International Conference on Multidisciplinary Innovation in Academic Research

(ICMIAR-19)

Kolkata, West Bengal

17th -18th May 2019

Institute For Engineering Research and Publication (IFERP)

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Editorial:

We cordially invite you to attend the ***International Conference on Multidisciplinary Innovation in Academic Research (ICMIAR-19)*** which will be held at ***Dee Empresa Hotel, Kolkata, West Bengal*** on ***May 17th-18th, 2019***. The main objective of ***ICMIAR*** is to provide a platform for researchers, engineers, academicians as well as industrial professionals from all over the world to present their research results and development activities in relevant fields of Engineering Science, Technology and Multidisciplinary Innovation. This conference will provide opportunities for the delegates to exchange new ideas and experience face to face, to establish business or research relationship and to find global partners for future collaboration.

These proceedings collect the up-to-date, comprehensive and worldwide state-of-art knowledge on cutting edge development of academia as well as industries. All accepted papers were subjected to strict peer-reviewing by a panel of expert referees. The papers have been selected for these proceedings because of their quality and the relevance to the conference. We hope these proceedings will not only provide the readers a broad overview of the latest research results but also will provide the readers a valuable summary and reference in these fields.

The conference is supported by many universities, research institutes and colleges. Many professors played an important role in the successful holding of the conference, so we would like to take this opportunity to express our sincere gratitude and highest respects to them. They have worked very hard in reviewing papers and making valuable suggestions for the authors to improve their work. We also would like to express our gratitude to the external reviewers, for providing extra help in the review process, and to the authors for contributing their research result to the conference.

Since March 2019, the Organizing Committees have received more than 60 manuscript papers, and the papers cover all the aspects in Electronics, Computer Science, Information Technology, Science Engineering and Technology and Management. Finally, after review, about 17 papers were included to the proceedings of ***ICMIAR-2019***.

We would like to extend our appreciation to all participants in the conference for their great contribution to the success of ***ICMIAR-2019*** We would like to thank the keynote and individual speakers and all participating authors for their hard work and time. We also sincerely appreciate the work by the technical program committee and all reviewers, whose contributions made this conference possible. We would like to extend our thanks to all the referees for their constructive comments on all papers; especially, we would like to thank to organizing committee for their hard work.

Acknowledgement

IFERP is hosting the ***International Conference on Multidisciplinary Innovation in Academic Research*** this year in month of May. The main objective of ICMIAR is to grant the amazing opportunity to learn about groundbreaking developments in modern industry, talk through difficult workplace scenarios with peers who experience the same pain points, and experience enormous growth and development as a professional. There will be no shortage of continuous networking opportunities and informational sessions. The sessions serve as an excellent opportunity to soak up information from widely respected experts. Connecting with fellow professionals and sharing the success stories of your firm is an excellent way to build relations and become known as a thought leader.

I express my hearty gratitude to all my Colleagues, Staffs, Professors, Reviewers and Members of Organizing Committee for their hearty and dedicated support to make this conference successful. I am also thankful to all our delegates for their pain staking effort to travel such a long distance to attain this conference.

INSTITUTE FOR ENGINEERING RESEARCH AND PUBLICATION ★ IFERP

Mr. Ankit Rath
Chief Scientific Officer (CSO)
Institute for Engineering Research and Publication (IFERP)

International Conference on Multidisciplinary Innovation in Academic Research (ICMIAR -19)

Keynote Speaker

Dr. Siddhartha Bhattacharyya
Senior Research Scientist,
Faculty of Electrical Engineering and Computer Science,
VSB Technical University of Ostrava, Ostrava
&
Principal
RCC Institute of Information Technology, Kolkata, India

Message

Welcome to the International Conference on Multidisciplinary Innovation in Academic Research (ICMIAR-19) which is going to be held on 17th & 18th May Dee Empresa Hotel, Kolkata, the city of joy. ICMIAR-19, a premier conference is focused on the dissemination of information on latest technological innovations and advances in diverse disciplines of engineering and technology. The conference is being organized by the Institute for Engineering Research and Publication (IFERP) to usher in an opportunity for the budding scientists to interact with the working groups of different technological domains. The primary objective of the conference is to spread the technical knowledge base among the scientific community.

I hope that the conference will be a great success and would open up new opportunities for global and national research cooperation.

(Dr. Siddhartha Bhattacharyya)

Biography

Dr. Siddhartha Bhattacharyya did his Bachelors in Physics, Bachelors in Optics and Optoelectronics and Masters in Optics and Optoelectronics from University of Calcutta, India in 1995, 1998 and 2000 respectively. He completed PhD in Computer Science and Engineering from Jadavpur University, India in 2008. He is the recipient of the University Gold Medal from the University of Calcutta for his Masters. He is the recipient of the coveted National Award Adarsh Vidya Saraswati Rashtriya Puraskar for excellence in education and research in 2016. He is the recipient of the Distinguished HoD Award and Distinguished Professor Award conferred by Computer Society of India, Mumbai Chapter, India in 2017. He received the Honorary Doctorate Award (D. Litt.) from The University of South America and the South East Asian Regional Computing Confederation (SEARCC) International Digital Award ICT Educator of the Year in 2017. He also received the Rashtriya Shiksha Gaurav Puraskar from Center for Education Growth and Research, India in 2017. He has been appointed as the ACM Distinguished Speaker for the tenure 2018-2020. He received the Young Scientist (Science & Technology) Award from CSERD, India in 2018.

He is currently serving as the Principal of RCC Institute of Information Technology, Kolkata, India. In addition, he is also serving as the Professor of Computer Application and Dean (Research and Development) of the institute. He served as a Senior Research Scientist in the Faculty of Electrical Engineering and Computer Science of VSB Technical University of Ostrava, Czech Republic from October 2018 to April 2019. Prior to this, he was the Professor of Information Technology of RCC Institute of Information Technology, Kolkata, India. He served as the Head of the Department from March, 2014 to December, 2016. Prior to this, he was an Associate Professor of Information Technology of RCC Institute of Information Technology, Kolkata, India from 2011-2014. Before that, he served as an Assistant Professor in Computer Science and Information Technology of University Institute of Technology, The University of Burdwan, India from 2005-2011. He was a Lecturer in Information Technology of Kalyani Government Engineering College, India during 2001-2005. He is a co-author of 5 books and the co-editor of 30 books and has more than 230 research publications in international journals and conference proceedings to his credit. He has got two PCTs to his credit. He was the convener of the AICTE-IEEE National Conference on Computing and Communication Systems (CoCoSys-09) in 2009. He was the member of the Young Researchers' Committee of the WSC 2008 Online World Conference on Soft Computing in Industrial Applications. He has been the member of the organizing and technical program committees of several national and international conferences. He served as the Editor-In-Chief of International Journal of Ambient Computing and Intelligence (IJACI) published by IGI Global, Hershey, PA, USA from 17th July 2014 to 06th November 2014. He was the General Chair of several international conferences like ICCICN 2014, ICRCICN 2015, ICRCICN 2016 and ICRCICN 2018 organized by the Department of Information Technology, RCC Institute of Information Technology, Kolkata and held at Kolkata, India.

ICMIAR-19

International Conference on Multidisciplinary Innovation in Academic Research

Kolkata, West Bengal, May 17th – 18th, 2019

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International Conference on Multidisciplinary Innovation in Academic Research

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PAPERS

ICMIAR - 19

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A New Monopole Antenna Design for ISM Band Coverage

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***Abstract*—This paper proposes monopole antenna which is a wearable textile based model unites with an Artificial Magnetic Conductor (AMC) reflector. The suggested design entirely covers ISM (Industrial, Scientific, and Medical) band. Complete characteristics of AMC reflector have been analysed and produced effective radiation which is inclined for several wearable applications. In the design the space between the AMC reflector and antenna ground is changed up to which it radiates at multiple bands of frequencies. The presented prototype is fabricated on 40×20×0.5mm3 jeans substrate which has a dielectric constant of 1.6mm as its characteristics. Complete analysis of the design is showcased in various cases and in all the situations antenna holds its production. A systematic compact size, giant gain and radiation patterns builds prototype model of antenna a personage choice for wireless body area network communication.**

***Index Terms*— PMC, AMC, ISM, Reflectors**

1. INTRODUCTION

Wearable communication is one of the fast advanced fields of application-based research because of its applications in different fields. wearable antennas can be made of various fabric textiles which are applied to the human body[2] and considered as on-body mode[3].To apply the wearable technology, the designed antenna should be minimized and also should be implanted in various surfaces[4]. Under these circumstances there are several challenges for performing wearable communication system i.e.., on the antenna performance there is a deteriorating effect of human body. As due to the dispersive and lossy nature of the body tissues, the body of human can absorb very large amounts of electromagnetic power that is radiated from the antenna [1]. When the antennas are placed very close to human body radiation reduction and frequency-detuning issues arises [4]. Also an adverse biological effect arises when the electromagnetic power is absorbed by the human body. To reduce these effects there are some structures that separate the antenna from environment. Artificial magnetic conductors are prominently used in low profile antenna systems. By using several patterns on electric conductor backed dielectric substrate provides a Meta material structure [5]. AMC is a kind of Meta material which imitates the PMC (perfect magnetic conductor) which does not exists in nature [6].

In [7], they have presented a planar inverted-f structure which is presented in the dual band and wearable communication system is applied to it considering nylon as fabric. This EBG structure which is a general and basic structure designed in this paper is also implemented with the above structure. The designed antenna works at 2.4 and 5.8 GHz frequency. This structure produces many important characteristics like low SAR value, high gain, and these characteristics are primary for wireless body area network applications. This paper [8], contains a bow-tie shaped antenna which is included with a CPW (Coplanar waveguide) to reduce backward scattering wave in the human body. The substrate used here is polyethylene terephthalate. It operates at the frequency 2.4 and 5.8 GHz frequency. Here [9] presents a monopole patch antenna and it is isolated with EBG (Electromagnetic band gap) structure. This structure covers GSM (1.8GHz) and ISM (2.45GHz) bands and also the radiation of human body is also decreased over 15Db. Here the effect of frequency de-tuning over the human body is also decreased and several crumpling, bending and on-body conditions of an antenna are studied and presented to obtain the performance and also assessment of SAR (specific absorption rate) is also performed. In this paper [10] fractal antenna for satellite communications is designed with dual band is designed with FR-4 epoxy glass substrate. Here radiation pattern, reflection coefficient, gain and directivity. The designed antenna resonates at 4GHz and 5.9 GHz respectively. Considering [11] feeding network for aperture coupled wearable antennas is designed. Here probe feeding method in traditional based is avoided. This design is constructed on PCB producing Industrial, Scientific and Medical (ISM) applications with frequency 2.4-2.4835 GHz. It also produced high front to back ration and low cross polarization along with gain of 5.6dBi and efficiency with 47%. Taking paper [12] into view millimeter-wave antenna is developed and it is merged with electro-magnetic band gap (EBG) which is a self-similar window like structure. Here polyester fabric is used. It operates at the frequency range of 20-40GHz with the backward radiation reduction by 15dB. Here the combination of this CPW-EBG antenna

shows it is not highly sensitive to human body proximity. Regarding [13], here a micro-strip antenna is designed which is combined with chess-board like AMC structure with frequency range of 13.4 -20.5GHz this is mainly implemented to have the radar cross section reduction. Investigating [14] I observed a dipole antenna which is integrated with artificial magnetic conductor (AMC). The substrate used here is Rogers 5880Duroid. The applications resulted here is in X band i.e.., near 9.454 GHz. Here efficiency, directivity and front to back ratio of the antenna are identified. Here in paper [15], T type resonator antenna is designed and it is merged with AMC (artificial magnetic conductor) which operates at ISM (industrial, scientific and medical) bands with frequency 2.4 GHz. In this paper latex is used as a substrate and parameters of antenna like return loss, radiation efficiency, frequency detuning, gain and SAR values are observed. Taking paper [16] into account, a circular ring-slot antenna is designed and also integrated with EBG (Electromagnetic Band Gap) structure. The defined antenna has bandwidth of 2.28- 2.64 GHz, and covers the applications like Industrial, Scientific and medical applications at 2.4 GHz. Front back ratio is measured and specific absorption rate value for 1g and 10g of tissues are measured. In this letter, I am designing a CPW (Co-Planar Waveguide) fed rectangular patch antenna and it is implemented with several fabric materials like jeans, cotton, polyester and wool and identifying the fabric that produces the maximum output compared to others. Following this, the antenna is integrated with various AMC structures to identify the maximum reduction in the specific absorption rate (SAR) and also to increase gain value and to improve antenna radiation characteristics with human body. Generally designed antenna operates at several frequencies i.e.., at 2.5 GHz, 4.1 GHz and 5.9 GHz.

2. ANTENNA BASIC DESIGN

Proposed antenna is acquired from the following iterations as described in figure 1 and the outcome is shown in figure 3. The Antenna has the dimensions of 57×32.1mm.This basic antenna design configuration is obtained depending on the design of (1) which is operated in the ISM band i.e.., 2.45GHz. Here the radiating element and feeding line which is CPW (coplanar waveguide) were designed at the similar side with the Pellon fabric and it is modified by several fabric materials like jeans, cotton polyester and wool. The primary design configuration is based on jeans substrate with thickness 1mm, dielectric constant εr =1 and loss tangent of tan δ=0.004. Furthermore, jeans shows flexible characteristics, low profile 0which indicates multiple layers to rule the thickness of the antenna substrate when it is conformal to the user's body. Here figure1, indicates the monopole antenna of fabricated prototype and also describes the dimensional values of the antenna.

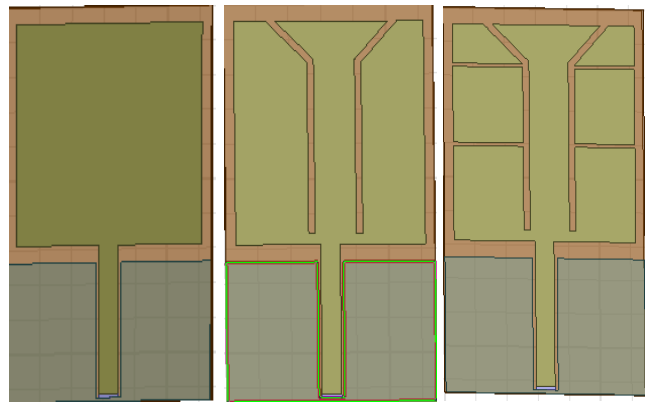

Fig1. Iterations for Variable antennas

3. DESIGN OF AMC REFLECTOR

Reflection phase characterization method was used to design AMC reflector. In a specific frequency band, AMC acts as a perfect conductor which produces in phase reflection characteristics. In this paper 2 different Artificial Magnetic Conductor's (AMC) are designed and these AMC's are integrated with monopole antenna. In the proposed monopole antenna design a Jeans AMC (4×2 array) is considered with dimensions of 24mm×25mm at a distance of 11 mm from the antenna.

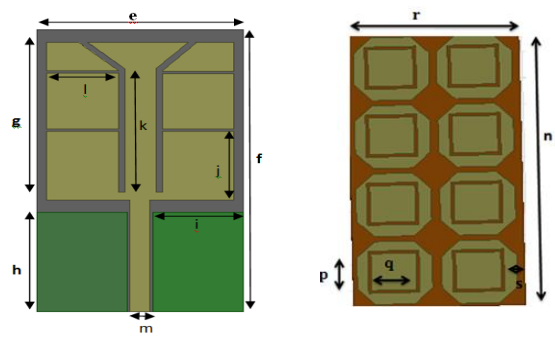

Fig2.AMC Reflector

Table1. Dimensions for the AMC antenna

Parameters	Value(mm)	Parameters	Value(mm)
e	32.1	l	11.2
f	57	m	3
g	32	n	104
h	20	p	12
I	14	q	17
J	14	r	57
k	24.98	s	4.3

4. RESULTS AND DISCUSSION

Iterations of AMC integrated antennas is mentioned out in the figure 3. Comparing the performance, first iteration output is obtained scarcely at 3 GHz and 5.65 GHz. Therefore second iteration is designed and it is produced at 3.05 GHz,5.6 GHz and 6.2 GHz respectively which is not considerable. So third iteration is performed which resulted

the output at 2.4 GHz which certainly produces the applications that are not present till now. The designed antenna totally covers the entire medical and ISM band frequencies including wireless body centric application

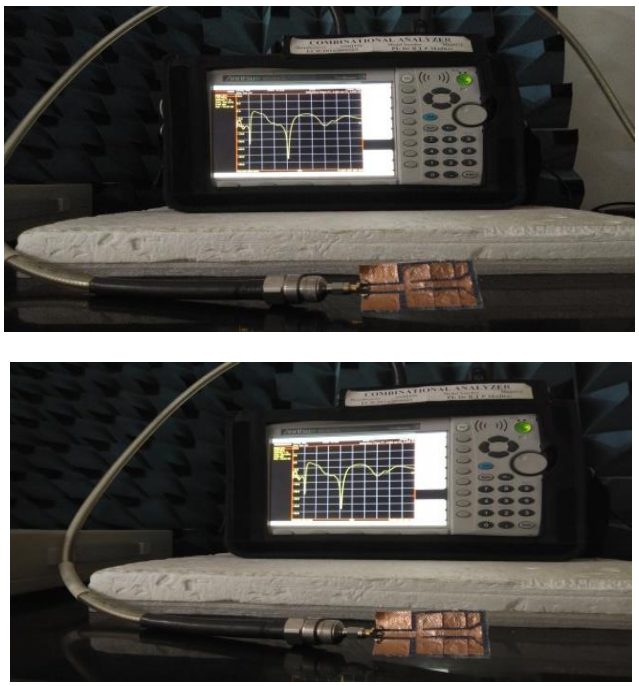

Fig3. Measured Results of Fabricated Antenna

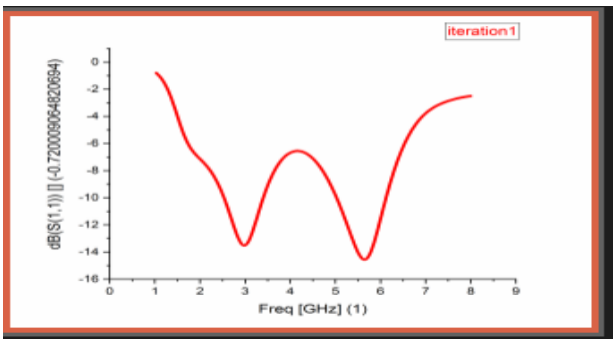

Fig4.Iteration1

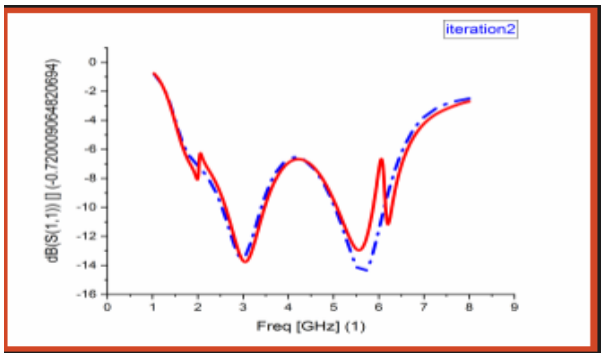

Fig5.Iteration2

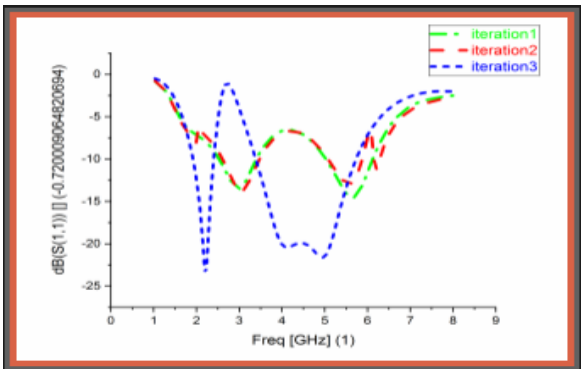

Fig6.Iteration3

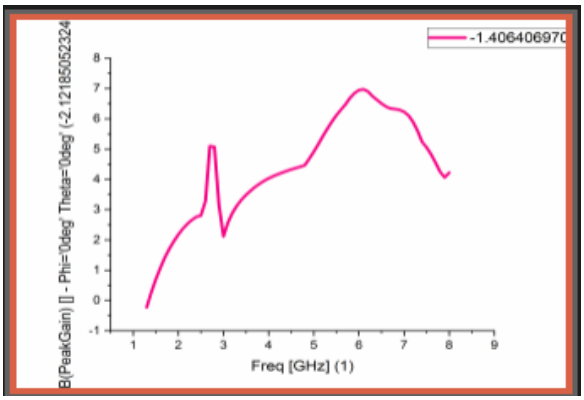

Fig7. Peak Gain Result

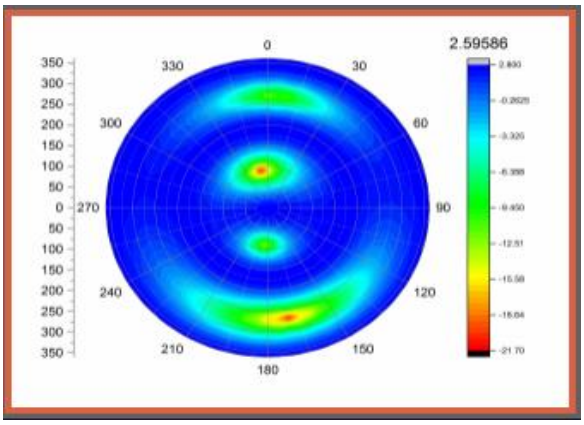

Fig8. Radiation Pattern

5. CONCLUSION

A flexible compact wearable antenna is manufactured and checked in this study. The dimensions of fabricated antenna are 57×32.1×1 mm3 which produced high gain at the applications of ISM band and resonates at multiple bands of frequencies. The proposed antenna is designed particularly for wireless body area networks which is a part of medical application. Future scope of the antenna can be introduced without any effects on the human body and also directly be interacted with human body to transmit signals and thereby to obtain readings from the human body.

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Analysis of WiMAX Networks with Bandwidth Allocation Algorithms (Round Robin and Strict Priority)

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***Abstract*— IEEE 802.16 is today playing a promising and challenging role in wireless network and thus it is considered to be an alternative solution to wired broadband technologies. Availability of network in all the way is an important challenge for WiMAX networks. Lesser availability of network in rural, hilly, lakes and sea shores is a major issue today. Various algorithms in wireless networks are available for allocation of data and services today. This paper focuses on evaluating the performance of WiMAX networks with increasing number of nodes and distances. This paper proposes two important algorithms Round Robin for Relay and Strict Priority in WiMAX Networks. By analyzing it in WiMAX networks, in terms of throughput and Goodput, could play a supportive role for industries and researcher for implementing it in real scenarios. Implementing these algorithms in WiMAX networks at base stations could be efficient for sustaining maximum number of users in terms of data usage and calls.**

***Index Terms*—802.16, Light WiMAX Simulator (LWX), Bandwidth Allocation Algorithm (BWA), Round Robin (RR), Strict Priority (SP)**

1. INTRODUCTION

Broadband Wireless Access (BWA) is a solution for rapid requirement of internet for data and voice services. BWA is a fast and easy alternative of cable network sand Digital Subscriber Line (DSL) technologies [1].The IEEE working group has designed IEEE802.16standard based on BWA systems for last mile wireless access [2]. This can be used to achieve goals like high data rate deployment, large area coverage and to use large frequency spectrums in the available networks. The IEEE 802.16 technology is less cost competitive ubiquitous technology that supports portable and fully mobile operations offering integrated voice, video and data services. Rural areas and crowded geographical areas where no wired infrastructure is available, point to multipoint (PMP) architecture of IEEE 802.16 can be deployed in easy and cost effective manner. The point to multipoint (PMP) architecture of IEEE802.16 consists of one Base Station (BS) and many Subscriber Stations (SSs). Clients are connected to SS for data transfer or any SS can itself be a client. All SSs have to be synchronized with BS. SSs are also allowed to send data by Base stations. The BS communicated to all SS in the beginning of each frame via Uplink Map (UL MAP) [3]. Transporting data with Light WiMAX could play a promising role in WiMAX networks. Allocation of proper bandwidth for data usage could play an effective role on IEEE 802.16. The contribution of LWX is in the area mainly focused on QoS, OFDMA, and multi hop relay. The mechanism provided by LWX for user to plug and play different algorithms without modifying and recompiling those algorithms could be analyzed and studied. One of the important research area is to allocate a suitable algorithm, related to this field is analyzed here.

2. BANDWIDTH ALLOCATION ALGORITHMS

Round Robin algorithm has various advantages and disadvantages. One Important advantage is that it doesn't face the problem of starvation. All the processes share a defined time slice on the processor to process. Time slice is defined as the allocation of limited intervals of time slices on the base station. A time slice is simply an amount of time that each job process in contention for use of the Base station [4]. A time slice is simply an amount of time that each process will spend on the base station per iteration of Round Robin Algorithm. All Processes are done in a First come First serve Basis and are preempted after a time slice. Either the job will finish in the allotted slice given or the job will be returned to the tail of the job queue and returned to the processor of Base station at a later time. This is a disadvantage since all jobs are basically given the same priority. Round Robin favors short virtual processes and penalizes long ones [5].

Another Problem is that the time slices must be correct unless there may be other problems. If the value of time slices is too small than the value of context switching time increases in relation to actual work done by the base station. The time slice value also needs to be small enough to prevent Round Robin from becoming a non-preemptive FCFS algorithm. For a better output it should be such that it must be of adequate length so that maximum jobs can be completed in one time slice[6].

While considering Priority scheduling, which could be preemptive or may be non preemptive. Another important feature of priority scheduling is that it suffers the problem of starvation. A process losses control of the base station through one of the following task completion, a higher priority task becoming ready or a wait condition[7].Higher Priority processes becoming ready can cause lower priority processes to be neglected. Even in non priority preemptive scheduling a high priority process that takes a long time on the base station will create a starvation environment. Aging implementation and weighting of process along with the basic Round Robin structure helped with the solution.

3. NETWORK SETUP AND SIMULATION STUDY

The network setup is used to analyze the performance of Light WiMAX without relay station considering Base Stations with Round Robin and Strict Priority Algorithms for channel allocation. The simulation topology shown below contains one BS, and many SSs. The connections from BS to SS are taken for downlink data transfer and various cases are taken to analyze the performance. The individual TCP connections are created from BS to SSs in downlink packet transmission. Two different bandwidth allocation techniques are used to allocate the channel bandwidth to multiple SSs which is gradually increases along with time for data transfer from BS to SSs. The performance analysis is done as per the picture given below.

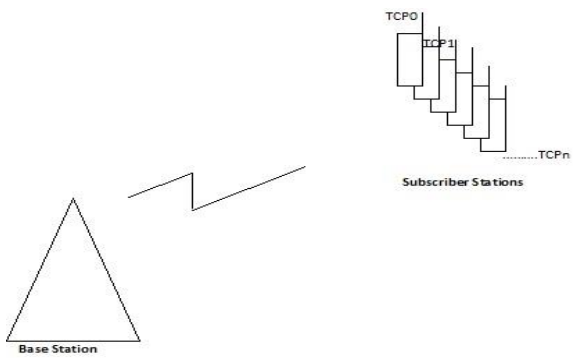

Fig. 1 Connection of Base Station with Subscriber Stations with RR and SP

4. SIMULATION PARAMETERS

The performance of Light WiMAX without Relay stations is analyzed in WiMAX scenarios by considering following simulation parameters given in table I:

Table I. Parameters Used For Simulation

Parameters	Values
Routing Protocols	AODV
Transmission Protocol	TCP
Bandwidth Allocation Algorithm	Round Robin and Strict Priority
Simulation Time	300 Sec
Number of Nodes	10,20,……..100

5. PERFORMANCE METRICS

The three performance metrics are considered to evaluate the performance:

- *Throughput* that measures the amount of raw bytes sent by a source.
- *Goodput* that measures bytes that are successfully received.
- Number of dropped packets

6. RESULTS

It is observed from the graph shown in fig. 3 that the value of throughput is obtained maximum when number of nodes are lesser because higher order modulation techniques is used with OFDM. As the number of subscriber station increases multiple bits are carried in a single OFDM symbol. A wireless channel suffers from delay spread due to the existence of multiple propagation paths (especially in NLOS conditions).

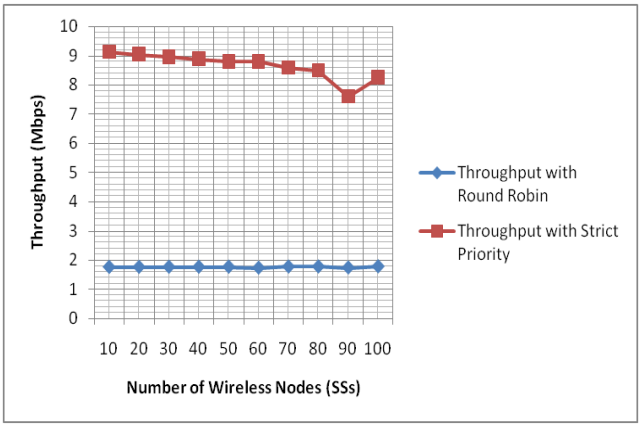

Fig. 3 Coverage of Base Station with Number of Nodes and Throughput with RR and SP

When the data symbol is longer, the delay spread is a small and insignificant fraction of the symbol length, so the effect due to delay spread is minimized. It is also observed that Strict Priority gives better results as compared to Round Robin Algorithms. It is observed that Throughput of Round Robin is obtained 9.12 Mbps for least number of subscriber stations. And as the subscriber stations increase its value decreases up to 8.24 Mbps. While in case of Strict Priority it is observed that the initial value of Throughput obtained is 1.758 Mbps and for maximum number of subscriber station it is obtained to be 1.77 Mbps. When number of subscriber stations increases, full utilization of Base station happens and use wider channels. If this condition is satisfied, the system capacity may be increased

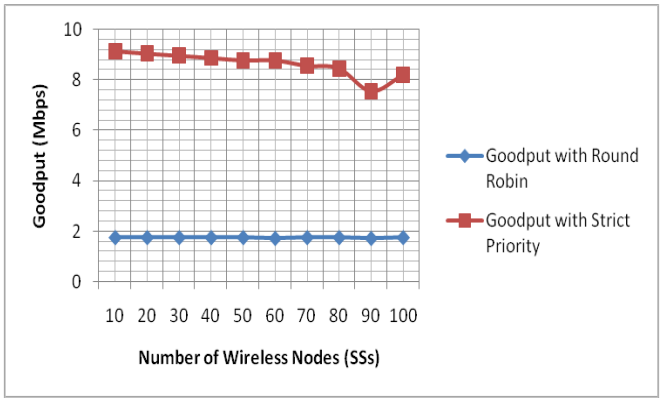

Fig. 4 Coverage of Base Station with Number of Nodes and Goodput

It is observed from the graph shown in fig 4 that the value of Goodput is also obtained maximum when number of nodes are lesser for the connection. It is observed that the value of goodput in Round Robin algorithm initially obtained is 9.12 Mbps and for 100 subscriber station it is obtained to be 8.19 Mbps for SP. While in case of RR it is 1.754 Mbps for least subscriber and obtained 1.74 Mbps for maximum subscriber stations. This is due to the fact that as number of packets per second transferred also increases, data transmission capacity of channel also increases and hence is obtained highest in lesser subscriber stations. As number of nodes from base increases, it is observed the coverage of base station ends and the Goodput becomes lesser.

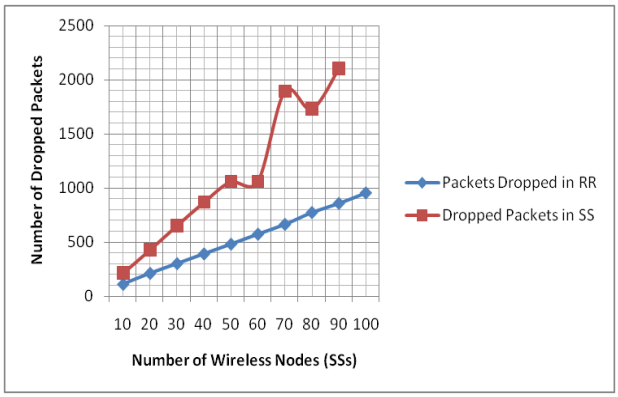

Fig. 5 Dropped Packets with Number of Nodes

It is observed that number of dropped packets is more in strict priority as compared to Round Robin this is due to the fact that when packets are sending then there is less possibility of packets to be lost since the signal is transmitting with maximum power from base station. As the traffic load increases then calls are not serviced properly and are dropped after long waiting time [8].It is observed that from fig. 5 below that Dropped packets are also increased since high modulation cannot be maintained over the entire length of the link or in a Non Line of sight environment. For such cases the error rates rises and the adaptive modulation feature drops the modulation to lower density modulation. WiMAX being able to provide 114 dropped packets in case of RR for one subscriber station and obtained 956 for 100 subscriber station. Similarly obtains 210 for one SS in case of SP and 2103 in case of 100 SS. The data rates changes through the entire coverage area and depends on whether the reception is LOS or NLOS. In case of NLOS reception the data rates drop significantly because of change of modulation [9][10].

7. CONCLUSION

In this paper the performance of WiMAX system is analyzed with two important bandwidth allocation algorithms named Round Robin and Strict Priority without relay stations[11]. The simulation results show that Strict Priority performs much better than Round Robin algorithms.

When number of nodes increases it is observed that throughput is obtained higher in case of Strict Priority than Round Robin. As number of nodes increases value of throughput is observed higher with least nodes in case of strict priority as compared to round robin. Similarly for Goodput also, better value in terms of strict priority is obtained as compared to round robin. When number of nodes increases it is observed that dropped packets are obtained higher in case of strict priority than round robin.

8. FUTURE WORK

Further studies can be carried out about the performance of base station with various other bandwidth allocation techniques with different types of connections and with various Services parameters. This whole analysis could also be done with UDP protocols and with IPV-6 version too.

9. ACKNOWLEDGEMENT

I am thankful to Computer Science & Engineering Department for an early draft of this paper. I am also thankful to my parents, my wife and the friends who coordinated me all the time during this research work. This research was done in Mewar University, Gangrar Chittorgarh Rajasthan, India.

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Investigation of Dispersion Compensation Methods for the Data Rates of 2.5 and 10 Gbps Using Standard and Dispersion Compensated Fibers

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***Abstract*— We have investigated pre-, post-, and symmetry dispersion compensation methods for the data rates of 2.5 and 10 Gbps using standard and dispersion compensated fibers using optisystem. The performance characteristics like bit error rate (BER), eye diagrams, Q factor of the received signal is studied by different system configurations. The results of three compensation methods have been compared and it is found that the symmetrical compensation method is superior to pre and post compensation methods.**

***Index Terms*— Dispersion Compensation, EDFA, DCF**

1. INTRODUCTION

Due to the dependence of speed of information carrying signal on the refractive index of the fiber which depends on the wavelength of the signal carrying information, different signals having different wavelengths reach the output of the fiber at different times as in case of multimode fiber [1]. Even in a single mode fiber the information carrying signal does not consist of a single wavelength rather a continuous group of wavelengths called the spectral width of transmitting source. These wavelengths experience deferent refractive index and hence travel with different velocities and reach output of the fiber at different time causing the pulse spreading [2-4]. Now if the data rate of the information signal is increased, the pulse at the output may overlap with each other. These causes inter symbolic interference (ISI). Due to inter symbolic interference we cannot increase the data rate of the fiber optic communication link. Thus in order to achieve high data rates, dispersion compensation is the most important requirement in fiber optic communication link [5-6].

2. LAYOUT AND PARAMETER SETTINGS

A transmitter is a core equipment of the fiber optic transmitter consisting of laser, electrical pulse generator and the optical modulator. The channel is composed of single mode fiber. An optical receiver is composed of PIN Photo detector, Bessel low pass filter and BER analyzer. Dispersion parameter D is given in ps/nm/km for different fiber used. It is also a function of wavelength. Typical value of D is about 16 ps/nm/km in the 1.55 µm wavelength for a standard single mode fiber (SMF). Fig.1. is the layout of the simulation for symmetric dispersion compensation technique. The layout of pre- and post- dispersion compensation techniques are not shown here.

For externally modulated sources, transmission distance limited by chromatic dispersion is-

$$L < \frac{2\pi c}{16|D|\lambda^2 B_T^2} \qquad (1)$$

Where, L is length of fiber in km, c is speed of light (m/s), λ is wavelength in meter, is Bit rate in Gbps [7]. Fiber length used satisfies the condition as indicated by equation -1.

Dispersion compensating fiber (DCF) is used before transmission fiber and amplifier combination in pre-dispersion compensation technique. In post-dispersion compensation technique DCF is placed after the transmission fiber and amplifier combination and in case of symmetric- compensation technique two DCFs are used, one before and another after the transmission fiber and the amplifier combination.

Optical amplifiers are used after each fiber to compensate for the propagation loss. The dispersion parameter of SMF 16ps/nm/km. Total accumulated dispersion is 16x120=1920ps/nm for 120 km length. This much dispersion can be compensated by using a 24 km long DCF with 80 ps/nm/km dispersion. Total transmission distance is used is 240 km for each cases. SMF attenuation 0.2 dB/km and DCF attenuation 0.6dB/km.

3. RESULTS AND DISCUSSION

The performance of the system for 2.5 and for 10 Gbps data rate is evaluated on the basis of BER and Q factor.

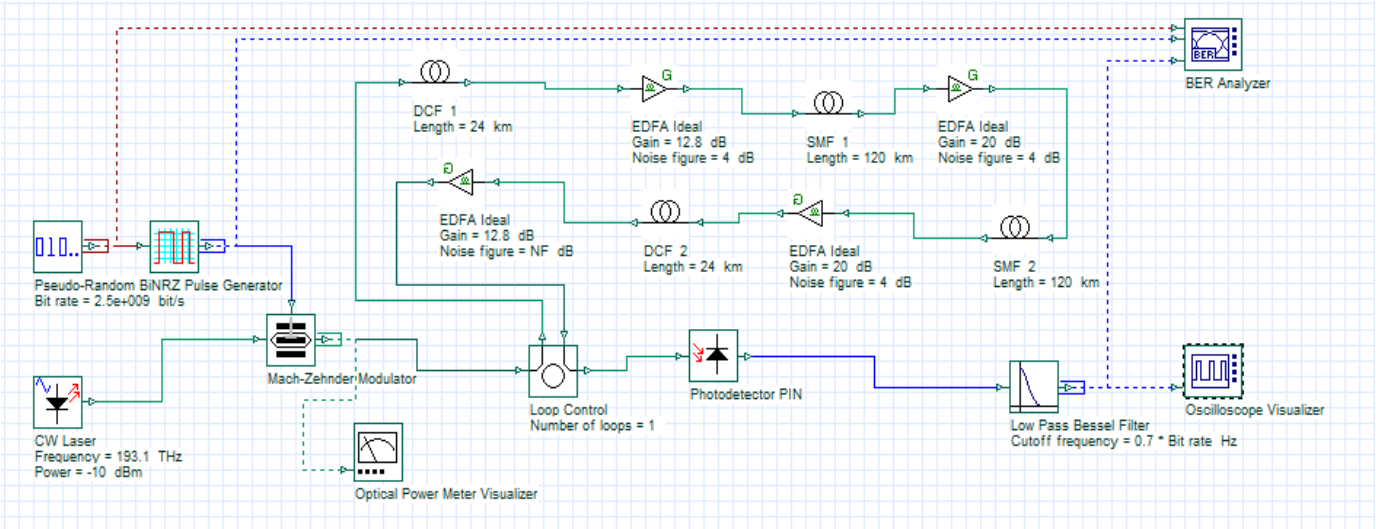

Fig.1. Simulation Layout- Symmetrical- Disperssion Compensation

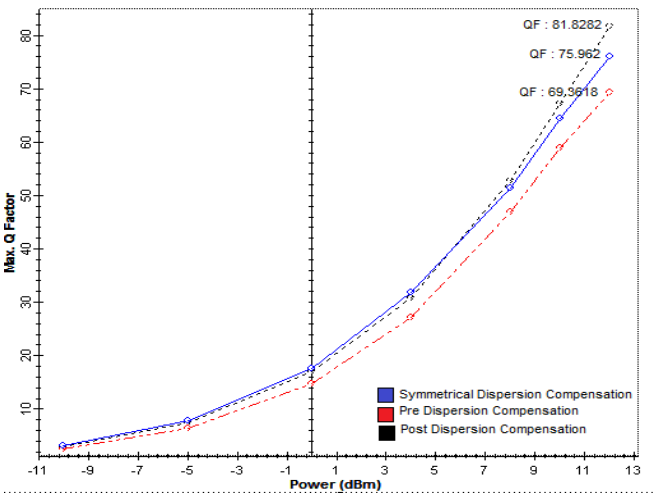

Fig. 2. Q factor vs signal power plot at 2.5 Gbps

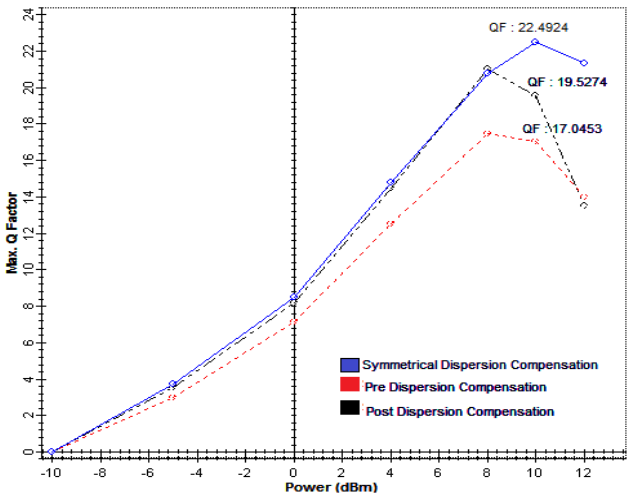

Fig. 3. Q factor vs signal power plot at 10 Gbps

The performance of the system is evaluated using the parameters, BER and Q factor with pre, post and symmetry compensation technique using DCF for 2.5 and 10 Gbps data rate. A receiver is said to be more sensitive if it achieves the same performance with less optical power on it. Fig. 2 and Fig. 3, show Q factor of received signal versus transmitted signal power for these schemes at 2.5 Gbps and 10 Gbps data rate respectively. When Q factor improves BER also improves. As evident from Fig. 2, with the increase of signal power post compensation scheme gives better performance compared to pre- and symmetric compensation schemes.

Increase of data rate from 2.5 to 10 Gbps, Q factor decreases with the increase of the signal power and an abrupt decrease of Q factor is occurred for post compensation scheme, which is depicted in Fig. 3. It also shows that the symmetry compensation scheme is the best one compared to the post and pre compensation cases. At 2.5 Gbps, the dispersion compensation scheme is much better at 10 dBm than what is at -5 dBm. It has also a better eye diagram shape and larger Q factor. But dispersion compensation scheme is better at 8 dBm than at -5 dBm when data rate is enhanced to 10 Gbps.

Fig. 5 to Fig., 7. show the Eye diagrams of symmetric-, post- and pre- compensation techniques for input power levels of -5 dBm and 10 dBm at data rate 10 Gbps. Fig. 8 shows the Eye diagram for three schemes at input power level of 12 dBm and data rate of 2.5 Gbps. Performance parameters values are summarized in Table 1 and Table 2 for the data rate of 10 Gbps and 2.5 Gbps respectively.

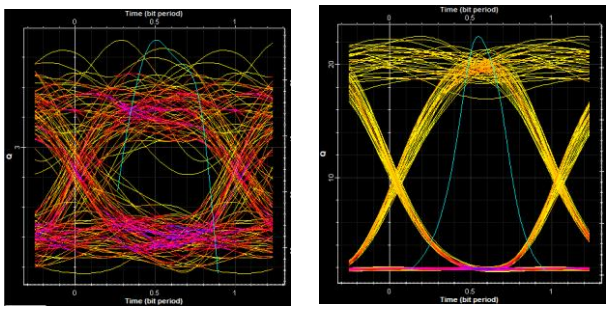

Fig. 5. Eye diagram Symm.DC scheme at 10 Gbps for -5 & 10 dBm laser power

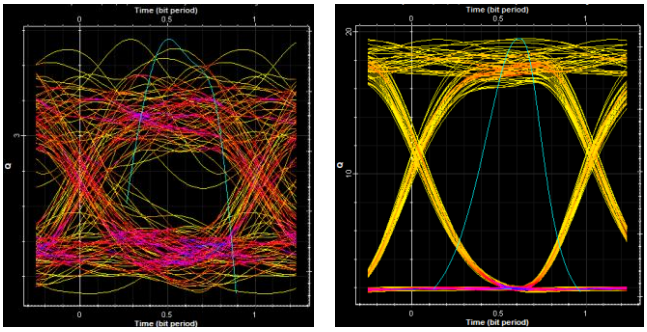

Fig. 6. Eye diagram Post .DC scheme at 10 Gbps for -5 & 10 dBm laser power

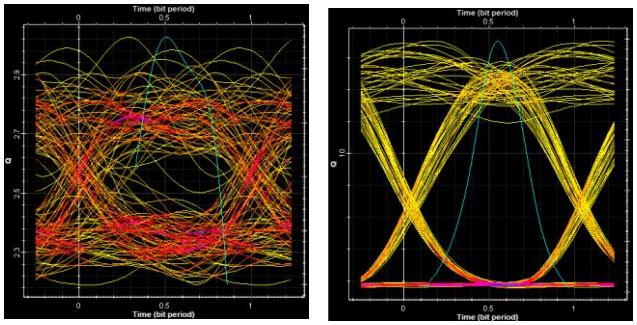

Fig. 7. Eye diagram Pre DC scheme at 10 Gbps for -5 & 10 dBm laser power

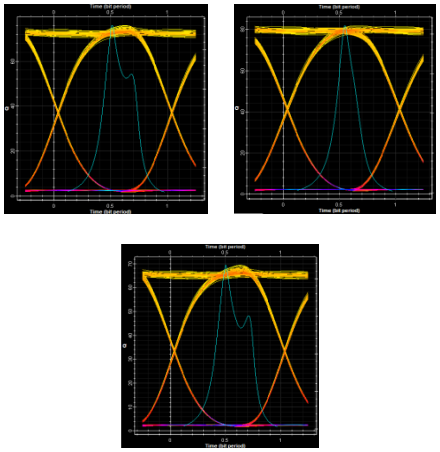

Fig. 8. Eye diagram Pre, Post & Symmetrical Dispersion Compensation schemes at 2.5 Gbps for 12dBm power

Table 1. Dispersion Compensation at 10Gbps system

10Gbps						
Compensation Schemes	**Q Factor for input power level**			**Eye Height for input power level**		
	10 dBm	**4 dBm**	**-5dBm**	**10 dBm**	**4 dBm**	**-5dBm**
Symmetrical	22.49	14.79	3.72	0.000672892	0.000151104	4.45E-06
Pre	17.05	12.51	3.03	0.000651984	0.000144797	2.07E-07
Post	19.53	14.48	3.54	0.000604506	0.000146852	3.56E-06

Table 2. Dispersion Compensation at 2.5Gbps system

2.5Gbps						
Compensation	**Q Factor for input power level**			**Eye Height for input power level**		
Schemes	**10 dBm**	**4 dBm**	**-5dBm**	**10 dBm**	**4 dBm**	**-5dBm**
Symmetrical	64.52	31.93	7.75	0.000724576	0.000172875	1.48E-05
Pre	58.92	27.25	6.36	0.000722059	0.000169969	1.27E-05
Post	67.20	30.82	7.43	0.00072294	0.000172035	1.44E-05

It can be shown that as the length of fibers are increased, the eye opening reduces. The eye opening for the post compensation method is better than the pre compensation method. For pre compensation method, the deterioration is so large that further increase in length is not feasible. From the analysis it can be concluded that the best performance is obtained by using symmetrical dispersion compensation for high data rate and low input signal power compared to other two schemes.

4. CONCLUSION

In this work, three compensation techniques using dispersion compensation fiber is analyzed. Performance parameters such as Q-factor, Min BER, eye Height etc. are evaluated for these three dispersion compensation schemes. Based on the analysis it is observed that performance of the symmetry dispersion compensation is much better than the other two methods. Eye diagram shows better value of threshold and eye height which alternatively results in reduced and improved synchronization in optical fiber communication networks. The symmetrical compensation has the best performance followed by post- and pre-compensation. In high data rate (40 Gbps) long-haul transmission systems, dispersion compensation is one of the most important areas which may be considered for future study.

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Earth-Air Heat Exchanger: An Extensive Study

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***Abstract*— The underground temperature at the depth nearly 5 m below continues almost immutable all through the year and it remains at a higher level than the over the earth temperature in winter and a lower level in the summer. This fact of invariant earth's temperature conditions is exploited in the case of earthair heat exchanger (EAHE) systems. Due to the mounting degradation of non-renewable energy resources through the years, we are now showing attention in shifting towards cleaner and sustainable renewable energy sources and in that case, an earth to air heat exchanger can be exercised as a valuable heating and chilling options of the buildings. This paper shows the extensive overview of the experimental and modeling studies accomplished on the EAHE systems so that it may be utilized efficiently to reduce the thermal loads in the buildings.**

***Index Terms*— Earth, Air, Heating, Cooling, Buildings**

1. INTRODUCTION

The development of our society depends on the energy use, and now it is essential and imperative to unfurl alternative

energy source to deputize non-renewable energy source or mi- nimize its rampant exercise and repercussions on the climate. The progressive adoption and endorsement of renewable en- ergy policies, equipment and practices is the way towards the energy and ecological sustainability [1]. Earth-Air heat exch- anger technique is one type of green building control strategy which uses the conception of natural heating and ventilation [2]. The notion is to make use of an under-ground heat exchanger that would absorb/release heat from/to the earth, replacing the usual belief of the vapor compression cycles, as its explicit uses instigate global warming. The subterranean temperature maintains a tiny fret all over the year or mean soil- air temperature every year over the ground surface [3]. EAHE uses air as a medium for transferring heat; and ground soil as heat storage for winter heating and summertime cooling. The soil's high thermal inertia accounts the steady attributes and the consequences of temperature fluctuation of the earth's plane is trimmed down as the deepness underneath increases over 5 m [4].

A harmonic variation with yearly amplitude nearly equal to the air is pursued by the daily mean soil surface temperature. The heat conduction theory based annual earth below-surface temperature taking a semi-infinite homogenous solid [5] have been mathematically modelled by Kusuda and Achenbach [6] as shown in Eq. (1).

$$T_g(z,t) = T_m - A_{surf} exp^{[-z\left(\frac{\pi}{8760\alpha}\right)^{0.5}]} \cos[\frac{2\pi}{8760}\left(t - t_0 - \frac{z}{2}\left(\frac{8760}{\pi\alpha}\right)^{0.5}\right] \quad (1)$$

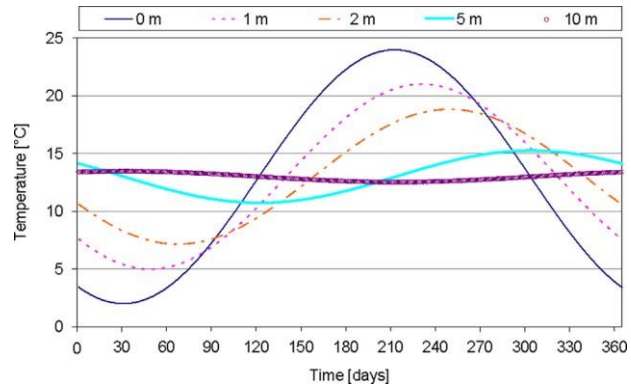

Fig. 1. Ground temperature oscillation [5]

Where, t is the time passed from the begining of the year in hours; Tm is the yearly mean soil temperature [in ºC]; the amplitude of the earth surface temperature change is Asurf [in ºC]; and the phase constant of the lowest mean soil surface temperature is to [in hrs] from the starting of year. The outcome of Eq. (1) is shown in Fig. 1 [5].

The sufficiently below-surface temperature of soil is regu- larly larger than the ambient temperature in winter and lesser in summer, owing to a finite time lag amid the temperature deviations on the ground surface and below surface. This temperature grade is able to be get exploited for pre-cooling/ pre-heating in summer/winter, by mounting a proper EAHE system.

Advantages of EAHE systems are environment-friendly, high effectiveness, fine thermal comfort and air quality, low recurring expenditure, easy control with simple apparatus, and lucrative in durability. The emergence of lethal micro-organisms, higher initial cost and limited accessibility of skilled technicians are the only drawbacks. The working of an EAHE system depends upon the depth, length, diameter and material of the buried pipes, fluid flow rates, temperature gradient between the ambient and the soil at the depth and initial soil temperature.

The motive of the present is to reconsider the present state- of-the-art of the EAHE systems being used in the world and may facilitate the researchers for further study to improve the technology in view of environmental safety of mankind.

2. EAHE TECHNOLOGY

To receive returns in certified emission reduction (CER) is the most essential factor to utilize EAHE besides the advantages mentioned before where one ton of carbon di-oxide-equivalent (CO2-e) is symbolized by an CER unit. An additional revenue of 234x107 Euros can be gained using EAHE by the developing countries under CER [7]. These systems are desired to the locations of high ground surface temperature variations and need an urgent drop of CO2 acq-uitted into the ambience.

EAHE systems typically comprise of an inlet shaft fitted with filters and encloses buried conduits in a range of per-mutations, in an open loop or a closed loop; both either vertical or horizontal (Fig. 2). Air is driven through underlying pipes with a suitably sized blower fan mounted on one of the end [8]. The vertical ducts are more efficient, requires a lower aspect than horizontal loops, but costlier [9]. Two-layer, two holes structures in upright bore holes are more effective than one hole system [10].Open-loop and closed-loop, each intake air from unlike end, the previous from outdoor and latter from thr indoor. EAHE elements are enlisted in Table 1.

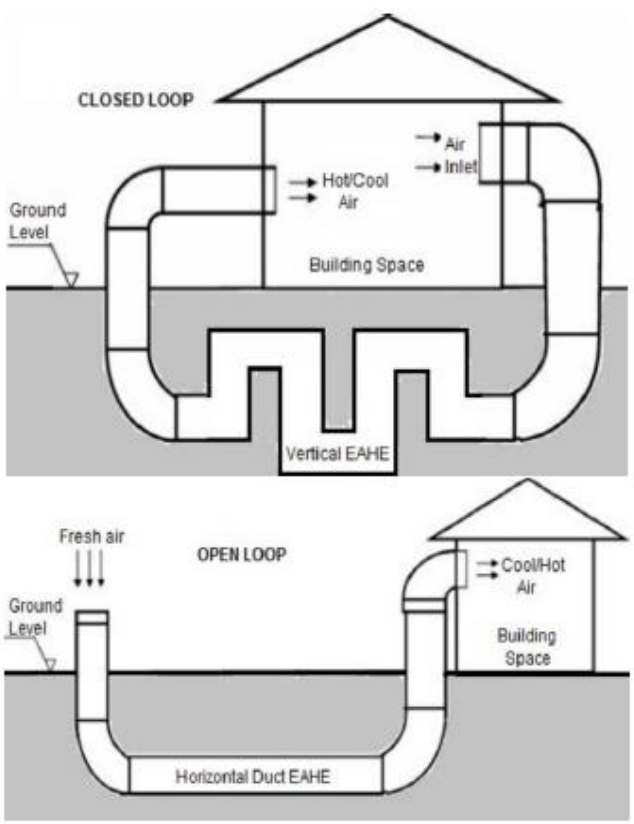

Fig. 2. Schematic diagrams of EAHE

Heat is transmitted through the duct thickness to or from the adjacent soil by conduction and convection between the air and the duct surfaces, as air passes through the EAHE. Conduction heat transfer here is fully three-dimensional tran- sient flow inside the soil, where condensation and evaporation also occur [11]. The enthalpy and thus the dry bulb tempe- rature of the air reduce down the flow rate. If the channel is sufficiently long and its surface is being at a lower temperature than the dew point of air, condensation might occur.

3. BRIEF ENERGY ANALYSIS AND ENERGY MATRICS

The daily thermal power productivity attained from an EAHE may be found from the following equation [12]:

$$\dot{Q}_{daily} = N_h F_R \dot{m}_a C_a (T_{in} - T_{out}) \quad (2)$$

Where N_h is number of hours of use of EAHE system in a day, FR is heat removal factor, $\dot{m}_a$ is the mass flow rate of air through the pipe assembly in kg/s; Ca is the specific heat capacity of air in J/kgK, Tin and Tout air temperature at inlet and outlet of EAHE in ^oC, respectively. If EAHE pipe radius is r in m, heat transfer coefficient of soil and pipe interface is hsoil in W/m^2K and the total length of buried pipe is L in m, then the heat removal factor is given by:

$$F_R = 1 - \frac{2\pi r h_{soil} L}{e^{\dot{m}_a C_a}} \quad (3)$$

Now, monthly and yearly thermal energy output in kWh and kWh/year, respectively, can be calculated by using following equations, for Nd number of days the EAHE used in a month [12]:

$$\dot{Q}_{monthly} = N_d \frac{Q_{daily}}{1000} \quad \text{and} \quad \dot{Q}_{yearly} = \sum_{i=1}^{12} \dot{Q}_{monthly} \quad (4)$$

Energy Payback Time (EPBT) is the number of years required to recuperate energy spent, i.e. in developing, shipping and carrying, fitting, process and maintenance of the system while in exercise. EPBT can be defined as the ratio of the embodied energy of EAHE system (kWh) to total yearly energy output of the EAHE system (kWh) and is obtained by [12]:

$$EPBT = \frac{E_{EMB}}{Q_{yearly}} \quad (5)$$

where for 0.1016 m diameter and 19.228 m long, 57.5 kg PVC pipe network working with 0.5 hp blower, E_{EMB}, the total embodied energy is: Embodied energy of 0.1016 m dia- meter PVC pipe + Embodied energy of 0.5 hp blower = 104.15 MJ/kg +373 W =1663.5 kWh +0.38 kWh =1663.88 kWh.

The seasonal energy efficiency ratio (SEER) is a measure of the energy transfer effectiveness of any heat exchanger device. The value of SEER is determined by dividing the total monthly heat energy interaction (kWh) from the room air by the total monthly energy consumed (kWh) by the EAHE. The SEER value is always needed to be larger than one for any such system to be cost-effective. The electrical energy devoured by the air blower may be

decided by multiplying the time hours of function of an EAHE with the motor capacity of 373 W.

4. EAHE SCENARIO IN THE WORLD

The heat exchanger blow/propel air to/from a building for warmth healing ventilation called earth tube (in Europe) or earth-air heat exchanger (in North America). The perception of utilizing the earth like a heat source or sink was well- known in the primeval periods. Iranian architects already used to design wind towers and underground air passageways in about 3000 B.C. for passive cooling [13]. EAHEs had been utilized con-nected with solar chimneys in horticultural (like greenhouses) and agricultural amenities in hot dry areas in the United States over thousands of years, possibly outset in the Persian Empire.EAHE system execution in China, Denmark, Germany, Austria,and also in India has been developed quite commonly since the 90s, and was gradually being accepted in North America. EAHE is the fastest rising examples of renewable energy after solar energy globally, with a yearly increase of 10% in the number of setting up in more than 30 countries in last fifteen years [14], except in Switzerland and Sweden where the market access is still a meek throughout the Europe [15]. From the 20th century, several researchers have deliberated the thermal prospective of underlying ducts [13, 16]. More than thousand passive house elements were ass- embled in Germany till 2001, and this numbers prudently doubles each year [17]. In Europe, over 5000 domestic units were effectively built and installed [18].

Table 1. EAHE Element Details

Element	Material	Features
Air intake tower	Stainless steel/PVC	High efficiency filter to introduce air
Pipe (seamless)	Steel/PVC/PE/PP	Transport air and exchange heat
Fan (intake/ exhaust)	Integrated, Carbon Steel	Take air from indoor/remove exhaust air
Condensation Management	Integrated or standalone	Drain condensed and expel water

Traditionally,EAHE system related studies and implementations were detained in America, Europe and other nations in the cold regions. Recently, several EAHEsystems were explored in other developing nations also. Various investigators implemented EAHE system by itself or in arra- ngement with the conventional heating, ventilation and air conditioning (HVAC) systems, phasechanging materials, solar chimneys, and other non-conventional technologies, using numerical modeling, experimental or both methods for their investigation efforts.

5. EAHE ANALYTICAL STUDIES

Any EAHE performance is illustrated by the energy inte-raction by conduction method to/from the soil considering the moisture into account, heat transport of the ground water, heat transfer to the sky and adjustments in the ambient temperature and humidity. Several numerical and analytical models of EAHEs are available now published recently. The operating variables are numerically solved in one, two or three dimen- sional simulation models. Highly intricate three dimensional conduction heat and moisture transport models for the soil are often not ready to use by the designers. De Paepe and Janssens [19] graded the algorithms available in the literature into basic two groups:

a) first calculating the heat flow by convection of the circulated air, scheming the conduction heat flow then from the duct to the soil.

The needed data are-

- geometrical details of the scheme
- soil thermal properties
- duct thermal properties
- unchanged soil temperature during operation

b) Only calculate convection heat flow from the circulated air to the duct and the necessary data are-

- geometrical details of the scheme
- soil thermal properties
- duct thermal properties

Moreover, numerical optimization merely applies to any particular specified arrangement, whereas, structural modifi-cations may able to advance the cost efficacy of the system. A steady state one-dimensional model may exemplify the nature of EAHE. Mihalakakou et al. [20], Gauthier et al. [21], Bojic et al. [22], Hollmuller et al. [23] and Lee and Strand [24] have worked on more absolute and dynamic models of EAHE design. Wu et al. [25] extended a transient numerical heat transfer based model, then executed it on the CFD model to assess the outcomes of operating factors like the duct radius, depth, length and air velocity on the process and capacity of EAHE. Tittelein et al. [26] recognized theoretical studies on several analytical models about EAHEs and detailed them. Ajmi et al. [27] found the cooling capacity of EAHEs for house building, and simulation proved that the EAHE might offer a 1700 W drop in peak cooling load, with an inside temperature drop of 2.8ºC in an arid climate during summer. An analytical model to resolve the annual cooling and heating potential of the subterranean air duct system was proposed by Sodha et al. [28]. The model presumes steady and uniform soil thermal properties discounting condensation and evaporation inside the ducts. Hollmuller and Lachal [29] have introduced and validated an analytical model for compound-pipe EAHE which considers multifarious geometries and additional boundary conditions with water penetration, pressure drop and the air flow path inside the pipe using FEM. Ghosal et al. [12] developed a model for a greenhouse EAHE thermal performance with the

assumptions of the quasi-steady state conditions, uniform air flow and no radiative heat transfer. Singh [30] determined that long plastic pipe could execute analogous to concrete pipe working on 1D numerical model of an earth-tunnel operation.

Sethi et al. [31] developed 1D thermal model using C++ for a farming green-house incorporated with an aquifer coupled duct flow heat exchanger system and experimentally validated. Reynolds number and the form factor were considered for estimating an EAHE system performance by Sehli et al. [32] and validated 1D steady-state analytical model experimentally. Freire et al. [33] considered multilayer configurations and 1.5 m was the optimum distance between the layers in metropo- litan areas as concluded. Pfafferott [34] concluded that thermal revival of soil was enough to retain the performance in testing on minute diameter EAHE in Germany for one year. Kumar et al. [35] performed on 2D model using artificial neural network (ANN) and extended intelligent and deterministic models with experimental validation. Badescu [36] build up an accurate EAHE model based on analytical transient bi-dimensional way counting soil temperature at several depths starting from the surface.

6. EAHE EXPERIMENTAL STUDIES

Vaz et al. [37] performed analytical solution and its experimental validation of an EAHE to decrease the use of conventional energy. An investigation of thermal and moisture treatment of wet and dry soil heated by sowing capillary plaits was performed by Balghouthi et al. [38]. Santamouris et al. [39] examined the impact of several soil boundary conditions on the performance of a single and a compound tube EAHE system. Li et al. [40] offered an experimental study of an EAHE in chilly regions in Herbin Institute of Technology, China. Eicker and Vorschulze [41] experimentally found the performance of vertical and horizontal EAHE executed in two office building accommodation projects in Germany.

Goswami et al. [42] put up an open loop experimental unit at the university of Florida with a 0.2 kW blower, a 2½-ton heat pump consisting of a 30.5 m long 0.3 m diameter corrugated PVC pipe buried at a depth 2.75 m to conclude that the efficiency can be recovered by increasing pipe length, buried depth and pattern, reducing the mass flow rate of air and pipe diameter, though lower diameter needs more fan power. The EAHE performance significantly affected by the soil conditions as Ascionetal. [43] concluded that the best performance could be attained for moist soil by implementing more than 50 m pipe length of 3 m buried depth. Dubey et al. [44] experimented EAHEsystemwith3GI64mm ID parallel pipes, each 3 m long with the same intake and outlet, concealed under 1.5 m depth in a plane land of arid soil and surveyed that a lower velocity of air creates a higher energy loss and COP. Ralegaonkar et al. [45] concluded that EAHE might save up to 90% more electricity than common air conditioning setup and 100% consumption of water using evaporative cooling method, investigating an EAHE scheme at Nagpur in India. Sodha et al. [46] confirmed the effects of various ground exterior treatments on an EAHE system performance for one 4 m □ 3 m □ 3 m room in India and inferred that surface treatment could perpetuate a lot of energy. Yassine et al. [47] investigated that best possible fence arrangement combined with EAHE systems in every zone could ease 76.7% energy with respect to the conceptual cooling. Bansal et al. [48] arranged an experimental unit at Ajmerin India to explore its working regarding the duct length, the earth thermal conductivity and the period of operation, and then validated the figures with CFD getting deviation of 3.4-8% only. Abbaspour-Fard et al. [49] performed 72 experimental assessments on an EAHE varying burial depth, pipe material and lengths, air velocities in Iran and concluded that the cooling coefficients (COP) were much higher than heating. Mongkon et al. [50] presented their experimental outcomes of horizontal EAHEused in a rural greenhouse in the steamy weather of Thailand in the winter, the summer and the monsoon periods and also established that heating COPs were much less that those of cooling.

7. CONCLUSIONS

Recent studies regarding EAHE designing and evaluating the performance throughout the world have been presented here. EAHE can be such as Mediterranean, moist subtropical, hot barren region, extreme cool or oceanic ambiences. This is used to minimize the energy use by pre-heating the air of a buildings in winter and vice-versa in summer. They offer a large drop in cooling/heating load of buildings and green- house gas emission. Universally, any EAHE system performance gets amplified with increase in depth and length of the buried pipe while the performance declines with larger velocity of air and pipe diameter.

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A Study Showing the Influence of People Competencies on the Performance of Medical Interns/Post Graduate Medical Students in Hospitals Of Kolkata

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1. INTRODUCTION

In India as in other developing economies medical education is in need of moving from the traditional knowledge based one to one where it is more important to know how to get the required knowledge and use it successfully. In developed economies there is a distinct shift from knowledge based, discipline based to integrated learning, to problem based learning where information technology will be of help to help students to learn to solve problems. To ensure this, development of certain competencies are required for carrying out professional tasks by doctors.

Competency of a healthcare professional encompasses sufficient knowledge, psychomotor skills, communication, decision making skills and the right attitude. Competencies described by The Medical Council of India for healthcare professionals1 are as follows:

1. Clinician – who understands and provides preventive, promotive, curative, palliative and holistic care with compassion.2. Leader and member of the healthcare team and system – with capabilities to collect, analyse, synthesize and communicate health data appropriately.3. Communicator – with patients, families, colleagues and community. 4. Life-long learner – committed to continuous improvement of skills and knowledge.5. Professional – who is committed to excellence is ethical, responsive and accountable to patients, community and profession.

2. STATEMENT OF THE PROBLEM

According to the report of the Medical Council of India (Vision 2015) – "The goals of MBBS training is to create doctors with requisite knowledge, skills, attitudes, values and responsiveness….". In order to fulfill these goals the doctor must be able to function in the following roles:

1. Clinician who understands and provides preventive, promotive, curative, palliative and holistic care.2. Leader and member of the health care team and systems with capabilities to collect, analyze and synthesize health data.3. Communicator with patients, families, colleagues and community. 4. Lifelong learner committed to continuous improvement of skills and knowledge.5. Professional who is committed to excellence, is ethical, responsive and accountable to patients, community and patients.

Since there has been an increasing emphasis on defining outcomes of medical education in terms of 'performance' of medical trainees, my area of study will be focused on analyzing whether the roles and goals related to that of a 'communicator' or people competencies gathered from their course of study in medicine is enhancing their performance. Broad competencies such as skills in leadership and management, team work, communication and interpersonal skills, empathy, and self-directed and life-long learning to effectively discharge their duties is the need of the hour. These will be addressed through my study of the people competencies of the medical graduates working as interns or recently passed out and working as doctors.

3. OBJECTIVE OF THE STUDY

1. To identify the average profiles of people competencies required by recent medical graduates/ interns working in Kolkata
2. To examine whether the people competencies can determine the performance level of the medical graduates/interns working in Kolkata.

4. BENEFITS OF THE STUDY

Findings of this study can help the various hospitals and medical institutions in Kolkata to become more aware of the people competencies required by interns/medical graduates. It will help in establishing a direct connect between requirements of patients and the delivery that they get from the interns/fresh medical graduates. It may help hospitals to formulate an informal system to assess the performance of the medical graduates/interns, since knowledge of the requirements of patients from the doctors will become known through this study.

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5. LITERATURE REVIEW

Various literature studies have been carried out in the above areas to understand and focus on competency based medical education.

Knowledge, skills and attitudes (KSA) comprises the three elements of competency as defined by Dr.P. H. RAO2 in his article "A Framework for Building Competency: Improving the Quality of Care at the Primary Health Level", ASCI Journal of Management (2010) Administrative Staff College of India. While knowledge means knowing what behaviour is appropriate in a given situation, skill refers to possessing the ability to behave in the desired way in a given context. Attitude or motivation implies having the desire to communicate in a competent manner.

Types of Competencies

Essential Competencies: The UNIDO (2002: 10) model categorizes essential competencies as: (a) managerial, (b) generic and (c) technical/functional.

Anderson and Pulich (2002) identify planning, organizing, leading and controlling as the set of managerial competencies necessary in today's dynamic health care environment.

Marshal (1999) groups competencies as: (a) threshold and (b) differentiating.

While, threshold competencies (such as product knowledge, computational skills) enable a job-holder to do the job effectively, it is differentiating competencies (such as customer orientation, ability of salespersons to place themselves in the shoes of the potential buyer of the product) that make for superior performers.

Core Competencies: Core competencies of successful physician executives comprise skill sets such as: (a) leadership (inspiration, vision and motivation), (b) technical (knowledge, information systems and conflict resolution), and (c) management (change, uncertainty and expectations). These core competencies have a capability continuum that make them special and valuable to the organizations (Lazarus, 2002). Freshman and Rubino (2002) identify emotional intelligence as a core competence of health administrators.

Cultural Competence: Cultural competence is "the ability of systems to provide care to patients with diverse values, beliefs, and behaviors, including tailoring delivery to meet [the] patients' social, cultural and linguistic needs (Betancourt, Green and Carrillo, 2002: 2)." Since culture influences an individual's health beliefs, behaviour, activities and treatment outcomes, it is desirable that health care professionals also be culturally competent. Cultural competency assumes greater significance while dealing with patients from certain castes, tribes and religious groups.

Level of Competencies

The Quality Chasm report (Institute of Medicine, 2001a)3 has recommended the following:

Provide patient-centered care. identify, respect, and care about patients differences, values,

preferences, and expressed needs; relieve pain and suffering; coordinate continuous care; listen to, clearly inform, communicate with, and educate patients; share decision making and management; and continuously advocate disease prevention, wellness, and promotion of healthy lifestyles, including a focus on population health.

- ***Work in interdisciplinary teams.*** cooperate, collaborate, communicate, and integrate care in teams to ensure that care is continuous and reliable.
- ***Employ evidence-based practice***. integrate best research with clinical expertise and patient values for optimum care, and participate in learning and research activities to the extent feasible.
- ***Apply quality improvement.*** identify errors and hazards in care; understand and implement basic safety design principles, such as standardization and simplification; continually understand and measure quality of care in terms of structure, process, and outcomes in relation to patient and community needs; design and test interventions to change processes and systems of care, with the objective of improving quality.
- ***Utilize informatics***-communicate, manage knowledge, mitigate error, and support decision making using information technology.

From the archives of Medical Health Science, 2014 Mr. T.V. Chaco's4 article on "Moving towards competency based education: Challenges and the way forward" Mr. Chaco has given a broad overview of competency based education and how countries have adopted these practices aligning these with the health needs of the country and the challenges which are faced thereon.

The article by Nilima Shah, Chetna Desai, Gokul Jorwekar, Dinesh Badyal and Tejinder Singh titled "Competency based medical education: An overview and application in Pharmacology" published in the Indian Journal of Pharmacology in 2016 elaborates about how competency based medical education can be implemented in pharmacology and in basic sciences and what are the perils involved in order to maximize the gains to be derived.

The book "Health Professions Education: A Bridge to Quality"5 edited by Greiner A.C., Knebel. E, Published by National Academics Press(US) 2003, Washington DC, which was compiled during the Institute of Medicine(US) Committee on the Health Professions' Education Summit, talks about the challenges in healthcare systems in the US, a set of simple, core competencies to be possessed by healthcare professionals and how these competencies can be practiced.

Support for competency-based training (CBT) is increasing (Sullivan, 1995; Dubois and Rothwell, 2004)6. CBT is participant-centered and focuses on the mastery of specific knowledge and skills. It is appropriate in training situations where trainees have to attain a small number of specific and job related competencies (Watson, 1990)7. Important benefits of CBT include achievement of competencies and building the confidence of participants. Since the trainer is a facilitator of learning and focuses on individual needs, training time is used more efficiently and effectively. CBT enables the evaluation of each participant's ability to perform essential job skills. Participants receive the list of competencies they have to achieve (Norton, 1987)8. Since CBT is participant-centered, time can be devoted to accelerate the learning process through the extensive use of models and simulation. The learning environment should be as similar as possible to that of the workplace.

Unfortunately, the curriculum of medical courses in India has not kept pace with the fast-changing knowledge, skills and technology deployed for the diagnosis and treatment of diseases. Medical graduates and even postgraduates are found deficient in clinical skills and problem-solving abilities due to inadequate provision of faculty, equipment, and financial and other resources in both government and private medical colleges. Exposure to behavioural sciences and managerial and communication skills receives no attention (Sood and Adkoli, 2000)9, depriving medical graduates and postgraduates of systems and people management competencies. The National Health Policy, 2002 (MHFW, Govt. of India, 2002)10 does acknowledge many, but not all, of the weaknesses of medical education in India. Therefore, as Mavalankar (1996: 13)11 argues, employing (supposedly) qualified staff by itself does not ensure the technical competence needed for the job.

In India the teaching and the learning methods focus more on knowledge than on attitude and skills whereas competency based medical education focuses on greater accountability, flexibility, learner-centeredness. This would mean that time based teaching and training will be replaced by focusing on the development of competencies till the desired level is achieved within the relevant timeframe of the syllabus. Assessment of students will be on individual basis independent of the performance of other students. The Dreyfus model propounded in an article by Batalden P, Leach D, Swing S, Dreyfus S, Dreyfus S12, talks about five milestones of a student from a novice, advanced beginner, competent, proficient to an expert.

The other important aspect in competency based method of teaching is assessment. International collaborators of CBME have enlisted six key features for effective assessment in CBME:

1. It needs to be continuous and frequent, 2. It must be criterion based, 3. The assessment needs to be largely work based, 4. The assessment tools themselves must meet certain minimum standards of quality, 5. More qualitative approach to assessment must be incorporated, 6. The trainee should be actively involved in the assessment process.

To assess performance one must first understand what performance is. According to Health Evidence Network (HEN)13 synthesis report on hospital performance (2003) which is a work commissioned by World Health Organization's Regional office for Europe, "Performance" must be defined in relation to explicit goals reflecting the values of various stakeholders (such as patients, professions, insurers, regulators). In reality, however, very few performance measurement systems focus on health outcomes valued by customers. "Measurement" implies objective assessment but does not itself include judgement of values or quality; these may be added by those who later present and interpret the data. Hospital performance may be defined according to the achievement of specified targets, either clinical or administrative. Targets may relate to traditional hospital functions, such as diagnosis, treatment, care and rehabilitation as well as to teaching and research. Measurement is central to the concept of quality improvement. Hospitals have many targets and many stakeholders out of which, I would like to concentrate on performance and its assessment in respect 'service improvement' and 'whether the service and patient experience constituting only of people competencies in respect of the fresh medical graduates are compatible with the learning provided to them and measuring the same in 'referrer and patient choice' in respect of the following two targets:

1.Service improvement: Purchasers and providers can compare performance within and among hospitals to stimulate and measure change and 2. Referrer and patient choice: Patients and their referrers can use information such as waiting times, outcomes and patient experiences in choosing a provider.

Under third-party assessments (one of the types of measurement of hospital performance) 'Peer Review' is a closed system for professional self-assessment and development. Reciprocal visiting is driven by professional (often single-discipline) organizations and has a long tradition as a form of peer review, especially for the recognition of training posts. It is endorsed by clinical professions as a means of self-regulation and clinical improvement, and is integrated with undergraduate, specialty and continuing professional development.

6. METHODOLOGY

Participants:

The participants in this study will consist of:

a) MBBS student community in Kolkata who are pursuing internship in various hospitals in Kolkata and

b) Students pursuing post graduate studies in medicine in various hospitals and Kolkata

Procedure:

- Identifying the interns and the MD students in hospitals in Kolkata
- Identifying the senior doctors in each department of the hospitals who are mentors to these students
- Identifying the people competencies required to handle patients by administering a questionnaire to senior doctors and taking the help of the competencies elaborated by the Medical Council of India through their reports, then collating both of them.
- Patient Satisfaction Survey through a questionnaire to be administered to patients in the hospitals handled by the above students to judge whether the performance of these medical graduates in being affected by the people competencies present in them.
- Another survey to be taken by administering a questionnaire of the senior doctors under whom these medical graduates are working to assess whether their performance is being affected by the people competencies present in them.

Measures:

- A self developed 5-point People Competency Scale, taking the feedback from the Medical Council of India's reports on People Competencies of doctors will be developed by me and used to determine People Competencies of interns/post graduate medical students.
- A self developed 5-point Performance Measurement Scale developed by me about people competencies needed by the above students to handle patients -
    a. taking feedback from the senior doctors under whom the interns/medical graduate students work and
    b. the Patient Satisfaction Survey results

will be used to judge whether the performance of the above students are influenced by the people competencies.

Tools to be used:

After collection of data the same will be analyzed by a relevant statistical tool taking the help of SPSS 25.

7. CONCLUSION

The above study will be helpful in more awareness being generated about patient handling by the newly passed out doctors so that general improvement in patient handling process can be made in hospitals.

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Deep Learning - An Advancement of Artificial Neural Network

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***Abstract*— Deep learning algorithm has rapidly become a methodology of choice for the analysis of huge unstructured data using unsupervised learning. In this paper I have discussed Deep learning as a successor of Artificial neural network, types of Deep learning network, its application in different areas, its strengths and challenges.**

***Keyword*— Deep learning, artificial neural network, unsupervised learning**

1. INTRODUCTION

Deep learning is basically a software which mimics the brain neuron network in. Deep learning is a division of Machine learning a field that examines computer algorithms that learn and improve on their own and is called deep learning because it uses deep neural networks. Deep learning technique is strongly capable of learning from data and environment. Because of its highly adaptive nature now a days it is mostly used in self driving cars, image recognition software, and recommender systems.

2. ARTIFICIAL NEURAL NETWORK

In information technology (IT), a neural network is a system of hardware and/or software patterned after the operation of neurons in the human brain. Neural Networks (NN), also called as Artificial Neural Network is named after its imitation representation of nervous system of human brain.

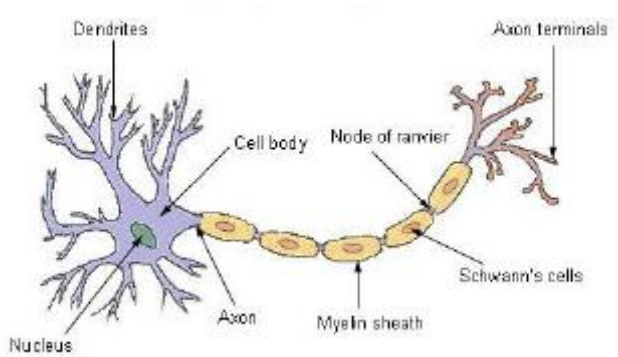

Figure 1: Structure of a neuron

The major components are:

- Dendrites- It takes input from other neurons in form of an electrical impulse
- Cell Body– It generate inferences from those inputs and decide what action to take
- Axon terminals– It transmit outputs in form of electrical impulse

Each neuron takes input from various other neurons through the dendrites. It then performs the necessary processing on the input and sends electrical pulse through the axiom into the end nodes from where it is transmitted to other neurons. ANN works on similar manner.

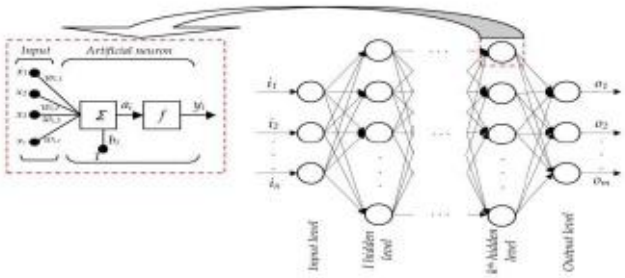

Figure 2: Artificial Neuron

A neuron collates all the inputs and processes them. Finally, it transmits the output to all other neurons of the next layer. Neural Network is divided into layer of 3 types:

1. Input Layer: The training observations are fed through these neurons
2. Hidden Layers: These are the intermediate layers between input and output which help the Neural Network learn the complicated relationships involved in data.
3. Output Layer: The final output is extracted from previous two layers.

3. FRAMEWORK OF WORKING OF ANN

i. Assign random weight to all the linkage.

ii. Find the activation rate of the hidden nodes using the input and input to hidden node linkage.

iii. Find the activation rate of the output nodes using output and hidden to output node linkage.

iv. Find the error rate at the output node and recalibarate all the linkage between hidden and output nodes.

v. Using the erroe at the output node and its weight cascade down the error to hidden nodes.

vi. Recalibarate the weight beteween hidden and input nodes.

vii. Repeat the process till the convergence criteria is made an dusing the final linkage weights score the activation rate of the output nodes.

3.1 Working of single neuron

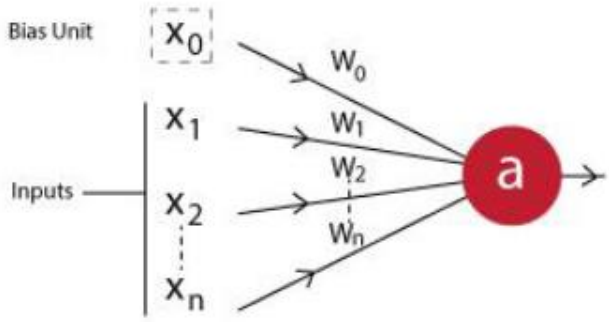

Figure 3: Single Neuron Network

The different components are:

1. $x_1, x_2, \ldots, x_N$: Inputs to the neuron. These can either be the actual observations from input layer or an intermediate value from one of the hidden layers.

2. x_0: Bias unit. This is a constant value added to the input of the activation function. It works similar to an intercept term and typically has +1 value.

3. $w0, w_1, w_2, \ldots, wN$: Weights on each input. Note that even bias unit has a weight.

4. a: Output of the neuron which is calculated as:

$$a = f\left(\sum_{i=0}^{N} w_i x_i\right)$$

f is the an activation function. This makes a Neural Network extremely flexible and imparts the capability to estimate complex non-linear relationships in data. It can be a Gaussian function, logistic function, hyperbolic function or even a linear function in simple cases.

The AND function can be implemented as:

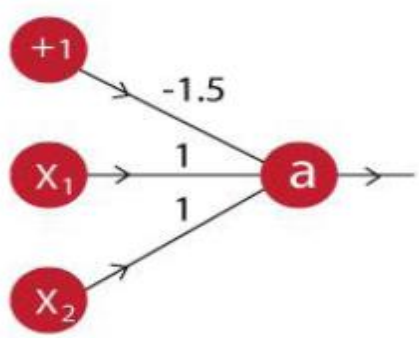

Figure 4: AND function using Bias unit

The output of this neuron is: $a = f(-1.5 + x_1 + x_2)$

Truth table:

x_1	x_2	x_1 AND x_1	$(-1.5 + x_1 + x_2)$	a
0	0	0	-1.5	0
0	1	0	-0.5	0
1	0	0	-0.5	0
1	1	1	0.5	1

Same as single neuron, Neural Network can model complex relations using multiple layers. Let's take an example of xnor function

$$\begin{aligned} a1 \text{ xnor } a2 &= \text{not}\ (\ a1 \text{ xor } a2\ ) \\ &= \text{not}\ [\ (a+b).(a'+b')\ ] \\ &= (a+b)' + (a'+b')' \\ &= (a'.b') + (a.b) \end{aligned}$$

x_1	x_2	$a_1 = 0.5 - x_1 - x_2$	$a_2 = -1.5 + x_1 + x_2$	$a_3 = a_1 + a_2$
0	0	0.5	-0.5	0
0	1	-0.5	1.5	1
1	0	-0.5	1.5	1
1	1	-1.5	-0.5	0

Truth table of XNOR function using multilayer neurons based on Figure 5.

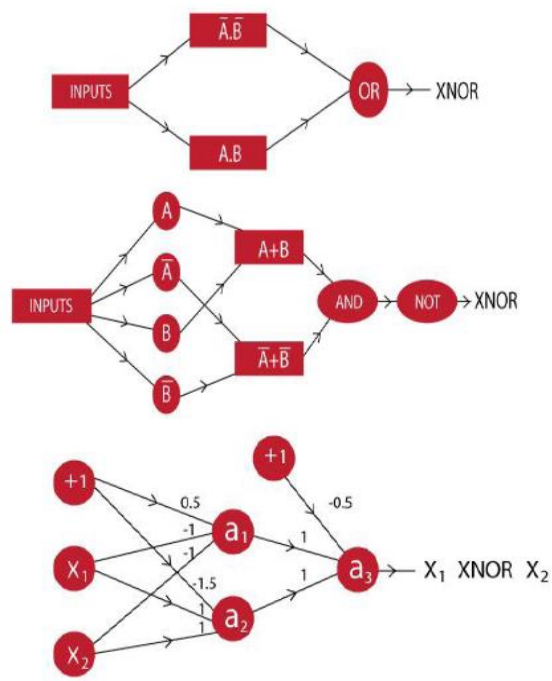

Figure 5: Step by step procedure to generate XNOR function using multilayer neurons

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4. CLASSIFICATION OF NEURAL NETWORKS

Shallow neural network: The Shallow neural network has only one hidden layer between the input and output.

Deep neural network: Deep neural networks have more than one layer. For instance, Google LeNet model for image recognition counts 22 layers. Now a days, deep learning is used in many ways like a driverless car, mobile phone, Google Search Engine, Fraud detection, TV, and so on.

5. TYPES OF DEEP LEARNING NETWORKS

a) Feed-forward neural networks: It is the simplest type of artificial neural network where information flows in only forward direction without any loop. It means, the information's flows starts at the input layer, goes to the "hidden" layers, and end at the output layer.

b) Recurrent neural networks (RNNs): RNN is a multi-layered neural network that can store information in perspective nodes, allowing it to learn data stream and output a number or another stream. It uses looping structure. In simple words it an Artificial neural networks whose connections between neurons include loops. RNNs are well suited for processing sequences of inputs.

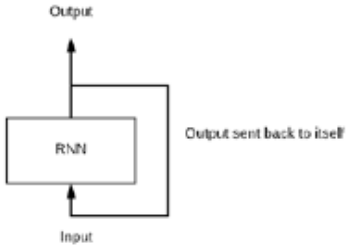

Figure 6: Recurrent neural network

Common uses of RNN

- Help securities traders to generate analytic reports
- Detect abnormalities in the contract of financial statement
- Detect fraudulent credit-card transaction
- Provide a caption for images
- Power chat bots
- The standard uses of RNN occur when the practitioners are working with time-series data or sequences (e.g., audio recordings or text).

c) Convolutional neural networks (CNN): CNN is a multi-layered neural network with a unique architecture designed to extract progressively more composite features of the data at each layer to determine the output. CNN's are mostly used for perceptual tasks involving unstructured data.

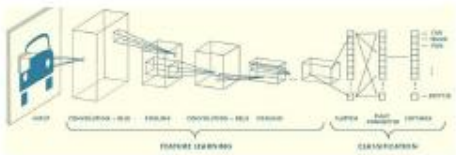

Figure 7: Convolutional neural network

d) Reinforcement Learning: Reinforcement learning is a subfield of machine learning where the systems are trained by receiving virtual "rewards" or "punishments," essentially learning by trial and error. Google's Deep Mind has used reinforcement learning to beat a human champion in the Go games. Reinforcement learning is also used in video games to improve the gaming experience by providing smarter bot. One of the most famous algorithms are:

- Q-learning
- Deep Q network
- State-Action-Reward-State-Action (SARSA)
- Deep Deterministic Policy Gradient (DDPG)

6. KEY CONCEPTS OF DEEP NEURAL NETWORK

Deep-learning networks are distinguished from the other single-hidden-layer neural networks by their depth; which is the number of node layers through which data must pass in a multistep process. Earlier forms of neural networks were shallow, composed of one input and one output layer, and at most one hidden layer in between. More than three layers (including input and output) make the grade as “deep” learning. So deep is a strictly defined term that means more than one hidden layer. In deep-learning networks, each layer of nodes trains on a distinct set of features based on the previous layer’s output. The further you advance into the neural net, the more complex the features your nodes can recognize, as they aggregate and recombine features from the previous layer, known as feature hierarchy which is basically a hierarchy of increasing complexity and abstraction. These neural nets are capable of discovering concealed structures within unlabeled, unstructured data. Deep Learning network is enable to perform feature extraction without human intervention.

7. EXAMPLES OF DEEP LEARNING APPLICATIONS

In Finance: The financial technology sector has already started using Deep learning to save time, reduce costs, and add value. Deep learning is changing the lending industry by using more robust credit scoring. Credit decision-makers can use AI for robust credit lending applications to achieve faster, more accurate risk assessment, using machine intelligence to factor in the character and capacity of applicants.

In HR: Some companies are hiring and modernizes the candidate experience with the help of Deep learning. Ex, Armour.

In Marketing: Deep learning is a valuable tool for customer service management and personalization challenges. Improved speech recognition in call-center management and call routing as a result of the application of Deep learning techniques allows a more seamless experience for customers.

In Medical ground: Deep learning is widely used in medical object classification, Organ, region and landmark

localization, object detection, organ and substructure segmentation, content based image retrieval, combining image data with reports

8. STRENGTHS OF DEEP LEARNING

a) No need for feature engineering: Feature engineering is the process of extracting features from raw data to better describe the underlying problem. It is a fundamental job in machine learning as it improves model accuracy. The process can sometimes require domain knowledge about a given problem. One of deep learning's main advantages over other machine learning algorithms is its capacity to execute feature engineering on its own. A deep learning algorithm will scan the data to search for features that correlate and combine them to enable faster learning without being explicitly told to do so.

b) Best results with unstructured data: According to research from Gartner, up to 80% of a company's data is unstructured because most of it exists in different formats such as texts, pictures, pdf files and more. Unstructured data is hard to analyze for most machine learning algorithms, which means it's also going unutilized. That is where deep learning can help.

c) No need for labeling of data: Getting good-quality training data is one of the biggest problems in machine learning because data labeling can be a tedious and expensive job. Sometimes, the data labeling process is simple but time-consuming. With deep learning, the need for well-labeled data is made obsolete as deep learning algorithms excel at learning without guidelines. Other forms of machine learning are not nearly as successful with this type of learning.

d) Efficient at delivering high-quality results: Once trained correctly, a deep learning brain can perform thousands of repetitive, routine tasks within a shorter period of time than it would take a human being. The quality of its work never diminishes, unless the training data includes raw data that does not represent the problem you are trying to solve.

9. CHALLENGES OF DEEP LEARNING

a) The need for lots of data: the amount of data needed for training will be much higher compared to other machine learning algorithms. The reason is that the task of a deep learning algorithm is two-folded. First, it needs to learn about the domain, and only then solve the problem. When the training begins, the algorithm starts from scratch.

b) Overfitting the model: Overfitting happens when an algorithm learns the detail and noise in the training data to the extent that negatively impacts the performance of the model in real-life scenarios.

c) Lack of flexibility: In order to solve a given problem, a deep learning network needs to be provided with data describing that specific problem, thus rendering the algorithm ineffective to solve any other problems. This is true no matter how similar they are to the original problem.

10. CONCLUSION

In spite of these limitations Deep learning is a powerful tool to make prediction an actionable result. Deep learning excels in pattern discovery (unsupervised learning) and knowledge-based prediction. Big data is the fuel for deep learning. When both are combined, an organization can reap unprecedented results in term of productivity, sales, management, and innovation. Deep learning can outperform traditional method. For instance, deep learning algorithms are 41% more accurate than machine learning algorithm in image classification, 27 % more accurate in facial recognition and 25% in voice recognition.

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A study on load sensitive power generation in Hybrid Solar-Wind system using Metaheuristic Algorithms based -EMS control

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***Abstract*— In recent years, power demand increases due to rapid increase in industrialization, transportation and population. Under this circumstance, for getting ecofriendly, sustainable, clean, reliable and cost-efficient source of energy, we need to develop renewable energy resources (RES). Solar and wind are highly potential resources therefore by integrating these two renewable resources has gained immense attention globally and given a new integration system, named Hybrid wind solar PV system. In this paper the emphasis is made on developing a load sensitive energy management system (EMS) control function or battery charging and discharging control model for Solar PV-wind HRES system. Our proposed model encompasses Solar PV-Wind HRES with bi-directional converter, Li-ion battery storage, variable speed controlled PMSG WT generator and EMS control units. Our proposed model applies two metaheuristics algorithms assisted PID controller. In this paper, metaheuristics algorithms like Flower Pollination Algorithm (FPA) and Hyper-Spherical Search (HSS) have been developed to be used for online PID tuning. The simulation results reveal that our proposed HSS-PID controller-based EMS control system exhibits better charging-discharging control even under dynamic load and non-linear power generation.**

***Keyword*— Renewable Energy Sources; Hybrid-RES; Non-linear Load-Generation Sensitive EMS control; Metaheuristics Algorithms**

1. INTRODUCTION

In recent years, the exponentially rise in electricity demand to meet residential, commercial and industrial power requirements have alarmed academia-industries to achieve more efficient source of energy while maintaining environmental sustainability. To fulfill such demands, Renewable Energy Sources (RESs) have emerged as the potential solution. Interestingly, features like eco-friendly, low cost, and sustainability make RESs the vital energy source for future [1]. Surveys reveal that till 2050 RESs would be capable of delivering almost 80% of the residential, commercial and industrial power demands [2]. Being sporadic in nature RESs undergoes exceedingly high dynamism as per regional environmental conditions makes its implementation with micro-grid complicate [3]. Typically, the availability and feasibility of RESs differ as per geographical conditions. For instance, a geographical location with sufficient sun-light presence can be ideal for solar power, while oceanic coastal regions, mountains etc. can be suitable for wind-turbine based power generation [4]. The dynamic variation in load side might impose significantly huge change in energy consumption and hence can affect overall EMS. On the other hand, an inferior EMS system might lead sever damage of the infrastructure and may impose load shedding conditions. Under such circumstances developing a load sensitive EMS control model can be vital. Similarly, the non-linearity in power generation in HRES due to dependency on the local environmental conditions can make power transmission vulnerable. Thus, considering real-time dynamism in power generation, transmission and load conditions in the Hybrid-RES system containing PV cells and the Wind Turbine systems developing a highly robust and efficient EMS control system is must.

Apower grid with Hybrid-RESs requires battery storage units to store power generated from the individual RESs and make it at the reach of consumers [5][6]. To ensure optimal power distribution and transmission across the grid network, Energy Management System (EMS) and allied Battery Management System (BMS) are must. As stated, to enable quality power and reliable transmission enabling efficient charging and discharging of the battery system (i.e., BMS) can play significant role [7–10]. Developing a robust EMS and/or BMS solution by considering dynamic generation pattern as well as load variation can be of utmost significance to ensure reliable and safe power transmission for HRES power grid network [12]. To deal with such HRES non-linearity optimizing charging and discharging control in EMS by considering both power generation

condition as well as load side variation can be stated as the driving force behind this research. Though, numerous efforts have been made for EMS control in RES systems [13-14], majority of the existing systems use traditional controllers such as PID controllers, Fuzzy controllers for state of charging and discharging control. Prominently, classical PID controllers use static gain parameters to perform charging- discharging control which may take more time in achieving convergence, especially for transient control. On the other hand, Fuzzy controllers require huge and precise membership functions to perform control that under exceedingly high non-linearity and dynamism seems highly complicate. Heuristic algorithm such as the Genetic Algorithm (GA), Particle Swarm Optimization, Ant Colony Optimization (ACO), etc. have been applied for PID gain parameter estimation to be used in EMS control. Though, this metaheuristics algorithm assisted EMSs have augmented performance; however, the key issues like local minima and convergence makes them questionable to delivery optimal solution. It motivates authors to exploit and develop more efficient algorithms to perform enhanced PID assisted online EMS control in PV-WT based HRES systems. With this motivation, in this research paper, enhanced metaheuristics algorithms like Flower Pollination Algorithm (FPA), Hyper-Spherical Search (HSS) algorithms have been developed for PID gain parameter tuning that eventually leads more efficient and transient state of charging and discharging control. Unlike classical EMS control systems, proposed models apply ITAE error function as the objective function to perform algorithm (FPA/HSS) assisted PID gain parameter estimation that eventually perform generation and load-sensitive battery charging and discharging control. The MATLAB 2016a/SIMULINK based simulation with PV-WT HRES system has revealed that proposed HRES model exhibits more swift charging-discharging control along with efficient WT speed control that as cumulative solution achieves maximum power generation while maintaining optimal power provision to the loads.

2. PROPOSED MODEL

This research paper proposed a robust EMS control function for PV-WT HRES system where the emphasis was made on achieving load and generation sensitive EMS control under non-linear or dynamic conditions. Here, WT model with PMSG generator having maximum capacity of 3kW, while PV system was considered for single diode design with 1kW power capacity. A snippet of our developed HRES- EMS model is given in Fig. 1.

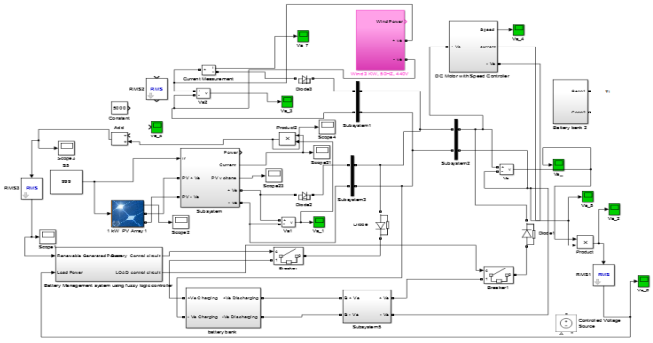

Fig. 1 Proposed PV-WT HRES EMS control model

3. RESULT AND DISCUSSION

A) FPO based EMS control:

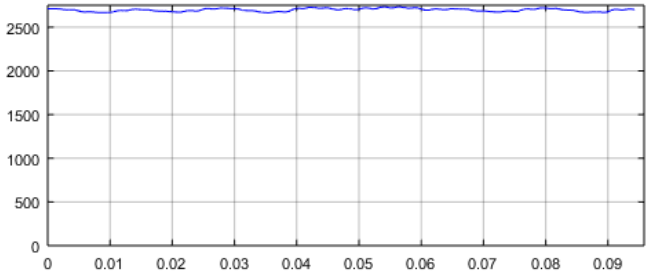

Fig. 2 WT RES generated power (W) with FPO-EMS control

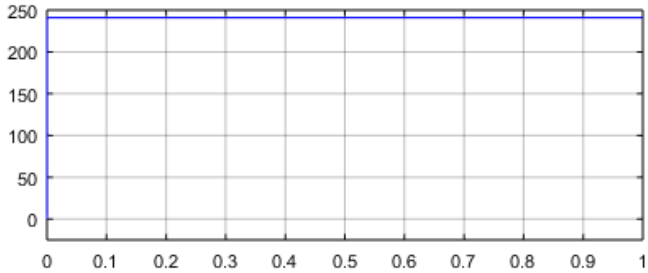

Fig. 3 WT RES voltage output (V) with FPO- EMS control

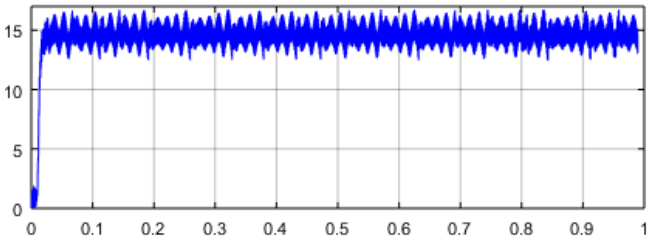

Fig. 4) WT RES current output (A) with FPO- EMS control

Fig. 2 presents the WT RES generated power (W). The maximum power generated was found to be 2752 Watts while the maximum capacity of the power generation at the standard WT speed of 13km/h, is 3 kW. In Fig. 3 and 4 WT voltage and current generation outputs are shown.

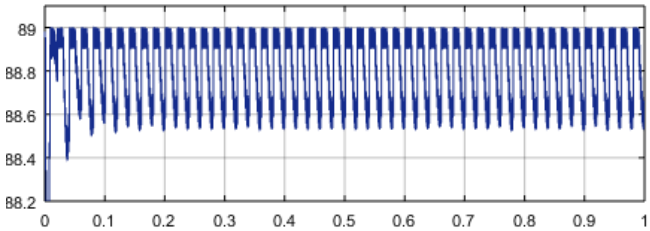

Fig. 5 PV-RES generated power (W) with FPO- EMS control

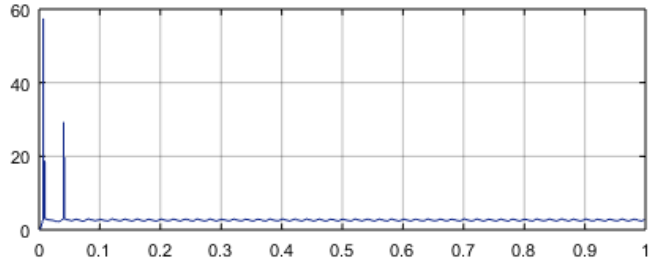

Fig. 6 PV-RES generated current (A) with FPO-EMS control

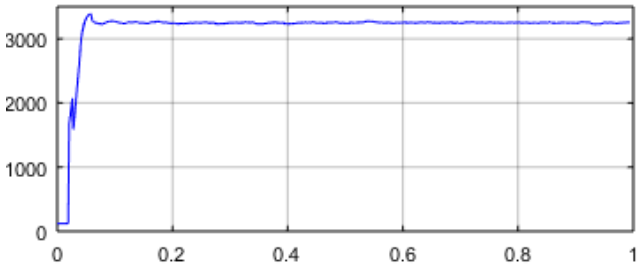

Fig. 7 PV-WT HRES generated power (W) with FPO-EMS control

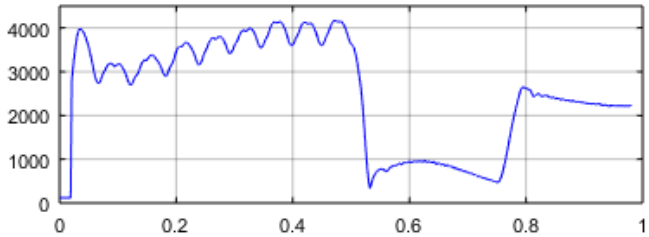

Fig. 8 Load side power (W) demand variation

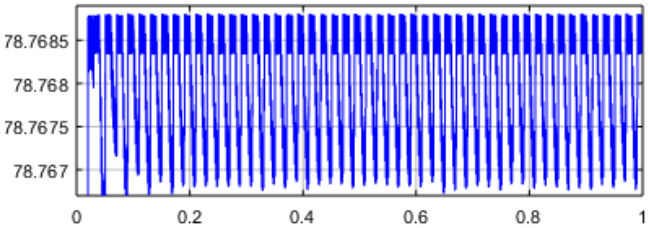

Fig. 9 Switching control with FPO EMS model

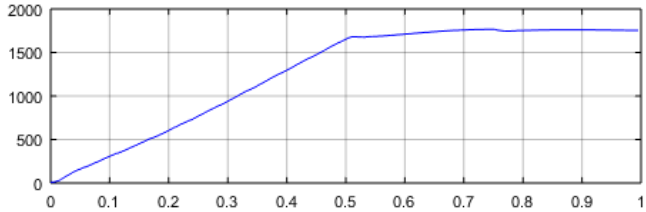

Fig. 10 Speed control with with FPO-EMS control

The power and current generated by the applied PV unit of 1 kW power capacity are presented in Fig. 5 and Fig. 6. The overall generated HRES power is given in Fig. 7 and found that the maximum power generated is 3256 Watts (i.e., 3.25 kW). The load fluctuation is shown in Fig.8. The charging and discharging pattern for the proposed FPO-PID EMS controller is depicted in Fig.9. The speed control achieved by FPA-EMS is shown in Fig, 10.

B. HSS Based EMS Control

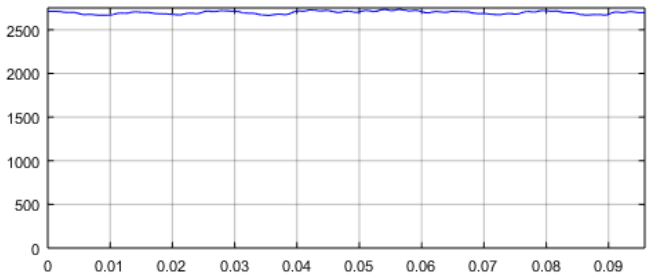

Fig. 11 WT-RES Power generated with HSS- EMS control

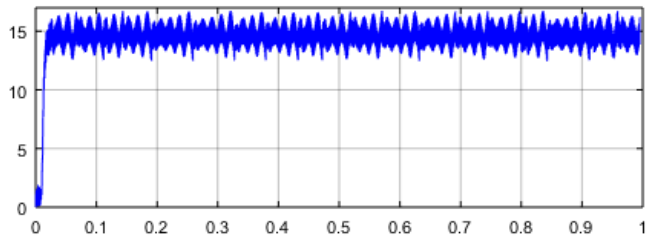

Fig. 12 WT -RES current (A) generated with HSS-EMS control

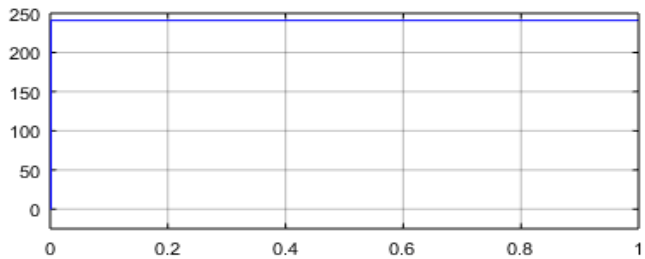

Fig. 13 WT-RES voltage (V) generated with HSS-EMS control

In Fig. 11, the highest power generated was observed to be 2900 Watts by WT system, whose maximum capacity is 3000 W. Fig. 12 and Fig, 13 exhibit the current and voltage generated by WT, respectively.

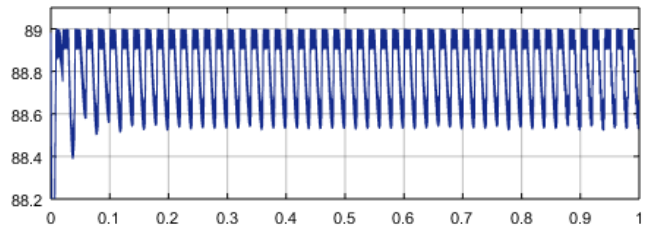

Fig. 14 PV-RES generated power (W) with HSS-EMS control

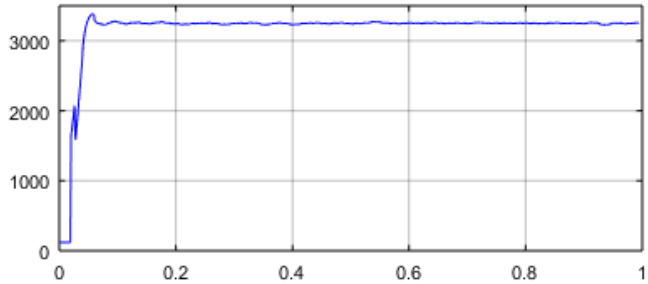

Fig. 15 Proposed PV-WT HRES based overall power (W) generation with HSS-EMS control

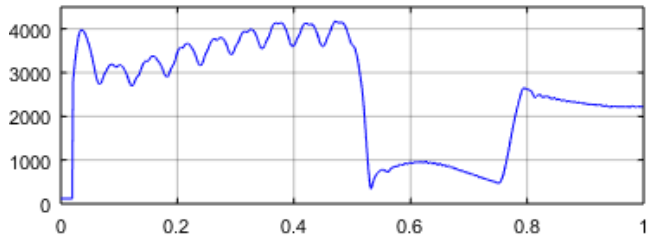

Fig. 16 Load variaitons for HSS-EMS

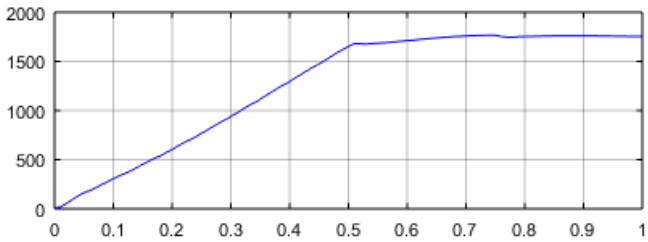

Fig. 17 Speed control variaiton with HSS-EMS control

Fig. 14 exhibits PV RES generated power. Fig. 15 exhibits the overall power generated by proposed PV- WT HRES system. Non-deniably the power generated with HSS-PID control solution and FPO- PID controller are near-similar; however, the maximum power generated with HSS-PID based (load sensitive) EMS control was found to be 3840 Watts, which is higher than the FPO-PID based EMS control. HSS-PID which emphasizes on retrieving optimal solution by exploiting search space has depicted better and stable performance as compared to FPO. However, superiority of these heuristics approaches for PID tuning in EMS control can't be ignored. As contribution, this research paper recognizes HSS based PID controller for EMS control in HRES system to ensure reliable and quality power delivery to the customers. Now, taking into consideration of the results obtained in both FPA- EMS and HSS EMS systems, especially the WT RES power generation, it can be observed that though both algorithms exhibit near-similar performance however HSS show more transient speed control under load- and generation sensitive charging and discharging control.

4. CONCLUSION

In this research work proposed metaheuristics algorithm based PID systems such as Flower Pollination Algorithm (FPA) and Hyper-Spherical Search (HSS) based PID tuning to perform swift and transient charging-discharging control for PV-WT HRES power system. One noticeable contribution is the inclusion of load and generation sensitive EMS followed by condition-awareness based WT speed control that helps in overall performance augmentation. Simulation results reveal that the proposed HSS based PID for EMS control can achieve more efficient performance and hence can be applied for real-time power grid management for reliable quality power supply.

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Influence of piston bowl shape and number of holes in injector on spray, combustion and pollutant emissions of a diesel engine: A numerical study

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***Abstract*— Present study considers numerical simulation to investigate the combine effects of piston bowl shape and number of holes on fuel spray, combustion and pollutant emissions of a naturally aspirated direct injection diesel engine. The fluid flow behavior in combustor is extensively depends on piston bowl shape that affects the air fuel mixing, combustion and emissions. The number of holes of a fuel injector in diesel engines is also an important parameter that influences the distribution of the fuel inside the combustor. In order to study the effect of piston bowl shape, three combustion chambers have been considered for the same bowl volume and compression ratio of 17.5. The injector used for the study varied number of holes from 3 to 6 and the size of holes varied from 0.2121 to 0.3 mm. The investigation has been performed on a diesel engine using the commercial CFD code AVL FIRE. Simulation results reveal that increasing the number of holes considerably enhances combustion and improve emissions from piston bowls and the TRCC piston bowl predicts better performance.**

***Keyword*— Combustion, Spray, Swirl, Turbulence**

1. INTRODUCTION

Diesel engines are extensively used as prime movers in transport sector, power generation and agricultural applications due to their high performance compared to gasoline engines. In diesel engines, air-fuel mixing process needs to be addressed and improvement in air-fuel mixing is possible in compression ignition engines through changes in injector nozzle hole strategy and shape of combustor. Numerical investigation has been done to study the effect of injector nozzle hole and shape of combustor on spray development, combustion and pollutant emissions in diesel engine. The combustion process in compression ignition engine is mainly depends on fuel injection system and perceptive of fuel spray process. The shape of combustor and the number of holes in nozzle are the important controlling parameter effecting air fuel mixing in a direct injection diesel engine and significantly influences the combustion process and pollutant emissions.

B. H. Lee et al. [1] proposed an optimal number of holes for better engine performance and emissions in diesel engine and their result demonstrates that increased number of holes greatly affects evaporation, mixing, atomization, and combustion. C. Arcoumannis et al. [2] reported that the presence of swirl in combustor air, the squish–swirl interaction generates turbulence at the end of compression process which is much more influential in case of re-entrant combustor. M. Montajir et al. [3] investigated that the mixing process is controlled by the injection system, the in-cylinder air swirl, turbulence, and the fuel spray. S. P. Venkateswaran and G. Nagarajan [4] studied that the swirl and Turbulence level of bowl with more re-entrance are much higher compared to baseline piston bowl and it generates enhanced performance and combustion which is helpful in reducing the specific fuel consumption and exhaust soot. L. Lin et al. [5] reported that to have better combustion with reduced pollutant emissions, it is necessary to have better distribution of fuel throughout the combustion chamber. Thus piston bowl shape, fuel injection and fluid dynamics are the important factors responsible for better combustion. A. R. G. S. Raj et al. [6] investigated that a centre bowl on piston is the best in terms of swirl, tumble and turbulence which play crucial role in developing suitable air motion, thereby increasing the energy conversion process of the engine. J. Abraham et al. [7] reported that the number of holes in fuel injector significantly affects the interaction between the fuel jet and the wall depend on mass and momentum of fluid particles which in turn affect the fuel-air mixing process. S. Jaichandar and K. Annamalai [8] that the ignition delay, specific fuel consumption and UBHC are less for TRCC combustor compared to baseline combustor and brake thermal efficiency, the peak pressure, NOx are higher due to enhanced air-fuel mixing. J. Li et al. [9] investigated that

Omega piston bowl is more efficient piston bowl profile in generating powerful squish in a short period which in turn improves the engine performance compared to other combustion chamber configurations [10]. TRCC piston bowl have better performance, combustion and emission characteristics over other configurations of combustor [11-13]. H. M. Ismail et al. [14] reported that the modeling combustor of an engine correspond to one of the most tricky fluid dynamics issues owing to compressible nature of the flow with great density variation. S. K. Gugulothu and K. H. C. Reddy [15] investigated that a flat piston bowl enhances in-cylinder swirl and turbulence which improves air and fuel interaction. S. W. Park and R. D. Reitz [16] reported that injector nozzle hole layout influences effective fuel injection process which improves fuel consumption and pollutant emissions. C. D. Rakopoulos et al. [17] studied that the quasi-dimensional model handles to predict the temperature profile correctly and how it may affect by the piston bowl profile. Y. Zhu et al. [18] investigated the influence of re-entrant lip and piston bowl profile on performance of a high speed direct injection diesel engine and reported that re-entrant lip shape and piston bowl radius plays an important task to have better mixture formation, lower ISFC and higher soot oxidation due to high temperature. V. Kumar [19] reported that modified piston bowl geometries resulted into better atomization in engine cylinder that resulted into uniform combustion which increases the brake thermal efficiency and reduces the fuel consumption compared to baseline engine. B. Kim et al. [20] examined the influence of modification in breakup model constant C_2 with respect to spray angle and breakup time as a function of density of fluid in combustion chamber on combustion duration. B.V.V.S.U. Prasad et al. [21] reported the numerical simulation in several swirl inducing combustors in diesel engine and showed that a high re-entrant bowl generate improved swirl and turbulence and hence reduced pollutant emissions. C.P.A. Gafoor et al. [22] investigated that piston bowl geometry significantly affect the swirl and turbulence which intern enhance the quality of combustion. S. Jaichandar et al. [23] examined that combustion, performance and emission characteristics of DI diesel engine may enhanced by introducing tangential air passages to TRCC piston bowl. V. S. Yaliwal et al. [24] reported that better power output and the trade-off between NOx and smoke emissions may be obtained through dual fuel operation with optimized nozzle geometry along with re-entrant combustor.

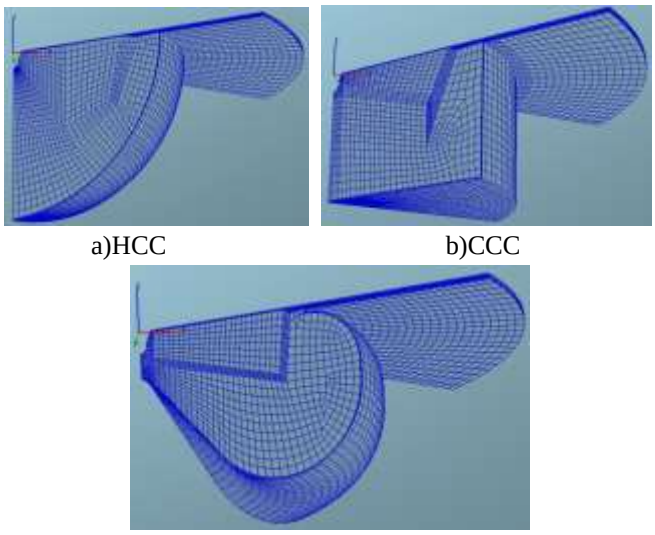
It is evident from above literature, very few analysis have been performed on the basis of piston bowl shape along with number of nozzle holes on fuel spray, combustion and emissions in diesel engine. Hence, to have better perceptive of these issues, it is necessary to investigate the influence of piston bowl shapes and the number of nozzle hole in injector. The goal of the present work is to improve the fuel distribution, atomization, evaporation and fuel-air mixing through efficient spray and air motion in combustion chamber. The detailed in-cylinder spray, combustion and emission characteristics have been studied to find out an optimal piston bowl shape and number of holes in fuel injector.

2. MATERIALS AND METHODS

The performance and emission characteristics of diesel engines are mainly governed by fuel atomization, evaporation and spray processes which in turn are robustly influenced by the fluid dynamics through injector nozzle. In order to study the effect of number of holes in injector associated with modification of piston bowls, the number of holes varied from 3 to 6 and the size of nozzle orifice varied from 0.2121 to 0.3 mm so that the total discharged area of the holes remains constant. The detailed injection strategies for different injectors have been shown in Table 4. The mass flow rate of fuel was distributed across the nozzle holes such that the total amount of fuel injected into the combustion chamber remains constant. A centrally mounted injector location has been adapted to all the cases.

A. Piston Bowl Shapes

In present numerical analysis, to study the impacts of piston bowl shape on fluid motion, combustion and emission characteristics of diesel engine, the combustion chamber shape was customized to have Cylindrical combustion chamber (CCC) and Toroidal re-entrant combustion chamber (TRCC) apart from the baseline Hemispherical combustion chamber (HCC). For all three combustion chambers, the bowl volume was kept constant to have same compression ratio. Furthermore, the cell size of each created medium mesh for all combustion chambers was considered to be same. The created meshes for three investigated piston bowls with 60° sectors were illustrated in Fig. 1. The detail technical specifications of the engine have been illustrated in Table 1.



a)HCC b)CCC

c)TRCC

Fig. 1. Generated meshes of three piston bowls with 60° Sector

Table 1 Technical Specifications of Engine.

Engine type	4-Stroke, Single Cylinder, Diesel Engine
Bore X Stroke	87.5 X 110 mm
Compression ratio	17.5:1
Length of connecting rod	234 mm
Rated power	5.2 @1500 RPM
Rated Speed	1500 RPM
Number of nozzle hole	3
Outlet diameter of hole	0.3 mm
Injection timing	23° before TDC
Injection Pressure	210 bar
Combustion chamber	Hemispherical
Inlet valve closing	35.5° after BDC
Exhaust valve opening	35.5° before BDC

B. Solution Algorithms

In the present investigation commercial CFD code AVL FIRE, specially developed for in-cylinder simulation is used to simulate the in-cylinder processes. It uses finite volume based implicit discretization procedure to solve the governing equations of fluid movement, which is based on the pressure correction method. The SIMPLE algorithm has been considered for pressure velocity coupling in the solution of the flow field. The discretization of continuity equation has been done based on central differencing scheme and upwind differencing scheme is considered for the discretization of momentum, energy and turbulence equations with implicit temporal discretization. The applied sub- models for this present analysis have been listed in Table 2.

Table 2 Sub-models for simulation.

Turbulence model	k-ζ- f
Breakup model	WAVE
Evaporation model	Dukowicz
Wall interaction model	Walljet1
Combustion model	ECFM-3Z
NO model	Extended Zeldovich
Soot model	Kinetic Model
Wall treatment model	Hybrid wall treatment

C. Boundary and Initial Conditions

In present study, cylinder head and cylinder wall have been considered as wall boundary conditions. Cyclic symmetry boundary condition has been applied to continuous boundaries. The piston bowl has been chosen as moving wall boundary condition. Wall boundaries like cylinder head, cylinder liner and piston bowl are treated as no-slip boundary condition. The near wall cells and the corresponding quantities on the wall have been considered as standard wall boundary conditions. The details of initial conditions for the CFD calculation specified at intake valve closing are listed in Table 3.

Table 3 Initial Conditions for Simulation.

Initial temperature	335 K
Initial pressure	1 bar
Piston temperature	525 K
Cylinder head temperature	425 K
Residual gas ratio	0.05
Liner temperature	375 K
Fuel	Diesel

D. Mesh Independence Study

Mesh independence study has been done using hemispherical piston bowl to decide the optimum mesh size with 120° sector (based on 3 holes injector). The coarse, medium and fine mesh consists of 14854 cells, 29525 cells and 45700 cells respectively were considered at Top Dead Center (TDC). To clarify the grid independence, simulations have been done for three meshes at constant engine speed of 1500 rpm at full load. The calculated in-cylinder pressure results were compared as shown in Fig. 2. It have been observed from the figure that with further refinements on the mesh size there is no considerable change observed on the calculated in-cylinder pressure curves from the medium mesh to the fine mesh. Therefore, to save computational

cost, the medium mesh was adopted throughout the investigation.

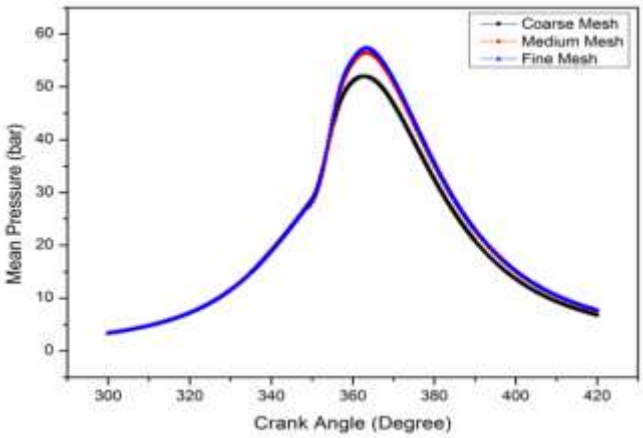


Fig. 2. Combustion pressure comparison for coarse, medium and fine meshes at full load

E. Model Validation

The comparison between experimental and numerical results has been done to validate the numerical model, conducted on a single cylinder diesel engine having 3 holes nozzle in injector and hemispherical combustor. It is obvious from Fig. 3, the in-cylinder pressure between predicted and experimental results are able to accurately predict the in-cylinder combustion characteristics with acceptable tolerance limits.

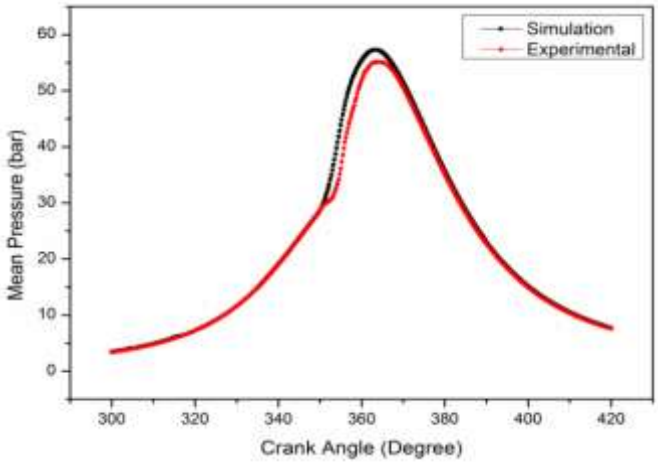
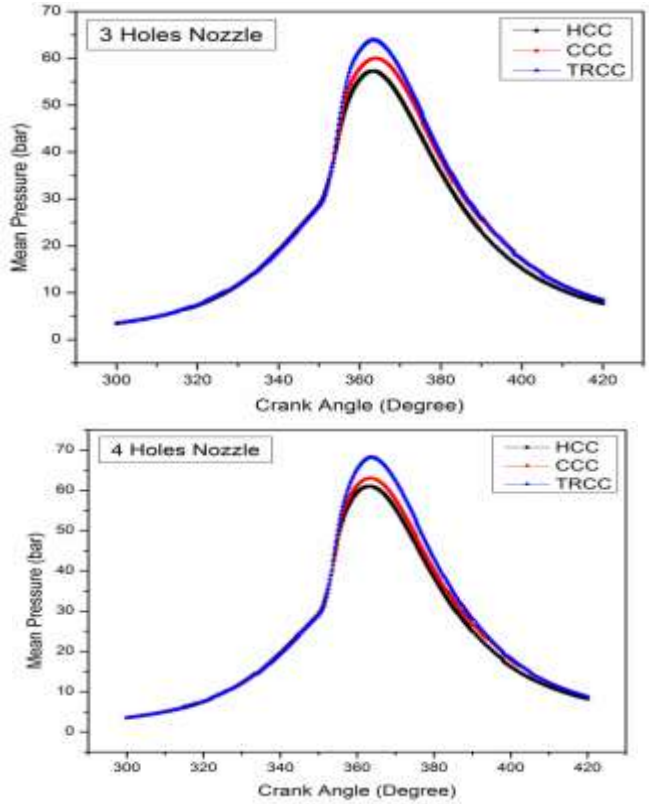


Fig. 3. Validation results of cylinder pressure at full load operation

3. RESULTS AND DISCUSSIONS

In present investigation, to study the influence of piston bowl shape and number of nozzle holes on fuel spray progression and combustion characteristics. The impact of these parameters on combustion was analyzed using combustion pressure, heat release rate, cylinder temperature and emissions against crank angle at full load operation. Simulations have been carried out for the crank angle period of intake valve closing (IVC) to exhaust valve opening (EVO) at constant engine speed of 1500 RPM.

The predicted combustion pressure distribution with crank angle among three piston bowls against the injector nozzle holes have been shown in Fig. 4. It has been found that TRCC bowl depicts highest mean cylinder pressure compared to CCC and baseline HCC bowl geometry. The improved air entrainment due to shape of combustor during fuel injection is favourable for air-fuel mixing process and combustion in TRCC piston bowl. It was also found from the figures that increase in number of holes from 3 to 6, ensured better fuel-air mixing process in the combustor, leads to better combustion and hence increased cylinder pressure.



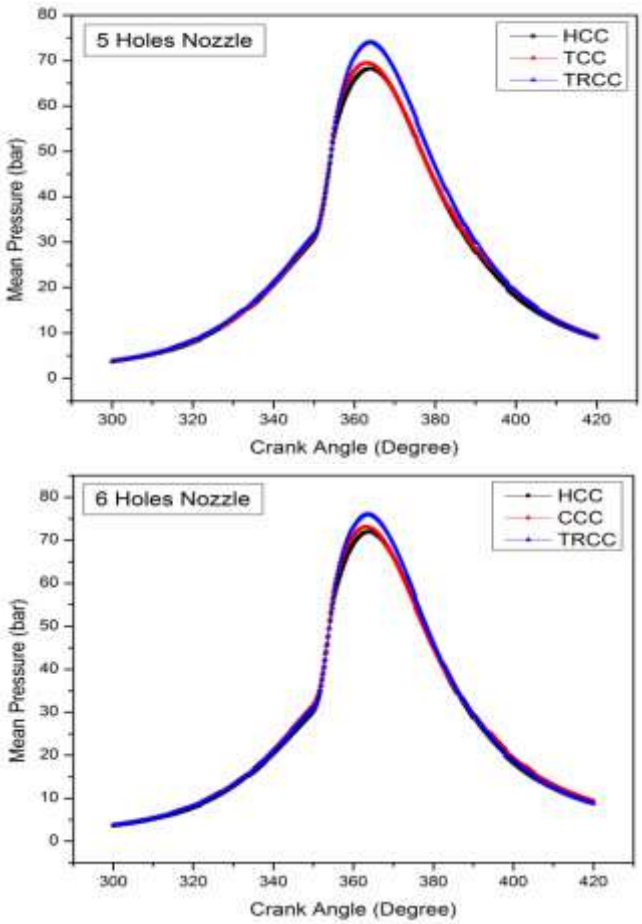


Fig. 4. Predicted in-cylinder pressure in three piston bowls for different nozzle holes

Fig. 5 demonstrates rate of heat release variation against the number of holes in three piston bowls. It was observed from the figure that TRCC bowl geometry predicts the highest rate of heat release compared to other piston bowls. The enhanced air entrainment into the fuel being injected due to increasing turbulence of TRCC piston bowl is responsible for enhanced fuel-air mixing and combustion. Also it has been found that injector having 6 holes nozzle shows highest heat release rate compared to other nozzle holes. The increased number of holes in nozzle will inject the same amount of fuel at more locations. This would have improved the fuel distribution, atomization and evaporation within the engine cylinder which promotes the combustion.

Fig. 6 shows the mean temperature distribution in three combustion chambers against the number of holes. It have been observed from the figures that the cylinder combustion temperature increases as the number of holes increases and the TRCC piston bowl shows higher temperature among the piston bowls. The higher turbulence in TRCC piston bowl prepares more homogeneous mixture of injected fuel with air, resulting in improved combustion responsible for higher temperature.

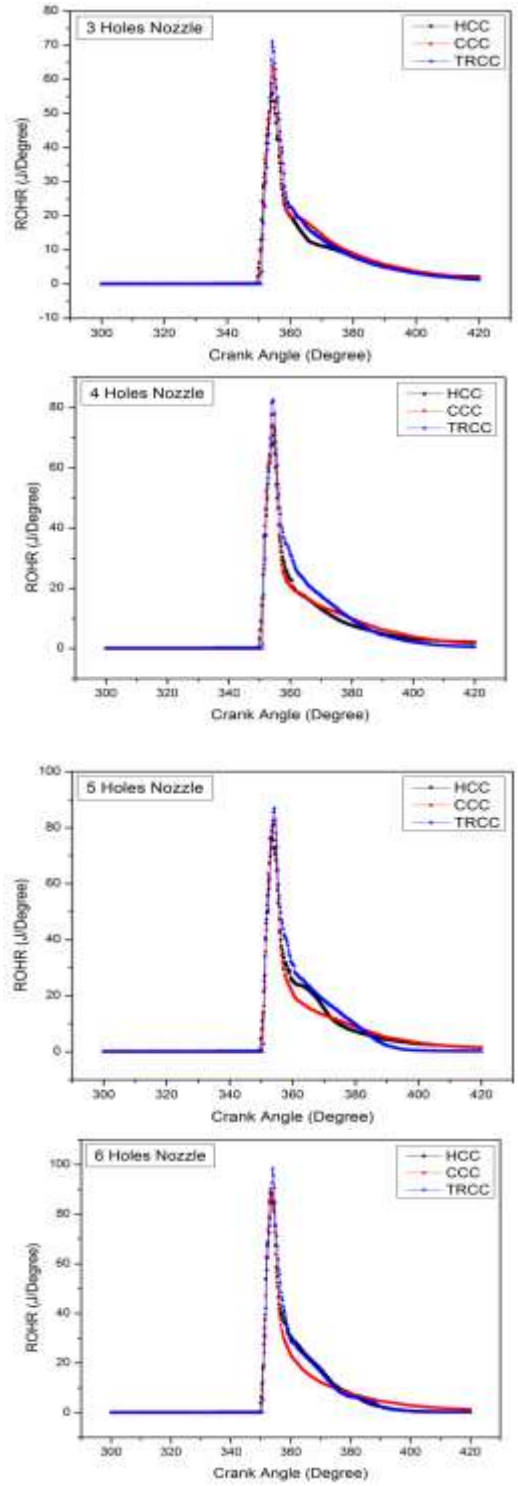


Fig. 5. Comparison of rate of heat release in piston bowls operating on different nozzle holes

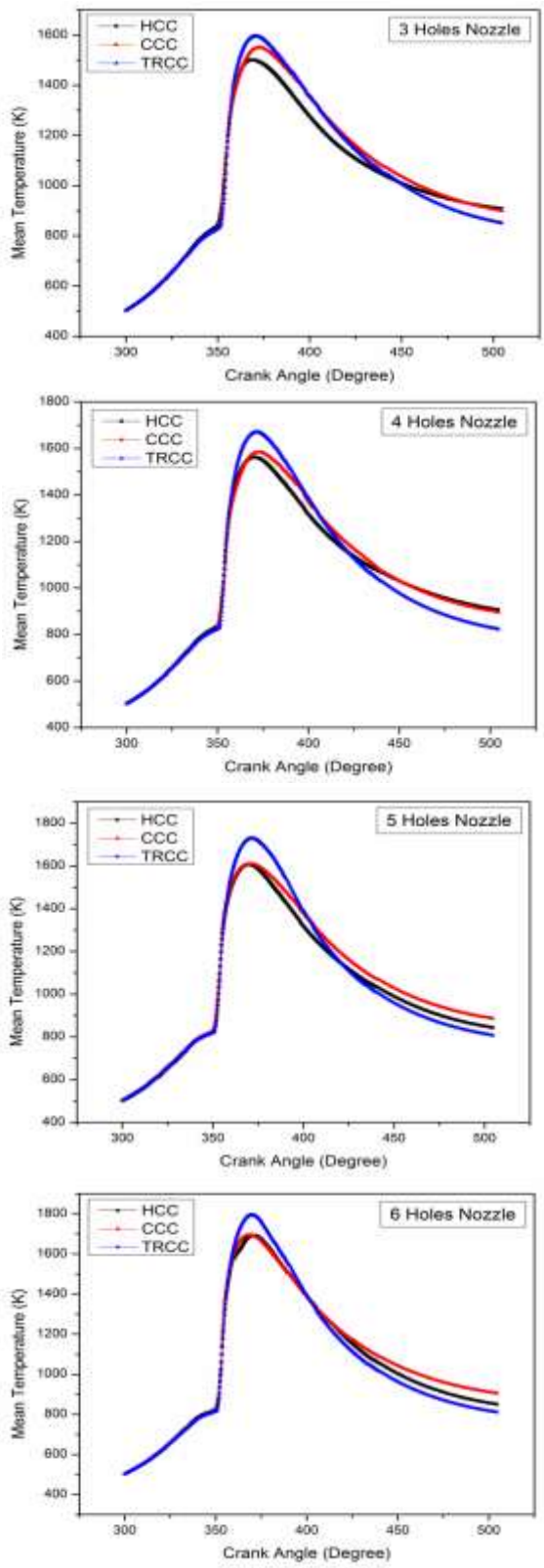


Fig. 6. Distribution of cylinder temperature in three piston bowls against nozzle holes.

The fuel spray interaction with combustion chamber air and wall has important influence on air-fuel mixing process. The injected fuel spray pattern among three investigated piston bowls has been shown in Fig. 7 for fuel injector with 3 to 6 holes nozzle. It has been observed from the figures that the increased number of holes reduces the size of the droplets and fuel is going to be injected at more locations for all three piston bowls. This would have improved the fuel distribution within the engine cylinder and decreases wall impingement. Fuel spray pattern and atomization characteristics are the driven keys to improve combustion and emission characteristics.

Fig. 8 represents the traces of turbulence kinetic energy at 5° crank angle before TDC among piston bowls operated under different number of holes in injector. The result implies that there is larger area of high turbulent kinetic energy in TRCC bowl compared to other piston bowls. Consequently, air-fuel interaction in the combustor could drastically be improved by increasing turbulence due to piston bowl profile.

Fig. 9 shows the mass fraction of NO emission from combustors at 15° crank angle after TDC operated with different number of holes in injector. The result implies that there is larger area of high NO emission in TRCC piston bowl compared to CCC and baseline HCC configuration. The increase in NO emission from TRCC piston bowl configuration is due to higher in-cylinder combustion temperature resulting from better combustion due to improved mixture formation. Also it has been found that NO emission is increasing with the number of holes in fuel injector for all three piston bowl configurations due to reduction in the sizes of the fuel droplet particles present inside the combustion chamber.

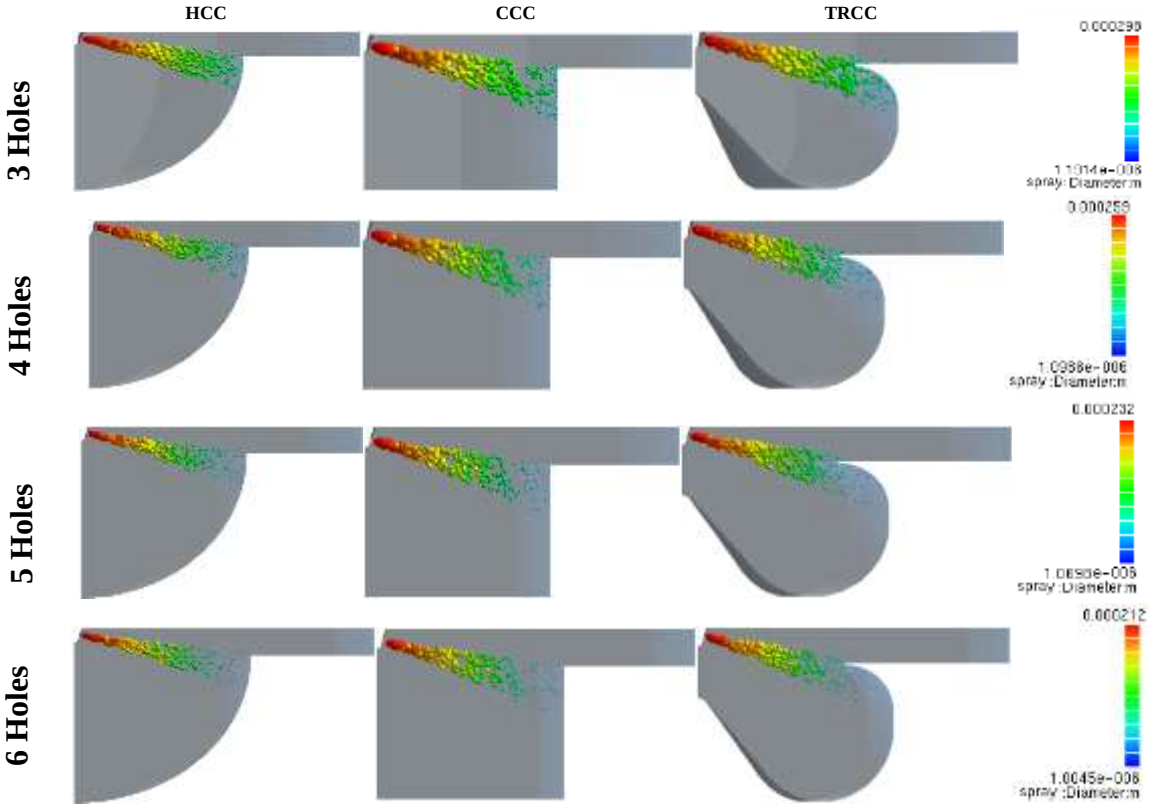


Fig. 7. Droplet size distribution among piston bowls for different nozzle holes at 20° before TDC

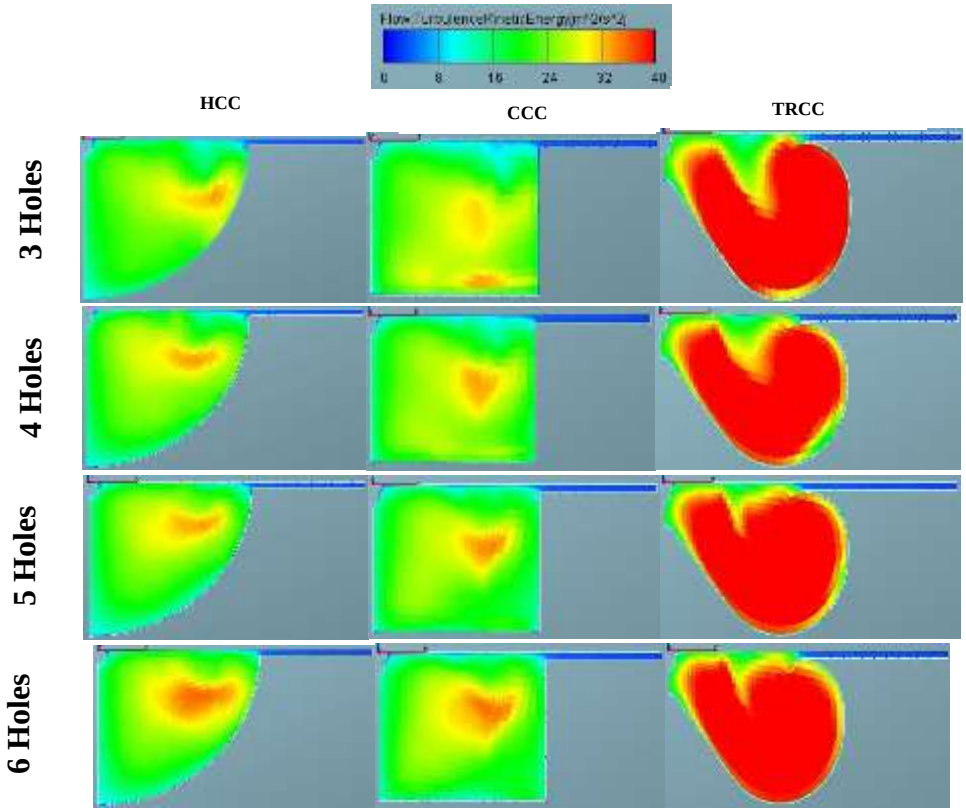


Fig. 8. TKE distribution in piston bowls with different number of holes at 5° crank angle before TDC

Fig. 10 shows the traces of soot mass fraction emission at 15° crank angle after TDC from combustors operated under different number of holes in injector. It has been observed from the contours that higher hole size injector mainly injects fuel on the combustion chamber walls due to higher fluid momentum and thus have larger fuel rich regions as well. Hence soot emissions were found to be more with 3 holes and least with 6 holes injector. The soot oxidation is mainly a function of the local temperatures which are also controlled by the air fuel mixing process. It has been found that in case of TRCC piston bowl soot oxidation is more and formation of soot is low. It could also be attributed to higher air entrainment in TRCC could be the reason for better soot oxidation compared to CCC and baseline HCC piston bowls.

The brake specific fuel consumptions against number of holes for three piston bowls have been shown in Fig. 11. As the number of holes increasing, size of nozzle holes is decreasing to inject same quantity of fuel inside the combustor which enhances the atomization of fuel. The improved atomization and mixture formation ensures superior combustion which in turn reduces the specific fuel consumption of engine. The specific fuel consumption for CCC and HCC are higher than that for TRCC piston bowl. The higher turbulence in TRCC piston bowl improves fuel-air mixture formation which in turn reduces specific fuel consumption due to more complete combustion.

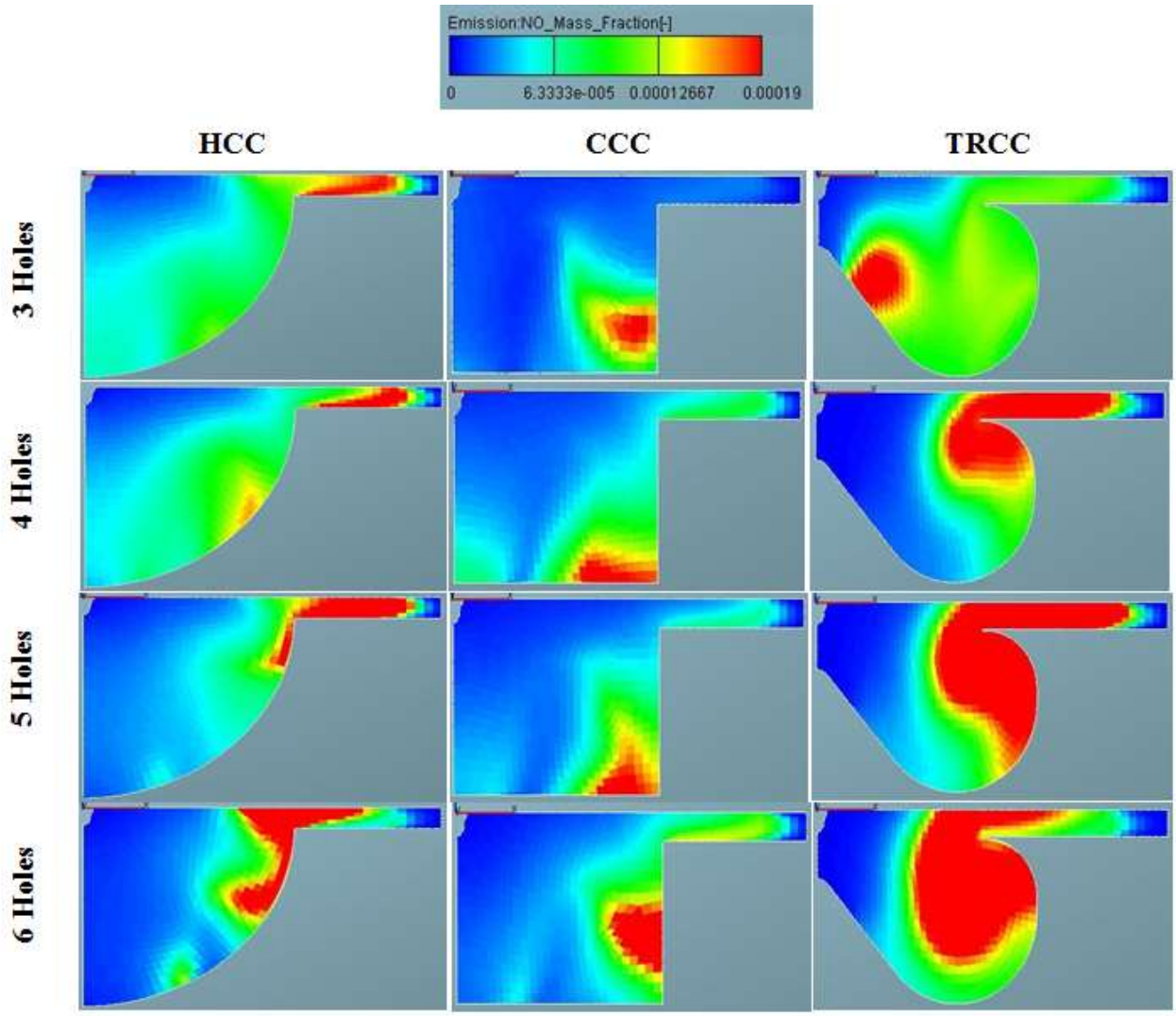


Fig. 9. Traces of mass fraction of NO emission from piston bowls at 15° crank angle after TDC

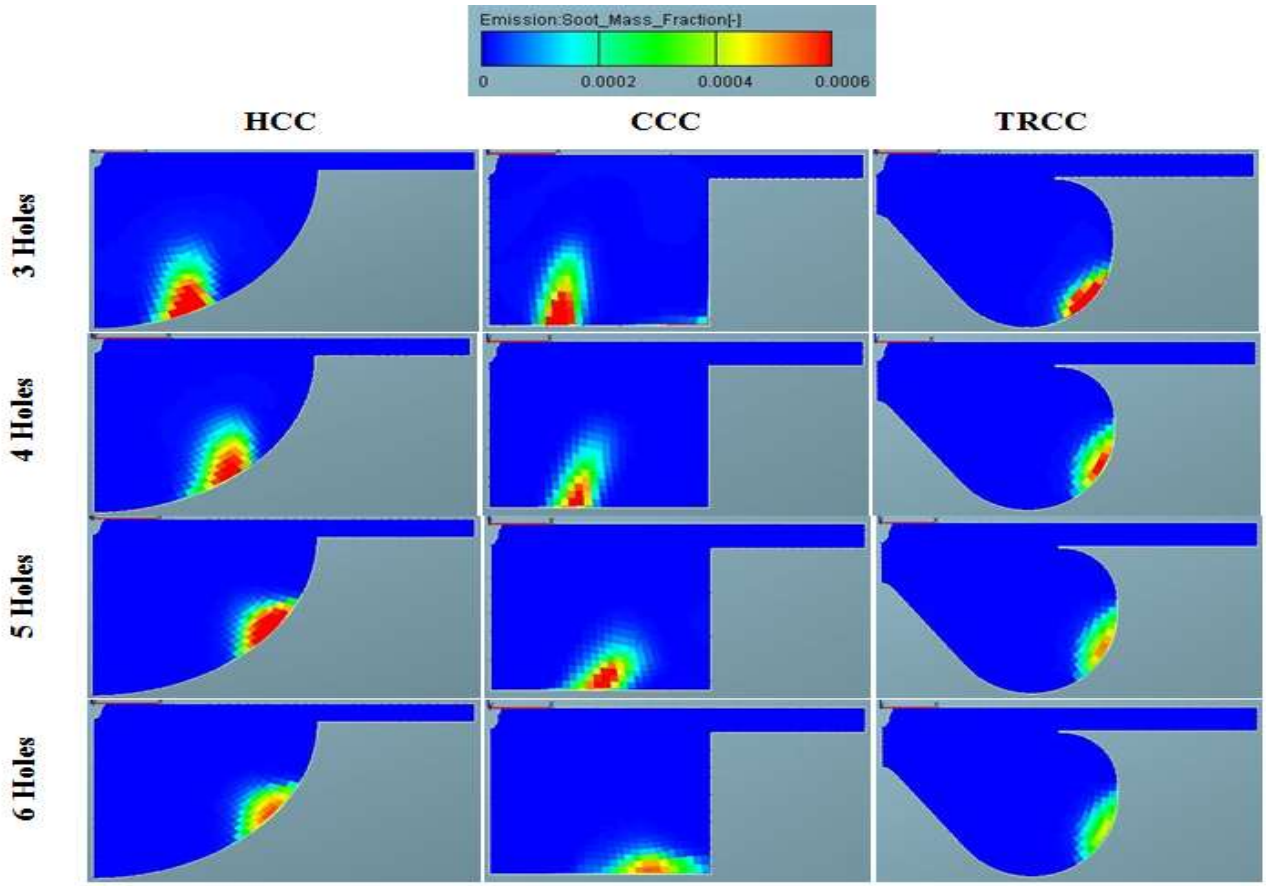


Fig. 10. Predicted soot emission from different piston bowls at 15° crank angle after TDC

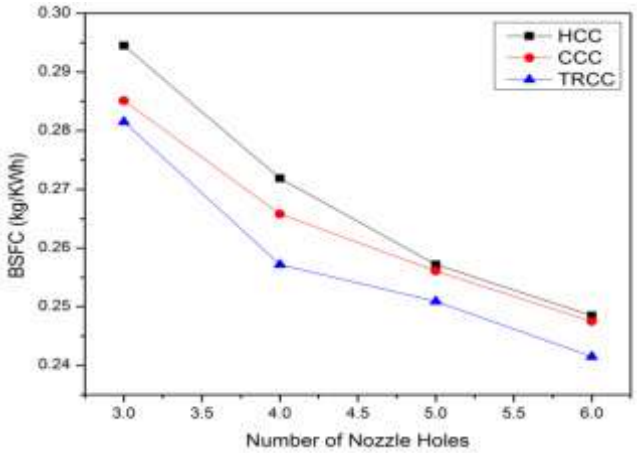


Fig. 11. Brake specific fuel consumption against nozzle holes for three piston bowls

4. CONCLUSION

The numerical simulation has been performed to study the impact of piston bowl shape and number of holes in fuel injector on spray pattern, fuel-air mixing, combustion and emission characteristics of a diesel engine at full load condition. The fluid flow phenomenon inside the combustor is robustly dependent on piston bowl shape and the number of injector nozzle holes effects spray break up, atomization, air fuel mixing and evaporation of fuel. The general conclusions have been drawn from the investigation have been summarized as follows:

- Increasing the number of injector nozzle holes significantly improves spray characteristics, fuel distribution, atomization, fuel-air mixing and evaporation of fuel which results in better combustion with enhanced performance and emission as well.
- The six holes nozzle shows best combustion behaviour and engine performance among investigated nozzle holes, due to better distribution of fuel and decreased wall impingement.
- The enhanced air motion during injection due to increasing turbulence of TRCC piston bowl ensure better air fuel interaction within the engine cylinder which promotes the combustion.

The higher turbulence in TRCC piston bowl due to its bowl shape improves combustion which in turn decreases

the BSFC and promotes soot oxidation compared to CCC and baseline HCC piston bowls.

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Deepening Democracy in India: From Ancient Period to Modern Period of Dr. B.R. Ambedkar'S Views

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Abstract: -- **The proposed paper explores the intimate historical and modern connection between Deepening Democracy in India from Ancient period to Modern period; Democracy is a Greek Word which means peoples power. The word comes from demos "Common People" and Kratos, "Strength". Democratic form of Government is the best form ever. It improves the lives of every individual in the system. It treats every individual equal before law. Evidence of a Democratic system of Government in India is originally found in the Vedas. There is a distinctive evidence from Rig-Veda, which mentions thriving republican form of Government in India. We may quote a few beautiful slokas from Rig-Veda. The Rig-Veda is so committed to democratic principles and ideals that has made democracy a deity and aptly called it "Samjnana". The term Samjnana means the collective consciousness of the people, the National mind to which the individual mind is to pay its homage as the source from which it derives its potency. The hymn addressed to samjnana (in Rigveda) called upon the people together in their assembly (Samgachaddhram) and speak there is one voice (Samvadaddhvam) in a Union of minds (Sammanah), or hearts (Samachittam), of policy (Samanmantrah) and of hopes and aspirations (akuti). Democracy in modern India. The British rule also was against democracy. It was the Government of India Act 1935 that laid the foundation stone of democratic rule in India. The efforts forgiving political freedom to India started from 1946 till it became free in August, 1947. Dr. BR. Ambedkar was architect of Indian Constitution. He was also called father of Indian Constitution. He believed that Democracy essential in imparting social (4) justice, political democracy cannot succeed without social and economic democracy is to achieve political democracy.**

Keywords — **Common People, Principles, Social Justice, Republican, Union of Minds, Economic Democracy**

1. INTRODUCTION

HISTORY

LEGISLATIVE: In India still Legislative should come with laws which will give truths to all particularly the poor, marginalized people laws must empower. People too early out democratic reforms.

EXECUTIVE: Every public servant should work hard to serve people rather than serving themselves.

JUDICIARY: Every Lawyer or Magistrate should favour 'JUSTICE' rather than following favors. It is said that "justice delayed is rustle denied" by keeping their quote in mind every Court should try to resolve early faster.

MEDIA: Print, digital media etc., ply a key role in democracy, they can demand transparency and accountant behalf of people.

The word 'democracy' originates from two Greek words demos (people) and Kratia (rule). In a literal sense, it means 'rule of the people'. So the great Athenian leader (Pericles) defined it as 'a government in which people are 'powerful'. According to Abraham Lincoln, it is the government of the people, by the people, and for the people. In the words of Sir John Seeley, "it is a government in which everyone has a share". To Dicey, "it is a form of government in which the governing body is comparatively a large fraction of the entire nation. Lord James Bruce affirms, since the times of Herodotus, the word 'democracy' has been used to denote that form of Government in which the ruling power of a state is largely vested not in any particular class or classes but in the members of the community as a whole.

Historically, democratic system a governance in India was started from Vedic period. Since ancient times, democratic system has been strong in India? Its evidence is derived from an ancient literature, coins and various records. It would not be wrong to say that the principle of democracy is originated from the Vedas. The Sabha and Smiti are mentioned in both Rig Veda and Atharva Veda. In these meetings decision were made after the discussion with the King, Ministers and Scholars. Therefore, it is come to be known that how politics was at that time, because people together used to settle the decisions of the Sabha and Samiti with good vision. Even people of different ideologies were divided into various groups and take a decision were divided into various groups and take a decision after mutual consultation. Occasionally there was also a conflict between ideas due to the differences in the mindsets of people. So it will not be wrong to say that the beginning of a bicameral legislation can be considered since the Vedic period. Even the selection of Indra was also due to these committees during the vedic period. At that time, Indra was the post which was known as kings of kind. The word republic has been used forty times in Rig Veda, 9 times in Atharva Veda and in Brahman texts many times. After the

decline of the vedic era, the monarchs emerged and remained the ruler for a long time.

Some Slokas form Rig Veda were to be sung in unison at the beginning of the republic assembly. They were : Sam Sam id Yuvase Ur Sann Agne Vishv Any arya Alias pada sam idhyase sa no vas Uny A Bhara Sam gachadhvam Sam Vadhavamm Sam Vo Man Amsi jAnatAmdeva bhagam yathm purve Samjan Ana up Asate Sam Ano mantram abhi Mantraye vah sam Anena Vo havi sa juhomi Sam An Iva Akutih Sam Ana Rvday Ani Vah Sam Anam astu vo mano yatho Vah Sasah Astaill the term Sabha (gathering) Samiti (Smaller Gathering or Committee) Rajan or Raja (House holder, Leader) exists and are found in vedic literature. Rig Veda also says that the position of the King (Leader) was not absolute, and he could be removed by the Sabha or the Assembly. Rig Veda had made democratic principles and its ideals a deity and called it as 'Samjnana'. This term means the collective consciousness of the people. The hymns of Rig Veda addressed to Samjnana called upon the people to gather in their assembly i.e., Samgachchaddhvam and speak there in one voice i.e., Samvadaddhvam, in a union of minds (Sammanah), of hearts (Samachittam) of Policy (Samanmantrah), and of hopes of aspirations (Akuti).

Some important facts of modern Parliamentary democracy like decision by the majority were also prevalent at the time? After Vedic period, the description of small Republics is found in which people participate together in the decision making process related to the administration. The Republic was defined as a democratic system in the ancient India. In the Atreya Brahmins, Ashtadhyayi of Panini, Inscriptions of Mahabharata, Ashoka Pillars the historical writings of contemporary historians, Buddhist and Jain Scholars, in Manusmruti, various historical evidences are found.

WHAT IS DEMOCRACY?:

India is the largest democracy in the world. It was declared secular and democratic its constitution came into force on 26th January 1950. The democratic India believes in the principles of equality, liberty, justice and fraternity. The people from any caste, creed, sex, religion and religion have an equal right to vote and choose their representatives. The Parliamentary form of government in India is based on the pattern of the British. In India there is a federal form of government which means there is a government at the centre at the state. The government at the centre is responsible to the Parliament, and the state government are responsible towards their respective legislative assemblies. The government at the centre and the state are democratically elected at the centre and the state and democratically elected and allow the patterns of the two houses of the Parliament Lok-Sabha and Rajya Sabha. The government at the Centre and State together elect the President of the Country who is also the Head of the State.

Elections play a vital role in democratic system of governance. In India for most thing is every citizens who are above 18 years should Vote. In India the political propaganda is related with elections. The election process in India is considered to be the inheritance or the main thing of the political corruption. The present elections are not in a way of correct manner as it requires an enormous amount of money and muscle power to win the elections in India. The persons who are contesting in elections usually spent enormous amount of money to attract the votes of people by giving money for vote or spending lavishly to get the votes in elections. Voting system in India has gone through multiple changes. During the first general elections in Lok Sabha in the year 1952 and 1957, each candidate was allotted a separate ballot box with the symbol of the candidate and the names and symbols of the candidates were no printed on the ballot paper and voters had to drop an pre-printed ballot paper in the ballot box of the candidate of their choice. The system created the thinking and fears of tampering, both capturing and handling in the minds of the various stake holders and was soon replaced. In 1977, the ECI, requested the electronic corporation of India to study the possibility of using an electronic device for conducting elections and the government of designing and developing an electronic gadget for conducting elections.

WHY IS DEMOCRACY?:

In 1979, a prototype was developed and it s operation was demonstrated by the ECI before representatives of political parties on the 6th August, 1980. In 1982, the Election Commission of India issued directive under the Article of 324 of the Constitution of India for the use of Electronic Voting Machines (EVMs) and conducted elections at 50 Poling Stations using the machines in a bye elections in Parur Assembly Constituency (AC) of Kerala in the way of an experimental basis. Due to the absence of any specific law prescribing the use of EVMs, the election was challenged in a petition and on 5th March 1984, the Hon'ble Supreme Court of India held that EVM cannot be used in an election unless a specific provision is made in law for its use. After this a law was amended by the Parliament in December 1988 and a new Section 61A was included in the representation of the People Act 1951, there by empowering the ECI to use EVM and the amendment came into force on the 15th March, 1989. The further of democracy and the system of parties in a country depends upon the perception of the society to change according to the demands of the democracy. Illiteracy among he backward groups, citizens affected by poverty, lack o awareness among the rural people are some of the reasons why there is prevalence of casteism in elections. The Election Commission has conducted a number of ideal electoral reforms to strengthen the democracy enhance the efficient functioning of elections. The election machinery, under the protection and support of the E.C., deserves credit for the conducting elections in a free and fair manner. But our system is still affected by many problems. To win votes political parties resort to foul methods and corrupt practices. These encourage the anti-social elements to enter the electoral

fray. The problem is not insufficient of laws, but lack of their strict implementation. In order to stamp out these unfair tendencies. There is a need to strengthen the hands of the EC and to give more legal and institutional powers. The EC must be given with the powers to punish powers. The EC must be given with the powers to punish the corrupted politicians who violate electoral laws.

WHY DOES INDIA'S NEED THE DEEPENING DEMOCRACY?:

India is a very large country of diversities on the basis of language, culture, and religion. At the time of independence, it was economically underdeveloped. There were enormous regional disparities, wider spread poverty, illiteracy, unemployment and shortage of almost all public welfare means. Since independence, Indian democracy has been in perpetual conflict with the quasi-feudal structure of society. Caste based hierarchies are undemocratic, unscientific and unethical, ruining relentlessly at the foundation of our democracy. Unfortunately, rather than advancing the cause of fraternity, our political parties have by and large succumbed to the use of caste-based identities to create long-term electoral vote banks. It has been a determinant of political participation, voting behavior and almost all other aspects of Indian Politics. Though Casteism has also been contributing towards continuation of socio-economic inequalities, what is more alarming is the mixing of caste and politics resulting into 'Politicization of Caste' in contemporary Indian Polity which has become a grave challenge on the way of deepening f the democracy.

Deepening democracy in India is getting developed through observation and following the effective participation f social movement in India, possibility, practicality and feasibility, educational status of Indians, political consciousness and of commoners, political movement of women, Dalits, Adivasis, minorities of society, grass roots level democracy, emergence of regional political parties, state and civil society : democracy and development, the state of good governance in India, the State of cultural diversity, the continuation of lineage of colonial official hegemony, the complex relationship of between state and democracy, the persistence of religious intolerance.

Right to Vote: means nothing to a hungry person for him/her the first requirement is food. Therefore poverty is considered as the greatest challenge to Indian democracy. It is, in fact, the root cause of all kinds of deprivations an d inequalities. Poor people are being exploited at every phase of life by the politicians. Political liberty without economic equality is meaningless. Poor people can never take impartial interest in the politics of the country. Without participation of the masses democracy cannot work.

Poverty: is attributed to many factor, one of which is mass unemployment and under employment. A large number of people in rural areas do not have regular and adequate work. In urban areas also, the number of educated unemployed is very high. The growing population is regarded as the root cause of poverty, though population is the greatest resource in the country.

Corruption: is one of the biggest threats to democracy corruption in public life has been a major concern in India. In fact, corruption is rampant in all spheres of life, be it land and property, health, education, commerce and industry, agriculture, transport, police, armed places of spiritual pursuits. Corruption continues to exist in covert and overt ways at all three levels political, bureaucratic and corporate sector. The tentacles of corruption have effected all organs of government, even including the judiciary.

Education: being the most fundamental need of any developing country, should be the number one priority for India because it is pre-requisite for the success and survival of democracy. Democratic values like liberty, fraternity, justice, equality, co-operation and dignity of individual etc., are applied to education to make more meaningful, effective and relevant. The concept of education for democratic citizenship considers democracy to be the aim and method of instructions. If democracy has to become vibrant, people are to participate fully in it. An educational concept rooted in democracy, and which practices democratic method instruction, helps student upgrading the necessary democratic skills and values. Women's participation: is a central element of democracy and the nature and degree of women's participation is a key indicator of the quality of democratic culture. Though India is the world's largest democracy, women in India still find them selves under represented and fare removed from decision making levels. They face many political, socio-economic ideological and psychological obstacles which need to be remove to enable their equal participation in all spheres of life. Women's in the economy, in academic and the media are fundamental to democracy and essential to the achievement of sustainable development and peace in all contexts. The goal of democracy "of the people, for the people and by the people" cannot be fully realized without active female participation in politics. That is why, beside constitutional provisions, several laws have been enacted, policies have been made and implemented and institutional reforms have been carried out for the empowerment of women by the government of India. The 73rd and 74th Constitutional Amendment Acts in 1993 milestones in the process of political empowerment of women.

DR. B.R. AMBEDKAR'S VIEWS:

Dr. Bhimrao Ramji Ambedkar (1891-1956) 'a symbol of revolt' was one of the front-ranking nation-builders of modern India. He is popularly known as the 'pioneer' who initiated the 'liberation movement' of roughly sixty-five million untouchables of India. Dr. Ambedkar, the chief architect of Indian Constitution. Dr. Ambedkar believed that in democracy revolutionary changes in the economic and social life of the people are brought about without bloodshed. The conditions for that are as follows. There should not be glaring inequalities in society, that is privilege for one class; the existence of an opposition; equality in law

and administration observance of constitutional morality no tyranny of the majority moral order of society; public conscience addressing the constituent assembly, he suggested certain devices essential to maintain democracy, constitutional methods, not to lay liberties at the feet of a great man, make a political democracy a social democracy.

In views of Dr. Ambedkar, political democracy cannot succeed without social and economic democracy. For him, the best mode of achieving socio-economic democracy is to achieve political democracy at the fist instance. The importance of ideas of political, social and economic democracy lies in the fact that, rights cannot be enjoyed by the citizens of any nation in the absence of them. The co-existence of all three democracies is imperative to achieve the goals of equality and fraternity as enshrined in our constitution in Preamble. Underlining the importance of democracy. Dr. Ambedkar stated that, "It seems to me that there lies on us very important duty to see that democracy does not vanish from the earth as the governing principles of human relationship. If we believe in it, we must both be true and loyal to it. We must not only be staunch in our faith in democracy, but we must resolve to see that whatever we do not help the enemies of democracy to uproot the principles of liberty, equality and fraternity. He also expressed a caution and stated that, these three concepts i.e., liberty, equality and fraternity cannot be separated from each other and cannot be treated in trinity. The combination and coexistence of these will only serve the purpose and object of true democracy.

2. CONCLUSION

Despite the preamble of Indian Constitution recognizes India as a Democratic nation endeavoring to secure to the citizens of India, Justice, Liberty, Equality and Fraternity, there is a lot of disparity and discrimination in the land of India. The Government of India Act, 1935 enacted during British days and having undergone about 100 amendments, now comprises of 395 Articles divided in 22 parts and 12 schedules, which broadly imbibes and adopts democratic values. In India, today's debates on tolerance and intolerance upon all forms of democracies like social, political and economic as well as the real solution to maintain peace and harmony in the society, but caste divides the society, thereby resulting in absence of equality and hampering the existence of true democracy. Therefore, all democratic governments must follow the Constitutions rules and regulations that are merged for the sake of the people. Then all the democratic governments and countries will be existing/existed in the safe manner foreverlasting.

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Land Use Change Detection of Yamuna River Flood Plain Using Geospatial Technique: A Case Study

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***Abstract*— The present study intends to quantify the changes and transformations in features classes of Yamuna River Flood Plain in Delhi. ERDAS imagine 9.2 and Terrset geospatial software were used for image processing and quantitative assessment, transformation, gain and loss, contribution o net change and spatial trend analysis. The Landsat 8 (2018), TM (2000) and MSS (1989) images were acquired for assessing LULC change detection using Maximum Likelihood Classifier. LULC classification was achieved with kappa coefficient and overall accuracy for Satellite images of MSS (1989), TM (2000) and Landsat 8 (2018) as 0.781, 0.892 and 0.804and 86.00%, 92.31%, 86.00% respectively. Analysis reveals the addition of built up area up to 25% from year 2000 onwards and loss in dense forest from 40% to 30%. Vegetation areas recorded a reduction of 15% from 1989 to 2000. Spatial trend reveals the qualitative vulnerability of vegetation classes during the study period. During 1989-2000, dense forest, vegetation and water classes contributed maximum to settlement class and during 2000-2018 an interchange of dense forest and vegetation was witnessed. The study provides an insight to the sustainable planning and management of the river ecosystem that is affected by population expansion.**

Keywords — Land use land cover, Change detection, MLC algorithm, geospatial techniques, Terrset, Yamuna River

1. INTRODUCTION

An accurate land cover map is critically essential for sustainable resource utilization and for modeling and analyzing the land as a system (Salberg and Jenssen, 2012; Ahmad et al., 2012). The use of satellites data for land use mapping was widely utilized by researchers in the last decade (Beuchle et al., 2015). Analysis of the data creates impressions of human interaction and nature towards land use evolution thereby, assisting in identifying the optimal land cover (Ghebrezgabher et al., 2016; Jin, S et al., 2017). Changes in flood plain of Yamuna River along Delhi due to anthropogenic involvement in unplanned manner have shaped the fragile ecosystem whilst posing a severe environmental threat to the surrounding areas (Misra et al., 2013; Liu et al., 2017; Zanetti et al., 2018).

With the advancements in geospatial techniques, monitoring, mapping and modeling of land use cover has afforded a way to enhance the capacity in decision making towards sustainable development and management of an area involving low cost and higher accuracy (Misra et al., 2013; Misra and Balaji, 2015; Rawat and Kumar, 2015; Wu et al., 2017). However, concerns over land form classification accuracies have been addressed by various researchers detecting change of flood plains in varied environments. Image classification techniques based on algorithms provides satisfactory results subject to condition of large the sample size. However, in Maximum likelihood classification (MLC), training sample per pixel signature file is created from the real ground information for clustering of those pixels having maximum likelihood of the digital numbers (DN) falling in a particular land use class (Afify, 2011; Iqbal and Khan, 2014; Butt et al., 2015b). Landsat images offer relatively precise analysis of change detection for supervised classification performed using maximum likelihood classifier (Joshi et al., 2011; Lv, Z et al., 2017).

The Land Change Modeler (LCM) in TerrSet is used for map change analysis and spatial trend analysis for a relatively stable land cover which requires relatively low data with dynamic utility (Mishra, V.N et al., 2014;Yasmine Megahed et al.,2015). Based upon transition potential modeling, change prediction and change analysis, future land use land cover can also be predicted with the historical change of maps (Krishna Rajan et al., 2018; Rahel Hamad et al., 2018).

This study intends to appreciate the Land cover changes over a period of 30 years by utilizing Landsat images and employing MLC via supervised classification scheme and Land Change Modeler (LCM) in TerrSet. The study furnishes an insight towards understanding the changing trends that constitutes a crucial prerequisite for efficient interdisciplinary policies leading to sustainable regeneration of an ecologically fragile flood plain.

2. MATERIALS AND METHOD

Study Area

The study covers a 22 km flood plain stretch of river Yamuna passing through Delhi state entering at Wazirabad barrage and exiting at Okhla barrage confining within geographical coordinates from 77° 10′ 00″ E to 77° 20′ 00″ E

longitude and 28° 32′ 00″ N to 28° 43′ 00″ N latitude and extending an area of 51.2 km2 (Fig. 1). The topography of the area is gently sloped in southwestward direction bounded between semi meandering river course coupled with straight and curved paths. The climate of the basin varies from semi arid to humid with most of the precipitation occurring during the monsoon season (June to September). Yamuna River enters Delhi near Palla (28°50'N, 77°12'E) and leaves Delhi 4 km downstream of the Okhla barrage near village Jaitpur (28°31'N, 77°20'E).

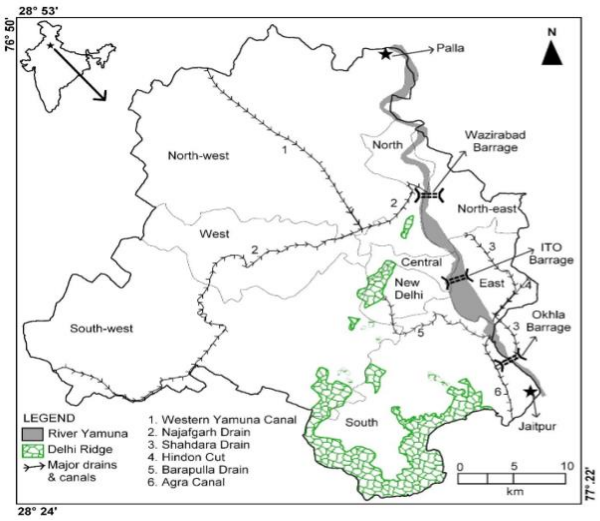


Fig. 1 Location map of the Study Area

Data Used and Image Processing

Satellite images from Landsat 8 OLI-TIRS (Operational land imager/thermal infrared sensor), Landsat-5 TM and Landsat-2 MSS were acquired from united states geological survey web portal for the year 1989, 2000 and 2018 all having spatial resolution of 60m, 30m and 30m respectively. While acquiring the images, suitable scales were considered so as to get cloud free imageries. Fig. 2 illustrates the broad overview of methodology employed for the assessment and evaluation of change and transformation in features within the study area.

ERDAS imagine 9.2 were used for image processing, layer stacking, masking, extracting AOI, supervised classification, and accuracy assessment and confusion matrix creation.

Methodology for Land Use Land covers Change

MLC algorithm was employed on three Landsat images acquired during the period from 1989 to 2018 in ERDAS Imagine Software. The base area for the study scene was prepared by Google Earth Pro and used to extract the study area. The MLC algorithm uses the spectral signatures of training samples collected from field survey with the help of GPS. The DN values of pixels corresponding to the color tones were chosen as criteria to train the given data set. A polygon was drawn to individual training sites with a number of pixel collections and at least 40 to 60 samples for each feature class viz. water, Vegetation, Dense forest area, Settlement and barren land were drawn and saved as a signature file (.sgs extension). Before classification, feature space technique was executed for correction of misclassification or overlapping to the training set data (Gurgel et al., 2017; Lv, Z et al., 2018). During process of feature extraction, a minimal confusion in clustering was ensured with the availability of satisfactory spectral signature (Butt et al., 2015a, López-Serrano et al., 2016).

Finally signature file containing training samples for all feature classes was used for the supervised classification. Ground truth data along with Google Earth Pro were applied for the verification of generated land use cover map for the year of 1989, 2000 and 2018. USGS – LULC II classification endeavors distinct feature definition to differentiate discrete classes belonging to common category by providing suitable attributes (Mosammam et al., 2017). The magnitude of the land use change, percent change and annual rate of change was obtained from Eq. 1 to 3 respectively (Kamrul Islam et al., 2018).

Magnitude of Change = Changes in current year - changes in previous year (1)

%Change = Magnitude of Change/Base year magnitude ×100 (2)

Annual rate of Change = (Final year – Previous year)/ Duration (3)

Where, base year magnitude is the current year of consideration for change detection. Duration in Eq. 3 was obtained by taking difference between the respective years under consideration i.e. for 1989-2000(duration=11 years) and 2000-2018 (duration=18 years).

Methodology for Spatial Trend and Change maps

Idrisi's land change modeler (TerrSet) for ecological sustainability was used to assess spatial trend change analysis with linear, cubic, sixth and ninth order polynomial transition trends of different feature classes into settlement class. The analysis of spatial trend change provides a generalized pattern of land use feature classes. Higher the numbers (red colors), more likely to be changed than lower numbers (darker green to blue colors). Polynomial trend fits a smooth surface by a mathematical function to accommodate the actual topography of the surface.

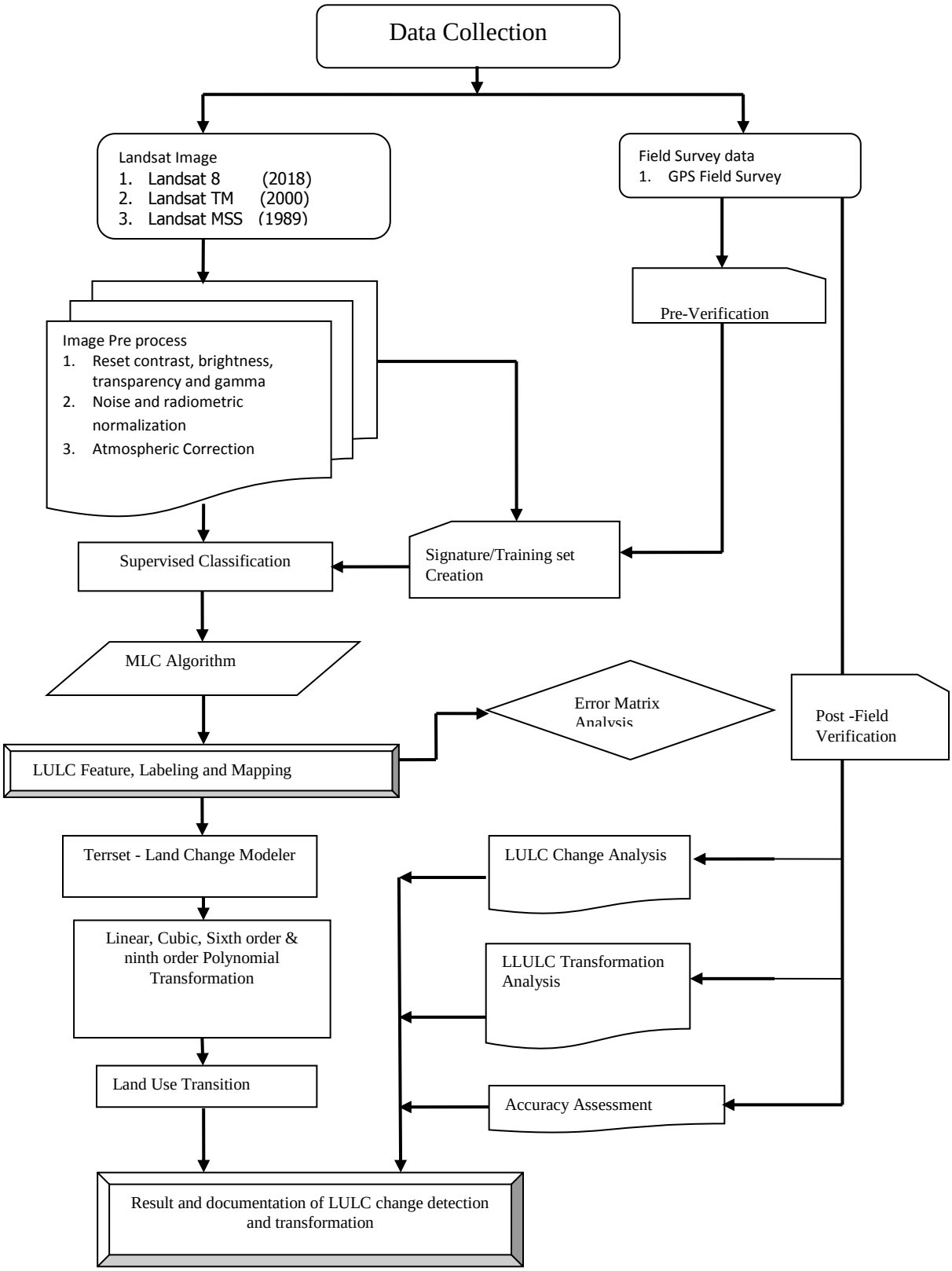


Fig. 2 Methodology adopted for LULC change detection assessment.

Accuracy Assessment

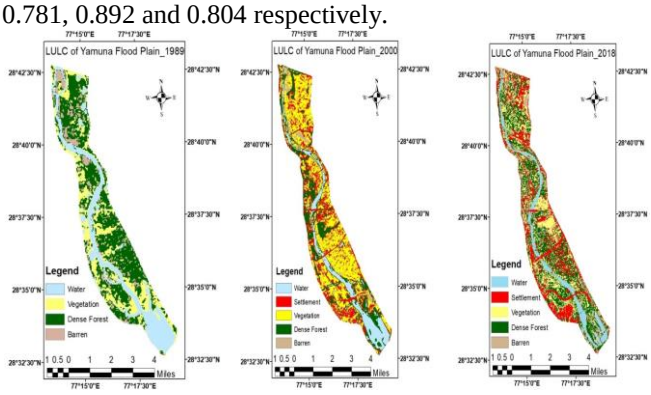
Accuracy assessment of supervised classification performed on images of years 1989, 2000 and 2018 was carried out using ERDAS Imagine software. Pixel based random points from within the classified images were collected that were considered as reference values and the same were assigned into different classes by the user. Error matrix and kappa statistics were generated through identification of correct points as classified values. Kappa coefficient matrix is calculated as per Afify, 2011.

$$K^{\wedge} = \frac{P_o - P_c}{1 - P_c} \qquad (4)$$

Where, P0 is the Sum of proportion of pixel in ith row and ith column for all number of row in the error matrix and Pc is the Multiplication of the proportion of the marginal total of ith row and the proportion of the marginal total of ith column for all number of row in the error matrix.

3. RESULTS AND DISCUSSION

Supervised classification scheme was employed to MLC algorithm for generating LULC maps of study area by utilizing Landsat MSS, TM and Landsat 8 images of assessment years 1989, 2000 and 2018 respectively shown in Fig. 3a,b and c. Land forms within the study area were categorized into five feature classes namely; water, Settlement, Vegetation, Dense Forest and Barren. Changes in land forms were evaluated with overall accuracies of 86.00%, 92.31% and 86.00% and kappa coefficient as 0.781, 0.892 and 0.804 respectively.



(a) (b) (c)

Fig. 1 LULC map of the study area for the assessment year (a) 1989, (b) 2000 and (c) 2018

Assessment of LULC maps derived from supervised classification using MLC algorithm for change detection and transformation of feature classes is categorically summarized in Table 2, 3 and 4. Analysis reveals no areal extent of settlement class within the study area during the year 1989, however, built up class grew to 12.15 km2 and a significant loss of dense forest into vegetation was also witnessed during 1989 to 2000.

Table 1 Distribution of LULC in km2 and Percentage from 1989 to 2000

LULC class	1989		2000		2018	
	Area (km^2)	% of Area	Area (km^2)	% of Area	Area (km^2)	% of Area
Water	12.85	25.12	6.52	12.75	5.52	10.79
Settlement	0.00	0.00	12.15	23.75	13.19	25.79
Vegetation	12.60	24.64	20.57	40.22	12.19	23.83
Dense Forest	20.96	40.97	9.83	19.22	15.15	29.62
Barren	4.74	9.26	2.08	4.07	5.10	9.97

LULC change between 1989 and 2000

Duration from 1989 to 2000 observed large scale changes of dense forest and vegetation area and a large scale settlement surfacing on the flood plains amounting to 25% of the total study area was also observed reflecting high rate of infiltration of migrants from neighboring states in search of livelihood (Table 2). The demographic alteration in the region signifies a stimulus of economic up rise in terms of wide scale infrastructural development with a lesser priority towards the ecological threat to the fragile river corridor. However, a moderate decline of 4.52% in the water bodies along with the forest and vegetation class that too shrank substantially to 19% with an annual rate of 4.82% which is consequential of the aforesaid fact.

Fig. 4(a) depicts the net change and contribution of land use classes during 1989 to 2000. A maximum gain of setllement and loss of dense forest is recorded during 1989-2000. Fig. 5(a) depicts the transition into settlement of land use classes during 1989 to 2000 which further depicts the concentrated anthropogenic activity within the yamuna river flood plain.

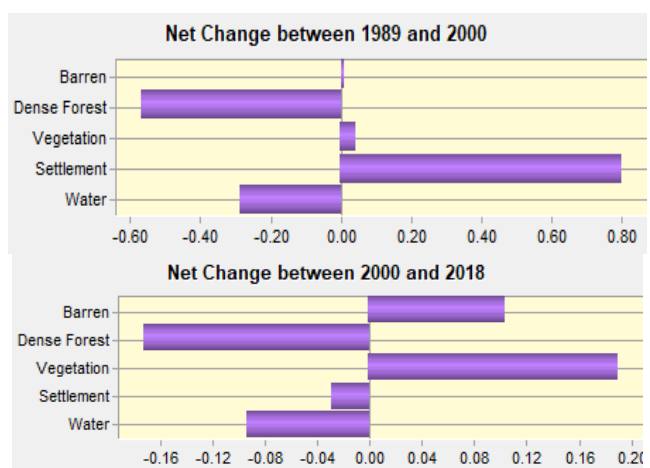


Fig. 2 (a) Net Change of LULC Class between 1989-2000 (b) Net Change of LULC Class between 2000-2018

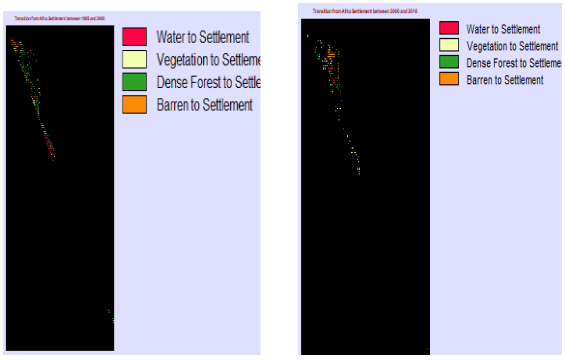


Fig. 5 (a) Transition into Settlement between 1989-2000 (b) Transition into Settlement between 2000-2018

LULC change between 2000 and 2018

Agricultural area witnessed decline during the assessment period from 2000 to 2018 from 40 % of total area to 25% at a rate of 2.07% (Table 2) on account of wide scale job opportunities in construction firms hiring inhabitants as unskilled laborers thus pressuring quit farming practices. Built-up area recorded no change during the period owing to stringent policies adopted by the state Govt. towards regeneration of the severely deteriorated river flood plain. Forest areas exhibited marked increment from 19% to 30 % at a rate of 3.2% on account of green Yamuna action plan, an initiative taken up by National Green Tribunal (NGT) for reviving the deteriorated ecological habitat of the area.

Fig. 4(b) depicts the net change and contribution of land use classes during 2000 to 2018. A maximum gain of vegetation and loss of dense forest is recorded during 2000 to 2018. Fig. 5(b) depicts the transition into settlement of land use classes during 2000 to 2018 which further depicts the concentrated anthropogenic activity within the yamuna river flood plain.

LULC transformation during 1989 to 2000

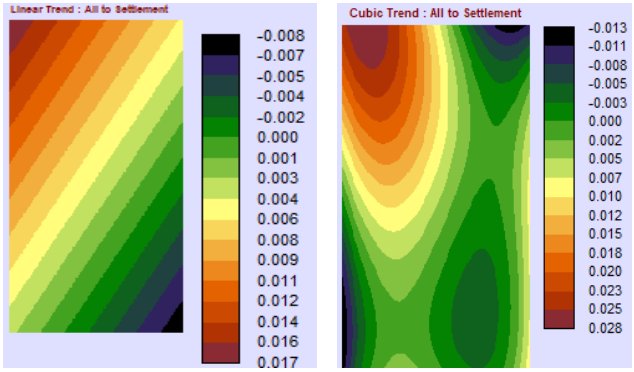
Assessment period from 1989 to 2000 detected maximum transformation of water body to dense forest and vegetation class to a magnitude of 3.32 km^2 and 1.98 km^2 respectively. The transformation of vegetation in terms of gain and loss was observed highly associated with the dense forest amounting to 11.99 km^2 and 4.17 km^2 respectively which signifies a balancing fulcrum between forest and food requirement (Table 3).

Table 1 LULC Transformation during the Assessment Period from 1989 to 2000

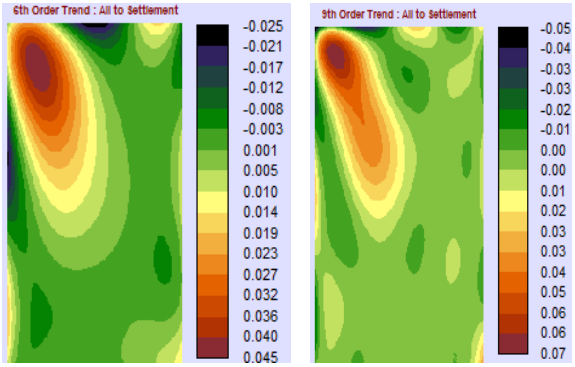
LULC class		Water	Settlement	Vegetation	Dense Forest	Barren	Area of LULC gain in km^2	Area of LULC in km^2 in 2000
Area of LULC in km^2 in 1989	**Water**	**12.85**	0	0.62	0.35	0.11	1.08	6.52
	Settlement	1.71	**0**	3.69	5.94	0.81	12.15	12.15
	Vegetation	1.98	0	**12.61**	11.99	2.81	16.78	20.57
	Dense Forest	3.32	0	4.17	**20.95**	0.53	8.02	9.83
	Barren	0.4	0	0.34	0.86	**4.74**	1.6	2.08
	Area of LULC loss in km^2	7.41	0	8.82	19.14	4.26	39.63	51.15

(Note: the diagonal value represents area of Land use in 1989; the column represents the net loss of Land use into other feature class and row shows the net gain of LULC from other feature classes, LULC area in succeeding year is the summation of LULC of preceding year with net gain minus net loss of LULC).

A significant transformation of barren to dense forest class was observed as 0.86 km^2 in terms of gain and 2.81 km^2 loss. In the late 1980's and early 1990's, a massive construction of various structures embarked along the river segment that included Okhla barrage (1986), ISBT flyover (1990) and NH 24 flyover (1994) imposing establishment of construction units and labor settlements on flood plains thereby resulting in the massive makeshift of the already existing Built-up area.



(a) (b)



(c) (d)

Fig. 6 Spatial Trend analysis between 1989-2000 (a) Linear Trend Analysis – All to settlement (b) Cubic Trend Analysis – All to settlement, Barren to settlement (c) 6th order Trend Analysis – All to settlement (d) 9th order Trend Analysis – All to settlement

Fig 6 depicts the spatial trend analysis between 1989 to 2000. Fig 6 a depicts the linear trend analysis, Fig 6 b depicts the cubuic trend analysis, Fig 6 c depicts the 6th order trend analysis and Fig 6 d depicts the 9th order trend analysis between all to settlement. It is further revealed that dense forest and vegetation has maximum transformation into settlement where as barren contributed minimum to settlement.

LULC transformation between 2000 and 2018

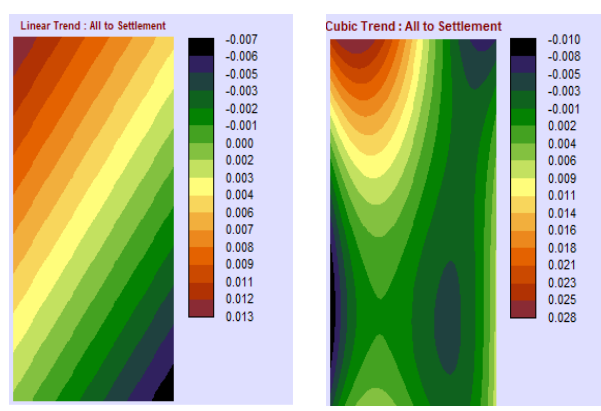
Assessment period from 2000 to 2018 witnessed (Table 4) the transformational gain and loss of vegetation class was observed to be highly interlinked with the dense forest class amounting to 11.99 km^2 and 4.17 km^2 respectively. Also, conversion of dense forest into vegetation class in terms of gain and loss was recorded as 4.17 km^2 and 11.99 km^2 respectively and bearing a surplus loss of 5.94 km^2 to built-up area. Likewise, a substantial transformation of barren land to forest and vegetation class in terms of gain and loss was observed as 0.86 km^2 and 2.81 km^2 respectively. Transformations during this assessment period are associated to commencement of large scale construction phase along the river stretch utilizing appreciable agricultural and forest land for dumping and crushing waste construction material and having been left thereafter.

Table 2 LULC Transformation during the Assessment Period from 2000 to 2018

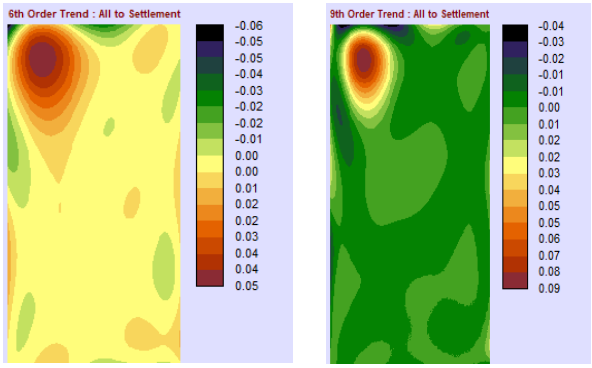
LULC class		Water	Settlement	Vegetation	Dense Forest	Barren	Area of LULC gain in km^2	Area of LULC in km^2 in 2018
Area of LULC in km^2 in 2000	**Water**	**6.52**	0.32	0.29	1.11	0.05	1.77	5.52
	Settlement	0.44	**12.15**	5.04	2.02	0.64	8.14	13.19
	Vegetation	0.82	3.14	**20.57**	2.4	0.56	6.92	12.19
	Dense Forest	1.32	3.53	7.24	**9.83**	0.5	12.59	15.15
	Barren	0.19	1.39	2.01	1.38	**2.08**	4.97	5.1
	Area of LULC loss in km^2	2.77	8.38	14.58	6.91	1.75	34.39	51.15

(Note: the diagonal value represents area of Land use in 2000; the column represents the net loss of Land use into other feature class and row shows the net gain of LULC from other feature classes, LULC area in succeeding year is the summation of LULC of preceding year with net gain minus net loss of LULC).

Fig 7 depicts the spatial trend analysis between 2000 to 2018. Fig 7 a depicts the linear trend analysis, Fig 7 b depicts the cubuic trend analysis, Fig 7 c depicts the 6th order trend analysis and Fig 7 d depicts the 9th order trend analysis between all to settlement. It is further revealed that vegetation has maximum transformation into settlement.



(a) **(b)**



(c) **(d)**

Fig. 7 Spatial Trend analysis between 2000-2018 (a) Linear Trend Analysis – All to settlement (b) Cubic Trend Analysis – All to settlement (b) 6th order Trend Analysis – All to settlement (c) 9th order Trend Analysis – All to settlement

Accuracy Assessment

The kappa coefficient and Overall accuracy for Satellite images of MSS (1989), TM (2000) and Landsat 8 (2018) were evaluated as 0.781, 0.892 and 0.804 and 86.00%, 92.31%, 86.00% respectively (Fig. 8 (a)). Fig. 3 **(b)** depicts the variation of producer and user accuracy for different classes for the year of assessment 1989, 2000 and 2018. Maximum producer and user accuracy for the year of assessment 1989 is 100.00%, 92.86% for dense forest and minimum producer and user accuracy is 62.5%, 62.5% for vegetation. Likewise for the year of assessment of 2000, maximum producer and user accuracy is 100.00%, 100.00% for water, settlement and vegetation and minimum producer and user accuracy is 80.00%, 75.00% for dense forest.

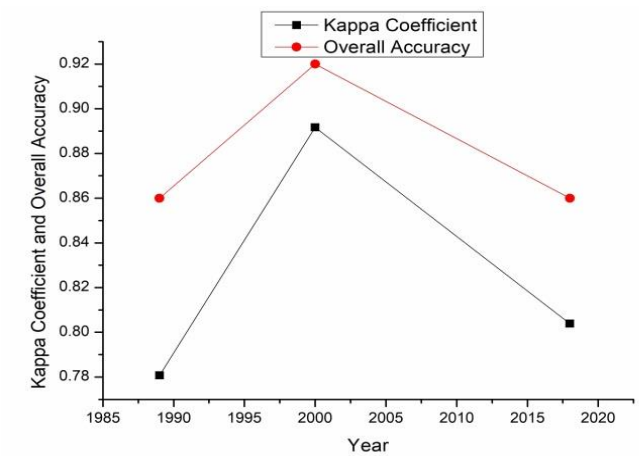


Fig. 8 (a) Kappa coefficient and Overall accuracy for the image of 1989, 2000 and 2018.

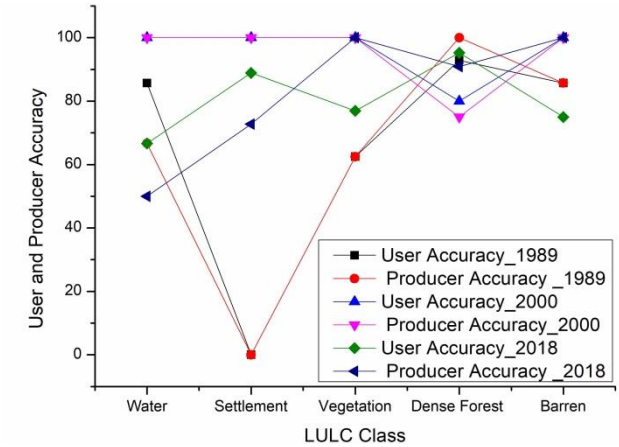


Fig. 4 (b) User and Producer Accuracy for the image of 1989, 2000 and 2018

4. CONCLUSIONS

Socioeconomic activities and land use expansion posing vulnerability to an area can very well be evidenced through time series change detection of land use along with interpretation of change. Geospatial techniques provides an effective platform to assess, examine and organize the land use land cover changes and its relative transformation from one feature class to another and vice versa. In this study, land use land cover change and transformation of flood plain area of River Yamuna along Delhi, NCR was analyzed using satellite images of 1989, 2000 and 2018. ERDAS Imagine and IDRISI Terrset software for land change modeler were used for image processing, quantification and transformation with gain and loss and net contribution of feature classes. The development of built-up area up to 25 % of total area within the study period and loss of 10% in dense forest with fluctuation in vegetation and water class was observed. The spatial trend change analysis of land use modeler reveals a more rampant land use during 1989 to 2000 as compared to 2000 to 2018 which reflects a means of generalizing the pattern of change. The land use modeler further reveals the specific zone of transformation and gain and lost due to various anthropogenic activities. Overall accuracy, producer's accuracy and kappa statistics was found to be satisfactory for all the images. This study provides a strategic guide to land use planners for an effective river management. The selection of images with higher resolution, without cloud cover or with the same percentage of cloud cover and similar temporal aspect could best be utilized for the better result in overall accuracy and kappa statistics.

Conflict of Interest

It is hereby declared that that no conflict of interest regarding the possible publication of this article exists.

Acknowledgement

The availability of the free downloaded high resolution satellite imageries by NASA-Global Land Cover Facility

(GLCF) and USGS Series Archive motivated and made it possible to carry out this study.

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Purification of anti-cancerous enzyme L-glutaminase from marine Streptomyces parvus HSBT0318

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***Abstract*— The present study reports purification of extracellular glutaminase enzyme from streptomyces parvus. Screening was performed from twenty Actinomycetesisolates from soil; one isolate (Isolate HSBT0318) was finally selected based on the activity of glutaminase(36.48 U/ml).The isolate was identified as Streptomyces sp. The L-glutaminase produced from Streptomyces parvus was purified by ammonium sulphate precipitation, dialysis method and ionexchange chromatography. After the purification of the enzyme by ion exchange chromatography, it has been purified 46-fold from cell-free extract and yield was 3.25%. Characterization of extracellular L-glutaminase showed optimal activity at temperature of 30°C, pH 7, at 3% NaCl and for 0.04M substrate and the Km value was calculated to be 2.8mM and Vmax was 7.57 U/ml. The molecular weight of enzyme as determined by sodium dodecyl sulphate polyacrylamide electrophoresis(SDS-PAGE) was found to be 45 kDa.**

***Key words*—L-Glutaminase, Actinomycetes, Marine sediments, Streptomyces.sp, ion exchangechromatography, SDS-PAGE**

1. INTRODUCTION

Intensive work has been carried out to find sources of glutaminases and to study their properties against tumors. L-Glutaminase is an amido-hydrolase enzyme that cleaves glutamine into glutamic acid and ammonia. Glutamine, a non-essential amino acid and the primary substrate for L-glutaminase, is present in circulating blood and also serves as a fuel for cell growth and nucleic acid synthesis (Hartman 1971; Wade 1980). The consumption of glutamine by cancer cells is faster than that of other amino acids, and its uptake rate is directly proportional to its supply (Souba 1983). Though cancer cells consume more amounts of glutamine, they are incapable of producing their own glutamine de novo (Wise et al. 2010), while normal cells can do so. Hence, a strategy that reduces blood glutamine levels using glutaminase would control the growth of cancer cells under hypoxic conditions. Besides its applications in cancer therapy, Lglutaminase is also a much sought-after enzyme in the food industries as a flavour-enhancing agent(Nandakumar et al. 2003), for the production of acrylamide-free potato food (Pedreschi et al. 2008), and as a biosensor that detects glutamine (Padma et al. 2010). Previous studies have shown that marine environments could be a source of many enzymes that display useful characteristics, including salt tolerance and stability under various conditions (Chandrasekaran et al. 1997). A novel fermentation medium is of critical importance because of its significant influence on product yields; thus, designing an appropriate medium for a particular product is gaining importance as this would also contribute to maximum yields of the product. The enzyme was purified to homogeneity, entrapped in PEG and immobilized on PHB nanoparticles.

2. MATERIAL AND METHODS

Optimal conditions required for maximal growth and L-glutaminase production by the selected strains were determined by subjecting them to various incubation temperatures, different levels of p^H, substrate concentrations, NaCl concentrations, additional carbon and nitrogen sources, glucose concentrations, inoculum concentrations in the growth media and different incubation periods. Minimal glutamine broth was used for these studies. The prepared media were dispensed in 100 ml aliquots of 250 ml Erlenmeyer conical flasks, autoclaved and used for optimization studies. 1% Concentration of inoculum was used. The growth of bacteria in the minimal glutamine broth was followed by estimating the turbidity of the broth by taking the absorbance at 660 nm in a UV-Visible Spectrophotometer (Hitachi Model 200).

Enzyme production in the media was estimated in terms of enzyme activity except for the incubation temperature as 28°C and incubation time as l5 minutes instead of 30 minutes, since it was observed that maximal amounts of enzyme units are obtained under these conditions. pH of the buffer varied from 6 to 8 according to the optimum pH of enzyme from each organism.

Inoculum preparation

Initially a loopful of 24 hours old agar slope culture was transferred to 10 ml of NBG (Nutrient Broth added with Glutamine) and grown for 24 hours at room temperature(28 ± 2°C). One ml of the cultured broth was then aseptically

transferred into another 50 ml of NBG media and incubated for 24 hours in a rotary shaker (150rpm) at room temperature (28 ± 2°C).Cells were harvested by centrifugation at 5000 rpm for 20 min.The harvested cells were made upto 10 ml volume using physiological saline (0.85% NaCl) after repeated washing with the same. The prepared cell suspension was used as inoculum at 1% level for further inoculation of 50 ml MGB. All the flasks were uniformly inoculated and incubated on rotary shakers (150 rpm) for a period of 24 hours at room temperature (28 ± 2°C).

Submerged fermentation

1ml of inoculum was added to 100ml of the production medium in 250ml Erlenmeyer flasks and incubated in orbital shaker at 28^0C for 108 hrs. The enzyme production medium (EPM) was designed based on the data obtained from the studies conducted for optimization of growth conditions for maximal enzyme production in MSG broth. It was supplemented different carbon and nitrogen sources to study their effect on growth and L-Glutaminase production.

Effect of initial pH

To determine the effect of pH on growth and production of enzyme L-Glutaminase, the initial pH of the medium was adjusted to different pH values, i.e.: 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, and 11.0.

Initial pH for growth and enzyme production was determined by subjecting the organisms to various p^H levels adjusted in the culture broth (MGB) using 1 N NaOH or 1 N HCl. After inoculation and incubation for 24 hours at room temperature (28 ± 2°C), the culture broths were centrifuged and growth and enzyme production were determined.

Effect of Incubation Temperature

Optimal temperature for maximal growth and enzyme production was estimated by incubating the MG broth inoculated with the test strains at ‘various temperatures (15, 25, 30, 35, 45 and 55°C) for a total period of 108 hours. Growth and enzyme production were determined.

Optimization of Substrate concentration

Optimal substrate concentration that favours growth and enzyme production of the strains was checked by growing them in MSG broth supplemented with different glutamine concentrations (0.25, 0.5, l, 2, 3%). After 24 hours of incubation at room temperature (28± 2°C) the growth and enzyme production were estimated .

Optimization of NaCl concentration

Optimal NaCl concentration that promotes maximal growth and enzyme production of the organisms was determined by subjecting them to different NaCl concentrations (0, l, 3, 5, 7 and 10%) adjusted in the MG broth. After 24 hours of incubation at room temperature (28 ± 2°C) growth and enzyme production were analyzed.

Effect of Carbon sources

Effect of various carbon sources on growth and production was studied by incorporating them at 1 % (w/v) level into the Pridham and Gottlieb's inorganic salts medium. To optimize the concentration of glucose for maximum growth and antibiotic production, it was incorporated into the production medium at different concentrations of 2.5, 5.0, 7.5, 10.0, 12.5, 15.0, 17.5 and 20.0 g/L After 24 hours of incubation at room temperature (28 ± 2°C), growth and enzyme production were estimated.

Effect of Nitrogen sources

The influence of various nitrogen sources on growth and L-Glutaminase production was studied by adding inorganic nitrogen sources and organic nitrogen sources at 0.2% (w/v) level into the Pridham and Gottlieb's inorganic salts medium. Glucose at 1% (w/v) level was employed as carbon source.

The concentrations of ammonium nitrate used to determine the optimum concentration for growth and L-Glutaminase production are (g/L) 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0 and 4.5. After 24 hours of incubation at room temperature growth and enzyme production were estimated.

Effect of Glucose concentration

Since glucose was found to enhance enzyme production during the studies, optimal

requirement of glucose level in the culture medium was estimated by incorporating different concentrations of glucose (0.5, l, 2, 3%) along with 1% glutamine in the MGB. After 24 hours of incubation at room temperature (28 ± 2°C) growth and enzyme production were estimated.

Effect of Inoculum size

Optimal inoculum size that yields maximal growth and enzyme production was determined in MSG broth at their optimal growth conditions determined by inoculating the broths with various levels of the prepared medium(1-7%). After 24 hours of incubation at room temperature (28 ± 2°C) growth and enzyme production in the media were estimated.

Effect of Incubation period

Optimal incubation time that leads to maximal growth and enzyme production of the strain was estimated by incubating culture flasks for various incubation periods upto a maximum of 108 hours and analysing the samples at regular intervals of 24 hours. Growth and enzyme production in the broths were estimated.

Effect of different concentrations of K2HPO4

To optimize the concentration of K_2HPO_4 enzyme L-Glutaminase production, it was incorporated into the production medium at different concentrations of 0.4, 0.8, 1.2, 1.6, 2.0, 2.4, 2.8, 3.2, 3.6 and 4.0 g/L.

Effect of different concentrations of $MgSO_4$

To determine the optimum concentration of $MgSO_4$ for L-Glutaminase production, $MgSO_4.7H_2O$ were incorporated

into the Pridham and Gottlieb's inorganic salts medium at 0.25,0.5,0.75, 1.0, 1.25, 1.5, 1.75 and 2.0 g/L.

Effect of Agitation

To determine the effect of agitation on the growth and L-Glutaminase production, the fermentation was carried out at different agitation speeds, i.e., 30, 60, 90, 120, 150, 180, 210 and 240 rpm

Growth Curve of enzyme L-Glutaminase with optimized parameters

The growth of the organism was measured as dry weight of the mycelium. The contents of the culture flask were filtered through a previously weighed dry Whatmann No.1 filter paper, washed twice with distilled water and then the filter paper along with the mycelia mass was dried in a hot air oven at 80˚C for 18-24hrs and then the filter paper was weighed.

The prepared media were dispersed in 50 ml aliquots in 250 ml conical flasks, autoclaved and inoculated with 0.5 ml of the prepared inoculum and incubated at room temperature (28 ± 2°C). Samples were drawn at regular intervals and growth was determined by measuring the turbidity at 660 nm in a UV—Visible Spectrophotometer. From the results obtained growth curve was constructed.

Purification of L-Glutaminase

Enzyme purification was carried out following the methods suggested by Hartman (1968) and Roberts (1976). L-Glutaminase produced by *Streptomyces parvus* under submerged fermentation was purified employing ammonium sulfate precipitation, followed by dialysis and gel chromatography on sephadex column as detailed below. All the operations were done at 4 °C unless otherwise specified.

(NH4)2S04 fractionation

Solid ammonium sulphate was slowly added to the crude enzyme filtrate with gentle stirring to bring 40% saturation (fraction I). The mixture was allowed to stand overnight at 4º C. It was centrifuged at 10,000 rpm at 4°C for 20 minutes to remove the precipitate while the resulting supernatant was subjected to the addition of ammonium sulphate until reached to the concentration 50% saturation (fraction II), then it was allowed to the same previous conditions. The resulting supernatant was further subjected to ammonium sulphate precipitation to bring 80% saturation (Fraction III) in a sequential manner. The enzyme precipitate obtained from each saturation was dissolved in a minimal volume of 0.01M phosphate buffer (pH 8) and dialyzed against 0.01M phosphate buffer (pH 8) for 48 -72 hours at 4°C and the buffer were changed occasionally (Davidson L.,et al,. 1977)

Dialysis

The precipitate obtained after (NH4)2SO4 fractionation was dissolved in phosphate buffer (0.2 M) (pH 6 or 8) and dialyzed against the same buffer extensively at 4°C for 24 hours. Enzyme activity and protein content of the dialyzate were determined.

Gel chromatography using Sephadex G-100 column

Finely powdered ammonium sulphate was added with constant stirring to the supernatant of fermented broth obtained after centrifugation and was incubated overnight at 4°C. Maximum L-glutaminase activity was observed with the fraction precipitated at 60–80 % saturation. The Sample after centrifugation was dialyzed against the phosphate buffer for 24 h. Further dialyzed sample was subjected to gel chromatography on sephadex G-100 column. All the fractions were assayed for L-glutaminase activity. L-Glutaminase activity, protein content and specific activity were determined as described earlier and expressed as U/ml, mg/ml and U/mg protein respectively.

Determination of purity by Reverse Phase High Performance Liquid Chromatography

The homogeneity of the L-Glutaminase sample from the active fractions from sephadex G-100 column was determined by RP-HPLC.

Determination of purity and molecular weight by SDS-PAGE

The active fractions were used for testing the purity by polyacrylamide gel electrophoresis. The chromatographic fractions were electrophoretically analyzed on SDS-PAGE.

3. RESULTS AND DISCUSSION

Growth phase and L-Glutaminase production

L-Glutaminase production and growth of *Streptomyces parvus* HSBT0318 as a function of time is shown in **Figure 1**. The production of enzyme could be observed from the early exponential growth phase of the strain. It is clear that the maximum specific activity 2.48 U/mg protein was obtained during mid stationary phase i.e., after 108 h of incubation. Results of present study indicated that production of L-Glutaminase was dependent on the bacterial cell growth.

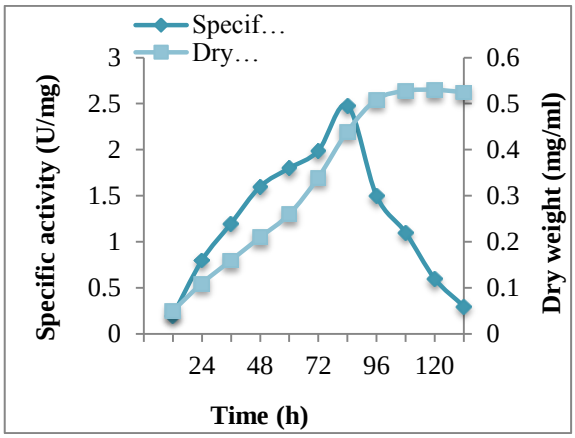

Figure 1: Growth phase and L-Glutaminase

Effect of carbon source

The results demonstrate that glucose was the best carbon source for L-Glutaminase production (**5.01** U/mg protein).

Effect of glucose concentration

The effect of different concentrations of glucose on growth and L-Glutaminase production was studied and the results are presented in **Figure 2**. At 10 g/lt concentration of glucose, the maximal specific activity (13.5 U/mg protein) and growth (4.5 mg/ml) was observed.

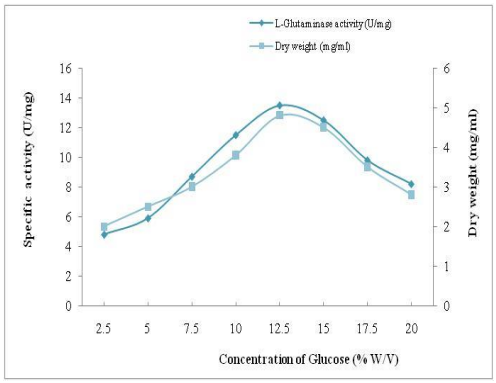

Figure 2: Effect of glucose concentration

Effect of nitrogen source

Among both the inorganic and organic nitrogen sources, Glutamine exhibited the highest level of cell growth (5.5 mg/ml) and L-Glutaminase activity (15.10 U/mg protein).The effect of different concentrations of L-Glutamine on growth and L-Glutaminase production was investigated and the results are presented in **Figure 3**.

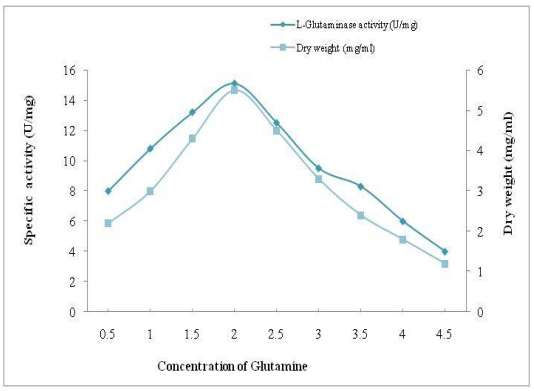

Figure 3: Effect of glutamine concentration

Effect of K2HPO4

The effect of different concentrations of K_2HPO_4 on growth and L-Glutaminase production was studied and the results were presented in **Figure 4**. The maximum L-Glutaminase was obtained at 14.01 U/mg activity of K_2HPO_4 with a biomass of 8.3 mg/ml.

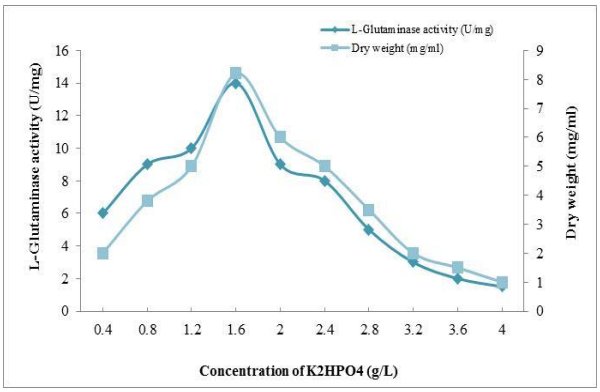

Figure 4: Effect of K_2HPO_4 concentration

Effect of MgSO4

The effect of different concentrations of $MgSO_4$ on growth and L-Glutaminase yield was investigated and the results (**Figure 5**) revealed that, incorporation of $MgSO_4$ in the medium at 1.0 g/lt concentration exhibited the maximum L-Glutaminase activity (15.23 U/mg protein) and biomass (9.86 mg/ml) production.

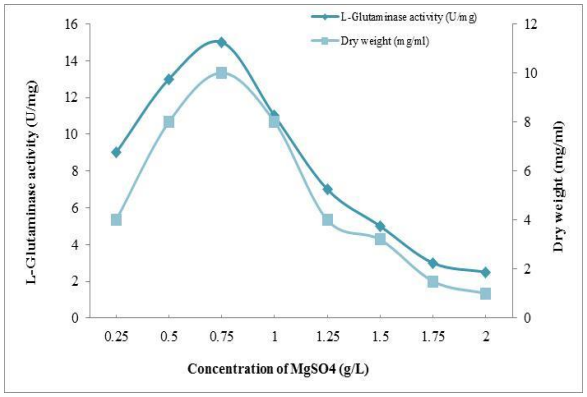

Figure 5: Effect of $MgSO_4$ concentrations

Effect of incubation temperature

In the present study growth and L-Glutaminase yield by strain HSBT0318 was detected at various temperatures (**Figure 6**) within the range of 10–90°C, with 30°C being the optimum temperature for L-Glutaminase production (18..35 U/mg protein) and growth (14.03 mg/ml).

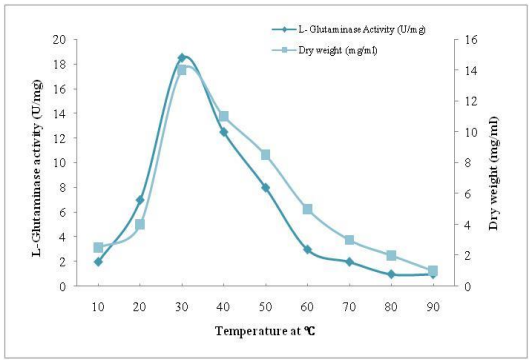

Figure 6: Effect of incubation temperature

Effect of initial pH

In this study initial pH of 7.0 resulted in maxium L-Glutaminase production (22.13 U/mg protein) and cell growth (15. 92 mg/ml) (**Figure 7)**. The maximal enzyme output was noticed at pH 6.0 (2777.7 U/ml) with biomass (0.0117 g/l), either excess or lowering in the pH of the medium led to reduction of enzyme production.

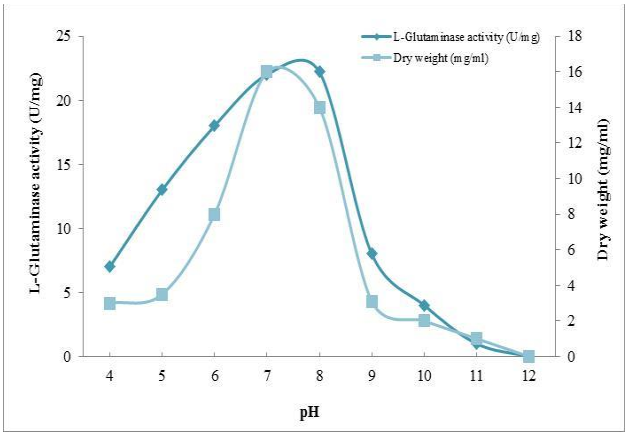

Figure 7: Effect of pH

Effect of incubation period

The effects of incubation periods on L-Glutaminase production and growth was studied. The results (**Figure 8**) indicated the L-Glutaminase activity of 11.03U/mg at 48 hrs of incubation and increased upto 96 hrs reaching a maxmium (23.98 U/mg protein) and then declined on further incubation. The highest biomass production (17.93 mg/ml) was also obtained after 96 hrs of incubation.

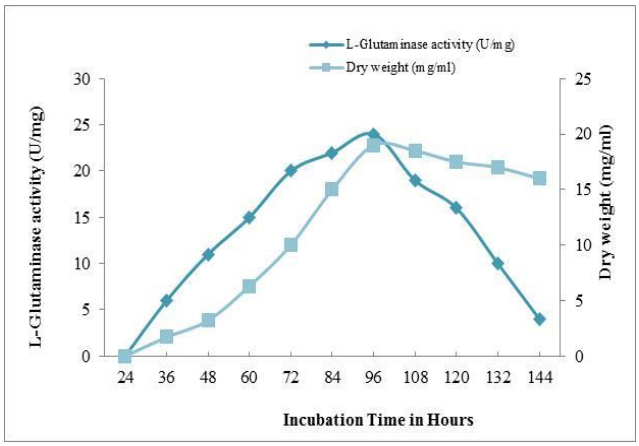

Figure 8: Effect of incubation period

Effect of inoculum size

The results (**Figure 9**) revealed that, L-Glutaminase yield (25.23U/mg protein) and actinobacterial growth (18.35 mg/ml) were optimum when 6.0% (v/v) of inoculum was used. Higher inoculum size at 8.0% (v/v) and 10.0% (v/v) decreased the , L-Glutaminase production.

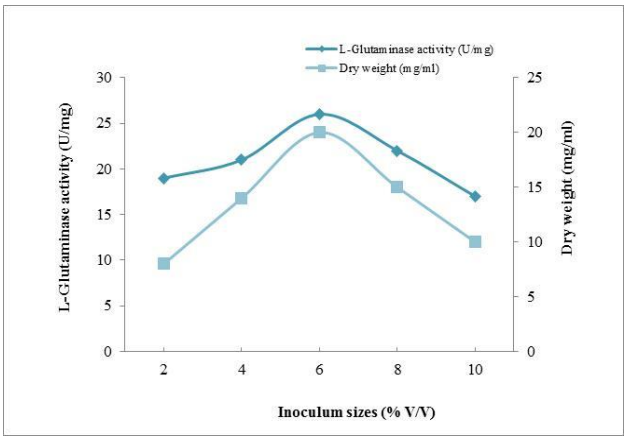

Figure 9: Effect of inoculum size

Effect of agitation

The oxygen demand of a fermentation process is generally met by agitation and aeration. The results represented in **Figure 10** revealed that enzyme production increases with increasing speed. The maximum L-Glutaminase activity (28.02 U/mg protein) and growth (22.35 mg/ml) were observed at 120 rpm.

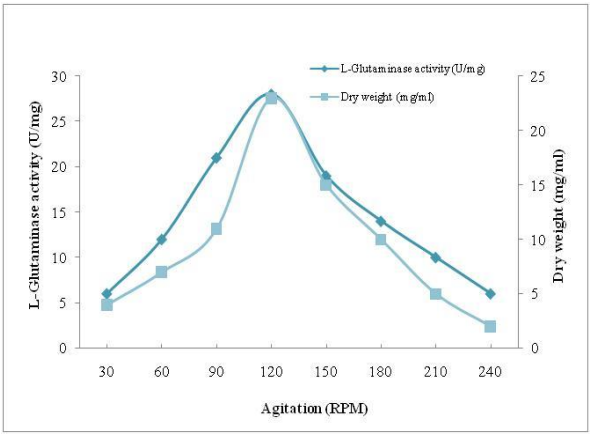

Figure 10: Effect of agitation

Production of L-glutaminase with optimized parameters

The fermentation was conducted by maintaining all the parameters at the optimum levels and the results obtained are presented in **Figure 11**. A 6% (v/v) of 48 hrs aged inoculums was transferred to the modified production medium and incubated at 30°C for 96 h.

It was evident from the result that the L-Glutaminase activity employing optimized fermentation conditions was (32.12 U/mg) 9.4 fold higher than the specific activity using initial fermentation conditions (5.01 U/mg).

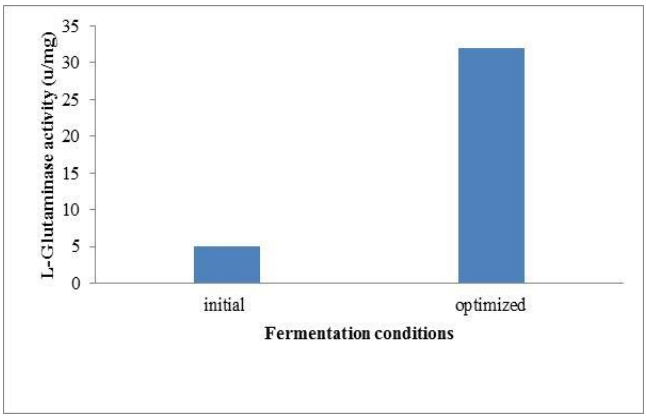

Figure 11: L-Glutamine production by the isolate *Streptomyces parvus* employing initial and optimized fermentation conditions.

Purification of L- Glutaminase

Applying standard protein purification procedures, such as ammonium sulfate fractionation followed by dialysis and gel filtration L- Glutaminase was purified. Different amounts of the enzyme were precipitated from the supernatant by addition of different quantities of ammonium sulfate up to 100% saturation. However the precipitation of the enzyme was maximum between 60 to 80% saturation. The purification elution profile (**Figure 12**) from sephadex G - 100 column exhibited a major peak with L- Glutaminase activity. The L- Glutaminase activity and ultra violet absorbance at 280 nm of the fractions under the peak were superimposed. The enzymatically active fractions from sephadex G-100 column (fraction numbers 20 to 30) were pooled and dialyzed against distilled water for 18 hrs at 4 °C with the change of dialysate four times. Then it was concentrated by placing the dialysis sac containing the protein in sucrose crystals for four hours at 4 °C and lyophilized (LARK).

Employing a purification protocol, involving ammonium sulfate precipitation and sephadex G-100 gel filtration chromatography, L- Glutaminase produced by *S. parvus* was purified to homogeneity with 40% yield and 45 fold purification. These results were in the agreement with that reviewed by Mohana Priya *et al.* (2011).

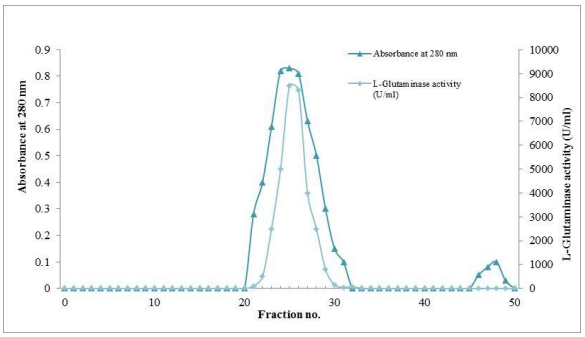

Figure 12: Elution profile of *Streptomyces parvus* L-Glutaminase through Sephadex G-100 column

Homogeneity of the L- Glutaminase

The homogeneity of the L- Glutaminase sample from the active fractions of sephadex G-100 column was determined by RP-HPLC and the elution profile is shown in **Figure 13**. The enzyme was eluted as a single symmetrical peak with the retention time of 3.394 mins from RP-HPLC column.

Sodium Dodecyl Sulfate-Polyacrylamide Gel Electrophoresis (SDS-PAGE)

SDS-PAGE performed under reducing conditions yielded a single band, thus confirming the monomeric nature of the enzyme (**Figure 14**). The molecular mass of the L-Glutaminase, estimated by comparison with the electrophoretic mobility of marker proteins, indicated that the *Streptomyces parvus* L-Glutaminase has an apparent molecular mass of 45 KDa.

Native-Polyacrylamide Gel Electrophoresis (Native-PAGE)

All the fractions which had significant L-Glutaminase activity, obtained after gel chromatography were pooled and lyophilized. They were subjected to Native polyacrylamide gel electrophoresis and the enzyme migrated as a single band in Native-PAGE (**Figure 15**), indicating its homogeneity.

Reverse Phase High Performance Liquid Chromatography

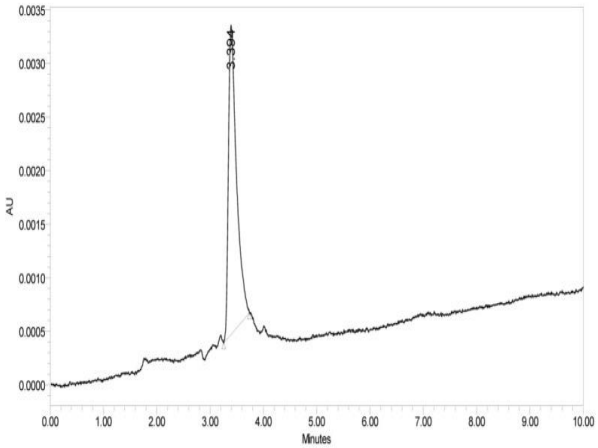

Figure 13: RP-HPLC Elution profile of *Streptomyces parvus*

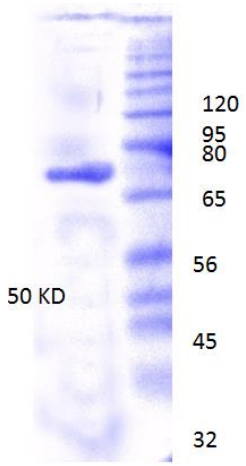

Figure 14: SDS-PAGE of purified sample

4. CONCLUSION

Since the discovery of its anti-tumour properties, L-glutaminases have been in prime focus and microbial sources of the enzyme are sought.

The purification and characterization of L-Glutaminase from Streptomyces parvus HSBT0318 deals with the studies on evolution of the L-Glutaminase by its biochemical characterization. The extracellular L-Glutaminase was purified 40- fold with 34% yield and a specific activity of 32.12.U /mg protein. The enzyme was eluted as a single symmetrical peak with the retention time of 3.394 mins from RP-HPLC column, exhibiting the homogeneity of the purified L-Glutaminase. The molecular weight of L-Glutaminase determined by SDS-PAGE was found to be 45 KDa.

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Restoring Motor functions in Spinal cord injury, Hemiplegic Cerebral Palsy, and Stroke by Botulinum toxin-induced Synaptic Competitive-Learning Therapy

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Abstract- **Botulinum toxin (BoTx) is well known as a popular drug of choice for spasticity relief. Recent research shows that the toxin has synaptic competitive-learning (SCL) restoring plasticity properties acting at peripheral and central nervous sensory-motor centers. In the intact brain, SCL is naturally-endowed, that controls-regulates all learn-register-recall-execute (motor) functions, and memory storage functions during development and throughout adult life. In spinal cord injury (SCI), hemiplegic cerebral palsy (HCP), and stroke, there is partial/complete cessation of all SCL mechanisms in those injured and denervated centers. The denervated synaptic fields soon become reinnervated by spontaneous growths of aberrant, maladaptive synaptic weights. The massive loss of neurons in the injured site/s and the resultant synaptic weights (=defined as learned motor experiences stored as memory weights) distortions in the denervated centers cause spasticity and sensory-motor paralysis. It is known that BoTx spasticity relieving effects in single, isolated muscle/s are short-lived. However, clinical studies indicate that when given to multiple spastic muscles in serial/ repeats, BoTx generates significant recovery. Basic science studies show that BoTx generates neosynaptogenesis at motor-endplates, on spinal motoneurons and motor cortex. It reinstalls the three cardinal courses of SCL viz. initial redundant connections, activity-dependent, competition-based pruning-selection refinement of connections at these sites. This paper presents i) a cognitive systems perspective of spasticity and motor paralysis, ii) a low-dose, multi-muscles BoTx treatment protocol designed to keep its paralyzing effects minimized, while prolong its SCL duration in order to initiate and consolidate long-lasting motor recovery in these disorders.**

Key words: **Acetylcholine (Ach); Botulinum Toxin (BoTx); Hemiplegic Cerebral Palsy (HCP); Motor recovery; Spinal Cord Injury (SCI); Stroke; Synaptic Competitive-Learning (SCL); Neurorehabilitation; Traumatic Brain Injury (TBI).**

I. INTRODUCTION

Botulinum toxin (BoTx) is well known as a popular drug of choice for spasticity relief [1-3]. Recent research shows that BoTx has synaptic competitive-learning (SCL) restoring properties that act at neuromuscular, spinal cord, and central nervous sensory-motor centers [4-6]. Contemporary research in sensory-motor cognitive systems indicate that in SCI, HCP,and stroke the motor paresis/ paralysis, and spasticity is caused by partial/complete disruption of all SCL mechanisms in the injured and denervated target neuron centers synaptic fields [5-7]. In the intact brain-cord, SCL is naturally-endowed, that controls-regulates all sensory-motor learn-register-recall-(motor) execute functions, and memory storage functions during development and throughout adult life. SCL consists of an initial redundant numbers of synaptic connections, muscles activity-dependent, competition-based selection of appropriate connections and pruning of inappropriate ones. Basic science research shows that BoTx has SCL-restoring properties that act transiently (weeks) at neuromuscular synapses, spinal cord motoneuron pools and the motor cortex [4-7]. Until now BoTx use in motor paralytic disorders is limited to spasticity/overactivity relief in isolated limb muscles and in dyssynergic bladder-sphincters. BoTx administration into spastic/ overactive muscle causes transient blockade of Ach release from the motor axon terminals, and extensive sprouting of the terminals; the paralyzing effect lasting 3-5 months [1-3,8,9]. This paper explains the SCL-restoring properties of BoTx acting at neuromuscular synapses, spinal motoneurons-interneurons and at the cerebral motor cortex [5,10,11] and presents a low-dose, multi-muscles, serial/repeat BoTx treatment protocol designed to prolong the SCL duration in the affected neural centers in the above disorders so as to initiate and promote motor recovery.

What is Synaptic Competitive-Learning (SCL)?

In the intact brain and spinal cord SCL is a naturally-endowed developmental event during motor/locomotor learning and maturation in the neuromuscular junctions, spinal motoneurons, Renshaw neurons, cerebellar cortex Purkinje neurons, and cerebral motor cortex. SCL is not unique to the motor system alone. SCL is the natural developmental process in the visual cortex, lateral geniculate ganglion, and in the autonomic ganglia [10]. SCL consists of generation of an initial redundant numbers of synaptic connections, activity-dependent, competition-

based, selection of connections, and redundancy pruning [5,12-15]. A striking example from human perinatal life is that, both sides motor cortexes project nearly equal numbers of corticospinal tract (CST) axons to each side of the spinal cord ventral horn neurons. Later, by around twelve years, by motor/locomotor learning activity-dependent, competition-based, selection-pruning process over 85 percent of axons from the contralateral motor cortex are selected and retained, while only around 15 percent CST axons retained from the ipsilateral motor cortex, and locomotor maturity reached [14,15]. Cognitive systems studies have come out with further interesting, complementary findings. In the intact adult brain-spinal cord centers too SCL is the principal form of sensory-motor skills learning and acquisition throughout adult life [5]. A principal difference, however, between the developmental SCL, and adult SCL is that in the former, there is actual growth of redundant synaptic connections and their competitive selection-elimination. Where as in the latter, there is no actual large scale growth, but redundant sets of connections are allocated from existing ones in the synaptic fields for competitive-interplay (SCL) and selection [5,7,16,17]. Both basic science and cognitive systems studies taken together convincingly show that in SCI, HCP, and stroke there is partial/complete cessation of all SCL mechanisms in the injured and denervated synaptic fields which cause spasticity, paresis/paralysis.

Sensory-Motor Paralysis: Clinical and Cognitive Systems Perspective

Clinical perspective

In these disorders, i) there is large scale degeneration/death of neurons at the injured site/s, ii) the target center/s these neurons project into (e.g. spinal cord ventral horn neurons, cerebellar cortex, thalamus) become denervated at varying degrees of severity. In the next several weeks, the remaining intact inputs to those target center/s spontaneously sprout-out and reinnervate the denervated synaptic sites [5]. In SCI paralytics there is extensive local sprouting and compensatory reinnervation at spinal cord, thalamus, cerebellar and cortical levels [18-20]. In cortical/sub-cortical stroke and in CP paralytics there is extensive local sprouting, and compensatory reinnervation of the denervated areas at ipsi-lesional, contra-lesional cerebral cortex. Following unilateral motor cortical damage there is compensatory sprouting of ipsi-lesional side corticospinal tract in the spinal cord [21-26]. The usefulness or otherwise of such local compensatory connections in these paralytics towards motor recovery is a subject of ongoing debate. Clinicians are currently speculating how this compensatory plasticity could be exploited to promote motor relearning and recovery [23,26]. Depending on the severity and extent of injury the clinical picture presents as i) spasticity/overactivity/paresis/paralysis across limb muscles, ii) excitation-inhibition imbalance between synergists-antagonists [5,7,27], iii) the motoneuron's firing properties are in severe disarray, iv) orderly recruitment-derecruitment of motor units within and across muscles are severely impaired/lost, v) failure of adequate numbers of motor units activation presents as muscle weakness, vi) abnormal co-contractions of synergists-antagonists muscles [27]. Also see below, what current clinical investigations, cognitive systems, and brain-modeling studies have to say.

Cognitive systems perspective

In the intact brain sensory-motor centers' synaptic fields all learn-register-recall-execute functions and memory storage functions are controlled-regulated by two core fundamental brain properties, namely self-organizing, and stability-plasticity balancing [5,7]. In SCI, HCP, and stroke these two vital functions become severely disrupted/ ease altogether in the injured and denervated centers. Self-organizing is defined as the brain's inherent property to continually evolve in time and space that begin as simple networks in fetal life and progress into increasingly complex network systems that exhibit a hierarchy of emergent (e.g. motor) properties [16,17]. The learned-experiences (e.g. spontaneous movements in fetal life; hands-eyes-head coordination, reaching and grasping in the baby; crawling, sitting, standing, stepping, and walking in the infant; swimming, bicycling, playing piano in the adult) are stored at specific sites in the synaptic fields as memory weights in a self-organizing manner on the basis of previously learned, and closer to functionally associated weights [associative memory 16,17]. Stability-plasticity balancing is a fundamental brain property that controls and regulates all learn-register-recall-execute functions, and memory storage functions in the sensory-motor synaptic fields throughout life. While plasticity enables continual learning, stability ensures the storage of the learned experiences into memory weights [5,7]. In SCI, HCP, and stroke the spontaneously added compensatory, aberrant weights are not competition-based, nor activity-dependent. They distort partially/completely all memory traces and SCL mechanisms. New learning and recalls of previously learned skills into motor tasks execution are severely disrupted/lost altogether--known as stability-plasticity dilemma [5,7]. In brief, cognitive systems studies point out that restoration of self-organizing and stability-plasticity balancing properties are essential pre-requisites for motor recovery to occur. This also sends a clear message to other therapies e.g. stem cells that they should, first address these issues.

Can SCL be Re-installed in the Injured Brain-spinal Cord Synaptic Fields?

When a motor nerve is sectioned and allowed to regenerate into its muscle, or the nerve is crushed (neurapraxia), or the muscle partially denervated, or BoTx injected into muscle [5,10,11] the motoneurons transiently display for some weeks, a number of SCL-restoring plasticity properties. In each of the above procedures, the motor axons sprout and hyper-innervate (polyneuronal) the denervated muscle fibers. The motoneuron soma size enlarges, dendrites hyper-expand; new dendro-dendritic

electrotonic couplings become established between motoneurons. Transient neosynaptogenesis develops on the motoneuron soma-dendrites, and on pre-motoneuronal interneurons. This is followed by activity-dependent, competition-based (SCL) selection, and pruning of redundant connections at these two sites. The principal difference between the naturally-endowed developmental SCL and the induced SCL (by nerve section, neurapraxia, partial denervation, BoTx etc) in the adult is that the former lasts for several weeks/months. In the latter procedures, the induced SCL is rather localized and short-lived, lasts for few weeks. The pressing question is that how to prolong the SCL duration in the injured brain-cord as comparable to developmental SCL processes?

BoTx Peripheral and Central Mechanisms of Action in Spasticity Relief

The beneficial effect of BoTx in spasticity relief is generally attributed to its Ach release blocking action at the motor terminals, the altered afferent signals from the injected muscle on to its synergists-antagonists, and the sensory plasticity at spinal and supra-spinal levels [1-3]. It should be stated however, that the far-reaching actions of BoTx at the motor system have been overlooked for far too long [4-6]. BoTx causes extensive sprouting of intramuscular motor axons, resulting in transient hyper-innervation (polyneuronal) of the injected muscle [4,6,8-10]. The motor units in that muscle start sharing each other's territories and thus the average size of motor unit becomes larger. This retrogradely acts on the motoneuron's soma-dendritic membrane. The soma size transiently increases together with hyper-expansion of the dendrites, and neosynaptogenesis occurs on the motoneuron-interneurons [4-6] (Figure 1). In spinal motoneuron, its soma size is one of the most important determinants of its firing properties. In the intact adult spinal motoneuron its soma size is directly proportional to its motor unit size. Excitability of the motoneuron is inversely related to its soma size. Large motoneurons are less readily excitable than smaller ones (Henneman's size principle of the motoneuron) [28,29]. To sum up, the motoneuron's firing properties are determined

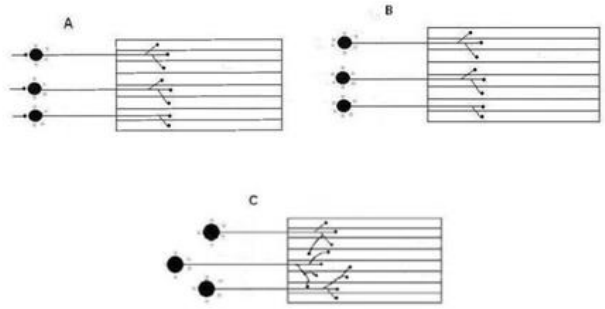

Figure 1: BoTx-induced SCL in the injured spinal cord: A) Intact sensory-motor-neuromuscular system. The three large black spheres are alpha-motoneurons that innervate the muscle (rectangle with eight muscle fibers). Each muscle fiber receives a single motor axon terminal at its endplate (mononeuronal innervation). Grey dots are spindle and tendon organ afferents synapses. Black dots are synapses from descending motor tracts. Grey squares are spinal interneuronal synapses. These synapses on the motoneuron represent the learned motor experiences stored as motor memory weights

by- i) its soma size, ii) the precise locations of the learned weights (excitatory, inhibitory, and disinhibitory) on the dendrites, soma and axon hillock, iii) the relative distances between the weights. These three regulatory mechanisms finely balance each other during development and throughout adult life. In SCI, HCP, and stroke all the above three regulatory mechanisms are thrown into disarray and hence the normal firing pattern of the motoneuron is severely disrupted. Following BoTx injection into single, isolated spastic muscle/s the initial increase in motoneurons soma sizes and the resultant decrease in their excitability ameliorate the overactivity-spasticity [4,6]. The neosynaptogenesis at the spinal motoneurons-interneurons and the motor cortex repulses growth of aberrant synaptic weights. In the ensuing weeks, Ach release gradually resumes and muscle contractions begin. Competitive-selection-pruning of connections occurs at motor endplates and in spinal motoneuron circuits. The motoneurons soma sizes become reduced and resized and thus the synaptic weights become repositioned in a self-organizing process [4-7]. But then, all the above beneficial SCL peripheral and central plasticity lasts only for some weeks. Then spasticity returns to the muscle, warranting repeat BoTx injections. Thus we see that BoTx has two distinct, but closely inter-related function facets. First is its acetylcholine release-blocking property that relieves spasticity by paralyzing that overactive muscle. However, as the effect of the toxin vanes off the spasticity returns [1-3]. The second is its SCL-restoring property at motor endplates, spinal motoneuron soma-dendrites, spinal interneurons, and cerebral sensory-motor cortex. This includes motoneuron soma size, formation of new dendro-dendritic coupling, new synapses formation, modification of excitation-inhibition balance, motoneuron firing frequency, reflex response, long-latency polysynaptic pathways, motor cortex maps reorganization [4-6]. Now the question is how to sustain this transient SCL effects to long periods? Basic science and clinical studies indicate that instead of injecting single, isolated muscle/s, if given in smaller doses to multiple, opposing muscles, in serial-repeats BoTx will reinstall-replay the SCL processes in several motoneuron pools as happens during infant motor-locomotor learning [4-6,11]. As until now, BoTx treatments have not taken these points into consideration.

Clinical Outcomes in BoTx Spasticity Therapy

The older clinical studies used BoTx in isolated muscle/s in a single session injection protocol with the sole objective of spasticity relief [1-3]. Thus the benefits were transient and spasticity returned later. But then, clinical neurologists

had suspected that besides relieving spasticity, BoTx brought improvement in function. It was concluded then, that the existing study designs, injection protocols, the choice of outcome measures, and an incomplete understanding of the pathophysiology of motor paralysis were all the reasons for not detecting precisely the function improvement [30-33]. Later studies that used BoTx in repeat/serial sessions, and long-term for spasticity relief in SCI [6,34-38] in CP [39-43] and, in stroke [44-47] had reported improvement in function besides spasticity relief. Note that in all the above studies the dosing, the number of muscles, and spacing between injections were, in principle, designed for spasticity relief. Non-spastic, synergists-antagonists muscles were not treated. Even so, significant, and lasting improvements in function appeared. A number of clinical studies have vouched support on motor recovery brought by BoTx treatment. In CP in younger children each additional injection of BoTx had shown further gain in function improvement [40]. Studies further show that low-dose, and repeat injections are as effective [41-44] compared to high-dose single session procedures. In stroke, and brain injured spastics, serial injections of BoTx was found to be a useful strategy to avoid drug toxicity and resistance formation [38]. In stroke, SCI, CP, and traumatic brain injury (TBI), repeated treatment with BoTx showed sustained or enhanced improvement in efficacy/ and or duration over a follow-up period of up to ten years. In stroke hemiparetics BoTx, besides reducing spasticity in the paretic arm, also significantly reduces associated reactions, thus reducing the adverse impact of associated reactions on daily activities [46]. In all the above studies, despite the rather limited objective, namely spasticity relief, the improvement in function reported is strongly suggestive of the SCL effects of this drug. This clearly shows that if SCL-restoring objectives were also included in the treatment procedure, then far significant improvements in function would emerge. It should be mentioned here that few, if any, of the above studies explained the neurobiology-plasticity mechanisms as to how the function improvement occurred in their patients.

The BoTx-SCL Treatment Protocol: Keep the Paralyzing Effect Minimized--prolong the SCL Duration

The primary objective of BoTx-SCL treatment protocol presented is to keep the paralyzing effects minimized while prolong its beneficial SCL effects. To achieve this, besides spastic muscles other paretic/ paralyzed muscles should be selected for low-dose BoTx treatment. Muscles should be selected after careful neurological examination and investigations (e.g. EMG). Spastic muscles should be given clinically effective doses of BoTx. Indeed they would need far smaller doses as several other muscles are being treated that have closely related motoneuron pools. If in the first session a prime mover muscle is injected, then in the subsequent sessions one of its synergists should be targeted for injection. Selected muscles should be given one third or less the dose as indicated for spasticity. The optimum low-dose for various limb muscles will have to be investigated by clinical trials. In the lower limb the segmental innervation of tensor fascia lata=L4, 5; biceps femoris=L5, S1, 2; gastrocnemius-soleus=S1, 2; extensor digitorum brevis= L4, 5, S1. These muscles are anatomically far distant from each other, but their motoneuron pools are close together, indeed segmentally overlap each other. Thus injecting BoTx into one muscle will trigger SCL effects in the other three motoneuron pools (Figure 2) [5,6,11]. Such pools overlapping exist also in upper-limb muscles. Thus only few key important synergists-antagonists will need injections in a given time frame. The optimum dosage and intervals between injections for best SCL effects will need be worked out on an individualized basis. The low-dose, multi- muscles concept is based on findings in clinical studies. A clinical trial pilot study showed that one half or one quarter standard dose of BoTx given to elbow, wrist, and finger flexors within three weeks of stroke onset not only averted spasticity formation in the paretic arm, but also brought improvement in arm function [48]. Injections should be timed in such a manner that while in a first set of muscles competition comes to end there is beginning of competition in the second set of injected muscles. Hence while the paralyzing effects are confined to few muscles, the SCL duration is stretched to long periods, acting at several motoneuron pools. Injections may be repeated, if need be, as assessed by motor recovery outcome measures until satisfactory recovery is reached. How is the long-term safety and prolonged efficacy of this proposed treatment protocol envisaged? Available clinical evidence as of now suggests that repeated/serial BoTx administrations are safe; negligible or no adverse effects noted. Function improvements were sustained or enhanced for a follow-up period of few years and up to ten years [38,40,41,43,44].

BoTx-SCL Neurorehabilitation

As discussed earlier [4-7] BoTx recreates SCL environment in

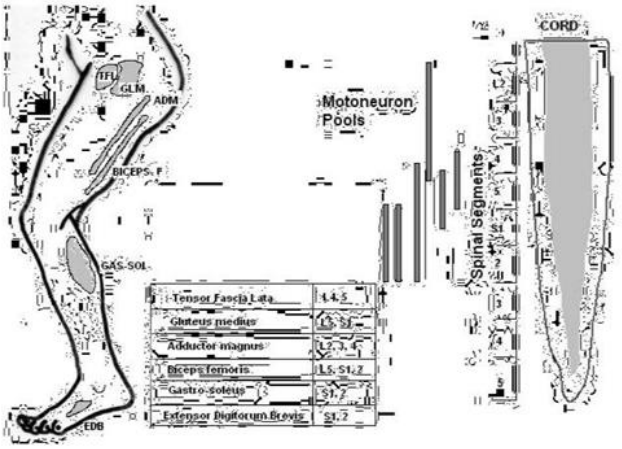

Figure 2: BoTx-induced SCL in the paretic/paralyzed lower limb Low-dose BoTx is injected into a few, selected muscles in serial/repeat sessions. Muscles selected are from among flexors and extensors of the hip, thigh, leg,

and foot. Contracting muscles are not injected. In the next few weeks, intramuscular motor axonal sprouting, polyneuronal innervation control of the muscles fibers, and synapse competition (SCL) will take place. In the mean time, plastic increase in motoneuron soma size, neosynaptogenesis, and synapse competition (SCL) will eventuate in the spinal cord and motor cortical circuits. Note the close proximity, and segmental overlapping of motoneuron pools, though the respective muscles are anatomically far distant apart. Remote, un-injected muscles will also participate in the SCL processes and develop signs of recovery due to the pools' segmental proximity. Thus only few key important prime mover-synergist muscles would need be injected in a given time-frame [5,6,11].

the denervated brain-cord centers; and that lasts only for few weeks. Secondly, the synapses thus generated are rather functionally un-weighted, dummy synapses. The new connections should now be loaded with weights (remember, weights are learned-experiences) which have to be acquired by concurrent activity-dependent retraining programs [5,7]. What is activity-dependent relearning? Infant motor development studies [49], and humanoid robot motor-learning [50] reveal that sensory-motor skills are learned-acquired by initial random, exploratory, trial-and-error movements executed in a number of different (variability) ways on which more complex movement skills are learned and added upon [7]. They show that systems that employ competitive-learning (SCL) principles learn 44 percent faster than other learning systems [50]. Clinical studies have confirmed these observations. In stroke patients, on whom variable training schedules and random functional movements were practiced have shown superior retention of the learned practices that generalize into activities of daily living [51].

Computational modeling [52,53] and fMRI clinical study [54] of motor cortex hand map reveal that the maps are highly dynamic, malleable representations. Shifts in the map borders are resulted from continually ongoing competitive organizing process between neuron groups that control the map borders. Alterations in the hand map can be readily brought up by manipulations of the periphery, e.g. immobilization, amputation, BoTx treatment etc. For example, even a trivial procedure such as immobilizing two fingers together by a plaster-splint for a few weeks can blur the finger borders in the motor map which become reversed and borders become clearly defined once the splint is removed [54]. In hand muscles dystonia (Writer's cramp), the hand motor map is displaced from its normal site. BoTx injection into affected hand-forearm muscles brings relief of spasticity; restores the map to its original site. However, as the BoTx effect wears off, spasticity returns and the map is again displaced [55,56]. Why is the beneficial effect short-lived? This might be due to that only one or two affected hand, forearm muscles were injected in a single session and not repeated. Thus the SCL duration was inadequate for map's corrective processes to complete and establish. The inference is that in BoTx treatment, lasting functional gain can be achieved only by sustaining SCL processes to long periods for loading of weights to occur and establish [5,7]. Another example is from present-day rehabilitation programs for SCI paralytics. In these paralytics, even after intensive, long-term training (body-weight support treadmill) motor recovery appears long-delayed (five years), in small increments, and is rather marginal [57,58]. Why such long delay? As stated earlier the principal reason is that the affected neural circuits have lost their self-organizing capabilities, are in a state of stability-plasticity dilemma and thus re)learning-resistant. It should be pointed out that as until now rehabilitation programs have not addressed these concerns. Most motor tasks e.g. arm reaching-grasping, are multi-joint, multi-muscles complex movement synergies. This means, hand motor map will receive from and project to shoulder, upper-arm, and forearm map regions. The human musculo-skeletal-motor system is endowed with redundant muscles, motor units, joints and degrees of movements [5,7]. Thus a specific movement can be performed in a number of different, variable ways. The maps complexity and the continually ongoing synapse competitive (SCL) processes will explain why multiple muscles, repeat BoTx injections, and relearning-time are needed for long lasting recovery to establish. In stroke and CP hemiplegics, the possibility of using the undamaged hemisphere, e.g. the ipsilaterally descending cortico-spinal tract (CST) axons, the bilateral hemispheric pre-motor centers, and bilaterally operating neuronal networks at brainstem and spinal cord levels etc have been proposed recently [22-26] for inducing compensatory recovery of motor function. In HCP children fMRI studies have shown that the normal competitive process between the crossed and uncrossed CST axons to gain connections with the spinal ventral horn neurons is severely perturbed [14,15,21]. In these paralytics the interruption-disruption of a fair competition and the occupation by aberrant, maladaptive weights has been recognized as factors that hinder motor recovery. This [14,15] is an important finding in the sense that it recognizes SCL as a fundamental neuronal process that controls and regulates motor development and maturation and that its disruption can affect normal motor maturation, and restoration. The present paper addresses these fundamental issues and the proposed BoTx-SCL treatment protocol is aimed to avert aberrant connections, reinstall SCL mechanisms and promote function restoration.

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Assessing and Managing customer's perception on the dimensions of service quality in fast food restaurants/stalls in India: In perspective of Howrah District

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***Abstract*— Objective: The purpose of this study is to deciphering the cognizance of customer in the emerging industry of fast food restaurants in Howrah District of West Bengal. Accordingly, we had explored and investigate the parallel association between the customer's delightness, their behavioral intentions and the service quality. In this paper, we had also examined the attributes of service quality which will be acting as the vital factor for the growth of fast food industry in terms of revenue generation and customer retention.**

Design: In this research paper, a survey has been conducted by making 30 self-administered questionnaires available to customers. By using a five point Likert scale, we have accumulated data from 300 respondents near the cities in Howrah district with a response rate of 66.67 percent. We had performed the descriptive statistics in SPSS which includes Cronbach's alpha, KMO test, Variable matrix and Confirmatory Factor Analysis technique to get the relationship between the attributes of quality which will help us to understand the customer's perception of fast food restaurants.

Finding: The attributes of service quality used in this analysis are as follows: physical support of a restaurant, employee behavior towards customers, reliability towards customers, restaurants quality assurance, understanding and caring and the last one is restaurant image. These attributes are gauged using survey as well as CFA technique in form of higher impact positive association and lower impact negative association which is used to explain the customer satisfaction level for the significance of customer's perception.

Limitation: This study has certain limitation. The present study is conducted only in one district of West Bengal i.e. Howrah, with a small number of respondents. In future a large sample can be taken from wide geographic area in order to generalize the result. Moreover the responses were self-reported.

Value: The authors are not aware of the concerned research in the field of fast food industry related to quality. By reducing the service gap, it can control the difference between expectations and perceptions. The relationship of six attribute of service quality can be useful in assessing and managing the customer's perception in fast food restaurants. And, in this way they can retain their repeated customers. Therefore, it will act as a positive enhancer for the word of mouth of this sector. Finally, the owners / managers of fast food restaurants can perform accordingly to customer's perspective.

***Keywords*—Service Quality, Customer's Perception and Fast Food Restaurant**

1. INTRODUCTION

Indian food is complex in nature as it is much regionalized because of its differing taste buds. Eating is arguably an essential activity of human being that makes them revive the lost energy and rejuvenate. But nowadays, due to the advent of technological economy as well as the adoption of modern life in our country has changed the Indian society and it is contributing to the growth of fast food restaurant industry. In the ongoing trend people love to eat outside rather than traditionally at home. Moreover, the Indian diaspora presents a significant array of opportunities in the food service domain; as they have long association with urban development, it means whenever in history there is a sprung in highly populated area, so did the fast food restaurants. The NRAI (2016) in their research finds that the Indian food services market will grow at the rate of 10% per annum which is estimated to be Rs. 4,981.3 billion by 2021. In today's competitive business environment, customer satisfaction is of great interest to marketing practitioners and scholar (Babin & Griffin, 1998; Oliver 1999). Like most service industries, the importance of perceived quality has been recognized in the resturant industry as well (McCullough, 2000, Oh, 2000). Therefore among the potential candidates, perceived quality has been generally accepted as the foremost antecedent of customer satisfaction (Churchill & Surprenant, 1982, Dabholkar et al. 2000). The Indian fast food market has been witnessing rapid growth on the back of positive development and presence of massive investment. Current, market growth is largely fuelled by the rising young population working women, hectic schedules and increasing disposable income of the middle class

household. Unique properties of fast food like quick service, cost advantage, etc. are actually making it popular among masses. Any food company, big or small, that wants to grow needs to follow a customer centric approach in all strategies. Food is hygiene which is what all customers expect (Tarun Bhasin, President, Dunkin Donuts). The demand for fast food resturant industry has seen a rise, as it remains to be seen of consumer rate of retention because the urban Indian consumer spends nearly one third of their earning on food, therefore they are equally sensitive on quality, taste and price. The rise of number of fast food restaurants is mainly due to the following reason: i) Environment (the access to capital to innovative has become easier), ii) demand (changing demographic, increase in income, urbanization and hygienic food) and lastly, iii) supply (improved infrastructure & private investment in cold chain network has made access to quality raw material).

According to Oxford Dictionary (2013) Fast food is food which could be easily prepared, processed food served in snack bars and restaurants as a quick meal or to be taken away. Fast food industry is known as Quick Service Resturant (QSR). These are known to have consistent, simple look and even music according to the location There meals are short depending upon the quality and taste as per the order given by customers. It focuses on consistency of experience, affordability and mostly speed. Fast food has yet to broadly expand beyond the larger cities. "What's important for a fast food industry to perceive is that the Indian terrain is a typical - consumers are mostly demanding, and there is too much focus on consumer preference towards the service quality and green measures". As Indian economy is growing and large number of women is joining the workforce, the trend of consumption of fast food will grow more and more, if good quality food and service is offered to customer. Today quality is an important consideration. It is often defined as "consistently meeting or exceeding customer's expectations" Moore (1987), Lewis and Creedon (1989). Prime value for any business is their customers and profits. Therefore it is assertive for fast food firms to know about the perception of their customers towards service quality attributes. This study is the first attempt to examine and explore the cognizance of consumers, presumption and buying preference towards service quality in fast food sector of West Bengal, on the sample size of 300 respondent using conveniences sampling to overcome the constraints of time and budgets. Based on the results from this study, Indian consumers have positive perception of service quality attributes while choosing a fast food firm. So, the consumer preference has become an important part for marketer to segment and target their customer according. With the growing fast food firms and changing lifestyle of consumers, these consumers are looking for best services and innovation in the product. This study has certain limitation. The present study is conducted only in one city of West Bengal i.e. Howrah, with a small number of respondents. In future a large sample can be taken from wide geographic area in order to generalize the result. Moreover the responses were self-reported. So, it might be possible that respondents overstated their concern for service quality.

2. LITERATURE SURVEY

Service - According to Wilson et al. (2008), services are usually discussed in terms of its distinctive characteristics. These four unique characteristics are as follows: i) Intangibility: Services that cannot be seen, touched, smelled or tasted, ii) Inseparability: Services are generally produced and consumed simultaneously. Usually the provider and consumer are present when the service is being provided, so both are part of the service process. They cannot be separated from service. iii) Heterogeneity: The quality of services cannot be consistent as they are performed by different employees and at varying time intervals. It is difficult to reproduce services of the same standards, as can be done with products, because they are produced by people, iv) Perishability: Service cannot be stored like products, at the same time; services cannot be returned or resold.

Quality - It is multi-dimensional, multi-level and dynamic (Vlasceanu et al, 2004). Harvey and Green (1993) stated that quality is relatively in 2 ways. First it is in the eyes of the beholder and secondly, quality is relative to the standard one maintains. They also said that quality is exclusive, unique, distinct and sometimes not necessary to prove, quality can be measured against its objectives and purpose, it can be improved and adds value to a product.

Service Quality - In today's business environment, Service quality is considered as the top priority for organization. It not only provides the competitive advantage, but it is also an important factor to sustain growth (Ladhari, 2009). Today customers expect qualitative service which creates pressure on businesses to have better understanding and evaluation on service quality (Wisniewski, 2005). Researchers and marketers are interested in the area of service quality because it is important factor related to costs and customer satisfaction (Howat et al, 2008, Chen, 2008). Different researchers shows that service quality has an impact on company performance, which attracts new customers (Seth et al, 2005) and help organizations to earn profit. There is a clear connection between improving service quality and higher profit (Johnson et al, 2008). Researchers show that one of the most important factors that affect the consumer's choice is service quality (Swobada, 2007). Researchers say that assurances are critical contributors to the measurement of service quality (Constantinos-Vasilios Priporas, Nikolaos Stylos, Roya Rahimi, Lakshmi Narasimhan Vedanthachari, 2017). Research on customer satisfaction (CS), service quality (SQ) and customer value (CV) remains robust in both the frequency and volume of appearance in the hospitality and general business literature(Haemoon Oh, Kawon

Kim,2017). Service quality has been recognized as an important theme in the service industries and particularly in the hospitality sector (Dedeoglu and Demirer, 2015; Wilkins et al., 2007) and as an essential factor for the survival of hospitality providers.

Service Quality in Restaurants - Service quality in the hotels has discovered that service quality is a growing concern for most of the service sectors. Today service firms are paying more attention in reducing the service gap by improving its quality of services provided to the customers. They reviled 4 main attributes of service quality i.e. intangibility, heterogeneity, perishability and inseparability by Jiju Antony, Frenie Jiju Antony and Sid Ghosh (2004). A study by Byeong Yong Kim and Haemoon Oh (2004) on how firms can obtain a competitive advantage discovered that hotel managers should understand how their firm can achieve competitive advantage. There are 3 conceptual frameworks: Porters five force model, the resource based approach and the relational approach. This 3 approaches pursue similar objectives i.e. customer value creation and high firm performance. A study by Marta Pedraja Iglesias and M. Jesus Yague Guillen (2004) on Perceived quality and price: their impact on the restaurant customer discovered that in the restaurant sector makes of this competitive environment it is vital that firms to achieve customer satisfaction in order to survive in the long term. Obtaining customer satisfaction means that customers repeat the experienced service and that they become an effective and efficient communication resource, at no cost to the firm. Prominent among the antecedents that determine the level of customer satisfaction are perceived quality and total perceived price. They also concluded that perceived quality has a direct and positive impact on the level of customer satisfaction, while, contrary to what was expected, total perceived price does not influence that satisfaction. The main factors that lead to customer satisfaction is its cleanliness, physical appearance, the atmosphere and the service received during the meal system (Johns and Pine, 2002).

Service Quality in Indian Restaurants - Indian restaurants originated from the growth of Indian Railways and also due to the growth of the clerical jobs, civil services in places like Mumbai, Kolkata and madras which were meant for the people who travel a lot. Previously the restaurants were like small stalls that used to sell tea, coffee etc. because in those days people like to cook food by their own. There are more than 1000 restaurants in India.

Service Quality in West Bengal Restaurants - Bengali cuisine is one of the finest blends of non-vegetarian and vegetarian dishes. Bengal is known as the land of 'Maach aar Bhaat' which means 'fish and rice'. The Bengali cuisine has a unique feature being an assimilation of the best of the world gastronomy and Indian diverse cookery. Rasogolla and sweets of Bengal are world famous. We invite visitors and tourists to have a taste of Bengali Cuisine. In Bengal lots of family restaurants like "Bhojohori Manna" which serves delightful variety of Bengali cuisine .The menu over here is handwritten on the whiteboard and are designed on the basis of the season, weather or the festive. Then there are multi cuisine restaurant like "XII ZODIAC" which is bit different which serves you the food that is best suited for your zodiac. It is 72 seaters offer a relaxed ambience with easy-on-the-eyes décor. Then there are restaurants that offer sea food and Bengali dish cravings. It provides fast service that anyone cannot afford to miss. In this way there are varieties of restaurants catering in the area of Bengal and satisfying customer's appetite.

3. RESEARCH GAP

Previously in USA researchers (Su Jin Han, Woo Gon Kim, Sora Kang, 2017) have analyzed about the service gap of the restaurant but it has not been done in India. Usually in India lower and middle level income customers eat food from the street side restaurant or the fast food stalls but they usually do not complain about the service quality of the particular stall. They return home with an unsatisfied mind and never return back to the same restaurant to eat food and even avoid complaining. The managers of the restaurant are unaware of these issues. They don't get repeat customers and these increases the negative perception and low revenue generation for the stall.

4. OBJECTIVE OF THE STUDY

The purpose of this research is to investigate the important dimensions of service quality which are very vital for fast food industry in West Bengal. Prioritize the essential elements in those dimensions of service quality. To save the customers from being fooled and buff led. To help the restaurants managers to earn more revenue from their old customers and try to retain them.

5. RESEARCH METHODOLOGY

The study was carried out in the city of West Bengal, Howrah on the sample size of 300 respondents with a response rate of 66.67 percent that is exactly 200 responses. Over here, the structured questionnaire is prepared to know the consumers awareness, perception and the choice of preference toward the green measures in the fast food firm. The scaling used over here is of five point likert scale (5 as extremely important and 1 as unimportant). The major attribute towards consumer preferences was found out by using Factor Analysis which includes cronbach's alpha, KMO & Bartlett's test and variable matrix using SPSS.

Data Collection Method: The primary sources of data were collected from questionnaire survey to the customer of Howrah city. And, in addition to that the preliminary qualitative data were gathered from a series of exit customer as well as owners to gain qualitative insights into customer's perception and preference about the service quality of the fast food restaurant. The questionnaire for this study was developed based upon concepts, theories and past research

information's. The questionnaire are basically divided on six attributes of service quality and they are as follows,

• Physical support of the restaurant: This dimension is real and actual, rather than imaginary or visionary.

• Employee's behavior with customers: This dimension shows about the employee's attitude and behavior towards their customers.

• Reliability towards customers: This dimension is shown to have the highest influence on the customer perception on quality. It is the ability to perform the promised service dependably and accurately.

• Restaurant quality assurance: It defines the ability of a company to inspire trust and confidence in the service delivery. This dimension is considered vital for services that involve high risk as the customers are not be able to evaluate all the uncertainties involved in the process between the total process.

• Understanding & caring: This dimension is used to show the attention, caring the firm provides to each customer.

• Restaurant image: Customer's perception about the restaurant.

Scale Development: Historically, two formats one proposed by Likert (1932) and one proposed by Thurstone (1928) have been most commonly used. As the two most popular procedures, Likert and Thurstone methods have been compared (Roberts, Laughlin & We-dell, 1999; Ferguson, 1941) and a summary of their strengths and weaknesses has found that the Likert method tends to be more reliable and can efficiently produce reliable scores using fewer items (Seiler & Hough, 1970). For these reasons, and, undoubtedly, because it requires fewer steps to develop scales, Likert is an extremely common perception and preference measurement format, and, consequently is the accepted scale chosen for this study. It measures a property of something that can vary quantitatively rather than qualitatively.

Table of Likert's Scale

5.00	Strongly Agree
4.00	Somewhat Agree
3.00	Neutral
2.00	Somewhat Disagree
1.00	Strongly Disagree

Data Analysis: Collected data has been coded, tabulated and analyzed using the statistical package SPSS. Statistical tools used for data analysis include **Results and Finding:**

Chronbach Alpha for reliability of research and Factor Analysis.

Factor Analysis: 200 replies were used to conduct a factor analysis. Barlett's test of sphericity and Kaiser-Meyer-Olkin (KMO) test is two statistical tests that determine suitability of data for factor analysis. Barlett's test of sphericity tests the null hypothesis that no relationships exist between any of variables (items) (Nunnaly & Bernstein, 1994c). If the Chi Square test is significant, it means there are discoverable relationships in the data and there is at least one factor (Ferguson & Cox, 1993; Nunnaly & Bernstein, 1994c). If it is not found to be significant, the matrix should not be factor analyzed (Karpe, 2005; Pett, Lackey, & Sullivan, 2003a). TheBarlett's test in the questionnaire was highly statistically significant indicating a meaningful relationship between the items. Therefore, the null hypothesis (no relationship existed between any of items) was rejected. Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is useful for evaluating factorability (Worthington & Whittaker, 2006). The KMO compares the magnitudes of the correlation coefficients to the magnitudes of the partial correlation coefficients (Pett et al., 2003a). It indicates the extent to which a correlation matrix actually contains factors or chance correlations between a small subset of items (Worthington & Whittaker, 2006). The KMO measure can range between 0 and 1 (Pett et. al 2003a). A value of 0.60 and higher is required for good factor analysis (Worthington & Whittaker, 2006). Above 0.90 is "marvelous'', 0.80 is "meritorious", 0.70 is "just middling", and less than 0.60 is "mediocre" or "unacceptable" values. The statistical tool used for this research work is factor analysis which has been elaborated here. Factor analysis is a statistical method used to describe variability among observed, correlated variables in terms of a potentially lower number of unobserved variables called factors. Factor analysis is commonly used in the field of psychology and is considered the method of choice for interpreting self-reporting questionnaires. Exploratory factor analysis was used to find out the factors that affect the awareness service quality attributes by customers. Cronbach's alpha is not a statistical test, it's a coefficient or reliability i.e. consistency. 26 numbers of items have been inducted to scale and test the reliability. The cronbach's alpha value is 0.963.

Table 1: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.963	.963	42

The KMO measures the sampling adequacy which should be greater than 0.5 for satisfactory factor analysis to proceed. Bartlett's test is another indication of strength of the relationship among variables. This tests the null hypothesis that the correlation matrix is an identity matrix. From the same table we can see that the Barlett's test of sphericity. That is, its associated probability is less than 0.05.

Table 2: KMO & Barlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.940
	Approx. Chi-Square	0.940
Bartlett's Test of Sphericity	Df	435
	Sig.	000

Eigen value actually reflect the number of extracted factors whose sum should be equal to number of items which are subjected to factor analysis. The next item shows all the factors extractable from the analysis along with their Eigen values. The Eigen value table has been divided into three sub sections, i.e. Initial Eigen value, Extracted sums of squared loading and Rotational of sums of squared loading. For analysis and interpretation purpose we are only concerned with Extracted sum of squared loadings. The total variance explained in table 3 shows all the factors extractable from analysis along with their Eigen values, the percent of variance attributes to each other, and the cumulative variance of the factor and the previous factors. Here one should note that the first factor accounts for 11.93% of the variance, the second factor 23.73%, the third factor 34.86%, the fourth factor 45.83%, the fifth factor 56.52% and the sixth factor 65.09%. All the other factors are not significant (table 3).

The table 4, six factors have been extracted. The idea of rotation is to reduce the number of factors on which the variables under investigation have high loadings. Rotational does not actually change anything but makes the interpretation of the analysis easier. Rotated components matrix provides sufficient evidence that all variable can segregated into six factors.

Table 4 depicts the derived factors which are explained as follows. After deducting the dimensions, the six factors which have been extracted are narrated hereby.

F1: While observing the results, variables employees provide prompt service, I will continue to choose this place before others, employees gives answers to queries, quick in solving questions have a loading of 0.671, 0.648, 0.502 and 0.447 on factor F1 respectively. Therefore this factor can be interpreted as “Understanding and Caring”. This factor is by far the most important one explaining 11.931% of the total variance.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	14.574	48.579	48.579	14.574	48.579	48.579	3.579	11.931	11.931
2	1.137	3.791	52.370	1.137	3.791	52.370	3.538	11.795	23.726
3	1.083	3.608	55.979	1.083	3.608	55.979	3.339	11.129	34.855
4	.955	3.183	59.161	.955	3.183	59.161	3.293	10.978	45.832
5	.906	3.020	62.181	.906	3.020	62.181	3.206	10.688	56.520
6	.875	2.915	65.097	.875	2.915	65.097	2.573	8.577	65.097
7	.826	2.753	67.850						
8	.792	2.640	70.489						
9	.745	2.483	72.972						
10	.665	2.217	75.188						
11	.653	2.177	77.365						
12	.597	1.989	79.354						
13	.587	1.956	81.310						
14	.530	1.766	83.076						
15	.501	1.670	84.746						
16	.490	1.632	86.378						
17	.466	1.554	87.932						
18	.418	1.395	89.327						
19	.403	1.344	90.671						
20	.387	1.291	91.962						
21	.352	1.172	93.134						
22	.319	1.065	94.199						
23	.316	1.053	95.252						
24	.284	.945	96.197						
25	.262	.875	97.072						
26	.222	.739	97.811						
27	.198	.661	98.472						
28	.166	.553	99.025						
29	.153	.511	99.537						
30	.139	.463	100.000						

Table 3: Total Variance Explained

F2: As it is clear from Table 4, statements like employees understand the specific needs of customer, employees use personal initiatives to fulfill customer requests, a receipt given after billing, quick in resolving problem, providing the services as they promised have loadings of 0.695, 0.640, 0.638, 0.636 and 0.455 represented by F2. It accounts for 11.7% of the total variance and has been named as “reliability towards customers”.

F3: Table 4 indicates 6 statements, namely, employee over here are helpful, the quality of the food is excellent, orders are served according to the customers want, the prices are charged appropriate as per service, furniture and room fittings are well maintained, employees give individual attention to customers has loadings of 0.679, 0.623, 0.517, 0.513, 0.511 and 0.499 represented by F3. It accounts for 11.1% of the total variance and has been named as “restaurants quality assurance”.

	Component					
	Understanding and Caring	reliability towards customers	restaurants quality assurance	restaurant image	employee behavior towards customers	physical appearance of a restaurant
UC00007	.671					
UC00026	.648					
UC00010	.502					
UC00019	.447					
REL00022		.695				
REL00021		.640				
REL00014		.638				
REL00018		.636				
REL00020		.455				
RQA00008			.679			
RQA00029			.623			
RQA00011			.517			
RQA00013			.513			
RQA00004			.511			
RQA00024			.499			
RI00006				.625		
RI00030				.624		
RI00016				.592		
RI00015				.532		
RI00012				.489		
RI00023				.487		
EB00009					.735	
EB00025					.534	
EB00003					.534	
EB00027					.521	
EB00002					.520	
PA00001						.685
PA00017						.636
PA00005						.543
PA00028						.445

Table 4: Rotated Component Matrix

F4: Table 4 indicates 6 statements, namely, employee provide a sincere service, order are served to customer at a promised time, secured e-payment service facility available, employees have experience in the field, overall I am satisfied with the dining experience, the operating hours are convenient for all customers and it has loadings of 0.625, 0.624, 0.592, 0.532, 0.489 and 0.487 represented by F4. It accounts for 10.9% of the total variance and has been named as "restaurant image".

F5: Table 4 indicates 5 statements, namely, the employees are friendly, employees put an extra effort to handle special requests, the dining halls have nice appearance, I would continue to favour the offerings of this Inn, employees are appropriately dressed has loadings of 0.735, 0.534, 0.534, 0.521 & 0.520 represented by F5. It accounts for 10.6% of the total variance and has been named as "employee behavior towards customers".

F6: Table 4 indicates 6 statements, namely, physical facilities are clean and comfortable, employees have knowledge to provide accurate assistance, material associated with the service are adequate , I will recommend my friends to come over here has loadings of 0.685, 0.636, 0.543 & 0.445 represented by F6. It accounts for 8.5% of the total variance and has been named as "physical appearance of a restaurant".

6. MANAGERIAL IMPLICATION

Identify critical quality attributes among diverse candidates is vital in maximizing customer satisfaction. The result of this study will help the fast food owner/manager to attain balance in their focus on the 3 facts of the QSR quality and at prioritizing limited business resource for improving more critical attributes that intensify customer satisfaction and eventually future favorable behavior. Furthermore, what occurs in the interaction between customers and service provider can have a substantial impact on consumer evaluation on restaurant service. The findings suggests that restaurant manager should recognize the level of service that the restaurant expect to provide for their customer. Although empathy is required of restaurant services, reliability, responsiveness were found to be more significant for high satisfaction.

7. CONCLUSION AND FUTURE WORKS

In this competitive world maintaining in business in fast food industry has become very difficult because of the dramatically change in market in and customers' expectations has also change over last decades. The competitive advantage on service quality has become very important the fast food business owner. In this research paper I have tried to collect the data on 6 important service quality dimensions and made a data set from this data gathering. Using the CFA technique I have tried to find out which factors have the highest impact on the service quality dimensions. Among the 6 factors factor 1, factor 2, factor 3 should be given more importance because of its high cumulative percentage. Much work has to be done in this fast food industry as my work was limited to certain area so scopes are high in geographical scenarios. As well as time constraint can also be a silent feature in my research. Fast food business owners should focus on the service quality dimension not only to satisfy customers but also this will help them to retain their customers. This will help them to retain their customers which become a very vital factor in order to sustain on this fast food business.

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Printed Ring Monopole Antenna for Medical Application

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***Abstract*— The Ring printed monopole antenna has been proposed for broadband application. The printed monopole ring microstrip line feed antenna is simulated on IE3D and its impedance matching bandwidth and the return loss and current distribution are shown, along with radiation pattern. The bandwidth measured in the laboratory is in the range of 1.87 to 4.6GHz. The proposed antenna has achieved fractional bandwidth of 167%.**

***Keywords*— Ring microstrip line feed antenna, VSWR, return loss, impedance bandwidth, current distribution**

1. INTRODUCTION

In medical field many advance technologies are available for detection of breast cancer like mammography, computer tomography etc. Breast cancer is more common disease found in women worldwide and its treatment process is very painful [1]. Breast cancer affects many women and hence its detection should be fast and accurate. To detect cancer in early stage is very important. Some of methods for breast cancer detection are X-ray mammography, MRI and ultrasound [2]. However, they have some limitations. Microstrip antenna is used to detect breast cancer is a promising method and there are many works in this area. There are many ways of Breast cancer identification such as Mammogram, X-ray, ultrasound, tomography and MRI [3]. However, this technique has some undesired results and is not preferred by younger age group. These techniques were overcome to some extent by recent growing techniques and technologies such as microwave imaging, wireless monitoring system [4]. Early diagnosis is the most important parameter to detect and interfere with cancer tissue. Some of methods for breast cancer detection are X-ray mammography, MRI and ultrasound [5]. However, they have some limitations. For example; between 4 to 34% of all breast cancers are missed because of poor malignant/benign cancer tissue contrast. Microwave imaging to detect breast cancer is a promising method and there are many works in this area [6].

The tissue with malignant tumour has higher water content than the normal breast tissue, hence they have higher dielectric properties than the normal tissue which have low water content, therefore strong scattering take place when the microwave hit the tissue with malignant tumour [7].

Microstrip line feed printed monopole antenna is used for breast cancer detection, it is easily used technique because of light weight, low cost, easy to fabricate. [8-9].

The basic idea of using microwave imaging system for breast cancer detection is to transmit electromagnetic waves from a transmitting antenna to the breast and receive the scattered waves at a receiving antenna. Differences between electric field and magnetic field are important to identify cancerous tissue's position and volume etc. Many types of microstrip antennas are used for breast cancer detection like rectangular, circular, antenna with array, UWB (Ultra Wide Band), Vivaldi etc. [9]. The printed monopole antennas are easy to fabricate on any substrate like fabric, sheet, paper, foil etc. by taking these advantages into consideration researchers design flexible antennas which can be implemented on jacket or cloth, can be conformal [10]. The proposed antenna covers ISM (Industrial Scientific Medical), which covers medical applications and as well as GSM (Global system for Mobile)/DCS (Distributed Control System) /PCS (Personal Communication Services)/UMTS (Universal Mobile Telecommunications Service) and WLAN (Wireless Local Area Network) [1-11].

2. ANTENNA DESIGN

The printed monopole antenna are low profile, light in weight, easily maintainable antennas. The printed monopole antenna has simplest design with conducting material on one side of the substrate as radiating patch and partial ground plane on other side of that. These antennas are available in various shapes such as circular, rectangular, ring, semi-circular etc. The printed monopole is equivalent to the cylindrical monopole antenna [11].

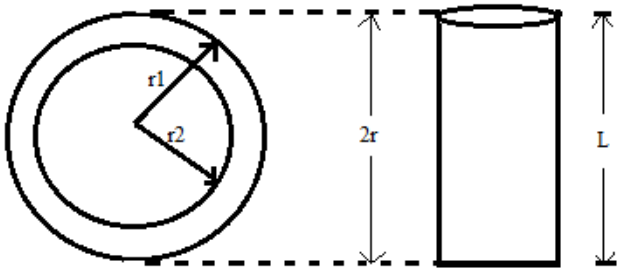


Fig.1 Printed Ring monopole antenna.

The area of cylindrical planar antenna is

$$W=2\pi r \quad (1)$$

Where,

W is a width of antenna.

The cylindrical antenna height is equal to the circular patch antennas diameter [12].

$$L=2(r_1) \quad (2)$$

But, the inner part of circular radiator is minimal of current vectors, so it does not take part in radiation. Therefore the area πr22 has been removed.

Therefore,

$$r_1 = L/2 \quad (3)$$

According to Fig.1 planar antenna area is equal to annular ring patch area.

$$= \pi(r1-r2)^2 \quad (4)$$

According to Fig.1 the surface area of cylindrical monopole antenna is equal to

$$= 2\pi r \times L \quad (6)$$

Equating the value of equations (4) and (5)

$$2\pi r \times L = \pi \times L^2/4 \quad (7)$$

Then

$$r=L/8 \quad (8)$$

The effective radius of cylindrical monopole antenna is equal to circular planar antenna [12]:

$$f_L = 7.2/ (L+r+p) \quad (9)$$

Because of the fringing edge of the circular monopole antenna on dielectric substrate the lower edge frequency is reduces the formula become:

$$f_L = 7.2 / (L+r+p)k \quad (10)$$

Where, k is a correction factor for FR4 K=1.15 [11].

Substituting value of k in equation (10)

$$fL= 7.2 / (L +L/8 +p)k \quad (11)$$

Printed monopole circular ring microstrip antenna:

Fig.2 Ring line feed antenna implemented on FR4.

The circular ring microstrip line feed printed monopole antenna is implemented practically by using FR4 glass-reinforced epoxy laminate material.FR4 has dielectric constant 4.4 with thickness of 1.59 mm and loss tangent tanδ = 0.02. It consists of four parts: a patch, a partial ground plane, a substrate and feed line part. The outer radius of ring is 25mm and inner radius of the ring 20mm. the feed line is 1.44mm.

3. RESULTS AND DISCUSSIONS

Simulation is carried out from frequency range from 1GHz to 5GHz.

The following figure shows the impedance matching bandwidth of antenna. The ideal value of VSWR (voltage Standing Wave Ratio) is unity but for printed monopole antenna below 2:1 value is desirable. Fig. 3 shows impedance matching bandwidth, frequency range is 1.87GHz - 4.6 GHz that is bandwidth of 2.73GHz. The measured values are shown in corresponding fig.4 and fig.5.

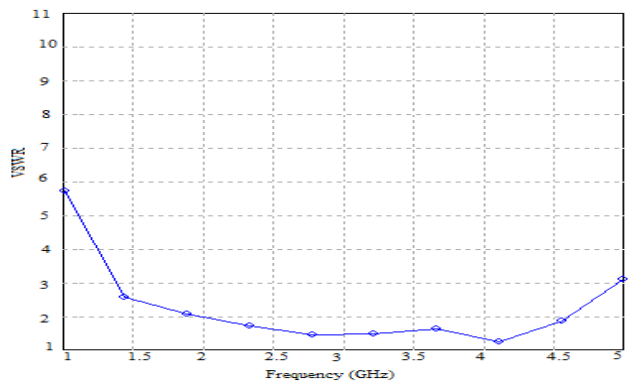


Fig.3 Printed ring monopole antenna simulation result

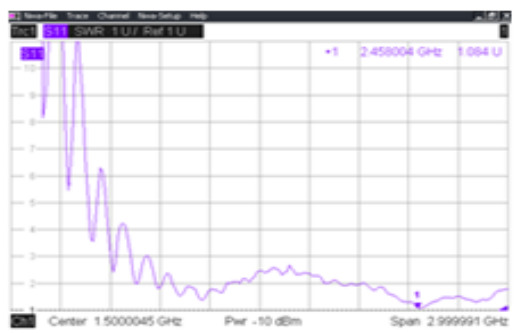


Fig.4 VSWR result of Printed ring monopole antenna

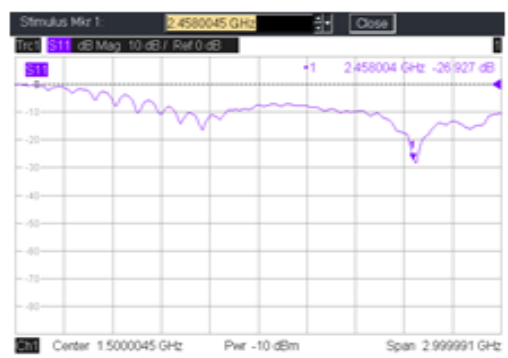


Fig.5 Return loss in printed ring monopole antenna

The maximum gain is above 2dBi in the needed frequency range from 1.87GHz to 4.6GHz.

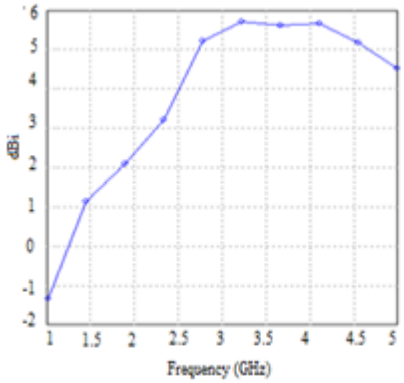


Fig.6 Antennas Max Gain Vs Frequency

Antenna radiation efficiency is more than 80% for the needed frequency band from 1.87GHz to 4.6 GHz.

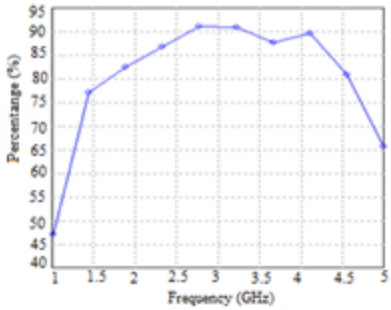


Fig.7 Antennas Efficiency Vs Frequency

The fig.8 shows the vector current surface distribution at 3.66GHz. The current vector distribution is minimum for inside circle as compare outside circle.

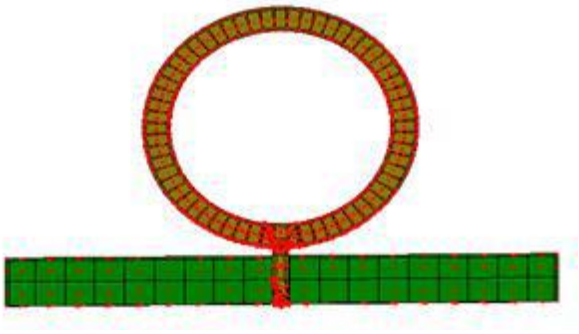
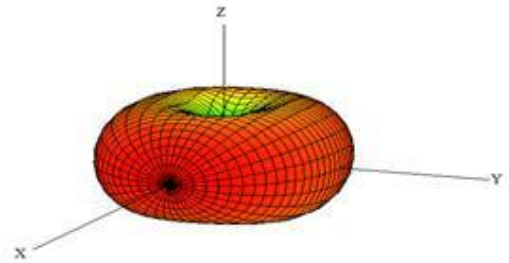
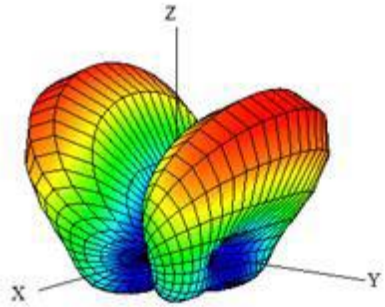


Fig.8 Current Distribution in Printed ring monopole antenna

The simulated vector current density is shown in fig. 9, which justifies the enhancement of bandwidth. The maximum radiation is shown by red color that is only at the edges of an antenna and at the center of antenna minimum radiation is present.



a)



b)

Fig. 9 The simulated 3D Radiation pattern of Printed Ring Monopole antenna at a) 1.44GHz b) 3.22GHz

The measure elevation plane shown in fig.10, it shows figure of eight. There are few nulls that is due to manual measurement in the laboratory.

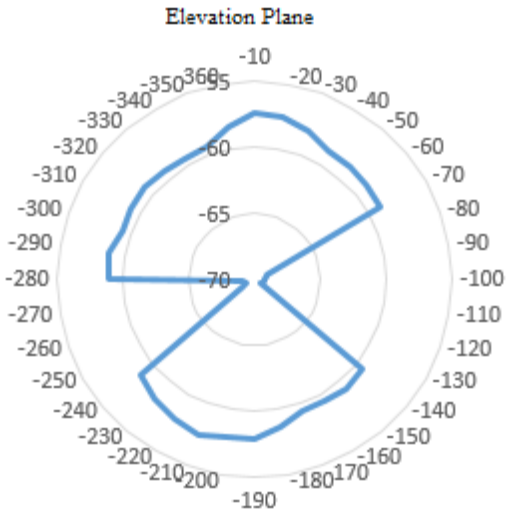


Fig.10 Elevation Plane of Printed Ring Monopole antenna

The azimuthal plane as shown in fig.11 is close to omnidirectional for overall bandwidth.

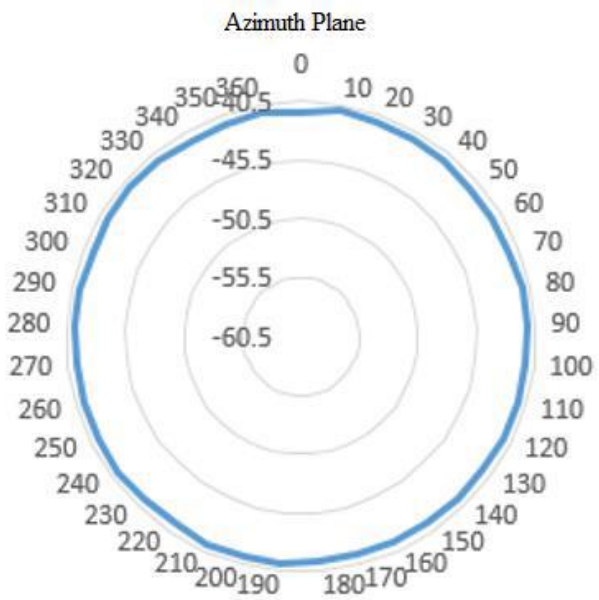


Fig.11 Azimuth Plane of Printed Ring monopole antenna

4. CONCLUSION

The printed monopole microstrip ring antenna provides ISM band for medical application like breast cancer detection. When the antenna radiation is used for detection of cancerous cells, it has been observed that the return loss deteriorate and with this observation it can be conclude that return loss parameter of PMA with microstrip line feed antenna can be used in medical science for detection of breast cancer.

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Cost efficient automatic waste segregation and monitoring using IoT

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***Abstract*— In the modern era, with the increase in the technology and rapid growth of the industries, excessive waste is being generated. The very idea to subdue the waste emanating from these industries and other subservient emitting agents is rudimentary. Rather the waste can be processed and can be used in an efficient way. The waste can mainly be classified into biodegradable and non-biodegradable wastes. The segregation and utilization of these wastes are the need of the hour. The general way of segregation requires more manual energy and time. Here we are going to present a project on automatic and economic segregation of the metallic, wet and the dry wastes using IoT.We are using IR sensors for the movement of the conveyer belt, inductive sensor for detecting metals, moisture sensor for detecting wet wastes and the ultrasonic sensor to detect if the bin is full or empty .Here Wi-Fi module and gsm modules are being used to send messages to the cloud and the mobile phones. This cost efficient model would address the primordial problem of the automatic waste segregation and can be further extended for the better applications in the future.**

Keywords – IOT, Wi-Fi, Inductive Sensor, Moisture Sensor, GSM Module

1. INTRODUCTION

Managing waste is essentially important for sustaining and making liveable cities .But the managing of the haphazard waste that is being created every day by many means has become a critical challenge. Although many countries have been coming with many ideas to subdue the waste,for example under swachh bharat campaign in India many of the ideas have been proposed to control and reduce the waste. According to the world bank reports In 2016 alone,the world generated 2.2 million tonnes of plastic waste, or 12 percent of the total solid waste. It is also an estimate that the waste would increase to 3.4 billion tons over the next 30 years[1].

Looking at these horrendous facts and figures the need to utilize the waste has become the need of the hour.So segregation of the waste is the first important step for the utilization of the waste. Previously hand picking was one of the methods to sort out the waste.It takes a lot of time and energy. Here we are discussing for the automatic separation of the waste wherein we are separating different kinds of wastes and placing then in the respective dustbins.The different kinds of wastes that are being produces are Liquid waste(dirty water,organic liquids wash waters,waste detergents),solid rubbish(plastic waste,paper/card waste,tins and metals,ceramics and glass),Organic waste(garden waste,manure etc),recyclable rubbish(solid items like paper and metals).In this paper we are concentrating on the separation of the metallic,dry and wet wastes as these are the most commonly produced wastes in the household as well as in the industries.After segregated, metallic waste can be reused many times to make new products.Wet wastes can be used as a manure for the organic matter and dry waste is used to produce recycled products.

2. LITERATURE SURVEY

Ashwini D. Awale in the paper automatic waste segregator talks about separating metals,wet and plastic in an economic way that can be well used for household purposes.In the paper,the metals are detected using inductive sensor ,plastics are detected using capacitive sensor and the glass is detected using LDR+LASER.The circular disc is mounted on the servo motor and four angles are fixed for four different wastes and the speed of the servo motor is controlled using pulse width modulation.

Amrutha Chandramohan in their paper describes about automatic waste segregator using metallic and capactive sensors.After the respective waste is detected it falls into the dustbins that are fixed at the lower part of the setup.In this model the cost of the sensors are relatively higher,where in we overcame this model by using moisture sensor

Aksan Surya Wijaya describes about “Design of smart waste bin for smart waste management” where he has used two levels sensors one mounted on the top and the other at the bottom.The top level sensor is used to identify the level of the waste and the bottom sensor is used to identify the weight of the dustbin.Also for the transmission of the data gsm modules and bluetooth are used

Fachmin Folianto in their paper “Smartbin: Smart Waste Management System” describes about the smart waste bin that identifies the fullness of the bin.Here they

have used three tier architecture like outdoor nodes,analytics,workstation.The nodes consists of ultrasonic sensor which determines the fullness of the bin and sends the data to the outdoor station from where the information is transmitted to the backend devices through 3g or wireless communication.

Gopal Kirshna Shyam in the paper "Smart Waste Management using Internet-of-Things (IoT)" talks about the level of the dustbins and sending the information to the server and designing different routes bases for the vehicles that collects data based on the readings that are being obtained.Different algorithms are being designed for the same models.

Sharanya.A in the paper "Automatic waste segregator" discussed about the segregating of the metals,plastics and wet waste using the circular disc on the top of the rotating single with sensors embedded at the ends of the perpendicular diameters.

All the above models either talk about waste segregation or the waste level detection.The cost for such projects is bit higher compared to our model.The above discussed models can be used only in the household purposes.The solution which we have discussed can be used in a certain areas where all the waste is stored and can be processed further.Here apart from the waste segregation we are also detecting the level of the each dustbin by using ultrasonic sensors and thereby reducing the power to constantly rotate the conveyer belt.Here moisture sensor is being used for the separation of the dry waste and the dry wastes ,which is cost effective when compared to the usage of the capacitive sensors.

3. PROPOSED MODEL

The main concept behind the smart waste management is to segregate the waste into their respective types and sending the information about the same through wifi and GSM modules for the effective monitoring of wastes collected.

A. General system:

In our low cost smart segregation of the waste and the monitoring system ,for the effective transmission of the data collected and for the web based monitoring for the interfacing and the communication different sensors like wifi modules and GSM modules are being used.Apart from that challenge lies in the identification of the metals and wet, dry wastes.For that purposes we have used Inductive sensor for metal detection and moisture sensor for the wet waste detection.Fig1 shows the block diagram of the system designed.

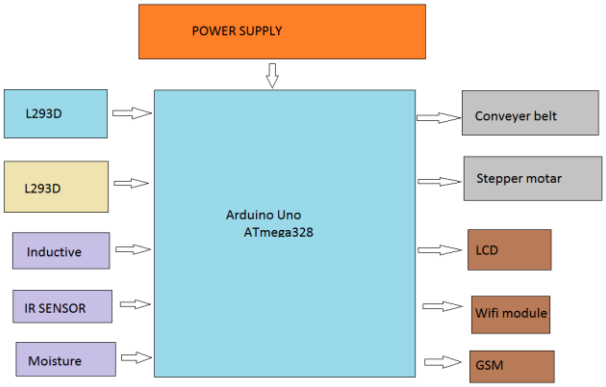

Fig1: Architecture of the system proposed

Components used:

Inductive sensors:These sensors are used to detect the metals by using electromagnetic induction.An inductor develops a magnetic field when the current flows through it and consequently any change in the magnetic will cause the current to alter in the sensor and can be used to detect the metals from the allied objects.

Moisture sensors:The wet objects can be detected using the moisture sensors.Through these sensors the moisture content of the objects are identified.If we were to put a threshold moisture value,if the objects that comes in touch with the sensor has a moisture content more than the required value then we can deduce that the object is of the wet type.

IR sensors:Infrared sensors are used to identify the objects.It consists of an IR transmitter and IR receiver.The transmitter sends IR waves and any object that comes in front of that reflects the waves and the receiver receives the IR waves and we can put forth that the object is detected.

Stepper motar:Unlike DC motors,the stepper motor is a brushless motor where the rotation is divided into number of steps and the steps can be commanded with respect to the angle of rotation based on the requirements.Unlike servo motors where angle is the basic criteria for the rotation,here number of steps are the basic criteria for the rotation.

Wifi module:This module is especially useful for connecting to the web.The module requires a low voltage of 3.3 V.A separate code has to be written for transmission of the data to the web through IP address.We have used ESP8266 module in our project.

GSM module:It is used to establish connection between the computer and gsm system.It is also used to send he SMS to the mobile about the status of the wastes being collected.We have used GSM SIM900A for the data transmission.

H Bridge:For switching the polarity of the voltage to the load applied H bridge is used.This module is heavily used in the robotics and in many other fields.In our project we used two modules,one is to control the conveyer belt and other is used to rotate the stepper motor.

Ultrasonic sensor:Ultrasonic sensor use a single transuder to send the pulse and receive the echo.Using this the distance of the object is sensed.In our project these sensors are used to detect the waste level content and thereby sends the information about the status of the trashbin

4. WORKING OF THE MODEL

The cost economical prototype is built which vividly depicts the functionalities of different sensors and is successful in justifying the basic theme and the title of the project.Fig2 is the side view of the prototype used

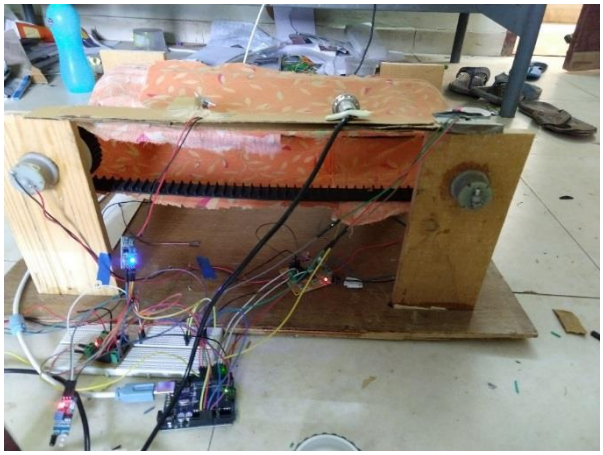

Fig3: The side view of the model proposed

It would be a waste of power if the conveyer goes on rotating all the time whether or not there is an object on the conveyer belt.To minimize the power consumption we have used IR sensors that detects the objects.Here two IR sensors are being used to control the rotation time of the conveyer belt.One sensor is placed at the start of the model,that detects the object and starts the conveyer belt.The other IR sensor is placed at the last amongst the series of sensors that inevitably detects the objects that are being passed and after a little delay it stops the conveyer belt.Meanwhile the object falls in one of the three dustbins that are separated by an angle of 120degrees.Fig3 shows the top view of the proposed model.

A. Inductive proximity section:

After the object is detected the conveyer belt starts to move.The next in the series of the sensors is the inductive sensor.This particular sensor detects the metal objects that comes in touch with the sensor.This proximity sensor works on the principle of the electromagnetic induction with the varying magnetic field when the metal objects that comes in contact with the sensor.Once the metal object is detected,the stepper motor rotates by 120 degrees and delays till the object falls into the dustbin.It retracts its original position after the object falls into the bin.The moment metal is detected the moisture sensor gets deactivated.The question arises as in why is that so?In this project we are separating metals without considering their wet and dry levels.

Fig4: The top view of the model

B. Moisture Sensor Section:

Once the object detected is not metal,it passes through the moisture sensor.If the wetness level of the object is greater than the threshold level that is set beforehand ,the object is detected as wet waste. This time the stepper motor rotates with an angle of -120 degrees and stays there till the object falls in the respective bin and retracts its original position.Fig4 shows the systematic flow chart of the process being demonstrated.

If both the conditions are not satisfied the waste would come under the category of the dry waste.Here the dustbins will be intact.It stays in the original position and the objects falls into the bin correspondingly.In this way the different wastes are separated based on the sensor values.The major advantage of this model is that ,moisture sensor is being used in place of capactive sensor.Capactive sensors are used to detect the wet wastes and dry wastes based on the dielectric values.Usually wet waste has high dielectric value compared to the dry waste.

C. Design Architecture of the dustbins:

The architecture of the dustbins is very important in the design part.Three dustbins are fixed over the stepper motar,separated by an angles of 120 degress.Based on the type of the object the bins rotate and once the mission is done,it retracts to its original position.The stepper motor consumes more power for this rotation,for this we are using a 12 v battery for the stepper motar and a separate H bridge for the same.Fig 5 shows the dustbin angled at 120 degrees.

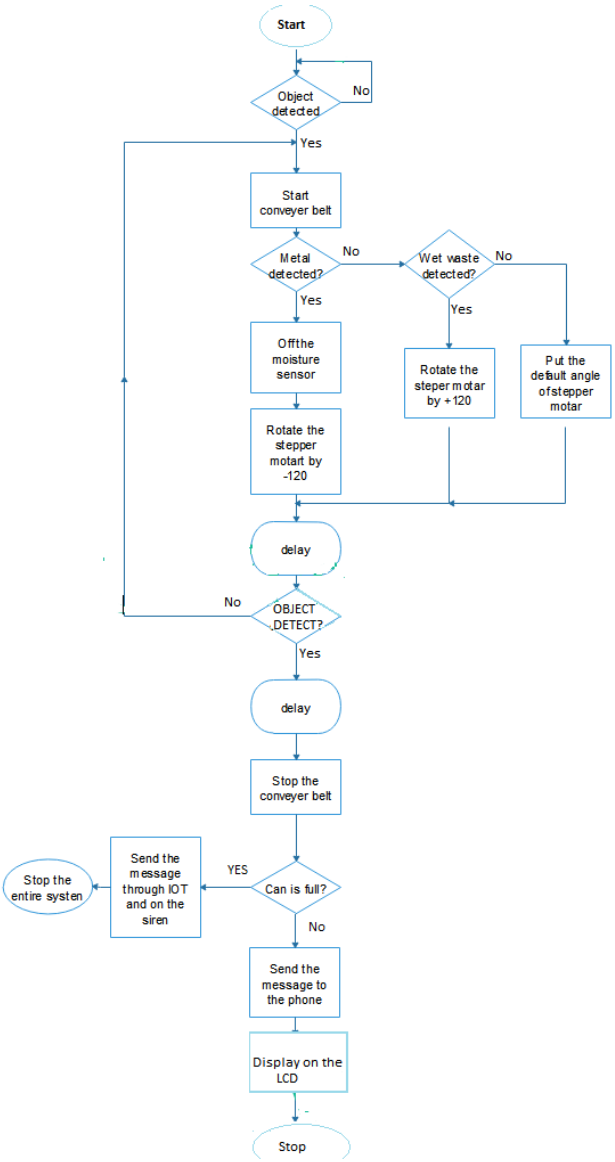

Chart1:Flow chart describing the process control.

Fig5:The model depicting the construction of the bins

D. Post Segregation:

After the objects are segregated it is important to realize the dustbin level.In our project we aim to detect the level of the dustbin using ultrasonic sensor and send the information to the web using the wifi module.Care has to be taken in supplying proper voltage to the wifi module.Its also important to halt the entire system if anyone of the bins is full so that overflowing of the wastes into the bins will not take place.For that purpose three ultrasonic sensors are used for three different bins.Fig6 shows the message sent to the server.

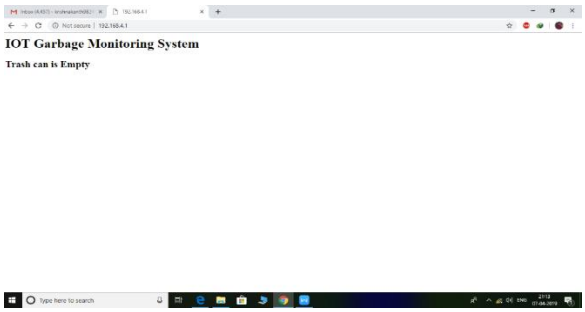

Fig6 shows the message delivered to the server

E. LCD Display:

After the object is detected the information is displayed on the LCD level and once every 30 min or for the threshold time that is predetermined -a message is sent to the mobile through the gsm module.Fig 7 showing the LCD display.

Fig7: The wet waste is detected with the content of 78%.

Here GSM module is used to send the message to the mobile phone. Based on the different sensor values different messages like wet waste with the moisture content, dry waste and metallic wastes are generated and the messages are sent using the gsm module.Fig8 shows the messages being sent to the mobile phones.

Interfacing the GSM to the Arduino is the challenging part in the project.It has to be tested many number of the times.Also the care must be taken in the selection of the sim card.In this project we have used 2g sim keeping the fact of

the economical constraint and also low range for the transmission.

Fig8: The different messages corresponding to different wastes are sent via gsm module

Advantages of the automatic waste segregation:

1. Manual power can be drastically reduced resulting in saving of time and energy.
2. Sorting of the waste at the lower level can be useful for the efficient processing.
3. The system is eco-friendly wherein the entire frame is made of wood.
4. The investment for the system is very less.

Disadvantages of the system:

1. High power is required to run both the conveyer belt and the stepper motor.
2. The moisture sensor should be calibrated regularly.
3. The size and the weight of the object should match the threshold weight of the conveyer belt since it would be a tedious task for the conveyer belt to carry heavy objects.
4. Of all the components inductive sensor requires more power, so in this project separate power supply is dedicated to the inductive sensor.

Table1:The different wastes used in the prototype

Waste tested	Inductive sensor	Moisture sensor(5% threshold)	Type of the waste
Paper	Nil	Nil(2% wet)	Dry waste
Metallic ring	Detected	Nil	Metallic waste
Soaked cloth	Nil	Detected (70%)	Wet waste
Plastic cylinder	Nil	Nil(4%)	Dry waste
Banana remains	Nil	Detected(7%)	Wet waste
Coke tin	Detected	Nil	Metallic waste
Steel glass	Detected	Nil	Metallic waste

5. CONCLUSION

The waste segregator separates the waste into metallic,wet and dry wastes.The proposed system would be able to monitor the waste content in the bins and sends the information through gsm and wifi modules.The calibration of the moisture sensor is very essential and should be monitored regularly,otherwise it would throw errors.Finally the system proposed is cost efficient and eco- friendly when compared to the existing models.

FUTURE SCOPE

The project can be extended to identify the plastic,toxic and non-toxic materials.Waste can be processed immediately after the segregation with the development of proper circuitry and prototype.

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Identification of Dominant Role of Bacillus sp. in Potential Aerobic Biological Treatment of Bulk Drug Industrial Effluent

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***Abstract*— A year-long study has been carried out on aerobic biological treatment of bulk drug industrial effluent which is highly acidic in nature and shows high value of BOD5 (≈ 36000 mg/l), COD (≈ 84000 mg/l), and volatile solids (≈ 1, 70,000 mg/l). Chemical treatment conducted for neutralizing the pH followed by biological treatment using a lab-scale reactor with acclimatized bacterial consortia isolated from natural soil has confirmed its biological treatability. About 99% removal of COD from starting value of around 8000 mg/l has been achieved. The COD value in different hydraulic retention time (HRT) has been brought down to less than 100 mg/l in treated effluent, showing high removal of dissolved organics by aerobic biological treatment. The biochemical and genetic analysis has confirmed the Bacillus sp. playing an omnipotent role in treating the chemically treated and diluted bulk drug industrial effluent and in bringing down the COD value to a level which conform the effluent standard for discharge to surface water.**

***Index Terms*—Keywords: Bulk Drug Effluent, Aerobic Biological Treatment, COD, Bio-kinetic Constants, Bacillus Sp.**

1. INTRODUCTION

Treatment of effluent is of great concern for any kind of industry, especially for bulk drug industry. A wide variety of chemical compounds generated from bulk drug or pharmaceutical industry mix with the effluent causing highly polluted wastewater [2, 4]. It includes organic, inorganic and suspended particles which alter the pH of the water and enhance the chemical oxygen demand (COD) and biochemical oxygen demand (BOD) of the wastewater [26].

Various strategies have been proposed for the treatment of the pharmaceutical effluents which includes physical, chemical and biological treatment [2, 10, 12, 26]. Biological treatment is a natural process and it plays significant role in degradation of the organic compounds [5, 17]. Both the aerobic and anaerobic biological systems have been proposed for the treatment of pharmaceutical effluents [15, 17, 27]. Anaerobic treatment is more efficient in terms of sludge yield, it deals with high concentration of wastewater, has low operation cost, causes recovery of methane gas etc. It is associated with high-capacity reactors and it requires skilled-man power for operation. Its installation cost is very high which can hardly be afforded by small bulk drug producing industries [12, 15]. On the other hand, aerobic treatment is a conventional process having low installation cost and efficient for treatment of various types of pharmaceutical wastewaters [5].

Activated sludge process is a very common aerobic treatment process which involves suspended microorganisms in the wastewater. The microorganisms are activated by air [26]. In this study acclimatized bacterial consortia isolated from natural soil has been introduced and their potentialities in bringing down the COD value to a level which conform the effluent standard for discharge to surface water has been investigated.

The main objective of this study is to develop a very simple wastewater treatment process which can be afforded by the small bulk drug producing industries [19]. The bacterial species have been identified and the bio-kinetic constants are evaluated This will also involve identification of bacterial species and evaluation of bio-kinetic constants for understanding their potentialities in degrading the pharmaceutical effluents emanated specifically from the small bulk drug industries [1, 16, 25]. This study will definitely help the small bulk drug producing industries to treat their effluents in a most cost-effective and affordable manner by using simple reactors and the identified bacterial species responsible for biodegradation.

2. MATERIALS AND METHODS

2.1 Material

The wastewater for the present study has been collected from the equalization tank of a small bulk drug producing industry situated in Kolkata, India. All the chemicals used

in this study are either AR grade or Molecular Biology grade. Double distilled water has been used for routine chemical analysis and Millipore water is used for Molecular Biology work.

2.2 Seed Preparation and Acclimatization

The inoculums for seeding the reactor have been prepared from the soil adjacent to the surface drain of the industry expecting probable presence of the specific waste degrading bacteria. The bacterial growth has been maintained in the media containing sugar, starch and peptone as carbon source, MgSO4, KCl, FeCl3, CaCl2, MnCl2 as micronutrients and NH4Cl along with (NH4)2HPO4 as nitrogen and phosphate source[14]. Acclimatization of the microorganisms has been done by introducing industrial effluent in the media with gradually increased dose [10, 24]. The acclimatization process has been initiated with the effluent containing the COD value of 1000 mg/lit and the concentration has gradually increased up to 8000 mg/lit with an increment of 1000 mg/lit in every stage. Each increment of 1000 mg/lit is done when the earlier dose of COD has been completely exhausted. The COD value has been measured at the interval of 6 hrs corresponding to each dose. For normal growth of the bacterium the requirement of BOD5: N: P = 100:5:1[14] has been strictly maintained. Bacterial propagation and acclimatization has been continued with constant aeration @ 2m3/hr at 300C temperature.

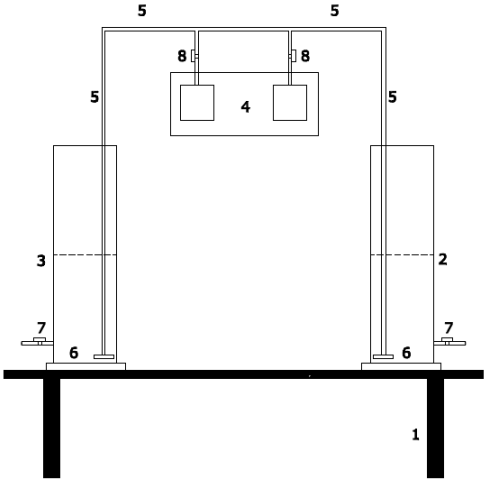

Fig.1. Schematic Diagram of the experimental setup (1- Reactor Stand, 2- Reactor I, 3- Reactor II, 4- Air pumps, 5- Aeration pipe, 6 - Air diffuser, 7- Sludge discharge way).

2.3 Reactor

A laboratory scale reactor made with cylindrical glass of 2 liter capacity has been used for biodegradation study. Constant air supply at the bottom of the reactor has been maintained by an air diffuser fitted with air pipe which is ultimately connected to an air pump. Air valve is used for controlling the volume of the air in the reactor. The reactor is equipped with an outlet facility to discharge the sludge and the wastewater (Fig 1).

1.4 Chemical Analysis

The physico-chemical characteristics {pH, COD, BOD, Total solids (TS) and Total Volatile solids (TVS)} of the wastewater have been routinely determined following the procedures provided in the Standard Methods [21].

1.5 Bacterial Identification

1.5.1. Biochemical Characterization by Staining Method

Before and after acclimatization the bacterial colonies have been microscopically identified by standard gram staining.

1.5.2 Genetic Characterization

Total genomic DNA was isolated from the soil and 16S rDNA amplified by PCR with 8F and 1492R universal primers (Fig 6-f and 6-g). The capillary sequencing was done by ABi 3730 XL DNA Analyzer machine (GCC Biotech, Kolkata)[13].

1.5.2.1 Bioinformatics Analysis

Organisms have been identified for each assay by comparing consensus sequences to a database library of known 16S rRNA gene sequences in GenBank (http://www.ncbi.nlm.nih.gov/blast/Blast.cgi) by multiple sequence alignment. The bacterial source of the sequence has been identified by matching it with a sequence for the highest maximum identity score from the GenBank database. Where more than one bacterial species have the same highest score, all species have been recorded in the results. Sequences with 97 % similarity to hits from the GenBank database have been considered to be of poor quality and has been excluded from this study. With respect to the 762/598 bp PCR, the individual 762 bp and 598 bp sequences as well as the 1445 bp consensus sequence have all been analyzed using the GenBank database to ensure that the two fragments have been derived from the same bacterial species.

The evolutionary relationships of 17 taxa have been deduced from UPGMA method. The optimal tree is depicted with the sum of branch length = 1.46861360. The percentage of replicate trees in which the associated taxa clustered together in the bootstrap test (500 replicates) is shown above the branches. The evolutionary distances have been computed using the Maximum Composite Likelihood method and are in the units of the number of base substitutions per site. Codon positions included are 1st+2nd+3rd+Noncoding. All positions containing gaps and missing data have been eliminated from the dataset (Complete deletion option). There are a total of 1383 positions in the final dataset. Phylogenetic analyses have been conducted in MEGA4 software.

Before and after acclimatization the bacterial colonies have been microscopically identified by standard gram staining.

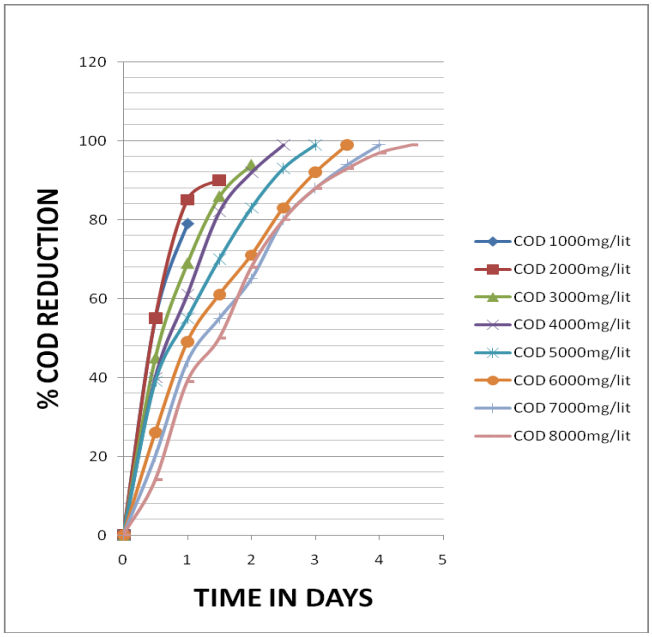

Fig.2. Acclimatization of the Microorganisms: The microorganisms have been acclimatized with the gradual increase of concentration of COD of the wastewater (1000mg/l- 8000mg/l)and their complete reduction have been studied with time. Each colour represents the concentration of COD

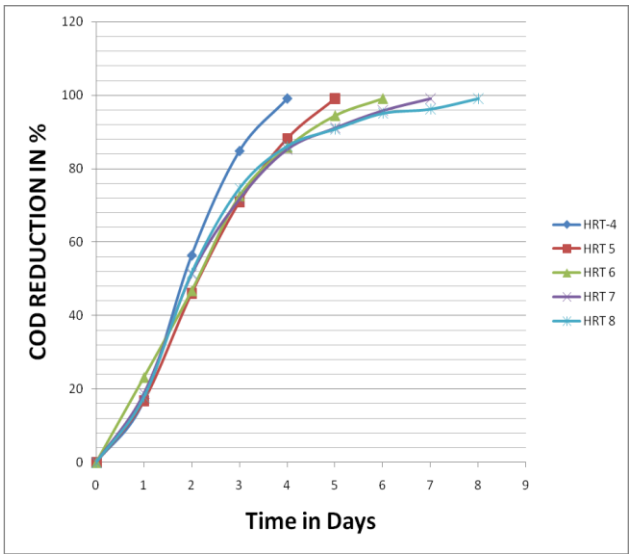

Fig.3. Percentage of COD Reduction of the effluents in the bioreactor: Different hydraulic retention time (HRT) has been observed (HRT-4 to 8; represents by different colour) for reduction of initial COD value (8000mg/l) to permissible level(80mg/l; approximate 100%).

3. RESULT AND DISCUSSION

3.1 Characteristics of the Wastewater

The physicochemical characteristics of the wastewater are given in the Table 1. The wastewater is highly acidic. The BOD and COD values are quite high as huge amount of organic components are present in the sample and the BOD/COD ratio is 0.44, which accounts for less biodegradability of the waste. High value of volatile solids content of the effluent sample reflects also presence of great amount of organic solids.

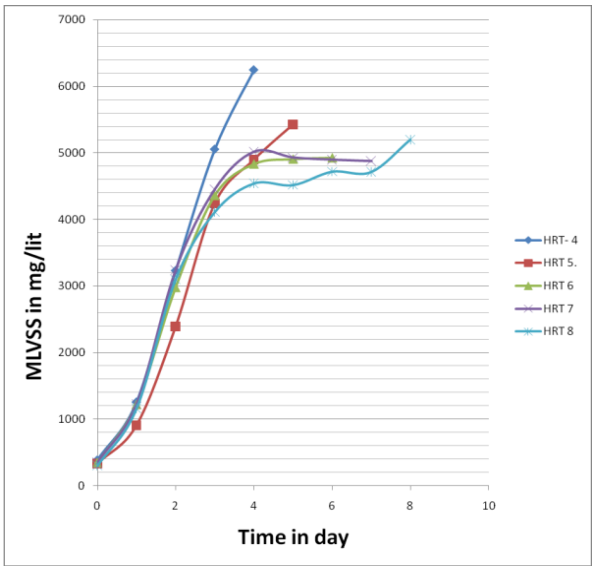

Fig.4. MLVSS Concentration in different HRT.

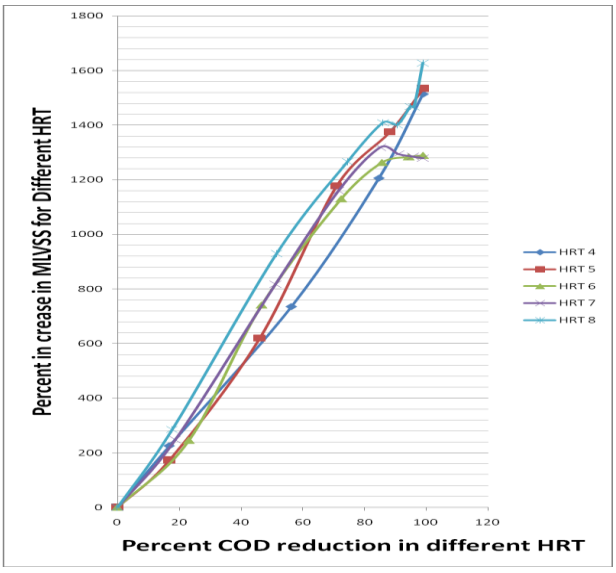

Fig.5. Correlation between percentage of increase of MLVSS concentration, vs. percentage COD reduction in different HRT.

Table 1: Results of Analysis of Effluent Sample of the Industry

Sl. No.	Parameter	Quantity
1.	pH	3.4
2	Total solids	379.46 x 10^3 mg/lit
3.	Volatile solids	168.43 x 10^3 mg /lit
4.	Fixed solids	188.02 x 10^3 mg /lit
5.	COD	83793 mg/lit
6.	BOD_5	36885 mg/lit

Table 2: Results of Chemical Treatment

Sl. No.	Parameter	Before Chemical treatment by $Ca(OH)_2$	After chemical treatment by $Ca(OH)_2$
1.	pH	3.5	7.0
2.	Total solids gm/lit	379.46	206
3.	Volatile solids gm/lit	168.43	100
4.	Fixed solids gm/lit	188.02	106
5.	COD mg/lit	83793	36008
6.	BOD_5 mg/lit	36885	30606

Table 3: Results of COD uptake at the end of day 1 during acclimatization

Initial strength in mg/l	1000	2000	3000	4000	5000	6000	7000	8000
COD removal in %	79	85	69	61	55	49	44	39
COD removal in mg/lit	790	1700	2070	2440	2750	2920	3100	3150

3.2 Chemical Treatment

This sample is not suitable for biological treatment because of the acidic characteristic, high COD value and less BOD/COD ratio. The sample has been treated by Lime [Ca(OH)2] for neutralization and the chemical properties of the treated sample are given in Table 2. During the neutralization process huge amount of suspended solids (Calcium oxalate) has been formed due to the reaction between Oxalic acid and Ca(OH)2 and this oxalate (solubility of Ca-Oxalate in cold water 0.67 mg/100 ml) mostly precipitate at the bottom of the container where the neutralization is done.

Table 4: The results of biodegradation study

Sl. No.	Parameters	COD mg/lit	BOD_5 mg/lit
1.	Raw Effluent sample	83793	36885
2	Chemically Treated Sample (pre treated)	36008	30606
3.	After bio degradation (HRT = 4days)	79.85	50.31
4.	After bio degradation (HRT = 5days)	79.09	50.02
6.	After bio degradation (HRT = 6days)	79.87	50.21
7.	After bio degradation (HRT = 7days)	81.05	51.01
8.	After bio degradation (HRT = 8days)	79.48	50.82

Table 5: Average Biokinetic Constants Evaluated in different HRT

Sl no.	Hydraulic retention time (HRT)	Total no of Batch	K_s mg/lit	K d^{-1}	K_d d^{-1}	Y
1	HRT = 4days	7	2801	1.2	0.057	0.72
2	HRT = 5days	10	2907	1.32	0.055	0.71
3	HRT = 6 days	7	3934	1.50	0.064	0.82
4	HRT = 7days	9	2379	1.24	0.039	0.81
5	HRT = 8days	7	2634	2.17	0.051	0.35

Ca(OH)2 + HO2C-CO2H ---> Ca(C2O4) + 2H2O
Calcium Hydroxide Oxalic acid Calcium Oxalate

The result of this experiment suggests that the chemical treatment with calcium hydroxide plays a vital role for reducing significant amount of COD value, the removal being about fifty four percent (54%). The pH remains almost neutral at 7.0 and BOD/COD ratio becomes 0.85 showing increase in biodegradability of the treated waste. Total solids (TS) and total volatile solids (TVS) are substantially reduced.

3.3 Acclimatization of the Microorganisms

The percentage COD removal corresponding to each addition of 1000 mg/lit of COD till the complete exhaustion of the same during acclimatization period is shown in Fig 2. It can be concluded from Fig 2 that COD uptake by microorganisms are gradually increased up to the peak concentration of COD (8000 mg/lit). Table 3 shows the gradual increase in COD removal in mg/lit by microorganisms after one day for different concentrations of COD value. The increase in COD removal confirms the enhancement of biodegradation capacity of microorganisms and establishes acclimatization of the bacterial species in the environment of the bulk drug effluent.

3.4 Identification of Bacterial Organism Isolated from Soil

Routine gram staining has been performed for the identification of the bacterial organisms isolated from the soil and examined under light microscope (Fig 6- a,b,c). Microscopic examination has suggested the abundance of both the gram positive and gram negative bacteria and the morphological structure of the bacterium suggested the presence of both bacilli and cocci[22].

3.5 Treatability Studies of Pharmaceutical Wastes

Chemical treatment has neutralized the pharmaceutical wastewater and has also reduced the COD level in significant amount (Table 2). Further biological treatment of the wastewater has been followed in the reactor and efficiency of the bacterial organism has been evaluated with regard to the degradation of the organic material.

3.5.1 Reduction of BOD and COD

The biodegradation in the reactor has occurred at normal climatic temperature (temperature varies in Durgapur from 120C-420C throughout the year) and the experiments have been conducted throughout year. In individual batch of experiment the COD value has been measured every day until it reaches to around 80 mg/lit and conforms the effluent standard of 250 mg/lit as per the environment protection rules of Govt. of India, 1986 [1, 7, 8, 23]. The initial COD value was 8000 mg/L and to achieve the final value of 250mg/L i.e. about 97% reduction in COD, different hydraulic retention times (HRT 4, 5, 6, 7 and 8 in days) have been observed. As the experiments have been conducted throughout the year, the variation of the climatic condition (temperature, humidity etc.) may be attributed to the change in HRT values. (Fig.-3).

Gradual increase in the mixed liquor volatile suspended solids (MLVSS) values measured at regular interval of 1-day indicates the positive activity of the microorganisms in reducing the COD values [18]. The amount of MLVSS in different HRT has been measured and represented graphically in Fig 4. The experiment suggests that corresponding to each HRT (5, 6, 7 and 8 days) the amount of MLVSS has increased with the time and the curves have reached the steady stage. At this stage the growth rate of the microorganism has become slow due to inadequate availability of food. It is obvious that as the microorganisms are very active in degradation of chemical compounds, the COD values are reduced and MLVSS values are increased. From these two different experiments one correlation can be drawn between the percentage of COD reduction and MLVSS amount in each HRT. This correlation has given in the Fig 5, which suggests that the MLVSS amount is directly proportional to percentage of COD reduction.

The experiments have been started with the initial COD and BOD5 concentrations of wastewater around 84000 mg/l and 37000 mg/l respectively. Ultimately after chemical treatment followed by biological treatment the COD values have significantly reduced to 80 mg/l. As a consequence the BOD5 values have also been reduced to the level of 50 mg/l (Table 4). The reduction of both COD and BOD5 after biological treatment has confirmed the high efficiency of bacterial removal of organic content from the wastewater.

3.6 Evaluation of Biokinetic Constants

With starting BOD5 concentration of 5670 mg/l (the value obtained after chemical treatment and diluting the same four times with distilled water), the BOD5 values at varying θc in the reactor have been considered for the evaluation of biokinetic constants by using the following modified Monad's equations.

$$\frac{1}{U} = \left(\frac{K_s}{K}\right)\left(\frac{1}{S}\right) + \left(\frac{1}{K}\right) \quad (1)$$

$$U = \frac{S_0 - S}{\theta X} \quad (2)$$

$$\frac{1}{\theta_c} = YU - K_d \quad (3)$$

Where K_s = half-velocity constant mg/l, Y = yield coefficient, K = rate of substrate utilization per day, K_d = decay coefficient per day, μ_{max} = maximum specific growth rate, θ_c = mean cell residence time, U = specific utilization rate, mg BOD applied / mg MLVSS / day. The BOD based values for Ks, K, K_d and Y were 2379 – 3934 mg/l, 1.2 – 2.17 d^{-1} , 0.039 - 0.064 $d^{-1}$and 0.35 – 0.82, respectively. Average constants are cited in **Table 5** for different HRT.

3.7 Identification of Bacterial Organism Isolated from Post-Treatment Sludge

To identify the bacterial species present in the post-treatment sludge, routine gram staining has been performed and observed under the light microscope [22]. Only the gram positive bacilli have been identified (**Fig 6-d,e**). To confirm

this observation Molecular Biology technique was adopted. The conserved 16S rRNA gene of the bacteria contains variable regions which are genus and species specific and characterization of the bacteria on the basis of the variable region of the 16S rRNA is a widely used method [9,13, 20]. The 16SrRNA gene has been amplified and further sequenced for identification of the variable region. When the sequence has been searched from the database, only the bacillus species have been identified. The sequence showed 100% homology with Bacillus strain and phylogenetic analysis based on 16S rRNA gene sequences has indicated that the best homolog is *Bacillus aerius* strain 24K (ref / NR_118439.1/)[3, 6, 20] (**Fig 6-h**).

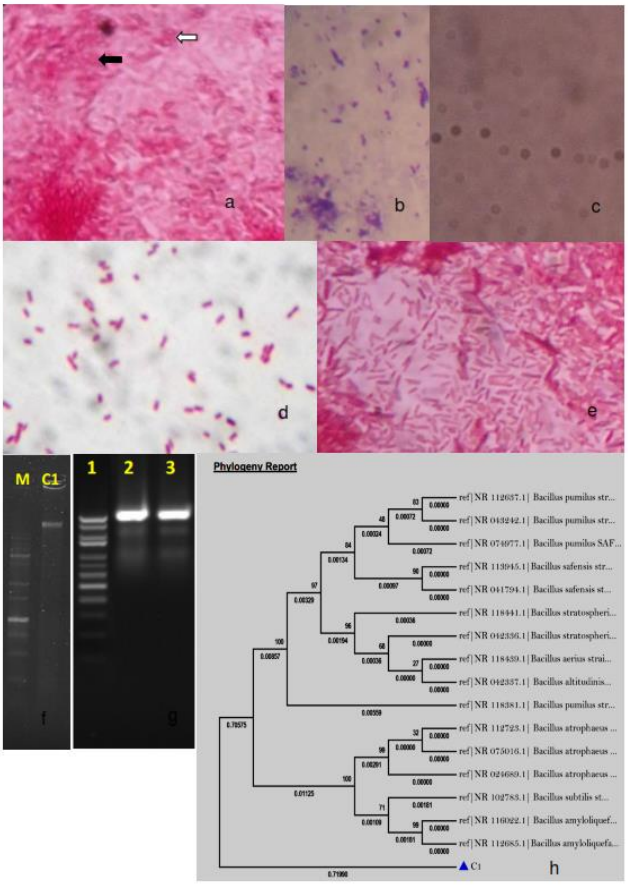

Fig.6. Identification of bacterial species: a,b and c: bacteria from pre- acclimatization soil;a: both gram positive (black arrow) and gram negative (white arrow) bacteria. b: shows bacilli and c: shows cocci forms. d and e: bacteria identified from post treatment sludge; d: gram positive and e: only bacilli form. f: lane M represents the DNA ladder and lane C1 represents the genomic DNA isolated from post treated sludge. g: Lane 1 represents the DNA ladder and lane 2 & 3 represent the PCR amplification of 16sRNA gene. h: The phylogenetic tree has drawn on the basis of the sequences of 16sRNA gene of bacteria (C1) isolated from post treated sludge.

4. CONCLUSIONS

Aerobic biological treatment has showed the reduction of the BOD_5 and COD of the concerned effluent to required level within short hydraulic retention time (starting from 4 days to maximum 8 days). From this study it is concluded that this treatment can be effectively carried out to treat the small-scale bulk drug industrial effluents throughout the year irrespective of change in climatic condition (temperature, humidity etc.). The most significant part of this study is identification of the dominant role of Bacillus species in treating the wastewater specifically for the small bulk drug producing industrial effluents.

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ATM Theft Detection by Integrating LDR with GSM

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***Abstract*— Going through the ATM theft strategies, there are possibilities of physical damage of the ATM machines, which involves in breakage of the machines and scrapping out the whole machine itself with heavy machineries. Thieves also threaten to hand over money from the victims at an ATM and in rural area cutting off the power to the cameras and to spray paints that can help them to keep their identity hidden; this seems to prevail among most of the thieves. Thefts, accounting for more than Rs.18.48 crore lost across India, according to information released by Reserve Bank of India (RBI) in 2017.**

1. INTRODUCTION

In this modern world, every possible field has become so much advanced and enhanced that has made the necessity for its security an important aspect. Security equipments differ in their use with each other. Based on the need one has to use suitable equipment to handle the security.

1. Standard Security System Equipment
   Control Panel, Keypad, Alarm Siren
2. Security System Entry Detection Sensors
   Motion, Glass Break, Vibration Sensors
3. Security System Threat Detection Sensors
   Smoke, Heat, Freeze, Flood Sensors
4. Security System Cameras
   Wireless Cameras, Image Sensor

Innovation in the project is to identify when the camera not performs and automatically alerts by sending a message through GSM Module. Going through the ATM theft strategies, there are possibilities of physical damage of the ATM machines, which involves in breakage of the machines and scrapping out the whole machine itself with heavy machineries. Thieves also threaten to hand over money from the victims at an ATM and in rural area cutting off the power to the cameras and to spray paints that can help them to keep their identity hidden, this seems to prevail among most of the thieves. Thefts, accounting for more than Rs.18.48 crore lost across India, according to information released by Reserve Bank of India (RBI) in 2017.

2. OBJECTIVE

A. Scenario

To provide a solution that particularly addresses when there is a scenario when power is cut off to the cameras in the ATM room.

B. Solution to the Scenario

The solution would focus on reducing the number of ATM thefts and Crime caused by the malfunction or disabling the camera by the thieves.

3. DESIGN OF COMPONENTS

In order to come up with a solution that could indicate the police or the authority in charge, through a Message when there appears to be any malfunction of the camera at any instant. This system is an optional accessory to ATM and an external battery back powers it up that could keep it in function all the time. This system is for the cameras only installed in the ATM rooms and not in the ATM itself.

A. GSM Sim 900 A:

- GSM module (*Fig 1*) is a compatible Quad-band cell phone.
- It works on the frequency of 850-1900 MHz and which can be used not only to access the internet but also for oral communication.
- It is used in the project to send messages to a person in charge in case of any mal function in power supply to the security camera in the ATM. It plays an important role in this project to alert the officials with a text message (i.e.) SMS.

Fig 1 Photo of GSM module

B. Arduino UNO:

- Arduino UNO (Fig 2) is an open-source hardware and software that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices.
- It interacts with objects that can sense and control objects in the physical and digital world. It works on the frequency of 850-1900 MHz and which can be used not only to access the internet but also for oral communication.
- It is used to give needed commands to the GSM sim 900 A. All the commands given to the GSM are AT commands which are specified in its datasheet.
- It also receives the analog voltage from the LDR circuit and converts into digital values using its inbuilt 10bit ADC. It gives AT command to the GSM sim900 a when there's an increase in the LDR's digital output above the Threshold value.

Fig 2 Photo of Arduino UNO

C. Light Dependent Resistor:

- A photo resistor (Fig 3) is a light-controlled variable resistor. The resistor of a photo resistor decreases with respect to increasing incident light intensity.
- A photo resistor can be applied in light-sensitive detector circuits and light activated and dark activated switching circuits.

Fig 3 Photo of Light Dependent Resistor

D. Transistor- BC547:

- BC547 (Fig 4) is an NPN bipolar junction transistor. A transistor, stands for transfer of resistance,
- It is commonly used to amplify current. A small current at its base is to controls a larger current at collector and emitter terminals.
- Transistor such as BC 547 is used to amplify the output signal from LDR and drive the emitter to the Arduino and collector to drive the Buzzer.

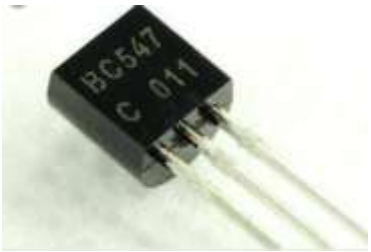

Fig 4 Photo of BC547

E. Buzzer:

- Buzzer (Fig 5) is an audio signalling device, which may be mechanical, electromechanical or piezoelectric.
- It includes the uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as mouse click.
- It is placed in the ATM to give alarming sound when there's a malfunctioning of the security cameras.

Fig 5 Photo of Buzzer

Table 1

S.NO	COMPONENTS USED
1.	GSM Sim 900 A
2.	Arduino UNO
3.	Transistor BC-547
4.	LDR
5.	Resistors
6.	Buzzer
7.	12V dc Adapter ,LED, wires, Jumpers

4. IMPLEMENTATION

A. Block diagram

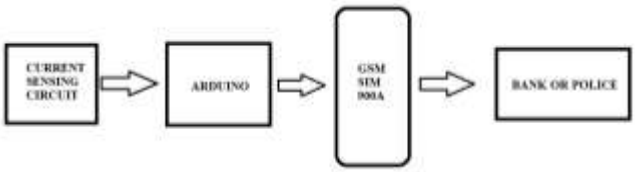

Fig 6 Simple Block diagram

The block diagram (*Fig 6*) that represents the entire circuits used in the project. Here the current sensing circuit, which uses LDR to sense current, using the light source, As the current sensing circuit indicates then the logic becomes one and the GSM module gets activated through the Arduino and the alerts can become acquired to the respective officials and Police station.

B. The Automatic ON/OFF LDR Circuit.

A light source is placed in line with the camera in which the light source is kept closer to the LDR in another circuit. As any change in the light source get happen then LDR suddenly reflects its consequences. The LDR circuit is designed to give output when the light intensity to the LDR becomes nil.

C. Current Sensing Circuit

This circuit (*Fig 7*) connection consist of LDR, Transistor (BC547), Buzzer and Resistors (10 kΩ).

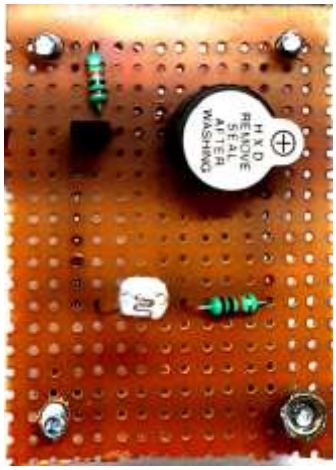

Fig 7 Current Sensing Circuit

- Emitter of the transistor is connected with the negative terminal of LDR and they are grounded.
- Positive terminal of the LDR is connected with the resistor and given to Buzzer. Other terminal of Buzzer given with collector of the transistor.
- Base of the transistor is given to Arduino pin 3 through resistor for enabling them.
- This circuit senses darkness and gives the output.
- The current sensing circuit is implemented in PCB-DOT board.

D. Arduino and GSM module circuit.

The module (*Fig 8*) is connected with the light source along with the camera. The external circuit, which consists of LDR and Arduino, interfaced GSM module. The GSM module, which requires 12 volts DC voltage to power up externally. As the camera wire, get interrupted the loss of current supply takes place. When there is, no current flowing through a camera's line it sensed by LDR where LDR has the ability to acquire high resistance at the darkness and the LDR placed in another circuit, in which the output drives the GSM module through Arduino.

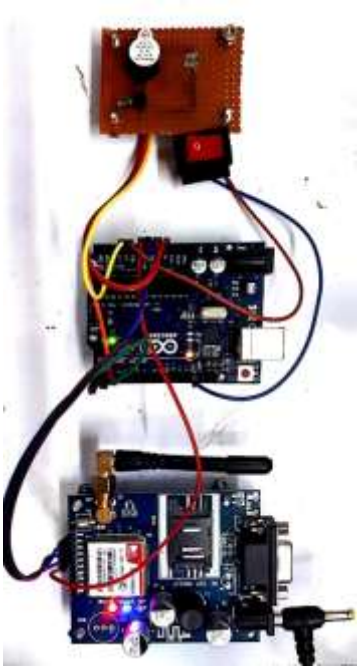

Fig 8-Interfaced Circuit

E. Focus on reducing the number of ATM thefts and Crime caused by the malfunction or disabling the camera by the thieves.

5. Result

A. Message Alert

- First message in fig(9) which indicates when the GSM signal to the port gets activated and represent by sending a indication message that the GSM module is ready to perform the operation
- The second message in fig(9) is the required alert message that indicates that the LDR dark environment arise due to the occurrence of null current flow.

Fig (9) Message box of GSM

B. Buzzer Alert

When the Digital value obtained from LDR exceeds the given threshold value, Buzzer alarms with a loud noise with the voltage from the Arduino.

6. FUTRE ASPECTS

This System can be enhanced using a pitch black detector with the help of Image Processing techniques such as open CV and Numpy in Python which could help in case of spraying black paints and other substrates to cover the lens of the camera completely so that it shows only a blank screen.

This system could be improved with Emotional sensing AI which could differentiate between a normal person and a thief with their face expressions.

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