature. Also, the effectiveness of the proposed method is evaluated with the coordination problem considering multiple characteristics on IEEE 30-bus network.

**Keywords:** characteristic selection; constrained optimisation; directional overcurrent relay; DOCR; improved harmony search algorithm; IHSA; meta-heuristic; nonlinear programming; optimum relay coordination; power system protection; relay setting.

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# Implementation of Isolated DC-DC converter for MOSFET Driver circuit

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*Abstract— **Now a days isolated DC-DC converters are widely used in power metering, industrial programmable logic controllers (PLCs), insulated-gate bipolar transistor (IGBT) driver power supplies, industrial fieldbus, and industrial automation. These converters often are used to provide galvanic isolation, improve safety, and enhance noise immunity. In this paper different types of DC-DC converters (chopper) are listed out and paper also includes hardware design and implementation of isolated buck DC-DC Converter specially used for MOSFET/IGBT driver circuit. Design of high frequency transformer is also described in this paper with help of mathematical equations. Output of PWM controller IC and hardware results of high frequency transformer and also is shown in this paper.***

*Keywords— **MOSFET, IGBT, PWM, PLCs, Chopper, SMPS.***

## INTRODUCTION

A DC-DC converter converts an input DC voltage into a regulated or non-regulated DC output voltage which can be higher or lower, inverted or non-inverted and isolated or non-isolated. Converters are broadly categorized as isolated and non-isolated converters. They are sub-categorized as follows:

(i) Non-isolated DC-DC Converters

- Buck (Step-down)
- Boost (Step-up)
- Buck-boost (Step-up and Step-down)
- Inverting
- SEPIC

(ii) Isolated DC-DC Converters

- Flyback
- Forward
- Push-pull
- Half-bridge
- Full-bridge

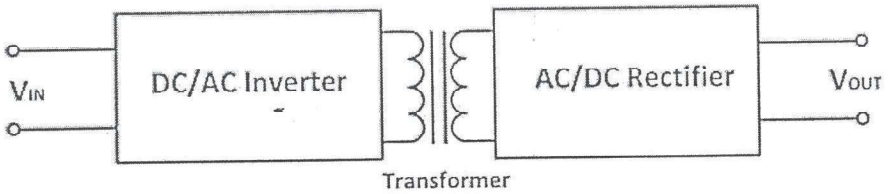


*Fig. 1 Block Diagram of an Isolated DC-DC Converter Power Stage.*

The non-isolated converters represent an inexpensive solution for many applications and are often used for small voltage conversions. However, they cannot offer much protection against high input voltages or transients. In contrast, the isolated DC/DC voltage converters have a high isolation voltage and can therefore be used for isolating floating ground connections between input and output. The isolated converters are more complex circuits and require a higher number of components and hence costly solutions. In this paper Push-pull converter is used for implementation of isolated DC-DC converter.

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# IEEE 34 Node test system as Simulation Test Bench for Load Flow Analysis in EMTP RV

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*Abstract—**The IEEE Power Engineering Society Distribution Subcommittee published five benchmark distribution feeders with their configurations and parameters. Amongst these feeders, the IEEE 34 node distribution test feeder was selected. Load flow or Power flow studies exhibits its importance for determining sinusoidal steady state of entire system-voltages, real and reactive power generated and line losses. EMTP RV incorporates its significance for load flow, steadystate, time domain and frequency scan simulation enhancing most advanced user defined modelling capabilities. The main objective of this paper is to analyse this test bench in EMTP RV and report its results.***

*Keywords— IEEE 34 Node test system, Load flow analysis, EMTP RV*

## INTRODUCTION

IEEE 34 Node Test Feeder is an existing feeder located in Arizona, with a nominal voltage of 24.9 kV. It is characterized by long and lightly loaded overhead transmission lines, two in-line regulators, one in-line transformer for a short 4.16 kV section, a total number of 24 unbalanced loads, and two shunt capacitors.The IEEE Distribution System Analysis Subcommittee developed and published data for a variety of unbalanced radial distribution test feeders the primary purpose of which is the evaluation of power system analysis software. These test systems are for use by software developers and field engineers for validating their studies. The IEEE 34 Node Test Feeder represents an actual feeder in Arizona and has the following features reflecting the physical world.

*1)* Each section of the distribution system is modeled by actual phase impedance values.

*2)* The system includes single and two phase laterals.

*3)* Loads on each phase of each section are specified in real and reactive power

*4)* Distributed load models represent load on feeders with closely spaced load taps.

*5)* The system includes voltage regulators and capacitive reactive power compensation.

*6)* The system has very long distributions lines and is lightly loaded.

*7)* There is an in-line transformer for reducing voltage to 4.16 kV for a short section of the feeder.

## I. Load Flow Analysis

AC power flow analysis is basically a steady-state analysis of the AC transmission and distribution grid. Essentially, AC power flow method computes the steady state values of bus voltages and line power flows from the knowledge of electric loads and generations at different buses of the system under study.Load flow analysis is the most important and essential approach to investigating problems in power system operating and planning. Based on a specified generating state and transmission network structure, load flow analysis solves the steady operation state with node voltages and branch power flow in the power system. Load flow analysis can provide a balanced steady operation state of the power system, without considering system transient processes. Hence, the mathematic model of load flow problem is

a nonlinear algebraic equation system without differential equations.The purpose of power flow studies is to plan ahead and account for various hypothetical situations. For example, if a transmission line is be taken off line for maintenance, can the remaining lines in the system handle the required loads without exceeding their rated values.

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# Flashover Characteristics Performance Assessment under Contamination Possessions on the Surface of Porcelain Insulators

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*Keywords:* Porcelain Insulators, Dust, NaCl, Moisture, Contamination, Flashover, Breakdown Voltage

ABSTRACT

This paper presents the experimental outcomes regard to the flashover performance of pin, shackle and disc insulators under contaminated conditions. For making contaminated surface various samples are made like salt, dust, industry pollution and miscellaneous foreign particles of wet and dry conditions as per IEC testing techniques. Moreover, each insulator has been tested under above mentioned conditions. For each insulator its breakdown voltages were measured. After doing performance analysis of different insulators under contaminated condition measurement of breakdown voltages are done with incorporation of real field application of insulators and making analogy with various regions of India.

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## 1. Introduction

Due to the demand of electric power is substantially improved in recent days. Each and every electrical equipment must be designed, commissioned and tested for critical situations. To keep the system healthy and sound from transmission to distribution to consumer end continuous monitoring is required. For longer transmission system different insulators are used with different materials like porcelain, ceramic, glass.The performance of insulator under different contaminations was also studied [1]. As per the research it has been evaluated that various parts of country is having various pollutants that deposit on the surface of insulators [2]. Porcelain, ceramic, polymeric types insulators are also affected by NaCL and other foreign particles deposition and just due to that various flashover mechanisms have been observed under wet and dry conditions [3]. The insulators commence to fail due to mixture of air particles, water dew drops, salt and fog conditions under behavior of

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# Fuzzy Logic Controlled Power System Stability for Long Power Transmission Line using UPFC

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**Abstract:** In this study, the research is carried on a long transmission line model which is simulated by MATLAB Simulink tool for the enhancement of power system stability with improved power factor and reduction in harmonic distortion.The UPFC(unified power flow controller) which is a shunt FACT device, were used in between the transmission line at the center of T model for compensation.UPFC is a combineendeavor of SSSCand STATCOM devices and is controlled using the implementation of FLC (fuzzy logic controller) and the results shows that power factor and other parameters were improved with less distortion.

**Key words: Long Transmission Line, UPFC, Fuzzy Logic Controller, MATLAB Simulink**

## I. INTRODUCTION

In the power system, the transient stabilityis the stability of the system to maintain synchronism when subjected to a severe trouble within the power line, such as a fault on transmission line, unexpected loss of generation, or loss of uncertain loadability. The power system response to such turbulencesincludes large trips of generator rotor angles, bus voltages, power flow and other system variables or components. With the invent of Flexible Alternating Current Transmission(FACTS) devices based on power electronics, excellent operating experiences available world-wide, these devices are becoming more mature and more reliable to improve the performance of long distance AC transmission. The FACTS controllers can be categorized in two different wayssuch as first variable impedance type controllers and other voltage source converter based controllers. This article considered one of the FACTS devices Unified Power Flow Controller (UPFC). UPFC is the most useful FACT device that can be used to enhance steady state, dynamicand transient stability. The UPFC is capable of both supplying and absorbing real and reactive power [1-4]. The FACT family in form of histogram is shown in Figure 1.

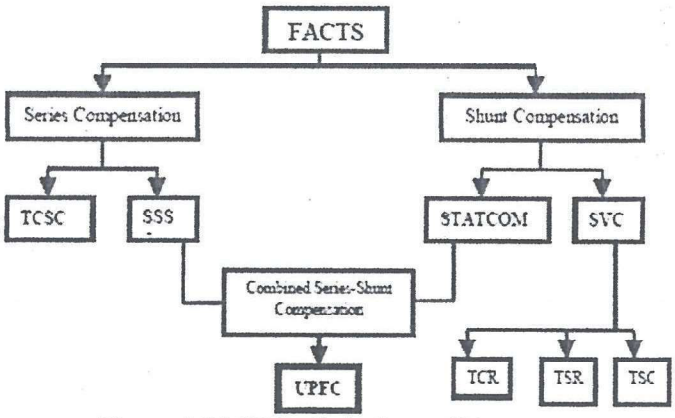


**Figure 1.**FACT family in form of histogram

Analysis of transient stability from with UPFC in MATLAB/SIMULINK WSCC model has been done. This paper considered three different conditions i.e. pre fault, with fault, and with UPFC (steady state, LLG fault, and after fault with UPFC).

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# Ester Oil Characteristics, Hot Spot and Overloading Capacity Analysis with Temperature Rise Test on Ester Oil filled Power Transformers

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*Abstract*— **Natural ester and Synthetic ester fluids may be used in new transformer units in order to improve their performance and reliability. Designing power transformers with natural ester and synthetic ester fluids requires, however, to account for a number of significant differences in properties, characteristics, and material parameters between natural ester fluids and mineral oil in order to obtain the desired performance. In this paper hot spot and overloading capacity of ester oil filled power transformers are discussed with the temperature rise test on power transformers. Currently mineral oil filled power transformers are used commonly but it can be replaced with ester oil filled power transformers. Ester oils (Natural ester oil and synthetic ester oil) have a high viscosity as compared to mineral oil so temperature rise test results need to be analyze because its directly affect on life of power transformer. Overloading capacity also discussed in this paper with results analysis.**

***Keywords-Ester oils, hot Spot, overloading, temprature Rise,design improvement***

## I. INTRODUCTION

Power transformers are most important components of the power system. Transformers are used in power system for step up and step down the level of voltage, for energy saving. Efficient transformers are very important for power system to reduce the transmission losses. The life of a power transformer is also important for reliability and stability of the power system.

Due to internal losses of transformer like load loss, iron loss, eddy current loss, stray loss transformer gets heat up during loading condition.

Due to generation of heat, cooling of transformer is important. According to rating of transformer cooling systems are provided to transformer. For example, Oil Natural Air Natural (ONAN), Oil Forced Air Forced (OFAF) etc.

Transformer oil is used in transformer for mainly two purpose, as an insulating material and as a cooling medium. By providing transformer oil heat exchange to the environment is possible, by this transformer can work more efficiently.

Different types of oils are used in power transformers for cooling purpose. Mostly mineral oils are used in power transformers due to its lover cost and availability. But mineral oils have some drawbacks also. Due to this currently a craze of ester oil is increased.

Basically, mineral oil is a mixture of different hydrocarbon compounds like naphthenic CnH2n, such as cyclohexane $C_6H_{12}$, paraffin CnH2n+2, such as hexane $C_6H_{14}$, and aromatic CnHn, such as benzene $C_6H_6$. The proportions of the contents of the individual components depend on the composition of the petroleum and, for example, most prized naphthenic transformer oils can be obtained only with the certain types of petroleum. Therefore, in the case of spillage of oil to the environment, the oil is not a neutral for it. So basically, mineral oil is hazardous material which can directly affect on soil and water.

Mainly transformer oil used in transformer due to two reasons, one is for cooling purpose and second is for insulating purpose. Mineral oils are highly non-biodegradable so they are highly hazarders for environment. Even miner oils have low fire point and flash points compared to ester oils.

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ELECTRICAL ENGINEERING

# Optimal selection of distributed generating units and its placement for voltage stability enhancement and energy loss minimization

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KEYWORDS

Continuation power flow (CPF);
Distributed generation (DG);
Eigenvalue;
Modal analysis;
Participation factor

**Abstract** The integration of distributed generation (DG) in distribution network may significantly affect its performance. Transmission networks are no longer accountable solely for voltage security issues in distribution networks with penetration of DGs. The reactive power support from the DG sources greatly varies with the type of DG units and may potentially distress the larger portion of the network from the voltage stability aspects. This paper presents the analysis for the selection of the best type of DG unit among different categories and its optimal location that can enhance the voltage stability of distribution network with simultaneous improvement in voltage profile. Voltage sensitivity index and bus participation factors derived from continuation power flow and Modal Analysis, respectively, are used together for voltage stability assessment and placement of DGs. Changes in mode shapes and participation factors with the placement of DGs are comprehensively analyzed for 33 and 136 nodes radial distribution network.

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## 1. Introduction

The integration of DG is expected to play an increasingly important role in the electric power system infrastructure planning and market operations. The integration of DG at the distribution network results in operating situations that do not occur in a conventional system without generation directly connected at the distribution level [1]. Attention must be paid to effectively eliminate the potentially adverse impacts that DG penetration could impress on the electric delivery system. Inappropriate DG placement and sizing may increase system losses and network capital and operating costs. Hence, systematic studies and planning are required to locate and operate the DGs at the distribution level in order to improve voltage profile, to reduce system losses, and to enhance the stability [1–3].

Power systems are expected to become more heavily loaded in the forthcoming years as the demand for electric power rises sharply. The economic and environmental concerns limit the construction of new transmission and generation capacity. This may result in deficit of local reactive power support in

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International Journal of Engineering & Technology

*Website: www.sciencepubco.com/index.php/IJET*

***Research paper***

# Modeling Transport Layer Protocol Behaviour to Improve Data Center Network Performance

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**Abstract**

Today, there is a generalized standard usage of internet for all.The devices via multiple technologies that facilitates to provide few communication methods to scholars to work with. By forming multiple paths in the data center network, latest generation data centers offer maximum bandwidth with robustness. To utilize this bandwidth, it is necessary that different data flows take separate paths. In brief, a single-path transport seems inappropriate for such networks. By using Multipath TCP, we must reconsider data center networks, with a diverse approach as to the association between topology, transport protocols, routing. Multipath TCP allows certain topologies that single path TCP cannot use. In newer generation data centers, Multipath TCP is already deployable using extensively deployed technologies such as Equal-cost multipath routing. But, major benefits will come when data centers are specifically designed for multipath transports. Due to manifold of technologies like Cloud computing, social networking, and information networks there is a need to deploy the number of large data centers. While Transport Control Protocol is the leading Layer-3 transport protocol in data center networks, the operating conditions like high bandwidth, small-buffered switches, and traffic patterns causes poor performance of TCP. Data Center TCP algorithm has newly been anticipated as a TCP option for data centers which address these limitations. It is worth noting that traditional TCP protocol.

***Keywords***: *Data Center Network, Transport Protocol, Multipath Transport, Data Center TCP, Multipath TCP.*

## 1. Introduction

TCP is the leading protocol on the Internet and has demonstrated its scalability to operating conditions of the network. TCP is leading Layer-3 transport protocol in the data centre situation, particularly in cloud computing data centres. However, its performance in the data centre is of poor, and the prime reason is the small-buffered and high-speed switches used in the data centre. Also, the types of traffic of applications in data centers are quite different from WAN; data centre applications produce a mixture of burst traffic, short Messages, and often have firm deadlines for the completion of those data traffic In the last decade, data centres have dominated the computing market. Nowadays, large data centres have thousands of servers which performs distributed applications that distribute computation and storage to thousands of machines. It is unfeasible to manually allocate tasks to machines when there are so many hosts. Though we can write applications to take benefit of locality in the data centre, huge distributed calculations are distributed across many racks of machines, with the adverse result creating bottleneck networks.

Such topologies creating bottleneck networks are in progress to be conveyed; Amazon Web Service's most recent EC2 server farm has a repetitive structure - between a few hosts, there are multi-path accessible. Regularly switches run a variation of Equal-cost multipath routing, casually hashing streams to meet cost ways to adjust the heap over the topology.

Nonetheless, with most such topologies it takes numerous synchronous TCP associations per host to produce adequate streams to verge on adjusting activity.

With more regular load levels, utilizing ECMP on these multi-arrange topologies causes flows to collide on at least one link with high probability.

The techniques used by Data Center Transport Protocol are a queue management scheme called as active queue management at the switch, based on Explicit Congestion Notification and a sender/receiver window control scheme at the source end device, which reacts to Explicit Congestion Notification marks by reducing the window size in proportion to the fraction of packets that are marked with special characteristics used for marking congestion in the packet. The performance of Data Center TCP relies on two important parameters associated with Data Center TCP protocol : (1) K, the threshold on the queue at the switch above which packets are marked with special characteristics used for marking congestion and (2) g, the weight parameter used for exponentially averaging explicit congestion notification mark values at the sender end node [01].

It has been observed that modern data center has different traffic requirements. If we classify the data center based on the type of traffic handled by the data center, then network traffic is broadly classified as under following.

Data center which handles query traffic (inflows and outflows) (very short length traffic like Google search query). Data center which handles medium range traffic (inflows and outflows) (like e commerce traffic consist of images and other relevant information).

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# A Survey on Techniques to Protect Video files Using Watermarking

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**Abstract: -**In this advanced age the principle issue with multimedia documents like picture and video is theft. The Radical increment in trades of information over the web and the incessant utilization of advanced medium has been watched. Computerized data can be shielded from unapproved get to and sharing through watermarking. Digital watermarking is the methodology of inserting some applicable data in the host signal. With the utilization of watermarking systems on unique medium, licensed innovation rights can be saved over web. An investigation deals with various elements and techniques for computerized watermarking has been carried out and introduced in this paper.

***Keywords:*** *Video watermarking, content security, Robust, DWT, SVD, Security, Authentication.*

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## I. INTRODUCTION

Digital watermarking is an appropriate instrument for recognizable proof of source, proprietor, wholesaler, or approved shopper of an archive, picture or video. This procedure can likewise be utilized to recognize an archive, picture or video about its genuineness.In the computerized world, a watermark is an example of bits embedded into a digital medium that can distinguish the maker or approved client. Property of video documents and pictures are distinctive, so the watermarking strategy for picture can't be specifically connected to video some adjustment is required because of extra property of video records. Computerized video involves a progression of orthogonal bitmap advanced picture showed in fast progression at a steady rate.A payload is data that is inserted in video groupings. In all actuality video watermarking techniques need to meet diverse challenges than that in picture watermarking scheme, for instance, broad volume of the naturally reiterated progression of data between frames[1].Watermark can be embedded either into the host signal or to changed adaptation of the host signal. There are three fundamental methodologies (DFT, DCT, DWT) that are utilized for changing host signal as a part of the frequency domains in such an approach to alter the change coefficient. Spatial domain watermarking is the adjusting of pixel values specifically on the spatial area of a picture[2].The utilization of perceptual models is additionally an imperative part in producing a compelling and adequate watermarking scheme for sound pretty much as it is utilized as a part of picture watermarking.

This paper has been sorted out into five segments. The ensuing area of this manuscript clarifies the significant parts of video watermarking methods. Area II concentrates on the systems of video watermarking where different areas of video watermarking are explored and with the end goal of thought a vigorous algorithm in every domain is considered.

## II. FEATURES OF VIDEO WATERMARKING

Video watermarking inserts information in the video with the end goal of recognizable proof, comment and copyright. Various video watermarking procedures have been proposed. These systems exploit diverse ways while keeping in mind the end goal to insert a vigorous watermark and to keep up unique video loyalty. Ordinary encryption algorithms allow just approved clients to get to encoded digital information. Once such information is unscrambled, in any case, there is no chance to get in precluding its unlawful duplicating and dissemination.

Numerous algorithms for creating watermarks on pictures are reached out for recordings. Be that as it may, a few focuses should be considered amid the augmentations[3].

a) Between the frames an enormous measure of naturally repetitive information exists.

b) A strong balance must be there between the motion and the motionless regions of images.

c) Strong concern must be put forth in real time and streaming video applications

The following features are important for the development of watermarking system.

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Original Article

# DEVELOPMENT AND VALIDATION OF A STABILITY INDICATING RP-HPLC METHOD FOR THE DETERMINATION OF POTENTIAL DEGRADATION PRODUCTS OF DIFLUPREDNATE IN OPHTHALMIC EMULSION

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## ABSTRACT

**Objective:** The objective of the current study was to develop and validate a simple, robust, precise and accurate RP-HPLC (reverse phase-high performance liquid chromatography) method for the quantitative determination of potential degradation products of Difluprednate (DIFL) in the ophthalmic emulsion.

**Methods:** Chromatographic separation was achieved on the YMC pack ODS-AQ (150× 4.6) mm, 3µm column with a mobile phase containing a gradient mixture of mobile phase A (0.02M Ammonium formate buffer pH 4.5 adjusted with formic acid) and Acetonitrile as mobile phase B, at flow rate of 1.5 ml/min and with UV detection at 240 nm.

**Results:** The peak retention time of DIFL was found at about 17.2 min, the RRT of degradation product-1 (DP-1), degradation product-2 (DP-2), and degradation product-3 (DP-3), were found to be about 0.49, 0.65 and 0.79 respectively (calculated with respect to Difluprednate). Stress testing was performed in accordance with an ICH (international council for harmonisation) guideline Q1A (R2) [1]. The method was validated as per ICH guideline Q2 (R1)[2]. The calibration curve was found to be linear in the concentration range of 0.1 to 0.75 µg/ml for Difluprednate, DP-1, DP-2 and DP-3. The LOD (Limit of detection) was found to be 0.1µg/ml and LOQ (Limit of quantification) of 0.15µg/ml for Difluprednate, DP-1, DP-2 and DP-3 respectively. The recovery from LOQ to 150% was within 90-110%. The forced degradation data confirms the stability indicating the nature of the method.

**Conclusion:** A simple, robust, precise and accurate RP-HPLC method for the quantitative determination of potential degradation products of Difluprednate in the ophthalmic emulsion was developed and validated.

**Keywords:** Difluprednate, Stability indicating, RP-HPLC, Degradation products, Forced degradation

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## INTRODUCTION

Difluprednate (DIFL) [(6S,8S,9R,10S,11S,13S,14S,17R)-17-(2-Acetyl-oxyacetyl)-6,9-difluoro-11-hydroxy-10,13-imethyl-3-oxo-6,7,8,11,12, 14,15,16-octahydrocyclopenta[a] phenanthren-17-yl] butanoate (fig. 1) is a glucocorticoid receptor agonist and a diflurinated derivative of prednisolone having anti-inflammatory activity. DIFL ophthalmic emulsion is a topical formulation of DIFL that is an ophthalmic corticosteroid emulsion for topical instillation [4-10].

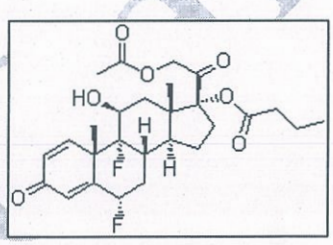

**Fig. 1: Chemical structure of DIFL**

Literature survey revealed that RP-HPLC method has been reported for the estimation of DIFL from biological matrices, for assay in bulk drug as well as in eye drops [5]. The UV-Visible spectrometric method was also reported for estimation of DIFL [10]. DIFL and its formulations are not official in any pharmacopeia.

To the best of our knowledge, no stability indicating reverse-phase high-performance liquid chromatography [RP-HPLC] method has been reported for the determination of DIFL and its related impurities in the emulsion based eye drops. Very less work has been done on the quantification of related substances of DIFL in the ophthalmic emulsion; hence a simple robust and sensitive stability indicating RP-HPLC method was developed and validated for determination of DIFL and its related impurities in the ophthalmic emulsion as per the ICH guidelines [1-3].

Three potential degradation products were observed in the marketed products and in the degradation studies, the identified degradation products were enriched, isolated and purified. These purified degradation products were degradation product-1(DP-1), degradation product-2 (DP-2) and degradation product-3 (DP-3) which were then used to validate the method. The specification limit for the three degradation products and unknown impurities is considered as 1.0% based on the maximum daily dose as per ICH guideline [11]. The main aim of this research work was to develop a stability indicating the RP-HPLC method for determination of degradation products of DIFL in the ophthalmic emulsion.

Stability indicating RP-HPLC method is defined as a validated method having the ability to specifically quantitate the analyte in the presence of excipients, degradation products, and process impurities. Due to the impact of stress (hydrolysis, oxidation, temperature and photolytic) during shelf life and instability studies, various degradation products shall be formed, specific quantification of these degradation products provides additional assurance of the stability indicating nature of the method [12-14].

## MATERIALS AND METHODS

### Chemicals and reagents

DIFL (active pharmaceutical ingredient) and DIFL ophthalmic emulsion were procured as a gratis sample from Sun Pharma, Baroda. Market samples of Flupred© were also received from Sun

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# PHYTOCHEMICAL EVALUATION OF THE AERIAL PARTS OF *CORCHORUS DEPRESSUS* L

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## ABSTRACT

*Corchorus depressus* a medicinally important herb was evaluated for its phytoconstituents. Chloroform soluble portion of Methanolic extract of *C. depressus* on bioactivity-guided fractionationation using the MCF-07 breast cancer cell line resulted in isolation of terpenoids, flavonoid and a β-carboline alkaloid. The constituents were identified as Oleanolic acid, Lupeol and apigenin. The identity of alkaloid isolated is yet to be confirmed which appears to be a β-carboline alkaloid. It is a first report of isolation of an alkaloid from any *Corchorus* species.

**KEYWORDS:** *Corchorus depressus*, Oleanolic acid, Lupeol, Apigenin, β-carboline alkaloid, phytochemistry.

## INTRODUCTION

The genus *Corchorus* comprises of over 100 species which are distributed in the tropics and subtropics, chiefly South-East Asia and South America[1]. *Corchorus depressus* (L) (Tiliaceae) is a prostrate deep rooted, much-branched, perennial herb, yellow flowers and cylindric straight or curved capsules, found in drier parts of North India[2]. The uses of *C. depressus* (CD) in ethnomedicine are varied. Whole plant is used in urinary disorders, as an aphrodisiac, on swelling and in internal injury, urinary inflammation, fever and also for strengthening the body, while seed and fruit decoctions are used as demulcent, mucilage is applied for gonorrhea and leaves are used in liver disorders and impotency[3-10]. The plant is sweetish hot sharp acrid; removes tumours and pain; cures piles. It is given as a cooling medicine in fevers. The leaves are emollient. The seeds in decoction with milk and sugar are given as a tonic[11].

The plant is less explored phytochemically and till date presence of secondary metabolites like sitosterol glucoside, β-sitosterol, apigenin, luteolin and α-amyrin derivatives, viz. cordepressic acid, cordepressenic acid, and cordepressin have been confirmed along with flavonoids quercetin and kaempferol from leaves and flowers[12-13]. The biological activities attributed to this

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REVIEW ARTICLE

# Recent Patents on Polymeric Electrospun Nanofibers and Their Applications in Drug Delivery

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ARTICLE HISTORY

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**Abstract:** ***Background***: In the recent years, polymeric nanofibers have gained lots of attention in the area of drug delivery applications. Owing to its simplicity, ease of composition method and high drug loading capacity, it provides various benefits for the therapeutic applications. Nanofibers are useful for the delivery of antibiotics, anticancer drugs, analgesic's agents and various proteins for drug delivery applications. Electrospinning method is widely used method for the preparation of nanofibers, based on their feasibility background for scale-up process from laboratory to the industrial applications.

***Method***: A literature review was conducted to summarize the reported articles as well as patents that have been granted and filed for work related to nanofibers in drug delivery. Efforts have been made to include various types of research undertaken by the researchers for the fabrication of nanofiber and its application in drug delivery system.

***Results***: In this paper, a detailed information is reported about researches and developments related to electrospun polymer nanofibers including its fabrication process, structure, properties, characterization, applications, and patent. Amongst all the patents available, 18 most relevant granted patents and 14 filed patents was summarized in the review article.

***Conclusion***: We expect that these fundamental applications of nanofibers could help the researchers to develop and gain knowledge about nanofibers in drug delivery application.

**Keywords:** Nanofiber, drug delivery, pharmaceutical applications, tissue engineering, chemotherapeutic agents, patents.

## 1. INTRODUCTION

Nanofibers possess low pore size as well as mechanical properties and have increased a lot of attention due to their numerous applications such as biomedical application, tumor targeting, tissue engineering, wound dressings and drug-delivery systems. Nanofibers can be defined as continuous filaments that are usually less than 0.1 micrometer in diameter range and are able to provide various advantages in the field of drug-delivery [1-3]. Nanofibers are useful for the controlled release of drugs. Enlargement of a macromolecules system into nanofibers helps to alter the polymeric chain and also enhance the intermolecular interactions; while the diameter of a fiber is generally reduced by an appropriate process that can further produce strong materials [4, 5]. The incorporation of the active agent into the nanofibers may be very useful for the drug-delivery applications [6, 7]. Nanofibers possess great potential and investigation of new polymeric composite for multifunctional application and improve both physical as well as chemical properties. Polymeric composite nanofibers mostly comprise of two or more polymer composites, polymer/inorganic salts composite nanofibers *etc.* [8, 9]. The present report includes information about preparation, characterization and various applications of nanofibers in the specialized area of drug delivery. Morphological characteristics of nanofiber such as diameter and thickness are generally studied by scanning electron microscopy (SEM).

Fig. (**1**) demonstrates reported descriptions of nanofibers loaded with drug. Nanofibers are fibers with diameters in the nanometer range that is responsible for physical, chemical and biological properties [10]. Fiber diameter ranges from 50-1000 nm, these properties have significant importance in the areas of drug delivery such as morphological structures of nanofibers that include thickness, as well as the diameter, which plays a vital role in biological applications. Surface area, as well as pore size, is important for cell adhesion properties, cell growth, proliferation and also have importance in various applications. Therefore, high porosity and surface area are desirable for nanofibers [11, 12]. In comparison with morphology, mechanical properties also possess importance for materials applicable to tissue engineering. Optimization of surface properties is the critical step toward the development of a new scaffold as well as the hydrophilic/hydrophobic character of the surface significantly influenced

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Research Article

# ESTIMATION OF GUGGULSTERONE-Z IN *GOKSHURADI GUGGULU* USING REVERSED-PHASE HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY

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***Received: 5 April 2018, Revised and Accepted: 06 July 2018***

**ABSTRACT**

**Objective:** A study was aimed to estimate guggulsterone-Z (GZ) in *Gokshuradi Guggulu* (GG).

**Methods:** An analytical method was developed and validated using Waters Alliance high-performance liquid chromatography system (Empower software), equipped with photodiode array detector. Separation was achieved using Phenomenex, C-18 (250 mm×4.6 mm, 5 µ) column. Mobile phase consisted of acetonitrile:water (70:30,v/v). Flow rate was set to 1 ml/min and detection was performed at 251 nm.

**Results and Discussion:** Validation parameters such as linearity, precision, accuracy, limit of detection, limit of quantification, and robustness were performed. Amount of GZ was estimated using linearity equation.

**Conclusion:** GG was found to contain 0.815±0.03 g% w/w GZ. Validated method may be used as one of the parameters to standardize the formulation.

**Keywords:** *Gokshuradi Guggulu*, Guggulsterone-Z, High-performance liquid chromatography.

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## INTRODUCTION

*Gokshuradi Guggulu* (GG) is a solid formulation, prepared using *Guggulu* as basic ingredient. The formulation is official in *Ayurvedic* Formulary of India. *Gokharu* (*Tribulus terrestris*) and *Guggulu* (exudates from *Commiphora wightii*) are the major ingredients of GG. GG is used in the treatment of dysuria, urinary obstruction, excessive vaginal discharge, gout, spermatogenic, and vitiation of semen [1]. Guggulsterone is an active constituent of *Guggulu*, characterized as cis (E) and trans (Z) stereoisomers of 4,17(20)-pregnadiene-3,16-dione [2,3]. Chemical structure of guggulsterone-Z (GZ) is shown in Figure.1. GZ was first isolated from ethyl acetate fraction of gum resin of *Commiphora mukul* (known as *Guggulu*) belongs to family Burseraceae [4-7]. The oleo gum resin is traditionally used in the management of hypercholesterolemia and obesity [8-10]. Apart from this, *Guggulu* is used extensively as base in many *Ayurveda* formulations, commonly known as *Guggulu*.

Various physical parameters were evaluated for shodhit guggul [11]. Several analytical methods are reported for the estimation of GZ in different matrix present in combination with different phytoconstituents. Guggulsterone was estimated by high-performance liquid chromatography (HPLC) from its raw material *C. wightii* [12-14], rabbit plasma [15], and from a marketed herbal formulation [16]. Guggulsterone was also estimated using reversed-phase HPLC (RP-HPLC) in few herbal tablet formulations [17]. GZ with gallic acid and piperine was estimated using HPLC–mass spectrometry (MS) [18]. High-performance thin-layer chromatography (HPTLC) method was developed to estimate guggulsterone from tablets [19], amount of GZ was estimated from *Triphala Guggulu* using HPTLC [20,21]. There has been no report of any chromatographic method for the estimation of GZ in GG; thus, it was planned to develop a chromatographic method for the estimation of GZ in GG.

## METHODS

GG was manufactured by Sunder Pharmacy (GMP certified manufacturing unit associated with J and S Ayurveda College, Nadiad, Gujarat, India) on our request. GZ (>95%) was purchased from Natural Remedies, Bangalore, India. All solvents used were of HPLC grade and procured from Merck India. Water used was double distilled. The solvents were filtered through a 0.45 µm filter (Millipore Bedford, MA, USA) and degassed in an ultrasonic bath (Remi Instruments, Mumbai, India) before use.

### Preparation of combined standard stock solution

Accurately weighted, 10 mg GZ was dissolved in 5 ml of methanol using sonication. The solution was diluted up to 10 ml using methanol.

### Preparation of working standard solution

Different volumes of standard stock solution were diluted using methanol to produce different dilutions in the range of 20–320 µg/ml, for GZ.

### Preparation of sample solution

GG was received in the form of compressed tablets. Tablets were grounded to powder using mortar and pestle. 50 g tablet powder was weighed accurately and transferred quantitatively to a 250 ml round bottom flask and extracted using 50 ml of chloroform for 2 h. Mixture was allowed to cool at room temperature. Chloroform extract was collected. Procedure was repeated twice using 100 ml of chloroform for 1 h each. Chloroform extracts were mixed together, filtered through Whatman filter paper and subjected to evaporation using rotary vacuum evaporator at 40°C. Resulting semisolid mass was stored in a container and analyzed immediately after drying. 4 g of chloroform extract was dissolved in 50 ml of methanol in a volumetric flask. This solution is diluted up to 50 ml using methanol. 1 ml of resultant solution as diluted up to 10 ml using methanol. This solution was filtered using syringe filter to avoid the presence of insoluble extractives in sample solution. This clear solution was used as sample solution for the estimation of GZ and injected directly in HPLC system.

### Development and optimization of chromatographic conditions

Initially, reported HPLC-based analytical methods were adopted to separate peak of GZ in sample solution [12-17]. The studies revealed

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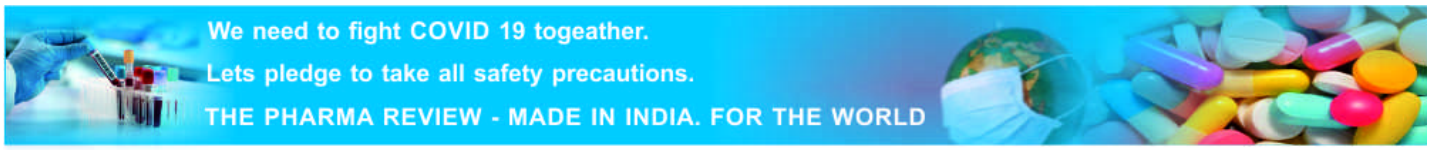


**THE PHARMA REVIEW (SEP – OCT 2018)**

# Sources, Separation and Identification of Impurities in Pharmaceuticals

**Dr. Mehul M. Patel & Harshal J Shah**

**Introduction:**

**Abstract**: In pharmaceutical field, impurity is considered as any other organic material, besides the drug substance, or ingredients, arise out of synthesis or unwanted chemicals that remains with API's. Impurity profiling includes identification, structure elucidation and quantitative determination of impurities and degradation products in bulk drug materials and pharmaceutical formulations. There are various forms of impurities incorporated in the pharmaceuticals. These impurities are classified into three main categories such as organic, inorganic and residual solvents. The control of impurities in formulated products and active pharmaceutical ingredients are regulated by various regulatory authorities like US-FDA, ICH, MHRA, TGA etc. Qualification of impurities is most essential for establishing the biological safety of an individual impurity. Various methods are used to isolate and characterize impurities in pharmaceuticals, such as, capillary electrophoresis, electron paramagnetic resonance, gas–liquid chromatography, gravimetric analysis, high performance liquid chromatography, solid-phase extraction methods, liquid–liquid extraction method, ultraviolet spectrometry, infrared spectroscopy, supercritical fluid extraction column chromatography, mass spectrometry, Nuclear Magnetic Resonance (NMR) spectroscopy, and RAMAN spectroscopy. Among all hyphenated techniques, the most exploited techniques for impurity profiling of drugs are Liquid Chromatography (LC)-Mass Spectroscopy (MS), LC-NMR, LC-NMR-MS, GC-MS, and LC-MS. This reveals the need and scope of impurity profiling of drugs in pharmaceutical research.

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ORIGINAL

# IMPACT OF MIGRAINE ON PATIENT'S QUALITY OF LIFE

Solanki Nilay, Patel Varsha, Champaneri Ishita

**ABSTRACT**

Introduction: Migraine is a neurological condition which found in large numbers of populations. Migraine is 3rd most prevalent and 7th leading cause of disability worldwide. It adversely impacts on the patient's quality of life.

Objective: Main objective of the study was to evaluate theimpact of migraine condition on the quality of life of migraine patient.

Method: After taking ethical approval and inform consent from the patient, patient's demographic details and prescribing details were recorded. Migraine specific quality of life questionnaire version 2.1 was examined for neurology outpatient department at multispecialty hospital at Ahmadabad for six month study period.

Result: 100 patient were reported for this condition during our study period. Out of them male patients (61.76%) were high in numbers as compared to female (41.18%). 78.63% patients were suffering migraine from more than one year, 11.12% patients were suffering migraine headache from more than six months, rest were newly diagnosed with the same. From the risk factor assessment we reported that among all, 32.23% patients had family history for the migraine headache. 48.23% patients were reported with the caffeine intake history. More than 90% patients received prophylactic treatment for monotherapy or polytherapy. 95% prescribing medicines were found from WHO essential drug list. According to the data we reported that large numbers of prescriptions were prescribed in the rational prescribing format. Only 5% patients were reported with comorbidity.

Conclusion: Migraine condition is the impact on the patients' mental, physical, social and cost factor. Patients feel mental burden for the same.

Migraine – Polytherapy – Prescriptions – Quality Of Life

***RESUMEN***

*Introducción: La migraña es una afección neurológica que se encuentra en un gran número de poblaciones. La migraña es la tercera causa más importante y la séptima causa de incapacidad en el mundo. Afecta negativamente en la calidad de vida del paciente.*

*Objetivo: El objetivo principal del estudio fue evaluar el impacto de la migraña en la calidad de vida en pacientes con migraña.*

*Método: Se registraron los datos demográficos y los datos de la prescripción del paciente después de obtener la aprobación y el consentimiento del paciente. Se evaluó la versión 2.1 de la del cuestionario de calidad de vida de la migraña específica para el departamento de neurología ambulatoria en el hospital de múltiples especialidades de Ahmadabad durante un período de estudio de seis meses.*

*Resultado: Se seleccionaron 100 pacientes durante nuestro período de estudio. El número de pacientes varones (61,76%) era superior al de mujeres (41,18%). El 78,63% de los pacientes sufría migraña durante más de un año, el 11,12% de los pacientes sufría migraña durante más de seis meses y el resto fue diagnosticado con el mismo problema. A partir de la evaluación del factor de riesgo, se observó que el 32,23% de los pacientes tenían antecedentes familiares con migraña. El 48,23% de los pacientes tenían historial de consumo de cafeína. Más del 90% de los pacientes recibieron tratamiento profiláctico en monoterapia o politerapia. El 95% de los medicamentos prescritos estaban incluidos en la lista de medica-*

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TPR ARTICLE

# Comparing Key Registration Requirements of Generic Drugs in East Africa, West Africa, USA & Europe with Main Focus on Kenya

Monika A. Patel[1], Mrunali R. Patel*[1], Rashmin B. Patel[1]

***Abstract:*** *Pharmaceutical Regulatory Affairs (PRA) is a consequential unit in a pharmaceutical company that prosperously drives the Research and Development (R&D) endeavor of the company to the market. Each nation has its own regulatory authority who is responsible for the rules and regulations and guidelines namely, Food and Drug Administration (FDA) - USA, European Medicines Agency (EMA) - Europe, Pharmacy and Poisons Board (PPB) - Kenya, National Agency for Food and Drug Administration and Control (NAFDAC) - Nigeria. Africa is the second largest and most populous continent of the world and African people suffer from numerous diseases. The objective of this study is to investigate in various parameters required for registration of drug product to country- specific Kenya (West Africa). Also, a comparative study is done which might help the sponsor to file the Dossier in many countries. This comparison of the registration procedure is useful to the new producer to globalize their business in the worry countries.*

## Introduction

Drug Regulatory Affairs deals with pharmaceutical products. It is a comparatively new profession which is developed from the desire of governments to protect public health by controlling the safety and efficacy of products in areas including pharmaceuticals, medical device, veterinary medicines, agrochemicals, pesticides, cosmetics and complementary medicines[1]. The companies responsible for the discovery, testing, manufacture and marketing of these products also want to ensure that they supply products that are safe and make a worthwhile contribution to public health and welfare.

The East African Community (EAC) is a regional inter-governmental organization including five partner states, namely the Republic of Burundi, Uganda, Kenya, Tanzania and Rwanda. The EAC has its headquarters in Arusha, Tanzania[02]. The five EAC countries collectively cover an area of around two million square kilometers, with Burundi, Uganda, Kenya, Tanzania and Rwanda. Officially the Republic of Kenya is a sovereign state in the African Great Lakes region of East Africa with IV A (Hot and Humid) climatic zone. It's Capital and largest city is Nairobi. Kenya covers 581,309 $km^2$ area and has a population of about 44 million in July 2012. The regulatory body of Kenya is Pharmacy and Poisons Board (PPB)[03]. It is the Drug Regulatory Authority organized under the Pharmacy and Poisons Act, Chapter 244 of the Laws of Kenya. It is an agency overseen by the Ministry of Health. PPB manages the practice of pharmacy and the manufacture and trade in drugs and poisons in Kenya[03]. The services offered and functions of the board are as shown in table 1.

## Procedure for Registration of Pharmaceutical Product for Submission to The Pharmacy and Poisons Board (PPB)[04]:

The guideline for Registration of Pharmaceutical Product for submission to PPB is based on World Health Organization (WHO) Guidelines on Submission of Documentation for Prequalification of Multi-Source Finished Pharmaceutical Products and the International Conference on Harmonization of Technical Requirements for Registration of Pharmaceuticals for Human use on the CTD. Applicants are required to fill in application form, prepare dossiers and submit them in two hard copies (Original and duplicate) as well as a summary of the dossier contents as an electronic copy (MS Word on a CD - ROM) of modules 1 and 2 only[03]. The guideline is divided into Five Parts[05]:

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SHORT REPORT

# Oral bioavailability enhancement of agomelatine by loading into nanostructured lipid carriers: Peyer's patch targeting approach

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Sneha D Verma
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**Abstract:** Agomelatine (AGM) is a new antidepressant drug with a novel mechanism of action and fewer side effects compared with older antidepressants. AGM is a melatonin receptor (MT1 and MT2) agonist and 5-hydroxytryptamine receptor (5-$HT_{2C}$) antagonist. In the present study, the enhancement of the oral bioavailability of AGM was formulated and loaded into nanostructured lipid carriers (NLCs), using ultrasonication method. In vitro and ex vivo drug release was performed using a dialysis bag and rat duodenum, respectively. Our pharmacodynamic study showed that AGM–NLCs are more efficacious than a pure drug and marketed product, and confocal microscopy revealed lymphatic uptake of AGM–NLCs. The present study concluded that the NLCs enhanced the oral bioavailability of AGM (6.5-fold) by avoiding its first-pass metabolism by way of lymphatic uptake.

**Keywords:** agomelatine, nanostructured lipid carriers, antidepressant drug

## Introduction

Agomelatine (AGM) is a new antidepressant drug with a novel mechanism of action and fewer side effects compared with older antidepressants, such as selective serotonin reuptake inhibitors and tricyclic antidepressants. AGM is a melatonin receptor (MT1 and MT2) agonist and 5-hydroxytryptamine receptor (5-$HT_{2C}$) antagonist. It undergoes extensive first-pass metabolism showing poor oral bioavailability (<5%). The purpose of this study was to develop a delivery system capable of improving its oral bioavailability. It was hypothesized that by formulating AGM loaded into nanostructured lipid carriers (NLCs) and targeting Peyer's patch, the oral bioavailability could be increased and hence the therapeutic effect also increased. It can also be effective long term by having a controlled release of the drug from NLCs. NLCs are second-generation lipidic nanoparticles, which have gained the interest of scientists for the oral delivery of drugs. By developing a system like NLCs, one can enhance the solubility, and as the system is lipidic in nature and nano size, NLCs can directly and easily get absorbed by the M cells of Peyer's patches. It can also avoid first pass metabolism due to their nano size.

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## Materials and methods

### Materials

The materials used were AGM (Servier, Suresnes, France), Dynasan 118 (Sasol Germany GmbH, Hamburg, Germany), Labrafil M 2125 CS (Gattefosse, Mumbai, India), Tween-80 (Loba Chemicals, Gujarat, India), trehalose (Sigma Aldrich, Gujarat, India), Rhodamine dye (Sigma Aldrich, Gujarat, India), methanol (Loba Chemicals,

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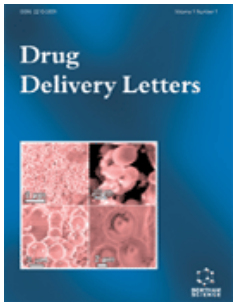


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Research Article

# Thiocolchicoside Niosomal Gel Formulation for the Pain Management of Rheumatoid Arthritis through Topical Drug Delivery

**Author(s):** Mansi Paradkar*, Sneha Vaghela

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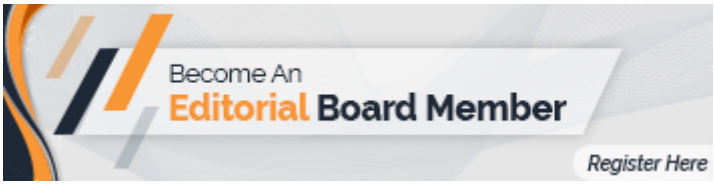

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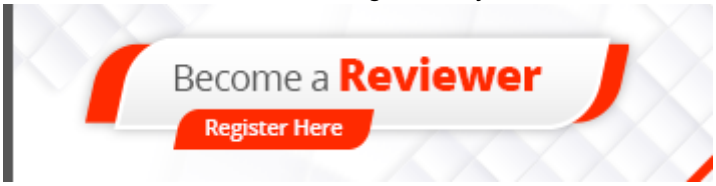

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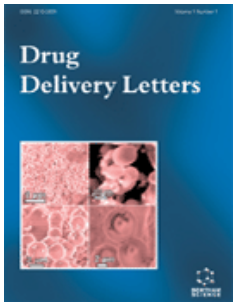


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Research Article

# Formulation Development and Evaluation of Transdermal 5-Fluorouracil Ethosomal Formulation through $2^{5-2}$ Fractional Factorial Design

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**Journal Name:** Drug Delivery Letters

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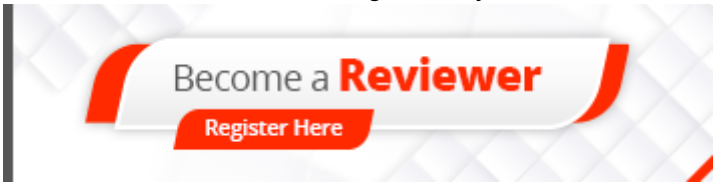


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SHORT REPORT

# Thermosensitive nanohydrogel of 5-fluorouracil for head and neck cancer: preparation, characterization and cytotoxicity assay

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**Abstract:** Systemic chemotherapy has been shown to produce side effects. A small fraction of the drug reaches the tumor site; other healthy organs or normal tissues get affected or damaged due to the nonspecific action of these cytotoxic agents. Furthermore, due to their short period of activity, repeat injections are often required, which can lead to the exacerbation of side effects and inconvenience. To overcome these obstacles, in this study, we developed controlled and targeted intratumoral injection. Hydrogel was prepared by physical cross-linking method; however, nanohydrogel was prepared using tip probe-sonicator method. Our results revealed that biodegradable and thermosensitive 5-fluorouracil-loaded methylcellulose nanohydrogel synthesized by physical cross-linking method may be a beneficial approach in targeting the therapeutic agent to the tumor site.

**Keywords:** biodegradable, intra tumor, targeted drug delivery

## Introduction

The primary treatment for solid tumors is surgery followed by irradiation and/or systemic chemotherapy to kill malignant cells, which may remain even after surgery. Systemic chemotherapy has been shown to cause side effects upon administration as they are extensively transported to the whole body; a small fraction of it reaches the tumor site, whereas the rest is taken up by other healthy organs or normal tissues thereby getting damaged due to the nonspecific action of the cytotoxic agents. Due to their short period of activity, repeated injections are often required, which can lead to exacerbation of side effects and inconvenience to the patients. To overcome these obstacles, in this study, we developed controlled and targeted intratumoral injection. Such targeted delivery may be potentially more effective in maintaining therapeutic concentrations of drug, while reducing systemic drug levels and decreasing the side effects in healthy normal tissues. In recent years, an injectable in situ thermosensitive nanohydrogel has attracted considerable attention because it achieves targeted drug delivery and prolonged activity.[1,2] This in situ nanohydrogel exhibits sol phase to gel phase transition in response to temperature. At room temperature, various cytotoxic drugs can be easily incorporated into the solution by simple mixing, and this forms a gel in situ after administration under physiological conditions.

Among the many cytotoxic drugs used in clinics, 5-fluorouracil (5-FU) is an effective chemotherapeutic agent that is extensively employed in systemic chemotherapy for solid tumors such as head and neck cancer, breast cancer, colorectal cancer and brain tumor. After administration, 5-FU is rapidly metabolized in the body with an apparent terminal half-life of approximately 8–20 minutes as it is metabolized by

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# Rational Discovery of Novel Squalene Synthase Inhibitors through Pharmacophore Modelling

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PMID: 29732977 DOI: 10.2174/1573409914666180507143024

## Abstract

**Introduction:** In the present research work, a pharmacophore based virtual screening was performed using Discovery Studio 2.1 for the discovery of some novel molecules as inhibitors of Squalene Synthase Enzyme, a key enzyme in cholesterol biosynthetic pathway.

**Methods:** A quantitative pharmacophore HypoGen was generated and the best HypoGen had two ring aromatic and one hydrogen bond acceptor lipid features. The best HypoGen showed a very good correlation coefficient (r = 0.901) with satisfactory cost analysis. Furthermore, the HypoGen was validated externally by predicting the activity of test set. The developed model was found to be predictive as it showed low error of prediction for test set molecules. The developed model was used as a search query for virtually screening two chemical databases: sample database from catalyst and minimaybridge.

**Results and discussion:** The best hit with good fit value and low predicted activity was further modified to design novel drug-like molecules, which were able to bind to Squalene synthase enzyme active site.

**Conclusion:** The best scoring molecule, compound 67 showed 53% inhibition of the human Squalene synthase enzyme, isolated from the cell lysates of Human Hepatoma Cell Line, at a dose of 10 mcg with an IC50 value of 9.43 µm.

**Keywords:** Pahrmacophore; chemical databases; hits; hypogen; hypothesis; squalene synthase..

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Review Curr Drug Deliv. 2018;15(4):461-469. doi: 10.2174/1567201814666171013150534.

# Nanomedicine for Intranasal Delivery to Improve Brain Uptake

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## Abstract

Intranasal drug delivery system provides distinct advantage over conventional drug delivery system for a drug that is pharmacokenetically or biologically unstable. Major concern for the treatment of central nervous system diseases is, low concentration of therapeutically active molecule within brain as blood brain barrier is creating obstacle, where intranasal drug delivery provides direct transport of therapeutically active moiety into brain via olfactory or trigeminal pathway. Nasal mucosa provides distinct advantages like improved bioavailability, law dose and quick onset of action and high patient compliance, and the major disadvantage is residence time of drug and irreversible entrapment of drug. This article provides anatomical and physiological information about nasal route and various factors. Article discusses various types of nanoparticles used intranasally and moreover article also emphasizes patents, formulation under development and some.

**Keywords:** Brain uptake; drug delivery system; intranasal delivery; nanomedicine; nasal route; pharmacokinetic..

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# Peyer'e patch targeting of Isradipine loaded Solid Lipid Nanoparticles: It's cellular uptake study

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ABSTRACT

Isradipine (ISR), BCS Class II antihypertensive drug undergoes extensive first pass metabolism (FPM) with low bioavailability (15–24%). FPM may be avoided by formulating ISR loaded Solid Lipid Nanoparticles (SLN). Lipidic ISR-SLN get absorbed through M-Cells of peyer's patches. Preformulation study was performed. Dynasan 114 was selected as lipid. Poloxamer 407 was selected as surfactant. ISR-SLN was prepared using High Speed Homogenization-Ultrasonication method, optimized by $3^2$ full factorial design. ISR-SLN was lyophilized. (1:5 = solid: cryoprotactant). Process parameters like homogenization speed, time and sonication cycle were also optimized. *In-Vitro* % Cummulative drug release(%CDR) study of ISR-SLN (dispersion & lyophilized) was performed using dialysis bag method in 0.1 N HCl + 2% tween 80 for 2 h (obtained 10% drug release) than in phosphate buffer Ph 7.4 + 2% tween 80 (Aprx. 100% drug release after 130hrs, followed higuchi model). *Ex-Vivo* %CDR was performed using chicken duodenum in same condition as *In-Vitro*. Characterization was done using zeta potential (−21.5 mv), TEM(Spherical shape and smooth surface), MPS(204 nm), %EE (90.85 ± 3.55%), XRD, DSC, FT-IR. Confocal Laser Scanning Microscopy of Rodamine B labeled ISR-SLN was performed to study uptake of ISR-SLN through M-Cells, Peyer's Patches. Stability study of 45 days shows the ISR-SLN is stable. ISR-SLN give controlled release, permeates M-Cell of Peyer's patch and are stable.

## 1. Introduction

ISR is having low bioavailability (15–24%) due to extensive FPM. So, by loading ISR into SLN, FPM may be avoided due to its nano size. As SLN are Lipidic in nature, they are easily absorbed via M-Cells of Peyer's Pathch of intestine. ISR is Lipidic in nature so it is efficiently loaded into SLN. Therefore, by avoiding FPM and targeting Peyer's Patch, bioavailability of ISR may be increased.

Polymeric nanoparticles made from non-biodegradable and biodegradable polymers. Advantages of these particles are site-specific targeting and controlled release of the incorporated drugs. The cytotoxicity of the polymers after internalization into cells is a crucial [1]. Furthermore, large-scale production of polymeric nanoparticles is problematic.

In the middle of the 1990s, the attention of different research groups has focused on alternative nanoparticles made from solid lipids, the so-called solid lipid nanoparticles (SLNs or lipospheres or nanospheres) [2]. SLN combines the advantages of other innovative carrier systems (e.g. physical stability, protection of incorporated labile drugs from degradation, controlled release, excellent tolerability) while at the same time minimizing the associated problems of toxicity.

Isradipine, dihydropyridine calcium-channel blocker, so that ISR does not usually decrease the heart rate [3], potent antihypertensive agent has been used in the treatment of hypertensive disorders. It is highly lipophilic (log P 2.9) [4].

The cellular lining of the gastrointestinal tract is composed of absorptive enterocytes interspersed with membranous epithelial (M) cells. M cells that cover lymphoid aggregates, known as Peyer's patches, take up nanoparticles by a combination of endocytosis or transcytosis [5]. Hence by preparing ISR-SLN, FPM may be avoided as drug and lipid are highly lipidic in nature. So they will be absorbed by lymphatic route, and it may bypass FPM, may be increasing bioavailability of Isradipine [6].

## 2. Materials and methods

### 2.1. Materials

ISR (Shasun Pharmaceuticals, Tamilnadu, India), Dynasan 114, 116, 118 (Sasol Germany), Compritol 888 ATO (Gattefose India Pvt LTD,

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# DISSOLUTION ENHANCEMENT OF RALOXIFENE HCl BY LIQUISOLID COMPACTS TECHNIQUE

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## ABSTRACT

Raloxifene HCl (RLX) is a BCS class – II drug, used in osteoporosis. For RLX liquisolid compacts (LSC), selection of non volatile liquid vehicle, carrier, coating material, super disintegrant were done and they were developed by using Propylene Glycol (PG): Polyethylene Glycol (PEG) 600 as a combination of non volatile liquid vehicles, Avicel PH101 as a carrier, Aeroperl 300 as coating material and Kyron T 314 as super disintegrant. The optimized batch was characterized by tests like flow property, content uniformity of mass, weight variation, tablet hardness, friability, disintegration time, XRD (X-ray diffraction) study, in vitro drug release test. The results of in vitro drug release study of RLX optimized batch illustrated a remarkable improvement in the dissolution rate as compared to Reference product (Ralista) and pure drug with other parameters of tablet. Accelerated stability study of the optimized batch was done for 3 months (at 25℃ ± 2℃ temperature and 40% ± 5% Relative humidity) and showed no significant change in appearance, drug content and in vitro drug release. This study concluded that LSC of RLX prove as one of the suitable approach for developing stable solid oral dosage form of poorly water soluble drug - RLX.

**KEYWORDS:** Dissolution enhancement, Liquisolid compacts, Osteoporosis, Raloxifene HCl.

## INTRODUCTION

Dissolution enhancement techniques remain the most emerging field for the scientists in formulation science. Dissolution is the core concept of any physical or chemical science including biopharmaceutical and pharmacokinetic considerations in therapy of any therapeutic agent. The dissolution behaviour of a drug is key determinant to its oral bioavailability, the latest frequency being the rate-limiting step is absorption of drugs from the gastrointestinal tract. As a result, more than 40% of new candidates entering drug development pipeline fail because of non optimal biopharmaceutical properties. [1]

Over the years, various techniques have been employed to enhance the dissolution profile, the absorption efficiency and bioavailability of water insoluble drugs and/or liquid lipophilic medication.[2] Nowadays, there are large no. of techniques, which can be used for solving this

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Research Article

# DEVELOPMENT AND VALIDATION OF STABILITY-INDICATING REVERSE-PHASE HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY METHOD FOR THE SIMULTANEOUS QUANTIFICATION OF POTENTIAL DEGRADATION PRODUCTS OF REGADENOSON FROM ITS PARENTERAL DOSAGE FORM

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**ABSTRACT**

**Objective:** The objective was to develop and validate the stability indicating reverse-phase high-performance liquid chromatography method for the quantification of potential degradation products of regadenoson (REGA) from its injectable dosage form.

**Methods:** YMC-PAK ODS AQ, 150 mm × 4.6 mm, 3 µm composed with hydrophobic high carbon loading and a relatively hydrophilic surface chemically bonded to porous silica particles column was used with the temperature maintained at 40°C. Mobile phase A composed of 0.1% triethylamine buffer having pH 4.5 while mobile phase B is 100 % acetonitrile was used for gradient elution with 1.5 ml/min as a flow rate. The wavelength used for quantification was 245 nm and 20 µl as an injection volume. The suitability of the method has been checked and validated according to the International Council for Harmonization (ICH) guidelines for different parameters, namely, specificity, linearity, accuracy, precision, limit of quantification (LOQ), Limit of detection (LOQ), and robustness studies.

**Results:** The resolution between REGA and its two-degradation product is >8.0 for all pairs of components. The high correlation coefficient ($r^2$>0.990) values are for drug and all potential degradation products from LOQ to 150% of specification limits for impurities calculated based on the maximum daily dose of REGA. LOQ for the drug as well as each degradation product is <0.02% w/w. The % relative standard deviation (RSD) for precision and intermediate precision is in the range of 0.17–0.89, and % RSD for precision at LOQ is 0.86–2.35. The % RSD for robustness study is maximum 2.59.

**Conclusion:** The developed method can quantify the specified and unknown degradation products from 0.1% in the injectable dosage form which indicates that method is sensitive. Method fulfills the ICH criteria for its different validation parameters and demonstrates that the developed analytical method is highly specific, precise, and robust and would have a great value when applied in quality control and stability studies for REGA injection.

**Keywords:** Regadenoson, Degradation products/related substances, High-performance liquid chromatography, Validation.

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## INTRODUCTION

Regadenoson (REGA) (1-[6-amino-9-[(2R,3R,4S,5R)-3,4–dihydroxy-5-(hydroxymethyl)oxolan-2-yl]purin-2-yl]-N-methylpyrazole-4-carboxamide) (CVT-3146, Lexiscan) (Fig. 1) is an A2A adenosine receptor agonist. The molecular formula for REGA is $C_{15}H_{18}N_8O_5 \cdot H_2O$ and its molecular weight is 408.37. REGA is a coronary vasodilator that is commonly used in pharmacologic stress testing. It produces hyperemia quickly and maintains it for a duration that is useful for radionuclide myocardial perfusion imaging (MPI). The selective nature of the drug makes it preferable to other stress agents such as adenosine, which is less selective and therefore causes more side-effects [1].

The dosage form available is an injection which is the non-pyrogenic solution for intravenous injection. The solution is clear and colorless. Each 1 mL in the 5 mL pre-filled syringe contains 0.084 mg of REGA monohydrate, corresponding to 0.08 mg REGA on an anhydrous basis, 10.9 mg dibasic sodium phosphate dihydrate or 8.7 mg dibasic sodium phosphate anhydrous, 5.4 mg monobasic sodium phosphate monohydrate, 150 mg propylene glycol, 1 mg edetate disodium dihydrate, and water for injection, with pH between 6.3 and 7.7. It is a pharmacologic stress agent indicated for radionuclide MPI in patients unable to undergo adequate exercise stress. It is available in single-dose pre-filled syringe which is clear, colorless solution containing REGA 0.4 mg/5 mL (0.08 mg/mL). The recommended intravenous dose is 5 mL (0.4 mg REGA). Based on literature review, it was found that few analytical methods are available for the estimation of REGA using high-performance liquid chromatography (HPLC) [2] and HPLC/MS/MS [3].

During pharmaceutical development of the drug product, impurity profiling plays a vital role. The different regulatory bodies such as US-FDA and EMA recommend identifying and estimating the impurity present above 0.1% of the label claim for the active substance. The International Council for Harmonization (ICH) has also provided a guidance document to monitor impurities present in new drug substances and new drug products [4]. During the shelf life, the dosage form factors can influence the drug stability and ultimately result into the forced recall of the marketed products. Pantoprazole for injection, 40 mg per vial, was recalled from the United States markets because of failed impurities/degradation products limit for N-Oxide generated leading to the sub-potent formulation [5]. Determination of related substances should be the first step in the examination of safety and quality of the drug product. Therefore, the analytical method being used should be sensitive (having a low limit of detection [LOD] and limit of quantification [LOQ]) and stability indicating, i.e., should be able to separate and quantify the drug, its related substances, and degradation products [6,7].

A very low concentration of drug and presence of other critical excipients pose the challenges in developing the analytical method for

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Volume 14, Issue 4, 2018, Pages 349-362

## Molecular docking, in-silico admet study and development of 1,6-dihydropyrimidine derivative as protein tyrosine phosphatase inhibitor: An approach to design and develop antidiabetic agents(Article)

Patel, A.D., Barot, R., Parmar, I., Panchal, I., Shah, U., Patel, M., Mishtry, B.

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Abstract

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Huseynzada, A.E. , Jelsch, C. , Akhundzada, H.N.

Synthesis, crystal structure and antibacterial studies of 2,4,6-trimetoxybenzaldehyde based dihydropyrimidine derivatives

*(2021) Journal of Molecular Structure*

Patel, A.D. , Pasha, T.Y. , Lunagariya, P.

A Library of Thiazolidin-4-one Derivatives as Protein Tyrosine Phosphatase 1B (PTP1B) Inhibitors: An Attempt To Discover Novel Antidiabetic Agents

*(2020) ChemMedChem*

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Current Pharmaceutical Analysis

Volume 14, Issue 4, 2018, Pages 373-381

## Determination of protodioscin in rabbit plasma by LC-MS/MS method: Application to preclinical pharmacokinetics(Article)

Variya, K., Parmar, V., Trivedi, M., Raval, M., Sastry, N.

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### Abstract

Background: Protodioscin, a furostanolic saponin type phytocompound, is claimed to have aphrodisiac and anticancer activities. Determination of protodioscin is challenging problem since it lacks chromophoric or florophoric groups. Pharmacokinetic data after administration of protodioscin-rich extract prepared from Trigonella foenum-graecum in rabbit was not yet reported. A selective and sensitive LC–MS/MS method with solid phase extraction was developed

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## Application of cocrystallization approach in drug development: Recent patents review(Review)

Shah, K., Parmar, V.K.

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## Abstract

Background: Cocrystals of active pharmaceutical ingredient has been of interest in the field of pharmaceutical research due to their potential for tailoring the physicochemical properties of pharmaceutical molecules. The increase in number of cocrystals screening experiments being reported and simultaneously the draft guidelines issued from regulatory bodies on pharmaceutical cocrystals provide the evidence of the acceptance of cocrystals in the drug development. This review presents the numerous patents addressing the key properties of an active pharmaceutical

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Peng, B. , Wang, J.-R.

Advances in drug-drug complexes based on the crystal engineering design

*(2020) Yaoxue Xuebao*

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Volume 24, Issue 2, June 2018, Pages 131-140

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Patel, N., Parmar, V.K.

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[a]Ramanbhai Patel College of Pharmacy, Charotar University of Science and Technology, CHARUSAT Campus, Changa, Ta. Petlad, Dist. Anand, Gujarat 388421, India

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Al Majidi, M.I.H. , El-Shaheny, R. , El-Shabrawy, Y.

Screening and greenness profiling of oxidative-coupling and electrophilic aromatic substitution reactions for determination of three phenolic drugs

*(2019) Microchemical Journal*

Alvani, A. , Jouyban, A. , Shayanfar, A.

The effect of surfactant and polymer on solution stability and solubility of tadalafil-methylparaben cocrystal

*(2019) Journal of Molecular Liquids*

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Volume 15, Issue 4, 2018, Pages 315-325

## Molecular docking, synthesis and biological evaluation of sulphonylureas/guanidine derivatives as promising antidiabetic agent(Article)

Panchal, I.I., Sen, D.J., Patel, A.D., Shah, U., Patel, M., Navale, A., Bhavsar, V.

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### Abstract

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Lal, K. , Poonia, N. , Rani, P.

Design, synthesis, antimicrobial evaluation and docking studies of urea-triazole-amide hybrids

*(2020) Journal of Molecular Structure*

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## Stability indicating reverse phase HPLC method for estimation of Rifampicin and piperine in pharmaceutical dosage form(Article)

Shah, U., Patel, S., Raval, M.

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Department of Pharmaceutical Chemistry, Ramanbhai Patel College of Pharmacy, Charotar University of Science and Technology, Changa, Gujarat, India

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### Abstract

Background: High performance liquid chromatography is an integral analytical tool in assessing drug product stability. HPLC methods should be able to separate, detect, and quantify the various drug-related degradants that can form on storage or manufacturing, plus detect any drug-related impurities that may be introduced during synthesis.

Cited by 2 documents

Zhang, N. , Helu, M.B. , Zhang, K.

Multiwalled carbon nanotubes-ceo2 nanorods: A "nanonetwork" modified electrode for detecting trace rifampicin

*(2020) Nanomaterials*

Yu, Y. , Hu, S. , Fu, D.

Surfactant-assisted enzymatic extraction of piperine from Piper nigrum L

*(2020) International Journal of Food Properties*

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Koradia, K.D., Parikh, R.H., Koradia, H.D.

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### Abstract

Albendazole is a broad spectrum anthelmintic. Its efficacy is often limited by poor intestinal absorption mainly due to its low aqueous solubility. One of the best approaches to enhance aqueous solubility and dissolution of drug is nanoparticles. In the present study nanocrystals of albendazole were prepared by antisolvent precipitation technique followed by spray drying. The nanocrystals were optimized using $3^2$ full factorial design considering stabilizer

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Türkan, F.

Investigation of the toxicological and inhibitory effects of some benzimidazole agents on acetylcholinesterase and butyrylcholinesterase enzymes

*(2021) Archives of Physiology and Biochemistry*

Mekkawy, A.I. , Fetih, G. , EL-Badry, M.

Development and optimization of albendazole nanosuspension as local adjuvant therapy for treatment of enterobiasis

*(2020) Bulletin of Pharmaceutical Sciences*

Turkan, F. , Harbi Calimli, M. , Akgun, A.

Toxicological effects of some antiparasitic drugs on equine liver glutathione S-Transferase enzyme activity

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Brazilian Journal of Pharmaceutical Sciences

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## Formulation development and evaluation of colon targeted delayed release methotrexate pellets for the treatment of colonic carcinoma(Article) (Open Access)

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Abstract

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Sheng, Y. , Gao, J. , Yin, Z.-Z.

Dual-drug delivery system based on the hydrogels of alginate and sodium carboxymethyl cellulose for colorectal cancer treatment

*(2021) Carbohydrate Polymers*

Shejawal, K.P. , Randive, D.S. , Bhinge, S.D.

Green synthesis of silver, iron and gold nanoparticles of lycopene extracted from tomato: their characterization and cytotoxicity against COLO320DM, HT29 and Hella cell

*(2021) Journal of Materials Science: Materials in Medicine*

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International journal of nanomedicine

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Patel, B.K., Parikh, R.H., Patel, N.

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### Abstract

Mannosylated polymeric nanoparticles (NPs) enable improvement of brain bioavailability and reduction of dosing due to efficient drug delivery at the target site. Mannose receptors are present on the surface of macrophages, and therefore, in this study, it is expected that mannosylated NPs of anti-human immunodeficiency virus drug may target the macrophages, which may improve the therapeutic outcome and reduce the toxicity of antiretroviral bioactives. Poly(lactic-co-glycolic acid) (PLGA) and mannosylated-PLGA NPs (Mn-PLGA NPs) were prepared and administered by

Cited by 9 documents

Aggarwal, N. , Sachin , Nabi, B.

Nano-based drug delivery system: a smart alternative towards eradication of viral sanctuaries in management of NeuroAIDS

*(2021) Drug Delivery and Translational Research*

Pardeshi, C.V. , Agnihotri, V.V. , Patil, K.Y.

Mannose-anchored N,N,N-trimethyl chitosan nanoparticles for pulmonary administration of etofylline

*(2020) International Journal of Biological Macromolecules*

de Arcocha-Torres, M. , Quincoces, G. , Martínez-López, A.L.

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Paradkar, M.U., Hudda, K.

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## Cytotoxic effect of corchorus depressus against hepg2 and hle human liver cancer cells(Article)(Open Access)

Kakrani, P.H., Kakrani, H.N., Raval, M.

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## Abstract

Objective: The present study was designed to examine the cytotoxic effects of methanolic extract of aerial parts of Corchorus depressus and hexane, chloroform, ethyl acetate, and aqueous fractions of the same extract in the human hepatocellular carcinoma (HCC) (HepG2) and invasive hepatocellular carcinoma cell lines (HLE). Methods: Anti-proliferative effects were evaluated using 3-(4,5-dimethythiazol2-yl)-2,5-diphenyl tetrazolium bromide (MTT) and

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Abarikwu, S.O. , Onuah, C.L. , Singh, S.K.

Plants in the management of male infertility

*(2020) Andrologia*

Felix Joe, V. , Sathesh Kumar, S.

Anti-alzheimer activity of tacrine loaded methoxypoly (Ethylene glycol) poly (caprolactone) nanoparticles

*(2018) Asian Journal of Pharmaceutical and Clinical Research*

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Asian Journal of Pharmaceutical and Clinical Research

Volume 11, Issue 6, June 2018, Pages 208-211

## Anti-cataract activity of garcinia indica against naphthalene-induced cataract in rats(Article)(Open Access)

Patel, M.R., Patel, B.G.

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Department of Pharmacology and Toxicology, Charotar University of Science and Technology, Changa, Gujarat, India

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## Abstract

Objective: The objective of this study is to investigate the anti-cataract activity of the aqueous extract of Garcinia indica (AGI) fruit rinds on naphthalene-induced cataract using rats. Methods: Anti-cataract activity of AGI was evaluated using naphthalene model. Rats were divided into five groups (n=6 in each). Naphthalene solution was prepared by dissolving naphthalene in warm corn oil and administered at the dose of 0.5 g/kg/day p.o. for first 3 days and 1 g/kg/day p.o. thereafter for the induction of cataract. Group I normal control received corn oil 5 ml/kg/day. Group II cataract control received naphthalene solution. Group III received Vitamin E 50 mg/kg/day p.o., and Groups IV and V

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Vol. 08, Issue 5 (May. 2018), ||V (IV) || PP 16-22

# Applying Supervised Machine Learning Algorithms for Analytics of Sensor Data

Sanskruti Patel
*(Assistant Professor, Faculty of Computer Science and Applications, CHARUSAT, Changa, Gujarat, India)*
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**Abstract:** - The Internet of Things (IoT) is defined as a system with interconnected physical objects having ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. It is estimated that IoT will consist 30 billion objects by 2020. In IoT, either billions of smart sensors and devices interacts with one another to collect or supply data without human intervention follows Machine-to-Machine (M2M) communication. Methodologies and approaches are needed to process these data intelligently in order to provide information and control of events and objects to humans in remote physical environments. Machine learning approaches are best suited where ample amount of data are available, but very less is known about the process. Machine learning approaches possesses a capability to vary the outcome according to knowledge, observation and situation, which are essential for IoT based applications. This paper addresses how different supervised machine learning algorithms are applied in order to analyze, process and extract meaningful information from massive amount of structured and unstructured data gathered from IoT devices. It also discussed the performance evaluation of these algorithms base on the experiment carried out on sensor data set.

***Keywords:*** *- Supervised Machine Learning, IoT data, Sensor data analytics*

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Date of Submission: 27-05-2018 Date of acceptance: 10-06-2018

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## I. INTRODUCTION

The Internet of things (IoT) is defined as a network of physical devices including objects like vehicles, home appliances, software, sensors, actuators etc. and connectivity which enables these objects to connect and exchange data.[1][2][3] Each thing is uniquely identifiable through its embedded computing system but is able to inter-operate within the existing Internet infrastructure. IoT is one of the crucial developments in the field of ICT (Information and communication technologies) as it mainly aims to provide worldwide internet-based architecture, which mainly facilitates the exchange of services, information and data between millions or trillions of objects. This term introduced by Kevin Ashton in 1998 and since then it has obtained a lot of attention in the industry and academia [4]. It is estimated that by 2020, there will be 30 million objects consisted by IoT and the global market value of IoT will reach to $7.1 trillion. IoT is realized through the usage of sensors and actuators and it is part of cyber-physical systems. The objects residing in IoT sensed or controlled remotely across existing network infrastructure in order to make direct integration of the physical world into computer-based systems. By thus, it is aimed to reduce human intervention and to improve efficiency, accuracy and economic benefit. Many applications based on IoT being used in variety of sectors including smart health, smart agriculture, smart transportation, smart home, smart shopping, smart car etc.

The volume of data associated with and produced through IoT devices increases exponentially with the widespread usage of IoT enabled applications and devices. The extensive growth in the number of devices connected to the IoT generate and consume enormous data. These data sets are in form of structured, semi-structured or unstructured. However, such large data sets are not useful without analytic power. To extract meaningful information from these massive and varying data sets, some data analytics process should be applied. IoT analytics refers to the analytical process apply on data to make IoT more efficient, reliable and fruitful.

Traditional mathematical & statistical models can be used for analytics as they may use for optimization and prediction. The data generated through IoT enabled technologies are highly dynamic by nature and contains many variables that modify over time. In such a scenario, in a place of using a statistical model, it is better to apply machine learning algorithms as they possess the capability to learn from the data [6] and improved over time in order to improvise outcomes. Moreover, machine learning approaches are best suited where ample amount of data are available, but very less is known about the process. Machine Learning is an emerging field of Artificial Intelligence and as its name suggests, the objective of machine learning is to recognize patterns in data to perform useful inference using those patterns that have been learned [5]. The

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Research Paper Vol.-6, Issue-5, May 2018 E-ISSN: 2347-2693

# Analysis of Various Image Preprocessing Techniques for Denoising of Flower Images

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***Abstract***— Identification, and classification of flower images is a crucial issue faced by academicians and researchers. The manual process to distinguish different flower images is a complex task and found difficult for novice persons. A process of extraction, analysis, and understanding of useful information from images is accomplished by an automated process using Computer vision. It basically aims to model, replicate and exceed human vision using computer hardware and software. Image processing techniques may help to recognize a flower image for further identification and classification of them in different species. The fundamental step in image processing is image preprocessing that is applied to improve the quality of images and removing the irrelevant noises existed in images. This paper represents a comparative analysis of different image preprocessing techniques implemented on flower images. The performance evaluation of these techniques is based on their potential to remove noise in flower images. For performance evaluation, Peak Signal to Noise Ratio (PSNR) and Root Mean Square Error (RMSE) methods are used.

***Keywords***—Image processing, Image preprocessing techniques, PSNR, RMSE

## I. INTRODUCTION

In agriculture applications, image processing is having its significant importance. Moreover, one of the growing fields of image processing is floricultural image processing. There are various kinds of flower species available in the world. Each of them has its own characteristics and importance [1]. However, societies who know these flowers are not experts. Therefore, it is very hard for them to recall and differentiate the different flowers. Even an expert who has habituated himself with flowers for a long time sometimes cannot identify the flower correctly [2]. While applying image processing techniques on flower images, the first application is to identify the flower and to classify them an inappropriate way [3]. This classification can be done to identify the individual flower as well as flower category [4] [5]. The common approaches for flower detection comprise with various steps includes preprocessing, segmentation, feature extraction, and classification. Meanwhile, the outcome of each and every phase is the input of next phase, all phases have an essential role [6] [7].

Preprocessing is the essential phase for flower identification and classification. In this paper is divided into three section, section II is about the literature survey, section III is information of image preprocessing and their two phases: image enhancement and image restoration. Each phase includes different techniques elaborated in this paper. And section IV, a proportional analysis is available on various filters applied on flower images.

## II. RELATED WORK

This section covers different image pre-processing techniques used and discussed by various researchers and authors in their papers. KIM (1997) [8] has discussed that the intensity of scene can be altered following the histogram equalization. The essence of the proposed algorithm is to conserve the mean intensity of an image while the contrast is enhanced.

An image enhancement algorithm under non-uniform lighting conditions for digital images is proposed by Saibabu et al. (2006) [9]. The proposed algorithm constitutes three problems, adaptive intensity enhancement, contrast improvement and color restoration. Cheng et al. (2012) [10] has worked upon detection of over- enhancement. The over enhanced areas located accurately and effectively as per

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Survey Paper Vol.-6, Issue-6, June 2018 E-ISSN: 2347-2693

# Deep Leaning Architectures and its Applications: A Survey

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Accepted: 11/Jun/2018, Published: 30/Jun/2018

***Abstract***— In the field of Artificial Intelligence (AI), Deep Learning is a method falls in the wider family of Machine Learning algorithms that works on the principle of learning. Deep learning models basically works without human intervention and they are equivalent, and sometimes even, superior than humans. With the rise of emerging technology, deep learning draws an attention by many researchers and it is widely used in several areas including image, sound and text analysis. The paper discussed deep learning background, types of deep learning architectures and applications from different domains where researchers used deep learning models successfully.

***Keywords***—Deep Learning, Convolutional Neural Network, Deep Belief Network, Recurrent Neural Network

## I. INTRODUCTION

In the field of Artificial Intelligence (AI), Deep Learning is a method falls in the wider family of Machine Learning algorithms that works on the principle of learning. For learning, Supervised and Unsupervised, both of forms may use. In deep learning, a computerized model will perform specific set of classification or pattern analysis tasks based on previously learned data. For that, a model must be trained first with set of labeled data. Deep learning basically used to classify images, text or sounds. Deep learning models works without human intervention and they are equivalent, and sometimes even, superior than humans. Deep learning models are realized mostly through deep neural networks. It has been applied to several arenas that includes bioinformatics, image processing, Industrial automation, natural language processing, text and sound recognition and many more.

Artificial Intelligence consists a set of techniques that applied to develop computerized models that makes machines to act like human expert. Machine learning, a part of Artificial Intelligence paradigm, consists techniques that makes machines to learn by themselves based on experience. It makes enable machines improvised automatically over time. Deep learning is a part of machine learning and contains algorithms that makes machine "to learn" based on experience to perform the assigned task, mostly text, sound and image recognition. For that, it mainly uses an architecture of artificial neural network with higher number of hidden layers, called deep neural networks. In this paper, section II explained the deep learning background. Section III represented three well-known deep learning architectures with its applications from different domains and section IV discussed the conclusion.

## II. BACKGROUND

The foundation of the concept of deep learning was based on artificial neural network research. The general example of the models work with deep architecture is a well-known feed-forward neural networks or multilayer perceptron that consists many hidden layers. In the arena of 1980, another algorithm for learning the weights of these networks is Back-propagation [1]. An artificial neural network constructs by consisting three layers of neurons: Input Layer, Output Layer and one or more Hidden Layers resides between Input and Output Layer. In Artificial Neural Network (ANN), a mathematical function is used to represent a neuron, an essential element of ANN. Neurons resides in each layer receives one or more values as an input, which are output of previous layers, except Input layer. A weight is usually assigns to each input and to calculate sum of these values, an activation function is used. In deep learning, a deep neural network is used that has more number of hidden layers and that makes a neural network "deep". These multiple layers are used for feature extraction and each layer uses output value of previous layer as an Input value.

Deep learning was basically introduced in 1980s but it gains tremendous popularity since 2006. As deep learning models require large number of hidden layers and huge amount of labeled training data, sustainable computational power is required. In last few years, machines with high performance GPUs are available in market. Also, cloud computing and parallel architectures gains huge popularity. Such high

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# A Comprehensive Study of Deep Learning Architectures, Applications and Tools

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***Abstract***— The Deep learning architectures fall into the widespread family of machine learning algorithms that are based on the model of artificial neural network. Rapid advancements in the technological field during the last decade have provided many new possibilities to collect and maintain large amount of data. Deep Learning is considered as prominent field to process, analyze and generate patterns from such large amount of data that used in various domains including medical diagnosis, precision agriculture, education, market analysis, natural language processing, recommendation systems and several others. Without any human intervention, deep learning models are capable to produce appropriate results, which are equivalent, sometime even more superior even than human. This paper discusses the background of deep learning and its architectures, deep learning applications developed or proposed by various researchers pertaining to different domains and various deep learning tools.

***Keywords***— deep learning, architectures, applications, tools

## I. INTRODUCTION

Deep Learning is considered as the subset of machine learning which is intern subset of Artificial Intelligence, a prominent field of computer science over the past decade. Artificial Intelligence makes machines to think intelligently without minimal human intervention. Machine learning comprises with various algorithms that are capable to model high level abstractions from input data. Deep Learning provides a more adaptive way using deep neural network that learns feature itself from the given input data and make machine capable for taking decision. Unlike task specific algorithms of machine learning, deep learning is a method based on learning data representations. Learning can be supervised, semi-supervised or unsupervised. Deep learning provides set of algorithms and approaches that learns features and tasks directly from data. Data can be of any type, structured or unstructured, including images, text or sound. Deep learning is often referred as end-to-end learning because it learns directly from data. Moreover, Deep learning techniques works without human mediation and sometime capable of producing more accurate result than human being itself. Nowadays, deep learning is widely used in the areas like computer vision, natural language processing, pattern recognition, object detection. Representative learning methods of deep learning provides multiple level of representation, generated by linking simple but non-linear modules that transmute the representation at one level into a representation at next higher layer, slightly in more abstract way.

## II. DEEP LEARNING: OVERVIEW AND BACKGROUND

Machine Learning provides the vast collection of algorithms including singular algorithms, together with statistical approach like Bayesian networks, function approximation such as linear and logistic regression, or decision trees. These algorithms are indeed powerful, but there are few limitations of these algorithms when to learn for enormously complex data representations. Deep learning is emerged from cognitive and information theories and human neurons learning process along with strong interconnection structure between neurons is looking for to imitate. One of the key feature of computing neurons and the neural network model is, it can be able to apply generic neurons to any type of data and learn comprehensively [1]. Deep learning is considered as a promising avenue of research as it is capable of automatically identifying the complex features at a high level of abstraction. It is about learning multilevel representation and abstraction, which is useful for the data, such image, text and sound. One of the exceptional Deep learning characteristics is its capability of using unlabeled data during the training process [2].

According to the definition of Deep learning, it is considered as the application of multi-layer neural network with multiple neurons at each layer to perform the desired tasks like classification, regression, clustering and others. Fundamentally, each neuron with activation function is considered as the single logistic node, which connected to the

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# Current Trends and Future Implementation Possibilities of the Merkel Tree

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***Abstract***— A current popular trend of wallet security research is cryptography. For that Merkle tree is one of the solutions to enhance wallet security. It is basically used for cryptocurrencies, file system authentication, backup system, control system, database, etc. but it can be used for communication authentication and many more. And that is highlighted in this paper by stating the few future Merkle tree implementation possibility with its basic technical requirements. In this survey study also discuss about the Merkle tree concept with its advantages and disadvantages and its implementations such as Bitcoin, Ethereum, Hash-based Cryptography, Apache Cassandra, Btrfs, ZES, IPFS with their comparisons.

***Keywords***— Merkle Tree, Bitcoin, Ethereum, Hash-based Cryptography, Apache Cassandra, Btrfs, ZES, IPFS

## I. INTRODUCTION

Considering the fact that now a day everyone needs their data secure on devices, application, network and databases. So the current trends of research are wallet security enhancement. To enhance the security in current time one of the solutions is Merkle tree. Merkle tree is data structure used for cryptocurrency with hashing algorithm. Its popular implementation is Bitcoin. This article study contains the basic concepts of Merkle tree, Merkle tree node, its advantages and disadvantages with its current popular implementation's basic information and functionality based comparisons. Also identify the basic technical parameters for future Merkle tree implementation and suggest the combination of GUI, Sensor detection and NFC based innovative system of merkle tree implementations in wireless environment.

This paper organized as follows, Section II contains the Merkle tree concept which explain using an example and its advantages and disadvantages, Section III contains the Merkle tree implementations like Bitcoin, Ethereum, Hash-based Cryptography, Apache Cassandra, File Systems, Section IV contains the comparison of merkle implementations based on its functionality for identifying the future applications, section V explain future Merkle tree implementation possibilities, Section VI describes technical requirements for Merkle tree implementations, and Section VII contains conclusion with future directions of this paper.

## II. MERKEL TREE

In computer science applications and cryptography, a tree *data structure used for cryptocurrencies is a "Merkle tree"*. It is also called *"Binary Hash tree"*. Binary hash tree has given named Merkle tree by Ralph Merkle in 1987 paper titled "A Digital Signature Based on a Conventional Encryption Function." This concept is patented by Ralph Merkle in 1979 and proposed the cryptographic hashing. [17, 18] Merkle tree has hashing paired data as tree leaves or node, then pairing and hashing the results until the single hash remains as the Merkle root. Merkle root is the root node of the Merkle tree with a successor of all the nodes in the tree. In a Merkle tree context, record may refer the word "transaction". In a Merkle tree transaction is a packet of data whose hash communicates to a leaf node. All the permanent transaction data records in files that represents as the Merkle tree leaves is called blocks. The constant transactions are the tree leaves from a single block access by Merkle root. In Merkle tree each leaf node has the block data hash and each non-leaf node has its child nodes cryptographic hash. Merkle tree manages the complete account ledger of each user's transactions. See the example of Merkle Tree in Fig. 1

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ORIGINAL RESEARCH

# Identification of essential parameters for post graduate students' job placement in computer applications in India

**Chirag Patel**[1]

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**Abstract** India is considered as the youngest country in the world as it is having the highest numbers of young people in the age range of 20–40 years. It is very important for a young student to get the job after finishing the study. After the announcement of Digital India, the Post Graduate (PG) students in computer applications have enormous opportunities in getting job placement in this domain. To get absorbed in these companies easily, a student must acquire certain essential attributes. In this research, we have collected data of students of computer applications discipline who have completed their PG course and those who are doing the study in the final semester of PG course. These data contain the various details such as whether the student is placed or not, salary package of the placed student, apart from a PG degree any additional certificate obtained by that student and many other related parameters. A survey through Google form is also conducted to extract the fundamental knowledge of the placed and the un-placed students. So these data are processed and essential parameters for the job placement of a PG student are extracted and unwanted parameters are filtered. In the paper all the possible parameters or attributes to get the job are discussed and essential parameters are selected based on the processed data.

**Keywords** Job placement · CGPA · Under graduation (UG) · Post graduation (PG) · Computer applications

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## 1 Introduction

In the knowledge driven world, utilization of knowledge to monetize it through getting job in good company is indispensable. In India numbers of software companies necessitate huge numbers of fresh graduates. Many companies conduct their campus placement process at various institutes across India. The companies are of different types such as small scale, large scale, medium scale as well as MNC or having the CMM level etc. It is a challenging task for the students of the concern institute to easily get jobs in these companies. It is interesting to note that student placement it not a straightforward process as it seems. Sometimes the student with good academic performance might not be able to get the job at the first attempt and student with average performance is able to get the job effortlessly. There various parameters which are directly related to their performance in the campus placement. In this paper our focus is to identify these important parameters for the post graduate (PG) Students of various departments such as Masters in Computer Applications (M.C.A) and Masters of Science in Information Technology (M.Sc. IT) of our institute. The parameters such as a percentage or Cumulative Grade Percentage Average (CGPA), Graduating University, core subject knowledge, student's individual key skills and other parameters are really affecting parameters for getting the job in the company immediately after completing the post-graduation course. The further details regarding these parameters are provided in Sect. 3. Several authors have attempted to predict student academic performance [1, 2]. Their focus is to predict student academic performance only while our focus to identify the important parameters of student placement prediction. Throughout this literature parameters and attributes are used interchangeably.

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ORIGINAL ARTICLE

# Rainfall and financial forecasting using fuzzy time series and neural networks based model

Pritpal Singh[1]

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**Abstract** In this study, the author presents a new model to deal with four major issues of fuzzy time series (FTS) forecasting, viz., determination of effective lengths of intervals (i.e., intervals which are used to fuzzify the numerical values), repeated fuzzy sets, trend associated with fuzzy sets, and defuzzification operation. To resolve the problem of determination of length of intervals, this study suggests the application of an artificial neural network (ANN) based algorithm. After generating the intervals, the historical time series data set is fuzzified based on FTS theory. In part of existing FTS models introduced in the literature, each fuzzy set is given equal importance, which is not effective to solve real time problems. Therefore, in this model, it is recommended to assign weights on the fuzzy sets based on their frequency of occurrences. In the FTS modeling approach, fuzzified time series values are further used to establish the fuzzy logical relations (FLRs). To determine the trends associated with the fuzzy sets in the corresponding FLR, this article also introduces three trend-based conditions. To deal repeated fuzzy sets and trend associated with them, this study proposes a new defuzzification technique. The proposed model is verified and validated with real-world time series data sets. Empirical analyzes signify that the proposed model has the robustness to deal one-factor time series data sets very efficiently than existing FTS models. Experimental results show that the proposed model also outperforms over the conventional statistical models.

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**Keywords** Fuzzy time series (FTS) · Artificial neural network (ANN) · Fuzzification · Indian summer monsoon rainfall (ISMR)

## 1 Introduction

Fuzzy time series (FTS) is a modeling approach, in which historical values of time series are used to forecast the future values by employing fuzzy set concept. Forecasting using FTS is applied to several areas, including forecasting university enrollments [3], sales, road accidents and financial forecasting [7, 8, 12, 53]. In a conventional time series, the recorded values of a special dynamic process are represented by crisp numerical values. However, in a FTS model, the recorded values of a special dynamic process are represented by linguistic values. Based on FTS concept, first forecasting model was introduced by [52]. They presented the FTS model by means of fuzzy relational equations involving max-min composition operation and applied the model to forecast the enrollments in the University of Alabama. In 1996, Chen [9] used simplified arithmetic operations, avoiding the complicated max-min operations and their method produced better results. Later, many studies provided some improvements to the existing methods in terms of effective lengths of intervals [46], fuzzification [13], fuzzy logical relationships [1] and defuzzification techniques [45, 47]. Detail description of the FTS modeling approach can be found in these articles [6, 33, 43, 44, 50, 57].

The literature review reveals that ANN and fuzzy logic theory have great capability in solving many real life problems, especially when it comes to the process of complex decision making [2, 20, 32, 58, 59]. So, it is beneficial to hybridize ANN and fuzzy set techniques

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ACCEPTED MANUSCRIPT

# Indian summer monsoon rainfall (ISMR) forecasting using time series data: A fuzzy-entropy-neuro based expert system

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Abstract

This study presents a model to forecast the Indian summer monsoon rainfall (ISMR) (June–September) based on monthly and seasonal time scales. The ISMR time series data sets are classified into two parts for modeling purposes, viz., (1) training data set (1871–1960), and (2) testing data set (1961–2014). Statistical analyzes reflect the dynamic nature of the ISMR, which couldn't be predicted efficiently by statistical and mathematical based models. Therefore, this study suggests the usage of three techniques, viz., fuzzy set, entropy and artificial neural network (ANN). Based on these techniques, a novel ISMR time series forecasting model is designed to deal with the dynamic nature of the ISMR. This model is verified and validated with training and testing data sets. Various statistical analyzes and comparison studies demonstrate the effectiveness of the proposed model.

Keywords: Indian summer monsoon rainfall (ISMR), Fuzzy set, Entropy, Artificial neural network (ANN), Forecasting

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# Uncertainty Representation using Fuzzy-Entropy Approach: Special Application in Remotely Sensed High-Resolution Satellite Images (RSHRSIs)

Pritpal Singh & Gaurav Dhiman

**Abstract**

Remotely sensed high-resolution satellite images contain various information in context of changes. By analyzing this information very minutely, changes occurred in various atmospheric phenomena can be identified. Therefore, in this study, a novel change detection method is proposed using the fuzzy set theory. The proposed method represents the uncertain changes in the form of a fuzzy set using the corresponding degree of membership values. By using the fuzzy set operators, such as max and min functions, this study derives very useful information from the images. This study also proposes a new function to identify the boundary of uncertain changes. Further, this study is propagated to identify the similarity or dissimilarity between different images of the same event that contain various uncertain changes. To recognize the changes in a fine-grained level, this study introduces a way to represent the fuzzy information in a granular way. The utilization of the proposed method is shown by recognizing changes and retrieving information from the remotely sensed high-resolution satellite images. Various experimental results exhibit the robustness of the study.

**Index Terms**

Fuzzy sets; Change Recognition; Entropy; Probability; Granularization; Convex Set; Remotely Sensed High-Resolution Satellite Images (RSHRSIs).

## I. Introduction

In the universe, changes always take place due to the occurrence of various uncertain events in the atmosphere. The intensity of these events may be moderate or severe. For example, earthquake, cyclone, flood, etc., always make the changes in the earth's surface [1]. By simply monitoring, these changes can't be observed. Therefore, researchers use the spatio-temporal images to detect temporal effects in these uncertain events. Hence, change detection is a technique to find out any changes in the surface of the universe by analyzing remotely-sensed digital images, which are captured at different time stamps. Identifying the changes are one of the most challenging tasks in the domain of pattern recognition and



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# A quantum approach for time series data based on graph and Schrödinger equations methods

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The supremacy of quantum approach is able to solve the problems which are not practically feasible on classical machines. It suggests a significant speed up of the simulations and decreases the chance of error rates. This paper introduces a new quantum model for time series data which depends on the appropriate length of intervals. To provide effective solution of this problem, this study suggests a new graph-based quantum approach. This technique is useful in discretization and representation of logical relationships. Then, we divide these logical relations into various groups to obtain efficient results. The proposed model is verified and validated with various approaches. Experimental results signify that the proposed model is more precise than existing competing models.

*Keywords*: Time series; Quantum; Cluster; Particles.

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## 1. Introduction

Various applications of the fuzzy set theory[1] can be found in these papers.[2–10] This theory also has the capability to deal with uncertainties involved in time series events and in optimization process.[11–14] For example, sudden rise and fall of

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# A four-way decision-making system for the Indian summer monsoon rainfall

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Due to non-stationary nature of Indian summer monsoon rainfall (ISMR), analysis of its patterns and behaviors is a very tedious task. Advance prediction and behaviors play a significant role in various domains. Literature review reveals that researchers' works are limited to design predictive models but not on inherited patterns and behaviors for the ISMR. In this study, a novel method based on the hybridization of two computational techniques, viz., fuzzy and rough sets is proposed for patterns and behaviors. The proposed method initially classifies the information into the four distinct regions, as fuzzy positive region, fuzzy negative region, completely fuzzy region, and gray fuzzy region. Based on four regions, four different patterns of decision rules are explored. Further, a method is discussed to represent such decision rules in terms of graph, which helps to analyze the patterns of ISMR by discovering new knowledge. The proposed method is validated by performing various statistical analyses.

*Keywords*: Fuzzy set; rough set; time series data; Indian summer monsoon rainfall; four-way decision-making approach; drought.

## 1. Introduction

As India is an agri-based country, Indian farmers are always dependent on the summer monsoon (June–September) rainfall. Therefore, amount of summer monsoon rainfall is important factor for agricultural sector. Therefore, prior information and

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# Image Segmentation Improvement by Reversible Segment Merging

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***Abstract*—The paper focuses on image segmentation by means of approaching by piecewise-constant approximations. The objective is the improvement of the segmented image, expressed in the noticeable drop of image approximation error (total squared error). The proposed method involves segment dividing into two in some image part and merge of a pair of adjacent segments in another image part, keeping a total segment number constant. For further enhancement of the segmentation, the proposed method is used in combination with advanced *K-means* method. The steep decline of the approximation error is provided along with obvious increase of perceptual quality of image segmentation. The effect is achieved owing to binary adaptive hierarchy of nested segments, generated for each segment. The segmentation improvement method is usable for the advancement of the computer vision systems using conventional segmentation by partitioning image into connected segments.**

***Keywords—image segments, piecewise constant approximation, segmentation quality estimation, standard deviation, reversible computing***

## I. INTRODUCTION

This paper pertains to the classical methods of the cluster-analysis [1], [2] for digital image processing at the segmentation stage. Segmentation consists in original image decomposition into sub-images, which are referred to as objects, for the purpose of further automatic feature analysis and recognition. *Piecewise constant approximation* is produced by averaging the pixel intensities within the nested images. The quality of image segmentation and corresponding approximation of $N$ pixels is assessed by the standard deviation $\sigma$ of the approximation pixels from the image pixels or by the total square error $E=3N\sigma^2$, where factor 3 corresponds to the number of color components in the image. Segmentation implies all the pixels of any nested image to compound connected area or segment, whereas clustering admits object to consist of several non-adjacent segments. Image approximation with the given number of pixel clusters, in particular image segments, is considered to be optimal, if it corresponds to the lowest possible value of the total squared error $E$ or standard deviation $\sigma$. In this case, objects are defined as clusters or segments of the optimal image approximation. Contrary to conventional approaches [3], [4] in this paper all $N$ partitions are considered as outcome.

The formulated definition of the objects is suitable for the images of arbitrary content. It does not restrict the algorithms of generation of the optimal approximations and allows the unified methods of pixel clustering and segmentation to be developed and verified. The precise generation of optimal approximations either clustering the pixels or, even more so, segmenting the color or multispectral images is the challenging task. Its computational complexity grows exponentially with the rise of pixel number $N$. However, the task of simulating the optimal approximations by means of optimized ones emerges in practice of image segmentation. The latter may be generated in top-down and bottom-up segmentation algorithms of minimizing the total square error $E$ or standard deviation $\sigma$ with a sufficient speed.

## II. IMAGE PIECEWISE-CONSTANT APPROXIMATIONS

If the image is filled with the pixels that are averaged within the clusters, in particular within the segments of some image partition, then such image is referred to as piecewise-constant approximation or simply an approximation.

The total squared error $E$ for the three-component image pixels $x_i$ and the approximation pixels $y_i$ is defined as the sum of squared Euclidian distances $\|x_i - y_i\|^2$:

$$E = \sum_{i=0}^{N-1} \|x_i - y_i\|^2 \qquad (1)$$

Where the summation is carried by $i$-coordinates, RGB-components $x_i$ are integer-valued, RGB-components $y_i$ are real-valued. Wang and Blasch et al [5], [6] calculate the total squared error $E$ by formula mentioned in equation (1). The $y_i$ are considered to be pixel values of the image, obtained by distortion of the original image in a limited range of error $E$. Distorted image is not necessarily is the approximation of the original one. Moreover, Blasch [6], and Wang [5], faced the need for preliminary segmentation to adequately compare different images by means of optimization of certain quality functional.

In this way, the method considered in [5], [6] is the solution of the general problem of the image comparison. This

# Uncertain Information Classification: A Four-Way Decision Making Approach

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***Abstract*—In this study, the concept of *four-way decision space (4WDS)* is introduced. In real life, most of the information is incomplete furthermore, uncertain. From such kind of information, it is extremely dreary to take the precise levels of decision. In the proposed concept, such kind of information can easily be classified into the four distinct regions, as: *fuzzy positive region, fuzzy negative region, completely fuzzy region* and *gray fuzzy region*. These four regions comprise of four various types of uncertain information. For each particular region, decision rules can be set up from the classified uncertain information. For a better portrayal of this information, a graphical approach is proposed. This study provides a new insight into the uncertain information by classifying and visualizing them using the 4WDS concept and the proposed graphical approach.**

***Keywords*-Fuzzy set, Rough set, Three-way Decision Space (3WDS), Four-way Decision Space (4WDS).**

## I. Introduction

In the rough set theory [1], the objects available in the decision table can be characterized into three classes, as: (a) lower approximation, (b) upper approximation, and (c) boundary region. This approach of classification indicates that (a) if any object belongs to the lower approximation, then it must be *prominent* for decision; (b) if any object belongs to the upper approximation, then it must be *non-prominent* for decision; and (c) if any object belongs to the boundary region, then it must be *indecisive* for decision. In light of these characterizations, one can't state that the primary cause of a specific severe event is because of this specific attributes value. Rough set approach also can't recommend which information ought to be accepted or rejected depending on their significant of occurrence. In this way, Yao [2] recommended for trisecting the information available in the decision table into three regions, as:

- If any particular information belongs to the lower approximation, then it must be prominent for decision. This kind of information must be accepted for the final decision making. Hence, the region formed by such class of information is called *positive region*.
- If any particular information belongs to the upper approximation, then it must be non-prominent for decision. This class of information must be rejected for the final decision. Hence, the region formed by such class of information is called *negative region*.
- If any particular information belongs to the boundary region, then it can be indecisive for final decision (i.e., may or may not be). This kind of information may be either accepted or rejected.

In view of these three trisecting regions, a three-way decision space (3WDS) concept was initially proposed by Yao [2]–[4]. This approach is influenced by the classic principles of two-way decision space [5] and rough set theory [1].

In view of the 3WDS concept, different works have been proposed. For example, Liu et al. [6] presented a model for taking three-way decision from the incomplete and missing values. Using the 3WDS concept, Yu et al. [7] proposed a new tree-based incremental overlapping clustering method for the dynamically modified data sets. The 3WDS theory and the three-way decisions are also applied in email spam filtering [8], identification of complex and overlapping regions in the social community networks [9], identification of overlapping and non-overlapping regions in the complex social community networks [10], analysis of spatial as well as social graphs of friendships, decision making associated with complicated decisions in medical field [11], and the selection process of new product ideas [12]. Liang and Liu [13] studied various properties of the three-way decisions based on the interval-valued decision-theoretic rough sets. Hu [14] derived various decision evaluation functions by using hesitant fuzzy sets and interval-valued hesitant fuzzy sets on the 3WDS and three-way decisions.

In the following, we have listed the drawbacks of the 3WDS concept, as:

(a) The 3WDS is simply a portrayal of three regions of the rough set into three diverse naming conventions.
(b) As the rough set can't suggest what action should be made for the information available in the boundary region, correspondingly the 3WDS theory additionally not able to provide any particular conclusion for the similar kind of information.
(c) Yao [2] only used the partial ordered set to divide the information into positive and negative sets of information. The problem of classification of decision table into the 3WDS depends on partitioning it into three specific sets of

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# ROLE AND SIGNIFICANCE OF EMERGENT SYLLABUS IN TEACHING-LEARNING PROCESS OF ENGLISH LANGUAGE

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## ABSTRACT

*The classroom is the meeting place or interaction point between the predesigned syllabus and individual learner syllabuses. The interaction will generate the real syllabus or the syllabus in action which is jointly constructed by teachers and learners together"(Breen, 1994). In a nutshell, the actual classroom implementation of a predesigned syllabus is different as its end users (teachers, schools, students) perceive it from their respective perspectives on the basis of criteria like convenience, time constraints, difficulty level, and individual competence. Moreover, the predesigned syllabus is dependent on generally centralized teaching or prescribed course material and central examinations. In the case of this predetermined syllabus the decision regarding the content or what of learning, the why and how of learning are made by policy makers and syllabus experts. As a result, many a times, the predetermined syllabus may serve as an ideal syllabus for the students and teachers of specific location and backgrounds but not for all the locations and backgrounds. With a view to this fact, the paper discusses the role and significance of emergent syllabus and curriculum in teaching-learning of English as a Second Language (ESL).*

**KEYWORDS:** Syllabus, Curriculum, Emergent Syllabus, English as a Second Language (ESL)

## SYLLABUS AND CURRICULUM

Syllabus is a document specifying the content items/study material to be taught/learnt by the target learners. It states the selection, organization and sequencing of content to be delivered to the specific group of students. It provides information about the content, aims and objectives of the course, the required level of competence i.e. entry level behavior of the learners, outcome expected from the learners at the end of the course, the suggested methods and techniques to be adopted, the pattern of evaluation and question paper. It also states

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# Patient Flow Management through Waiting line Models in Rural based Multi-Specialty Hospital in Charotar Region, Gujarat

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**Abstract.** Service systems and Waiting lines are significant parts of the effective health care delivery. This article describes queuing situations and presents a mathematical model to analyze waiting lines pertaining to required assumptions and its relationship to patient satisfaction. The model is illustrated in the rural based multispecialty hospital for the patients with multiple-channel queuing model with Poisson Arrival and Exponential Service Times (M/M/S). This paper explains the analysis of Queuing systems for the empirical data of multi-specialty hospital in Charotar region of Gujarat, India. The research paper aims to bring out the queuing model specifically focusing on utilization and waiting length by estimating the waiting time and length of queue(s).To meet the objectives of the study, this research paper has analyzed the empirical data including the variables, such as time, when patients arrive and join the queue, checkout operating unit (server), time when the patient leave/ depart, service time received from Health Management Information System (HMIS) of the hospital. The model designed in the research is a single queue multiple-server. The model contains seven servers, attached to each server is a queue.

**Keywords:** Queuing Theory, Waiting Line Theory, Health Care Management, Multispecialty Hospital

## 1 Introduction

Waiting lines or queuing theory, is considered as one of the most extensively used quantitative and mathematical analysis techniques. Waiting lines are an everyday happening. One experiences queuing in bank, shopping malls, bill payments, reservation counters, government offices, airports, railway stations and many more to mention a but a few. Queues may also formed for machines waiting for repairing, trucks, consignments, containers lined to be loaded and unloaded, or aircrafts lined up to take off. In hospitals queuing theory is used to assess staff schedules, productivity and efficiency of staff members, waiting time of patients, counseling-time of patients. The applicability of queuing theory is to take operational and managerial decisions which may lead to patient centric better health care delivery. Decision makers make decisions to increase the satisfaction level of all the relevant groups: patients,

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# Modelling Patient Flow Using Advanced Computer Simulation System

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**Abstract**

Analysis of hospital operations and processes in particular managing patient flows is essential to develop and improve practices, methods, policies and decision tools. Patient flow management and its modelling can help the decision makers to take appropriate decisions related to hospital planning (capacity), scheduling (appointments and operations) and allocations (human resources) to provide the quality healthcare. In last few decades, the concept and modelling of patient flow has gained remarkable attention by healthcare management professionals and researchers. This research paper aims to provide a basic framework of patient flow modelling, key performance indicators. Detailed analysis and simulation of patient flow can contribute to better and efficient functioning of healthcare system. Due to lack of awareness and technical training of open source software it is hardly ever incorporated in regular healthcare operations. Simantics System Dynamics-a free and open source simulation software tool is used in this research paper.

**Key Words**

Simantics System Dynamics, Patient Flow, Health Care, Open Source Software

## INTRODUCTION

A model of flow is a set of different compartments, through which uninterrupted entities move. With special reference to healthcare applications,

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# Process Teaching: An Innovative Method to Teach Writing in English to ESL Learners

**Kaushik Trivedi**

ABSTRACT

*Having effective English Communication Skills is an indispensable skill to survive in this fast growing professional world. Academic Organizations, Employers, universities and professional bodies agree that India needs to develop professionals who are highly skilled and ready to face the challenges of increased competition. More than ever we need professionals who are confident, assertive and having strong communication skills to be responsive towards economic, social, cultural, technical and environmental change and can work flexibly and intelligently across business contexts. Considering this demand of globalization, we must venture towards advocating and applying new creative and innovation methods of developing English Communication Skills. This paper mainly focuses to inform, to motivate and to explore the Process Teaching Method in teaching-learning of writing skills in English in ESL classroom. This paper also highlights the list of class room activities through process teaching method to promote English Language among the ESL Learners*

**Key Words** : Process Teaching, ESL Learners, Communication Skills

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Indivisual learner may be better suited for learning in a specific way through varies innovative methods and approaches. The idea of learners having particular learning approach and style has always motivated facilitator to implement new strategies and activities. As each indivisual prefers different modes of teaching as per his or her needs, it is challenging for the teachers to come out with variety of teaching strategies for effective teaching-learning process to meet the needs of the learners. A student centric approach that involves the young learner in the learning process should be adopted and executed. Within the classroom, teachers should be sensitive enough to value the learning need and attitude of the learners. The classrrom environment should be such that students be comfortable in sharing his or her thoughts with classmates and teachers. Learning should be meaningful and holistic for the overall development of the students. The active involvement of the learners will be beneficial in developing the cognitive, aesthetic and social dimentions of the learners. (EECD, 2017)

Some of the innovative strategies and approaches include self-directed learning, co-operative learning, role-play, peer work, task based learning, remedial teaching. These strategies provide generate an opportunity for learners to broaden his or her horizons in the particular topic.

# Limitless V/s Limited Technology in the Teaching of English Literature to Graduate Students: Some Experiences and Observations

Mr. Robert Parmar

**ABSTRACT**

*The emergence of ICT as the core requirement in teaching-learning process from nursery to higher educationhas brought in drastic changes in teaching-learning process, roles of teachers and curriculum. ICT can be as "anything which allows us to get information, to communicate with each other, or to have an effect on the environment using electronic or digital equipment" (Siraj-Blatchford &Siraj-Blatchford, 2003).Each day, researches on effective implementation of ICT in teaching English language and Literature are carried out. Among all the efforts or (sometimes) a hustle to use ICT, however, raises a concern about sustaining students' ability to imagine independently. VernorVinge believes 'So much technology, so little talent'.*

*By using ICT we get ready-made well developed images for anything we are curious about but the uncertainty of an idea is vanished.Curiosity to know something andto experience something gets satisfied too quickly and thus, it loses its stimulus midstream. The present research paper aims at sharing practical experiment carried out in literature classroom and a serious concern raised out of it.*

**Key Words :** Technology, Imagination, Perception, Realistic,

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In an era where technology has been an inevitable part of human life, teaching fraternity has accepted and adopted widely the idea of use of ICT in teaching – learning process. Technology has drastically changed the traditional classrooms atmosphere. So many researches are carried out to make best use of ICT tools for more effective outcome based teaching – learning process. Motivating Government policies has made it possible for ICT to reach almost every class from nursery to higher education. Teachers and students are encouraged and trained for adopting

ICT tools for effective teaching – learning process. In such a time, where there is strong advocacy of using ICT for educational purpose, the idea of limiting ITC in any way may likely raise the frowns. In a hustle to use ICT, however, we may kill the students' ability to imagine independently. The renowned scientist Einstein said that Imagination is more important than knowledge as knowledge is limited to what is known and understood while imagination embraces the world and points to all there ever will be to know and understand. Technology has brought an essential change in the human lives but it is necessary to view its effect upon human imagination. This issue can be explored underlying the transaction between creativity and technology. Creativity is that which can be developed through independent imagination while technology is programmed that may kill the imagination if used inconsiderately.

I would here relate my own class room experience of teaching graduate students a few literary texts. One of them was Romeo and Juliet by William Shakespeare. The text was discussed line by line followed by fine narration of the same. Students' warm response made it possible to spring the literary taste to ecstasy level. While the discussions were on and after the classes even, students raised many questions about the characters, their actions, views etc. some of them drew nice sketches of the characters and developed beautiful images and presented in the form of paintings. After the completion of theory / discussion sessions during

# Protest Literature : An Effective Tool to Impart Values in Engineering Students

Mr. Rajanikant Vankar

ABSTRACT

*Enriching the motherland with the provision of higher studies among her sons and daughters is a duty of everyone of who are enriched before. Along with the knowledge of main stream subjects, the impartation of values which will create in them the ethical responsibility in them to right utilize the knowledge and information they have obtained. For the same the protest literature is made as the support of it. The word Protest refers to a statement or action expressing disapproval or disagreement. In the same way Protest Literature refers to the literature that expressesdisagreement or feeling of rejection of something. The literature has an objective to mould the readers and teach lesson. Further, for years, Literature has been an effective tool toteach language and impart Values as one of the objectives of Literature is to teach moral values. During the course of life we come across many incidents and situation where we have to disagree with the opinions and views of others but what matters is the way we express our protest and happen to go on wrong path. If our protest takes the form of rebellion and aggression, it would destroy everything and there will be havoc. There have been many examples of Protest Literature which has registered protest in non-aggressive manner. Values in the students' life place a crucial role. In their course of learning, if students are inspired to follow their values, it will undoubtedly make the world worth living and peace would prevail everywhere. Even if the students come across the situation where they disagree or disapprove the things, the protest should have societal approval. Hence, present paper mainly deals with enhancing the presentation skills among the Engineering students through Protest Literature.*

**Key Words** : Protest, Literature, Protest Literature, Values, Higher Education

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Following values by the learners is of utmost importance in this era. It is quite necessary that students are given this knowledge during their course of learning for the welfare of the society. There is a growing need for the cultivation of values among the students for the sustainable development and living. It may happen that after a couple of years when they are hired by any organization and he/she will be in a position to decide between profit and welfare of the society. Here, it requires the conviction of the person to decide what is good and acceptable. The protest literature here plays an important role to guide the student to be with righteous side. The knowledge of this protest literature would help the students to behave moderately and act peacefully. At every stage one may have to disagree with one or the other point but this is not a problem. The issue is the expression of that disagreement or the protest. If we trace the history, we may come to know various incidents of pretest have occurred; some have taken the form of aggression or violence. Inpresent epoch we come across various forms of protest taking place. Thepresent paper deals with studying the protest literature which has registered protest in a moderate way to impart the knowledge of values. The study of this literature is taken as a base to impart this sagacityof protest in the lives of thestudents. The present study carries the experiment with engineering students. This requires lot of effort and preciseobservation and continuous and consistent focus and guide.

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RESEARCH

# Methacrylate copolymers and their composites with nano-CdS: synthesis, characterization, thermal behavior, and antimicrobial properties

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## Abstract

Homo- and copolymers of 2-(*N*-phthalimido)ethyl methacrylate (NPEMA) and p-chlorophenyl methacrylate (PCPMA) were prepared in *N*,*N*-dimethyl formamide (DMF) solution at 70 °C using 2,2-azo-bisisobutyronitrile (AIBN) as initiator. The nano-CdS-doped polymer composite of NPEMA and PCPMA was prepared via in situ technique. The homo- and copolymers of NPEMA and PCPMA were characterized using FT-IR spectroscopy and gel permeation chromatography (GPC). The polymer nano composites were characterized using FT-IR spectroscopy, X-ray diffraction, and transmission electron microscopy. The reactivity ratios ($r_1$ and $r_2$) were obtained from the various linear graphical methods. The values of $r_1$ (NPEMA) = 0.55 and $r_2$ (PCPMA) = 1.30 were found from the same graphical methods. The copolymer microstructures were found from the mean sequence length, run number, and dyad fraction. Thermal behavior of polymers and polymer nano composites under nitrogen atmosphere was studied. The activation energies of neat polymers were varied in the range of 56–85 kJ/mol, while 28–56 kJ/mol energies were found for nano-CdS-doped polymer composites. The thermodynamic parameters of thermal degradation were also obtained. Kinetic and thermodynamic parameters were confirming the stability of the neat polymers than polymer nano composites. The polymers were assessed on different microorganisms for obtaining the antimicrobial properties. Overall, the polymers permit 10–52, 20–58, and 18–56% growth of bacteria, fungi, and yeast, respectively.

Keywords Copolymerization · Polymer nano composites · Reactivity ratio · Thermal properties · Antimicrobial properties

## Introduction

Copolymerization technique is an adaptable technique to prepare copolymers from two or more different types of monomers. These copolymers have different properties than their individual homopolymers. The acrylates or methacrylates are normally polymerized through various techniques. These techniques are free radical solution polymerization [1], bulk polymerization [2], emulsion polymerization [3], atom transfer free radical polymerization (ATRP) [4], reversible addition–fragmentation chain transfer free radical polymerization (RAFT) [5], redox polymerization [6], photo polymerization [7] living polymerization [8], etc. It is required to choose the polymerization process to obtain copolymers having desirable chemical, optical, mechanical, and electrical properties. Free radical solution polymerization is a simple, versatile, and effective technique to prepare the acrylate or methacrylate homo- and copolymers. The functionalized copolymers of acrylates were applied in various fields such as biomedical [9], textile [10], coating [11], adhesions [12], food packaging [13], and many more [14, 15]. Knowing the copolymer microstructure is useful to predict the properties of the copolymers. The microstructure of copolymers is easily predicted from the values of reactivity ratios of two monomers and the ratios of these values are possible to find from the various linear and non-linear methods [16–18].

Polymers are the most preferable host materials to prepare the inorganic nano particles (Nps)-doped composites.

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# Magnetic Nanoparticle Supported Phosphotungstic Acid: An Efficient Catalyst for the Synthesis of Xanthene Derivatives

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**Abstract.** Magnetic nanoparticle supported phosphotungstic acid ($Fe_3O_4$@$SiO_2$-HPW) was applied as a highly efficient catalyst for the synthesis of 14*H*-dibenzoxanthene derivatives *via* condensation reaction of 2-naphthol and aryl aldehydes. The catalyst was found highly efficient for the synthesis of xanthene derivatives under solvent free condition. The catalyst showed high activity and stability during the reaction and provided excellent yield of the corresponding products in short reaction time. All the synthesized compounds were characterized through FT-IR, $^1$H-NMR and $^{13}$C-NMR spectroscopic techniques. Furthermore, the catalyst is magnetically recoverable and can be reused several times without significant loss of its catalytic activity.

## INTRODUCTION

Heterogeneous catalysts gain the attention of scientific community due to their excellent reusability and easy handling compare to its homogeneous counterpart. As a result, catalysis *via* heterogeneous catalyst becomes one of the prime aspect of the green chemistry. Again, in case of heterogeneous catalysis, the nano-size catalysts have their own advantages due to higher surface area. In nano-catalysts, the catalysts having magnetic nanoparticles (MNPs) as a solid support gain popularity due to their insoluble and paramagnetic nature. The prime advantage of magnetic nanoparticle supported catalyst is their magnetic separation from reaction mixture without filtration or centrifugation. Additionally, MNPs also possess higher stability, low manufacturing cost and simple methods of preparation [1, 2].

On the other side, xanthene derivatives emerged as a moiety of great interest because of their wide range of biological and pharmaceutical properties such as anti-inflammatory [3], antiviral [4], analgesic [5] and as an agricultural bactericide [6]. They have also been used as sensitizers in photodynamic therapy [7], as leuco dyes in laser technology [8] and as a fluorescent material for the visualization of biomolecules [9]. There are many reported procedures for the synthesis of 14*H*-dibenzoxanthene derivatives, which involves the use of catalysts such as $H_2SO_4$ [10], p-toluene sulfonic acid [11], sulfamic acid [12], $I_2$ [13], boric acid [14], $NaHSO_4$ [15], cyanuric chloride [16], alum [17], silica sulfuric acid [18], Dowex-50w [19], $NH_4H_2PO_4$ [20] and $HClO_4$–$SiO_2$ [21] etc. However, many of these reported methods suffer from one or more disadvantages such as lower yield, harsh reaction condition, longer reaction time, use of toxic solvents, use of excessive catalyst and tedious catalyst recovery.

Recently, the use of Keggin-type heteropolyacid like $H_3PW_{12}O_{40}$ (HPW) in chemical reaction is in demand due to their high brønsted acidity. In this report, we investigate the catalytic efficiency of magnetic nanoparticle supported phosphotungstic acid (HPW) in the synthesis of 14*H*-dibenzoxanthene derivatives through condensation of 2-naphthol and aryl aldehydes under the solvent free condition.

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# COMPATIBILITY OF *KOCURIA FLAVA* FA10 WITH *PSEUDOMONAS PUTIDA* FOR GROWTH PROMOTION AND BIOCONTROL OF ROOT KNOT NEMATODES IN OKRA (*ABELMOSCHUS ESCULENTUS*)

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*Key words : Biocontrol, Kocuria flava, Meloidogyne incognita, Okra, PGPR, Pseudomonas putida.*

**Abstract**– In the present study the compatibility of seven commercially available PGPR with a biocontrol agent isolated in our laboratory was studied. From the compatible group of PGPR, *Pseudomonas putida* was found to be compatible with biocontrol agent *Kocuria flava* FA10. Talc powder based bio formulations were prepared for individual bacteria and mixed culture to treat seeds as well for application in soil for Okra (*Abelmoschus esculentus*). *P. putida* was found to enhance the shoot growth and *K. flava* FA10 the root growth. Number of leaves was enhanced by the combination of both of the bacteria than their individual formulations. Very few were observed in treatment comprising of *K. flava* FA10, compared *to P. putida* and control. Seed treatment was found to be more effective for plant growth promotion and biocontrol of root knot nematodes.

## INTRODUCTION

Two major aspects are considered to be limiting factors in agricultural yield, *viz* plant parasites that cause diseases in plants, and availability of nutrients. In order to achieve improved crop productivity, plants need to be provided with essential nutrients for growth and disease prevention (Santiago *et al.*, 2017). Plant-parasitic nematodes are major yield limiting factors in many crops including potato, sugar beet, soybean, tomato, brinjal, okra and others. Overall, average annual loss of the world's major crops damaged by plant parasitic nematodes was estimated to be 12.3% (Walia and Bajaj, 2003), and in India it was Rs. 242.1 billion. Annual yield losses of USD 100 million have been reported worldwide due to root knot nematodes. The estimated crop yield losses reported are 16.67%, 18.20%, 21.35%, 14.10%, 27.21% and 10.54% in brinjal, cucurbits, jute, okra, tomato and rice, respectively in India (Jain *et al.*, 2007). Although chemicals can be used for nematode control, e.g., methyl bromide, these compounds tend to be highly toxic to people and the environnent. Excessive and uncontrolled use of inorganic/ organic chemical fertilizers have hazardous effects on plant growth and development (Marimuthu *et al.*, 2013). Hence, biocontrol agents are desirable alternative to chemicals. The root-microbe interactions has been categorized as positive when mediated by PGPR-plant growth promoting rhizobacteria and negative in case of plant pathogens. Positive interactions may be enhanced by introduction of plant growth promoting rhizobacteria as well as biocontrol agent that act against the plant parasite. For enhancement of positive interactions, compatibility between the PGPR microbes and biocontrol agents to colonize the root system without inhibiting each other is a pre-requisite for accomplishment of using multiple microbes in a crop field. The approach of implying mixed cultures in soil is simply an effort to apply principles of natural ecosystems to agricultural soils, and to shift the microbiological equilibrium in favor of increased plant growth, production and protection (Higa, 1994). As of now, not much work have been done to find the compatibility between the different PGPR bacteria and with the biocontrol agents too, except for some mixed formulations involving two biocontrol agents or two biofertilizers. Direct field trials using mixed

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# Bioproduction and characterization of extracellular melanin-like pigment from industrially polluted metagenomic library equipped *Escherichia coli*

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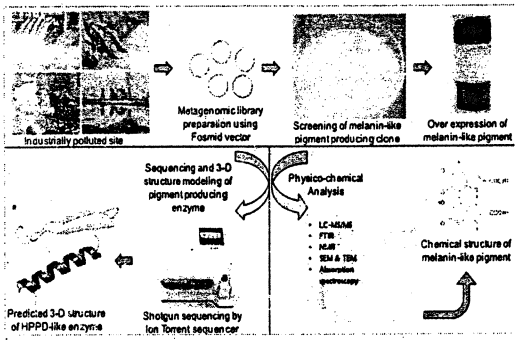
## HIGHLIGHTS

- Metagenomic library from the industrially stressed environment was constructed.
- Melanin-like pigment producing clone was sub-cloned, sequenced, over expressed.
- Pigment was purified, characterized for its physic-chemical, structural properties.
- Homology-based structure and function prediction of melanin producing enzyme HPPD.

## GRAPHICAL ABSTRACT

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## ABSTRACT

To explore the potential genes from the industrially polluted Amlakhadi canal, located in Ankleshwar, Gujarat, India, its community genome was extracted and cloned into *E. coli EPI300™-T1*$^{R}$ using a fosmid vector (pCC2 FOS™) generating a library of 3,92,000 clones with average size of 40 kb of DNA-insert. From this library, the clone DM1 producing brown colored melanin-like pigment was isolated and characterized. For over expression of the pigment, further sub-cloning of the clone DM1 was done. Sub-clone containing 10 kb of the insert was sequenced for gene identification. The amino acids sequence of a protein 4-Hydroxyphenylpyruvate dioxygenase (HPPD), which is know to be involved in melanin biosynthesis was obtained from the gene sequence. The sequence-homology based 3D structure model of HPPD was constructed and analyzed. The physico-chemical nature of pigment was further analysed using $^{1}$H and $^{13}$C NMR, LC-MS, FTIR and UV–visible spectroscopy. The pigment was readily soluble in DMSO with an absorption maximum around 290 nm. Based on the genetic and chemical characterization, the compound was confirmed as melanin-like pigment. The present results indicate that the metagenomic library from industrially polluted environment generated a microbial tool for the production of melanin-like pigment.

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# An approach for scalable production of Silver (Ag) decorated $WS_2$ nanosheets

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**Abstract.** In the Present study we report the synthesis of Ag nanoparticles (NPs) decorated $WS_2$ nanosheets by sonochemical exfoliation followed by simple chemical reduction process at room temperature. The morphology and microstructure of the as-synthesized Ag-$WS_2$ nanocomposite were characterized by X-ray diffraction (XRD), transmission electron microscopy (TEM) and optical absorption (UV-Vis.) spectroscopy. X-ray and TEM analysis shows the presence of Ag with significant peak over 38.08°, 44.22°, 64.37° and 77.33° at 2θ angle for (111), (200), (220) and (311) respectively. The Ag nanoparticles are randomly distributed throughout the surface of the $WS_2$ nanosheets without undergoing further oxidation during the formation of composites. The formation of Ag-$WS_2$ nanocomposites shows a clear blue shift in the absorption as we obtained the characteristics absorption valleys at 456, 536 and 631 nm from the UV Vis spectroscopy analysis compared to pure $WS_2$ nanosheets. Henceforth a facile method for the Ag decoration on $WS_2$ nanosheets was put forward and briefly discussed. The proposed synthesis method is very promising for the low cost and large-scale synthesis of other noble metal incorporation TMDC compounds.

## INTRODUCTION

The emerging classes of layered semiconductors (i.e. $MoS_2$, $WS_2$, GaSe, GaTe and so on) are getting mature in many terms in recent years. From last decade, many researchers have justified tremendous potential in two dimensional (2D) few to monolayer transition metal dichalcogenides (TMDCs) working with its unique properties. The use of 2D materials been widely utilized for diverse applications such as catalysis, supercapacitors, energy storage devices, and high-performance sensors. The other explored and promising application is in the field of electronic devices[1-3]. Many efforts are going on the synthesis, characterization and applications of single- and few-layered 2D materials to unveil their electronic, magnetic, optical and mechanical properties as well as applications semiconductor devices. In TMDCs, M (transition metal) layer sandwiched between two X (chalcogen) atomic layers. Thus the TMDC materials have layered structure and weak interlayer van der Waals force holding these layers together. All the major type of 2D material has layered van der Waals structure which has strong in-plane covalent or ionic bond and weak interlayer van der Waals bonding. This weak out-of-plane bonding allows the extraction of few- to mono-layers of 2D materials from their bulk counterpart through mechanical or liquid exfoliation [4]. Layered tungsten disulfide ($WS_2$), a newly emerging 2D semiconductor, has attracted much attention due to its many unusual properties, which make it has broad applications in the field such as energy devices, spintronics, optoelectronics and electrochemical applications [5-7]. The layered nature of the $WS_2$ generally exists in expanded two-dimensional sheet-like structure. This sheet like structure renders highly-exposed surface area for it and also gives an opportunity to exploit as a matrix in supporting other inorganic nanoparticles (NPs) to form new class of nanocomposites. The addition of noble metal (such as Au, Ag, Pt and Pd) nanoparticles will always improve the electron mobility and increase the specific surface area of the nanocomposites, enhanced electrochemical properties of nanocomposites is expected. Thus modifying 2D $WS_2$ like TMDC nanosheets with 0D noble metal nanocrystals to form 0D–2D functional hybrids not only enhance the intrinsic properties of the materials, but also bring novel properties and functions. This in turn converts it to use

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# Ferrofluid Lubrication of a Double Layer Porous Rough Slider Bearing

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**Abstract:** A study on the performance of a ferrofluid based double layer porous rough slider bearing is presented. The stochastic model of Christensen and Tonder has been used to evaluate the effect of surface roughness. The expressions for pressure distribution, load carrying capacity, friction coefficient, centre of pressure and temperature rise are obtained. The effect of double layer increases the load carrying capacity and decreases the coefficient of friction. It is appealing to see that the positive effect of double layered gets enhanced by the magnetic fluid lubrication. The negatively skewed roughness further augments this performance. However, for lower values of magnetization parameter the effect of temperature rise is not that significant. The centre of pressure shifts towards the outlet edge for lower to moderate values of magnetization.

**Keywords:** Slider bearing; roughness; magnetic fluid; double layered porous.

## 1. Introduction

Amongst the hydrodynamic bearings, slider bearing is the simplest and frequently encountered because the expression of film thickness is simple and boundary conditions to be required zero at the bearing ends are not that complicated. The fundamental aspect in a hydrodynamic slider bearing is the formation of a converging wedge of the lubricant. The hydrodynamic slider may be constructed to provide this converging wedge in a number of ways. Major applications of slider bearing include factory automation, machine tools, semiconductor, printing, automotive assembly and aerospace. Prakash and Vij [1] analyzed a plane slider where in one of the surface was having a porous facing.

The effect of porosity decreases the load carrying capacity but the load carrying capacity of the bearing can be augmented by reducing the seepage into the wall of the bearing. This can be obtained by lowering the permeability. Unfortunately, this is impractical as reduction in the permeability results in the reduction of porosity and hence reduction of the fluid contained within the bearing material. A double layer porous facing may be useful because it may not only increase the load carrying capacity, but also help to bring the fluid between the surfaces, thereby, improving the performance of the bearing system when it is not completely saturated with the fluid. Bujurke *et al.* [2] theoretically studied the performance of a porous slider bearing in the presence of a couple stress fluid. The couple stress effect yielded an increase in load carrying capacity but ensured the decrease in the coefficient of friction. Malvano and Vatta [3] dealt with the problem of determining the influence of pressure at the bearing entry on load carrying capacity of a plane slider bearing. It

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# Investigation of structural, electrical and optical properties of $Sb_xW_{1-x}Se_2$ single crystals

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ABSTRACT

This article presents systematic studies of $Sb_xW_{1-x}Se_2$ (X = 0, 0.1) single crystals grown by direct vapour transport technique. The purity and stoichiometry were tested by energy dispersive analysis of X-ray (EDAX). To explore lattice structure of grown compounds, powder X-ray diffraction was performed. A surface morphology of $Sb_{0.1}W_{0.9}Se_2$ crystals was checked by optical microscope and scanning electron microscope. The transmission electron microscopy was also used to verify the crystallinity of grown samples. The variations of electrical resistivity parallel and perpendicular to c-axis were measured in the temperature range from 303 to 673 K. The results showed semiconducting behaviour and anisotropic charge conduction of grown single crystals. The n-type semiconducting nature was confirmed by Hall-effect measurements. The optical band gap was determined by UV–Visible-NIR spectroscopy. The Raman spectrum was also taken from grown $Sb_xW_{1-x}Se_2$ (X = 0, 0.1) single crystals using excitation of 785 nm. The obtained results suggest the substitutional doping of $Sb^{+5}$ on $W^{+4}$ lattice site.

## 1. Introduction

Recently, two dimensional transition metal dichalcogenides (2D-TMDC) have shown great potential for applications in the field of electronics, optoelectronics and spintronics [1–5]. The 2D-TMDCs have high on/off ratio and band gap emission which make them more suitable for field effect transistors (FETs) [6]. These compounds with generalized formula $MX_2$ have hexagonal lattice structure with metal plane is sandwiched between two chalcogen atom planes [6–9]. TMDCs hold great promise for various intended applications due to their tuneable band gap. This can be achieved by different elemental compositions and presence of dopant or impurity [10–14]. The doping or intercalation is the key material parameter to modify physical and chemical properties of TMDCs. The properties such as carrier concentration, electrical conductivity, mobility of charge carriers, etc. can be significantly altered by this way [11,13,15–19]. Further, substitutional doping by Nb can alter the n-type conduction of material into p-type [13]. Besides this, TMDCs also show application as electro-catalyst in hydrogen evolution and doping improves the reactivity of host materials [19]. However, concentration of dopant is most critical parameter and at high doping level there may be possibility of fall in quality of material. As per literature survey, research has been carried out on doped materials with different concentration of dopant elements and researchers have found drawbacks of doping process [20]. The growth, structural characterizations and various excitonic mechanisms in vanadium doped $WSe_2$ single crystals have also been demonstrated [14]. In present article, efforts have been applied to grow single crystals of Sb doped $WSe_2$ which is completely unexplored. The Sb was added to tune electrical and optical properties of $WSe_2$. The grown single crystals were characterized by different sophisticated techniques and discussed in detail.

## 2. Materials and methods for crystal growth

The $Sb_xW_{1-x}Se_2$ (X = 0, 0.1) single crystals were grown by direct vapour transport technique in dual zone horizontal furnace. For growth, antimony (Sb), tungsten (W) and selenium (Se) (99.99%, Alfa Aesar) were weighed in stoichiometric proportion and the mixture was loaded in quartz ampoule. This ampoule was slowly evacuated to around $10^{-6}$ Torr pressure and sealed off. The ampoule was then placed in high temperature furnace controlled by temperature controller with an accuracy of ± 1 K. The source material was kept at one

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# Sensing Properties of Pristine Boron Nitride Nanostructures towards Alkaloids: A First Principles Dispersion corrected Study

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## Abstract

To understand the underlying physics behind the interaction of biomolecules with the nanomaterials to use them practically as bio-nanomaterials is very crucial. A first principles calculation under the frame work of density functional theory is executed to investigate the electronic structures and binding properties of alkaloids (Caffeine and Nicotine) over single walled boron nitride nanotube (BNNT) and boron nitride nanoribbon (BNNR) to determine their suitability towards filtration or sensing of these molecules. We have also used GGA-PBE scheme with the inclusion of Van der Waals interaction based on DFT-D2. . Increase in the accuracy by incorporating the dispersion correction in the calculation is observed for the long range Van der Waals interaction. Binding energy range of BNNT and BNNR with both alkaloids have been found to be - 0.35 to - 0.76 eV and -0.45 to -0.91 eV respectively which together with the binding distance shows physisorption binding of these molecules to the both nanostructures. The transfer of charge between the BN nanostructures and the adsorbed molecule has also been analysed by using Lowdin charge analysis. The sensitivity of both nanostructures BNNT and BNNR towards both alkaloids is observed through electronic structure calculations, density of states and quantum conductance. The binding of both alkaloids with BNNR is stronger. The analysis of the calculated properties suggests absence of covalent interaction between the considered species (BNNT/BNNR) and alkaloids. The study may be useful in designing the boron nitride nanostructure based sensing device for alkaloids.

**Keywords:** Boron Nitride Nanostructure, Alkaloids, Electronic Properties, Binding energy, Quantum Conductance, Sensors.

## 1. Introduction

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# The First Principle Calculation of Structural, Electronic, Magnetic, Elastic, Thermal and Lattice Dynamical Properties of Fully Compensated Ferrimagnetic Spin-Gapless Heusler Alloy $Zr_2MnGa$

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## Abstract

The first principle calculation for geometry optimization, elastic, electronic, magnetic, thermal, transport and lattice-dynamical properties of new spin gapless full heusler compound $Zr_2MnGa$ were studied within Density Functional Theory approach (DFT). The material obeys Slater Pauling (SP) rule and exhibit spin gapless semiconducting behavior with fully compensated ferrimagnetism (FCF). To the best of our knowledge, various mechanical, thermal, transport and lattice dynamical properties like elastic constant, bulk modulus and Debye temperature are reported for the first time using density functional theory (DFT). The structure satisfies all stability criteria and is thus found stable at equilibrium value of lattice constant. $Zr_2MnGa$ crystallizes in inverse heusler structure which is stable at ground state and have zero magnetic

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ORIGINAL PAPER

# Influence of $Pb^{+2}$-Thiourea complex concentration on the structural, optical, thermal and electrical properties of PbS/PVP-PVA nanocomposite films

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**Abstract**
Deposition of nanocomposite films of lead sulphide (PbS) nanoparticles in blend (1:1) of polyvinyl pyrrolidone (PVP) and Polyvinyl alcohol (PVA) by dip-coating from a precursor aqua-methanolic solution containing of $Pb^{+2}$-TU complex (LTUC) is reported. To obtain nanocomposite films, solid precursor films are heated at about 110 °C in air for 10 mins to convert the LTUC in to PbS nanoparticles in PVP-PVA by in-situ thermolysis. PbS/PVP-PVA films with different loading of PbS was prepared by varying the concentration of LTUC in precursor solutions. The effect of LTUC on the microstructural, optical, thermal and electrical properties of the films was investigated. The X-ray diffraction of films confirms the presence of PbS nanoparticles in PVP-PVA matrix. The band gaps of PbS/PVP-PVA films varied from 1.8 to 0.8 eV as the concentration of LTUC varied from 0.0125 to 0.1 M due to formation of PbS nanoparticles. Transmission electron microscopy (TEM) shows that PbS nanoparticles are spherical with maximum diameter of 18 to 22 nm. The Fourier transformed infrared (FTIR) spectroscopy and X-Ray photoelectron spectroscopy (XPS) indicate the formation of hydrogen bond between –O–H group of PVA and –C = O group of PVP. However, PbS nanoparticles does not interact with either of the polymers. Thermogravimetric analysis (TGA) reveals that there was an improvement in thermal stability of PbS/PVP-PVA nanocomposites as compared to PVP-PVA blend. The dc conductivities of PVP-PVA and PbS/PVP-PVA(0.1 M) NC were found to be $3.2 \times 10^{-6}$ S $cm^{-1}$ and $14.2 \times 10^{-6}$ S $cm^{-1}$, respectively.

Keywords Polymer blend · Nanocomposites · PbS nanoparticles · Band gap

## Introduction

In recent years, synthesis and characterization of polymer based nanocomposites (NC) have drawn considerable attention because of their extensive applications in optical and photonic devices. For the optical and photonic devices point of view, the inorganic nanoparticles (NPs) must be incorporated in solid polymer matrix. For the available matrixes, the blend of two polymer is also suitable for preparing metal/polymer and inorganic nanocrystals/polymer NC films. The preparation of polymer blends is readily dependent on the hydrogen bonding between two polymers and their miscibility. Sometimes the blend shows pronounced effect on the optical properties, mechanical properties and thermal stability of the polymers which can't be accomplished by utilizing single polymer [1].

The incorporation of inorganic NPs or metal sulphide nano crystals into a polymer matrix permits the properties of inorganic NPs and polymers to be shared. NC containing nanostructured transition metal sulphide such as CdS, ZnS, PbS, HgS, CuS, etc. exhibit very unusual physical and chemical properties compared with their bulk. Out of the different semiconductors, PbS is unique and exceptional. Bulk PbS has a narrow direct band gap of 0.41 eV with large excitonic Bohr radius of 18 nm. Consequently PbS NC has significant size-dependent band gaps from 0.4 to 3.5 eV. Thus, the synthesis and processing of PbS/polymer NC pay much attention due to their different applications, such as, bulk heterojunction solar

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Regular Article – Theoretical Physics

# Status of quarkonia-like negative and positive parity states in a relativistic confinement scheme

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**Abstract** Properties of quarkonia-like states in the charm and bottom sector have been studied in the frame work of relativistic Dirac formalism with a linear confinement potential. We have computed the mass spectroscopy and decay properties (vector decay constant and leptonic decay width) of several quarkonia-like states. The present study is also intended to identify some of the unexplained states as mixed P-wave and mixed S–D-wave states of charmonia and bottomonia. The results indicate that the X(4140) state can be an admixture of two P states of charmonium. And the charmonium-like states X(4630) and X(4660) are the admixed state of S–D-waves. Similarly, the $X(10610)$ state recently reported by Belle II can be mixed P-states of bottomonium. In the relativistic framework we have computed the vector decay constant and the leptonic decay width for S wave charmonium and bottomonium. The leptonic decay widths for the $J^{PC} = 1^{--}$ mixed states are also predicted. Further, both the masses and the leptonic decay width are considered for the identification of the quarkonia-like states.

## 1 Introduction

In recent years remarkable experimental progress has been achieved in the investigation of charmonium-like and bottomonium-like states. The latest experimental results on heavy flavor hadrons have gained renewed interest in heavy flavor physics [1,2] to understand the properties of strongly interacting hadrons. Conditions seemed to be very different for spectra above and below the flavor threshold region. In the region above the open-charm threshold, a number of charmonium-like states (the so-called "X Y Z" states) have been discovered with unusual properties. These states might be exotic states, mesonic molecules or multi-quark states [1].

Most of these unknown states do not fit in the standard charmonium and bottomonium spectra [3,4]. All the narrow charmonium states below the open-charm threshold have been observed experimentally and their mass spectrum can be well described by potential models [5]. We have sufficient knowledge of $\eta_c(1S)$ and $\eta_c(2S)$. The BESIII/BEPCII facility in Beijing has shed more light on these spin-singlet states by collecting a new record of $\psi(3686)$ decays in electron–positron annihilations [6]. Recently, BESIII showed that the Y(4260) is split up into two resonant states: one with a mass of $4222.0 \pm 3.1 \pm 1.4$ MeV/c$^2$ and the other with a mass of $4320.0 \pm 10.4 \pm 7.0$ MeV/c$^2$ in their cross section measurement of $e^+e \to +J/\psi$ for center of mass energies from $\sqrt{s}$ = 3.77–4.60 GeV [7]. A large amount of data on charmonium and bottomonium production is available at RHIC [8–12] and at the LHC [13–19], significantly extending our understanding of quarkonium production in deconfined matter [20]. To understand all these, we have to go beyond the conventional quark or quark–anti-quark bound systems. There are various issues related to higher excited states which are still to be resolved. In this context, phenomenological models either non-relativistic quark model (NRQM) or the relativistic quark model have been developed to study the properties of heavy mesons (charmonium and bottomonium) [21–23].

In the present study we compute the masses of charmonium-like and bottomonium-like states in a relativistic frame work. The mass spectroscopy of charmonium and bottomonium states is observed experimentally with high accuracy [2]. But the masses of the S-wave charmonium states beyond 3S and the bottomonium states beyond 4S are not very well resolved. There are many other X, Y and Z states above the $c\bar{c}$ and $b\bar{b}$ threshold which also are required to be identified. For example $\psi(3770)$, $Y(4008)$, $Y(4220)$, $Y(4260)$, $Y(4330)$, $Y(4360)$, $X(4630)$, $Y(4660)$, $X(10610)$, $Y_b(10880)$ have the same $J^{PC}$ value $1^{--}$ and this justifies

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# Review on Cellulase and Xylanase Engineering for Biofuel Production

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## Abstract

*Energy security, climate change, and economic development are the driving forces behind the increasing focus on biofuel production worldwide. Lignocellulose can provide ample raw materials for biofuel production, via its hydrolysis and the fermentation of the released sugars. Currently, lignocellulases are often used to catalyze this step, which hydrolyze the β-1, 4 glycosidic linkages in lignocellulose. These enzymes offer a good starting point for enhancing the overall economics of biofuel production. To reduce cost in biofuel production, there is a need for enzymes with improved activity and broader substrate range. The rapid development of a variety of protein engineering techniques has facilitated the development of novel biocatalysts with improved properties. A range of specific properties can be enhanced in enzymes, including the catalytic activity, thermostability, and specificity, under industrial conditions.*

**Keywords:** Lignocellulose, glycoside hydrolase, enzymes, biofuels, protein engineering, site directed mutagenesis

## Introduction

Global demand for energy has grown with development of new industries, requiring constant improvement and the search for new sources of energy. The need for renewable energy generated an expectation for use of biomass as energy source. The current challenge is to unlock the glucose that nature has smartly wrapped into lignocellulosic biomass.

Lignocellulose—the most abundant component of renewable biomass produced by photosynthesis—is synthesized at an estimated rate of some 200 billion tons per year.[1] This biopolymer is composed of cellulose, hemicelluloses, and lignin. Cellulose is the most abundant polymer; in nature, it is found mainly as a structural component of plant and algal cell walls. Biomass is a primary source of food, fodder, and fiber, and as a bioenergy source provides about 10.2% (50.3 EJ/y) of the annual global total primary energy supply (TPES) from a wide variety of biomass sources.[2] More than 80% of biomass feedstocks used for energy is derived from wood and shrubs. The remaining bioenergy feedstocks come from the agricultural sector (energy crops, residues, and byproducts). An International Energy Agency report assessing available residues in 2030 concluded that 10% of global residues could yield around 5.2 EJ lignocellulosic ethanol, or roughly 4.1% of the projected transport fuel demand in 2030, and 25% of global residues converted to ethanol, diesel, or syngas could contribute 13–23.3 EJ globally.[3,4] It is well documented that cellulosic ethanol offers greater environmental benefits and sustainability.

An analysis of US Environmental Protection Agency shows that lignocellulosic ethanol generates 91% less greenhouse gases than fossil-based petrol or diesel in transport applications, compared with just 22% for corn-based ethanol.[5] However, the conversion process relies heavily on major technological innovations centered on effective and low-cost enzymes, feedstocks, and efficient process design.

Lignocellulosic biomass (plant biomass), is a great potential resource because it is inexpensive, largely abundant, and environmentally sound to produce. Agricultural resources (like leaves, stems, and stalks from corn fiber; sugarcane bagasse; rice hulls; woody crops; and forest residues) are a great source of lignocellulosic biomass—which is renewable, chiefly unexploited, and inexpensive. Also, there are multiple sources of lignocellulosic waste from industrial and agricultural processes, e.g., citrus peel waste, sawdust, paper pulp, industrial waste, municipal solid waste, and paper mill sludge. Approximately 70% of plant biomass is locked up in 5- and 6-carbon sugars. In naturally occurring cellulose, the degree of crystallinity varies between 40% and 90% and the rest of the cellulose is said to be "amorphous." This amorphous cellulose is a very tough substrate that often occurs embedded and entangled with hemicelluloses and lignin—forcing cellulose-degrading organisms to develop more or less typical sets of enzymes, including both endoglucanases and cellobiohydrolases.

The efficiency of cellobiohydrolases, in particular, is enhanced by their strongly progressive action, where a substrate-binding tunnel enhances the probability for the enzyme to remain bound after a catalytic cycle. Cellulose is primarily crystalline in nature. Cellulose chains in the crystals are stiffened by inter- and intra-chain hydrogen bonds, and the adjacent sheets that overlie one another are held together by weak Van-der Waals forces. During biosynthesis, 50–100 cellulose molecules associate to form an elementary fibril with a diameter of 4 nm. About 20 such elementary fibrils form a microfibril, which is readily visible with an electron microscope. Another major

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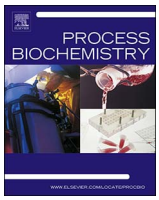

# Effects of mutations of non-catalytic aromatic residues on substrate specificity of *Bacillus licheniformis* endocellulase *cel12A*

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ABSTRACT

*Cel12A*, a gene that encodes an endocellulase of *Bacillus licheniformis*, was cloned and overexpressed in *E. coli* DE3. The rBLCel (wild-type recombinant cellulase) enzyme was assayed and characterized for its physical properties, including its optimum pH (9.0), temperature (50 °C), thermostability (175 h) and kinetic parameters ($K_m$16.38 ± 0.550 mg ml$^{-1}$; $k_{cat}$ 134.91 ± 0.377 min$^{-1}$ and $k_{cat}/K_m$8.23 ± 0.026 ml min$^{-1}$ mg$^{-1}$). To determine the role of conserved amino acids in the substrate binding pocket, five single mutations and one double mutation were studied for their effects on substrate specificity. All six purified engineered enzymes were assayed and compared to rBLCel regarding their catalytic activity with a specific substrate (CMC). All of the recombinant enzymes (wild type and engineered) were also assayed with non-specific substrates, such as xylan, avicel and filter paper (FP). Out of five point-mutant enzymes, three mutants (W197A, W98A and Y89A) showed reduced specific activity compared to rBLCel. However, the W139A and W53A mutants exhibited a 67% and 4% relative increase in their specific activity with a specific substrate (CMC), respectively. After replacing aromatic residues, the affinity towards the CMC increased in the case of the W139A and W53A mutants, indicating that the aromatic residues play a key role in substrate affinity and binding. One of the significant results that we obtained was that the increase in activity was additive in the double mutant enzyme, W139A_W53A, which showed 1216% higher activity than rBLCel on filter paper (FP). The activity of all of the mutated enzymes with non-specific substrates indicates that the substrate binding pocket is altered and has become flexible toward other substrates after mutation. Moreover, given the importance of the two enzymes in degrading lignocellulose, one bifunctional enzyme endowed with the two catalytic activities may be of great advantage. Despite the broad spectrum of cellulases being isolated, no single enzyme is completely suitable as it is, for the hydrolysis of lignocellulose. These enzymes have been used due to their biotechnological applications in several industries, including bio pulping wood, treatment of animal feed to increase digestibility, agro-processing, juice processing and baking.

## 1. Introduction

Global demand for energy has grown with the development of new industries. This demand has necessitated constant improvement and a ceaseless search for new sources. Lignocellulosic waste is a potential source of renewable energy. Complete hydrolysis of lignocellulose requires many lignocellulase enzymes. These hydrolytic enzymes have similar mechanisms of action that catalyze cleavage of b-1,4 glycosidic bonds in biomass polymers [1]. Though many of these enzymes are bifunctional in nature [2], the efficiencies of hydrolysis of xylan by cellulase and cellulose by xylanase are very poor. Binding of a ligand to a specific position of an enzyme for a specific reaction mainly depends on the amino acid residues present in the enzyme binding site [3]. These residues permit a specific substrate to bind. Many multifunctional enzymes exist; these enzymes are widely distributed in nature and have multiple activities against different substrates of same group [4]. During evolution, these enzymes have become increasingly specific toward their substrate based on availability [5,6]. A closer look at the substrate-binding region of these enzymes shows that the orientation of amino acids in the binding pocket determines the substrate preference. Thus, there is a need to modify and improve enzymes to make them potent, efficient and suitable for complete hydrolysis. This could be

*Abbreviations:* rBLCel, wild-type recombinant cellulase enzyme; MTCC, Microbial Type Culture Collection; LB, Luria-Bertani; $k_{cat}$, turnover number; $K_m$, Michaelis constant; PDB, Protein Data Bank; $V_{max}$, maximum velocity; *cel12A*, endocellulase gene; CMC, Carboxymethylcellulose; FP, Filter paper; ITASSER, Iterative Threading ASSEmbly Refinement

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ORIGINAL ARTICLE

# Molecular and biochemical characterization of a thermostable keratinase from *Bacillus altitudinis* RBDV1

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**Abstract**
A thermostable keratinase designated as KBALT was purified from *Bacillus altitudinis* RBDV1 from a poultry farm in Gujarat, India. The molecular weight of the native KBALT (nKBALT) purified using ammonium sulfate and ion exchange and gel permeation chromatography with a 40% yield and 80-fold purification was estimated to be ~ 43 kDa. The gene for KBALT was successfully cloned, sequenced and expressed in *Escherichia coli*. Recombinant KBALT (rKBALT) when purified using a single step Ni–NTA His affinity chromatography achieved a yield of 38.20% and a 76.4-fold purification. Comparison of the deduced amino acid sequence of rKBALT with known proteases of *Bacillus* species and inhibitory effect of PMSF suggest that rKBALT was a subtilisin-like serine protease. Both native and rKBALT exhibited higher activity at 85 °C and pH 8.0 in the presence of $Mg^{2+}$, $Mn^{2+}$, $Zn^{2+}$, $Ba^{2+}$ and $Fe^{3+}$ metal ions. Interestingly, 70% of their activity was retained at temperatures ranging from 35 to > 95 °C. The keratinolytic activity of both nKBALT and rKBALT was enhanced in the presence of reducing agents. They exhibited broad substrate specificity towards various protein substrates. KBALT was determined for its kinetic properties by calculating its $K_m$ (0.61 mg/ml) and $V_{max}$ (1673 U/mg/min) values. These results suggest KBALT as a robust and promising contender for enzymatic processing of keratinous wastes in waste processing plants.

**Keywords** *Bacillus altitudinis* · Keratinase · Protease · Heterologous expression

## Introduction

Keratinases are proteases that are capable of degrading extremely rigid and insoluble keratinous substrates (Lin et al. 1992) into valuable products such as rare amino acids, feedstuffs, fertilizers and compounds of medical importance (Radha and Gunasekaran 2009). So far, a large number of keratinases have been isolated from fungi, bacteria, and actinomycetes (Gopinath et al. 2015). Keratinases from members of the genera *Microsporum* and *Trichophyton* (dermatophytes) (Kumar et al. 2016; Lange et al. 2016; Gradisar et al. 2005) and *Paecilomyces marquandii* and *Doratomyces microspores* which are non-dermatophytes have been studied in great detail (Gradisar et al. 2005). Another limitations in application of keratinases is in large scale production, which is usually achieved by cloning the keratinase gene in heterologous hosts (Onifade 1998; Anitha and Palanivelu 2012; Selvam and Vishnupriya 2012). In this respect, cloning and expression of several keratinases has been carried out inside potential hosts but only a few keratinases have been successfully expressed in heterologous hosts such as *Bacillus* spp. and *Pichia strains* (Felix 2002; Lin et al. 1997; Sharma and Gupta 2010). The versatility of *Escherichia coli* has made it to the list of the most preferable hosts in expression studies but, it has hardly achieved any functional expression in case of proteases (Zhang and Li 2013). Commercially, these proteases account for sixty percent of the total enzyme market sale. Therefore, identifying new microbial sources of Keratinase (EC 3.4.99) holds great promise.

In this report, we describe a keratinase from *Bacillus altitudinis* strain RBDV1 which was overexpressed in *E. coli*, purified and characterized.

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RESEARCH ARTICLE Open Access

# Effects of substrate binding site residue substitutions of *xynA* from *Bacillus amyloliquefaciens* on substrate specificity

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## Abstract

**Background:** The aromatic residues of xylanase enzyme, W187, Y124, W144, Y128 and W63 of substrate binding pocket from *Bacillus amyloliquefaciens* were investigated for their role in substrate binding by homology modelling and sequence analysis. These residues are highly conserved and play an important role in substrate binding through steric hindrance. The substitution of these residues with alanine allows the enzyme to accommodate nonspecific substrates.

**Results:** Wild type and mutated genes were cloned and overexpressed in BL21. Optimum pH and temperature of rBAxn exhibited pH 9.0 and 50 °C respectively and it was stable up to 215 h. Along with the physical properties of rBAxn, kinetic parameters ($K_m$ 19.34 ± 0.72 mg/ml; $k_{cat}$ 6449.12 ± 155.37 $min^{-1}$ and $k_{cat}/K_m$ 333.83 ± 6.78 ml $min^{-1}$ $mg^{-1}$) were also compared with engineered enzymes. Out of five mutations, W63A, Y128A and W144A lost almost 90% activity and Y124A and W187A retained almost 40–45% xylanase activity.

**Conclusions:** The site-specific single mutation, led to alteration in substrate specificity from xylan to CMC while in case of double mutant the substrate specificity was altered from xylan to CMC, FP and avicel, indicating the role of aromatic residues on substrate binding, catalytic process and overall catalytic efficiency.

**Keywords:** Xylanase, Site-directed mutagenesis, Protein engineering, Substrate specificity

## Background

Lignocellulose is the principal and most plentiful component of the renewable biomass produced by photosynthesis and is synthesized at an estimated rate of some 200 billion tons per year [1]. These biopolymers are the major stored carbon source in the nature and are composed of cellulose (40%), hemicellulose (20–30%) and lignin (20–30%) [2]. Complete hydrolysis of these biomass requires the coordinated activities of a number of enzymes [3]. Even though a large number of xylanases are being isolated, no single enzyme has been found to be completely suitable as it is for complete hydrolysis of lignocellulose. However, these enzymes offer a good starting point for enhancing the overall economics of biofuel production. To reduce cost in biofuel production, there is a need for enzymes with improved activity and broader substrate range [4].

Research work on lignin-degrading enzymes has been focused mainly on fungi; however, of late higher growth rate, alkali tolerant and thermostable properties have directed attention towards bacterial enzymes. Modification of bacterial enzymes through protein engineering plays an important role in the production of efficient hydrolytic enzymes used in a broad range of industries. For example, cellulase enzymes access the glucose polymer cellulose while xylanases act on xylose polymer xylan and both enzymes share a common mechanism of action [5]. This is the reason why many xylanases are found to be bifunctional in nature. Though they share a similar mechanism of hydrolytic action, their preferential substrate is different. The difference lies in the architecture of the substrate binding site consist of many aromatic amino acid residues and the orientation of amino acids in the binding

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16

# Absence of association between *TLR4* Thr399Ile polymorphism and cervical cancer susceptibility

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ABSTRACT

*Background:* Toll-like receptors (TLRs) play a key role in pathogen detection and initiating inflammatory response. Several lines of evidence have suggested chronic inflammation as one of the major factors linked to carcinogenesis. Single nucleotide polymorphisms (SNPs) in *TLR* genes including *TLR4* have been shown to be associated with cancer susceptibility, although reports have been conflicting.
*Aim:* The present case-control study was designed to ascertain the association of *TLR4* C1196T/ Thr399Ile polymorphism with cervical cancer risk among Indian women.
*Patients and methods:* The study comprised of tumor biopsies from 110 histopathologically diagnosed cervical cancer cases and cervical smears from 141 disease free healthy controls. DNA was obtained using standard proteinase-K digestion and phenol-chloroform extraction method. Genotyping of samples was carried out by Polymerase Chain Reaction-Restriction Fragment Length Polymorphism (PCR-RFLP) method.
*Results:* The results showed presence of single genotype CC (Thr/Thr) and complete absence of T allele across all the sample types thereby showing genotypic frequency of 1.0, 0.0 and 0.0 for CC, CT and TT respectively in the study population. Patients aged > 45 years showed association with late stages of cervical cancer.
*Conclusion:* Complete absence of T allele in our study subjects demonstrate no involvement of *TLR4* Thr399Ile polymorphism in cervical cancer susceptibility. However, an association between increased age and late clinical staging was observed. A comprehensive analysis on a larger sample size covering diverse ethnic populations of India is warranted to comprehend the role of *TLR4* Thr399Ile polymorphism.

## 1. Introduction

Cancer of uterine cervix is the second most common gender-specific cancer in India as well as world-over (Ferlay et al., 2015). Although infection of high-risk human papillomavirus (hrHPV) is considered as one of the major culprits for development and progression of cervical cancer (Schiffman et al., 2007; Walboomers et al., 1999), women do develop cervical cancer without HPV infection and women infected with HPV do not always develop cervical cancer. This suggests the vital role being played by host genetic factors that include various cytokines and immune genes such as *HLA-DRB1, HLA-DQA1, HLA-DQB1, HLA-B, HLA-C, IL-17, IL-1β, TNFα,* (Govan et al., 2006; Hardikar et al., 2015; Leo et al., 2017; Qian et al., 2010; Yang et al., 2006) and DNA repair genes such as *p53, BRCA1, DMC1, DUT, EVER1/2 and GTF2H4* (Chen et al., 2011). Among immune genes, *Toll-like receptor (TLR)* family of genes have recently gained prominence as polymorphisms in these genes have been shown to alter susceptibility towards many infections and diseases including cancer (El-Omar et al., 2008; Misch and Hawn, 2008; Schröder and Schumann, 2005). TLRs are a type of pathogen recognition receptors that form one of the essential parts of the innate immune system and play a key role in the inflammatory response (Kawai and Akira, 2010; Rock et al., 1998). Furthermore, several studies have affirmed a positive link between chronic inflammation and predisposition to cancers, and persistent inflammation due to infections has been found to be associated with 15–20% cancer mortality worldwide (Mantovani et al., 2008).

Till date ten functional *TLR* genes are known in humans, designated as *TLR1* to *TLR10*, of which, *TLR4* gene is one of the most extensively studied. TLR4 has been found to recognize bacterial endotoxin lipopolysaccharide (LPS) as well as viral proteins (Akira et al., 2006; Kurt-Jones et al., 2000; Trianta and Trianta, 2004). LPS, a structural component of gram-negative bacterial is one the most potent ligand of

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RESEARCH ARTICLE

# REVISED Absence of toll-like receptor 9 Pro99Leu polymorphism in cervical cancer [version 2; referees: 2 approved, 1 not approved]

Alex Chauhan [1], Nilesh Pandey[1], Nitin Raithatha[2], Purvi Patel[3], Ajesh Desai[4], Neeraj Jain[1]

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## Abstract

**Background:** Toll-like receptor 9 (TLR9) plays a key role in the elimination of viral pathogens by recognising their CpG DNA. Polymorphisms in the *TLR9* gene may influence their recognition and subsequent elimination. Therefore, the present study was designed to elucidate the role of a rare unexplored *TLR9* gene polymorphism C296T/ Pro99Leu (rs5743844) in cervical cancer susceptibility among Indian women.
**Methods:** The genotyping of *TLR9* Pro99Leu polymorphism in 110 cervical cancer patients and 141 healthy controls was performed by polymerase chain reaction and restriction fragment length polymorphism (PCR-RFLP).
**Results:** The genotype frequency detected in both cervical cancer and control populations was 1.0 (CC), 0.0 (CT) and 0.0 (TT); while the allele frequency was found to be 1.0 (C) and 0.0 (T).
**Conclusions:** The present study demonstrates no involvement of *TLR9* C296T/ Pro99Leu polymorphism in cervical cancer susceptibility and supports minor allele frequency (MAF) (0.0002) status of the same as no nucleotide variation was detected in any of the study subjects.

## Keywords

Cervical cancer, TLR9, Polymorphism, Genotypic frequency, Susceptibility

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REVIEW ARTICLE

# *TLR4* Polymorphisms and Expression in Solid Cancers

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**Abstract**

Toll-like receptors (TLRs) are a type of pattern-recognition receptor (PRR) that are part of the innate immune system known to recognize pathogen-associated molecular patterns and thereby play a crucial role in host immune response. Among the various known TLRs, TLR4 is one of the most extensively studied PRRs expressed by immune, certain nonimmune, and tumor cells. When TLR4 binds with the bacterial lipopolysaccharide, it induces production of proinflammatory cytokines, chemokines, and effector molecules as part of the immune response. Continuous exposure to pathogens and TLR4 signaling results in chronic inflammation that may further lead to malignant transformation. *TLR4* is a highly polymorphic gene, and genetic variations are known to influence host immune response, leading to dysregulation of signaling pathway, which may affect an individual's susceptibility to various diseases, including cancer. Furthermore, TLR4 expression in different tumor types may also serve as a marker for tumor proliferation, differentiation, metastasis, prognosis, and patient survival. This review aims to summarize various reports related to *TLR4* polymorphisms and expression patterns and their influences on different cancer types with a special focus on solid tumors.

**Key Points**

Toll-like receptor 4 (TLR4) identifies and then eliminates foreign pathogens and harmful agents through the secretion of various proinflammatory cytokines.

Studies reporting genetic variations in the *TLR4* gene and their association with different cancer types have produced conflicting results.

A number of studies have also shown associations between TLR4 expression and tumor progression, metastasis, and the overall carcinogenesis process.

Chronic inflammation is one of the key events in solid tumor progression and malignant transformation. Therefore, a cumulative analysis of the polymorphisms and expression patterns of the *TLR4* gene in different cancer types may provide further insights into its role as a potential susceptibility and prediction marker.

## 1 Introduction

Although advanced diagnostic techniques and improvements in treatment regimens have reduced cancer morbidity and mortality [1], the "war on cancer" is ongoing. To minimize

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ARTICLE

# Effect of Size and Morphology on Stability and Thermal Conductivity of ZnO Nanofluid

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ZnO nanofluids with different crystallite size (25, 17.4, 11.3 and 8.6 nm) have been prepared by chemical route using different solvent. XRD pattern confirms that the samples have hexagonal Wurtzite structure. SEM image shows that 25 nm crystallite size particles are of rod shape whereas 17.4 nm crystallite size are star shape particles. 11.3 nm size particles are almost spherical aggregates whereas 8.6 nm crystallite size particles show mixed shape of spherical as well as elongated rod shape particles. The change in morphology is due to the different reaction rate of solvents used in the reaction to produce ZnO nanoparticles. Nanofluid thus prepared in distilled water was found highly stable and the stability is confirmed using the steady state photograph as well as UV-Vis spectral. DLS measurement shows the formation of aggregation over a period of time though the nanofluid is stable. Relative intensity variation analysis also confirms the non-sphericity of particles. The thermal conductivity increases with increase in volume fraction for all samples. It is observed that the maximum 3.126 W/m-K thermal conductivity is observed for smallest sized ZnO sample (8.6 nm) at 0.5465 volume fraction. The high value of thermal conductivity can be a collective effect due to the aggregation phenomena, morphology and conduction-convection mechanism. The result promises the possibility of enhanced heat transfer characteristics of ZnO nanofluid.

**KEYWORDS:** ZnO Nanofluid, Sedimentation, XRD, UV-VIS Spectroscopy, Thermal Conductivity.

## 1. INTRODUCTION

Enhancement of heat transfer using nanofluid with high thermal conductivity has been a topic of intense interest in recent years. With the advance in research at nanoscale science and technology it has been now possible to improve the thermal conductivity of nanofluid with the substitution of several nanoparticles in base liquid. Nanoparticles can be selected either from metal (Cu, Ni, Al, etc.), oxides ($Al_2O_3$, $TiO_2$, CuO, $SiO_2$, $Fe_2O_3$, $Fe_3O_4$, $BaTiO_3$, etc.) or some other compounds (AlN, SiC, $CaCO_3$, graphene, etc.) and stably dispersed in base fluids usually include water, ethylene glycol, propylene glycol, engine oil, etc. Due to very small sizes and large specific surface area of the nanoparticles, nanofluids have superior properties like high thermal conductivity, minimal clogging in flow passages, long-term stability, and homogeneity.[1,2] The advantage of nanoparticles dispersion into the base fluid is to have the large surface to volume ratio compared to that of micron sized particles and hence it increases the heat capacity of the fluid, modify the flow pattern and resulting in intensified heat transfer.

The desired physical and chemical properties of Zinc oxide (ZnO) has received great attention and make it viable for the design of optical, electrical and magnetic devices. The major advantage is its ability as large bulk single crystal. ZnO is amenable to wet chemical etching, which is particularly important in the device design and fabrication. By doping to ZnO, the optical properties such as transmittance, optical constant, band gap and absorption coefficient can be tailored to achieve the desired characteristics for optoelectronics and spintronic applications. Few papers exist in literature to produce ZnO nanofluid[3–6] for the enhancement of the thermal conductivity and ultrasonic study.[7] The result of thermal conductivity enhancement reported by Yu et al.[6] in ZnO-ethylene glycol (EG) nanofluid is 26.5% at 5% volume fraction for 10–20 nm average particle size of ZnO[6] whereas it is 21% and 10.7% at 3% volume fraction, respectively for 30 nm and 60 nm average particle size.[4] Though the thermal conductivity enhancement is reasonably large, the effect of particle size and long term stability of the nanofluid were not examined. These parameters are very crucial for both, fundamental thermal transport measurements as well as practical heat transfer experiment. Moreover, the commercial product is

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ARTICLE

# The Effect of Magnetic Field on the Structure Formation in an Oil-Based Magnetic Fluid with Multicore Iron Oxide Nanoparticles

**Zarana Laherisheth[1], Kinnari Parekh[2], and R. V. Upadhyay[1,2,*]**

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This study focuses on synthesis and characterization of fluid consisting of lecithin coated multi-core magnetic magnetite particles. The chemical structure of lecithin is responsible for the formation of multi-core structure. The strong enhancement in an average magnetic moment of cluster compares to single core structure confirms the formation of multi-core structure with coherence orientation of magnetic moments. This is confirmed by thermo-gravimetric analysis. This enables confident conclusions about the effect of magnetic field induced structure on the flow behaviour. The variation of yield stress with dilution at a given magnetic field is explained using the microscopic theory proposed by Zubarev et al. The results indicate that on dilution, the multicore concentration decreases rather than number concentration of single core in a system.

**KEYWORDS:** Multicore, Ferrofluid, Rheology, Magneto-Viscosity, Yield Stress.

## 1. INTRODUCTION

Stable suspensions containing magnetic nano-particles in an appropriate carrier liquid are known as magnetic fluid (ferrofluid). The average particle size (diameter) in magnetic fluid is approximately 10 nm, which assures sedimentation stability and to avert a strong long-range magnetostatic attraction between individual particles, the particles are either coated with a surfactant to produce entropic repulsion, or charge the surface of the particle to produce electrostatic repulsion.[1] The choice of carrier liquid depends on particular applications in mind, whether it be technological, for example, as coolants in loudspeaker, sealing of rotating axes, etc., or biomedical applications, like magnetic hyperthermia.[2,3] In all these applications it is of utmost important that the magnetic fluids are well characterized, i.e., particle size and its distribution, magnetic and rheological characterizations. However, the presence of agglomeration of molecules must be averted.

Under the influence of magnetic field, dispersed magnetic nanoparticles form magnetic aggregates in the pattern of chain-like structures due to strong interparticle interaction. Nevertheless, the magnitude of this depends upon the coupling constant $\lambda^* = \mu_0\mu^2/4\pi D_h^3 k_B T$ and volume fraction of magnetic particles ($\varphi_m$).[4] Here, $\mu_0$ denotes vacuum permeability, $\mu$ is the particle magnetic moment, $D_h$ is the hydrodynamic diameter of particle (=magnetic core diameter ($D_m$) + twice the thickness of the surfactant layer ($t$)). $k_B$ and $T$ denote, the Boltzmann constant and temperature, respectively. The formation of reversible chains or agglomerates modifies the viscosity of magnetic fluid, which is known as magneto viscous effect (MVE).[5] In addition, it also influences magnetic, optical and other properties of magnetic fluids.[6] Experimentally, these phenomena are detected using indirect experimental methods based on magnetorelaxometry,[7] viscosity,[8–10] ultrasound attenuation,[11] small angle neutron scattering, small angle X-ray scattering.[12,13] Theoretical explanation for the observed MVE effect based on the structure formation is given by Zubarev and Iskakova.[14–16] In all above studies one uses single core particles, i.e., one particle per core. However, recently research in the field of nanoparticles for hyperthermia has shown that the core diameter and the hydrodynamic diameter of the multi-core particle (core composed of several single-domain particles) as whole determines magnetic heating performance.[17] According to this research, the increase in core size, together with the decrease in the hydrodynamic size, leads to a decrease of the number of cores per multi core system, which is responsible for the decrease in demagnetization interactions between those cores and increase in specific absorption rate. Therefore, to engineer the core and core concentration

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ARTICLE

# Effect of Particle Concentration on Lubricating Properties of Magnetic Fluid

Kinjal Trivedi[1], Anjana Kothari[2], Kinnari Parekh[2,*], and Ramesh V. Upadhyay[1,2]

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The tribological properties of two mineral oil with different viscosities (219 and 10.3 mPa · s) are compared and analyzed using four ball tester. To improve the tribological properties of low viscosity mineral oil, magnetic nanoparticles are added. The concentration of magnetic nanoparticles was optimized for a minimum friction and wear. At optimum volume percentage (0.8 vol.%) of magnetic nanoparticles in low viscosity mineral oil, anti-friction and anti-wear properties enhanced by 36% and 49%, respectively. Likewise, at optimum concentration of magnetic nanoparticles, these attributes are improved by 20% and 43% respectively, in high viscosity mineral oil. The reduction in the coefficient of friction is explained by considering the ball bearing effect of magnetic nanoparticles. The lubrication mechanism was studied using scanning electron microscope and atomic force microscope, which shows the synergistic effect of polishing and mending effect.

KEYWORDS: Lubrication Mechanism, Nanolubricant, Magnetic Fluid, Viscosity, Four Ball Method.

## 1. INTRODUCTION

The lubricating oil plays an important role in reducing wear and friction in many industrial components as well as in automobiles. The lubricating oil parameters such as acid number, base number, viscosity, pour point, flash point affects machine components. Among them, the viscosity is the most influential parameter on lubricating properties. The lubricating oil viscosity affects the churning, splashing, friction, vibration and power characteristics.[1] The churning losses increase with an increase in viscosity at low speed[2] and decrease at high speed.[3,4] Similarly, increase in viscosity increases the temperature of a system due to internal lube friction.[5] This causes higher friction and wear. To reduce the losses due to high viscosity, the low viscosity lubricating oil is selected, but it needs modification so as to satisfy other lubrication properties.

The tribological properties of low viscosity lube oil can be improved by anti-wear and anti-friction additives such as sulfur, phosphorus, zinc dialkyl dithiophosphate (ZDDP) and chlorine. But, these are very toxic to flora and fauna as well as causes pollution.[8,9] Alternatively, many researchers have used nanoparticles (magnetic or nonmagnetic) to improve the tribological properties.[10–18] These particles are non-toxic and environmentally friendly. Among various nanofluids, magnetic fluid, consist of tiny magnetic particles of few tens of nanometer size dispersed in lube oil, has an additional feature of holding it to the desired place under magnetic field.[19,20]

Wang et al.[21] have studied the tribological property of turbine oil 46 having $Mn_{0.78}Zn_{0.22}Fe_2O_4$ magnetic nanoparticle as a lubricant additive. The transmission electron microscopic (TEM) size of the magnetic nanoparticle was 20 nm and volume fraction was varied from 0.5 to 6 wt%. The tribological properties were studied using four ball tester. The results show that for an optimum concentration of 6 wt%, load carrying capacity increases by 26%, anti-wear by 25% and anti-friction by 27%, compared to the base oil. They attributed this increase to self-repair phenomenon.

Similarly, Huang et al.[22] deliberated tribological properties of $Fe_3O_4$ magnetic nanoparticle based alpha olefin hydrocarbon synthetic oil (PAO4). The TEM size of $Fe_3O_4$ was 14.2 nm. The concentration of fluid was varied from 1 to 7 wt%. They have obtained optimum concentration of 4 wt%, and at this concentration load carrying capacity enhanced by 38%, anti-friction by 31% and anti-wear by 28% compared to base lubricating oil. The observed enhancements are explained based on the argument that nanoparticles occupies the space between steel balls and eliminate the contact. Thus, the mechanism of lubrication is ascribed to rolling friction.

The influence of nanoparticle shape on tribological properties is also investigated by Gao et al.[23] They have

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# Design and Development of Large Radial Clearance Static and Dynamic Magnetic Fluid Seal

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## Abstract

A large radial clearance (0.7mm) static and dynamic magnetic fluid seal is designed and its performance is tested. The radial clearance of 0.7 mm is quite higher than the most of the commercial seals which have maximum radial clearance of 0.3 mm. Hydrostatic magnetic fluid "plug" is created in 5.94 mm glass tube and it is tested for various plug heights with respect to the pole piece height. Results show that as plug height increases the pressure holding capacity increases and then for optimum fluid height it becomes maximum. The increase in fluid magnetization also increases the pressure holding capacity of fluid plug. Using these results the dynamic seal having a large radial clearance (0.7mm) is designed and simulated using FEMM. The prototype test set-up is fabricated with multiple magnetic sources for 0.7mm radial clearance between the rotating shaft (DIA: 25 mm) and the pole piece. The seal assembly is tested for transformer oil based magnetic fluid for variable speed and the number of stages under vacuum pressure of $10^{-3}$mbar. Results show three stages are sufficient to achieve $10^{-2}$mbar pressure difference at 1500 rpm. Such seal can work as the bearing protection in low vacuum devices.

**Keywords:** magnetic fluid; rotary seal; vacuum pressure; hydrostatic loading

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BIOMATERIALS SYNTHESIS AND CHARACTERIZATION

Original Research

# Defragmentation of lysozyme derived Amyloid β fibril using Biocompatible Magnetic fluid

Nidhi P. Parikh[1] · Kinnari H. Parekh[1]

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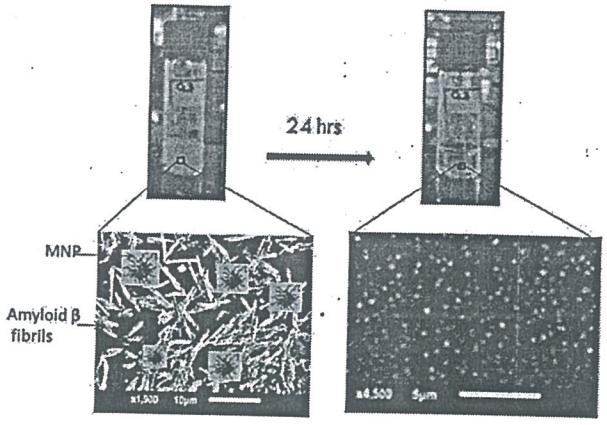
## Abstract

We present here a modulating effect on lysozyme derived Amyloid β fibrils by aqueous magnetic fluid. This non-conventional approach of treatment of lysozyme derived Amyloid β fibrils showed lysing of Amyloid fibrils to its secondary structures which can be seen using optical microscope and scanning electron microscopic image. The size of lysozyme derived amyloid fibrils before and after treatment was measured using dynamic light scattering technique. The mechanism of defragmentation of lysozyme derived Amyloid β fibrils by magnetic fluid is explained. This is a first report to identify the secondary structure of protein using Fourier Transform Infrared (FTIR) and Circular Dichroism (CD) spectra after lysing. The cyto-toxicity study of this magnetic fluid on neuronal (SH-SY5Y) and non-neuronal (NRK) cell lines shows non-toxicity up to a concentration of 250 µg/mL. The study indicates a novel and unique complementary approach to treat the amyloidogenic brain diseases.

## Graphical Abstract




## 1 Introduction

One of the major roles of nanotechnology is to deal with functionalizing inert and biocompatible materials and impart specific biological functions ranging from diagnosis to treatment [1–3]. Over the majority of years various conventional drugs have been proposed for neurodegenerative diseases like Alzheimer's disease (AD). The fact that 98% of the drugs are not able to cross the blood brain barrier (BBB), owed an explanation to the new research including the use of nanoparticles. Even though the research for AD has progressed to undercover the root causes for the

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# Density functional study of adsorption and desorption dynamics of hydrogen in zirconium doped aluminium clusters

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ABSTRACT

To reduce the greenhouse effect and as a fuel alternatives hydrogen is used as a secure and clean energy. But there are some challenges in the storage of hydrogen energy, the present accurate dynamics of adsorption and release of hydrogen. We report the adsorption and desorption of hydrogen atoms (up to eight) on the $ZrAl_m$ (m = 3 to 7) clusters using density functional theory within B3PW91/LANL2DZ basis sets in the GAUSSIAN 09 package. Adsorption energy for per hydrogen atom in all clusters is found in the range of −2.5 eV to −3.3 eV, which shows the chemisorption of hydrogen on the $ZrAl_m$ clusters. Change in the DOS with number of hydrogen is attributed to the charge transfer between the $ZrAl_m$ clusters and hydrogen atoms. Highest HOMO-LUMO gap of 3.055 eV is found for the $ZrAl_3H_7$ cluster which indicates that the $ZrAl_3H_7$ cluster is chemically more stable. Work function values for hydrogen doped clusters are in the range of 3.5 eV–4.4 eV which suggests the low optical absorption in considered clusters. The calculated enthalpy difference further confirms the chemisorption of hydrogen on $ZrAl_m$ clusters $ZrAl_3H_n$ and $ZrAl_7H_n$(for n = 1 to 5 and 7) are more exothermic than other considered clusters. Desorption energies per hydrogen for these clusters are found lower than the some of the best catalytic clusters $Pd_{13}$ and $Pt_{13}$ indicating more catalytic active nature.

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## Introduction

In recent years, researchers have a great deal of attention towards the renewable energy source due to increasing demand of energy in every sector and decreasing the quantity of the fossils fuels. The exploitation of these traditional fossil fuels which results into the pollutants have a negative impact on climate change [1]. However, several problems in this context faced by the researchers can be solved by some specifically designed materials [2–4]. Among these materials hydrogen is a prominent candidate for the high energy density which can be used as the regenerative fuel cell [5,6]. For the storage of hydrogen the material must belong to high gravimetric and volumetric density [7]. Due to the need of extreme high temperature and pressure condition compressive tanks are not

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# Strain and layer modulated electronic and optical properties of low dimensional perovskite methylammonium lead iodide: Implications to solar cells

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ABSTRACT

In the present work we report the effect of quantum confinement, biaxial and uniaxial strains on electronic properties of two dimensional (2D), one dimensional (1D) and layered system of Methylammonium lead iodide (MAPI) in cubic phase using first principles calculations based on density functional theory for its implications to solar cell. Our studies show that the bandgap of MAPI is dimension dependent and is maximum for 1D. We also found that the band gap of 2D MAPI can be modulated through application of biaxial strain, which shows linear relation with strain; compressive strain decreases the band gap whereas tensile strain increases the band gap. 1D MAPI shows near parabolic response towards strain which increases with compressive and tensile strain. Our studies show that the 2D MAPI is better for a solar cell due to lower effective mass of electron and hole arising from the strong s-p anti-bonding coupling. The calculated solar cell parameters suggest that the 2D MAPI is best suited for solar cell applications. The calculated open circuit voltage, fill factor and efficiency are highest for 2D MAPI. The highest theoretical efficiency of 2D MAPI is 23.6% with mesoporous (mp)-$TiO_2$ electrode.

## 1. Introduction

Perovskite crystals with chemical formula $ABO_3$ are known for their complex landscape and useful physical properties such as magnetic, ferroelectric and two dimensional electronic conductivity (Cohen, 1992; Peña and Fierro, 2001). Last few years have witnessed a tremendous effort for the organic – inorganic perovskites not only due to their more complicated structure than that of organic perovskites arising due to many possible orientation of organic materials (Baikie et al., 2013) but also due to phenomenal advancement in the solid state solar cells (Burschka et al., 2013; Jeon et al., 2014; Jung and Park, 2015; Kim et al., 2012; Lee et al., 2012; Stoumpos et al., 2013; Zhou et al., 2014). The photovoltaic efficiency in the solid state solar cells has reached its maximum about 21% (Jung and Park, 2015; "Natl. Renew. Energy Lab" https://www.nrel.gov/pv/assets/images/efficiency-chart.png.; Zhou et al., 2014). Further, it is observed that the organic cations and substitution of metal halides affect the bandgap through alternation of inorganic framework (Eperon et al., 2014; Filip et al., 2014; Noh et al., 2013). The organic-inorganic halide perovskites have unit cell generally composed of $AMX_3$ (where A = $CH_3NH_3^+$, or $(H_2N)_2CH^+$, $Cs^+$; M = $Sn^{2+}$, $Pb^{2+}$ and X = $Cl^-$, $Br^-$, $I^-$) (Mitzi, 2004, 2001). The best example of this alternation is Cs which is largest atom in the group I to hold cubic perovskite structure but the molecule $CH_3NH_3$ is larger than Cs, which makes $CH_3NH_3PbI_3$ (MAPI where MA represents $CH_3NH_3$ cation) more stable and perform better than $CsPbI_3$ (Zhang et al., 2015). Furthermore, they are known for many interesting properties such as high optical absorption spectra range, a long carrier diffusion and most importantly tuneable bandgap (Dong et al., 2015; Stranks et al., 2013) which leads them to be useful in various applications of optoelectronics and photonic devices including solar cells, photodetectors, light emitting diodes, field effect-transistors (FET), waveguides and nano lasers (Chin et al., 2015; Kojima et al., 2009; Snaith, 2013; Tan et al., 2014; Wang et al., 2015, 2016; Zhu et al., 2015). MAPI which was first reported by Weber (Weber, 1978) in the cubic crystal structure consequently has been studied intensively as a solid state solar cell due to its high photovoltaic efficiency over 20%

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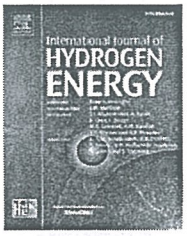

# Hydrogen evolution reaction and electronic structure calculation of two dimensional bismuth and its alloys

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ABSTRACT

We present a systematic ab initio study of atomic hydrogen and oxygen adsorption on bismuthene monolayer and its alloys with arsenic and antimony through electronic structure calculations based on density functional theory within generalized gradient approximation. We systematically investigated the preferable adsorption site for hydrogen and oxygen atom on 2D Bi, BiAs and BiSb. It was found that the hydrogen atom prefers top site of bismuth atom and oxygen atom prefers to reside in the hexagonal ring of these 2D bismuth alloys. The free energy calculated from the individual adsorption energy for each monolayer subsequently guides us to predict the best suitable catalyst among the considered 2D monolayers. The 2D BiSb serves better for hydrogen evolution reaction (HER) with hydrogen adsorption energy as −1.384 eV while 2D BiAs is suitable for oxygen evolution reaction (OER) with oxygen adsorption energy as −1.092 eV. We further investigated the effects of the adsorbate atom on the electronic properties of 2D Bi, BiAs and BiSb. The adsorption of oxygen on 2D BiAs and BiSb was shown to reduce the bulk band gap by 40.56 and 67.79% respectively which will be advantageous for the observation of Quantum Spin Hall effect at ambient conditions.

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## Introduction

Topological insulators (TIs) have gained great research enthusiasm in recent years due to their newly discovered quantum states and exotic properties [1,2]. Many layered thin films have been predicted to show quantum spin hall (QSH) effect, among which graphene was the first two dimensional (2D) candidate followed by silicene [3], germanene [3], stanene [4,5], plumbene [6] and arsenene [7]. However, the weak spin-orbit coupling (SOC) in these 2D materials results in an unobservable bulk gap not enough to support accessible QSH effect experimentally at room temperature (RT) [8]. Further, materials with strong SOC such as heavy metal bismuth (Bi) [9,10] and antimony (Sb), [11] their films were proposed to be Topological insulators and have been grown on various substrates [12,13]. However these topological insulators were shown to have very small finite band gap ~0.6 eV for bilayer Bi film making QSH observation challenging at room temperature. Other series of monolayer honeycomb structures from group IV and binary compounds comprising of group III and V were studied systematically using first principles calculation

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27

ORIGINAL PAPER

# FT-IR method for estimation of phytic acid content during bread-making process

Gayatri Dave[1] · Hasmukh Modi[2]

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**Abstract**
Phytic acid is famous as anti-nutrient factor usually present in whole-wheat, cereals and numerous plant-based supplements. The presented study focused on development of FT-IR based method for phytic acid estimation during the bread-making process. The impact of phytase supplementation was studied through incorporating the yeast-derived phytase in bread dough. Precise estimation for phytic acid content was performed towards mid-infrared region (1400–800 $cm^{-1}$) of FT-IR spectroscopy. The concentration of phytic acid was estimated for each steps of bread-making process and the FT-IR obtained results were compared with other reported methods. Pure solid solution of phytic acid gave five characteristic peaks recorded at 889, 1002, 1154, 1361 and 1418 $cm^{-1}$, because of P–H, P–H banding, phosphine and phosphoric acid respectively. In another set of experiment the impact of phytase supplementation was evaluated.

Keywords Phytate · Whole-wheat flour · FT-IR · Phytase

## Introduction

Currently, health authorities worldwide recommend an increase in the consumption of whole grain cereal products such as breads and breakfast cereals. This is to balance the dietary needs for animal proteins, fat and fibers. The dietary guidelines have moved towards the consumption of increasing amounts of fiber during the last decade. Whole-wheat flours, besides being a source of fiber, provide complex carbohydrates, proteins, vitamins and minerals [3]. Though the nutritional benefits are considerably significant, whole-wheat flour also contains some anti-nutrient substances like phytic acid. Phytate or *myo*-inositol hexakisphosphate is a common constituent of plant based products, mainly present in cereals, legumes, vegetables and fruits [4].

Phytic acid (IP6) contains hexaphosphate-substituted inositol ring compound in its deprotonated form and have high affinity towards divalent metal ions like calcium, magnesium, zinc, iron, and cobalt [15]. This natural phosphate storage molecule of plant when incorporated in diet it reduces the bioavailability of these minerals. This causes an adverse effect on monogastric animals and to the person with compromised phytase activity [7]. Many statuary bodies have drawn guideline towards the optimum concentration of these minerals, particularly for zinc. In order to fulfill the adequate requirement of these trace minerals the phytic acid content must be reduced to its lowest [2].

Bread-making process allows a decrease in phytic acid content. To lower the phytate content in bread crumbs various approaches have been reported in extent literature, one such report have suggested the increase of baking yeast concentration [8, 17].

In human, pancreas secrets little amount phytase but this little phytase activity is insufficient for phytate rich food products.

Numerous methods for estimation of phytic acid were presented in scientific literature. Each has their own set of advantages and disadvantages. The methods includes ferric precipitation method that proven very laborious and time consuming. The other method relates the HPLC based estimation that required multiple steps for the pretreatment

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Dipal M. Patel[1] and Ramesh V. Upadhyay[2]

# Testing and Evaluation of Linear Shear Mode Magnetorheological (MR) Damper Based on Rheological Properties of MR Fluid

**Reference**

Patel, D. M. and Upadhyay, R. V., "Testing and Evaluation of Linear Shear Mode Magnetorheological (MR) Damper Based on Rheological Properties of MR Fluid," *Journal of Testing and Evaluation* https://doi.org/10.1520/JTE20180030.
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**ABSTRACT**

Magnetorheological (MR) fluid exhibits variable yield stress and viscosity with the magnetic field, which is why it is classified under smart materials. Because of its controllable properties, MR fluid has many applications. The most common application of MR fluid is MR fluid damper. According to the flow of MR fluid, three types of dampers are possible; flow mode, squeeze mode, and shear mode. In this article, rheological properties of MR fluid, which has a high Bingham number (ratio of MR force on-state to off-state), are synthesized and the MR properties are studied. Based on these properties, a linear shear mode MR damper is designed and evaluated for its performance. A unique model is adopted to evaluate the performance of MR damper. In this model, the dimensionless Mason number is applied to establish the relation between test data of damper and rheological properties of MR fluid. This is verified for two different volume fractions of magnetic particles in MR fluid.

**Keywords**

magnetorheological fluid, Mason number, damper

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## Introduction

The tunable rheological properties of magnetorheological (MR) fluids under a magnetic field has winded its potential applications in vibrational control devices and vehicle suspensions as MR damper [1–5]. The MR fluid—a suspension of magnetic particles dispersed in a carrier liquid—develops a field-controllable yield stress and apparent viscosity.

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29

# Predicting the thermal sensitivity of MR damper performance based on thermo-rheological properties.

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**Abstract:** One factor which needs to be addressed in magnetorheological (MR) fluid device is operational stability under a given environmental condition and/or localized viscous heating within a device. So, one need to study thermal effects on MR fluids and its influence on performance of MR fluid devices. The aim the present paper is to predict the thermal stability of MR fluid device performance, based on the thermo-rheological properties. The MR fluid is synthesized using flake shape iron particles and its rheological study is carried out in the absence and presence of field using a magneto - rheometer. The thermo-rheology was studied and sensitivity was derived. This fluid is tested for its damper performance in the designed and fabricated flow mode damper. The thermo-sensitivity of the damper is studied and compared with rheological properties. It is suggested that one can predict the damper temperature dependent performance based on the thermo-rheological results.

**Keywords:** Magnetorheological fluid; thermo-sensitivity: damper; MR effect.

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# Low cost and efficient hetero-anthracene based small organic hole transporting materials for solid state photoelectrochemical cells

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ABSTRACT

A series of low cost phenothiazine (PTZ) based small organic hole transporting materials (OHTMs) with high conductivity, hole mobility and low crystallinity were synthesized and systematically investigated for solid state photoelectrochemical cells/dye sensitized solar cells (DSSCs). Thermal, optical, photoelectrical and electrochemical properties of all OHTMs were evaluated using thermal techniques, cyclic voltammetry (CV), UV–vis absorption and other techniques. Density functional theory (DFT) was used to calculate optical and electrochemical properties of OHTMs and compared with experimental data. Role of these OHTMs in solid state photoelectrochemical cells with metal-free carbazole dye, SK3 in presence of additives like lithium bis(trifluoromethyl sulfonyl)imide salt (LiTFSI) and tert-butyl pyridine (TBP) are discussed along with the thickness of photoanode. In order to take an insight into photovoltaic performance, electron transfer kinetics and electron recombination in the OHTMs with different thickness of $TiO_2$ thin film based ss-DSSCs were characterized by *I–V*, electrochemical impedance spectroscopy (EIS) and open circuit voltage decay (OCVD). The hole mobility, conductivity and photovoltaic performance of OHTMs are comparable with commercially available Spiro-OMeTAD. The highest power conversion efficiency (*PCE*), 4.91% is achieved from thiophene substituted (at 3,6 positions) phenothiazine based SJH-11, is comparable with reference device incorporating Spiro-OMeTAD as HTM with SK3 sensitizer. All the ss-DSSCs with OHTMs exhibit good long-term stability under 1 sun illumination and ambient humidity conditions. The results are promising and have scope for improvement upon optimization of substitution at 3 and 6 positions of PTZ central/core moiety.

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## 1. Introduction

In last two decades, Dye Sensitized Solar Cells (DSSCs) are highly studied and specialized low cost solar cell devices with the highest efficiency about 13% in liquid electrolyte [1–5]. A conventional DSSC device includes dye sensitized $TiO_2$ photoanode which is then infiltrate with a liquid solvent containing a redox couple. However, challenges like leakage of electrolyte, special sealing requirement and corrosion of electrode material in liquid electrolyte based devices, required a strategy which overcome these problems. In view of this, few years ago a concept of solid-state DSSCs has been introduced and received a great attention; the simplicity of fabrication process, better stability and no need of any special sealing materials unlike in liquid DSSC are the key advantages of solid-state DSSCs (ss-DSSCs)[6–9]. Generally, organic ionic conductors, *p*-type semiconductor or polymer gel matrix with a redox couple are used to replace liquid electrolytes [5,10–16]. Among these, some are working as hole transporting material in solid-state solar cell devices. Till today, mainly two different types of Hole Transporting Materials (HTMs), namely organic [17–19] and inorganic [20,21] *p*-type semiconductors have been investigated in ss-DSSCs. In DSSC, the role of HTM is regeneration of the oxidized state of the light harvesting material and high regeneration yield is required in order to achieve good power conversion efficiency (*PCE*), thus HTMs play an important role in the device. Bach et al. reported the first ss-DSSC based on organic HTM, 2, 2′, 7, 7′-tetrakis(N,N-di-*p*-

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# Kesterite $Cu_2ZnSnS_4$ thin films by drop-on-demand inkjet printing from molecular ink

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Electrical properties

ABSTRACT

Inkjet printing of kesterite $Cu_2ZnSnS_4$ (CZTS) thin films on glass from molecular ink is described. CZTS ink consists of copper acetate, zinc acetate, tin chloride and thiourea dissolved in a mixture of ethylene glycol and isopropyl alcohol. The printed precursor films are vacuum dried and thermolysed at 200 °C in air to obtain CZTS films. X-ray diffraction and Raman spectroscopy of films confirm the formation of kesterite CZTS without any secondary phases. The band gap of the films is 1.48 eV as deduced from transmission spectrum using Tauc plot. The films are p-type with hole density and mobility of $2.65 \times 10^{19}$ $cm^{-3}$ and 0.3 $cm^2V^{-1}s^{-1}$, respectively. Measurement of electrical conductivity of films in the temperature range from 77 to 300 K show that dominant mechanisms of conduction are Mott-Variable Range Hopping, Nearest Neighbour Hopping and Thermally Activated Band Conduction in the temperature ranges of 77–155 K, 180–240 K and 250–300 K, respectively.

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## 1. Introduction

Inkjet printing (IJP) is a direct-write, non-contact, non-vacuum and atmospheric method for deposition of solid thin films [1]. In this technique, picolitre drops of a liquid ink are impelled onto a substrate to precisely deposit films in pre-defined pattern. The ejected drops fall until they come in contact with the substrate. The drops spread because of momentum and surface tension and eventually coalesce on the substrate to form a film. Printed solid film is then formed by solvent evaporation. IJP has high material utilization factor. Printing of films can be sequential or layer-by-layer and can form any pattern without masks. Printed films are likely to be contamination free because of non-contact deposition. Further, IJP is amenable to large scale roll-to-roll deposition of films. Printing of films on a substrate depends on inkjet ink, jetting voltage and dots per inch (DPI). IJP has been utilized for fabrication of variety of devices and films, such as, flexible electronics [2–4], organic electronics [2,3,5], metal electrical contacts [3,4,6], photo-detectors [5,7,8], sensors [9–11], optoelectronic devices [7], thermoelectric devices [12], supercapacitors [13], micro-batteries [14], smart windows [15], ceramics [16], organic solar cells [17–19] and perovskite solar cells [18].

The special attributes of IJP have not been fully exploited for inorganic solar cells and only few investigations [20–26] have been reported so far. There are some recent studies on inkjet-printed $Cu_2ZnSn(S,Se)_4$ (CZTSSe) solar cells [20,25,26], $Cu_2ZnSnS_4$ (CZTS) films [21] $In_2S_3$ non-toxic buffer layers [22], $Cu(In,Ga)(S,Se)_2$ (CIGSSe) solar cells [23] and NiO dye-sensitized solar cells [24]. Lin et al. [20] were first to demonstrate inkjet-printing of solar cells. Solar cells with Mo/CZTSSe/CdS/i-ZnO/ZnO:Al/Ni:Al grids were fabricated based on the inkjet-printed CZTSSe absorbers. CZTS precursor layers were IJP on Mo/glass substrates from CZTS ink. Molecular solution ink was prepared by dissolving copper (II) chloride, zinc acetate dihydrate, tin (II) chloride dihydrate, thiourea and sodium fluoride in dimethyl sulfoxide (DMSO) with the help of overnight stirring. The printed precursor layers were preheated at 300 °C in air for 2 min to remove solvent. Later, the films were finally annealed in Se vapour at 560 °C for 20 min to obtain large-grained CZTSSe films. CZTSSe solar cell with an active area of 0.5 $cm^2$ yielded power conversion efficiency of 6.4% with an open circuit voltage ($V_{OC}$) of 431 mV, short current density ($J_{SC}$) of 34.6 mA/$cm^2$ and fill factor (FF) of 42.8%, respectively.

Colina et al. [25] optimized the inkjet-printed precursor films for CZTSSe solar cells. Light-yellow coloured CZTS molecular ink was made by stirring overnight DMSO containing copper (II) acetate monohydrate, tin (II) chloride dehydrate and anhydrous zinc (II)

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ORIGINAL PAPER

# Electrospun ZnO Nanoparticles Doped Core–Sheath Nanofibers: Characterization and Antimicrobial Properties

Mehdihasan I. Shekh[1,2] · Kaushal P. Patel[1] · Rajnikant M. Patel[1]

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**Abstract**
Coaxial electrospinning technique was used to fabricate the core–sheath composite nanofibers of ZnO nanoparticle (Nps) (10%, 20% w/w) doped polymethyl methacrylate (PMMA) (as sheath) and polyvinyl alcohol (PVA) (as core). Fourier transform infrared (FT-IR) spectra were confirmed the weak forces arise between ZnO Nps, PMMA and PVA matrixes. The hexagonal (wurtzite) structure of ZnO Nps with ~30.8 nm of diameter was confirmed from the X-ray diffraction pattern. The morphology and microstructure of core–sheath composite nanofibers were confirmed from the scanning electron microscopy (SEM) and transmission electron microscopy (TEM). It is clearly seen from the TEM images that the PMMA encapsulate the PVA core. Core–sheath composite nanofibers were assessed against *Escherichia coli* (*E. coli*) and *Bacillus subtilis* (*B. subtilis*) bacteria through quantitative, disk diffusion and viable cell count methods. It was found that ZnO Nps doped core–sheath nanofibers were effectively inhibit the growth of gram positive bacteria, *B. subtilis*.

**Keywords** Coaxial electrospinning · ZnO nanoparticle · Composite nanofiber · Thermal characteristic · Disk diffusion method

## Introduction

Electrospinning technique is most versatile, cost-effective, reliable and easy technique to fabricate the nanofibers from the polymer solution or polymers melts. Electrospinning is the process using electrostatic forces to form a fine filament of the polymer solution. A number of modifications were carried out on electrospinning setup and various types of the electrospinning techniques [1–9] have reported. These techniques are mainly multi-spraying electrospinning, bubble electrospinning, bail electrospinning, wire electrospinning, high speed electrospinning, plate edge electrospinning, bowl electrospinning, hollow tube electrospinning, rotary cone electrospinning, spiral coil electrospinning, electro blowing, needless electrospinning, coaxial electrospinning and melt electrospinning.

Among all electrospinning techniques, coaxial electrospinning is an abundant technique to fabricate multi-functional core–shell or hollow nanofibers. This technique is immerged by means of the compound (mainly biological species or molecules) which easily deformed or insoluble in organic solvents and their release can be controlled by encapsulation [10]. The core–sheath nanofibers have good mechanical strength, better thermal and electrical conductivities than single structure nanofibers [11, 12]. In 2002, Loscertales was first demonstrated the coaxial electrospinning [13]. For coaxial spinning, the spinneret is specially designed and have multi-channel consisting of core and sheath channels. The coaxial electrospinning setup is schematically shown in Fig. 1. The same parameters affect the coaxial electrospinning as those in the single-nozzle electrospinning. However, other parameters like miscibility of two different interfaces, solidification on needle tip and conductivity (i.e., solvent) difference of two different phases makes difficult for coaxial electrospinning. Some reports were deduced that sheath layer obstruct the evaporation of core materials during coaxial spinning [14–16]. It was also noticed by the researchers that the non spinnable

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# Fabrication and photoresponse of n-$WS_2$/p-$V_{0.25}W_{0.75}Se_2$ van der Waals heterojunction

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**Abstract.** Transition metal dichalcogenides (TMDCs) have shown tremendous potential for application in the field of optoelectronics owing to their extraordinary characteristics. The $WS_2/V_{0.25}W_{0.75}Se_2$ van der Waals heterostructure was fabricated by layer transfer technique and its $I$–$V$ characteristic was measured at room temperature. The fabricated pn-junction heterostructure shows obvious current rectification with a rectification ratio of ~39 at ±1 V. The heterostructure was analysed in the dark and under polychromatic illumination. The noticeable rise in reverse current is observed at higher intensity of illumination. The photocurrent and photoresponsivity are found to be enhanced as intensity and bias voltage are increased. The higher value of the ideality factor of ~2 is attributed to the inhomogeneity of the heterojunction.

**Keywords.** van der Waals heterojunction; photoresponse; responsivity.

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## 1. Introduction

Recently, layered materials including graphene and transition metal dichalcogenides (TMDCs) have attracted considerable attention in the field of electronics, optoelectronics and photonics [1–11]. The TMDCs with the generalised formula $MX_2$ (where M is a transition metal atom and X is a chalcogen atom) are composed of two-dimensional trilayer X–M–X sandwich structures. The M atom plane is in the middle of the two hexagonal X atom planes. These $MX_2$ sheets are weakly bonded together by van der Waal bonding to form crystals and hence the layers can easily be separated by mechanical or chemical exfoliation [12–15]. Besides this, the TMDCs exhibit layer-dependent properties, e.g. the indirect band gap of bulk materials converts into the direct band gap when the dimensions are confined to the monolayer [16–18]. The important members of the TMDC family, $WS_2$ and $WSe_2$, have found great applications due to their unique electrical and optical properties. The band gap of 1–1.5 eV and excitonic mechanism make these materials ideal for photovoltaics and photoconduction [11,19]. Moreover, the TMDCs have attracted huge attention due to their unique electrical properties including high mobility, conductivity, carrier concentration, etc. The properties of these semiconductors can also be tailored by doping or substitution or the intercalation process and semiconducting nature can also be changed [20–31]. Hyun Seok Lee and coworkers have reported the transformation from the n-type mechanism of pure $MoSe_2$ to the p-type charge conduction in Nb-doped $MoSe_2$ [32]. In the present study, single crystals of $WS_2$ and $V_{0.25}W_{0.75}Se_2$ were grown by direct vapour transport technique [11,19]. Efforts have been made to study the photoresponse of the n-$WS_2$/p-$V_{0.25}W_{0.75}Se_2$ heterojunction diode fabricated by the layer transfer technique.

## 2. Experimental

In the present study, the direct vapour transport grown crystals of n-$WS_2$ and p-$V_{0.25}W_{0.75}Se_2$ were exfoliated by Scotch tape to provide a fresh unreacted surface with minimum defects. The fresh surface of the crystals was observed by using a Carl Zeiss optical microscope and micrographs of the crystal are displayed in

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# Structure-activity relationship in phenothiazine antipsychotic drugs: Molecular orbital calculation, *in silico* molecular docking and physico-chemical parameters

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A series of antipsychotic phenothiazine drugs, whose results of clinical trials are known, have been subjected to all valence molecular orbital calculations using AM1 method. Phenothiazines are well known antipsychotic drugs and many molecules of this group are studied for their activity. These molecules are docked in dopamine receptor and the energies of the drug receptor complexes are obtained. The physico-chemical parameters like logP, PSA, Volume, BBB and drug likeness score have also been found. A regression analysis has been carried out to obtained dependency of antipsychotic activity with different parameters derived from MO calculations, molecular docking and physico-chemical studies.

**Keywords:** Docking, multiple regression, AM1 method, antipsychotic drugs, SAR

Amongst the various types of therapy available for the treatment of psychotic patients, drug therapy is by far the most potent. The neuroleptic drugs have been recognized as the preferred treatment for acute and chronic cases of psychosis[1-3]. The psycho-pharmacological drugs are aimed to act on central nervous system and since long they have been the subjects of much extensive research work.

A large number of antipsychotic agents are currently used clinically throughout the globe. One of the major classes belonging to the same is phenothiazines[4]. Pioneering work of Lehmann with chloropromazine which possesses a broad spectrum of clinical activity, have demonstrated phenothiazines a subject of many studies[5]. So far numerous clinical studies have been conducted on the antipsychotic activity of phenothiazines[4-6]. However, very limited information is available on the efficacy of these drugs with respect to electronic structure, *in silico* molecular docking score and physico-chemical parameters.

Few researchers in the past have carried out simple Huckel and Pariser-Parr-Pople molecular orbital calculations to correlate the antipsychotic activity and electronic structure of certain phenothiazine derivatives[7]. However, the molecules subjected to molecular orbital studies were not actual drugs and hence no quantitative correlation between drug-efficacy and results of the calculation could be provided. Moreover, the limitations of these simple calculations are too well known[8,9] and hence the question arises as to "what extent these results can be taken seriously" so far the main objective of the study is concerned. Interestingly, it has been accepted worldwide that proper understanding of the electronic properties and its correlation with the effectiveness of the drugs are of paramount importance to avoid lengthy clinical trials on a huge number of molecules by narrowing down the trials on a chosen few.

In light of the deficiencies inherent in the said methods, it was thought appropriate to carry out all valence molecular orbital calculations on a number of antipsychotic agents having phenothiazine derivatives. Only the molecules of known clinical results are subjected to the calculations. The semi-empirical method chosen for this investigation is AM1 which has been accepted as one of the reliable methods to study the electronic properties of molecules[10].

It is to be noted here that psychotic symptoms are believed to occur due to dopaminergic over activity in the limbic system; antagonism of dopamine from

# Presently a postdoctoral fellow at School of Chemistry, University of Bristol, Bristol, United Kingdom

**Abbreviations:** BBB - blood brain barrier, CI - chloropromazine index, logP - octanol-water partition coefficient, MO - molecular orbital, MW - molecular weight, PSA - polar surface area

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# Heating Efficiency Dependency on Size and Morphology of Magnetite Nanoparticles

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**Abstract.** Different size magnetite nanoparticles ranging from superparamagnetic (9 nm) to single domain (27 nm) and multi domain (53 nm) were synthesized using chemical route. Morphology of these particles as seen from TEM images indicates shape change from spherical to cubic with the growth of particles. The saturation magnetization ($\sigma_s$) and Specific Loss Power (SLP) showed maximum for single domain size, 72 emu/g and 102 W/g, respectively then those of multi domain size particles. These samples show higher SLP at relatively low concentration, low frequency and low amplitude compared to samples prepared by other routes.

## INTRODUCTION

Magnetic Fluid Hyperthermia (MFH) is one of the applications of nanotechnology in medicine in which tumor cells are heated and destroyed by magnetic nanoparticles (MNPs) injected into the body and targeted to the tumor site. Application of an external alternating magnetic field (AMF) causes heating of the nanoparticles. For successful magnetic hyperthermia therapy, one of the requirements is efficient heating of MNPs which is usually accomplished by measuring specific loss power (SLP) under controlled conditions. SLP is a function of the physico-chemical properties of MNPs, its concentration, and the parameters of AMF (frequency and amplitude). The physico-chemical properties of MNPs are crucial to determine pharmacokinetics, toxicity and biodistribustion of MNPs [1]. Higher SLP can be used to lower particle concentration in the tumor. In addition, the frequency and amplitude of the applied alternating magnetic field has to be adapted to the magnetic properties of the MNPs to optimize heat generation.

For MFH, the theoretical ideal magnetic particle core diameter for heat generation is in the range of 10-20 nm which is lower than the ideal size required for magnetic drug targeting. Particles smaller than 10 nm are ideal for tumor penetration, but are rapidly cleared by renal filtration and extravasation. Hence, particles in the 10-50 nm size range with appropriate coatings provide a good balance of circulation times, ability to be manipulated by an external magnetic field and heat generation by hyperthermia. Particles with sizes around the mono domain–multi domain transition, i.e. particles below 50 nm in diameter are preferred since they are expected to produce the maximum SLP. The SLP of 35 nm magnetite particles is more than twice as high as that of 10 nm particles. There are very few reports on the size variation from single domain to multi domain using chemical methods [2-3]. A correlation between physico-chemical properties of particles with SLP value was reported earlier in the particle range of superparamagnetic to single domain [4-5]. We report a chemical technique to produce the magnetic nanoparticles in different size ranges (superparamagnetic-SP, single domain-SD and multi domain-MD), different shapes (spherical and cubic). The aim is to produce these particles using an oxidation method; the oxidation rate will be controlled by changing Me/OH ratio, which is expected to vary average particle size. The study is focused to attain maximum heating response at relatively low frequency and magnetic field.

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ORIGINAL ARTICLE – NANOMATERIALS

# Two-Step Facile Preparation of $MoS_2$·ZnO Nanocomposite as Efficient Photocatalyst for Methylene Blue (Dye) Degradation

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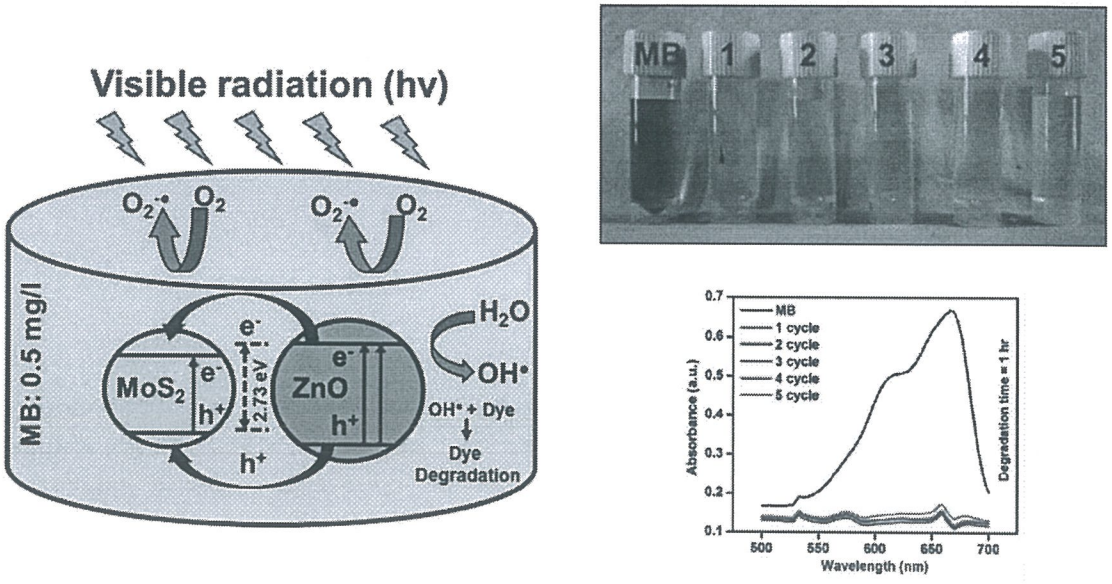
**Abstract**

In this work, we report the synthesis of binary semiconductor nanocomposite (NC) comprising spherical ZnO nanoparticles stacked with two-dimensional $MoS_2$ nanosheets, utilizing a facile microwave assisted synthesis technique. The fabricated product was characterized by X-ray diffraction, transmission electron microscopy, high-resolution transmission electron microscopy instrument, scanning electron microscopy, Raman spectroscopy, energy-dispersive X-ray spectroscopy (EDAX), inductively coupled plasma analysis and Fourier transform infrared spectroscopy to distinguish the structure and morphology of arranged NC. Ultraviolet–visible spectroscopy was used to understand the optical properties of $MoS_2$·ZnO NC. Optical transmission spectra gave a distinct red shift in the band gap of ZnO after making composition with $MoS_2$ nanosheets which eventually shows higher retention of visible light. This occurs due to effective separation of photogenerated charge carriers and rapid charge transfer to reactions sites of conduction band potentials of both ZnO and $MoS_2$ both. We plot that $MoS_2$·ZnO NC has a band gap of 2.73 eV which is fundamentally a long way from the band gap of ZnO (~3.3 eV). The outcomes recommended the effective fading out of methylene blue (more than 95%) in 1 h on the illumination of visible light. Besides, the association of $MoS_2$ prevents photo-corrosion of the ZnO bringing about upgraded photostability of the catalyst during the reaction. Moreover, we presented a recyclability test of the photocatalyst for five subsequent times to get the efficient dye degradation.

**Graphical Abstract**




Extended author information available on the last page of the article

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# Solution-based deposition of SnS nanostructures from mechanochemically prepared precursor bath

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ABSTRACT

Solution-based deposition techniques are emerging as an efficient route for low-cost photovoltaics (PV). We report deposition of tin sulphide (SnS) nanostructures (NS) from a simple, mechanochemically prepared precursor solution (PS) bath. Initially, to check the suitability of PS, SnS NS particles have been synthesized at low-temperature and deposition time in three atmospheres: air, vacuum, argon. In air atmosphere, spherical shaped particles of size ~300 nm have been grown. In argon and vacuum atmospheres, the particles show layered growth with few agglomerated bunches. Shiny, adhesive films of NS SnS have been deposited at room temperature (R.T.), 40 °C and 50 °C. X-ray diffractogram shows the NS belong to orthorhombic SnS phase. Scanning electron microscopy reveals these nanostructures are nanoflakes (~30 nm), nanostrands (~20 to 50 nm) and nanopetals (~100 nm) formed at different temperatures. The RMS roughness of films has been reported. The optical energy bandgap value derived for all the films is ~1.4 eV.

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## 1. Introduction

Solution-based deposition techniques are nowadays considered as one of the alternatives to accomplish the need of low-cost PV. These techniques not only widely exploits the earth-abundant, low-cost, non-toxic elements such as Cu, Sn, Zn, etc., but also forms various nanostructures of high aspect-ratio which have proven their ability to harness maximum solar radiation compared to the bulk [1,2]. Hence, development of such nanostructures by low-cost, non-vacuum, low-temperature processes has emerged as one of the major objectives these days. SnS, a potential solar cell material [3], shows high optical absorption above the photon energy threshold of 1.3 eV and intrinsic p-type conductivity with carrier concentrations in the range $10^{15}$–$10^{18}$ $cm^{-3}$ [4,5]. SnS films have been deposited by various techniques such as spray pyrolysis [6], CBD [7], SILAR [8], etc. To get pure phase of SnS, either a typical experimental set-up or an inert gas atmosphere, is required. In this paper, we report an ancient method, mechnochemical wet grinding [9–11], to grow SnS NS from the mechanochemically prepared aqueous PS bath.

## 2. Experimental

SnS NS were prepared by simple mechanochemical method using agate mortar and pestle. In a typical process, triethanolamine ($C_6H_{15}NO_3$, 1 M) was added to metal salt ($SnCl_2{\cdot}2H_2O$, 0.1 M) during the grinding process. Then, thioacetamide ($C_2H_5NS$, 0.1 M) and ammonia ($NH_3$ 30%, 1 M) were added sequentially to make the final volume 100 ml by using triple distilled water. Solution was then transferred in a beaker which contained a scrupulously cleaned microscopic glass substrate kept at 65° angle to the horizontal line. The films were deposited at R.T., 40 and 50 °C temperature using a hot water bath. The color of the PS turned milky, yellow, brown, deep brown and dark red within 24 h. After deposition, films were rinsed, dried and then collected. All the films were adhesive and smooth. The chemicals used were of analytical reagent grade supplied by Merck India Ltd.

The structural study of the particles and nanostructured films was carried out by X-ray diffraction (XRD) plots (θ/2θ) recorded with a Bruker D2 Phaser X-ray Diffractometer (using Ni filtered $CuK_\alpha$ radiation) from 20 to 70°. Morphology of the particles and films were studied with the Scanning Electron Microscope (SEM, LEOs:440i) and Atomic Force Microscope (Nanosurf Easyscan2). The transmittance spectra of NS SnS films were recorded using Shimadzu UV-1800 spectrophotometer in the wavelength range 300–1100 nm.

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RESEARCH ARTICLE

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# Evaluating the effect of diallyl sulfide on regulation of inflammatory mRNA expression in 3T3L1 adipocytes and RAW 264.7 macrophages during ethanol treatment

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**ABSTRACT**

Diallyl sulfide (DAS) has been studied extensively for its alleged role as an anticancer and protective agent. Alcohol influences and effects on human health have been extensively studied. However, investigations toward developing and testing therapeutic agents that can reduce the tissue injury caused by ethanol are scarce. In this backdrop, this study was designed to explore the potential effect of DAS in reducing alcohol induced damage of 3T3L1 adipocytes and RAW 264.7 macrophages. MTT [3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide] assay was performed to determine the DAS effect on cell viability. Reactive oxygen species (ROS) production was assessed by flow cytometer. Expression of inflammatory genes was studied by the qRT-PCR method. Our study results showed that DAS at concentrations less than 200 μM was not toxic to the cells and the viability of ethanol-exposed 3T3L1 adipocyte cells was found to be significantly increased when ethanol-exposed cells were treated with DAS. Further, treatment of ethanol-exposed 3T3L1 cells with 100 μM DAS for 24 h was found to reduce ethanol induced ROS production, expression of pro-inflammatory cytokines, and enhance anti-inflammatory cytokine production in the cells. Also, 100 μM DAS was found to increase the expression of M2 phenotype-specific genes in ethanol-exposed RAW 264.7 macrophage cells. Further, 100 μM DAS also improved the levels of lipid accumulation in 3T3L1 adipocytes that was down-regulated by ethanol exposure. Taken together, our study results imply that DAS may be effective in reducing ethanol induced injury of cells thereby suggesting its potential to be used in drug formulations.

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3T3L1 adipocytes; RAW 264.7 macrophages; alcohol; diallyl sulfide; inflammation; reactive oxygen species; macrophage polarization; lipid accumulation

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## Introduction

Use of garlic in folk medicine has been in existence since ancient times and it has been studied to have anticancer, anti-microbial, anti-diabetic, and several other beneficial effects (Block 1985, Thomson and Ali 2003, Rao *et al.* 2015). The chief constituent of garlic is the organosulfur compound besides it also has several minerals, enzymes, and amino acids (Amagase *et al.* 2001, Omar and Al-Wabel 2010). Metabolism of allicin present in garlic produces diallyl sulfide (DAS), the principle oil soluble organosulfur compound (Iciek *et al.* 2009). DAS is a selective inhibitor of cytochrome P450 2E1 (CYP2E1) enzyme that metabolizes alcohol and several analgesic drugs (Matsumoto *et al.* 1996, Morimoto *et al.* 1995a).

Alcohol, a principal etiological agent, causes most common health problems associated with disability adjusted life years (DALYs) and mortality (Room *et al.* 2005). Low doses of ethanol are metabolized by alcohol dehydrogenase, acetaldehyde dehydrogenase, CYP2E1, and catalase enzymes. When ethanol is consumed at higher doses or in chronic alcohol consumers, ethanol is primarily metabolized via the CYP2E1 pathway (Lieber 1997, Rao *et al.* 2015). Cellular toxicity is caused by ethanol induced oxidative stress, endoplasmic reticulum stress and inflammation that results in modifications at transcriptional, translational, and post-translational levels (Rao *et al.* 2015, Novak and Woodcroft 2000). Several investigations on the pathologies induced by alcohol metabolism have shown that CYP2E1 dependent ethanol breakdown results in oxidative stress that manipulates regulation of several genes at the transcriptional level leading to tissue injury (Rao *et al.* 2015).

Metabolism of alcohol via the CYP2E1 pathway generates excessive reactive oxygen species (ROS) production that results in oxidative stress and inflammation leading to alcohol induced cellular damage (Zima and Kalousova 2005). Recent studies have shown that adipose tissue function dysregulation has a role to play in the manifestation of alcoholic liver disease (ALD). Metabolism of alcohol via the CYP2E1 pathway in adipose tissue results in adipose tissue inflammation, hyper-lipolysis and apoptosis (Kang and Nagy 2006, Chen *et al.* 2007, Sebastian *et al.* 2011, Kema *et al.* 2015). Further, recent investigations have also suggested that macrophages play a central role in ALD progression (Karakucuk *et al.* 1989, Luna-Casado *et al.* 1997, Afford *et al.* 1998, Tapia-Abellan *et al.* 2012, Ju and Mandrekar 2015). Macrophages also

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RESEARCH PAPER

# A Comparison of Magnetic Fluid Flow Models on the Behavior of a Ferrofluid Squeeze Film in Curved Rough Porous Circular Plates Considering Slip Velocity

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**Abstract**
This study aims to present a comparison of all the three magnetic fluid flow models (Neuringer–Rosensweig model, Shliomis model, Jenkins model) regarding the behaviour of a ferrofluid based curved rough porous circular squeeze film with slip velocity. The Beaver's and Joseph's slip model has been adopted to evaluate the effect of slip velocity. Further, the stochastic model of Christensen and Tonder has been used to study the effect of surface roughness. The concerned stochastically averaged Reynolds type equation is solved with appropriate boundary conditions to get the pressure distribution lead thus leading to the calculation of load carrying capacity. The graphical representations ensure that Shliomis model may be preferred for designing the bearing system with enhanced life period. However, for lower to moderate values of slip even Neuringer–Rosensweig model may be adopted. In addition, when the slip is at minimum the Jenkin's model may be deployed when the roughness is at lower level.

**Keywords** Circular bearing · Magnetic fluid · Roughness · Flow models

## 1 Introduction

The squeeze film, which has its own importance from a long time, is used in clutch plates, automobile transmissions and domestic appliances. Due to this, many investigators (Prakash and Vij 1973; Bhat 1978; Bhat and Deheri 1995; Deheri et al. 2005; Deheri and Patel 2011) investigated the problem of squeeze film bearing.

Ferrofluids, which are prepared by dispersing the magnetic particles in the liquid carrier, are a kind of multi functional materials. Because of the dispersing particles, the magnetic fluids could be simply divided into magneto rheological fluid and ferrofluid. Due to their some important properties the ferrofluids have been attractive in different types of applications, such as vacuum sealing, magnetic resonance, imaging, intelligent sensors, buffer solution in chips and drug delivery.

In 1964, Neuringer and Rosensweig proposed a simple flow model to study the steady flow of ferrofluids in the existence of slowly changing external magnetic fields. Quite a good number of papers are available in the literature dealing with the discussion of different types of bearing using Neuringer and Rosensweig flow model, for example, Tipei (1982) in short bearing, Agrawal (1986), Shah and Bhat (2003) and Deheri and Patel (2011) in slider bearing, journal bearing by Nada and Osman (2007) and Patel et al. (2012) and circular plates by Shah and Bhat (2000) and Deheri and Abhangi (2011). Jenkins (1972) modified the flow model of Neuringer and Rosensweig (1964) using Maugin's modification. It was observed that Neuringer–Rosensweig model modified pressure while Jenkins flow model modified both the pressure and the velocity of the ferrofluid. The steady-state performance of bearings with Jenkins model based magnetic fluids was analyzed by Agrawal (1986), Ram and Verma (1999), Shah

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RESEARCH ARTICLE

# Column Chromatography Free Purification of Recombinant α-Amylase from *Bacillus licheniformis* by Tagging with Hydrophobic Elastin Like Polypeptide

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**Abstract** Thermal sensitive and highly hydrophobic elastin like polypeptide (ELP) tends to undergo inverse transition cycling (ITC) which can be used for non chromatographic purification. The present study reports non-chromatographic purification of industrially important α-amylase tagged with ELP and compared with IMAC (Immobilized metal affinity chromatography) purified α-amylase. *amyL*-Gene encoding α-amylase from *Bacillus licheniformis* was cloned and expressed in *E. coli* BL21. The expressed protein with His-tag was purified through IMAC using Ni–NTA matrix. Three ELP genes encoding repeats of pentapeptide $(Val\text{-}Pro\text{-}Gly\text{-}Val\text{-}Gly)_n$ with variable length (V = 20, 21, 22) were synthesized through PCR using overlapping primers. To generate ELP tagged α-amylase, *amyL* was placed at N-terminal of ELPs and transformed to *E. coli* BL21 for expression. After ITC, $ELP_{22}$ at 30 °C showed maximum yield. α-Amylase purification through ITC and IMAC showed 2.9 and 1.72-fold purification, respectively. Furthermore, physical parameters of ELP tagged α-amylase have shown improvement with working temperature and thermal stability in comparison to His-tag α-amylase. The $k_{cat}/K_m$ for ELP tag and His-tag α-amylase was found to be 61.4 and 23.7 $mg^{-1}$ $min^{-1}$, respectively, which shows that ELP-tag increased the enzyme efficiency. In conclusion, the ELP-tag purification strategy can be applied to industrially relevant enzyme for purification by the non-chromatography method.

**Keywords** α-Amylase · Elastin like polypeptide · Inverse transition cycling · Transition temperature · Hydrophobic peptide

## Introduction

Catalytic efficiency of enzymes has already been promoted for its use in industries and α-amylase is effectively applied in the starch, textile, food, brewing and paper industries [1, 2]. Microbial sources for α-amylase production are very economical as it is easy to cultivate for bulk production. Properties such as being active and stable in harsh conditions, like solubility at high temperature and extreme pH are necessary for industrial applications. α-Amylase produced by the *Bacillus licheniformis* is thermophilic and stable in nature due to lowering the rate constant of monomolecular conformational scrambling by the deamination of Asn/Gln residues [3]. Multiple techniques like affinity, ammonium sulphate fractionation, and size exclusion chromatography have been developed, however they are time consuming and economically not feasible [2]. To meet the bulk volume demand crude extract being supplied to make the process economical and viable. Such process requires high volume of water and subsequently it requires extensive effluent treatment.

Purification from bulk volume of the media containing α-amylase through conventional chromatography is adding up to the end product cost which directly affects the cost of essential commodities such as glucose from starch. To produce the purified proteins, a trend should be followed towards a decrease in the protein purification steps and an increase in purification yield. Recombinant enzymes with

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# Particle interaction energy and hysteresis in polar and non-polar medium based magnetic fluids

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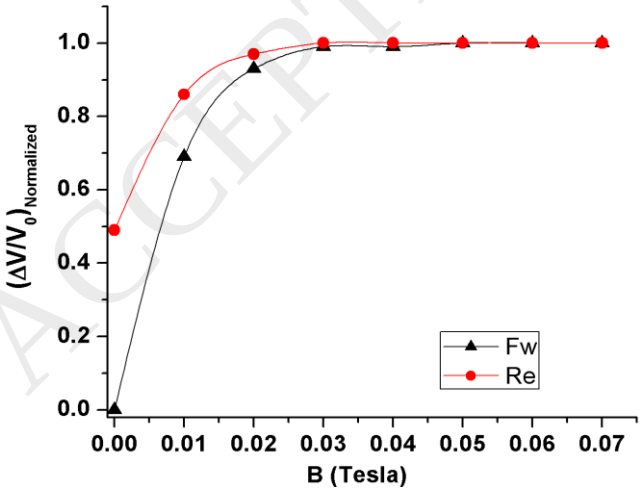
## Graphical Abstract

Inner structural properties of two different types of magnetic fluids (MFs) under the application of an external magnetic field were investigated by using the ultrasonic propagation velocity method. Specifically, we thoroughly investigated a number of MF-inherent phenomena that are important for determining the ultrasound propagation velocity; these phenomena included the effect of the medium, particle interactions, anisotropy, Brownian motion, and hysteresis. Using the measured data, we show that it is possible to explain the observed structural changes in the polar- and non-polar-medium-based MFs.



# Effect of Doping On All TMC Vertical Heterointerfaces

Salil Nair [1, a], Jolly Joy[1, b], K.D. Patel[1, c], Pratik Pataniya[1], G.K. Solanki[1], V.M.Pathak[1], C.K. Sumesh[2]

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**Abstract:** The present work reports the growth and basic characterizations of $GeSePb_x$ (x=0, 0.02, 0.04) layered mono chalcogenide single crystal substrates for preparation of heterojunction devices. These crystals are grown by Direct Vapour Transport (DVT) Technique [1,2]. Heterojunction interfaces on these substrates are prepared using thermal evaporation of nanocrystalline SnSe thin films having 5kA° thickness. The electrical characterizations reveal the rectifying behavior of the devices based on which its ideality factor, barrier height, saturation current, series resistance etc. have been determined using thermionic emission model [3,4]. The device parameters have been determined and analyzed by three different methods viz. LnI-V, Cheung's method and Norde method [5].The variation in the device parameters in light of doping is reported in the present work.

**Keywords:** Doping, Heterojunction, I-V, Ideality factor, Barrier height

## INTRODUCTION

The TMCs are a family of layered materials which provide a solid ground for application in the field of electronics and opto-electronics [6]. In particular, the variation in properties of these materials with thickness; makes it a best candidate in the fabrication of devices [7,8]. Among these, Germanium mono selenide (GeSe) has become a sought after material for fabrication of devices because of its properties such as band gap of 1.14 eV [9], high hole mobility (880.4 cm2/VS) and relatively earth-abundant constituents [9]. To study the effect of doping on various devices fabricated using TMCs, crystals of GeSePbx (x=0, 0.02, 0.04) were grown by direct vapor transport technique. The structural and electrical properties of the grown crystals were determined using various techniques. The heterojunction made using TMCs with some lattice mismatch have been reported to provide good rectification [10].To explore the rectification properties of such heterojunctions; devices were fabricated using GeSePbx / SnSe, and its current-voltage characteristics have been analyzed. Since the series resistance and ideality play an important role in the functioning of any devices, the diode parameters were analyzed using three different methods.

## EXPERIMENTAL DETAILS AND CHARACTERIZATIONS

Crystals of $GeSePb_x$ (x=0, 0.02, 0.04) were grown by DVT method by taking stoichiometric proportion of constituent elements in quartz ampoules evacuated to around $10^{-6}$ Torr and maintaining them at two different temperature zones. The structure of Crystals of $GeSePb_x$ (x=0, 0.02, 0.04) combination was portrayed by powder X-ray diffraction with the help of Rigaku Ultima IV powder X-ray diffractometer utilizing Cu(kα) radiation. Since the primary purpose of enthusiasm for the present work was examining the electrical properties of the as developed crystals, Hall Effect estimation was completed utilizing the Lakeshore 7504 Hall effect measurement system and estimations were taken at magnetic field 0-3kG, with the assistance of which a few properties of the crystals were contemplated which included the resistivity, carrier concentration and mobility of the crystals. Measurements were taken after the Van der Pauw geometry. Heterojunction interfaces were fabricated by thermally evaporating SnSe spots on to the grown crystals; which were later on subjected to room temperature I-V measurements using Keithley 4200 SCS.

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# Correlating growth mechanism and morphology in Cu-TCNQ organometallic complex: A microscopic study

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ABSTRACT

The structure-property correlation in the Cu-TCNQ organometallic complex is very important for explaining its unusual electrical, optical and magnetic properties. Consequently several morphological studies and their correlation with the properties of these materials can be found in the literature, although no systematic study of various morphologies with growth conditions and their correlation has been reported to the best of our knowledge. Therefore in this manuscript the interconversion of various morphologies is reported using electron and probe microscopies. A conventional Cu TEM grid acted as the copper source to form a Cu-TCNQ complex and the complex, which formed at the surface of the TEM grid. The complex thus prepared was characterized by FTIR and Raman spectroscopic techniques. The shifting of–C≡N from 2221 $cm^{-1}$ (TCNQ) to 2201 $cm^{-1}$ indicates formation of a complex and the identical nature of IR spectra in two phases indicates that they are polymorphs. The morphologies of Cu-TCNQ were followed through FE-SEM and TEM studies. Various morphologies such as needle, square tube, platelet etc. were observed as a function of time. A distinct transition from needle to platelet morphology was observed as the complex grew. The conductance of various morphologies in phase-I as well as phase-II were also measured and compared by Spreading Resistance Imaging (SRI) at different bias voltage i.e. 1 V, 3 V and 5 V.

## 1. Introduction

The organic semiconducting organometallic complexes of TCNQ (7, 7, 8, 8-tetracynoquinodimethane) molecule with transition metals such as copper, silver, nickel, manganese, iron and cobalt (Clérac et al., 2003; Harris et al., 2006; Heintz et al., 1999; Pace et al., 1982; Shi et al., 2010; Shields, 1985; Vickers et al., 2005) etc. have attracted extensive attention because of their potential applications in electrical (Sun et al., 1997; Zhiyong et al., 2005), optical (Xiao et al., 2008) and magnetic devices (Clérac et al., 2003). Among all these organometallic complexes, the Cu-TCNQ complex is the most important representative of this class due to their exceptional conductivity, electrical switching (Potember et al., 1979), photocatalytic properties (Pearson et al., 2012) and field emission application (Liu et al., 2010; Liu et al., 2005a). The Cu-TCNQ organometallic complexes have been synthesized by various methods such as chemical process (Heintz et al., 1999), spontaneous electrolysis process (Zhou et al., 2008), solution process (Liu et al., 2005b), vacuum vapour deposition (Cao et al., 2005), solid–solid transformation (Neufeld et al., 2003), metal-diffusion methods (Capitán et al., 2016) and vapour-solid route (Xiao et al., 2007) etc. Various morphologies including nanowire (Liu et al., 2005a; Xiao et al., 2007), nanotubes (Liu et al., 2010), nano-rod (Neufeld et al., 2005), nano-needles, platelet (Heintz et al., 1999), flower structure (Ji et al., 2010; Liu et al., 2005b), dendrites (Shields, 1985) and solid film (Liu et al., 1996) etc. has been reported. The corrosion-crystallization process (Duan et al., 1993) and reduction of TCNQ into $TCNQ^{-}$ during the electrochemical process (Harris et al., 2006) are the two most significant growth mechanisms reported. During fabrication of the organometallic complexes, the morphologies of fabricated products can be controlled through the reaction time, temperature and substrate or reactants (Duan et al., 1993; Liu et al., 1996). Two distinct polymorphs of Cu-TCNQ have been reported in the literature, termed phase I (kinetically favoured) and phase II (thermodynamically favoured) (Heintz et al., 1999). Generally, kinetically favoured phase I gives the rod or wire like morphology, whereas platelet morphology appears in phase II (Liu et al., 2009). However, kinetically favoured phase I shows more

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# Sonochemical synthesis of 2,3-dihydro-4(1*H*)-quinazolinones and 1-amidoalkyl-2-naphthols using magnetic nanoparticle-supported ionic liquid as a heterogeneous catalyst

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**Abstract** Ultrasound-promoted synthesis of 2,3-dihydro-4(1*H*)-quinazolinones and 1-amidoalkyl-2-naphthols were carried out using magnetic nanoparticle-immobilized ionic liquid (IL@MNP) as a magnetically separable catalyst. Ultrasound accelerates the reaction at ambient temperature making the protocol clean, simple and greener compared to conventional procedures. The catalyst showed high activity and stability during the reaction. The heterogeneous nature of the catalyst enabled easy recovery through an external magnet and it was reused up to six times without the loss of its activity. The synergistic effect of IL@MNP and ultrasound facilitate the reaction with excellent isolated yield in a shorter reaction time.

**Keywords** Ultrasound · Green chemistry · Heterogeneous catalyst · Magnetic nanoparticle

**Electronic supplementary material** The online version of this article (doi:10.1007/s11164-017-3093-2) contains supplementary material, which is available to authorized users.

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# Solution-Processed Nanocrystalline PbS on Paper Substrate with Pencil Traced Electrodes as Visible Photodetector

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**Abstract.**Paper-based PbS photodetector sensitive in the visible spectrum is reported. Nanocrystalline PbS-on-paper devices are fabricated by a spin coating method on white paper (300 GSM) from a methanolic precursor solution. Photodetector cells of gap 0.2 cm and length 0.5 cm are prepared by drawing contacts by monolithic cretacolor 8B pencil. X-ray diffractometer confirmed the deposition of nanocrystalline PbS films with 14 nm crystallites. The SEM illustrated the uniform coating of nanocrystalline PbS thin films on cellulose fibres of papers having an average thickness of fibres are 10 μm. The linear J-V characteristics in dark and under illumination of light using graphite trace on nanocrystalline PbS-on-paper shows good ohmic contact. The resistivity of pencil trace is 30 Ω·cm. Spectral response measurements of photodetector reveal the excellent sensitivity from 400 to 700 nm with a peak at 550 nm. The best responsivity anddetectivity are 0.7 A/W and 1.4 X $10^{12}$ Jones respectively. These paper-based low-cost photodetectors devices have fast photoresponse and recovery without baseline deviation.

**Keywords:**Nanocrystalline PbS, spin coated, visible photodetector
**PACS:** 68.65.-k, 68.55.-a, 73.50.-h

## INTRODUCTION

In the recent years there has been surge of interest [1-3] in paper-based sensors and devices since they are potentially low-cost, light weight, flexible, foldable and easily disposable. Paper is basically 3-dimensional hierarchical arrangement of cellulose fibres resulting in unique porous morphology. Paper sensors for strain [4], gas [5], glucose [6] and radiation [7-9] have been reported. Supercapacitors [10], batteries [11] and fuel cells [12] as paper energy devices have also been investigated. Paper-based microfluidic devices (μPAD) [13] for point-of-care diagnostic applications have been also devised. The studies on paper-based photodetectors (PPDs) are very few [7-9]. Gimenez et al [7] were first to report ZnO UV sensor on paper from suspension. Kiasari et al [8] fabricated ZnO PPD from nano ink for detection of UV radiation. He et al [9] reported flexible PPD made from PbS quantum dots (QDs) with pencil graphite contacts for sensing red light. PbS QDs were spin coated on stone paper and treated with Au nanocrystals to improve detectivity of PPD up to$10^{10}$ Jones for 650 nm light.

Easiest and inexpensive way of making electrical contacts on paper is by drawing pencil traces of graphite [2]. When pressure is applied to a pencil for drawing, graphite flakes deposit and adhere to the cellulosic matrix of paper creating conducting paths. Pencil tracings are chemically stable and heat-resistant. Hence, now-a-days such contacts are being used frequently in development of paper-based sensors [2].

Lead sulphide (PbS) is a IV-VI group semiconductor with a narrow band gap of 0.41 eV (at 300 K) having extraordinary size dependent properties at Nano scale. PbS has a large excitionic Bohr radius of 18 nm because of high dielectric constant 17.2 and low effective mass of electrons (≈0.1me). Thus, the band gap of PbS nanoparticles can be easily tuned from 0.41 (bulk) to 4 eV by selecting appropriate size [14]. Recently, Vankhade et al [15] have

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# Glycoluril: A heterogeneous organocatalyst for oxidation of alcohols and benzylic $sp^3$ carbons

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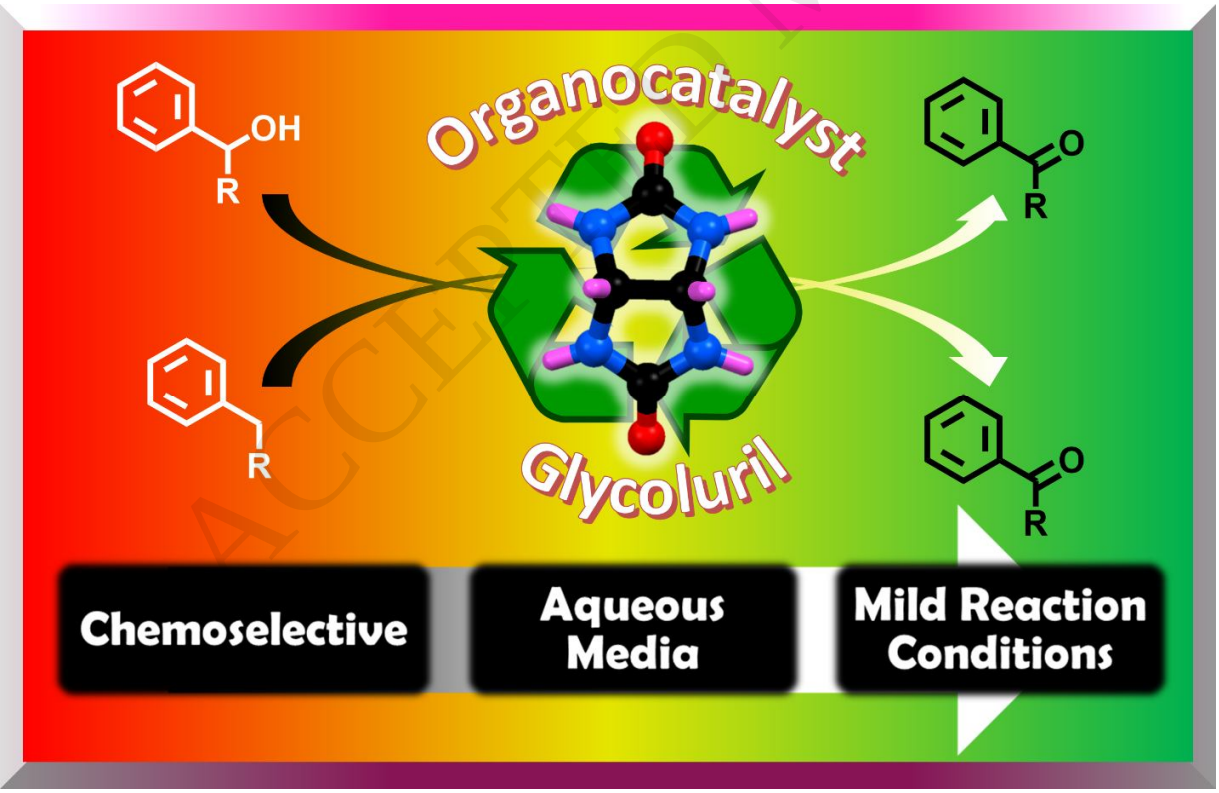
## Graphical abstract



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# Hydrogenation of furfural with nickel nanoparticles stabilized on nitrogen-rich carbon core-shell and its transformations for the synthesis of γ-valerolactone in aqueous conditions

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**Abstract**

In this article, we report the synthesis of nitrogen-rich carbon layer encapsulated Ni(0) nanoparticles as a core-shell structure (Ni@N/C-g-800) for the catalytic hydrogenation of furfural to furfuryl alcohol. The nickel nanoparticles were stabilized by the nitrogen-rich graphitic framework, which formed during the agitation of nickel acetate impregnated cucurbit[6]uril surface in reducing atmosphere. Further, the catalyst was characterized using various physicochemical methods such as P-XRD, Raman, FE-SEM, HR-TEM, XPS, BET-surface area, $CO_2$-TPD, ICP and CHN analysis. The nitrogen-rich environment of the solid support with metallic Ni nanoparticles was found to be active and selective for the catalytic hydrogenation of furfural with molecular $H_2$ in an aqueous medium at 100 $^oC$. To understand the reaction mechanism, DRIFT study was performed which revealed that the C=O bond is activated in the presence of a catalyst. In addition, we have extended our methodology towards the synthesis of "Levulinic acid" and "γ-valerolactone", by successive hydrolysis and hydrogenation of furfuryl alcohol and levulinic acid respectively in an aqueous medium. Moreover, the

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# Nitrogen-rich graphitic-carbon stabilized cobalt nanoparticles for chemoselective hydrogenation of nitroarenes at milder conditions†

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Herein, we report the synthesis of nitrogen-rich graphitic-carbon supported cobalt nanoparticles and their applications for the hydrogenation of various substituted nitroarenes. The aforementioned catalyst was synthesized by chelation of cobalt(II)acetate with cucurbit[6]uril unit and pyrolysis under argon atmosphere. The synthesized catalyst was characterized using various physicochemical techniques. The catalyst was very active, robust, and reusable, thus allowing selective hydrogenation of substituted nitroarenes with molecular hydrogen in a water–tetrahydrofuran solvent at 50 °C. In all cases excellent conversion and selectivity were observed with very high turnover frequency (up to 14 117 $h^{-1}$).

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## Introduction

Since the first hydrogenation reaction by Sabatier in 1910, it has been used as a unique route in organic synthesis for producing various chemicals and intermediates at production scales.[1–3] However, this apparently simple looking reaction requires careful selection of a catalyst to activate hydrogen across the π-bond with minimum possible energy inputs. Modern organic synthesis, catalytic hydrogenation reactions[4] routinely carried out by using different precious[5] (Pd, Pt, Ir, Rh, Ru, Re) and non-precious[6] (Fe, Co, Ni, *etc.*) transition metals along with a suitable hydrogen source ($H_2$, $NaBH_4$, *etc.*). However, until now Pd/C has been the most elegant industrial catalyst used for the hydrogenation reaction,[7,8] but due to its very high activity, it leads to poor selectivity of the desired product. Hence, the development of alternative catalysts which surpass disadvantages of Pd is required, and to this cause earth-abundant, non-precious cheaper metals can serve that purpose. Among non-precious metals, nickel-based catalysts are mostly used for the hydrogenation of many functional groups.[9–12] However, nickel catalysts are very sensitive, delicate to control, require very harsh reaction conditions, and end with low selectivity and recyclability.[9] Similarly, iron catalysts also possess these similar disadvantages.[13] Further, with cobalt catalysts, their synthesis and utility are challenging and require harsh reaction conditions to reduce them. Many efforts have been made to use cobalt as an active catalyst, and one such attempt reported that the activity could be enhanced by synthesizing the catalyst by calcination of a suitable cobalt precursor at a high temperature.[9] Moreover, when evaluating nickel, iron, and cobalt, cobalt catalysts are catalytically more efficient and have been extensively used for hydrogenations in the past few years.[9,12] Further, it is known that the activity of a cobalt catalyst depends on the particle size, nature of support, and solvent used for a reaction.[14] Moreover, it was reported that larger particle sizes of cobalt (≥10 nm) are the most active because smaller particles can easily oxidize in the presence of air.[14] The nature and surface of the solid support also play a significant role towards metal dispersion and particle size during impregnation.[14,15] While discussing the solid support, nitrogen-doped heterogeneous supports were extensively used for stabilizing the metal particles and better metal dispersion. Furthermore, recent literature reports reveal that nitrogen-containing graphitic carbon supports are worthwhile because they deliver better chemical, electrical, and surface related properties.[16–20] Nitrogen-rich supports also help heterolytic hydrogen cleavage at milder conditions.[15]

Selective hydrogenation of nitroarenes is highly important for delivering substituted amines which increase gradually and provide essential feedstocks for chemical, pharmaceuticals, pesticides, dyes, pigments, and agrochemical industries

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†Electronic supplementary information (ESI) available: All the detailed procedures, analytical data and NMR ($^1H$ and $^{13}C$) spectra. See DOI: 10.1039/c7qi00772h



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# Cycloaddition reaction of spiro-epoxy oxindole with $CO_2$ at atmospheric pressure using deep eutectic solvent

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**Abstract**

Developing a strategy to synthesize an unprecedented and previously unknown organic molecule is especially appealing. The design, synthesis and development of a new class of spiro-cyclic carbonates are reported. An efficient process involving the cycloaddition reaction of spiro-epoxyoxindoles with $CO_2$ [balloon] has been demonstrated using deep eutectic solvent [DES]. The reaction can be carried out under mild reaction conditions to afford desired spiro-cyclic carbonates in excellent yields [up to 98%]. The product could be separated easily and the DES was reusable for four times with retention of its activity.

**Keywords** Carbon dioxide, Deep eutectic solvent, Spiro-epoxy oxindole, Spiro-cyclic carbonates.

FULL PAPER

# Efficient Solvent Free $CO_2$ Fixation Reactions with Epoxides Under Mild Conditions by Mixed Ligand Zn(II) MOFs

Parth Patel,[a][c]† Bhavesh Parmar,[b][d]† Rukhsana I. Kureshy,[a][d] Noor-ul H. Khan*[a][c][d] and Eringathodi Suresh*[b][d]

Dedication ((optional))

**Abstract:** Mixed ligand 3D/2D Zn-MOFs {[Zn(**BDC**)(**L1**)].xG}$_n$ (**ZnMOF-1**) and {[Zn(**IPA**)(**L2**)]}$_n$ (**ZnMOF-2**) were synthesized using versatile synthetic routes including green mechanochemical (grinding) reaction. Chemical/ thermal stability, phase purity and characterization of both ZnMOFs synthesized by different approaches were established by various analytical methods. Both ZnMOFs can be used as a highly active solvent free binary catalyst for $CO_2$ cycloaddition with epoxides under ambient reaction condition of 1 atm pressure and RT/40 °C, in the presence of the co-catalyst n-$Bu_4NBr$ (TBAB). The yield, recyclability, and stability of **ZnMOF-1** as a potential catalyst towards epoxide to cyclic carbonate conversion are found to be excellent at ambient conditions. On the basis of literature and experimental inferences, a rationalized mechanism mediated by the zinc center of ZnMOFs for the $CO_2$-epoxide cycloaddition reaction has been proposed. To the best of our knowledge, very few MOF based catalysts have been reported to realize conversion of $CO_2$ to useful products under similar mild conditions. In the present investigation, *i.e.*, from catalyst preparation by green mechano-chemical synthesis to catalysis at ambient solvent free condition was performed by minimum energy utilization.

## Introduction

Sequestration of atmospheric $CO_2$ discharged as a by-product from industries/power plants and its conversion into value added product is a step towards resource utilization and maintaining the greenhouse emissions. $CO_2$ has attracted the attention of researchers in recent times as carbon source for several organic transformations because it is an abundant renewable and safe C1 feedstock which is easy to handle and enjoy properties like nonflammability and nontoxicity.[1-5] Transformations of $CO_2$, such as $CO_2$ fixation reactions with epoxides yielding five-membered cyclic carbonates has been well-established by various homo- and heterogeneous catalysts including metal oxides, coordination complexes and supported ionic liquids.[6-22] Green catalytic conversion of C1 feedstock profusely available from combustions to value added cyclic carbonates has potential application as a raw material for cosmetics, intermediates in the synthesis of ethylene glycol, acyclic carbonates, pharmaceuticals, polymers and as an electrolyte in batteries.[23-28] Homogeneous catalysts have been extensively employed for the catalytic generation of cyclic carbonates from epoxides. However, limitations of the separation of the product and catalyst recycling is a real concern in the homogeneous catalytic reaction. These limitations have been tackled to a great extent by the utilization of heterogeneous catalysts which includes metal oxides, coordination complexes, zeolites and functional polymers, etc. which displayed lower activity under ambient conditions or leaching.[13-22]

Coordination polymers (CPs) / Metal-organic Frameworks (MOFs) is an emerging class of materials in which the metal nodes or metal clusters are linked by multitopic organic ligands generating diverse network topology.[29-33] Design and tunability of the network topology and porosity, thermal and chemical stability and high surface area of MOF are well acknowledged and have potential application in gas adsorption and storage, molecular separation, drug delivery, and molecular sensing.[34-39] Further, the interest increases towards CPs/MOFs in recent few years as a heterogeneous catalyst due to the above-mentioned attributes. Well defined and uniformly distributed active catalytic sites provided by the metal nodes, presence of pores or channels for the selectivity of the substrates with recovery and recyclability by the heterogenous nature often advocates the efficiency of CPs/MOFs as a heterogeneous catalyst.[40-45] The first MOF catalyst (MOF-5) for the cycloaddition reaction was reported by Han *et.al.*[46] afterwards MOFs with different metal cations have been explored for the synthesis of cyclic carbonates.[47-55] Pioneering work for the catalytic conversion of $CO_2$ to cyclic carbonates *via* epoxide substrates using MOFs as a catalyst has been demonstrated under versatile reaction conditions by Dae Won Park and his group.[56-63] A binary catalytic system with a Lewis acid metal center in the presence of nucleophile partaking with easy leaving halide anion *via* a synergistic pathway endorses the efficiency of the synthesis of cyclic carbonates from $CO_2$-epoxide cycloaddition reactions. In addition to the chemical and thermal stability, CPs/MOFs relishing strategies such as good $CO_2$ adsorption capacity and well defined uniformly distributed

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# Amine-functionalized Zn(II) MOF as an efficient multifunctional catalyst for $CO_2$ utilization and sulfoxidation reaction†

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Herein, a zinc(II)-based 3D mixed ligand metal organic framework (MOF) was synthesized *via* versatile routes including green mechanochemical synthesis. The MOF $\{[Zn(ATA)(L)\cdot H_2O]\}_n$ (**ZnMOF-1-NH$_2$**) has been characterized by various physico-chemical techniques, including SCXRD, and composed of the bipyridyl-based Schiff base (*E*)-*N*′-(pyridin-4-ylmethylene)isonicotinohydrazide (L) and 2-amino-terephthalic acid ($H_2$ATA) ligands as linkers. The MOF material has been explored as a multifunctional heterogeneous catalyst for the cycloaddition of alkyl and aryl epoxides with $CO_2$ and sulfoxidation reactions of aryl sulfides. The influence of various reaction parameters is examined to optimize the performance of the catalytic reactions. It is found that solvent-free catalytic reaction conditions offer good catalytic conversion in the case of cyclic carbonates, and for sulfoxide, good conversion and selectivity are achieved in the presence of DCM as a solvent medium under ambient reaction conditions. The chemical and thermal stability of the catalyst are excellent and it is active for up to four catalytic cycles without significant loss in activity. Furthermore, based on the catalytic activity and structural evidence, a plausible mechanism for both catalytic reactions is proposed.

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## Introduction

The quest for green technologies that utilize the $CO_2$ emission from industries and power plants and facilitate sulfoxidation of organic compounds to value-added chemical intermediates by appropriate catalytic reactions is a prime area of research with respect to the greenhouse effect and human healthcare, respectively.[1–3] Recently, the development of adaptable catalysts that promote the transformation of $CO_2$ to cyclic carbonates has increased, which are necessary for a green and sustainable environment and the oxidation of organic sulfides to value-added drug intermediates in the pharmaceutical industry.[4–9] To negate the adverse effects of greenhouse gases, the utilization of $CO_2$ as a chemical feedstock to produce valuable chemicals has been proposed as a sustainable approach. Therefore, significant efforts are currently being devoted to the development of appropriate materials that can selectively capture $CO_2$ and facilitate catalytic conversion to useful products through chemical fixation.[10–14] The coupling reaction of $CO_2$ with epoxides to provide cyclic carbonates in the presence of different catalysts is considered as one of the best strategies for $CO_2$ conversion due to its excellent reactivity and high atom efficiency. Cyclic carbonates are well-known and have significant and extensive applications as aprotic polar solvents, precursors affording polycarbonates, and chemical intermediates in organic synthesis.[15–26] Many homogeneous catalysts have been developed for the cycloaddition reaction of $CO_2$ and epoxides and sulfoxidation reactions with good activity and efficiency.[27–39] However, their complex separation, purification, and recycling in homogenous catalysis severely limit their application in industry. Thus, robust, recyclable multifunctional heterogenous catalysts with good chemical and thermal stability that can function efficiently under mild reaction conditions are necessary.[40] Materials with features such as high surface area and porosity, good adsorption capacity, adequate Lewis/Brønsted acidic or basic sites, and high chemical and thermal stability upon exposure to the reaction conditions including substrates favor efficient heterogenous catalytic reac-

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# Waste eggshell derived calcium oxide and nano-hydroxyapatite biomaterials for the preparation of LLDPE polymer nanocomposite and their thermo mechanical study

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FULL PAPER

# Sustainable Heterogenous Catalysis for $CO_2$ Utilization by Dual Ligand Zn(II)/Cd(II) Metal Organic Framework

Bhavesh Parmar,[a][b] Parth Patel,[c][d] Rukhsana I. Kureshy,[a][c][d] Noor-ul H. Khan,[a][c][d] and Eringathodi Suresh*[a][b]

Dedication ((optional))

**Abstract:** Two-dimensional Zn(II)/Cd(II) based dual ligand Metal-Organic Frameworks $\{[M(\mathbf{CHDC})(\mathbf{L})].H_2O\}_n$ involving 4-pyridyl carboxaldehyde isonicotinoylhydrazone (**L**) in combination with flexible 1,4-cyclohexanedicarboxylic acid ($H_2$**CHDC**) as linkers has been synthesized by adaptable synthetic protocols including green mechanochemical (grinding) method. Characterization, chemical/thermal stability, phase purity and solid state luminescent property of both MOFs has been established by various analytical methods. Structural analysis revealed dimeric metal clusters composed of $[M_2(\mathbf{CHDC})_2]_n$ loops doubly pillared by **L** generating a 2D framework. Both MOFs can be used as a highly active solvent free binary catalyst for $CO_2$ cycloaddition with epoxides in the presence of the co-catalyst TBAB with good catalytic conversion up to six catalytic cycles without significant loss of activity. The present investigation demonstrates the application of MOFs as an efficient heterogenous catalyst for $CO_2$ utilization under moderate reaction condition. Based on the single crystal X-ray data, probable mechanism for the cycloaddition reaction has also been proposed.

## Introduction

Industrialization and modern living triggered environmental problems, and environmental protection have become important with air and water pollution causing great threat to both human health and animal species. Due to rapid industrial revolution and human activities in last few decades, emission of the greenhouse gas carbon dioxide ($CO_2$) to the atmosphere is increased in alarming rate which can adversely affect the ecological system including global warming. On account of the easy availability, nontoxicity and renewable nature, the greenhouse gas Carbon dioxide ($CO_2$) has attracted attention as a C1 building block for organic transformations. Intensive ongoing efforts for the efficient utilization of $CO_2$ to value-added chemicals by catalytic reaction has become one of the most urgent tasks in the $CO_2$ research field.[1-7] Nevertheless, the thermodynamic stability and kinetic inertness of $CO_2$ are the major limitations for its conversion at mild conditions.[8-10] Hence, development of new catalytic materials for the selective capture and conversion of $CO_2$ into useful chemicals at ambient condition has gained significant importance.[11-16] Cycloaddition of $CO_2$ to epoxides for generation of cyclic carbonates by a suitable catalytic material is one of the most promising methods for utilization of $CO_2$ to value-added product.[17-24] Cyclic carbonates offer widespread applications as a raw material in fine chemical/ cosmetics, intermediates in the synthesis of ethylene glycol, acyclic carbonates, polymers, as solvent and as an electrolyte in batteries.[25-33]

For catalytic cycloaddition of $CO_2$ with epoxides to generate cyclic carbonates variety of homogenous catalysts such as transition-metal complexes, ionic liquids, organocatalysts, and quaternary ammonium or phosphonium salts, etc. have been extensively studied, but catalyst recycling and product separation issues limit the submission.[34-47] On the other hand, heterogenous catalyst such as metal oxides, zeolites, and functional polymers, have also been developed for the for catalytic conversion of $CO_2$ which often entail high pressure of $CO_2$ and/or high activation temperatures.[48-59] Thus, there is an unrelenting need to develop novel robust materials to absorb $CO_2$ and convert it into value-added chemical as a heterogenous catalyst. Metal–organic frameworks (MOFs) with the following attributes such as well-defined pores, high surface area, functional groups on the linker moiety, unsaturated coordination sites and good thermal and chemical stability have been exploited to meet this challenge and explored its potential as a heterogenous catalyst in $CO_2$ utilization.[18,60] MOFs are well known not only for the aesthetic structural topology but also find promising applications in gas storage/separation, optical properties, magnetism, fluorescence sensing etc.[61-68] In addition to the mentioned application, MOF as a heterogenous catalyst for $CO_2$ conversion at ambient reaction condition is prime area of research contributing towards academic interest and industrial application.[69-77] The field of MOFs as heterogeneous catalysts for chemical fixation $CO_2$ has remained largely untapped and still there is scope for improvement. However, a limited number of MOFs are known for efficient conversion of $CO_2$ under ambient reaction conditions such as atmospheric pressure, low loading of catalyst/cocatalyst and room temperature.[78-89]

On the basis of the above discussions and in continuation of our ongoing research activity,[12,90] herewith presenting two MOFs,

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Inorganic Chemistry Frontiers Accepted Manuscript

# Efficient Heterogeneous Catalysis by Dual Ligand Zn(II)/Cd(II) MOFs for Knoevenagel Condensation Reaction: Adaptable Synthetic Routes, Characterization, Crystal Structure and Luminescence Studies

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Dual ligand MOFs {[Zn(**ADA**)(**L**)]·2$H_2O$}$_n$ **(1)**, {[Cd(**ADA**)(**L**)]·2$H_2O$}$_n$ **(2)** involving Zn(II)/Cd(II) metal centres and flexible 1,3-adamantanediacetic acid ($H_2$**ADA**)/ pyridyl based Schiff base ligand, 4-pyridylcarboxaldehydeisonicotinoylhydrazone (**L**) as linkers have been efficiently synthesized including green mechanochemical methods and characterised by various analytical methods. Crystal structures of both MOFs, luminescence and semiconducting properties have also been investigated. Both materials were exploited for efficient catalytic activity in Knoevenagel condensation reaction for variety of substrates with good yields and recyclability under ambient reaction conditions in aqueous media. Probably the Lewis acidic metal centre and presence of amide functionality in the **L** of the MOFs cooperatively involve in the efficient condensation reaction by these catalytic materials.

## Introduction

Metal-organic frameworks (MOFs) with ordered structures are built from metal ions or metal clusters as nodes with versatile coordination geometry and multidentate organic linkers. The structural and functional tunability of MOFs has caught increasing attention in recent years and turn out to be one of the fastest growing areas in synthetic chemistry and material science. Apparently, MOFs with easily tuned pore features show great promise for targeted applications. Because of their unparalleled structural diversities, uniformly distributed metal centers, high surface area, good chemical/thermal stability, MOFs attribute promising applications in the area of gas storage, separation, $CO_2$ capture, sensors, catalysis etc.[1-11]

As known, the versatile structures of MOFs greatly depend on the adaptable coordination modes of the central metal cations and organic linkers, as well as the reaction conditions.[12] Therefore, designing ligands with suitable functional groups is the key strategy for the construction of MOFs with novel structural features and desired application. Metal ions such as Zn(II) and Cd(II) with $d^{10}$ configuration can adopt different coordination geometries along with judicious choice of ligand moiety has been employed for the construction of luminescent MOFs. Luminescence properties of these materials may be exploited for sensing excimer formation and other processes leading to emission quenching/enhancement making them useful as chemical sensors, including in the detection of hazardous small molecules, like explosives, cations /anions as well as volatile organic compounds (VOCs).[13-14] Ordered extended metal cluster secondary building units (SBUs) composed of carboxylate group along with auxiliary N-donor ligands offers the viability of chemically tuning the bulk electronic properties of the MOF towards new type of semiconductor. For instance, when MOFs with $d^{10}$ (Zn(II), Cd(II)) metal clusters with conjugated carboxylate organic ligands revealed semiconductor behavior. One well documented application of semiconductor is their use as photocatalysts for the degradation of organic pollutants in addition to other optical properties. Based on the hydrolytic/chemical stability, band gap energy as well as photocatalytic activity, MOFs are currently in limelight for degradation of different dye molecules which has relevance in clean environment.[15-21]

In recent years MOF has been explored as a potential heterogeneous catalyst, owing to their well-ordered structures and porosity, designable channel surface and functional groups present in the ligand moiety to attract substrates. Knoevenagel reaction has been widely employed for carbon–carbon bond formation by condensation of aldehydes with active methylene compounds for the synthesis of useful chemicals.[22-27] Variety of catalysts such as amine-functionalized solid

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# Nitrogen-rich graphitic-carbon stabilized cobalt nanoparticles for chemoselective hydrogenation of nitroarenes at milder conditions†

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Herein, we report the synthesis of nitrogen-rich graphitic-carbon supported cobalt nanoparticles and their applications for the hydrogenation of various substituted nitroarenes. The aforementioned catalyst was synthesized by chelation of cobalt(II)acetate with cucurbit[6]uril unit and pyrolysis under argon atmosphere. The synthesized catalyst was characterized using various physicochemical techniques. The catalyst was very active, robust, and reusable, thus allowing selective hydrogenation of substituted nitroarenes with molecular hydrogen in a water–tetrahydrofuran solvent at 50 °C. In all cases excellent conversion and selectivity were observed with very high turnover frequency (up to 14 117 $h^{-1}$).

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## Introduction

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Selective hydrogenation of nitroarenes is highly important for delivering substituted amines which increase gradually and provide essential feedstocks for chemical, pharmaceuticals, pesticides, dyes, pigments, and agrochemical industries

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Organic & Supramolecular Chemistry

# Development and In vitro Anticancer Evaluation of Self-Assembled Supramolecular pH Responsive Hydrogels of Carboxymethyl Chitosan and Polyoxometalate

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Self-assembled supramolecular pH-responsive hydrogels of carboxymethyl chitosan (CMCh) and the trilacunary heteropolytungstate salt $Na_{12}[\alpha\text{-}P_2W_{15}O_{56}].24H_2O$ generating the free polyanion $\mathbf{P_2W_{15}}$ in solution, have been synthesized *via* electrostatic interactions. Benzoyl peroxide (BPO) was used as initiator for grafting poly (methacrylic acid) on polymer skeleton. The developed transparent hydrogels were characterized by scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR), X-ray powder diffraction (XRD) and thermal analysis including thermogravimetric analyses and differential scanning calorimetry (TGA/DSC) and the results confirmed the successful hydrogel formation. The dynamic swelling index and the controlled release pattern of the prepared hydrogels were evaluated at pH 1.2 and 7.4. The maximum swelling index and polyanion release were observed at pH 7.4. Different mathematical models including first order, zero order, Korsmeyer-Peppas model and Higuchi model were applied and suggested that the release of encapsulated $\mathbf{P_2W_{15}}$ follows the super case transport-II mechanism and zero order kinetics. An evaluation of the anticancer activity and cytotoxicity profiling showed that both encapsulated $\mathbf{P_2W_{15}}$ (hydrogel) and free $\mathbf{P_2W_{15}}$ possessed a good, dose-dependent anticancer activity against MCF-7 and Hela cells, with only minimal cytotoxic effects on normal cells (Vero).

## Introduction

Polyoxometalates (POMs) are discrete, anionic, polynuclear metal-oxides of early transition metals in high oxidation states (e.g. $W^{VI}$, $Mo^{VI}$, $V^{V}$) with a large compositional and structural variety, resulting in manifold associated properties.[1] POMs have been studied for potential applications in diverse areas such as catalysis,[2] electrochemistry[3] and material science.[4] Regarding medicinal applications it has been demonstrated that POMs have remarkable anti-diabetic, anti-cancer,[5] anti-bacterial,[6] anti-viral[7] and recently anti-Alzheimer potential as well.[8] As a potential drug candidate, POMs have the capability to be tuned with respect to the biological target, such as their shape, size, composition, charge, solubility, and redox properties.[9] Despite of remarkable biological activities, POMs use is limited probably due to their cytotoxic effects on normal cells. However, this issue can be addressed either by enhancing the cell's specificity to increase cellular uptake or targeted delivery i.e. by encapsulating POMs in biodegradable and biocompatible polymeric networks like carboxymethyl chitosan (CMCh).[10] CMCh is an amphoteric water soluble chitosan derivative possessing pH sensitive property. Because of good biocompatibility and chemical versatility it is used for various purposes like wound healing,[11] bio-imaging,[12] theranostics,[13] *in-vivo* diagnostics,[14] food technology[15] and gene therapy,[16] etc. Beside this, CMCh has got immense attraction of the researchers regarding tissue engineering and drug delivery[17] because of its tremendous properties including water solubility, high moisture retention capability, biodegradability, excellent biocompatibility,[18] anti-fungal[19] and anti-bacterial[20] properties. In CMCh skeleton both basic ($-NH_2$) as well as acidic (–COOH) groups are present. It possesses negative charge at normal physiological pH, while bears positive charge in acidic environment. Generally CMCh is safer and bioactive compared to simple Chitosan.[21] Regarding embedding of POMs, CMCh has already been reported in the literature.[10a]

Hydrogels are three-dimensional hydrophilic polymer networks with the ability to retain water or any biological fluid

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# Preyssler-Pope-Jeannin Polyanions $[NaP_5W_{30}O_{110}]^{14-}$ and $[AgP_5W_{30}O_{110}]^{14-}$: Microwave-Assisted Synthesis, Structure, and Biological Activity

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*Dedicated to Professor Peter Comba on the Occasion of his 65th Birthday*

**Abstract**. The Preyssler-Pope-Jeannin polyanion $[NaP_5W_{30}O_{110}]^{14-}$ (**1**) was prepared by microwave-assisted synthesis in only 2 h with a yield comparable to the reported hydrothermal procedure. The purity of **1** was confirmed by FT-IR and multinuclear NMR ($^{31}P$, $^{183}W$) analysis. The silver(I)-containing analogue $[AgP_5W_{30}O_{110}]^{14-}$ (**2**) was also prepared by hydrothermal (6 d) as well as microwave-based (2 h) procedures. Polyanion **2** was characterized in the solid state by FT-IR, single-crystal XRD, TGA, and elemental analysis and in solution by $^{31}P$ and $^{183}W$ NMR, and ESI-MS. The antiproliferative activities against human cells as well as the antimicrobial properties towards Gram-positive and Gram-negative bacteria were comparatively evaluated for **1** and **2**.

## Introduction

Polyoxometalates (POMs) are discrete anionic metal-oxides of early transition metals in high oxidation states such as $V^V$, $Mo^{VI}$, and $W^{VI}$.[1] POMs have many unique properties that render them of interest for a myriad of applications in diverse areas such as catalysis, magnetism, biomedicine, and materials science.[2] Due to their structural diversity, favorable solubility properties and adjustable stability in biological systems, some POMs have gained interest in medicinal applications, particularly in recent years.[3] Although the molecular mechanism of action is largely unknown, many biological activities of POMs can be attributed to the selective blocking of enzymes at the cell surface.[4] POMs and their inorganic-organic hybrids with antibacterial, antidiabetic, antiproliferative, antiprotozoal, and antiviral activity have been reported.[5] Very recently, the potential of POMs to act as radiosensitizers for treating hypoxic tumors has been recognized.[6]

POMs are usually synthesized via condensation of simple metalate ions in aqueous acidic medium. In such reactions the pH, concentration, temperature, and ionic strength are important parameters.[1] Controlled base hydrolysis can lead to the formation of mono-, di-, tri-, or even hexa-lacunary (defect) precursors which can act as inorganic polydentate ligands for all kinds of metal ions, leading to a large variety of novel POM structures.[1,2] Also, some plenary POMs can act as host templates and encapsulate metal ions, leading to "host-guest" systems. Two common examples of such POM host structures are the cyclic $[P_8W_{48}O_{184}]^{40-}$ ($\{P_8W_{48}\}$) and the donut-shaped $[NaP_5W_{30}O_{110}]^{14-}$ ($\{NaP_5W_{30}\}$).[7] $\{P_8W_{48}\}$ was first reported in 1985 by *Contant* and *Tézé*,[7b] and in 2005 some of us reported the encapsulation of 20 copper(II) ions into the cavity of $\{P_8W_{48}\}$.[8] On the other hand, $\{NaP_5W_{30}\}$ was first reported by *Preyssler* in 1970 and formulated as $(WO_3)_{18}(PO_4)_3H(NH_4)_3$.[7a] In 1985 *Pope* and *Jeannin* reported the actual formula and structure, as based on single crystal XRD.[9] These authors also discovered that the central cavity of $\{NaP_5W_{30}\}$ encapsulates a tightly bound $Na^+$ ion guest. In 1993, Pope's group demonstrated the exchange of $Na^+$ by lanthanide ions.[10] This work also inspired others to investigate the host-guest properties of $\{NaP_5W_{30}\}$.[11] More recently, $Ca^{2+}$, $Bi^{3+}$, and even two $K^+$ ions have been encapsulated in this POM host,[12] as well as $Ag^+$.[13]

$\{NaP_5W_{30}\}$ is not just of interest in terms of exchanging the central $Na^+$ ion, but it has also been used to form inorganic-

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# Gravitational collapse in (2+1)-dimensional Eddington-inspired Born-Infeld gravity

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We study here the gravitational collapse of dust in $(2+1)$-dimensional spacetimes for the formation of black holes (BH) and naked singularities (NS) as final states in a modified theory of gravity, with vanishing cosmological constant. From the perspective of cosmic censorship, we investigate the collapse of a dust cloud in Eddington-inspired Born-Infeld gravity (EiBI) and compare the results with those of general relativity (GR). It turns out that, as opposed to the general relativistic situation, where the outcome of dust collapse in $(2+1)$ dimensions is always a naked singularity, the EiBI theory has a certain range of parameter values that avoid the naked singularity. This indicates that a $(3+1)$-dimensional generalization of these results could be useful and worth examining. Finally, using the results here, we show that the singularity avoidance through homogeneous bounce in cosmology in this modified gravity is not stable.

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## I. INTRODUCTION

Several studies on gravitational collapse scenarios in $(2+1)$ dimensional spacetimes have been carried out by various authors [1–5]. These provide interesting toy models which may give important insights from the perspective of quantum gravity. This is because in $(2+1)$ dimensional spacetimes there is no gravity outside the matter. Also the spacetime metric is always conformally flat as the Weyl tensor vanishes identically everywhere. On the other hand, the situation in $(3+1)$ and higher dimensions is far more complicated compared to this [5,6].

To investigate the final collapse outcome in $(2+1)$ dimensional collapse, let us consider the geometry of trapped surfaces in this case. In general, for a spherically symmetric spacetime, the equation for apparent horizon is given by $g^{\mu\nu}\partial_\mu R\partial_\nu R = 0$, where $g_{\mu\nu}$ is the metric tensor, and $R$ is the area radius. In GR, the equation of an apparent horizon can alternatively be expressed as $F/R^{N-3} = 1$, where $N$ is the dimension of the spacetime, and $F$ is the mass function for the collapsing cloud [5]. Thus, we see that the equation of apparent horizon in the $(2+1)$ case is given by $F(t,r) = 1$ for the gravitational collapse of any general matter field.

It is therefore interesting to note that, in $(2+1)$-dimensional GR, the geometry of trapped surfaces is completely determined by the mass function alone of the cloud, and is independent of the area radius of the collapsing shells. If the mass function of the collapsing configuration is bounded from above, with say $F(t,r) < 1$ for the range $-\infty < t < t_s$ and $0 < r < r_b$, where $t_s$ and $r_b$ are the singularity time and the boundary of the cloud respectively, we then see that the trapping does not occur during the collapse and the complete singularity that forms as the collapse end state is necessarily visible to an outside observer. This situation is strikingly different from four or higher-dimensional spherically symmetric spacetimes, where a massive singularity is always necessarily trapped within an apparent horizon.

A very interesting subcase of this situation is that of $(2+1)$ dimensional dust collapse in GR, where $F(t,r) = F(r)$ gives the equation for the apparent horizon, with the mass function having no time dependence in this case [5]. Here we see that the initial mass of the collapsing cloud completely determines the final outcome in terms of BH or NS. Clouds with small enough mass always form a visible singularity, whereas for larger masses a trapped region is present at all epochs. However, as demanded by the regularity conditions, we must avoid trapped surfaces on the initial surface $t = t_i$, where the collapse commences. In that case, for the dust collapse case, there are no trapped surfaces developing at all at any other later epochs until the singularity formation, and as a result the $(2+1)$ dimensions dust collapse always necessarily produces a visible naked singularity (NS), as opposed to the BH/NS phases obtained in usual four-dimensional dust collapse.

However, the situation may be different in modified theories of gravity. In general, most of the modified gravity theories significantly differ from GR in strong curvature regimes. Therefore, in such regimes, the dynamics of gravitational collapse, the formation of spacetime singularities, trapped surfaces, the formation and dynamics of

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# Faculty of Medical Sciences

# Global, regional, and national age-sex-specific mortality and life expectancy, 1950–2017: a systematic analysis for the Global Burden of Disease Study 2017

GBD 2017 Mortality Collaborators*

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## Summary

**Background** Assessments of age-specific mortality and life expectancy have been done by the UN Population Division, Department of Economics and Social Affairs (UNPOP), the United States Census Bureau, WHO, and as part of previous iterations of the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD). Previous iterations of the GBD used population estimates from UNPOP, which were not derived in a way that was internally consistent with the estimates of the numbers of deaths in the GBD. The present iteration of the GBD, GBD 2017, improves on previous assessments and provides timely estimates of the mortality experience of populations globally.

**Methods** The GBD uses all available data to produce estimates of mortality rates between 1950 and 2017 for 23 age groups, both sexes, and 918 locations, including 195 countries and territories and subnational locations for 16 countries. Data used include vital registration systems, sample registration systems, household surveys (complete birth histories, summary birth histories, sibling histories), censuses (summary birth histories, household deaths), and Demographic Surveillance Sites. In total, this analysis used 8259 data sources. Estimates of the probability of death between birth and the age of 5 years and between ages 15 and 60 years are generated and then input into a model life table system to produce complete life tables for all locations and years. Fatal discontinuities and mortality due to HIV/AIDS are analysed separately and then incorporated into the estimation. We analyse the relationship between age-specific mortality and development status using the Socio-demographic Index, a composite measure based on fertility under the age of 25 years, education, and income. There are four main methodological improvements in GBD 2017 compared with GBD 2016: 622 additional data sources have been incorporated; new estimates of population, generated by the GBD study, are used; statistical methods used in different components of the analysis have been further standardised and improved; and the analysis has been extended backwards in time by two decades to start in 1950.

**Findings** Globally, 18·7% (95% uncertainty interval 18·4–19·0) of deaths were registered in 1950 and that proportion has been steadily increasing since, with 58·8% (58·2–59·3) of all deaths being registered in 2015. At the global level, between 1950 and 2017, life expectancy increased from 48·1 years (46·5–49·6) to 70·5 years (70·1–70·8) for men and from 52·9 years (51·7–54·0) to 75·6 years (75·3–75·9) for women. Despite this overall progress, there remains substantial variation in life expectancy at birth in 2017, which ranges from 49·1 years (46·5–51·7) for men in the Central African Republic to 87·6 years (86·9–88·1) among women in Singapore. The greatest progress across age groups was for children younger than 5 years; under-5 mortality dropped from 216·0 deaths (196·3–238·1) per 1000 livebirths in 1950 to 38·9 deaths (35·6–42·83) per 1000 livebirths in 2017, with huge reductions across countries. Nevertheless, there were still 5·4 million (5·2–5·6) deaths among children younger than 5 years in the world in 2017. Progress has been less pronounced and more variable for adults, especially for adult males, who had stagnant or increasing mortality rates in several countries. The gap between male and female life expectancy between 1950 and 2017, while relatively stable at the global level, shows distinctive patterns across super-regions and has consistently been the largest in central Europe, eastern Europe, and central Asia, and smallest in south Asia. Performance was also variable across countries and time in observed mortality rates compared with those expected on the basis of development.

**Interpretation** This analysis of age-sex-specific mortality shows that there are remarkably complex patterns in population mortality across countries. The findings of this study highlight global successes, such as the large decline in under-5 mortality, which reflects significant local, national, and global commitment and investment over several decades. However, they also bring attention to mortality patterns that are a cause for concern, particularly among adult men and, to a lesser extent, women, whose mortality rates have stagnated in many countries over the time period of this study, and in some cases are increasing.

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# Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017

GBD 2017 Disease and Injury Incidence and Prevalence Collaborators*


## Summary

**Background** The Global Burden of Diseases, Injuries, and Risk Factors Study 2017 (GBD 2017) includes a comprehensive assessment of incidence, prevalence, and years lived with disability (YLDs) for 354 causes in 195 countries and territories from 1990 to 2017. Previous GBD studies have shown how the decline of mortality rates from 1990 to 2016 has led to an increase in life expectancy, an ageing global population, and an expansion of the non-fatal burden of disease and injury. These studies have also shown how a substantial portion of the world's population experiences non-fatal health loss with considerable heterogeneity among different causes, locations, ages, and sexes. Ongoing objectives of the GBD study include increasing the level of estimation detail, improving analytical strategies, and increasing the amount of high-quality data.

**Methods** We estimated incidence and prevalence for 354 diseases and injuries and 3484 sequelae. We used an updated and extensive body of literature studies, survey data, surveillance data, inpatient admission records, outpatient visit records, and health insurance claims, and additionally used results from cause of death models to inform estimates using a total of 68 781 data sources. Newly available clinical data from India, Iran, Japan, Jordan, Nepal, China, Brazil, Norway, and Italy were incorporated, as well as updated claims data from the USA and new claims data from Taiwan (province of China) and Singapore. We used DisMod-MR 2.1, a Bayesian meta-regression tool, as the main method of estimation, ensuring consistency between rates of incidence, prevalence, remission, and cause of death for each condition. YLDs were estimated as the product of a prevalence estimate and a disability weight for health states of each mutually exclusive sequela, adjusted for comorbidity. We updated the Socio-demographic Index (SDI), a summary development indicator of income per capita, years of schooling, and total fertility rate. Additionally, we calculated differences between male and female YLDs to identify divergent trends across sexes. GBD 2017 complies with the Guidelines for Accurate and Transparent Health Estimates Reporting.

**Findings** Globally, for females, the causes with the greatest age-standardised prevalence were oral disorders, headache disorders, and haemoglobinopathies and haemolytic anaemias in both 1990 and 2017. For males, the causes with the greatest age-standardised prevalence were oral disorders, headache disorders, and tuberculosis including latent tuberculosis infection in both 1990 and 2017. In terms of YLDs, low back pain, headache disorders, and dietary iron deficiency were the leading Level 3 causes of YLD counts in 1990, whereas low back pain, headache disorders, and depressive disorders were the leading causes in 2017 for both sexes combined. All-cause age-standardised YLD rates decreased by 3·9% (95% uncertainty interval [UI] 3·1–4·6) from 1990 to 2017; however, the all-age YLD rate increased by 7·2% (6·0–8·4) while the total sum of global YLDs increased from 562 million (421–723) to 853 million (642–1100). The increases for males and females were similar, with increases in all-age YLD rates of 7·9% (6·6–9·2) for males and 6·5% (5·4–7·7) for females. We found significant differences between males and females in terms of age-standardised prevalence estimates for multiple causes. The causes with the greatest relative differences between sexes in 2017 included substance use disorders (3018 cases [95% UI 2782–3252] per 100 000 in males *vs* 1400 [1279–1524] per 100 000 in females), transport injuries (3322 [3082–3583] *vs* 2336 [2154–2535]), and self-harm and interpersonal violence (3265 [2943–3630] *vs* 5643 [5057–6302]).

**Interpretation** Global all-cause age-standardised YLD rates have improved only slightly over a period spanning nearly three decades. However, the magnitude of the non-fatal disease burden has expanded globally, with increasing numbers of people who have a wide spectrum of conditions. A subset of conditions has remained globally pervasive since 1990, whereas other conditions have displayed more dynamic trends, with different ages, sexes, and geographies across the globe experiencing varying burdens and trends of health loss. This study emphasises how global improvements in premature mortality for select conditions have led to older populations with complex and potentially expensive diseases, yet also highlights global achievements in certain domains of disease and injury.


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# Global, regional, and national disability-adjusted life-years (DALYs) for 359 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017

*GBD 2017 DALYs and HALE Collaborators**

## Summary

**Background** How long one lives, how many years of life are spent in good and poor health, and how the population's state of health and leading causes of disability change over time all have implications for policy, planning, and provision of services. We comparatively assessed the patterns and trends of healthy life expectancy (HALE), which quantifies the number of years of life expected to be lived in good health, and the complementary measure of disability-adjusted life-years (DALYs), a composite measure of disease burden capturing both premature mortality and prevalence and severity of ill health, for 359 diseases and injuries for 195 countries and territories over the past 28 years.

**Methods** We used data for age-specific mortality rates, years of life lost (YLLs) due to premature mortality, and years lived with disability (YLDs) from the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2017 to calculate HALE and DALYs from 1990 to 2017. We calculated HALE using age-specific mortality rates and YLDs per capita for each location, age, sex, and year. We calculated DALYs for 359 causes as the sum of YLLs and YLDs. We assessed how observed HALE and DALYs differed by country and sex from expected trends based on Socio-demographic Index (SDI). We also analysed HALE by decomposing years of life gained into years spent in good health and in poor health, between 1990 and 2017, and extra years lived by females compared with males.

**Findings** Globally, from 1990 to 2017, life expectancy at birth increased by 7·4 years (95% uncertainty interval 7·1–7·8), from 65·6 years (65·3–65·8) in 1990 to 73·0 years (72·7–73·3) in 2017. The increase in years of life varied from 5·1 years (5·0–5·3) in high SDI countries to 12·0 years (11·3–12·8) in low SDI countries. Of the additional years of life expected at birth, 26·3% (20·1–33·1) were expected to be spent in poor health in high SDI countries compared with 11·7% (8·8–15·1) in low-middle SDI countries. HALE at birth increased by 6·3 years (5·9–6·7), from 57·0 years (54·6–59·1) in 1990 to 63·3 years (60·5–65·7) in 2017. The increase varied from 3·8 years (3·4–4·1) in high SDI countries to 10·5 years (9·8–11·2) in low SDI countries. Even larger variations in HALE than these were observed between countries, ranging from 1·0 year (0·4–1·7) in Saint Vincent and the Grenadines (62·4 years [59·9–64·7] in 1990 to 63·5 years [60·9–65·8] in 2017) to 23·7 years (21·9–25·6) in Eritrea (30·7 years [28·9–32·2] in 1990 to 54·4 years [51·5–57·1] in 2017). In most countries, the increase in HALE was smaller than the increase in overall life expectancy, indicating more years lived in poor health. In 180 of 195 countries and territories, females were expected to live longer than males in 2017, with extra years lived varying from 1·4 years (0·6–2·3) in Algeria to 11·9 years (10·9–12·9) in Ukraine. Of the extra years gained, the proportion spent in poor health varied largely across countries, with less than 20% of additional years spent in poor health in Bosnia and Herzegovina, Burundi, and Slovakia, whereas in Bahrain all the extra years were spent in poor health. In 2017, the highest estimate of HALE at birth was in Singapore for both females (75·8 years [72·4–78·7]) and males (72·6 years [69·8–75·0]) and the lowest estimates were in Central African Republic (47·0 years [43·7–50·2] for females and 42·8 years [40·1–45·6] for males). Globally, in 2017, the five leading causes of DALYs were neonatal disorders, ischaemic heart disease, stroke, lower respiratory infections, and chronic obstructive pulmonary disease. Between 1990 and 2017, age-standardised DALY rates decreased by 41·3% (38·8–43·5) for communicable diseases and by 49·8% (47·9–51·6) for neonatal disorders. For non-communicable diseases, global DALYs increased by 40·1% (36·8–43·0), although age-standardised DALY rates decreased by 18·1% (16·0–20·2).

**Interpretation** With increasing life expectancy in most countries, the question of whether the additional years of life gained are spent in good health or poor health has been increasingly relevant because of the potential policy implications, such as health-care provisions and extending retirement ages. In some locations, a large proportion of those additional years are spent in poor health. Large inequalities in HALE and disease burden exist across countries in different SDI quintiles and between sexes. The burden of disabling conditions has serious implications for health system planning and health-related expenditures. Despite the progress made in reducing the burden of communicable diseases and neonatal disorders in low SDI countries, the speed of this progress could be increased by scaling up

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ORIGINAL ARTICLE

# Global, Regional, and Country-Specific Lifetime Risks of Stroke, 1990 and 2016

The GBD 2016 Lifetime Risk of Stroke Collaborators


## ABSTRACT

### BACKGROUND

The lifetime risk of stroke has been calculated in a limited number of selected populations. We sought to estimate the lifetime risk of stroke at the regional, country, and global level using data from a comprehensive study of the prevalence of major diseases.

### METHODS

We used the Global Burden of Disease (GBD) Study 2016 estimates of stroke incidence and the competing risks of death from any cause other than stroke to calculate the cumulative lifetime risks of first stroke, ischemic stroke, or hemorrhagic stroke among adults 25 years of age or older. Estimates of the lifetime risks in the years 1990 and 2016 were compared. Countries were categorized into quintiles of the sociodemographic index (SDI) used in the GBD Study, and the risks were compared across quintiles. Comparisons were made with the use of point estimates and uncertainty intervals representing the 2.5th and 97.5th percentiles around the estimate.

### RESULTS

The estimated global lifetime risk of stroke from the age of 25 years onward was 24.9% (95% uncertainty interval, 23.5 to 26.2); the risk among men was 24.7% (95% uncertainty interval, 23.3 to 26.0), and the risk among women was 25.1% (95% uncertainty interval, 23.7 to 26.5). The risk of ischemic stroke was 18.3%, and the risk of hemorrhagic stroke was 8.2%. In high-SDI, high-middle–SDI, and low-SDI countries, the estimated lifetime risk of stroke was 23.5%, 31.1% (highest risk), and 13.2% (lowest risk), respectively; the 95% uncertainty intervals did not overlap between these categories. The highest estimated lifetime risks of stroke according to GBD region were in East Asia (38.8%), Central Europe (31.7%), and Eastern Europe (31.6%), and the lowest risk was in eastern sub-Saharan Africa (11.8%). The mean global lifetime risk of stroke increased from 22.8% in 1990 to 24.9% in 2016, a relative increase of 8.9% (95% uncertainty interval, 6.2 to 11.5); the competing risk of death from any cause other than stroke was considered in this calculation.

### CONCLUSIONS

In 2016, the global lifetime risk of stroke from the age of 25 years onward was approximately 25% among both men and women. There was geographic variation in the lifetime risk of stroke, with the highest risks in East Asia, Central Europe, and Eastern Europe. (Funded by the Bill and Melinda Gates Foundation.)


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Disclosure forms provided by the authors are available with the full text of this article at NEJM.org.

## APPENDIX

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## REFERENCES

1. GBD 2016 DALYs and HALE Collaborators. Global, regional, and national disability-adjusted life-years (DALYs) for 333 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet 2017;390:1260-344.

2. GBD 2016 Causes of Death Collaborators. Global, regional, and national age-sex specific mortality for 264 causes of death, 1980-2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet 2017;390:1151-210.

3. GBD 2016 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet 2017;390:1211-59.

4. Feigin VL, Roth GA, Naghavi M, et al. Global burden of stroke and risk factors in 188 countries, during 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet Neurol 2016; 15:913-24.

5. Lloyd-Jones DM, Larson MG, Beiser A, Levy D. Lifetime risk of developing coronary heart disease. Lancet 1999;353:89-92.

6. Seshadri S, Wolf PA. Lifetime risk of stroke and dementia: current concepts, and estimates from the Framingham Study. Lancet Neurol 2007;6:1106-14.

7. Wang Y, Liu J, Wang W, et al. Lifetime risk of stroke in young-aged and middle-aged Chinese population: the Chinese Multi-Provincial Cohort Study. J Hypertens 2016;34:2434-40.

8. Turin TC, Kokubo Y, Murakami Y, et al. Lifetime risk of stroke in Japan. Stroke 2010;41:1552-4.

9. Leening MJ, Ferket BS, Steyerberg EW, et al. Sex differences in lifetime risk and first manifestation of cardiovascular disease: prospective population based cohort study. BMJ 2014;349:g5992.



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# Measuring performance on the Healthcare Access and Quality Index for 195 countries and territories and selected subnational locations: a systematic analysis from the Global Burden of Disease Study 2016

GBD 2016 Healthcare Access and Quality Collaborators*

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## Summary

**Background** A key component of achieving universal health coverage is ensuring that all populations have access to quality health care. Examining where gains have occurred or progress has faltered across and within countries is crucial to guiding decisions and strategies for future improvement. We used the Global Burden of Diseases, Injuries, and Risk Factors Study 2016 (GBD 2016) to assess personal health-care access and quality with the Healthcare Access and Quality (HAQ) Index for 195 countries and territories, as well as subnational locations in seven countries, from 1990 to 2016.

**Methods** Drawing from established methods and updated estimates from GBD 2016, we used 32 causes from which death should not occur in the presence of effective care to approximate personal health-care access and quality by location and over time. To better isolate potential effects of personal health-care access and quality from underlying risk factor patterns, we risk-standardised cause-specific deaths due to non-cancers by location-year, replacing the local joint exposure of environmental and behavioural risks with the global level of exposure. Supported by the expansion of cancer registry data in GBD 2016, we used mortality-to-incidence ratios for cancers instead of risk-standardised death rates to provide a stronger signal of the effects of personal health care and access on cancer survival. We transformed each cause to a scale of 0–100, with 0 as the first percentile (worst) observed between 1990 and 2016, and 100 as the 99th percentile (best); we set these thresholds at the country level, and then applied them to subnational locations. We applied a principal components analysis to construct the HAQ Index using all scaled cause values, providing an overall score of 0–100 of personal health-care access and quality by location over time. We then compared HAQ Index levels and trends by quintiles on the Socio-demographic Index (SDI), a summary measure of overall development. As derived from the broader GBD study and other data sources, we examined relationships between national HAQ Index scores and potential correlates of performance, such as total health spending per capita.

**Findings** In 2016, HAQ Index performance spanned from a high of 97·1 (95% UI 95·8–98·1) in Iceland, followed by 96·6 (94·9–97·9) in Norway and 96·1 (94·5–97·3) in the Netherlands, to values as low as 18·6 (13·1–24·4) in the Central African Republic, 19·0 (14·3–23·7) in Somalia, and 23·4 (20·2–26·8) in Guinea-Bissau. The pace of progress achieved between 1990 and 2016 varied, with markedly faster improvements occurring between 2000 and 2016 for many countries in sub-Saharan Africa and southeast Asia, whereas several countries in Latin America and elsewhere saw progress stagnate after experiencing considerable advances in the HAQ Index between 1990 and 2000. Striking subnational disparities emerged in personal health-care access and quality, with China and India having particularly large gaps between locations with the highest and lowest scores in 2016. In China, performance ranged from 91·5 (89·1–93·6) in Beijing to 48·0 (43·4–53·2) in Tibet (a 43·5-point difference), while India saw a 30·8-point disparity, from 64·8 (59·6–68·8) in Goa to 34·0 (30·3–38·1) in Assam. Japan recorded the smallest range in subnational HAQ performance in 2016 (a 4·8-point difference), whereas differences between subnational locations with the highest and lowest HAQ Index values were more than two times as high for the USA and three times as high for England. State-level gaps in the HAQ Index in Mexico somewhat narrowed from 1990 to 2016 (from a 20·9-point to 17·0-point difference), whereas in Brazil, disparities slightly increased across states during this time (a 17·2-point to 20·4-point difference). Performance on the HAQ Index showed strong linkages to overall development, with high and high-middle SDI countries generally having higher scores and faster gains for non-communicable diseases. Nonetheless, countries across the development spectrum saw substantial gains in some key health service areas from 2000 to 2016, most notably vaccine-preventable diseases. Overall, national performance on the HAQ Index was positively associated with higher levels of total health spending per capita, as well as health systems inputs, but these relationships were quite heterogeneous, particularly among low-to-middle SDI countries.

**Interpretation** GBD 2016 provides a more detailed understanding of past success and current challenges in improving personal health-care access and quality worldwide. Despite substantial gains since 2000, many low-SDI and middle-SDI countries face considerable challenges unless heightened policy action and investments focus on advancing

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# Effectiveness of Emotional Freedom Techniques: A Pilot Study

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## Abstract

**Objective:** To determine Effectiveness of add on Emotional freedom technique (EFT) on reduction of depression among depressive patients.

**Design:** Quasi Experimental study

**Setting:** Selected Mental Hospital

**Participants:** Ten patients who are aged above 18 years and diagnosed with depression and who were scored 21-40 for depression on the beck depression Inventory. Participants were randomly assigned to Experimental (EFT) (n=05) and Control (treatment as usual) (n=05) groups.

**Intervention:** This research is a pretest–post-test; single-blind randomized experimental study. An Emotional Freedom Technique group (EFT) and a Treatment as usual (TAUG) were formed, each consisting of 05 depression patients in each group determined by beck depression inventory (with moderate to severe level of depression). 40 min Emotional freedom technique was administered to the depressive patients along with routine treatment and TAUG group received the routine treatment. 3 days EFT session was planned and on 3rd day beck depression inventory is administered to determine the depression level in both groups. Data were compelled using descriptive and inferential statistics.

**Results:** EFT participants (n=5; M=11.80, SD= 2.59) depicts significant reduction in level of depression compared with treatment as usual group (n=5; M= 4.20, SD= 2.95) (p = 0.05, d = 1.75, 95% CI [-3.55-11.65]). In the pre-test no substantial difference was found between the two arms before the intervention in terms of the mean depression level score. After the administration of Emotional freedom technique, it was determined that the mean frequency of level of depression statistically significantly lower compare to treatment as usual.

**Conclusion:** Emotional freedom technique is a simple non invasive tool, which helps to reduce the depression level.

***Keywords:*** *Energy psychology, EFT, Acupressure, Meridians, Tapping Depression, Emotional Freedom Techniques.*

## Introduction

Depression is the most common Psychological disorder, characterized by hopelessness, helplessness worthlessness and aloofness in activities that we usually relish, followed by lack of ability to perform daily activities, for at least two weeks. Additionally individuals suffering from depression usually have many of the following: decrease in appetite; loss of energy, impaired sleeping; decreased concentration; anxiety indecision; restlessness, guilt and ideas of self-harm or suicide.[1]

Depression is a commonest mental health issue, with an approximately Three hundred and fifty million people suffering from depression. Depression is completely different from usual mood swings and temporary emotional reactions to challenges in daily life.[2]

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# Impact of Helfer Skin Tap Technique in Reduction of Pain During Vaccination among Infants- A Literature Review

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## Abstract

Pain is an unpleasant sensation that can range from mild, localized discomfort to agony. It is too difficult to face pain of vaccinations in children.Helfer skin tapping technique is resulting to minimize the level of pain during intramuscular injections among children.

**Objective-** Primary objective behind this literature review is to find out effectiveness of helfer skin tap technique in reduction of level of pain among children.

**Method-** A systematic literature review was conducted. The literature includes last 8years' data. The literature reviewed was obtained through different database includes CINHAL (Cumulative index TO Nursing & Allied Health Literature), MEDLINE (Medical Literature Analysis & Retrieval System Online), PubMed, Science Direct, SpringerLink, ProQuest & Google scholar.

**Result—**Pain level of experimental group is less than control group. Helfer skin tap technique is effective to reducing the level of pain among infants who are undergone with pentavalent vaccination.

**Conclusion—**Helfer skin tap technique is helpful in minimizing the level of pain during vaccination among infants. All the nurses can perform Helfer skin tap technique in routine practices for reducing pain intensity.

***Keywords-*** *Helfer skin tap technique, vaccination, pain, mechanical stimulation, intramuscular injection.*

## Introduction

Pain is an unpleasant sensation which caused by strong stimuli which create severe pain.[1] It is an unpleasant sensory and emotional experience associated with actual or potential tissue damage. It is a feeling triggered in the nervous system. Pain may be sharp or dull. It may come and go, or it may be constant.[2]Vaccinations can be painful. Kids don't like them, and parents don't like seeing their children suffer.[3] Fear of needles is a common phobia for children.[4] Children have fear to the injections and because of that fear they are crying. All parents are continually striving to find the best way to respond those cries.[5] Vaccination is the most widely practiced percutaneous procedure. Each child is compulsorily exposed to this in his early childhood. The most common side effect of vaccination is pain.[6]In 1998, Ms Joanne Helfer made an attempt to alleviate pain due to intramuscular injection by developing,, "Helfer Skin Tapping technique" in which tapping of the skin over the injection site. The technique uses basic concepts of theory of pain; including the gate control theory.[7]Mechanical stimulation which is given by tapping, can diminishes the influence of small, pain-carrying fibers. It consists two basic points:

Muscle relaxation, which physically decreases the resistance to needle entry into the skin.

Diversion, by simultaneous tapping over the skin before the needle is inserted and removed. [8]

It was concluded that there is need to minimize the pain level of children while giving intramuscular

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# Characterization of low molecular weight urinary proteins at varying time intervals in type 2 diabetes mellitus and diabetic nephropathy patients

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## Abstract

**Background:** To identify low molecular weight urinary proteins capable of detecting diabetic nephropathy patients which may predict renal alterations at early stages and prevent it from worsening further.

**Method:** Three hundred ninety (390) age-matched subjects were divided into 8 groups depending upon duration of diabetes and the severity of renal damage. Urinary proteome profile of all subjects was determined with the help of microfluidic array. Participants with similar profile were further selected to study proteome map of urinary low molecular weight proteins with the help of 2 dimensional gel electrophoresis.

**Results:** Out of 390 total patients 268 patients showed a similar one dimensional proteomic pattern. Further, two-dimensional urinary proteomic pattern of these patients with molecular weight < 50 kDa was studied. Eight proteins with molecular weight 11, 15, 17, 23, 34, 38 and 46 kDa were identified with MALDI-QTOF. These low molecular weight proteins showed gradual increase in urinary excretion along with the duration of diabetes and severity of renal damage.

**Conclusion:** The study concludes that proteomic analysis might be a useful tool for detecting some novel markers capable of detecting patients susceptible to diabetic nephropathy in the early phase.

**Keywords:** Urinary 2DE, Urinary proteomics, Diabetic nephropathy, Diabetic kidney disease

## Introduction

Type 2 diabetes mellitus (T2DM) patients are frequently diagnosed with well established microalbuminuric stage due to its inadequate diagnosis and prognosis [1]. The progression of diabetic nephropathy (DN), generally silent and remains clinically unnoticed [2]. DN, if undiagnosed or untreated leads to end-stage renal disease and the patients are solely left with only two survival options which are costly, dialysis or kidney transplantation. The morbidity and mortality rate of DN patients are escalating and there is thus a urgent need for new promising biomarkers capable of diagnosing DN prior to appearance of microalbumin and rise in serum creatinine. This may also lead to suggesting some new strategies for therapeutics.

Urinary proteomics has recently been applied to understand pathophysiology and complexity of pathogenic mechanisms during T2DM induced nephropathy [3, 4]. The proteomic techniques are considered sensitive capable of detecting low abundance proteins. We compared two-dimensional urinary proteomic pattern of proteins with molecular weight < 50 kDa. For detecting the earliest possible LMWP, T2DM patients without any secondary complications (T2DM duration 1–20 years), and T2DM patients with microalbuminuria and nephropathy as a secondary complication were included. Further, the pattern obtained from T2DM

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Research Article

# VARIATION IN THE SIZE OF ABDOMINAL AORTA MEASURED ON COMPUTED TOMOGRAPHY

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**ABSTRACT**

**Objective:** The normal size of the abdominal aorta is expected to be <3 cm though the size changes with age as well as workload. There is a need to know the variation in size of the abdominal aorta to avoid the formation of aneurysm and further complications.

**Materials and Methods:** This study was carried out at Kasturba Medical College after taking 130 patients considering the inclusion and exclusion criteria. 130 patients who all came for abdomen computed tomography (CT) were divided into 65 patients in each age group under 20–40 years and 40–80 years. The measurements of abdominal aorta were anteroposterior (AP) and right left (RL) measured at T12-L1 level on plain axial abdomen CT images on Extended Brilliance Workstation.

**Result:** We observed that there was a statistical significant difference in the average AP diameter between the two age groups ($p<0.001$). Another finding was a statistical significant difference in the average RL diameter between the two age groups ($p<0.001$), and, hence the size of abdominal aorta varies with age.

**Conclusion:** The proposed study concluded that there was variation in the size of abdominal aorta with age. These findings would be helpful in early detecting of aneurysm and in avoiding aortic dissection.

**Keywords:** Aortic dissection, Ectasia, Extended brilliance workstation, Multidetector computed tomography.

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## INTRODUCTION

Arteries are complex organ because of their bifurcation and subdivisions at different levels in the body. The normal diameter of abdominal aorta is expected to be <3.0 cm, but with time the size of the aorta varies. [1]. The normal change rate in size is about 1–2 mm/year. Variation in size can be observed in childhood as well as in adulthood due to exercise and workload [2]. If the increase in diameter of abdominal aorta exceeds 50%, this results in the presence of ectasia which further turns into the formation of aneurysm [3]. Aneurysm is defined as dilatation of abdominal aorta. Abdominal aorta aneurysms are not harmful as long as there are no complications because symptoms are not produced by enlargement in diameter alone unless overexpansion occurs. Aortic dissection and rupture can also be seen in abdominal aorta due to aortic diameter and expansion rate [4]. The probability of aneurysm occurrence is low during the first two decades of life and increases usually after the third decade [5]. The rate of aneurysm rupture increases with age [6]. The expansion rate for abdominal aorta is 2.6 mm/year. The diameter increases as the aneurysm enlarges [7]. There are various imaging modalities available to screen or to detect the early abnormal changes in size of abdominal aorta such as ultrasonography (USG), computed tomography (CT), angiography, and magnetic resonance imaging (MRI). Ultrasound is always a first choice of screening arteries because it is simple, inexpensive and involves no exposure of radiation to patients [4]. The studies earlier have used ultrasound because of its practical and economic reasons [8]. In the present study, CT is used for screening of early changes in size of abdominal aorta. CT has become an important pre-operative imaging technique well as less operator dependent and more objective [4,9]. CT has various tools and techniques to measure the size of arteries [10-12], while in the present study, 2D axial sections were taken to measure the variation in size of the abdominal aorta.

## MATERIALS AND METHODS

An evaluative study was conducted using purposive sampling technique for 3 months after obtaining the institutional and hospital ethical clearance from Kasturba Medical College. Patients who all were referred for abdomen CT were included in the study. The age ranged between 20 and 80 years. Patients with abdominal trauma, operation, and metallic implants were excluded from the study. Sample size was calculated using paired t-test. Total patients were 130, and 65 patients per gender group who all met inclusion criteria were involved in the study.

Abdomen CT was performed on MDCT Brilliance 64 slice Philips with a scan time of 0.4 s at an interval of 5 mm from C6 to the diaphragm using a collimation of 64 × 0.65 and slice thickness of 5 mm with abdomen filter to get better images.

During the scan, patients were instructed to breathe at full inspiration and hold his/her breathe for 1 s during scanning to reduce motion artifacts.

The original series of abdomen CT was taken with a slice thickness of 5 mm and incrementation of 5 mm with a standardized window and width (60/360) settings for the abdomen and sent to a dedicated extended brilliance workstation, and using common measuring tool size of abdominal aorta is measured at the level of T12-L1 in axial planes. Collected data were analyzed using SPSS 16 software (Fig. 1).

## RESULTS

We performed independent sample t-test to know the significant difference in the average anteroposterior (AP) and right-left (RL) diameters between the two age groups.

Mean and standard deviation (SD) of aortal measurements for the two age categories are provided in Table 1.

We observed that there was a statistical significant difference in the average AP and RL diameters of two age groups ($p<0.001$).

## DISCUSSION

There are various modalities available to measure the diameters of vessels such as CT, USG, and MRI; however, in the present study, anteroposterior