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Implementation of Various Human Resource Management Systems In Organization By Advanced Methodologic Pattern and Business Theory.

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ABSTRACT
This paper provide an insight to the fields of human resource management (HRM) and information technology (IT), and the combination of these two fields into human resource information systems (HRIS). The history of the field of HRM and the impact of computer technology on HRM will be covered, as well as the advent of using a human resource information system and the subsequent effects on both HR and IT professionals. The different types of HR activities will be discussed as well as the different types of information systems used in HRIS. A central focus of this chapter is the use of data from the HRIS in support of managerial decision making. The development of the field of HRIS has had a significant impact on the emergence of strategic human resource management (strategic HRM), as is discussed in this paper. Leading management thinkers suggest that "it is not technology, but the art of human- and humane management" that is the continuing challenge for executives in the 21st century. The effective management of human resources in a firm to gain a competitive advantage requires timely and accurate information on current employees and potential employees in the labor market. With the evolution of computer technology, meeting this information requirement has been greatly enhanced through the creation of HRIS. The final purpose is to emphasize how an HRIS can provide timely and accurate employee information to assist decision makers at both the strategic and operational levels in an organization. As a consequence, the quality of employee information will have a strong effect on the overall effectiveness of the organization.

Keywords **-** HRMS, Flow management, Information system, recruitment system, organization change

I INTRODUCTION

The growing importance of HRIS is evidenced by the recognition of human resource management (HRM) practitioners, academics, and managers that information technology (IT) has become a critical aspect of developing and using HRM programs to better manage the human capital of an organization. Thus, a comprehensive education in the HRM field requires the knowledge and skills for developing, implementing, and maintaining a human resource information system. After reviewing the many definitions of an HRIS, we define it as a system used to acquire, store, manipulate, analyze, retrieve, and distribute information regarding an organization's human resources to support HRM and managerial decisions. An HRIS is not simply computer hardware and associated HRrelated software. It requires cooperation among departments for its best use. That is, it includes hardware and software; it also includes people, forms, policies and procedures, and data. As you can see, creation of this "set of practices" would be impossible without the use of technology. We utilize technologies in the form of a Human Resource Information System (HRIS) to help us analyze individual applicants for employment; to maintain information on compensation packages, performance management, training, and retention; and to systematically capture knowledge from the people resources within our companies. You will be part of the generation of leaders that has to incorporate these technologies so that your organization can improve effectiveness and efficiency.

In an international environment, as long as proper research is performed, most HRM concepts can be applied. The important thing to consider is proper research and understanding of cultural, economic, and legal differences between countries. This section will provide an overview of some specific considerations for an international business, keeping in mind that with awareness, any HRM concept can be applied to the international environment. In addition, it is important to mention again that host-country offices should be in constant communication with home-country offices to ensure policies and practices are aligned with the organization. An application service provider (ASP) carries out on behalf of the organization all or much of the administration of the human resource information system. Organizations, often smaller or medium-sized, can use an ASP to outsource the burden of running the system. For data collection, structured questionnaires were distributed for survey research and cross-sectional research design was adopted. Relative Advantage and Compatibility had positive relationship with HRIS adoption. However, Top Management Support and HRIS Expertise were found to be the top contributors to the decision of HRIS adoption. It was stated that

introduction of new innovations in information systems could meet with organizational reluctance. The main cause was the complexity of new technology.

II LITERATURE REVIEW

The world of business has been stirred by advent of information technology, information systems and internet technology. Researchers have highlighted the fact that Information technology provided opportunities to transform organizations and help them achieve competitive advantages . In current knowledge economy, organizational success is dependent on efficiency of human resources (HR). It is opined that IT should play vital role in Human Resource Management (HRM) domain. Similarly, it is shared that businesses gain competitive advantages not only with Information Technology (IT), but with usage IT to complement resources.It is further stated that a successful way to run business in today's world is using appropriate application of Information Technology (IT) in HRM. Due to the increasing use of computerized information system in the industrial operations of developed economies, HR functions of enterprises got used to information systems highly during the 1980‟s. Human Resource Information Systems (HRIS) were primarily seen as a sub function of Management Information Systems (MIS) which support the HR functions of an organization. correctly pointed out that an HRIS (also known as a human resource management system, or HRMS) can be as informal as the payroll records and time cards of a small business, for the vast majority of organizations, corporate success will increasingly depend on the coordinated, strategic management and integration of the organization's human resources and information technology. Achieving this strategic coordination requires those responsible for developing, implementing, operating, and maintaining an HRIS to have a broad knowledge of the organization's human resource programs, the relationship between human resource programs and overall strategic planning, and the potential inherent in computer and data technology.

HRIS as a single system covers a whole range of activities ranging from HR planning to IT development for the human resource department. HRIS can help long range planning with information on labour force planning, employee demand and supply forecasts, staffing with appropriate employees, developing training programs that are necessary, salary and pay forecasts and budgets and overall employee assistance services. Risk and security management can be another important function done by HRIS by analysing individual employee data. So, HRIS can be defined as "integrated system used to gather, store and analyze information regarding an organization‟s human resources‟ comprising of databases, computer applications, hardware and software necessary to collect, record, store, manage, deliver, present and manipulate data for human resources function"

Perhaps, the most central use of technology in human resources management is an organization's human resources information system (HRIS). It provides current and accurate data for the purpose of control and decision-making; in this sense, it moves beyond simply storing and retrieving information to include broader application such as producing reports, forecasting human resources needs, strategic planning, and evaluating human resource's policies and practices. In spite of going through several studies, literature, directly relating to Human Resource Information Systems and the proper use of HR in the context of firms of Bangladesh is very scarce whereas our study assays to show the relationship between these variables.

III ROLE OF HRIS IN ORGANIZATION

HRIS shape an integration between human resource management (HRM) and Information Technology. Even though these systems may rely on centralized hardware resources operationally, a small group of IS specialists residing within the personnel department increasingly manage, support, and maintain them. HRIS support planning, administration, decision-making, and control. The system supports applications such as employee selection and placement, payroll, pension and benefits management, intake and training projections, career-pathing, equity monitoring, and productivity evaluation. These information systems increase administrative efficiency and produce reports capable of improving decision-making. Cost decrease: Effects of IS on HR costs appear in several ways. First, it reduces costs of processes and works. For example, transforming from traditional HR to e-HR reduces costs of some HR applications, such as, postal cost, announcement cost and data processing cost. Using self service technology reduces the processing costs of HR up to 75%. E-selections and e-recruiting decrease costs of staffing and selections due to reduced employee turnover, reduced staffing costs, and increased hiring efficiency. Second, using self service HR allows employees to perform their own work themselves directly. Thus, HR professionals spend less time on routine tasks.

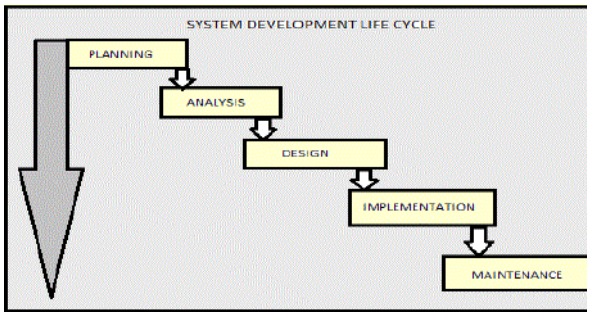

Fig 1 System Development Life Cycle : HRIS

Increase in Efficiency: Intense use of IS aromatizes and standardizes routines. HR professionals may focus less on administrative activities and more on interpreting information. HR professionals may spend more time on other aspects of their jobs. Thus, HR professional can access more information, respond the problems in a timely major from managers and employees and evaluate the complex information more effectively. Comparing with manual processes, reducing data errors, simplifying and fastening processes of HR practices make HRIS more advantageous .

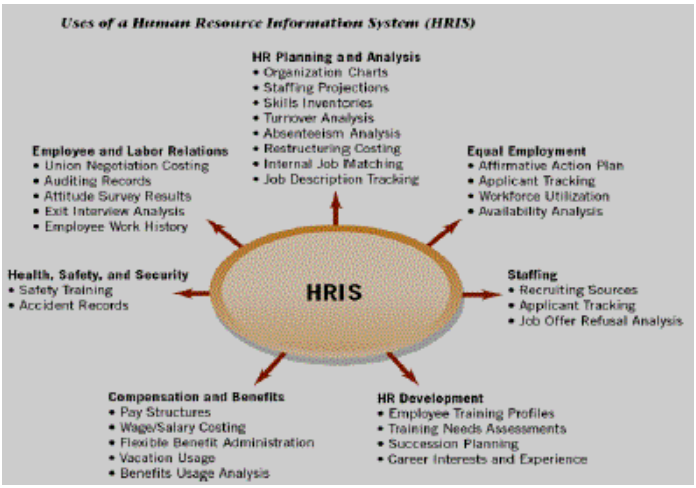

Fig. 2 Uses of HRIS

Successful implementation is the central goal of every HRIS project, and it begins with a comprehensive design for the system. As the steps in the system development process are covered in this paper, the foundation knowledge that is critical to the implementation process will be emphasized.

Only by understanding the users/customers of the HRIS, the technical possibilities, the software solution parameters, and the systems implementation process can we increase the probability that the completed software installation will adequately meet the needs of the human resource management (HRM) function and the organization. The will begin by identifying the potential users and the kind of information that the HRIS will be managing and storing to facilitate decision making. This will next discuss the technical infrastructure, how the technical infrastructure has evolved, and the many choices that the organization must make. After the technology is discussed, the systems implementation process will be presented. Top management support was recognized as an important element in adopting and implementing information technology. The understanding of innovation, attitudes toward innovation, extent of involvement in adoption process could influence top management support. It played a critical role in creation of a supportive climate and provision of adequate resource to adopt and implement new technology. Suggested by that top management could identify future business opportunities by exploiting information technology. Moreover, with active involvement and support, the top management could foster right direction for adoption of innovation. Additionally, visible top management support could signal the importance of innovation, lead to positive attitudes from users towards the innovation, and smoothen the conversion from existing work procedures to the Information System. With their leadership role, top management could ensure allocation of required capital and human resource for adoption of innovation. Top management support was crucial in overcoming user resistance and resolving probable conflicts. Top management support was required for continued success of HRIS.

Fig. 3 An overview of the study area.

(a) Core Transparency in HRS- As the development of an effective information system is costly and time-consuming so it is advisable to employ a project manager, which may be the HR manager or any other senior executive of HR department to overview the implementation process. The crucial factors in implementing HR information systems are :

(i) Continuing support from top management
(ii) The involvement and participation of users
(iii) A detailed plan of progress

All information systems need to be modified from time to time to suit organisational, changes. The project manager or consultative committee should continue to monitor and review all aspects of the HRIS. The important issues to be considered during an HRIS development and implementation are the HRIS's needs analysis. The needs analysis should be done first to ensure legal and government compliance, meet growing organizational needs, use technology to cut costs, and provide a long range view for the organization. The second important issue to consider during an HRIS development and implementation is the cross functional duties during the implementation. The third important issue to consider during an HRIS development and implementation is the costs related to an HRIS. In the last selecting a vendor is also an important aspect during the HRIS development and implementation. Not only this, performance appraisal being the top motivating factors in the organizations need to be managed properly and HRIS helps for the same by analyzing the employee's devotion to his work and his regularity in the organization. In this dynamic scenario, the importance of HRIS can't be neglected. This research work focuses on the contribution of HRIS in HR department of organizations in service sector. The literature review at hand highlighted the importance of HRIS and its various subsystems and some papers als highlighted the importance of HRIS in various industries of service sector.

IV FLOW RELATIONSHIP MODELS IN HRIS

We begin this section of the paper with an introduction to a process model of the management of change in organizations. The **HRIS-research model** can best be seen as a general perspective to use in any planned change effort. Examination of the use of any successful change effort used will reveal some, if not all, of the components of the action-research model. Thus, although we use the term *model* to describe the prescriptions of action research, it is better viewed as an approach to the management of change. Careful reading of the change management literature reveals that the action-research model appears in, or is part of, most change management projects. The basis of the action-research model is the interaction of managerial or organizational action and research that both evaluates the action taken and provides data for future planning of the change effort. Thus, using this model involves the interlocking of the research processes of data collection, analysis, and evaluation and the management action processes of planning, directing, and implementing change., a cycle in the action-research model would include the following: (1) initial data collection and gap analysis, (2) feedback of results to the HRIS project team, (3) action planning for the next phase of the HRIS project, (4) directing and implementing changes during the next phase, (5) data collection and analysis to evaluate the changes, and (6) feedback of results to the project team and action planning for the HRIS project.

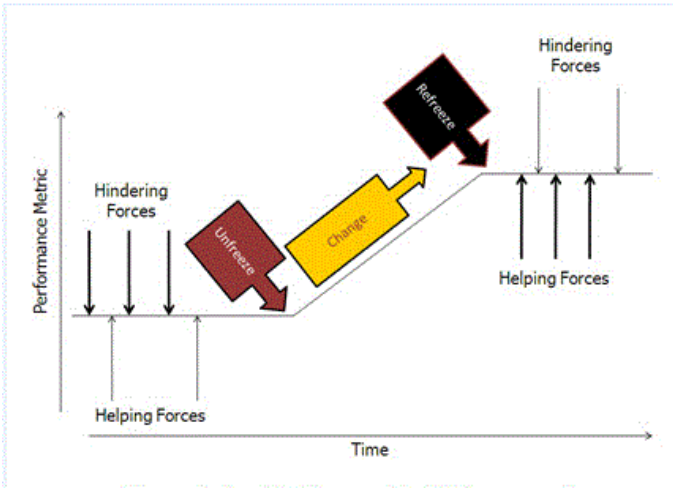

Fig. 4 Lewin's Three Step Model

One of the earliest and key contributions to organizational change is Kurt **Lewin's three-step change model** (see Figure 4). Lewin's (1946) framework serves as a general model for understanding planned change. The model has been used to explain how information systems can be implemented more effectively. Lewin's change model evolved from his interest in resolving social conflict and in improving the human condition through behavioral change. In his study of group behavior, Lewin argued that behavior was a complex interaction of what the individual brought to the situation and the environment (or *field*, as he called it). We can express this relationship as $B = f(P, E)$, where behavior is defined as a function of the person and the environment. In the main, Lewin believed that the existing condition (or status quo) was maintained by a set of forces affecting the situation, and only by identifying and plotting the potency of these forces is significant change possible.

(a) Change Equation Formula-When initiating an organizational change project, it's important early on to determine how ready people are to accept and implement the change. Gleicher's change equation formula, as modified by Dannemiller and Jacobs (1992), helps us assess this degree of readiness as follows (Beckhard & Harris, 1987): C = (D × V × F) > R, where C is the change, D the dissatisfaction with the status quo, V the vision, F the first steps (feasibility), and R the resistance to change (costs). If we refer to Lewin's (1946) force-field analysis discussed earlier, D, V, and F are all "forces for change," while R represents the "forces against change." Gleicher's change equation formula provides a simple and straightforward perspective that reveals the possibilities and conditions at work in organizational change. Note that all three forces for change must be active to offset the forces against the change, which are usually manifested as resistance to change from organizational members. The change program must address dissatisfaction with the present situation, present a clear vision of the future and what is possible, and demonstrate knowledge of the first steps necessary to reach the vision. If any one of the three is missing, the product of the equation will tend toward zero and resistance to change will dominate.

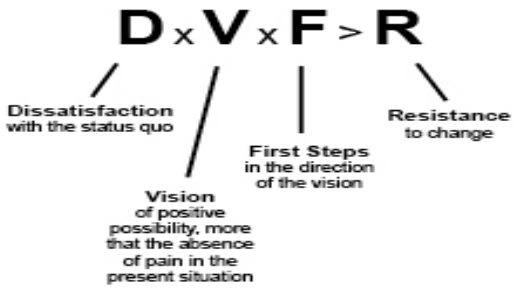

Fig. 5 Change Formula

(b) Kotter's Process of Leading Changhe- Kotter's (1996) eight-stage model was developed after studying more than 100 organizations undergoing change. The model offers a process to manage change successfully and avoid the common pitfalls that have beset failed change programs (see Figure 6). We can view his approach as a vision for the change process, one that calls attention to its key phases. The model provides two key lessons, first that the change process goes through a series of phases, *each lasting a considerable period of time,* and, second, that critical mistakes in any of the phases can have a devastating impact on the momentum of the change process. As can be seen in Figure 6, the first four stages coincide with Lewin's "unfreezing" first stage. The next three stages focus on introducing new practices into the organization. Finally, the last stage focuses on grounding the changes in the corporate culture, which coincides with Lewin's third stage, "refreezing." The model indicates that all the stages should be worked through in order to effect successful change. Skipping a step or getting too far ahead in the change process without a solid base may create problems. Without the follow-through that takes place in the final step, you may not be able to make any changes

Fig .6 Kotter 8 Stages

V CONCLUSION

Human resources information systems (HRIS) can play an important part in a company's HR function. After all, we live, work and play in the information age. Implementing an effective HRIS can be sure-fire for HR to stay on the cutting edge in its bid to deliver more effective and streamlined service. The main conclusion of this paper is the realization that the use of computerized HRIS is most effective then manual because its help to maintain data with more accuracy in less time. And that it also trues that HRIS functions improve HRM in terms of administrative purposes and analytical purposes. HRIS work as a key component of the organization and a good HRIS will provide important information about human resources needs and capabilities; this information will assist the management team in establishing the organizational mission and setting goals and objectives in motion. HRIS is not limited to the computer hardware and software applications that comprise the technical part of the system: it also includes the people, policies, procedures and data required to manage the HR function.

The recruitment system is composed of a series of workflows which interact and mutual influence with each other. Existing research about recruitment system focuses on how to combine qualitative and quantitative analysis to achieve scientific decisions. However, systems theory states that local optimum does not represent the overall optimum. Just paying attention to the selection of personnel and

scientific methods rather than to internal coordinating in the human resources department, will lead the recruitment ineffective. The total relationship flow management aims at better understanding and controlling the systems' problems.

This paper under the guidance of the theory, by determining the recruitment system behavior HOr(t) and the appropriate relationship flow set ( ) Ord Rf t , and focusing on the time delay and system maintenance gives some advice on building the recruitment system, hoping to expand the existing theoretical research in the field and to provide some management implications for managers.

REFERENCES

[1] P. Boxall, "The Strategic HRM Debate and the Resource Based View of the Firm," Human Resource Management Journal, Vol. 6, No. 3, 1996, pp. 59-75.

[2] J. Nelson, "HR Focus Efficiency and Effectiveness," 2010.

[3] B. Luck, "Innovation of Technology: Business for a New Century," 2010.

[4] R. Kenter, "Foreword," In: M. Effron, R. Gandossy and M. Goldsmith, Eds., Human Resources in the 21st Century, John Wiley & Sons, Hoboken, 2003, p. 12.

[5] A. Walker, "Best Practices in HR Technology," In: A. Walker and T. Perrin, Eds., Web-Based Human Resources: The Technologies and Trends That Are Transforming HR, 2001, pp. 3-14.

[6] D. Lewin, "Human Resource Management and Business Performance," In: M. Effron, R. Gandossy and M. Goldsmith, Eds., Human Resources in the 21st Century, John Wiley & Sons, Hoboken, 2003, pp. 91-98.

[7] L. Sartain, "Branding from Inside Out: HR's Role as Brand Builder," In: M. Losey, S. Meisinger and D. Ulrich, Eds., The Future of Human Resource Management: 64 Thought Leaders Explore the Critical HR Issues of Today and Tomorrow, John Wiley & Sons, Hoboken, 2005, pp. 181-188.

[8] W. Jack, "Building a Competitive Organization through HRM Initiatives: A Macro Perspective, Street Smart Human Resource Management & Business Practices," 2007.

[9] D. Ulrich, R. Michael and G. Losey, "Tomorrow's HR Management," John Wiley & Sons, Inc., New York, 1997.

[10] M. D. Fottler, R. L. Phillips, J. D. Blair and C. A. Duran, "Achieving Competitive Advantage through Strategic Human Resource Management," Hospital Health Service Administration, Vol. 35, No. 3, 1990, pp. 341-363.

[11] H. Ramsay, D. Scholarios and B. Harley, "Employees and High-Performance Work Systems: Testing Inside the Black Box," British Journal of Industrial Relations, Vol. 38, No. 4, 2000, pp. 501-531.

[12] D. Guest, J. Michie, M. Sheehan, N. Conway and M. Metochi, "Effective People Management: Initial Findings of the Future of Work Study," CIPD, London, 2001.

[13] B. Wood, W. Doellgast, M. Legge and I. Grugulis, "'Best Practice' Human Resource Management: Perfect Opportunity or Dangerous Illusion?" International Journal of Human Resource Management, Vol. 11, No. 4, 2000, pp. 905-925.

[14] D. Cooper, C. Psychd and C. Fiosh, "The Impact of Management's Commitment on Employee Behaviour: A Field Study," American Society of Safety Engineer, 2006.

[15] P. Boxall and J. Purcell, "Strategy and Human Resource Management," Palgrave Macmillan, Basingstoke, 2003.

[16] Nike Inc., "Workers and Factories," 2008.

[17] M. Bolton and M. Abdy, "Foundations for Organizational Development Practices in the UK and USA," 2007.

[18] S. Coro, "The Role of Human Resource Management in Corporate Social Responsibility," Strandberg Consultants, 2009, pp. 1-26.

[19] H. S. Becker and B. Geer, "Participant Observation: The Analysis of Qualitative Field Data," In: R. Adams and J. Preiss, Eds., Human Organization Research, The Dorsey Press, Homewood, 1960.

[20] S. M. Heathfield, "How to Change Your Culture: Organizational Culture Change," 2008. [35] M. S. Lise and A. J. Timothy, "Employee Attitudes and Job Satisfaction," Human Resource Management, Vol. 43, No. 4, 2004, pp. 395-407.

[21] J. E. Edwards and B. M. Fisher, "Evaluating Employee Survey Programs," In: J. E. Edwards, J. C. Scott and N. S. Raju, Eds., The Human Resources Program-Evaluation Handbook, Sage, Thousand Oaks, 2004, pp. 365-386.

[22] A. I. Kraut, "Organizational Surveys: Tools for Assessment and Change," Jossey Bass, San Francisco, 1996.

[23] K. Agarwal, "Corporate Excellence as an Outcome of Corporate Governance: Rethinking the Role and Responsibility of HRM," The ICFAI Journal of Corporate Governance, Vol. 6, No. 1, 2007, pp. 6-16.

[24] J. F. Hair, W.C. Black, B. J. Babin, R. E. Anderson and R. L. Tatham, "Multivariate Data Analysis," Pearson Education Inc., Delhi, 2009.

Experimental View on Performance of Flow Past Over A Symmetrical Aerofoil at Low Subsonic Speed

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ABSTRACT

This paper brings us the aero dynamics properties of flow over symmetrical aerofoil (NACA-0012) at low subsonic speed (M<0.3). Generally symmetrical aerofoil are used in supersonic aircraft for military purpose like fighter and bomber to give smooth speed at supersonic speed (M>1) and including compressible effect. Here attempt has been made to determine pressure distribution over symmetrical aerofoil at low sub-sonic speed and in viscid incompressible flow. The flow behavior on symmetrical aerofoil of upper and lower side has been investigated. So we get behavior of flow over a wing whose wing span and chord length is given, like we can predict about pressure distribution over any type of aerodynamics shape used in any subsonic and supersonic speed of vehicle (aircraft). Experiment were out in low subsonic open circuit wind tunnel having speed in test section is M<0.08 and theoretically analyzed for its performance.

Keywords: Pressure distribution over aerofoil, flow past body, fluid dynamics, aerodynamics, applied aerodynamics.

I INTRODUCTION

This paper brings you to performance analysis of presence distribution over flow past symmetrical aerofoil (NACA-0012) at (M<0.3) low subsonic speed in open circuit incompressible low speed subsonic wind tunnel.

We are considering M=0.08 and M=0.03 over symmetrical aerofoil (NACA-0012), its chord length 160mm and using span=260mm. We know that at zero angle of attack, zero lift produced or at low angle of attack, low lift would be produced. So we wanted to calculate "C_p" value at different flow speed [low, medium, high rpm of fan of wind tunnel] with constant angle of attack [like 0^o, 5^o, 15^o].

C_p will say about upper and lower surface flow distribution over aerofoil or wing, so they predict about circulation over an aerofoil due to that can predict about lift a drag over whole aircraft. So there an aim is concentrate only pressure distribution over the symmetrical aerofoil at low subsonic speed.

II SPECIFICATIONS OF WIND TUNNEL

TYPE:-Open Circuit Incompressible Subsonic

MACH: 0.08

TEST SIZE: - 1000*300*300mm with FRP body

MOTOR: - single phase 5 HPDC MOTOR

RPM: -2800, Thyristor Drive

BLOWER: - Cast Aluminium Axial Flow Fan

PITOT TUBE: -Prandi Pitot Tube

SMOKE GENERATOR:-Kerosine Smoke Generator

III GEOMETRY & SPCIFICATION OF AEROFOIL

As we know NACA-0012, its chord length is 160 mm and consisting 12 ports (points or holes on aerofoil) in it, shown in the figure as X-X axis plane. The port no. 7^{th} is stagnation point or leading edge point and port 1^{st} is trailing edge point. Port no. 8,9,10,11,12 and port no. 6,5,4,3,2 are upper port(suction port) and lower port (pressure port) respectively. On stagnation point is maximum value of C_p either theoretical or actual and least value of trailing edge port.

The $C_{p\ (actual)}$ value of upper ports (suction ports) are –ve and lower ports (pressure ports) are +ve but less than 1 because subsonic incompressible.

The given table no:1 Specification is mentioned. The aerofoil x-axis and y-axis value are given in this table and numbering of all the ports given their respective position. Fig:1 also mentioned about specification of NACA-0012 aerofoil which is placed on test section in wind tunnel.

Table 1

Specification of aerofoil

PORTS/POINTS	Y, UPPER (mm)	Y, BOTTOM(mm)	X (mm)	X/C
1	0	0	160	1
2	9	-9	120	0.75
3	12	-12	90	0.5
4	15	-15	55	0.3125
5	14	-14	30	0.1875
6	5	-5	10	0.0625
7	0	0	0	0
8	5	-5	10	0.0625
9	14	-14	30	0.1875
10	15	-15	55	0.3125
11	12	-12	90	0.5
12	9	-9	120	0.75

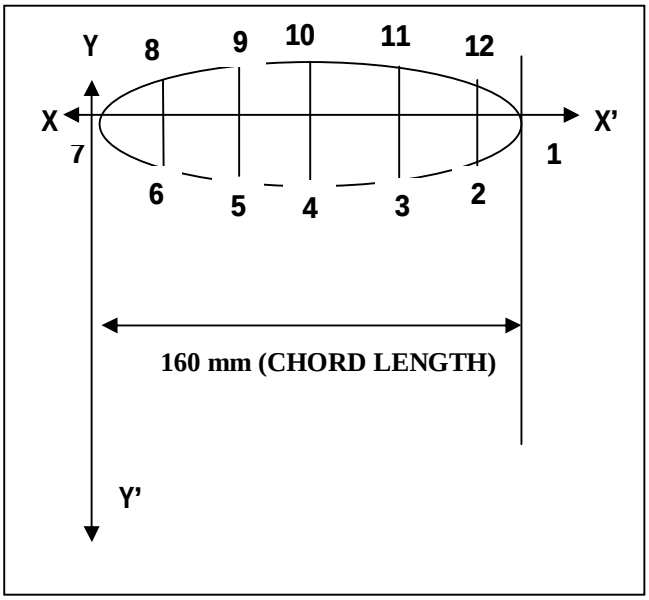

Fig. 1. NACA 0012 AEROFOIL

Table 2:

Pressure distribution over a symmetrical aerofoil for low speed at 0° AOA.

S.No.	P_i-P_∞	q_∞	Cp_{act}	Cp_{th}
1	9.799	107.8	0.09	0
2.	0	107.8	0	0.43
3.	9.799	107.8	0.09	0.75
4.	9.799	107.8	0.09	0.902
5.	9.799	107.8	0.09	0.965
6.	9.799	107.8	0.09	0.996
7.	78.39	107.8	0.727	1
8.	78.39	107.8	0.727	0.996
9.	78.39	107.8	0.727	0.965
10.	39.19	107.8	0.363	0.902
11.	9.59	107.8	0.181	0.75
12.	9.799	107.8	0.09	0.43

IV FORMULATION OF CO-EFFICIENT OF PRESSURE ($C_{P\ (ACTUAL)}$)

$$C_{p(actual)} = \frac{Pi - P\infty}{q\infty}$$

$$q_\infty = \frac{1}{2}\delta v^2$$

$$v_\infty = \sqrt{2gh_{air}}$$

$$\text{equivalent to air value} = P_i - P_\infty = \frac{101325}{0.76} \times h_{Hg}$$

Span area(s) = chord length × span length = 160 × 290 mm^2= 0.0464m^2

$C_{p(th)} = 1 - (x/c)^2$

Where,

δ_{Hg} **= 13600 kg/m^3**

δ_{Hyd} **= 1.23 kg/m^3**

V FLOW ANALYSIS

Flow analysis of 0^0, 5^0 and 15^0 AOA with vary of speeds of wind tunnel respectively. In a given AOA with different speed like low speed (600-1199 rpm), medium speed (1200-1999 rpm) and high speed (2000-2800 rpm).

At 0^0 AOA, 5^0AOA and 15^0 AOA are following analysis done with respective speeds.

(a) AT 0^0 AOA- As mentioned in early that flow analysis over a symmetrical aerofoil at 0^0 AOA in different speed like low speed ,medium speed and high speed observe through practical value and fig. It is in Table:2,3,4 and fig: 2,3,4 are respectively. The $C_{p\ (actual)}$ values and $C_{p\ (actual)}$ vs x/c fig. are given in above tables and fig. .

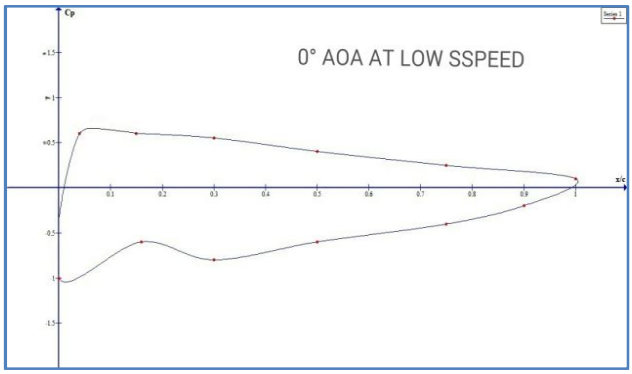

Fig. 2.

Table 3:
Pressure distribution over a symmetrical aerofoil for medium speed at 0° AOA.

S.No.	P_i-P_∞	q_∞	Cp_{act}	Cp_{th}
1	48.92	68.65	0.108	0
2.	29.33	68.65	0.065	0.43
3.	48.92	68.65	0.108	0.75
4.	48.92	68.65	0.108	0.902
5.	68.52	68.65	0.151	0.965
6.	154.98	68.65	0.345	0.996
7.	254.64	68.65	0.564	1
8.	9.799	68.65	0.021	0.996
9.	215.98	68.65	0.478	0.965
10.	97.99	68.65	0.217	0.902
11.	39.19	68.65	0.086	0.75
12.	0	68.65	0	0.43

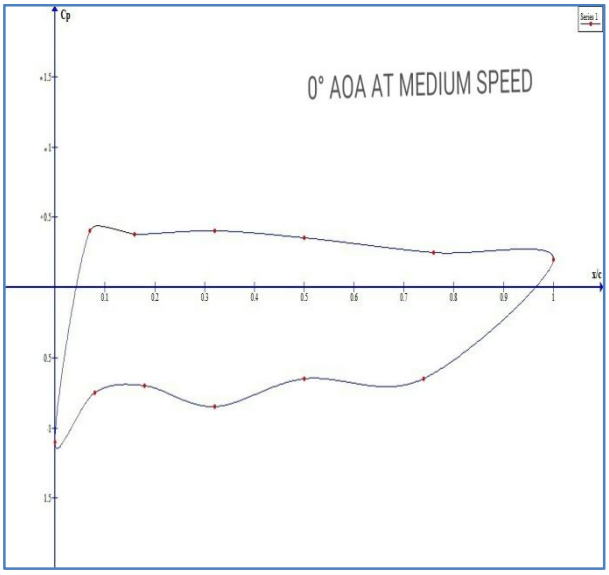

Fig. 3.

Table 4:
Pressure distribution over a symmetrical aerofoil for high speed at 0° AOA.

S.No.	P_i-P_∞	q_∞	Cp_{act}	Cp_{th}
1	19.598	254.96	0.076	0
2.	9.799	254.96	0.038	0.43
3.	19.598	254.96	0.076	0.75
4.	19.598	254.96	0.076	0.902
5.	19.598	254.96	0.076	0.965
6.	0	254.96	0	0.996
7.	117.89	254.96	0.461	1
8.	87.99	254.96	0.325	0.996
9.	87.99	254.96	0.325	0.965
10.	78.39	254.96	0.307	0.902
11.	9.799	254.96	0.038	0.75
12.	9.799	254.96	0.038	0.43

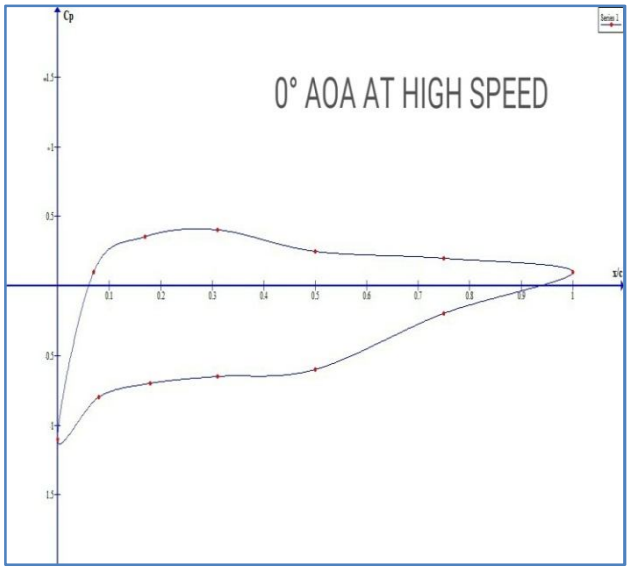

Fig. 4.

(b) AT 5^0 AOA- As mentioned in early that flow analysis over a symmetrical aerofoil at 5^0 AOA in different speed like low speed, medium speed and high speed observe through practical value and fig. It is in Table:5, 6, 7 and fig: 5, 6, 7 are respectively. The $C_{p\ (actual)}$ values and $C_{p\ (actual)}$ vs x/c fig. are given in above tables and fig. .If AOA increases graph will converse.

Table 5:
Pressure distribution over a symmetrical aerofoil for low speed at 5° AOA.

S.No.	P_i-P_∞	q_∞	Cp_{act}	Cp_{th}
1	0	68.65	0	0
2.	0	68.65	0	0.43
3.	9.799	68.65	0.142	0.75
4.	19.598	68.65	0.285	0.902
5.	9.799	68.65	0.142	0.965
6.	29.33	68.65	0.427	0.996
7.	78.39	68.65	0.142	1
8.	48.92	68.65	0.712	0.996
9.	29.33	68.65	0.427	0.965
10.	29.33	68.65	0.427	0.902
11.	0	68.65	0	0.75
12.	0	68.65	0	0.43

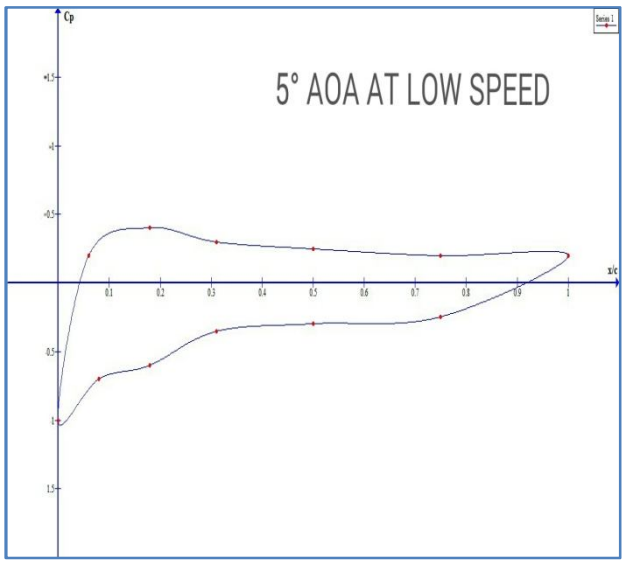

Fig. 5

Table 6:
Pressure distribution over a symmetrical aerofoil for medium speed at 5° AOA.

S.No.	P_i-P_∞	q_∞	Cp_{act}	Cp_{th}
1	9.799	166.75	0.058	0
2.	9.799	166.75	0.058	0.43
3.	9.799	166.75	0.058	0.75
4.	9.799	166.75	0.058	0.902
5.	0	166.75	0	0.965
6.	68.52	166.75	0.41	0.996
7.	97.99	166.75	0.587	1
8.	58.66	166.75	0.351	0.996
9.	97.99	166.75	0.587	0.965
10.	117.59	166.75	0.705	0.902
11.	19.59	166.75	0.117	0.75
12.	19.59	166.75	0.117	0.43

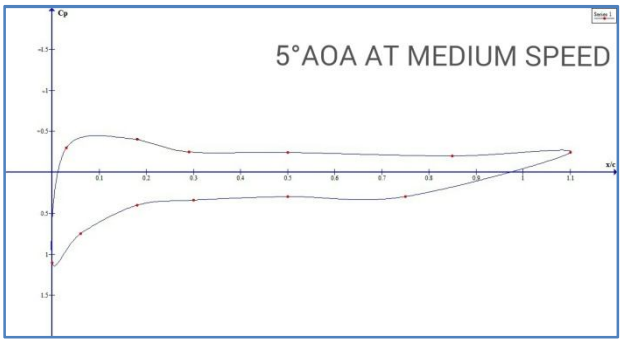

Fig. 6

Table 7:
Pressure distribution over a symmetrical aerofoil for high speed at 5° AOA.

S.No.	Pi-P_∞	q_∞	Cp_{act}	Cp_{th}
1	0	98.09	0	0
2.	19.598	98.09	0.199	0.43
3.	9.799	98.09	0.199	0.75
4.	19.598	98.09	0.199	0.902
5.	19.598	98.09	0.199	0.965
6.	39.196	98.09	0.399	0.996
7.	107.72	98.09	1.009	1
8.	9.799	98.09	0.09	0.996
9.	68.52	98.09	0.698	0.965
10.	58.66	98.09	0.598	0.902
11.	9.799	98.09	0.099	0.75
12.	0	98.09	0	0.43

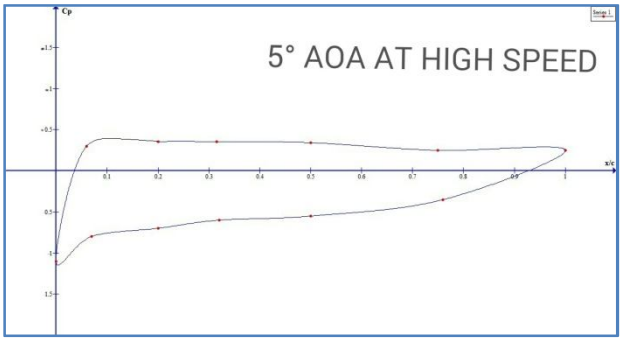

Fig.7

(c) AT 15^0 AOA- As mentioned in early that flow analysis over a symmetrical aerofoil at 15^0 AOA in different speed like low speed ,medium speed and high speed observe through practical value and fig. It is in Table:8, 9, 10 and fig: 8, 9, 10 are respectively. The $C_{p\ (actual)}$ values and $C_{p\ (actual)}$ vs x/c fig. are given in above tables and fig.

Now the stall region will start but it depends on shape and size of aerofoil and angle of attack between chord line and free stream.

Table 8:
Pressure distribution over a symmetrical aerofoil for low speed at 15° AOA.

S.No.	Pi-P∞	q∞	Cpact	Cpth
1	0	98.09	0	0
2.	19.598	98.09	0.199	0.43
3.	9.799	98.09	0.199	0.75
4.	19.598	98.09	0.199	0.902
5.	19.598	98.09	0.199	0.965
6.	39.196	98.09	0.399	0.996
7.	107.72	98.09	1.009	1
8.	9.799	98.09	0.09	0.996
9.	68.52	98.09	0.698	0.965
10.	58.66	98.09	0.598	0.902
11.	9.799	98.09	0.099	0.75
12.	0	98.09	0	0.43

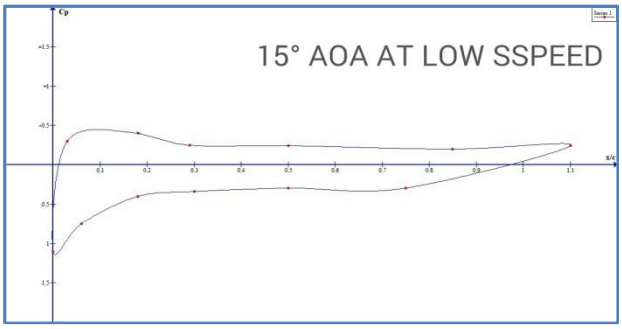

Fig. 8.

Table 9:
Pressure distribution over a symmetrical aerofoil for medium speed at 15° AOA.

S.No.	Pi-P∞	q∞	Cpact	Cpth
1	0	98.09	0	0
2.	19.598	98.09	0.199	0.43
3.	9.799	98.09	0.199	0.75
4.	19.598	98.09	0.199	0.902
5.	19.598	98.09	0.199	0.965
6.	39.196	98.09	0.399	0.996
7.	107.72	98.09	1.009	1
8.	9.799	98.09	0.09	0.996
9.	68.52	98.09	0.698	0.965
10.	58.66	98.09	0.598	0.902
11.	9.799	98.09	0.099	0.75
12.	0	98.09	0	0.43

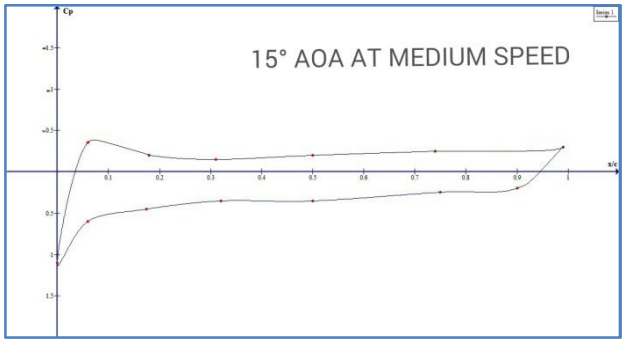

Fig. 9

Table 10:
Pressure distribution over a symmetrical aerofoil for high speed at 15° AOA.

S.No.	Pi-P∞	q∞	Cpact	Cpth
1	48.92	382.5	0.127	0
2.	29.33	382.5	0.076	0.43
3.	48.92	382.5	0.128	0.75
4.	48.92	382.5	0.128	0.902
5.	68.52	382.5	0.179	0.965
6.	156.78	382.5	0.409	0.996
7.	254.74	382.5	0.665	1
8.	9.799	382.5	0.025	0.996
9.	231.35	382.5	0.556	0.965
10.	97.99	382.5	0.256	0.902
11.	39.196	382.5	0.102	0.75
12.	0	382.5	0	0.43

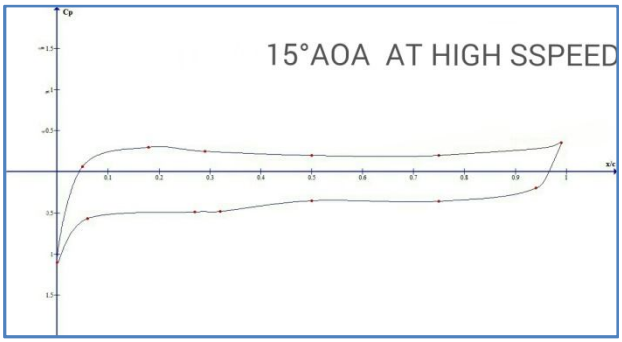

Fig. 10.

VI RESULT AND DISCUSSION

After different AOA with respective speeds, we got corresponding $C_{p(actual)}$ values with multi- tube manometer experimentally with their table and graphs.

The graph and table of experimentally verified value depict the behavior of flow over a aerofoil that given lift on different AOA with respective speeds.

The best ways to calculate lift over flow past body is to calculated first coefficient of pressure, so coefficient of pressure is calculated experimentally with given aerofoil(NACA-0012) with set up of instrument .

VII CONCLUSION

The experimentally carried out low subsonic open tunnel gives maximum speed as Mach No. less than and equal to 0.08. Due to pressure distribution over NACA-0012 aerofoil, taking AOA constant with varying the speed like low, medium and high speed, so taken three sequencly AOA repeating with another AOA got $C_{p\ (actual)}$ values and drawn graphs with corresponding values.

The analysis of $C_{p\ (actual)}$ values of corresponding AOA and its graph easy to predict next AOA but before stall limit of AOA.We can design an aerofoil either symmetrical or cambered ,this experiment will going to help and to develop design of aerodynamic of aircraft (any shape of other aerodynamic vehicles).

VIII FURTHER WORK

This is purely experimental work and its analysis but following to be done in future:-

(a) CFD analysis.
(b) Flow visualization at low speed (incompressible low) subsonic.
(c) Compare experimentally with CFD flow analysis with different contour.

REFERENCES

[1] E.G. Reid, A full scale investigation of ground effect, NACA Technical Report 265, 1927.

[2] K.V. Rozhdestvensky, Aerodynamics of a Lifting System in Extreme Ground Effect, 1st ed., Springer-Verlag, 2000, p. 30.

[3] J.D. Anderson Jr., Fundamentals of Aerodynamics, third ed., McGraw-Hill, 2001, p. 283, 284, 334, 335.

[4] R.G. Ollila, Historical review of WIG vehicles, J. Hydronaut. 14(3) (1980) 65–76.

[5] R. Ranzenbach, J.B. Barlow, Cambered aerofoil in groundeffect :wind tunnel and road conditions, AIAA Paper 95-1909, 1995.

[6] R. Ranzenbach, J.B. Barlow, Cambered aerofoil in ground effect, an experimental and computational study, Society of Automotive Paper No. 96-0909, 1996.

[7] M.R. Ahmed, Y. Kohama, Experimental investigation on the aerodynamic characteristics of a tandem wing configuration in close ground proximity, JSME Int. J. 42 (4) (1999) 612–618.

[8] X. Zhang, J. Zerihan, A. Ruhrmann, M. Deviese, Tip vortices generated by a wing in ground effect, in: Proceedings of the 11th International Symposium on Applications of Laser Techniques to Fluid Mechanics, Portugal, 2002.

Design of Bio-Structural View on Micro Aerial Vehicle's of Practical Flyer

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ABSTRACT
We can learn many things by observing the biological flight of insects, birds and bats since they fly with higher aerodynamic efficiency i.e., their lift to drag ratio is much higher as compared to our airplanes. They produce thrust by a complex morpho-functional flapping phenomenon. The comparison of flight features of these three types of fliers gives us some useful clues on the nature of natural wing materials having special properties (like light weight and high flexibility) which have to be considered seriously for their usage in Micro aerial vehicle to enhance their aerodynamic efficiency. The evolutionary history of these fliers and flapping is a notable feature. Insects are miniature fliers having low mass, resilin, and membranous chitinous wings, with high flapping frequency of 500 Hz or more. To imitate them is difficult. Birds and bat wings are modified teteapod limbs for flight. Birds have thousands of keratin feathers which cannot be replicated easily. In birds, the finger bones are reduced. However in bats, the finger bones are highly elongated (delicately) and the whole body is covered by membrane. It may be easier to imitate bat model and not its echo location. Anti stalling devices (Alula in birds) need further study. Their effortless landing and takeoff is notable for micro aerial vehicle design. Comparative moment of inertia studies give better aerodynamic information on biological wings. These natural fliers have extraordinary sensory perception, integration, feedback mechanism and adaptive control of flight. The researchers are trying to suggest how to incorporate some of these features in micro aerial vehicle designs. In fact in the most advanced fighter aircrafts (like F – 22 Raptor of USA) some sensory features are incorporated. We can think of flexible materials for wings, like silk, thin graphite with latex support etc. The biological wings are elastic and they withstand bending and damp the vibrations.

I INTRODUCTION

Biological flight of insects, birds and bats has an evolutionary history of millions of years and phylogenetically they are different in origin, structure but develop similar aerodynamic forces during flight. Biological fliers have higher aerodynamic efficiency (L/D ratio) and possess flapping flexible wings which differ in their origin and morphological structure. The biological fliers in a way can be called as MAV's keeping in mind their weight limits which are shown in Table 1.

In biomimicking MAV's we have to introduce flapping flexible wings and the problems of takeoff and landing have remained unsolved. For the development of an MAV we need an interdisciplinary approach of aeronautic engineers, ornithologists and biologists. It is advisable to go for biomimicking MAV's based on insect model, bird model or a bat model. The bat model is little complex however, its elastic patagium supported by elongated delicate bones which is more ideal to copy.

The present paper aims in comparing basic aerodynamic features of an insect, bird and bat which can be the basis in detail understanding of biomimicking principles of natural fliers. All the biomimicking fliers should satisfy the conditions for hovering and successful horizontal flight.

II LITERATURE REVIEW

Deakin (1970, 2010) has derived an expression for wing beat frequency by considering the dimension analysis as the basis. He considered two dimensionless ratios by using 'Bukingham Pi Theorem', which states that equations can be reduced to a simpler relationship by using dimensionless products.

Hovering is a kind of continuous power on flight where forward velocity becomes zero and the wings act as propellers of high frequency. The body is held more or less vertical and stroke plane of the wings is approximately horizontal. The wingtip traces a figure '8' and the wings move back and forth. The rate of change of momentum supports the bird weight. Small and medium size fliers such as humming birds, kingfishers practice hovering mainly for getting food. During hovering, oxygen consumption increases five times as compared to resting state. The wing stroke angle may be larger than 120^0, therefore S_d (disc area) may be taken as 360^0. The S_d concept in mass flow (1977, 2011) is replaced by S_w (small wing swept area) in Crawford theory (1971). Birds in nature hover at one spot, and the transition to horizontal flight. The wing motion in hovering is sinusoidal. There is a marked drop in power as the bird converts its position from hovering to forward flight. Big birds are not able to hover because of high energy cost and for not developing sufficient lift.

Puranik and Chari (1986) reviewed wing beat frequency in a chronological order. Pennycuick (1975) has suggested a formula for wing beat frequency of birds in steady flight. Sane (2003) has reviewed the aerodynamics of insect flight with emphasis on flapping flight. Wong (2005) has reviewed recent experimental, computational and theoretical approach to study the forces and flows around flapping wings of insects.

For the design and development of a MAV, necessary basic (Chari 2011) and derived parameters are listed in table 2.

III MECHANISM OF FLIGHT

Birds fly not only by flapping their wings, but by gliding with their wings outstretched for long distances. The work on a buoyancy principle.

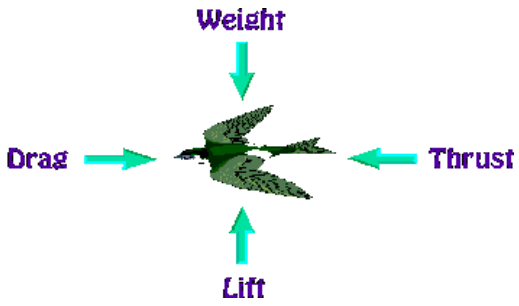

Fig.1

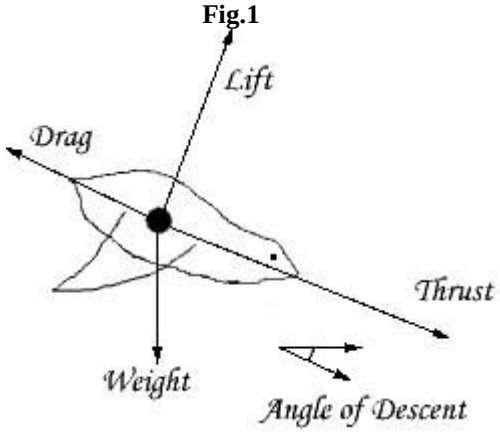

Fig.2

IV FORMULATION OF GLIDING FLIGHT

The actual wing span B of the bird could be determined, since

$\mathbf{B} = b1\frac{R1}{f}$

where

b1= was the wing span of the image of the bird on this negative.

f= is the focal length of the camera lens.
R1= pre-set on the rangefinder.
If *bi* was the span of the image on the i'th negative, then the range R_i at which it was taken is given by

$\mathbf{R_i} = \mathbf{f}.\frac{B}{bi}$

An estimate of range was thus obtained for each negative in a series, separated by a constant time interval. A regression of range on time was then calculated, and the regression coefficient was taken as an estimate of the bird's speed relative to the glider, i.e. the closing speed *Vx*.

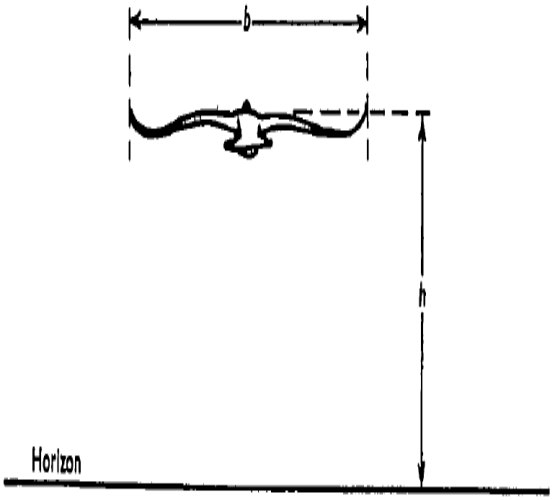

Fig. 3

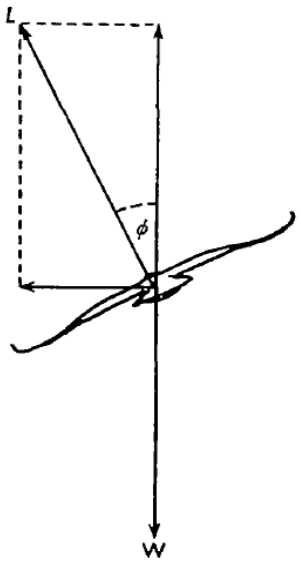

Fig. 4

V DISCUSSION AND SUGGESTIONS

The mass range as suggested for MAV's is from 0.1 to 0.2 Kg. The above mentioned fliers in Table 2 and their species specific, aerodynamic features have been very well tested in nature for millions of years under genetic control. Each flier as suggested in the Table 2 has definite environmental adaptation for flight. Our knowledge of airplane aerodynamic parameters is hardly 110 years old where we have separated lift and thrust. Therefore, scaling of biological features of insect, bird and bat flapping wing along with their body morphology might help in the design of better biomimicking MAV's. These prototypes have to be studied theoretically and experimentally.

The mass of the flier is carried on the flapping wings by developing lift and thrust at a particular frequency.

VI CONCLUSION

(a) For the biomimicking wing structure, pigeon (dove) or eagle (hawk) can be considered to start with. The materials should be less dense and stronger. Dragon fly or locust are the other easier insect models to mimick. Scaling is the most essential factor in biomimicking.

(b) The experimental work in wind tunnels is needed to obtain the aerodynamic parameters and to validate CFD studies. Since the experimental work is tedious, CFD analysis can be carried out on much geometry after their due validation. The experimental model needs a robust flapping mechanism, for the study of unsteady aerodynamics.

(c) If the flapping wing is not able to produce sufficient thrust, a stand by propeller can be thought of to generate the deficit thrust.

(d) For biological fliers, the landing and takeoff are not a problem either for terrestrial, aquatic or arboreal environment. Similar one can be thought of for the terrestrial MAV's. Since present MAV's do not have adequate landing and takeoff provisions.

Table1
Minimum and Maximum Weight of Biological Fliers

Parameter	**Insect**	**Bird**	**Bat**
Minimum Weight	$5 * 10^{-9}$	0.005	0.008
Maximum Weight	0.01	12	1.2

(All units are in SI system)

Table2
Species Specific Features of Insect, Bird and Bat

Parameters	**Insect**	**Bird**	**Bat**
Mass (M)	0.0008	0.168	0.0075
Wing Length (l)	0.0217	0.256	0.127
Wing Span (L)	0.0564	0.542	0.283
Wing Area (2A)	0.0004	0.0579	0.0114
Effective Wing Breadth, B_{eff}	0.015	0.113	0.041
Wing Loading (M/ 2A)	1.96	2.98	0.65
Wing Span Loading, (M/ L^2)	0.269	0.572	0.0936
Frequency, (ν_h)	49	11	5
Induced Power (P_i)	1.19	363.6	30.65
Time (T)	0.01	0.09	0.22
Wing Hinge	Point fulcrum	Ball and Socket joint	Ball and socket joint patagium attached to body

Insect – T. Javanica (Soap nut bug), Bird – S. d, decacto (Ring dove), Bat- H. spereosis (leaf nosed bat), (All units are in SI system)

REFERENCES

[1] Deakin, M. A. B., 1970. “The Physics and Physiology of Insect Flight”, American Journal of Physics 38:1003-1005.

[2] Crawford Frank S., 1972. Comments on “The Physics and Physiology of Insect Flight”, American journal of physiology 39: 584.

[3] Puranik, P.G., Gopal Krishna G, Adeel Ahmed and Chari N. 1977. “Wing Beat Frequency of a Flier – Mass Flow Theory”, Proc. Ind. Acad. SciSoc. A., 85, 327-329

[4] Puranik, P. G., and Chari N. 1986 “Bio-Aerodynamics of Fliers.” National Book Enterprises, Hyderabad, A.P. India.

[5] Pennycuick, C. J., 1972. “Mechanics of Flight in Avian Biology”, Vol. 5 (ed. D. S. Farner and J. R. King), pp. 1-75. Newyork: Academic press.

[6] Pennycuick, C. J., 1996. “Wing Beat Frequency of Birds in Steady Cruising Flight: New data and Improved Preditions”, Journal of Experimental Biology, Vol. 199: 1613-1618.

[7] Sane, S. P., 2003. “The Aerodynamics of Insect Flight”, Journal of Experimental Biology, Vol. 209: 4191-4208.

[8] Wang, Z. J., 2005. “Dissecting of Insect Flight”, Annu. Rev. Fluid Mech, Vol. 37: 183-210.

[9] Chari N., 2011 “Bio-Aerodynamics of Bird Flight.” Vistar Graphics, Hyderabad, A.P. India, V edition.

Protecting the Habitat from Heating Effect of Integrated Circuits

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ABSTRACT
Heating of integrated circuits (ICs) has become a big nuisance today in electronics world. Heat is an unavoidable by-product of operating electronics. Due to IC heat, reliability of integrated circuits decreases and parametric changes may occur in an electronic device and its components. Hazardous heat by ICs adversely affects the environment as it causes depletion of Ozone layer thus leading to global warming, skin cancer etc. Hence thermal management is essential. The cooling technique presented in this paper uses recently invented "digital microfluidic" platform.

Keywords-Integrated circuits, electronics, reliability, global warming, thermal management and digital microfluidic.

I INTRODUCTION

In technical world, electronic components consist of integrated circuits (ICs). Recently there has been a urge to monitor and control heat produced by ICs.Heat is anything but the unavoidable by-product in electronic equipments.Reliability of integrated circuits gets decreased due to heating of ICs as a result parametric changes may occur in the device[1].

Current flowing through active and passive components results in power dissipation and increased temperatures. The amount of power dissipated by a device is a function of [2]-

(a) Type of device
(b) Geometry
(c) The path from the device to the heat sink.

Power dissipation may occur in both active and passive devices. It is a function of the type of current that is received. This calls for effective thermal management of integrated circuits which will reduce the problems caused by IC heat to a considerable extent.

II IC COOLING TECHNIQUES

Wide range of cooling techniques exist which helps in effectively cooling of integrated circuits as they have certain characteristics that are common to them.Basically,cooling techniques are categorized into following-

(a) Passive Cooling Technique- Passive cooling includes thermal conduction (e.g., pastes, metal lines, and vias), natural convection (e.g., finned heat sinks and ventilation slots), and radiation (e.g., coatings and paints). Heat pipes and thermosyphons also fall in the category of passive methods, but they offer higher performance [3].These devices have following advantages-

- Less cost.
- Simple in design.

(b) Active Cooling Technique- Active cooling requires input power, and includes methods that require external components such as in forced convection (e.g., fans and nozzles), pumped loops (e.g., heat exchangers and cold plates), and refrigerators (e.g., Peltier/thermoelectric and vapor-compression based) [3]

III CURRENT METHODS FOR IC COOLING

Generally there are five cooling techniques used to tackle hazardous heating of integrated circuits (ICs).These are-

- Heat-sink-fan (HSF)-based cooling
- Macro fluidic-based cooing
- MEMS-based cooling
- Refrigeration cooling
- Microfluidic-based cooling

(a) Heat-sink-fan (HSF)-This type of cooling uses heat spreader and forced-convection methods. It is one of the mostcommonly used cooling techniquesthatisin use over the past years. Fan-based cooling technique is widely used in laptops. Due to its use in laptops, the amount of heat given off into the environment is reduced considerably. Thus it efficiently protects human being from hazardous diseases that are caused due to adverse dangers on environment like-depletion of Ozone layer, global warming, etc.

(b) Macro fluidic-based cooling- This involves methods pertaining to liquid cooling at macro scale. They are of two types-

(i) **Direct cooling**-It consist of a pool of inert dielectric liquid in which immersion of electronic chip occurs.
(ii) **Indirect cooling**-They are mainly concerned with two-phase flow.

(c) MEMS-based cooling- It has complex structures and made are by micro fabrication methods. Thus, this design promotes dissipation of heat and conduction.

(d) Refrigeration-based cooling systems- Integrated circuits (ICs) are cooled using refrigeration-based cooling systems, such as vapor compression, gas compression, or thermoelectric devices. They generate a sub-zero effective thermal resistance. This helps in avoiding global warming because of IC heat. To chip package, evaporator is connected whose contact temperature is lower than cooling temperature of air.

(e) Microfluidics based cooling-It operates on the premise of pushing small volumes of liquids (less than microliter volumes) across the surface of an IC in order to conduct and dissipate heat away downstream. Originally introduced in the 1980's, microfluidic handling technologies quickly faced limitations and was unable to be realized in a practical commercial system [3].Harmful UV rays are not able to penetrate the earth's environment thus the efficiency of this cooling method is good.

IV ADAPTIVE COOLING OF INTEGRATED CIRCUITS USING DIGITAL MICROFLUIDICS

We attempt to address these architectural and implementation issues by proposing an alternative approach to microfluidic cooling. We begin by first outlining the requirements for a viable reconfigurable IC-level cooling device. Based on these requirements, we propose a novel cooling method using a microfluidic technology called "digital microfluidics", which helps to safeguard the environment from the heat generated by integrated circuits (ICs).

As feature sizes decrease and operating frequencies interconnect resistance, and package densities continue to increase, ICs are quickly reaching temperatures that will render current package-level cooling techniques inadequate [4].

(a) Requirements for Adaptive cooling- In an attempt to provide safety to environment from hazardous integrated circuits (ICs) heat adaptive cooling is done at architectural as well as implementation level.

- **Requirements at architectural level** - The requirements are-
  (i) System should have a mechanism to transfer and remove heat efficiently.
  (ii) System should be a closed loop.
  (iii) Some cooling devices require a replenishable source.
- **Requirements at implementation level-** The requirements are following-
  (i) System should have an easily integral control mechanism.
  (ii) System should be self-regulating.
  (iii) System should easily interface with the IC.
  (iv) In the event that the primary cooling method fails, the system should revert to a backup cooling mechanism.

(b) Digital Microfluidics- We refer to this approach as "digital microfluidics," as it is analogous to the design techniques in digital microelectronics. Digital microfluidic platform is amenable to both hot-spot cooling and IC-level integration. A micro-pump utilizes the phenomenon of electrowetting. The surface energy in electrowetting is directly modified by application of an electric field.Due to decrease in electric field, contact angle decreases. This causes droplet to spread or effectively wet the surface.

Large number of discrete droplets can be independently programmed and reprogrammed to address the changing thermal profiles in an IC.The division of liquids into independently controlled packets of liquid for manipulation is done.

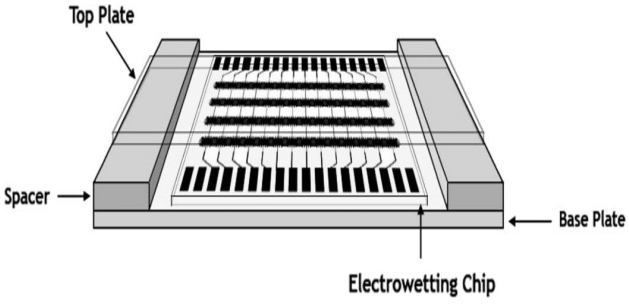

Fig.1 Schematic of an assembled digital microfluidic electrowetting chip[3].

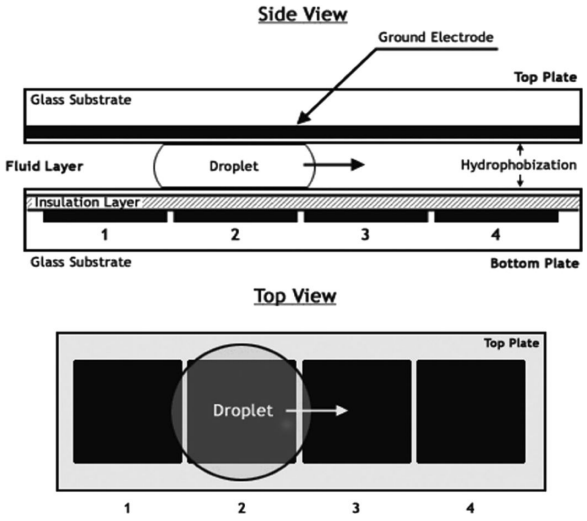

Fig.2 Schematic side and top views of the electro wetting chip.

(c) Advantages Over Existing Techniques

- Microfluidic operations can be reduced to a set of basic discrete operations.
- Absence of permanently etched structures allows for a completely reconfigurable system.
- Given a 2-D array of actuating electrodes, liquid droplets can be manipulated laterally in any arbitrary path without the need for external pumps and valves.
- Liquid flow has been shown to inherently increase with increasing temperature.

V CONCLUSION

We have presented a promising IC cooling technique based on a recently invented "digital microfluidic" platform which utilizes electrowetting phenomenon. Thus the cooling technique presented here reduces the IC heat which helps to safeguard environment.

REFERENCES

[1] Philip Y. Paik, Vamsee K. Pamula, and KrishnenduChakrabarty,"*Adaptive Cooling of Integrated Circuits Using Digital Microfluidics", IEEE Transactions on very large scale integration (VLSI) systems, Vol. 16, No. 4, April 2008.*

[2] M. G. Pollack, R. B. Fair, and A. D. Shenderov, "*Electrowetting-based actuation of liquid droplets for microfluidic applications," Appl. Phys. Lett., vol. 77, pp. 1725–1726, 2000.*

[3] M. G. Pollack, A. D. Shenderov, and R. B. Fair, "*Electrowetting-based actuation of liquid droplets for microfluidic applications," Lab on a Chip, vol. 2, pp. 96–101, 2002.*

[4] E. G. Colgan, B. Furman, M. Gaynes, W. Graham, N. LaBianca, J. H.Magerlein, R. J. Polastre, and M. B. Rothwell, "*A practical implementation of silicon microchannel coolers for high power chips," in Proc.21stIEEE Semi-thermSymp,pp. 1–7, 2005.*

Effect of Dredging on Intertidal Meiofauna Distribution of Tapi River

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ABSTRACT
Human Interference in the form of dredging in the estuary is a harmful activity which ultimately affects distribution of benthic community which may be caused due to change in sediment composition, unstable nutrient composition, lower dissolved oxygen levels, release of toxic substance during the process, and increased turbidity. Estuaries are the intermediate water body with extreme alteration in the composition of water and nearby soil properties due to influx of marine water during tides. Both by human interference as well as by natural commotion, this paper concludes the impact of such physical agitation on macro-faunal communities as well as physicochemical properties of water and sediment composition. Marine beds are very much in demand to get explored by dredging. The aim of present work was to provide a comprehensive study about the extent to which benthic community and prevailing ecosystem has been disturbed by the interference and an insight about recovery of the benthic population disturbed. The assessment has been done by comparing two sites which were subjected to dredging with one undisturbed reference sites. Most of the analyses suggested that sediment composition and lowered nutrient levels are the main constraints affecting the distribution of benthic community.

I INTRODUCTION

Human activities impart effect upon the environment so as upon estuarine ecosystem and prevailing ecological processes. Such effects cause deterioration in the quality of ecosystem and on estuarine and marine species also it is indirectly harmful for human (Balmford *et.al.,* 2002; Wackernagel *et.al.,* 2002)

The faunal community similar to the species which were present at the place prior to disturbance re-establish to the place which shows the inclination. The statistical analyses conclude the biological recovery; or by means of a comparison between altered areas and natural undisturbed reference areas (Cooper *et. al.,* 2007). Several indices, such as number of individuals, number of species and biomass, have been used to assess the status of community assemblages following aggregate dredging (Kenny and Rees, 1996; Carvalho et al., 2001; Boyd and Rees, 2003; Newell et al., 2004; Sanchez-Moyano et al., 2004; Cooper et al. 2005). According to Gray (2000), the number of species alone does not represent the real structure of an assemblage in a community because the number of individuals per species varies. Most popular indices use a combination of species richness and evenness, for example the Margalef index and the Simpson index (Magurran, 2004).

Dredging is the physical agitation which causes the disturbance in benthic habitat which promote the organism to move on to a new place. Macrofauna which are filter feeders are selective to a particular size of sediment, the species composition of such macrofauna changes frequently (Szymelfening *et. al., 2006).* In the study, samples has been taken from two site comparing the disturbed with comparatively undisturbed. The biodiversity of an disturbed may recover once the habitat settle down to normal condition (Elliott *et.al.,* 2007) Recovery pattern of meiofauna is after dredging activity is very important as it also helps to give an idea of rehabilitation of dredged area (Boyd *et.al.,* 2004). To restore the degraded habitat is a prime concern of ecosystem management (Apitz *et.al.,* 2006; Borja *et.al.,* 2008) An Ecosystem and its functioning can better evaluate as per the functional role of species (Loreau. e*t.al.,* 2001)

A recent study by Cooper et al. (2005) covering the period from 2001 to 2004 found that the meiofauna of the area was dominated by a number of polychaete worms (e.g. *Pomatoceros lamarcki, Lanice conchilega and Lumbrineris gracilis*), Crustacea (*Pisida longicornis),* echinoderms (*Amphipholis squamata* and *Echinocyamus pusillus)*; and also a high abundance of colonial species such as hydroids (*Sertularia cupressina, Plumularia setacea,*) and bryozoa (*Alcyonidium mytili* and *Bugula plumosa).*

Dredging imparts alteration of water quality and along with this also cause alteration in intertidal soil quality. Certain Physico-Chemical parameters have been analyzed throughout the season to relate quality of the aquatic habitat with the diversity of the organisms.

II METHODOLOGY

Study area: Certain dredging spots in Tapi river at surat district, has been selected for the study. Tapi river rises in the eastern Satpura Range of southern Madhya Pradesh state, and flows westward, draining south Gujarat, before emptying into the Gulf of Cambay of the Arabian Sea, in the Surat District of Gujarat. Three sites has been taken with-in the Surat, Gujarat. The sites are Furza-Chowk-S1, Magdalla Jetty-S2, Magdalla bridge- S3. Site 1 is 20 km away from Site 2 which in turn is nearly 8 km away from Site 2. Water sampling has been done monthly. The water parameters selected were pH, temperature, DO, BOD, COD, macronutrients, chlorine.

Soil sample has been taken by core sampler of 4Cm radius. Certain physical and chemical parameter observed includes soil pH, temperature, alkalinity, chloride, nutrients, soil texture, moisture, porosity.

III RESULT AND DISCUSSION

Other factors including biota itself cannot be overlooked for the disturbance in soil consistency. Species also show resettlement on the same substrate after dredging activity completion. Following are certain consequences which have been observed during one year of sampling.

(a) Effect of Benthic biota activity on sediment stability- Sediment dynamics, including profile, texture and moisture must be evaluate to understand and estimate morphological changes in soil, pollution quotient in estuarine, marine and intertidal ecology, interdependency of biota and sediment (Collins and Balson, 2007).

Shifting sediment due to any activity will change the topographical arrangement gradually the texture of soil (Kenny and Rees, 1996). Disturbance due to dredging ultimately releases sediments as well as contaminants into the water column which alters the water quality (Boyd et al., 2005; Cooper et al., 2005). Alteration in sediment quality by eroding the uppermost surface may also improve the sediment quality. This may improve the habitat for resettlement of benthic communities (Hall, 1994). The other way round dredging can also erode and uncover the unsuitable surface and which may hinder the resettlement of benthic community (Kenny and Rees, 1996). Thus, given that sediment fluctuation is very important when it comes for biodiversity development (Saunders, 2007)

(b) Effect of dredging on benthic community and sediment quality- There are few effects which dredging impart upon the physical as well as biological characteristic features of studied area. First direct most are removal and alteration of the sediment substrate, removal of biota from the substrate, destruction of biota by the dredger, alteration in benthic communities due to changes in quality of substrate. Certain indirect effects are like noise pollution raised due to dredger, released fine sediment particle in water profile, released or imported nutrients' concentration of an area. The influence of dredging is sometime not specific but also alters nearby areas too (Newell *et. al.,* 1998; Boyd *et.al.,* 2005) and it's a must to consider these factors when we talk about the potential environmental effect of dredging in an ecosystem.
The site S2 shown maximum variability in sediment composition when compared with S1*i.e.* Furza-chowk (fresh water area, near temple) and S3 *i.e.* Magdalla bridge (estuarine zone). There are some factors which also effect the sediment composition and cannot be explained well in dredging context like time era of sampling, dredger's head shape, frequency and topography of the riverbed. The S3 also shown variation in sediment composition with comparison to reference site S1 which explains that soil composition also varies naturally by the time and the species invading in that particular area adapt according to the simultaneous prevailing conditions. Boyd *et.al.* 2005 also contributed by his studies on sea bed that natural variation may have not changed due to any human activity and still participating and contributing along with post dredging settlement. While the gravel component in sediment texture has been recorded high at S3, the low dredging intensity site, an increase in gravel texture was significant along with reduction in coarser particles at S2, high intensity site. Sediment composition of S3 found to vary from S1, reference site in terms of gravel fraction. Although the basic features of the substrate were different, gravel part of the soil texture found increasing nearly in same trend at all of the sites throughout the study period (Cooper *et.al.*2005). The variation of gravel fraction found to be least in post-monsoon season, which support the concept of physical recovery of sediment naturally. After comparing sediment texture of all the three sites coarse sand and gravel fraction shown substantial variation due to dredging, gravel fraction being the more responsive particles shown intense sensitivity towards any agitation. It may be concluded by the results that the difference between the benthic gatherings of both sites is due to this factor. The biological impact includes decrease in richness of biodiversity as well as number of individuals. While the dredging impact on physical properties of sediments includes

variation in soil profile, soil texture and nutrients distribution (Cooper *et.al.*, 2007)

Intertidal zone near the high intensity and low density dredging site also show distinct agitation when compared to the reference site. The benthic biota compositions of these intertidal zones represent the communities of corresponding sites of estuarine area in river Tapi. This fact give an insight about the dwelling of biota between intertidal mud flats and river bed, because they found both of the environment nearly same in at least nutrients composition. Moreover, species gathering shows an abundance at intertidal mud flats (Newell *et.al.*, 2004). Species seems to shift over to intertidal mud flats to avoid the intense variation raise due to dredging activity (Szymelfenig *et.al.*, 2006). However some intertidal patches at reference site also shows similarity in biota composition. While few species shows no variation in composition resulting due to changes in sediment composition at dredging sites (Cooper *et.al*., 2011). Which can be observed as that some species are doesn't show affinity to a particular texture.

REFERENCES

[1] Apitz, S.E., Elliott, M., Fountain, M., Galloway, T.S. 2006. European environmental management: Moving to an ecosystem approach. Integrated Environmental Assessment and Management, 2(1): 80-85.

[2] Balmford, A., Bruner, A., Cooper, P., Costanza, R., Farber, S., Green, R.E., Jenkins, M., Jefferiss, P., Jessamy, V., Madden, J., Munro, K., Myers, N., Naeem, S., Paavola, J., Rayment, M., Rosendo, S., Roughgarden, J., Trumper, K., Turner, R.K. 2002. Ecology - economic reasons for conserving wild nature. Science, 297:950-953.

[3] Borja, A., Dauer, D.M. 2008. Assessing the environmental quality status in estuarine and coastal systems: Comparing methodologies and indices. Ecological Indicators, 8: 331-337.

[4] Boyd, S. E., Cooper, K. M., Limpenny, D. S., Kilbride, R., Rees, H. L., Dearnaley, M. P., Stevenson, J., Meadows, W.J., Morris, C.D., 2004. Assesment of the re-habilitation of the seabed following marine aggregate dredging. Science Series Technical Report, CEFAS Lowestoft, 130: 154 pp.

[5] Boyd, S.E., Limpenny, D.S., Rees, H.L., Cooper, K.M. 2005. The effects of marine sand and gravel extraction on the macrobenthos at a commercial dredging site (results 6 years post-dredging). ICES Journal of Marine Science, 62:145-162.

[6] Boyd, S.E., Rees, H.L. 2003. An examination of the spatial scale of impact on the marine benthos arising from marine aggregate extraction in the central English Channel. Estuarine Coastal and Shelf Science, 57: 1-16.

[7] Carvalho, S., Ravara, A., Quintino, V., Rodrigues, A.M. 2001. Macrobenthic community characterisation of an estuary from the western coast of Portugal (Sado estuary) prior to dredging operations. Bol. Inst. Esp. Oceanogr., 17 (1 y 2): 179-190.

[8] Collins, M.B., Balson, P.S. 2007. Coastal and shelf sediment transport: an introduction. Coastal and Shelf Sediment Transport, Geological Society of London, Special Publication, 274:1-5.

[9] Cooper, K., Boyd, S., Eggleton, J., Limpenny, D., Rees, H., Vanstaen, K., 2007. Recovery of the seabed following marine aggregate dredging on the Hastings Shingle Bank off the southeast coast of England. Estuarine Coastal and Shelf Science, 75: 547-558.

[10] Cooper, K.M., Eggleton, J.D., Vize, S.J., Vanstaen, K., Smith, R., Boyd, S.E., Ware, S., Morris, C.D., Curtis, M., Limpenny, D.S., and Meadows, W.J. 2005. Assessment of the rehabilitation of the seabed following marine aggregate dredging - part II. Sci. Ser. Tech. Rep., CEFAS Lowestoft. 130: 82 pp.

[11] Elliott, M., Burdon, D., Hemingway, K.L., Apitz, S.E. 2007. Estuarine, coastal and marine ecosystem restoration: confusing management and science – a revision of concepts. Estuarine, Coastal and Shelf Science, 74: 349-366.

[12] Gray, J.S. 2000. Species richness of marine soft sediments. Marine Ecology Progress Series, 224: 285-297.

[13] Hall, S.J. 1994. Physical disturbance and marine benthic communities: life in unconsolidated sediments. Oceanography and Marine Biology: An Annual Review, 32:179-239.

[14] Kenny, A.J., Rees, H.L. 1996. The effects of marine gravel extraction on the macrobenthos: results 2 years post-dredging. Marine Pollution Bulletin, 32:615-622.

[15] Kenny, A.J., Rees, H.L. 1996. The effects of marine gravel extraction on the macrobenthos: results 2 years post-dredging. Marine Pollution Bulletin, 32:615-622.

[16] Loreau, M., Naeem, S., Inchausti, P., Bengtsson, J., Grime, J.P., Hector, A., Hooper, D.U., Huston, M.A., Raffaelli, D., Schmid, B., Tilman, D., Wardle, D.A. 2001. Ecology - biodiversity and ecosystem functioning: current knowledge and future challenges. Science, 294:804-808.

[17] Magurran, A. E. 2004. Measuring biological diversity, Blackwell Publishing, UK. 256 pp.

[18] Newell, R.C., Seiderer, L.J., Hitchcock, D.R. 1998. The impact of dredging works in coastal waters: A review of the sensitivity to disturbance and subsequent recovery of biological resources on the seabed. Oceanogr Mar Biol Annu Rev, 36:127-178.

[19] Newell, R.C., Seiderer, L.J., Simpson, N.M., Robinson, J.E. 2004. Impacts of marine aggregate dredging on benthic macrofauna off the south coast of the United Kingdom. Journal of Coastal Research. 20: 115-125.

[20] Sánchez-Moyano, J. E., Estacio, F. J., García-Adiego, E. M., García-Gómez, J. C., 2004. Dredging impact on the benthic community of an unaltered inlet in southern Spain. Helgoland Marine Research, 58: 32-39.

[21] Saunders, J.E. 2007. Measuring and understanding biogenic influences upon cohesive sediment stability in intertidal systems. University of St Andrews. 256 pp.

[22] Szymelfenig, M., Kotwicki, L., Graca, B. 2006. Benthic re-colonization in post-dredging pits in the puck bay (Southern Baltic sea). Estuarine Coastal and Shelf Science, 68:489-498.

[23] Wackernagel, M., Schulz, N.B., Deumling, D., Linares, A.C., Jenkins, M., Kapos, V., Monfreda, C., Loh, J., Myers, N., Norgaard, R., Randers, J. 2002. Tracking the ecological overshoot of the human economy. Proceedings of the National Academy of Sciences of the United States of America, 99:9266-9271.

Fixed Point Theorem in Fuzzy 3 Metric Space

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ABSTRACT
In this paper we prove a common fixed point theorem for three mappings in fuzzy metric space, fuzzy 2 metric spaces and fuzzy 3-metric spaces. **AMS**: 54H25, 47H10.

Keywords: fixed point, fuzzy 2 metric spaces, and fuzzy 3 metric spaces.

I INTRODUCTION

In [31] the concept of fuzzy sets was introduced by Zadeh. Deng [8], Erceg [10], Kaleva and Seikkala [23], Kramosil and Michalek [25] have introduced the concept of fuzzy metric spaces in different ways. Many authors have also studied the fixed point theory in these fuzzy metric spaces are [1], [6], [11], [17], [20], [21], [22], [27] and for fuzzy mappings [2], [3], [4], [5],[19], [26]. Recently Wenzhi[30] and many others initiated the study of Probabilistic 2-metric spaces (or 2-PM spaces). We know that 2-metric space is a real valued function of a point triples on a set X, whose abstract properties were suggested by the area function in Euclidean spaces. Now it is natural to expect 3-metric space which is suggested by the volume function. The method of introducing this is naturally different from 2-metric space theory. In this paper we prove a common fixed point theorem for three mappings in fuzzy metric space, and then extend this result to fuzzy 2 metric spaces and fuzzy 3-metric spaces. This result is motivated by [32].

II PRELIMINARIES

Def.2.1. A binary operation *: [0, 1] × [0, 1] → [0,1]is called a t-norm in([0, 1], *) if for all a, b, c, d∈ [0, 1]following conditions are satisfied:

i. a*1 = a,
ii. a*b = b*a,
iii. a*b ≤ c*d whenever a≤c and b≤d,
iv. a*(b*c) = (a*b)*c.

Def.2.2. The 3-tuple (X, M, *) is called a fuzzy metric space (FM space) if X is an arbitrary set, * is a continuous t- norm and M is a fuzzy set in $X^2\times[0,\infty]$ satisfying the following conditions for all x, y, z ∈ X and s, t > 0

FM-1 M(x, y, 0) = 0,
FM-2 M(x, y, t) = 1 ∀t>0 iff x= y,
FM-3 M(x, y, t) = M(y, x, t),
FM-4 M(x, y, t) * M(y, z, s)≤M (x, z, t+s)
FM-5 M(x, y, .):[0, 1)→[0, 1] is left continuous ,
FM-6 $\lim_{t\to\infty}$M(x, y, t)= 1.

Lemma 2.1: M(x, y, z,.)is non decreasing for all for all x, y, z ∈ X.

Def.2.3.let (X, M, *) is called a fuzzy metric space:

1. A sequence $\{x_n\}$ in X is said to be convergent to a point $x \in X$ (denoted by $\lim_{n\to\infty} x_n = x$) if
   $\lim_{n\to\infty} M(x_n, x, t) = 1$ for all t > 0
2. A sequence $\{x_n\}$ in X is called a Cauchy sequence if if
   $\text{Lim}_{n\to\infty}M(x_{n+p}, x_n, t)= 1$ ∀ t> 0and p > 0
3. A fuzzy metric space in which every Cauchy sequence is convergent is said to be complete.

Lemma 2.2: let $\{y_n\}$ be a sequence in fuzzy metric space with the condition (FM-6). If there exist a number $q \in (0,1)$ such that
M (y_{n+2}, y_{n+1},qt) ≥M (y_{n+1}, y_n, t)
for all t > 0and n= 1 ,2, …. , then $\{y_n\}$ is a Cauchy sequence.

Lemma 2.3: If for all x, y in X, t > 0 and for a number$q \in (0,1)$, M (x, y, qt) ≥M (x, y, t), then x = y

Remark: Lemma 2.1, 2.2 and 2.3 hold for fuzzy 2 metric spaces and fuzzy 3 metric spaces also.

Def.2.4: A function M is continuous in fuzzy metric space iff whenever $x_n \to x$, $y_n \to y$ then

$$\lim_{n\to\infty} M(x_n, y_n, t) = M(x, y, t)$$

for each $t > 0$

Def.2.5: Two mappings A and Son a fuzzy metric space Xare said toweakly commuting if
M (ASx, SAx, t) ≥M (Ax, Sx, t) ,∀x∈ X and t > 0.

Def.2.6: A binary operation *: [0, 1] × [0, 1] × [0, 1] → [0,1] is called acontinuous t- norm if ([0, 1], *) is an abelian topological monoid with unit 1 such that $a_1 * b_1 * c_1 \le a_2 * b_2 * c_2$ whenever $a_1 \le a_2$, $b_1 \le b_2$, $c_1 \le c_2$, for all $a_1, b_1, c_1, a_2, b_2, c_2$ in [0,1].

Def.2.7: The 3-tuple (X, M, *) is called a fuzzy 2-metric space (FM space) if X is an arbitrary set, * is a continuous t- norm and M is a fuzzy set in

$X^3 \times [0,\infty]$ satisfying the following conditions for all x, y, z, u∈ X and $t_1, t_2, t_3 > 0$

FM'-1 M(x, y, z, 0) = 0,

FM'-2 M(x, y, z, t) = 1, ∀t > 0 iff x= y,

FM'-3M(x, y, z, t) = M(x, z, y, t) = M(y, z,x, t) (Symmetric about three variables)

FM'-4M(x, y, z, $t_1 + t_2 + t_3$) ≥ M(x, y,u, t_1) *M (x, u, z, t_2)*M (u, y, z, t_3)

(This corresponds to tetrahedron inequality in 2-metric space)

The function valueM(x, y, z,t) may be interpreted as the probability that the area of triangle is less than t.

FM'-5M(x, y, z, .):[0, 1)→[0, 1] is left continuous ,

Def.2.8: Let (X, M, *) is called a fuzzy 2 metric space:

1. A sequence $\{x_n\}$ in fuzzy 2 metric space X is said to be convergent to a point $x \in X$if $\lim_{n\to\infty} M(x_n, x, a, t) = 1$ for all a in X and t > 0
2. A sequence $\{x_n\}$ in fuzzy 2 metric space X is called a Cauchy sequence if if $\text{Lim}_{n\to\infty} M(x_{n+p}, x_n, a, t) = 1$ for all a in X and t> 0, p > 0
3. A fuzzy 2 metric space in which every Cauchy sequence is convergent is said to be complete.

Def.2.9: A function M is continuous in fuzzy 2 metric space iff whenever $x_n \to x$, $y_n \to y$ then $\lim_{n\to\infty} M(x_n, y_n, a, t) = M(x, y, a, t)$ for all $a \in X$ and $t > 0$.

Def.2.10: Two mappings A and Son a fuzzy 2 metric space X are said to weakly commuting if M (ASx, SAx, a, t) ≥ M (Ax, Sx, a, t),∀x, a ∈ X and t > 0.

Def.2.11: A binary operation *: $[0, 1]^4 \to [0,1]$ is called a continuous t- norm if ([0, 1], *) is an abelian topological monoid with unit 1 such that $a_1 * b_1 * c_1 * d_1 \le a_2 * b_2 * c_2 * d_2$ whenever $a_1 \le a_2$, $b_1 \le b_2$, $C_1 \le C_2$, $d_1 \le d_2$ for all $a_1, b_1, c_1, a_2, b_2, c_2$ and d_1 , d_2 are in [0,1].

Def.2.12: The 3-tuple (X, M, *) is called a fuzzy 3-metric space if X is an arbitrary set, * is a continuous t- norm and M is a fuzzy set in $X^4 \times [0,\infty]$ satisfying the following conditions for all x, y, z, u,w ∈ X and $t_1, t_2, t_3, t_4 > 0$

FM''-1 M(x, y, z, w, 0) = 0,

FM''-2 M(x, y, z, w, t) = 1, ∀t > 0 iff x= y, Only when three simplex ⟨x, y, z, w ⟩degenerate

FM''-3 M(x, y, z,w, t) = M(x, w, z, y, t) = M(y, z, w, x, t)= M(z, w, x, y, t) =…. (Symmetric about three variables)

FM''-4 M(x, y, z, w,$t_1 + t_2 + t_3 + t_4$) ≥ M(x, y, z, u, t_1) *M (x, y, u, w, t_2)*M (x, u, z, w, t_3)*M (u, y, z, w, t_4)

FM''-5 M(x, y, z,w, .):[0, 1)→[0, 1] is left continuous ,

Def.2.13: let (X, M, *) is called a fuzzy 3 metric space:

1. A sequence $\{x_n\}$ in fuzzy 3 metric space X is said to be convergent to a point $x \in X$if $\lim_{n\to\infty} M(x_n, x, a, b, t) = 1$ for all a ,b in X and t > 0
2. A sequence $\{x_n\}$ in fuzzy 3 metric space X is called a Cauchy sequence if if $\text{Lim}_{n\to\infty} M(x_{n+p}, x_n, a, b, t) = 1$ for all a, b in Xandt> 0, p > 0
3. A fuzzy 3 metric space in which every Cauchy sequence is convergent is said to be complete.

Def.2.14: A function M is continuous in fuzzy 3 metric space iff whenever $x_n \to x$, $y_n \to y$ then $\lim_{n\to\infty} M(x_n, y_n, a, , b, t) = M(x, y, a, b, t)$ for all $a, b \in X$ and $t > 0$.

Def.2.15: Two mappings A and Son a fuzzy 3metric space X are said to weakly commuting if

M (ASx, SAx, a, b, t) ≥ M (Ax, Sx, a, b, t) ,∀x, a, b∈ X and t > 0.

Lemma 2.3: let (X, M, *) be a fuzzy 2 metric space. If there exist k ∈ (0,1) such that M(x ,y, z, kt) ≥M (x, y, z, t) for all for all x, y, z ∈ X with z ≠ x , z ≠ y and t>0then x =y.

III MAIN RESULT

Theorem 3.1: Let(X, M, *) be a complete fuzzy metric space with the condition (FM6)&Let S &T be continuous mappings of X in X, then S & T have common fixed point in X if there exist a continuous mapping A of X into S(X)∩T(X) which commutes with S & T and

$$M(Ax, Ay, qt) \ge \min\{M(Sx, Ay, t), M(Tx, Ax, t), M(Ty, Ax, t)\}$$

(3.1.1)

for all$x, y, z \in X, t > 0$ & $0 < q < 1$.Then S , T& A have a unique common fixed point.

Proof: we define sequences $\{x_n\}$ such that $Ax_{2n} = Sx_{2n-1}$ and $Ax_{2n-1} = STx_{2n}$, n =1 ,2, ..

We shall prove that$\{Ax_n\}$ is a Cauchy sequence. For this suppose $x = x_{2n}$ & $y = x_{2n+1}$ in (3.1.1), we write

$$M(Ax_{2n}, Ax_{2n+1}, qt) \ge \min\begin{Bmatrix} M(Sx_{2n}, Ax_{2n+1}, t), \\ M(Tx_{2n}, Ax_{2n}, t), \\ M(Tx_{2n+1}, Ax_{2n}, t) \end{Bmatrix}$$

$$\ge \min\begin{Bmatrix} M(Ax_{2n+1}, Ax_{2n+1}, t), \\ M(Ax_{2n-1}, Ax_{2n}, t), \\ M(Ax_{2n}, Ax_{2n}, t) \end{Bmatrix}$$

$$\ge M(Ax_{2n-1}, Ax_{2n}, t)$$

$$\ge M(Ax_{2n-1}, Ax_{2n}, t/q)$$

Therefore $M(Ax_{2n}, Ax_{2n+1}, qt) \geq M(Ax_{2n-1}, Ax_{2n}, t/q)$

By induction

$M(Ax_{2k}, Ax_{2m+1}, qt) \geq M(Ax_{2k-1}, Ax_{2m}, t/q)$

For every k and m in N. further if $2m+1 > 2k$ then

$M(Ax_{2k}, Ax_{2m+1}, qt) \geq M(Ax_{2k-1}, Ax_{2m}, t/q)$

$\geq$

…

$\geq M(Ax_0, Ax_{2m+1-2k}, t/q^{2k})$

(3.1.2)

If $2k > 2m+1$ then

$M(Ax_{2k}, Ax_{2m+1}, qt) \geq M(Ax_{2k-1}, Ax_{2m}, t/q)$

$\geq$

.....

$\geq M(Ax_{2k-(2m+1)}, Ax_0, t/q^{2m+1})$ (3.1.3)

By simple induction with (3.1.2) & (3.1.3) we have

$M(Ax_n, Ax_{n+p}, qt) \geq M(Ax_0, Ax_p, t/q^n)$

For $n = 2k$, $p = 2m+1$ & by (FM-4)

$M(Ax_n, Ax_{n+p}, qt)$

$\geq M(Ax_0, Ax_1, t/2q^n) * M(Ax_1, Ax_p, t/2q^n)$ 3.1.4)

If $n = 2k$, $p = 2m$ or $n = 2k+1$, $p = 2m$, for every positive integer p & n in N, by noting that $M(Ax_0, Ax_p, t/q^n) \to 1$ as $n \to \infty$.

Thus$\{Ax_n\}$ is a Cauchy sequence. Since the space X is complete, there exist $z = \lim_{n\to\infty} Ax_n$ &

$z = \lim_{n\to\infty} Sx_{2n-1} = \lim_{n\to\infty} Tx_{2n}$

It follows that $Az = Sz = Tz$ &

$M(Az, A^2z, qt) \geq M(Az, AAz, qt)$

$\geq \min\{M(Sz, AAz, t), M(Tz, Az, t), M(TAz, Az, t)\}$

$\geq \min\{M(Sz, ATz, t), M(Az, Az, t), M(ATz, Az, t)\}$

$\geq \min\{M(Sz, ATz, t), M(Az, Az, t), M(ATz, Sz, t)\}$

$\geq M(Sz, ATz, t)$

$\geq M(Sz, AAz, t)$

$\geq M(Az, A^2z, t)$

.....

$\geq M(Az, A^2z, t/q^n)$

Since $\lim_{n\to\infty} M(Az, A^2z, t/2q^n) = 1$ so $Az = A^2z$

Thus z is common fixed point of A, S & T.

For uniqueness, let w (w ≠ z) be another common fixed point of S, T & A. by (3.1.1) we write

$M(Az, Aw, qt) \geq \min\{M(Sz, Aw, t), M(Tz, Az, t), M(Tw, Az, t)\}$

This implies $M(z, w, qt) \geq M(z, w, t)$

Therefore by lemma 2.3, we write z = w. This completes the proof of the theorem 3.1

Now we prove theorem for fuzzy 2 metric spaces.

Theorem 3.2: Let(X, M, *) be a complete fuzzy 2-metric space & Let S &T be continuous mappings of X in X, then S & T have common fixed point in X if there exist a continuous mapping A of X into S(X)∩T(X) which commutes with S & T and

$$M(Ax, Ay, a, qt) \geq \min\begin{Bmatrix} M(Sx, Ay, a, t), M(Tx, Ax, a, t), \\ M(Ty, Ax, a, t) \end{Bmatrix}$$

(3.2.1)

for all$x, y, a \in X, t > 0 \& 0 < q < 1$.

$\lim_{t\to\infty} M(x, y, z, t) = 1$ for all$x, y, z \in X$.

(3.2.2)

Then S, T& A have a unique common fixed point.

Proof: we define sequences $\{x_n\}$ such that

$Ax_{2n} = Sx_{2n-1}$ and $Ax_{2n-1} = STx_{2n}$, n =1 ,2, ..

We shall prove that$\{Ax_n\}$ is a Cauchy sequence. For this suppose $x = x_{2n}$ & $y = x_{2n+1}$ in (3.2.1), we write

$$M(Ax_{2n}, Ax_{2n+1}, a, qt) \geq \min\begin{Bmatrix} M(Sx_{2n}, Ax_{2n+1}, a, t), \\ M(Tx_{2n}, Ax_{2n}, a, t), \\ M(Tx_{2n+1}, Ax_{2n}, a, t) \end{Bmatrix}$$

$$\geq \min\begin{Bmatrix} M(Ax_{2n+1}, Ax_{2n+1}, a, t), \\ M(Ax_{2n-1}, Ax_{2n}, a, t), \\ M(Ax_{2n}, Ax_{2n}, a, t) \end{Bmatrix}$$

$\geq M(Ax_{2n-1}, Ax_{2n}, a, t)$

$\geq M(Ax_{2n-1}, Ax_{2n}, a, t/q)$

Therefore

$M(Ax_{2n}, Ax_{2n+1}, a, qt) \geq M(Ax_{2n-1}, Ax_{2n}, a, t/q)$

By induction

$M(Ax_{2k}, Ax_{2m+1}, a, qt) \geq M(Ax_{2k-1}, Ax_{2m}, a, t/q)$

For every k and m in N. Further if $2m+1 > 2k$ then

$M(Ax_{2k}, Ax_{2m+1}, a, qt) \geq M(Ax_{2k-1}, Ax_{2m}, a, t/q)$

$\geq ...$

$\geq M(Ax_0, Ax_{2m+1-2k}, a, t/q^{2k})$

… 3.2.3)

If $2k > 2m+1$ then

$M(Ax_{2k}, Ax_{2m+1}, a, qt) \geq M(Ax_{2k-1}, Ax_{2m}, a, t/q)$

....

$\geq M(Ax_{2k-(2m+1)}, Ax_0, a, t/q^{2m+1})$

(3.2.4)

By simple induction with (3.2.3) & (3.2.4) we have

$M(Ax_n, Ax_{n+p}, a, qt) \geq M(Ax_0, Ax_p, a, t/q^n)$

For $n = 2k$, $p = 2m+1$ & by (FM-4)

$M(Ax_n, Ax_{n+p}, a, qt) \geq M(Ax_0, Ax_p, Ax_1, a, t/3q^n)$

$* M(Ax_0, Ax_1, a, t/3q^n)$

$* M(Ax_1, Ax_p, a, t/3q^n)$ (3.2.5)

If $n=2k$, $p=2m$ or $n=2k+1$, $p=2m$, for every positive integer p & n in N, by noting that $M\left(Ax_0, Ax_p, a, t/q^n\right)\to 1$ as $n\to\infty$.

Thus $\{Ax_n\}$ is a Cauchy sequence. Since the space X is complete, there exists

$z=\lim_{n\to\infty} Ax_n$ & $z=\lim_{n\to\infty} Sx_{2n-1}=\lim_{n\to\infty} Tx_{2n}$

It follows that $Az=Sz=Tz$ &

$$\begin{aligned}
&M\left(Az, A^2z, a, qt\right)\\
&\geq M\left(Az, AAz, a, qt\right)\\
&\geq \min\left\{M\left(Sz, AAz, a, t\right), M\left(Tz, Az, a, t\right), M\left(TAz, Az, a, t\right)\right\}\\
&\geq \min\left\{M\left(Sz, ATz, a, t\right), M\left(Az, Az, a, t\right), M\left(ATz, Az, a, t\right)\right\}\\
&\geq \min\left\{M\left(Sz, ATz, a, t\right), M\left(Az, Az, a, t\right), M\left(ATz, Sz, a, t\right)\right\}\\
&\geq M\left(Sz, ATz, a, t\right)\\
&\geq M\left(Sz, AAz, a, t\right)\\
&\geq M\left(Az, A^2z, a, t\right)\\
&\text{.....}\\
&\geq M\left(Az, A^2z, a, t/q^n\right)
\end{aligned}$$

Since $\lim_{n\to\infty} M\left(Az, A^2z, a, t/q^n\right)=1$ so $Az=A^2z$

Thus z is common fixed point of A, S & T.

For uniqueness, let w (w ≠ z) be another common fixed point of S, T & A. by (3.2.1) we write

$M\left(Az, Aw, a, qt\right)\geq \min\left\{M\left(Sz, Aw, a, t\right), M\left(Tz, Az, a, t\right), M\left(Tw, Az, a, t\right)\right\}$

This implies $M\left(z, w, a, qt\right)\geq M\left(z, w, a, t\right)$

Therefore by lemma 2.3, we write z = w. This completes the proof of the theorem 3.2

Now we prove theorem 3.1 for fuzzy 3 metric spaces.

Theorem 3.3: Let(X, M, *) be a complete fuzzy 3-metric space & Let S &T be continuous mappings of X in X, then S & T have common fixed point in X if there exist a continuous mapping A of X into S(X)⋂T(X) which commutes with S & T and

$$M\left(Ax, Ay, a, b, qt\right)\geq \min\begin{Bmatrix} M\left(Sx, Ay, a, b, t\right),\\ M\left(Tx, Ax, a, b, t\right),\\ M\left(Ty, Ax, a, b, t\right)\end{Bmatrix} \qquad (3.3.1)$$

for all $x, y, a, b \in X, t>0 \& 0<q<1$.

$\lim_{t\to\infty} M(x, y, z, w, t)=1$ for all $x, y, z, w \in X$. (3.3.2)

Then S, T& A have a unique common fixed point.

Proof: we define sequences $\{x_n\}$ such that

$Ax_{2n}=Sx_{2n-1}$ and $Ax_{2n-1}=STx_{2n}$, n =1 ,2, ..

We shall prove that $\{Ax_n\}$ is a Cauchy sequence. For this suppose $x=x_{2n}$ & $y=x_{2n+1}$ in (3.3.1), we write

$$M\left(Ax_{2n}, Ax_{2n+1}, a, b, qt\right)\geq \min\begin{Bmatrix} M\left(Sx_{2n}, Ax_{2n+1}, a, b, t\right),\\ M\left(Tx_{2n}, Ax_{2n}, a, b, t\right),\\ M\left(Tx_{2n+1}, Ax_{2n}, a, b, t\right)\end{Bmatrix}$$

$$\begin{aligned}
&\geq \min\begin{Bmatrix} M\left(Ax_{2n+1}, Ax_{2n+1}, a, b, t\right),\\ M\left(Ax_{2n-1}, Ax_{2n}, a, b, t\right),\\ M\left(Ax_{2n}, Ax_{2n}, a, b, t\right)\end{Bmatrix}\\
&\geq M\left(Ax_{2n-1}, Ax_{2n}, a, b, t\right)\\
&\geq M\left(Ax_{2n-1}, Ax_{2n}, a, b, t/q\right)
\end{aligned}$$

Therefore

$M\left(Ax_{2n}, Ax_{2n+1}, a, b, qt\right)\geq M\left(Ax_{2n-1}, Ax_{2n}, a, b, t/q\right)$

By induction

$M\left(Ax_{2k}, Ax_{2m+1}, a, b, qt\right)\geq M\left(Ax_{2k-1}, Ax_{2m}, a, b, t/q\right)$

For every k and m in N. Further if $2m+1>2k$ then

$$\begin{aligned}
&M\left(Ax_{2k}, Ax_{2m+1}, a, b, qt\right)\geq M\left(Ax_{2k-1}, Ax_{2m}, a, b, t/q\right)\\
&\text{...}\\
&\geq M\left(Ax_0, Ax_{2m+1-2k}, a, b, t/q^{2k}\right)
\end{aligned}$$

(3.3.3)

If $2k>2m+1$ then

$$\begin{aligned}
&M\left(Ax_{2k}, Ax_{2m+1}, a, b, qt\right)\geq M\left(Ax_{2k-1}, Ax_{2m}, a, b, t/q\right)\\
&\text{...}\\
&\geq M\left(Ax_{2k-(2m+1)}, Ax_0, a, b, t/q^{2m+1}\right)
\end{aligned} \qquad (3.3.4)$$

By simple induction with (3.3.3) & (3.3.4) we have

$M\left(Ax_n, Ax_{n+p}, a, b, qt\right)\geq M\left(Ax_0, Ax_p, a, b, t/q^n\right)$

For $n=2k$, $p=2m+1$ & by (FM-4)

$$\begin{aligned}
&M\left(Ax_n, Ax_{n+p}, a, b, qt\right)\\
&\geq M\left(Ax_0, Ax_p, a, Ax_1, t/4q^n\right)\\
&* M\left(Ax_0, Ax_p, Ax_1, b, t/4q^n\right)\\
&* M\left(Ax_0, Ax_1, a, b, t/4q^n\right)\\
&* M\left(Ax_1, Ax_p, a, b, t/4q^n\right)
\end{aligned} \qquad (3.3.5)$$

If $n=2k$, $p=2m$ or $n=2k+1$, $p=2m$, for every positive integer p & n in N, by noting that $M\left(Ax_0, Ax_p, a, b, t/q^n\right)\to 1$ as $n\to\infty$.

Thus $\{Ax_n\}$ is a Cauchy sequence. Since the space X is complete, there exists

$z=\lim_{n\to\infty} Ax_n$ & $z=\lim_{n\to\infty} Sx_{2n-1}=\lim_{n\to\infty} Tx_{2n}$

It follows that $Az=Sz=Tz$ &

$$\begin{aligned}
&M\left(Az, A^2z, a, b, qt\right)\\
&\geq M\left(Az, AAz, a, b, qt\right)\\
&\geq \min\begin{Bmatrix} M\left(Sz, AAz, a, b, t\right), M\left(Tz, Az, a, b, t\right),\\ M\left(TAz, Az, a, b, t\right)\end{Bmatrix}\\
&\geq \min\begin{Bmatrix} M\left(Sz, ATz, a, b, t\right), M\left(Az, Az, a, b, t\right),\\ M\left(ATz, Az, a, b, t\right)\end{Bmatrix}
\end{aligned}$$

$$\geq \min\begin{Bmatrix} M(Sz, ATz, a, b, t), M(Az, Az, a, b, t), \\ M(ATz, Sz, a, b, t) \end{Bmatrix}$$

$$\geq M(Sz, ATz, a, b, t)$$

$$\geq M(Sz, AAz, a, b, t)$$

$$\geq M(Az, A^2z, a, b, t)$$

.....

$$\geq M(Az, A^2z, a, b, t/q^n)$$

Since $\lim_{n\to\infty} M(Az, A^2z, a, b, t/q^n) = 1$ so $Az = A^2z$

Thus z is common fixed point of A, S & T.

For uniqueness, let w ($w \neq z$) be another common fixed point of S, T & A. By (3.3.1) we write

$$M(Az, Aw, a, b, qt) \geq \min\{M(Sz, Aw, a, b, t), M(Tz, Az, a, b, t), M(Tw, Az, a, b, t)\}$$

This implies $M(z, w, a, b, qt) \geq M(z, w, a, b, t)$

Therefore by lemma 2.3, we write z = w. This completes the proof of the theorem 3.3.

REFERENCES

[1] Badard, R.: Fixed point theorems for fuzzy numbers, Fuzzy sets and systems, 13, 291– 302 (1984).

[2] Bose, B.K., Sahani, D.: Fuzzy mappings and fixed point theorems, Fuzzy Sets and Systems, 21, 53–58 (1987).

[3] Butnariu, D.: Fixed point for fuzzy mappings, Fuzzy Sets and Systems, 7, 191–207 (1982).

[4] Chang, S.S.: Fixed point theorems for fuzzy mappings, Fuzzy Sets and Systems, 17,181–187 (1985).

[5] Chang, S.S., Cho, Y.J., Lee, B.S., Lee, G.M.: Fixed degree and fixed point theorems for fuzzy mappings, Fuzzy Sets and Systems, 87(3), 325–334 (1997).

[6] Chang, S.S., Cho, Y.J., Lee, B.S., Jung, J.S., Kang, S.M.: Coincidence point and minimization theorems in fuzzy metric spaces, Fuzzy Sets and Systems, 88(1), 119–128 (1997).

[7] Cho, Y.J.: Fixed points in fuzzy metric spaces, J. Fuzzy Math., Vol. 5 No. 4, 949–962 (1997).

[8] Deng, Z.: Fuzzy pseudo-metric space, J. Math. Anal. Appl., 86, 74–95 (1982).

[9] Ekland, I., Ga¨hler, S.: Basic notions for fuzzy topology, Fuzzy Sets and Systems, 26,333–356 (1988).

[10] Erceg, M.A.: Metric space in fuzzy set theory, J. Math. Anal. Appl., 69, 205–230 (1979).

[11] Fang, J.X.: On fixed point theorems in fuzzy metric spaces, Fuzzy Sets and Systems, 46, 107–113 (1992).

[12] Fisher, B.: Mappings with a common fixed point, Math. Sem. Notes Kobe Univ., Vol.7, 81–84 (1979).

[13] Ga¨hler, S.: 2-metrische Raume and ihretopologische structure, Math. Nachr.,26, 115– 148 (1983).

[14] Ga¨hler, S.: Linear 2-normierte Ra¨ume, Math. Nachr.,28, 1–43 (1964).

[15] Ga¨hler, S.: U¨ ber 2-Banach Raume, Math. Nachr. 42, 335–347 (1969).

[16] George, A., Veeramani, P.: On some results in fuzzy metric spaces, Fuzzy Sets and Systems, 64, 395–399 1994).

[17] Grabiec, M.: Fixed points in fuzzy metric space, Fuzzy Sets and Systems, 27, 385–389 (1988).

[18] Hu, C.: Fuzzy topological space, J. Math. Anal. Appl., 110, 141–178 (1985).

[19] Heilpern, S.: Fuzzy mappings and fixed point theorems, J. Math. Anal. Appl., 83, 566–569 (1981).

[20] Hadzic, O.: Fixed point theorems for multi-valued mappings in some classes of fuzzy metric spaces, Fuzzy Sets and Systems, 29, 115–125 (1989).

[21] Jung, J.S., Cho, Y.J., Kim, J.K.: Minimization theorems for fixed point theorems in fuzzy metric spaces and applications, Fuzzy Sets and Systems, 61, 199–207 (1994).

[22] Jung, J.S., Cho, Y.J., Chang, S.S., Kang, S.M.: Coincidence theorems for set-valued mappoings and Ekland'svariational principle in fuzzy metric spaces, Fuzzy Sets and Systems, 79, 239–250 (1996).

[23] Kaleva, O., Seikkala, S.: On fuzzy metric spaces, Fuzzy Sets and Systems, 12, 215–229 (1984).

[24] Kaleva, O.: The completion of fuzzy metric spaces, J. Math. Anal. Appl., 109, 194–198 (1985).

[25] Kramosil, I., Michalek, J.: Fuzzy metric and statistical metric spaces, Kybernetica, 11,326–334 (1975).

[26] Lee, B.S., Cho, Y.J., Jung, J.S.: Fixed point theorems for fuzzy mappings and applications,Comm. Korean Math. Sci., 11, 89–108 (1966).

[27] Mishra, S.N., Sharma, N., Singh, S.L.: Common fixed points of maps on fuzzy metric spaces, Internet. J. Math. & Math. Sci., 17, 253–258 (1994).

[28] Schweizer, B., Sklar, A.: Statistical metric spaces, Pacific Journal Math., 10, 313–334 (1960).

[29] Sharma, P.L., Sharma, B.K., Iseki, K.: Contractive type mapping on 2-metric space,Math. Japonica, 21, 67–70 (1976).

[30] Wenzhi, Z.: Probabilistic 2-metric spaces, J. Math. Research Expo.,2, 241–245 (1987).

[31] Zadeh, L.A.: Fuzzy Sets, Inform. and Control, 8, 338–353 (1965).

[32] Sushil Sharma, On Fuzzy Metric Space, Southeast Asian Bulletin of Mathematics (2002) 26: 133–145.

Design of Stretcher Which Automatically Adjust To Horizontal Position While Moving Along Elevation

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ABSTRACT
In this approach we went on in search of a stretcher which can adjust the top to maintain the horizontal position all the time and wheels of stretcher should be made efficient to ease the handling. In this we are demonstrating clearly the design of stretcher which can adjust its top while moving along the elevation. For this the bed of stretcher with lever attachment is connected to D.C. motor. This D.C. motor is connected to the MOSFET. Potentiometer will sense the angle of elevation and send signal to IC, which in turn is connected to MOSFET. According to this signal the D.C. motor adjust the bed to horizontal position.

Keywords: D.C. Motor, Resistors, Capacitors, Transformers, Diode, MOSFET, Bipolar junction transistors, Bridge rectifier, Potentiometer, Worm gear.

I INTRODUCTION

A Stretcher is a Medical Device used to carry casualties or an incapacited person from one place to another It is a simple type of lifter, and still called by the name in some cases. A stretcher is usually moved by two people, one at the head and the other at the feet. The casualty is placed on the stretcher and can then be carried or wheeled away. Stretchers are used if a person is unable to walk by themselves or if other requirements mean a "stair chair" (wheel chair), or similar device can be used. Most modern civilian stretcher includes straps to avoid further injury to the patient. The casualty must be lifted (scoop) to be put on the stretcher. This lifting can be made manually, but it is also possible to use specific devices. These devices can also be used as stretchers, but only for short distances. A long spine board can be used to scoop and carry the victim to the stretcher, in case a spine trauma is suspected, the victim is left on the board and tied to it and the board is simply put on the stretcher. The spine and overall immobilization can also be performed by a vacuum mattresses put on the stretcher. When there is no suspicion of spine trauma, the vacuum mattresses can be used as a stretcher (it has handles), which is best in narrow places when the stretcher cannot be kept horizontal. It is more secure and comfortable than strapping the casualty to the stretcher. Some lifting devices are as stressful as manual lifting. Equipments need to be evaluated for ergonomics as well as user acceptance.

II FUNCTIONS OF MAIN PARTS

The details of main parts that are used here are shown in the table below:

Table 1
Function of various parts

SL NO	DESCRIPTION OF PARTS	FUNCTIONS
1	D.C. Motor	Uses electrical energy to produce mechanical energy.
2	Resistors	Two terminal electronic components that produces a voltage across its terminal.
3	Capacitors	Stores electricity or electrical energy.
4	Printed Circuit Board	Mechanically supports and electrically connects electronic components using conductive tracks, pads and other features etched from copper sheets laminated onto a non-conductive substrate.
5	Transformers	Transfers alternating (AC) electric energy from one circuit into another through electromagnetic induction.
6	Diode	Two terminal electronic component which conducts electric current in only one direction.
7	MOSFET	(MOSFET) is a transistor used for amplifying or switching electronic signals.
8	Bipolar junction transistors	It is a type of transistor that relies on the

		contact of two types of semiconductor for its operation. BJTs can be used as amplifiers, switches, or in oscillators. BJTs can be found either as individual discrete components, or in large numbers as parts of integrated circuits.
9	Bridge rectifier	Bridge rectifier is an electronic component which converts an input AC current in to a DC current as an output.
10	Integrated circuits	The function of an integrated circuit (IC) is to be a single component that can perform high-level tasks such as amplification, signal processing, or even sophisticated digital calculations as in the case of microprocessors.
11	Thyristors	They act exclusively as bitable switches, conducting when their gate receives a current trigger, and continue to conduct while they are forward biased (that is, while the voltage across the device is not reversed).
12	Potentiometer	A potentiometer is a resistor composed of three terminals and a voltage divider, and is typically used to control electrical devices.
13	Worm gear	It reduces rotational speed or allows higher torque to be transmitted.
14	Micro switch	A micro switch is an electrical switch which can be operated using a very small force and also possibly using a small movement.

III SPECIFICATIONS

Resistors	R1, R15 = 100 KΩ R2, R7, R10, R11, R12, R13 = 10 KΩ R3, R9, R14 = 47 KΩ R4 = 220KΩ R5 = 470KΩ R6 =33KΩ R8 =12 KΩ
Capacitor	C1 =10 nF C2 =100/63 nF C3 =100 nF
Diodes	D1, D2 = 1N4148 D3 = 1N4004
Bipolar Junction Transistor	Q1, Q2 = BC547 Q3, Q5 = IRF4905 Q4, Q6 = IRFZ44
Integrated Circuit	IC = LM 324
Potentiometer	P1 =100K
Motor	M =500 rpm

Photos

Fig:1 Test Model

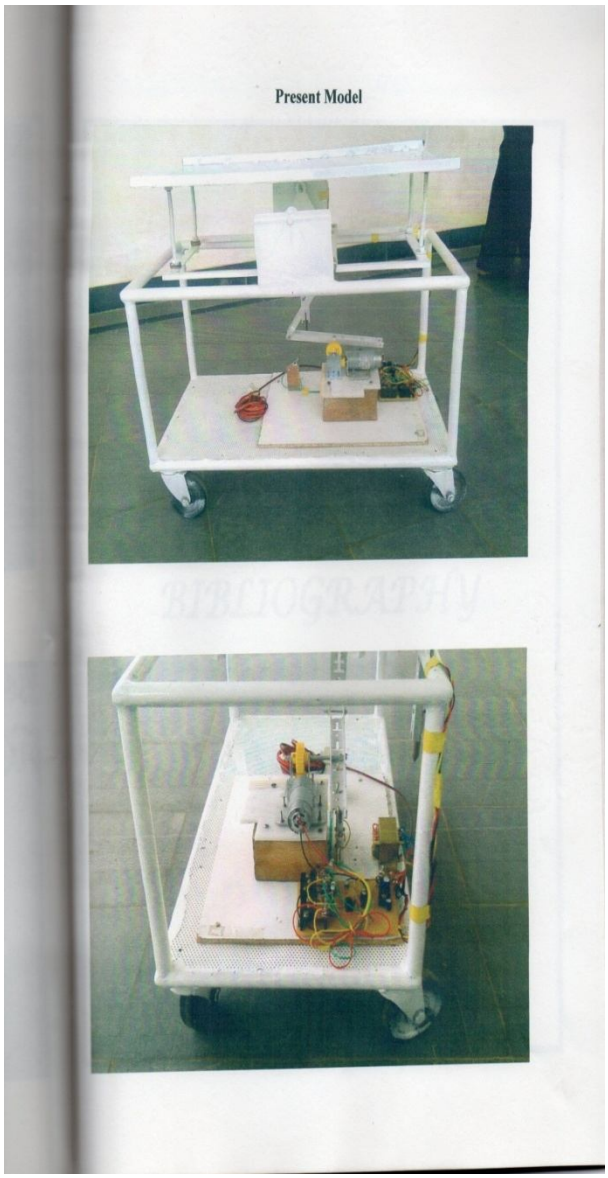

Fig:2 Present Model

IV CONCLUSION AND FUTURE SUGGESTION

We conclude that the project gives a small contribution to solve the present situation of a patient in hospital by replacing a normal stretcher by automatic level adjusting stretcher. It is a prototype and when it is tuned to the real world it would find a very wide implementation. This type of equipment could be installed in any type of hospitals.

In this work we are using both mechanical and electronic linkages. Hence we get accurate adjustment of stretcher to horizontal position.

The development of this type of stretcher play an important role, as it provides high degree of comfort to patient and also it can be easily moved without any disturbance.

As all of us know I design is an iterative process, even the stretcher can be designed/features to more sophisticated and advanced to increase the comfortness and patient safety.

REFERENCES

[1] Design Data Hand book by Dr K Lingaiah Mcgraw Hill , 2nd Edition. 2003.

[2] Mechanical Engineering Design by Joseph E. Shigley and Charles R. Michke.McGraw Hill international , 6th Edition ,2003.

[3] Design of Machine elements II by J . B .K. Das and P.L .Srinivasa Murthy, Sapna book house publications, 2007.

[4] Basic Electronics Solid state by B.L. Theraja , S Chanda publications,2000.

[5] Linear IC's and Applications by U.A Bakshi and A.P. Godse, Technical publications Pune, 2008.

[6] Mechatronics by W. Bolton, longman, 2nd Edition, Pearson Publications, 2007.

[7] Mechatronics principles, Concepts and Applications by Nitaigour and premchands Mahilik, Tata McGraw Hill ,2003.

[8] Introduction to Mechatronics and measurement System, david G. Aliciatore and Michael. B. Bihistaned, Tata McGraw hill, 2000.

[9] Product Design And manufacturing, A.C Chitale and R.C Gupta,PHI 4th Edition,2007.

[10] Power Electronics by M.H Rashid 3rd edition PHI/ Pearson Publications, 2004.

[11] Power Electronics by M.D Sing and Kanchandani K.B. TMH Publishers 2nd Edition, 2007.

[12] Digital Switching Systems by Syed R. Ali, TMH Publications, 2nd Edition, 2002.

A Comparative Study of Various Election Algorithms with Election Administration Approach for Distributed System

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ABSTRACT
In distributed computing systems when coordinator node fails the other nodes of the system need to elect another leader or coordinator to run the system smoothly. The bully algorithm is a classical approach for electing a leader in a distributed computing system. The improvement of the bully algorithm and other modify algorithms requiring less time complexity and minimum message passing over network. The performance analysis of bully and other modify election algorithm with our new proposed algorithm election administration would be appropriate to determine which algorithm performs better than the others. This paper represents the normal case of election in which we compare and discuss our approach with original bully algorithm and existing modified versions of bully algorithm.

Keywords: Election algorithm, Election administration, Distributed computing, failure, lowest priority, best case, detects, coordinator, worst case.

I INTRODUCTION

A distributed computing system is a collection of independent processors or node interconnected by a communication network. When a node fails it is often necessary to recognize the active nodes so that they continue to perform a useful task for their common goal. After the failure occurs in a distributed computing system the first step is to elect a coordinator node to manage the operation[1]. A process or node is used to coordinate many tasks. It is not an issue which process is doing the task, but there must be a coordinator that will work at any time. So electing a coordinator or a leader is very fundamental issue in distributed computing. There are many algorithms that are used in election process. Bully election algorithm is one of them. This works represents a modified version of bully algorithm using a new concept Election Administration. This approach will not only reduce redundant elections but also minimize total number of elections and hence it will minimize message passing, network traffic, and complexity of the existing system. In section 2 represents motivation and need of election algorithm section 3 objectives of study, section 4 represents objectives of study section 5 represents election administration approach, section 6 represents procedure of election, section 7 represents comparison and discussion of election administration with various election algorithm in normal case , section future work finally section 9 conclude the paper.

II MOTIVATION AND NEED OF ELECTION ALGORITHM

In distributed systems that involve multiple processes often utilize critical regions. When a process has to read or update certain shared structures it enters a critical section, performs its operation and leaves the critical section. We use special constructs to serialize access to critical sections (semaphores, monitors). These techniques do not support distributed systems because there is no single shared memory image. We need new techniques to achieve mutual exclusion. There are many algorithm used for distributed mutual exclusion. The main points to consider when evaluating of these algorithms are:

(a) What happens when messages are lost?
(b) What happens when a process or node crashes?

None of the algorithms have described to tolerate the loss of messages, process or node crashes. An algorithm for choosing a unique process to play a particular role is called an election algorithm. An election algorithm is needed for this choice.

III OBJECTIVES OF STUDY

The objects of study:

(a) To design a new Election Administration Approach to elect new coordinator for distributed system.

(b) To analysis of the Election Administration Approach.

(c) To compare Election Administration Approach with Bully Election Algorithm and different modify election algorithm.

IV LITERATURE REVIEW

Bully algorithm is one of the most famous election Algorithms which was proposed by Garcia-Molina in 1982. When a process P determines that the current coordinator is crashed because of message timeouts or failure of the coordinator to initiate a handshake, it executes bully election algorithm using the following sequence of actions[2]:

Step I. Process p sends an election message to all higher-numbered processes in the system. If no process responds then p becomes the coordinator. It wins the election and sends a coordinator message to all alive processes as shown in Fig.1.1 (a). Process 4 detects coordinator is failed and holds an election.

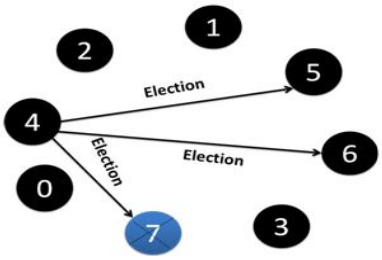


Fig.1.1 (a) Hold an Election

Step II. Process 5 and 6 respond to 4 to stop election they have higher priority than process 4as shown in Fig. 1.1(b).

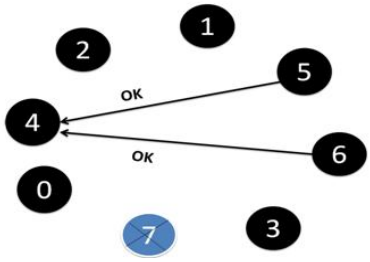


Fig. 1.2(b) Respond To Stop Election

Step III. Each of 5 and 6 process holds election now as shown in Fig.1.1(c). Process 6 responds to 5 to stop election.

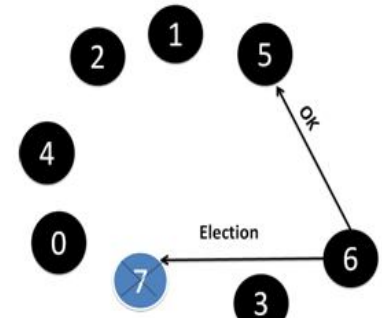


Fig.1.1(c) Election Message

Step V. The winner or new coordinator sends a message to other processes announcing itself as the new coordinator as shown in Fig. 1.1(d).

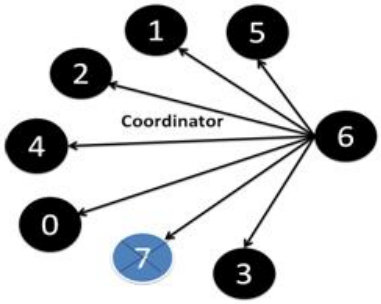


Fig.1.1(d) Coordinator Message

Immediately after the recovery of the crashed process is up, it runs bully algorithm. Bully algorithm has following limitations:

(a) The main limitation of bully algorithm is the highest number of message passing during the election and it has order $O(N^2)$ which increases the network traffic.

(b) As there is no guarantee on message delivery two processes may declare themselves as a coordinator at the same time.

(c) If the coordinator is running unusually slowly (say system is not working properly for some reasons) or the link between a process and a coordinator is broken for some reasons, any other process may fail to detect the coordinator and initiates an election. But the coordinator is up, so in this case it is a redundant election.

(d) Failure Detector is Unreliable Kordafshari et al. discussed the drawback of synchronous Garcia Molina's Bully Algorithm and modified it with an optimal message algorithm. They showed that their algorithm is more efficient than Garcia Molina's Bully algorithm, because of fewer message passing and fewer stages. Modified Bully algorithm by M.S. Kordafshari use following election process:

Step I. Process 2 detects coordinator process 6 is failed and holds an election by sending a election message to all the process who has higher priority than her as shown in Fig.1.2 (a).

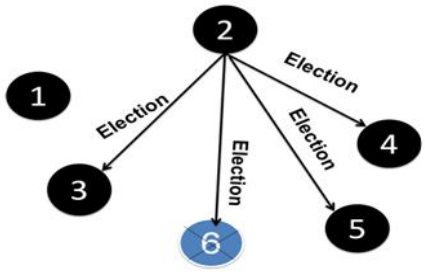


Fig.1.2(a) Hold a Election

Step II. Process 3, 4 and 5 respond with their process number as shown in the below Fig.4.2 (b).

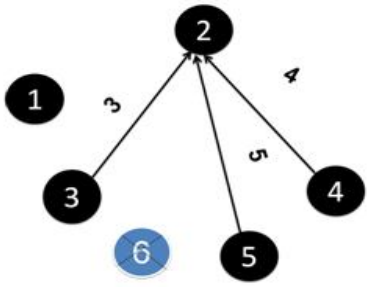


Fig.1.2 (b) Process Respond

Step III. Process 2 selects highest process number 5 and sends a grant message to 5 that means process 5 must be next leader as shown in Fig. 1.2(c).

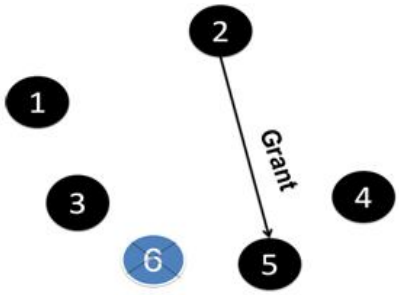


Fig.1.2(c) Grant Message

Step IV. Process 5 sends coordinator message to all processes coordinator will win again. This algorithm has following drawbacks.

(a) If a process p crashes after sending ELECTION message to higher processes or crashes after receiving priority number from higher processes, higher processes will wait for 3D (D is average propagation delay) time for coordinator broadcasting and if they do not receive any coordinator message, they will initiate modified algorithm again . If there are q different higher processes, then there will be q different individual instance of modified algorithm at that moment in the system. Those are redundant election[3].

(b) If process p sends GRANT message to the process with the highest priority number, and p does not receive COORDINATOR message from that process with in D time, p will repeats the algorithm, which is redundant election. As after any process with higher priority number compare to coordinator is up, it runs the algorithm, it increases redundant elections.

(c) Every redundant election takes resources, increases total message passing and increases network traffics.

Kabir Mamun et al. described an efficient version Bully algorithm to minimize redundancy in electing the coordinator and to reduce the recovery problem of a crashed process[4]. The operation of this algorithm is shown in Fig. 1.3.

Step I. Process 2 is the first one to notice this, so it sends election messages to all the processes higher than it, namely processes 3, 4, 5 and 6, as shown in Fig. 1.3(a).

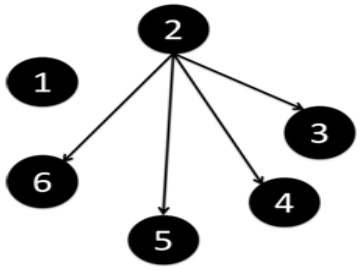


Fig.1.3 (a) Election Message

Step II. Processes 3, 4 and 5 are all response with ok message, as shown in Fig. 4.3(b).

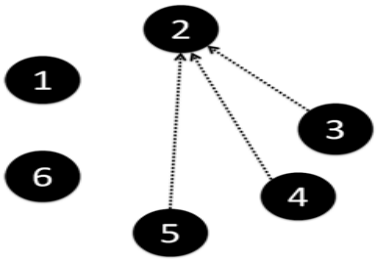


Fig.1.3 (b) Ok Message

Step III. Process 2 now knows who the alive process with highest process number is. So it elects process 5 as the new coordinator and sends coordinator messages to all other processes, as shown in Fig. 1.3 (c). The election is finished at this point. Every process knows process 5 as the new coordinator.

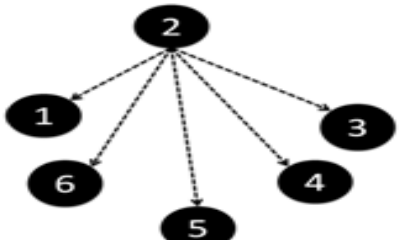


Fig.1.3(c) Coordinator Message

Step IV. Now process 4 has just crashed and process 6 has recovered from failure. As process 6 knows that it is the process with highest process number, it just sends coordinator message to all processes as shown in Fig. 1.3 (d) and becomes the new coordinator.

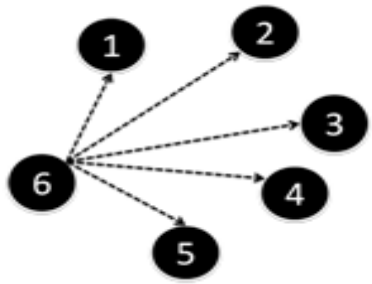


Fig.1.3(d) Coordinator Message

Step V. Suppose process 4 has recovered from failure and sends query messages to process 5 and process 6 instead of holding an election. Process 4 gets answer message from process 5 and process 6 in response of its query message and process 4 comes to know process 6 as the new coordinator.

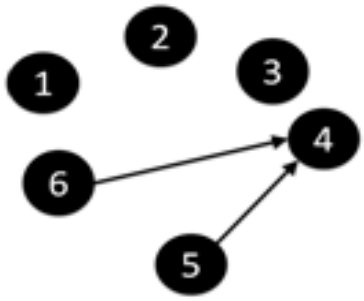


Fig.1.3(e) Answer Message

Although this algorithm reduces redundant election on some extent, it still has some redundant elections and also has high message complexity.

(a) On recovery, it sends query message to all processes with higher process number than it, and all of them will send answer message if they alive. Which increases total number of message passing and hence it increases network traffic.

(b) It does not give guarantee that any process p will receive only one election message from processes with lower process number. As a result there may be q different processes with lower process number can send election message to p and p will send ok message to all of them. This increases number of election and also number of message passing.

(c) It does not give any idea if p will crash after sending an election message to all processes with higher process number.

(d) It also does not give any idea if a process with the highest process number will crash after sending ok message to p.

Enhanced Bully Algorithm by **Md. Golam Murshed and Alastair R. Allen** (2012) proposes some modifications to Garcia-Molina's bully algorithm and the modified bully algorithm[6]. The basic system assumptions are as in, and the types of message used are very similar to the modification proposed in kazi kabir Mamun algorithm. In proposed they are proposing a set division. According to this concept, all the nodes of a synchronous distributed system are divided into two sets: Candidate nodes and Ordinary nodes.

(a) Candidate Nodes - Candidate is consisting of [N/2] nodes, where N is the number of nodes in the system.

(b) Ordinary Nodes - The other nodes will be in Ordinary, such that any node in Candidate has a higher node id than any node in Ordinary.

V ELECTION ADMINISTRATION APPROACH

Analyzing the shortcomings of bully and other modified bully algorithm we purposed a new approach. According to this concept, all the nodes of a synchronous distributed system are divided into two group: admin's and ordinary nodes or process. Admin's is comprised of (20: 1) nodes, where N is the number of nodes in the system. The other nodes will be in Ordinary, such that any node in Admin's has a higher node id than any node in Ordinary[7]. The election Administration architecture as shown in Fig. 1.4 made up with following type of processes: The election administration architecture consist following type of process.

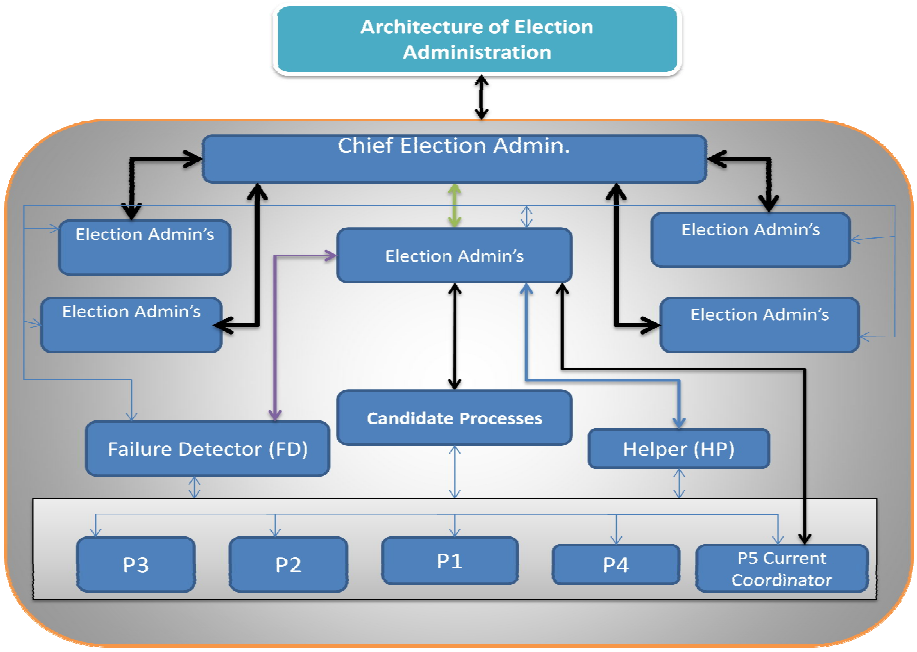


Fig.1.4 Architecture of Election Administration

(a) Chief Election Admin - Chief Election Admin CE_A is the coordinator process of Election Administration. It administrates other Election Admin's and handles F_D and H_P. This body works with one Chief Election Admin (*CEA*) and a few Election admin's. The process with the highest priority in Election Admin's will be the Chief Election Admin.

(b) Election Admin - Election Admin is a member of Election Administration. It is a special kind of process. Election Administration in a distributed system will have a few numbers of Election Admin's. All of them consult with the Chief Election Admin under the rules and regulation while there will be a need of an election. If any of the Admin's failed, Chief Election Administration will recover that admin's immediately and other processes (admin's) do not have concern of that. An Election Admin's has a unique group ID. Other processes in the system communicate with Election Admin's using this group ID.

(c) Ordinary Processes - These are general processes of the distributed system that performs a useful task to achieve a common goal. As we know that the system is synchronized, all these processes agreed to work with a coordinator which is select by the Election Administration. If the current coordinator fails then the process first knows can hold election for current coordinator.

(d) Failure Detector (FD) and Helper (HP) - As a result, if any of the admin's is down, there will be not any problem in election. It has a reliable failure detector (F_D). If maximum message transmission delay is Ttrans and maximum message processing delay is Tprocess then maximum time required to get a reply after sending a message to any process from Election Administration is T = 2Ttrans + Tprocess. If Election Administration does not get any reply from a process within T time, then F_D of Election Administration will report that requested process is down. Election Administration has another component named helper (H_P), the function of H_P is to find out the process with the highest process number using sending alive message. It knows process number of all processes of the system. As the system is synchronous and Election Administration has a failure detector F_D and helper H_P to solve limitations which is mentioned in previous chapter. Our proposed algorithm is briefly described below. There are total five types of message use in our approach for election process.

(i) Election Message. An *election message* is sent to announce an election.

(ii) Verify Message. A *verify message* to the current coordinator.

(iii) Alive Message. An *alive message* to the next highest process number if the current coordinator is fail.

(iv) Coordinator Message. *The Coordinator message* is send to all processes as a new coordinator of the system.

(v) Query Message. A *query message* is send when a crashed process is up. The up process can query to the election admin about the current coordinator.

VI PROCEDURE OF ELECTION

In normal case when a process normally detects the failure of the coordinator process it sends election message to the *EA* and waits for to receive coordinator message. *EA* sends verify message to the current coordinator to be sure about the election and sends alive message to the next highest process number to check either the current highest process is alive or not and gets a reply message. *EA* selects that process new coordinator of the system and sends coordinator message to all processes.

Step 1: The system consists of six processes with process number 1 to 6. Let the current coordinator be process with id 6. Thus process 2 discovers that the coordinator with process id 6 has crashed /failed and so it is the time for an election as shown in Fig.1.5(a). Now Process 2 sends an election message to the E*A* about the current coordinator failure.

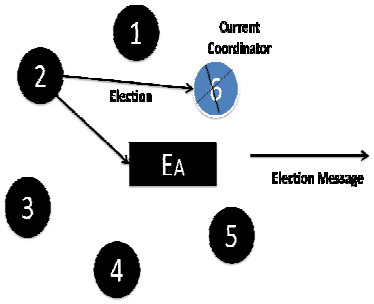


Fig.1.5 (a) Election Message

Step II. *EA* sends verify message to the current coordinator to be sure about the election message sent by process 2. After verification as shown in Fig. 1.5(b).

Step III: *EA* sends alive message to process 5 (the next highest process number) to check either the current highest process is alive or not. And *EA* gets a reply message from *EA* gets a reply message from 5 as shown in Fig.1.5(c). *EA* finds the alive process with highest number using alive message.

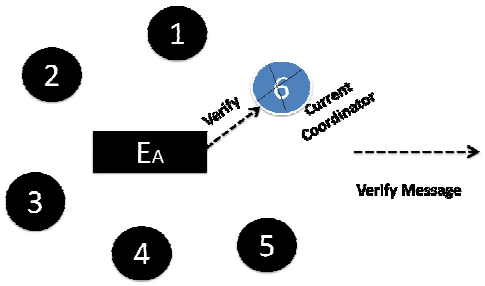


Fig. 1.5(b) Verify Message

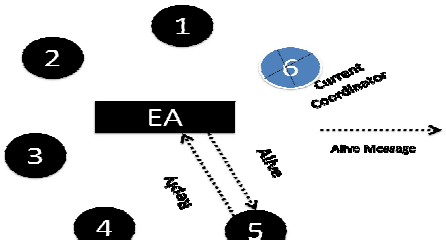
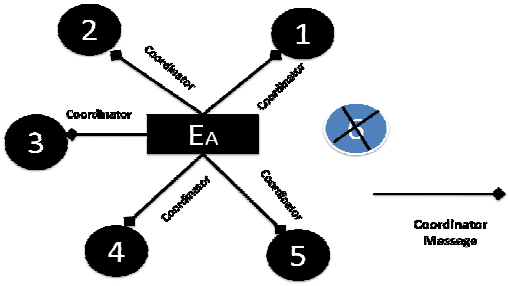


Fig.1.5(c) Alive Message

Step IV: A new message is broadcasted to all the processes informing about the new coordinator. *EA* select 5 as new coordinator and sends coordinator message to all processes having 5 as a new coordinator of the system as shown in Fig.1.5 (d). 1.5 (d) *EA* sends coordinator message to all process having process number of currently won.



1.5 (d) Coordinator Message

In Query After Crash Recovery Case (QCRC) case when a process ordinary recover from failure it send a query message to the *EA*.. If the query processes number is higher than *EA* elect that process as current coordinator and send the coordinator message to all other process of the system. If a process with lower number it sends coordinator message of current coordinator of the system. The following Fig. 1.6(a), (b), (c), (d) and (e) represents the test execution of election administration approach in query after crash recovery case (QCRC).

Step I. The status of last coordinator is failed. Now the last crashed coordinator 6 is up and sends a query message to *EA*. If the last crashed coordinator 6 is up and sends a query message to *EA* as shown in Fig.1.6 (a).

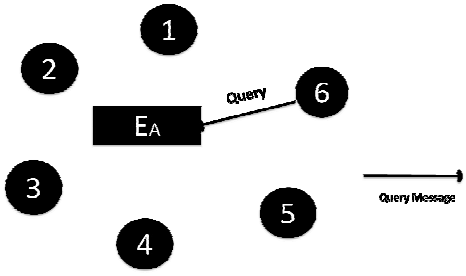


Fig.1.6 (a) Query Message

Step II. As process number of 6 is higher than the current coordinator of the system. The status of the process 6 will be coordinator. *EA* sends coordinator message to all processes with process number 6 as new coordinator [Fig.1.6 (b)].

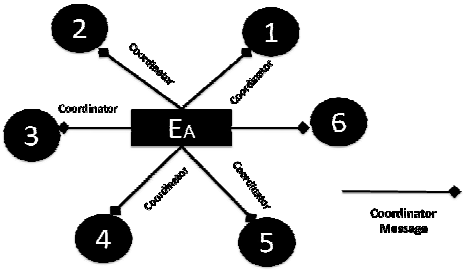


Fig.1.6 (b) Coordinator Message

1.6 (b) *EA* selects 6 as new coordinator and sends coordinator message to all processes.

Step III. Process 1 is now just Crashed [Fig. 1.6(c)].

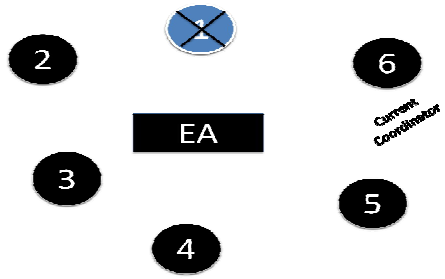


Fig.1.6(c) Crash Node

Step IV. Process 1 is just up after crashed, and it sends a query message to *EA*. *EA* checks that process number of newly entranced is lower than the current coordinator as shown in Fig. 1.6(d). Again process 1 is up and sends query message to *EA*.

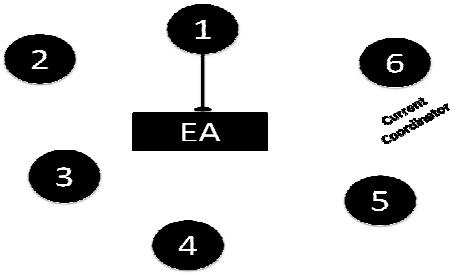


Fig.1.6(d) Query Message

Step V. *EA* sends coordinator message to only process 1 having the process number of current coordinator of the system [Fig. 1.6(e)].

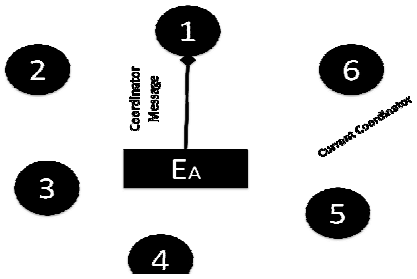


Fig.1.6 (e) Coordinator Message

Fig.1.6 (e) *EA* sends coordinator message to process 1 having the current coordinator.

In concurrent election case (CEC) case when more than one process may detect that the coordinator process has crashed. They will send election message to *EA* After verification will consider election request of the process having higher process number.

Step I. For example there are five processes in the system and the coordinator is process 5. In Fig. 1.7(a-d) represents the test execution of election administration approach in concurrent election case (CEC). Process 4 and 1 detect that coordinator 5 is down.

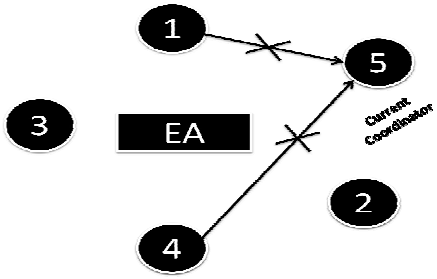


Fig. 1.7(a) Concurrent Process Detect Coordinator Down

Step II. To election a new coordinator 4 and 1 will send election message to *EA* as shown in Fig. 1.7(b).

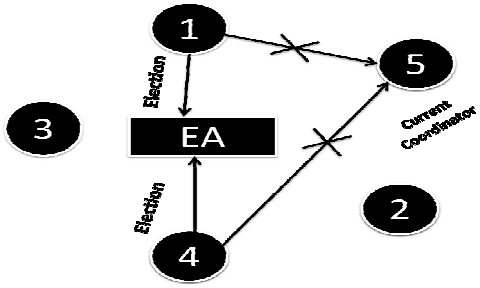


Fig. 1.7 (b). Election Message

Step III. *EA* sends verify message to the current coordinator to be sure about the election message sent by process 2. After verification as shown in Fig. 1.7(c).

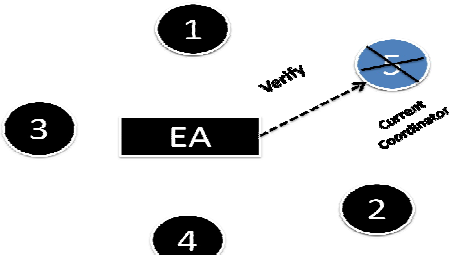


Fig. 1.7(c) Verification Message

Step IV. After verification EA only consider election message of process 4. It ensures less message passing to find out the highest process number. If *EA* considers election message of 1, then according to our algorithm, *EA* will have to send alive message to 4 to find higher process number.

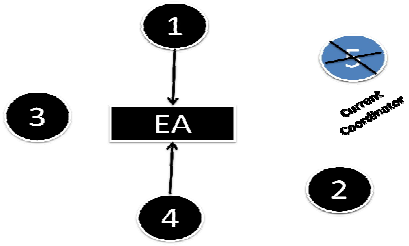


Fig. 1.7(d) Concurrent Process Message

But if *EA* considers election message of 4 it does not need to send alive message because 4 is already the higher process number and *EA* can select 4 as new coordinator. *EA* sends coordinator message to all processes having 4 as a new coordinator of the system as shown in above Fig. 1.7(e). This was *EA* can ensure less message passing.

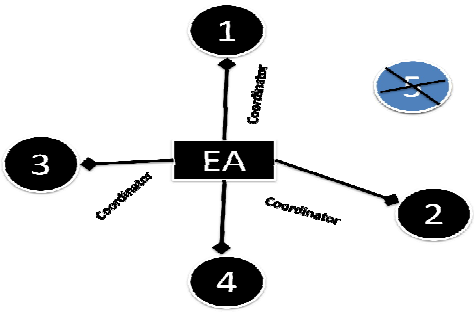


Fig. 1.7(e) Coordinator Message

VII COMPARISON AND DISCUSSION

In the normal case when a process with the lowest process number detects coordinator as failed, then it requires message passing. Garcia-Molina's bully algorithm requires $O(N^2)$ messages to elect a coordinator node. The modified Bully Algorithm proposed in Mamun, Q. K. gains a significant improvement in the worst case. It requires only O(n) messages to elect a new coordinator node in the worst case[2]. The algorithm proposed by Md. Golam Murshed and Alastair R. Allen also requires at most 2(N – 1) messages in the worst case if at least one node in Candidate is live. In worst case that is the process with lowest process number detects coordinator as failed our new developed approach requires only 1+2+n-1 messages passing[5,6,7]. The table 1.1, 1.2 and 1.3 shown the comparative NC performance analysis of our approach with bully and different modifies bully algorithms.

Table 1.1

NC Performance Analysis in Worst Case: Number of Node / Process = 5

Case	Algorithms	Number of Node / Process = 5		
		Node Failed	Detector Node	No. of Messages
Worst	Bully	P5	P1	20
Worst	Mamun, Q. K.	P5	P1	11
Worst	Golam and Alastair	P5	P1	9
Worst	Election Administration	P5	P1	7

Table 1.2

NC Performance Analysis in Worst Case: Number of Node / Process = 10

Case	Algorithms	Number of Node / Process = 10		
		Node Failed	Detector Node	No. of Messages
Worst	Bully	P10	P1	20
Worst	Mamun, Q. K.	P10	P1	11
Worst	Golam and Alastair	P10	P1	9
Worst	Election Administration	P10	P1	7

Here in the example of tables 1.1, 1.2 and 1.3 node/process 1 detects that the current coordinator nodes node P5, P10 and P20 has crashed.

Table 1.3

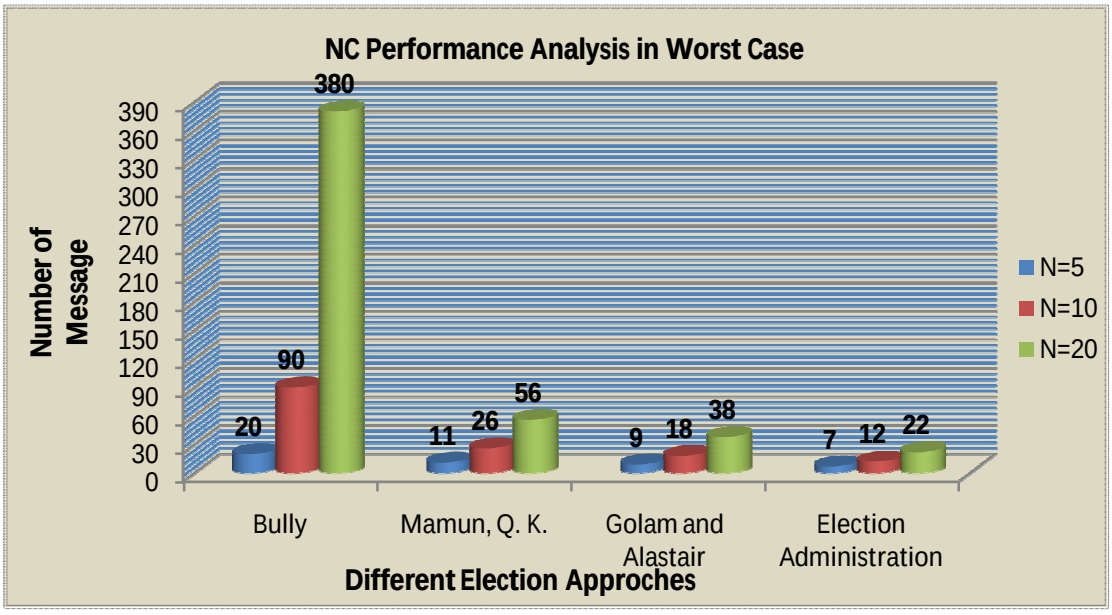
NC Performance analysis in Worst Case: Number of Node / Process = 20

Case	Algorithms	Number of Node / Process = 20		
		Node Failed	Detector Node	No. of Messages
Worst	Bully	P20	P1	380
Worst	Mamun, Q. K.	P20	P1	56
Worst	Golam and Alastair	P20	P1	38
Worst	Election Administration	P20	P1	22

The traditional Bully algorithm elects a new coordinator node in this case by performing a series of redundant elections and ends up when nodes are P5, P10 and P20. It producing 20, 90 and 380 messages in total. Mamun, Q. K. Algorithm needs 11, 26, 56 messages to elect a new coordinator. Md. Golam Murshed and Alastair R. Allen algorithm needs 9, 18, 38 messages to elect a new coordinator. Our proposed algorithm needs 7, 12 and 22 fewer messages. Our algorithm is fast and guarantees correctness and robustness, and the results show that it requires fewer messages to elect a new coordinator. The following graph 1.1 shown the comparative performance analysis of our approach with bully and different modifies bully algorithms in worst case.

In best case of election Garcia-Molina's bully algorithm requires N − 1 messages to elect a coordinator node in the best case, where N is the number of nodes. It will send election messages to N −1 nodes having higher id than itself. Each of the nodes eventually initiates a separate election one by one. Hence, it requires N − 1 messages in the best case. The modified Bully Algorithm proposed in Mamun, Q. K. also requires N − 1 messages in the best case. The algorithm proposed by Md. Golam Murshed and Alastair R. Allen also requires N − 1 messages in the best case. For the best case of our proposed algorithm there will be need of 1 election message to inform EA, 1 verify message to ensure the failure of coordinator, and n-1 messages to inform about new coordinator. In that case, our algorithm requires only 1+1+ n-1 messages.

In this case our new approach needs two extra messages to elect the coordinator: Election Message to inform the EA and verify message by EA to current coordinator but remove the problem of redundant election. In original bully algorithm and modified bully algorithm if coordinator is running unusually slowly say system is not working properly for some reasons or the link between a process and coordinator is broken for some reasons there will be redundant election, although current coordinator is up. But in our algorithm, as EA verifies either current coordinator is really up or down when EA receives any election message from any process, it ensures that there will be no redundant election in the system.



Graph 1.1 NC Performance analysis in Worst Case

Table 1.4

NC Performance Analysis in Best Case: Number of Node / Process = 5

Case	Algorithms	Number of Node / Process = 5		
		Failure Node	Detector Node	No. of Messages
Best	Bully	P5	P4	4
Best	Mamun, Q. K.	P5	P4	4
Best	Golam and Alastair	P5	P4	4
Best	Election Administration	P5	P4	6

Here in the example of Table 1.4 node/process P4 first detects that the current coordinator node/process P5 has crashed and declares itself as the new coordinator. The number of messages for this case is 4 the same for all three algorithms. In our approach it requires two extra messages one inform the *EA* and second is verified message by *EA.* It required 6 messages to elect new approach.

Table 1.5

NC Performance Analysis in Best Case: No. of Node / Process = 10

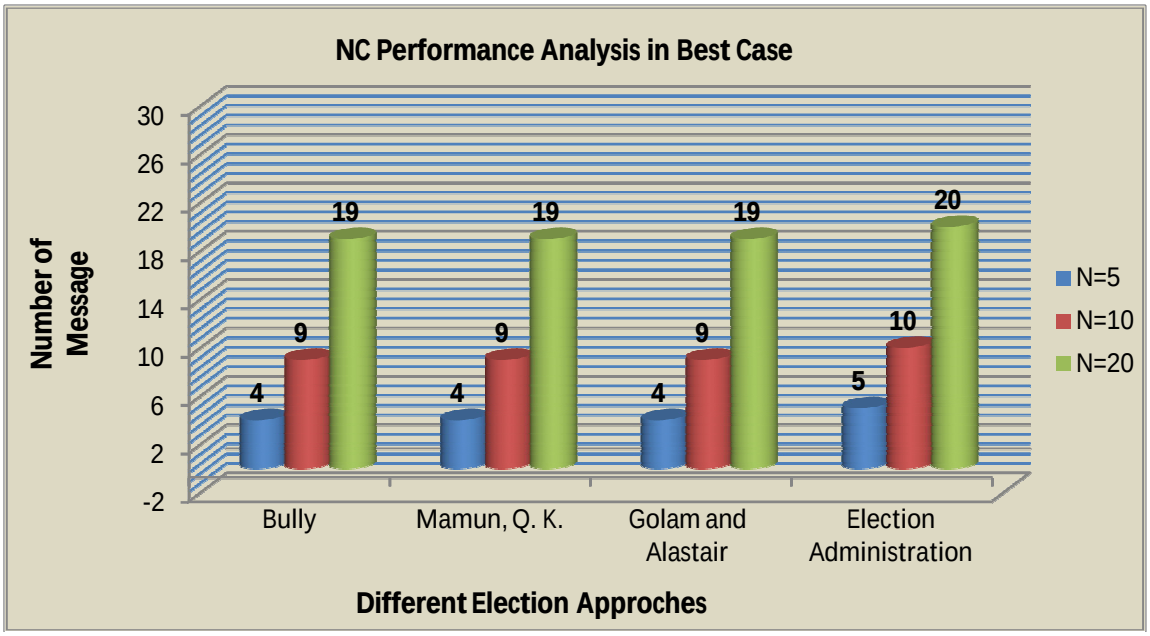
Case	Algorithms	Number of Node / Process = 10		
		Failure Node	Detecto r Node	No. of Messages
Best	Bully	P10	P9	9
Best	Mamun, Q. K.	P10	P9	9
Best	Golam and Alastair	P10	P9	9
Best	Election Administration	P10	P9	11

Table 1.6

NC Performance Analysis in Best Case: No. of Node / Process = 20

Case	Algorithms	Number of Node / Process = 20		
		Failure Node	Detecto r Node	No. of Messages
Best	Bully	P20	P19	19
Best	Mamun, Q. K.	P20	P19	19
Best	Golam and Alastair	P20	P19	19
Best	Election Administration	P20	P19	21

Here in the example of Table 1.5and Table 1.6, node P9 and P19 first detects that the current coordinator node, node P10 and P20 has crashed and declares itself as the new coordinator. The number of messages for this case is 9 and 19 the same for all three algorithms. In our approach it require on extra message that inform the election administration. It sends 11 and 21 coordinator messages. The following graph 1.2 shown the comparative performance analysis of our approach with bully and different modifies bully algorithms in best case..



Graph 1.2 NC Performance Analyses in Best Case

VIII CONCLUSION

This work presents some modifications to the classical bully algorithm which overcome the limitations of this algorithm and make it efficient and fast to elect a leader in synchronous distributed systems. The performance of the proposed algorithm has been compared with the original bully algorithm, Mamun, Q. K. approach Md. Golam Murshed and Alastair R. Allen algorithm and our proposal produces a better outcome. The algorithm is fast and guarantees correctness and robustness, and the results show that it requires fewer messages to elect a new leader.

REFERENCES

[1] Sinha P.K, (2008),Distributed Operating Systems Concepts and Design, Prentice-Hall of India private Limited,

[2] H. Garcia-Molina, (1982)*"Elections in Distributed Computing System"*, IEEE Transaction Computer, Vol. C-31, pp.48-59.

[3] Thakur P. Kumar , Kumar Ram, Ali Ruhi and Malviya Rajendra (2011)*"A New Approach of Bully Election Algorithm for Distributed Computing"*, Int. J. of Electrical, Electronics and Computer Engineering (IJEECE) Vol 1(1): pp. 72-79.

[4] Garcia-Molina, H, (1982). *"Elections in a Distributed Computing Systems", IEEE Transactions on Computers,* Vol. C–13, No. 1, pp. 48 – 59

[5] Mamun,Q.K., (2004) *"Modified Bully Algorithm for Electing Coordinator in Distributed System", 3rd WSEAS international conference on Software Engineering, Parallel Distributed Systems (SEPADS)"*, Salzburg, Austria,.

[6] Md. Golam Murshed and Alastair R. Allen, *"Enhanced Bully Algorithm for Leader Node* Election in Synchronous Distributed Systems", computers, www.mdpi.com/journal/computers, ISSN 2073-431X , June -2012.

[7] Dr. Gandhi S.K. and Thakur P. Kumar (2012) *"Election Administration Algorithm for Distributed Computing"* , IJE ECE, Vol 1(2): pp. 1-6.

Low Carbon Technologies (LCT) & Carbon Capture & Sequestration (CCS) – Key to Green Power Mission for Energy Security & Environmental Sustainability

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ABSTRACT
Despite the fact that we in India have taken a giant leap forward in increasing the installed capacity from a mere 1713 MW in 1950 to over 2,54,000 MW as on date, the renewable energy sources however contribute merely 13% with total capacity of over 31,600 MW. But this contribution has a major social and economic impact on rural and remote area population. The growth of clean energy technologies for mega Power generation, such as the Solar Mega Power under Jawaharlal Nehru Solar Mission, both Solar Thermal and PV, Clean Coal Technologies, CCTs, i.e. Supercritical power plants, Integrated Gasification Combined Cycle (IGCC) and fluidized bed combustion (FBC) are key to the success Green Power Mission for India. Carbon Capture & Sequestration (CCS) is considered as the frontier Green Energy technology. CCS technology is still in the demonstration phase, and it is important that India is not left behind in this area. While there is a considerable amount of work already underway domestically, there may still be a need for research collaborations and knowledge sharing and transfer. These areas of research in CCS include development of new adsorbents, better process integration of capture equipment, and conversion of CO2 to useful products, among others. The important challenge of Energy penalty in CCS being faced world-wide, can be met through use of Concentrated Solar Power (CSP) for supplementing steam for regeneration in a MEA and other solvent based post-combustion CCS in Thermal Power Plants. Low Carbon Technologies (LCT) and Carbon Capture & Sequestration (CCS) are key factors for Energy Security Environmental Sustainability and the same are forward in this paper leading to an opportunity for course- correction in our line of thinking in Green Power.

I INTRODUCTION

(a) Green Power Technologies – Clean Coal & Renewable Energy- We are aware that the Global concern for reduction in emission of green house gases (GHG) especially CO_2 emissions are likely to put pressure on Indian Power System for adoption of improved generation technologies. Although India does not have GHG reduction targets, it has actively taken steps to address the climate change issues. It is estimated that the Green Energy Projects undertaken by Indian Power Sector will generate over 600 million Certified Emission Reductions (CERs), by 2015. Mitigation options for CO2 reduction which have been planned to be taken up by Indian Power Sector include GHG emission reduction in power sector through adoption of Co-generation, Combined cycle, Clean Coal Technologies and Coal Beneficiation. CO_2 emissions per unit of electricity generated are significantly high in India as large proportion of power generated comes from low sized, old and relatively inefficient generating units which constitute over 50% of our total installed capacity of about 2,12,000 MW. The technology up gradation through life extension of old polluting units is expected to increase the generating efficiency of these units thereby reducing CO_2 emissions.

A major thrust on CO_2 reduction on long term and sustainable basis would however come through adoption of advanced technologies of power generation like Supercritical/Ultra-supercritical power cycles, Integrated Gasification Combined Cycles (IGCC), Fluidized Bed Combustion, and Gasification Technologies and so on. In addition to Clean Coal Technologies, India is currently sitting on a gold mine of opportunities of Energy farming for Bio-diesel production, Biomass gasification for decentralized power generation and for alternative rural energy security to a large extent. The planning commission report on Bio-diesel (2003) advocates for a substitute of 20% of current diesel demand by Bio-diesel through energy farming on the available 11.2 million hectare land comprising of waste land, spare forest land and cultivation of Jatropha in rural areas and both sides of vast Railway track. This would generate a vast sink for CO_2 while at the same time reduce exhaust emission through substitute of Bio-fuels for transportation and other decentralized energy production needs.

(b) Clean coal Technologies- A beginning towards adoption of Clean Coal Technologies in the form of super critical units has already been made in the country and it is foreseen that super critical technology would almost universally be adopted for all large sized pithead units in the country. The attained efficiency gains of these technologies are likely to reduce the environmental emissions especially CO_2 significantly. Adoption

of higher parameters for super critical units after sufficient feedback and operational experience would further reduce these emissions to a great extent. A total additional efficiency of about 1.5-2% is normally achieved for adoption of super critical parameters of 246-kg/cm2 (g) and 537/565C, chosen for the first Supercritical Power Plant under planning with unit size of the order of 660 MW. Adoption of still higher parameters would further enhance the efficiency. Attempts would also need to be made to further enhance the efficiency of conventional pulverized coal fired plant by adoption of ultra super-critical parameters. The main constraint being faced for adoption of these technologies is the availability of requisite material to withstand combination of high Pressures and temperatures encountered. A consortium of several equipment manufacturers globally has pooled their resources to develop necessary materials to overcome the constraints for adoption of ultra super-critical technology.

Another option for CO_2 reduction is the increased use of natural gas. This provides improvement in generation efficiency together with reduction in CO_2 emissions but would facilitate environmental pollution control only up to a certain extent. With addition of more and more generation capacity and also increasing CO_2 emissions from transport and other industrial sectors, progressive de-carbonization of generation resources may have to be adopted in certain regions/areas. Already, Natural Gas is being used in a big way in the country for power generation and GT/CCGT stations accounted for about 9.4% of total generation today. The natural Gas resource crunch being faced at present, even though there is quest for quick power generation restricts increased use of Natural gas in Combined Cycle mode, limiting it to some specific priority areas only. Research work in this area to increase the generation efficiency of Combined Cycle to an extent of 60% is already underway and this goal is likely to be realized in near future. These technologies can then be adopted as and when available. A much more efficient methodology of generating electricity from Natural gas is on the anvil and this is fuel cell technology which looks more promising source of Energy option in future.

Gasification of Coal is the cleanest way of utilization of coal; while combined cycle power generation gives highest efficiency, the IGCC is thus categorized as an environmentally benign Clean Coal Technology.

IGCC technology combines several desired attributes and are becoming an increasingly attractive option among the emerging technologies. First, IGCC systems provide high-energy conversion efficiency with the prospect of even higher efficiencies; if higher temperature turbines and hot gas clean up systems is employed. Second, very low emission levels for sulfur and nitrogen oxides have been demonstrated worldwide in such facilities as the Cool Water IGCC plant in California. Most designs for IGCC systems use cold gas cleanup including low temperature removal of SO_2 and particulate from the coal syngas, sulfur byproduct recovery, and syngas steam spray to reduce NOx formation in the gas turbine. IGCC is characterized by its potential to generate power at higher efficiency due to the possibility of coupling newer generation gas turbines with higher Turbine Entry Temperature (TET). IGCC is a superior technology due its capability to produce value added compound and fuels as well as ease of retrofitting a Carbon Capture and Sequestration (CCS) unit on an IGCC plant.

A 6.2 MW domestic coal based IGCC pilot power plant has been set up in India by Bharat Heavy Electrical Limited (BHEL), which has contributed in technology assessment of gasification of high ash Indian coals. However commercialization of IGCC needs technology demonstration at an intermediate scale of about 100 MW to address the issues regarding hot gas clean up, system optimization etc. and to establish reliability and performance on continuous operation. This would also enable to get the performance of an optimum module for air blown gasification, which in multiples would constitute a commercial size plant in the range of 300 – 600 MW sizes. Three options are possible for the demonstration plant.

(i) Retrofit to an existing gas based power plant with a coal gasifier system by utilizing the existing Power Island and operating the plant by replacing natural gas by coal gas.
(ii) Converting an existing thermal power plant to IGCC mode by installing a Gasification Island and gas turbine.
(iii) Setting up a green field IGCC plant.

Retrofit or conversion (options a, b) may be least cost options but will involve shut down of the existing power plant for carrying out modifications. In India due to acute power shortage it is not desirable to shut down any of the existing power producing capability. If appropriate financing were available, it would be preferable to set up a green field IGCC plant. This could act as a demonstration plant for generating design data for up scaling and for testing various types of coals as well as processes of gas cleaning and establish the integration between Gas Island and Power Island. A green field plant would also be a good option for human resource development and training of manpower in this field. NTPC, BHEL and APGENCO have joined hands for execution of 100 MW IGCC plant.

There is no doubt that IGCC can revolutionize the power generation scenario in India, once the commercial viability of technology with high ash coals is established for the proposed range of 100 MW plant. The success of the project will largely depend on maturity of Fluidized bed gasification technology for high ash Indian Coals.

(c) Renewable Energy Technologies- By virtually all accounts, renewable energy resources will be an increasingly important part of the power generation mix over the next several decades. Not only do these technologies help reduce global carbon emissions, but they also add some much-needed flexibility to the energy resource mix by decreasing our dependence on limited reserves and overseas sources of fossil fuels. The rising stars of the renewable world-wind power and photovoltaic (PV) are on track to become strong players in the renewable energy market of the next century. We shall see an emergence of the solar wind hybrid as major power packs for decentralized power generation.

Wind power is the fastest-growing electricity technology currently available. Wind-generated electricity is already competitive with fossil-fuel-based electricity in some locations, and installed wind power capacity in India is at a respectable level of 22,000 MW. Meanwhile, PV electricity, although currently three to four times the cost of conventional, delivered electricity, is seeing impressive growth worldwide. PV is particularly attractive for applications not served by the power grid. Advanced thin-film technology (a much less expensive option than crystalline silicon technology) is rapidly entering commercial-scale production, with 25 MW of manufacturing capacity installed in the past few years.

The energy-starved developing world, which accounts for a large portion of the projected new electricity demand over the next 20 years, is considered one of the biggest markets for renewable. Many of these countries are attracted to the technologies; modular nature; located close to the user, the units are far cheaper and quicker to install than central-station power plants and their extensive lengths of transmission line. There is no doubt that R&D in the optimum mix of Solar Wind & Biomass; having proven complementary nature in providing sustainable power, will have to be pursued more vigorously than today.

In the United States, national surveys show that well over half of consumers are willing to pay more for green power, and a number of power companies are now offering this option. We in India are also committed to achieve the target of 20 - 25% Renewable by 2017, though coal is going to remain our main stay for next 2-3 decades. The issue before Indian Energy Sector today is use of high ash Indian Coal for optimum power generation with minimal environmental impact due to CO2 emission.

The power sector already started witnessing a transition from conventional power generation technologies to the green power technologies. A major thrust on CO2 reduction on long-term and sustainable basis would come through adoption of Renewable Energy Technologies and advanced Cleaner technologies of power generation like Supercritical / Ultra-supercritical Power Cycles, Integrated Gasification Combined Cycles (IGCC), Fluidized Bed Combustion / Gasification Technologies and other such green energy technologies. In the short-term, the focus is mainly on energy conservation measures and use of selected hybrid of renewable technologies like solar-wind-biomass.

II CARBON CAPTURE & SEQUESTRATION – A FRONTLINE TECHNIQUE FOR COMBATING CLIMATE CHANGE

(a) Introduction- Climate Change & Energy generation- Climate change caused by the excessive industrial emissions of greenhouse gases (GHGs) is one of the gravest challenges facing our planet today. Studies have shown that there is no single option for combating this problem, but rather, a portfolio of measures, such as the increased use of renewable energy, improved energy efficiency, adoption of Clean Coal Technologies like Supercritical Plants, IGCC and Carbon Capture & Sequestration etc. will be needed.

India is rich in coal and is the third largest coal producer in the world. Coal continues to be the dominating energy source and meets nearly 58% of total requirement of commercial energy. India has huge Gondwana (mainly Permian, 99.5%) and Tertiary (Eocene and Oligocene) coal deposits distributed in several basins located in peninsular and extra-peninsular regions of about 257 billion tons. Coal is our main stay for Power generation and would continue to be so in next 3-4 decades.

CO2 sequestration is a multifaceted aspect involving capture of carbon from atmosphere followed by transportation, injection into favorable sites and post-injection monitoring. The favorable sites for storage of CO2 must be reliable in the sense that CO2 will be stored there permanently at least for 1000 years and no leakage is preferable. In this backdrop, coal bed and saline aquifer are the most suitable storage sites where CO2 will be fixed permanently by chemisorptions and chemical reaction respectively.

Carbon Capture and Sequestration (CCS) is one among these measures, being a collection of technologies that may be able to reduce GHG concentrations beyond what would be possible using other options alone.

Carbon Capture & Sequestration would play an important role in reducing Green House Gas Emissions at the same time enabling low carbon electricity generation from Power plants. As for example CCS applied to a 500 MW unit, that emits 3 million tones of CO2 per annum, would be equivalent to:

(i) Planting over 60 million trees and allow them to grow for 10 years
(ii) Avoiding Power related emission of 3 Lac houses

CCS involves the capture of carbon dioxide, the principal GHG, from concentrated emission sources, and then transporting it to and storing it perpetually in underground geological formations, used oil wells, or other secure locations. However, several challenges must be overcome before large-scale CCS deployment becomes practical, including establishing the technical feasibility of long-term geological CO2 storage, assessing the economics of capture, transport and storage of CO2 sensitizing the Government, industry, and the common man to the potential of this technology, etc.

(b) Current climate change policies and targets- India recognizes the seriousness of the threat of climate change, but is faced with the simultaneous challenge of ensuring socio-economic development which is largely linked to Energy generation in which Coal based Power generation is our main stay. Despite not having any fixed, legally binding emission reduction targets being a Non-Annex I country, India takes the issue of global warming seriously, given that the government expenditure on climate change adaptation in India already exceeds 2.6% of GDP, and that climate change is expected to have major impacts on water resources, agriculture, forests, etc. in India. To address the climate change issue, the Indian Prime Minister's Council on Climate Change released the National Action Plan on Climate Change (NAPCC) in 2008 according to which 'India is determined that its per capita greenhouse gas emissions will at no point exceed that of developed countries even as we pursue our development objectives.'

As per MOEF report 2010, the present and future CO2 emissions: India's total GHG emissions, inclusive of land use, land-use change and forestry, were 1727.71 million tonnes per annum (MTPA) of CO2 equivalent, and gross CO2 emissions were 1497.03 million tonnes. The CO2 generation per capita was 1.3 tonnes/capita per annum in the year 2007. Today the gross CO2 emission is at the level of 1602 MTPA and India's per capita CO2 emissions in 2031-32 are projected to be between 2.6 and 3.6 tonnes/capita. Around 66% of India's gross CO2 emissions came from the energy sector in 2007, with electricity generation alone accounting for almost 50% of the gross emissions. The industrial sector accounted for most of the remaining CO2 emissions, with 27% of the total emissions.
Accordingly, eight national missions for managing climate change have been set up:

(i) National Solar Mission
(ii) National Mission for Enhanced Energy Efficiency
(iii) National Mission on Sustainable Habitat
(iv) National Water Mission
(v) National Mission for Sustaining the Himalayan Ecosystem
(vi) National Mission for a "Green India"
(vii) National Mission for Sustainable Agriculture
(viii) National Mission on Strategic Knowledge for Climate Change

.

The planning commission has announced the Government's interest in adding a ninth mission i.e. 'Clean Coal Technologies mission' that would include CCS.

An important portion of the NAPCC deals with GHG mitigation in India's power sector. It points out that various measures for reducing GHG emissions from power plants, such as increasing the efficiency of existing power plants, using clean coal technologies, and switching to fuels other than coal where possible, must be viewed as being complementary and not mutually exclusive. CCS is however held in the NAPCC report as not being feasible at present, and concerns have been raised about the cost as well permanence of the CO2 storage. **It has been recommended at several Forums of Ministry of Power that a better option could be carbon Capture & Sequestration (CCS) through the technologies of conversion of CO2 into multipurpose fuels.**

III PROPOSED R&D WORK

Most Indian Research and Development (R&D) activities related to CCS occur under the Department of Science and Technology (DST) of the Indian Ministry of Science and Technology. The DST set up the National Program on Carbon Sequestration (NPCS) Research in 2007, with a view to competing with other countries in this area with respect to both pure/applied research and industrial applications. Four thrust areas of research were identified under this programme, viz. CO2

Sequestration through Micro algae Bio-fixation Techniques; Carbon Capture Process Development; Policy development Studies; and Network Terrestrial Agro-forestry Sequestration Modeling as detailed in DST reports on Projects under STAC / IS-STAC. The CO2 Capture, Sequestration and Production of Multi-purpose fuels – Hydrogen, Methane and Biodiesel through Algae route through Post combustion CCS on a fossil fuel fired Plant has been successfully demonstrated at the CO2 sequestration Pilot Plant at the State Technological University of MP, the 'RGPV' installed under DST sponsorship. This pilot project revalidated the possible use of the Amine absorption system to strip the CO2 from the flue gasses but also validated the data on its efficiency for a Power Plant. A CO2 Capture of over 93% has been achieved using MEA solvent of 20% concentration and the required heat for stripping captured CO2 is 3.88 MJ per kg of recovered carbon dioxide, which is provided by the low pressure steam about 150°C and 2 bar pressure from the associated boiler of 100 kg/hr capacity. Although the stripper uses a low grade steam and some heat it contains was not used for generating power anyhow, it still causes 20% reduction of power output of Boiler. Using the water gas shift reaction and a lignite / charcoal gasifier about 18% Hydrogen is being produced in this pilot plant, paving the way to production of multipurpose fuels from captured CO2. Efforts are underway to produce Methane from the stable CO and Hydrogen so produced, in a catalytic converter. CO2 from the stripper unit is also diverted to an open Algae pond, where solar flux is concentrated using parabolic collectors and CO2 is given in a regulated manner. Algal oil was extracted from algal biomass using soxhlet extraction by two different solvents viz. hexane and petroleum ether. Hexane extracted (4.76%) more oil from the alga than petroleum ether (2.52%) by soxhlet extraction procedures.

R&D in the area of carbon sequestration need to be directed and country's policy need to be dovetailed with the research. Stress needs to be given towards fixation and conversion of CO2 into useful products, building materials etc., rather than transportation and storage.

The simulation study has shown that if the technology of CO2 Capture Recycling & Sequestration in applied on a 500 MW Coal based Thermal Power Plant with 30% capture we will get benefits like:-

(i) Levelized Cost of Electricity or LCOE on a long term basis calculated through simulation exercise for retrofitting would be Re. 1.05 per kWh. The energy penalty for 30% abatement would be 25%, if CO2 is compressed and disposed. The total efficiency drop for 100% abatement is from 38.5% to 29.3%, i.e., 9.2%. The Loss in generation due to use of steam in MEA process would be 15000 kWh/hr. The Capital cost would be Rs. Over 1.50 Cr. per MW.

(ii) The simulation study further revealed that in a Thermal Power Plant, if a slip stream of the Flue gasses is recycled then a 30% reduction of CO2 would be achieved by direct abatement and recycle would result in a decline of fuel consumption by at least 7% and thereby reducing the CO2 emissions by about 10% due to use of CO as fuel, thereby overall reduction of CO2 by about 40% in the most cost effective manner. Thus the Net emission reduction when the Recycled CO2 is used in tandem with abatement would be 40% or down from 0.9 kg CO2/kWh to 0.54 kg CO2/kWh on a retrofitted Thermal Plant.

(iii) Simulations also showed the energy penalty for CO2 capture from 500 MW flue gas from coal-fired power plants to be 0.01572 kWh/g mol CO2.

(iv) A full scale plant on a 500 MW Pulverized Coal Fired Unit would require a CCS plant of 510 tones /hr capacity as shown below:

Efforts are underway to set up a CO2 Capture & Sequestration plant on an actual Coal Thermal Power plant through consortium approach. A scheme of retrofitting of existing 500MW Unit with CO2 Capture & Recycling of CO is being discussed with NTPC, TOSHIBA and BHEL and the broad outline of the same would be as under (Fig. 1:

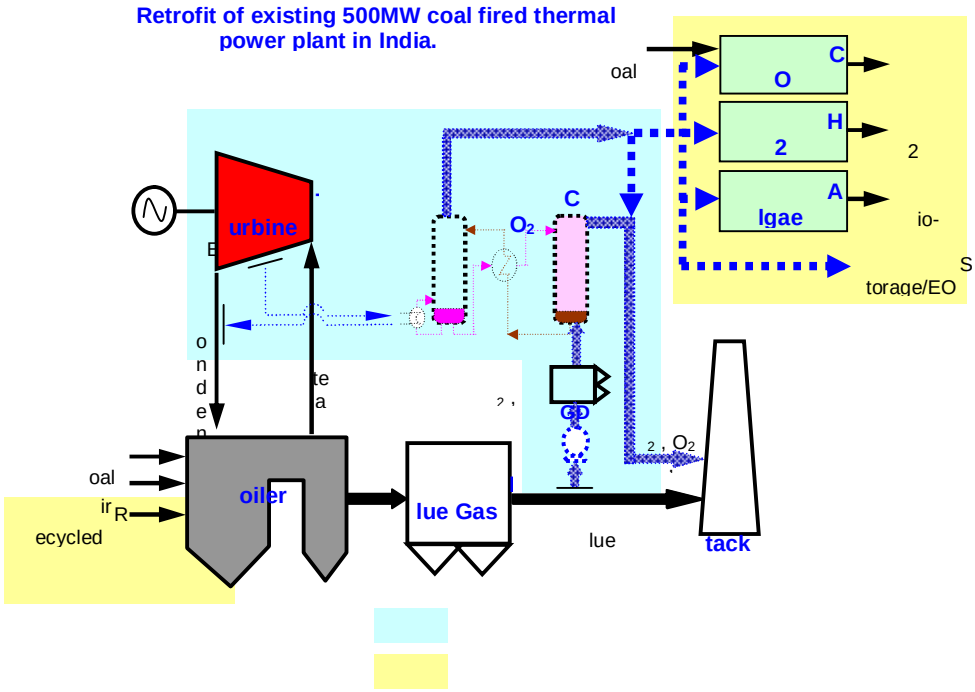

Fig. 1: Schematic of Demo Project – CO2 Capture Plant

The pilot unit of this impact project is considered an important milestone in CO2 Capture Technology for fossil fired power plants. The size of the plant is selected well above lab scale unit so as to produce appreciable moles of CH4 and H2. This Project is expected to resolve certain frontline issues in CO2 sequestration such as Energy intensive process optimization in terms of cost of generation and development of effective Catalyst for Methane, Hydrogen and Biodiesel recovery through Algae route.

IV NEW APPROACH – USE OF SOLAR FOR REDUCING ENERGY PENALTY

The thermal plants in India have a thermal efficiency of 35% and an emission ratio of 0.90 kg/kWh of CO2 emissions as published by CEA. The reduction of 20% intensity would translate to a decrease by 0.20 kg/kWh of CO2 emissions to 0.70Kg/kWh emissions by 2020. This decrease is possible by a combination of abatement and recycling measures.

However, the CO2 reduction by an Amine system of 30% CO2 capture would mean an Energy penalty of about 25% including about 15% for compression and pumping to deep reserves like mineral rocks, gas hydrates and ocean. In any case the Energy penalty in our case where CO2 Sequestration is considered a far more appropriate option than CO2 storage the Energy penalty still remains at level of 10- 12%. This can be further reduced to a level of 4-5% if Solar Thermal device is used for production of steam for MEA solvent regeneration and stripping of CO2. This can be demonstrated only after establishment of pilot scale CO2 Capture and Sequestration plant integrated with Concentrated Solar Power for carrying out System Optimization studies.

DST is being approached for funding this project to AISECT University in MP where a Center of Excellence in Energy & Environment is on the anvil.

Figure 2 below gives scheme of implementation of CO2 Capture & Sequestration Plant through integration of steam for stripping from Solar Thermal Plant.

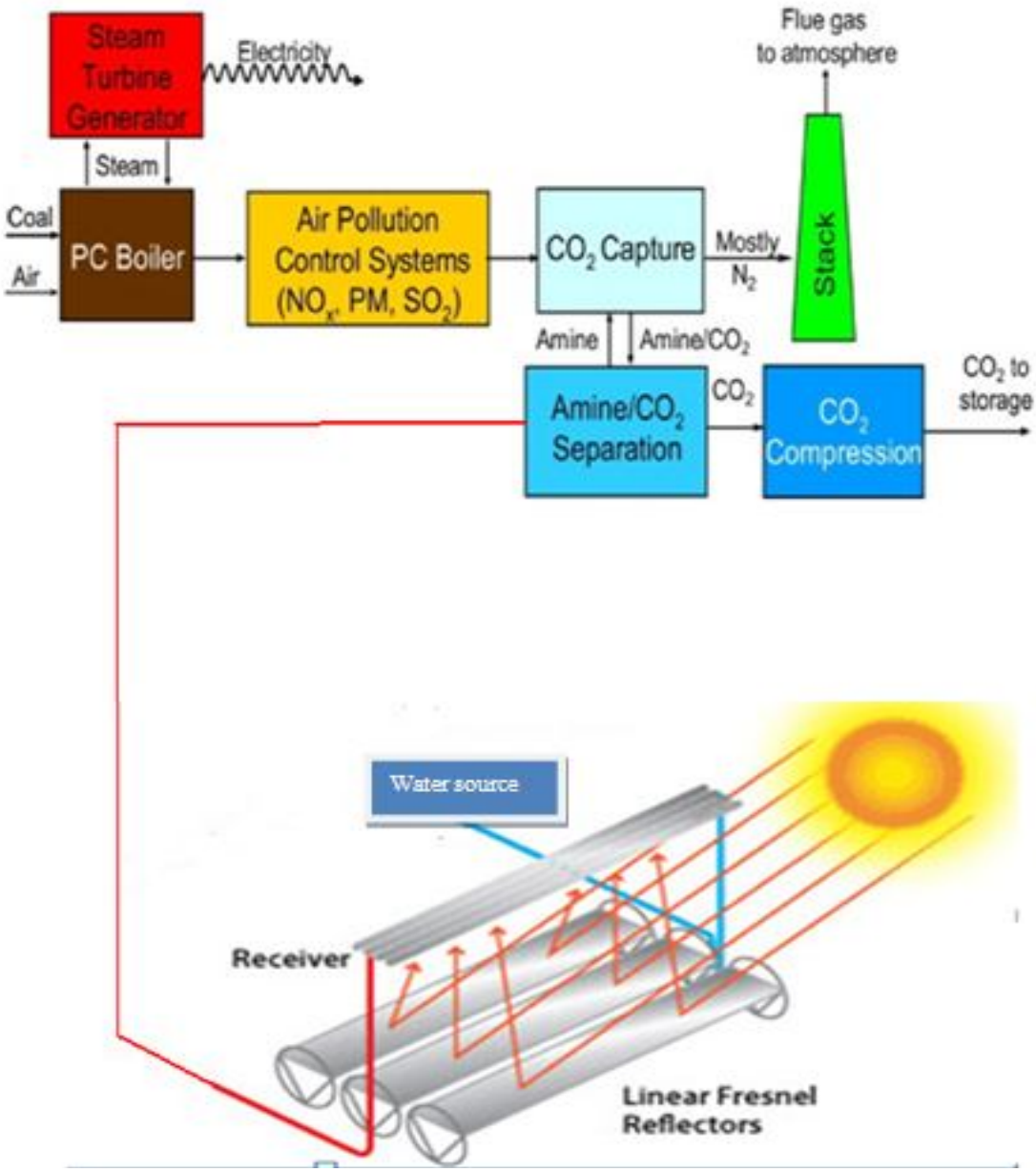

Fig: 2 - Scheme of implementation of CO2 Capture & Sequestration Plant Through integration with Solar Thermal at AISECT University

V CONCLUSION

Low Carbon Technology Vision for India together with Strategies, Challenges & Opportunities in Green Power for Energy Security Environmental Sustainability are put forward in this paper covering Low Carbon Technologies (LCT) and Carbon Capture & Sequestration (CCS) as key factors for Energy Security Environmental Sustainability.

By virtually all accounts, renewable energy resources as LCT's will be an increasingly important part of the power generation mix over the next several decades. Not only do these technologies help reduce global carbon emissions, but they also add some much-needed flexibility to the energy resource mix by decreasing our dependence on limited reserves and overseas sources of fossil fuels. Under the International Energy Agency (IEA) Energy Technology Perspectives 2012 (ETP 2012) 2°C Scenario (2DS), CCS contributes one-sixth of CO2 emission

reductions required in 2050, and 14% of the cumulative emissions reductions between 2015 and 2050 compared to a business-as-usual approach, which would correspond to a 6 °C rise in average global temperature.

Carbon capture and storage (CCS) will be a critical component in a portfolio of low-carbon energy technologies if we undertake ambitious measures to combat climate change. At the current trends of increasing global carbon dioxide emissions by energy sector and the dominant role that Coal continue to play in primary energy consumption, the urgency of CCS deployment is very important

The power sector already started witnessing a transition from conventional power generation technologies to the green power technologies. A major thrust on CO2 reduction on long-term and sustainable basis would come through adoption of advanced technologies of power generation like Supercritical / Ultra-supercritical Power Cycles, Integrated Gasification Combined Cycles (IGCC), Fluidized Bed Combustion / Gasification Technologies, Renewable Energy Technologies, Bio-fuels, other such green energy technologies. In the short-term, the focus is primarily on energy conservation measures and use of selected hybrid of 'renewable' like solar-wind-biomass. The LCT plus CCS Technologies are forward in this paper which may lead to an opportunity for course-correction in our line of thinking in Green Power.

REFERENCES

[1] Reddy DN, Basu K, Sethi VK. IGCC for Power Generation. A Promising Technology for India. Chia Laguna, Sardinia, Italy, Papers from CCT 2002 - International Conference on Clean Coal Technologies for Our Future (21-23 October, 2003).

[2] Rao JS, Ramani NVS, Srikanth G, Neelima J. IGCC a Clean Coal Technology for Power Generation in 21st Century.

[3] Reich Chevron Texaco EA, Coal Gasification. The Production of Chemicals and Clean Electric Power via the Integrated Gasification Combined Cycle (IGCC).

[4] Juniper L, Harris D, Patterson J. Australian Clean Coal Technology.

[5] Meier HJ, Theis K. Cleaner and Technologies - A New Initiative for Europe.

[6] Proceedings of Indo-European Seminar on "Clean Coal Technology and Power Plant Upgrading", Jan 14-16, 1997, CENPEEP, NTPC, Noida

[7] TEDDY. TERI Energy Data Directory and Year Book 2004-05. New Delhi, India (2004/5).

[8] Sharma PB, Sethi VK. Mitigating Climate Change through Green Energy Technologies. International Seminar on New Horizons of Mechanical Engineering (ISME 2008), March 18-20, 2008 at Rajiv Gandhi Technological University, Bhopal, M.P.

[9] Sethi VK, Mukesh Pandey & Savita Vyas "Production Potential of Electricity from Biomass in Indian Context", *Ultra Science* 2007; 19(1): 1-10.

[10] Sethi VK, Mukesh Pandey & Savita Vyas "A Novel Approach for CO_2 Sequestration and Conversion into Useful Multipurpose Fuel", *International Journal ICER, JERAD* 2010.

Improved Combustion Technique with porous structure in Internal Combustion Engine

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ABSTRACT
The currently employed heterogeneous combustion result in incomplete combustion and an uneven temperature distribution in the engine cylinder. The major effect of this improper combustion is on the efficiency of the engine. This yields high NOx, CO and HC, etc., emissions, resulting also extensive soot formation. The emission can only be improved by catalytic treatments, but such treatments, however, result in high cost and relatively low conversion efficiency. This paper suggests development of new combustion techniques to yield improved primary combustion process inside the engine for improving the efficiency with drastically reduced exhaust gas emission. The porous medium combustion technology for energy efficient and environmentally safe operations in IC engine. The main attention is focused on the engine concept having potential for homogeneous [nearly emission free] combustion process under variable engine operating conditions. The porus media can be used to great variety of improvement in combustion process. The key role of NOx reduction and soot emission elimination in homogeneous combustion engine. A brief identification and survey of porous material (PM) used in this area is also presented with their operating and limiting parameters. Homogeneous 3D thermal self ignition, wide and dynamic power regulation, extremely low pollutant emissions, incorporation of porous medium in the cylinder head, open type-and closed type- PM – engines.for in this technique may implemented from IC engines for improving the efficiency drastically and reduced exhaust gas emission.

Keyword - Porus medium combustion, internal combustion engine, Improve combustion technique

I INTRODUCTION

Nearly all engine manufacturers have been successful in the field of development of reduction in fuel consumption considerably for both diesel and gasoline engines and further progress can be expected in the year ahead. In particular the ongoing development of the direct injection (DI) concept still shows good potential to yield further reductions in fuel consumption. This concept also offers potential for the reduction of NO emission by applying exhaust gas recirculation (EGR) in the combustion region both for stoichiometric and for lean-burn engine operating conditions. However, inevitable trade-offs limit the possibilities for reducing emissions substantially if the conventional mixture preparation and combustion techniques are maintained, because this results in a non-homogeneous fuel-air ratio distribution in the combustion chamber and cause regionally slow, incomplete and diffsionally controlled combustion. From this, non-homogenous temperature fields emerge and high level, engine load-dependent emissions result that not only is difficult to control but can barely be reduced much further. This is outlined in the present paper and it is stressed that a new approach is needed to provide a better mixture preparation and / or improved combustion conditions. It has a claim that, without such a new approach, drastic reductions of emissions from internal combustion engines cannot be obtained i.e. the emission levels obtainable these days can only be reduced through improved and very costly catalytic treatments of the exhaust gases. The new concept of controlled combustion in porous media, suggested in this paper for DI-IC engines, offers the potential to increase the engine efficiency and a nearly zero emissions in IC engines.

(a) Porous Medium (P.M) Technology- The porous medium technology for IC engine means the utilization of specific features of a highly porous medium for supporting and controlling the mixture formation and combustion processes in I.C. engines the specific features of PM employed are directly related to a very effective heat transfer and very fast flame propagation within the PM. Most important features of PM are high heat capacity I large specific surface area, excellent heat transport property (radiation conductivity), transparency for fluid flow, flame propagation, variable pores size, pores density, pores structure, high thermal resistance, Mechanical resistance and thermal shock resistance.

(b) Design Modification By Incorporation Of Porous Structure Using Plasma ARC Spray- A plasma arc spray torch consists of a tubular copper anode in the rear of which is a tungsten cathode, both electrodes are water cooled and are surrounded by an insulating body which are in correct relation to each other and serves as an arc chamber. A high current arc is generated within the gas injected into the arc chamber where it is heated and, on passing through a constriction in the anode bore, is converted into a high temperature

plasma. Powdered surfacing material is injected in to this plasma jet and thus heated and accelerated on to the substrate.

The advantages of this method are high temperature I enables almost all material to be sprayed; deposits are of high density and strongly Figure below shows:

bonded to the substrate, very low heat input to the substrate This method is very much costlier and rarely available in the industry, used mostly for refractory, high melting point materials, ceramics etc.

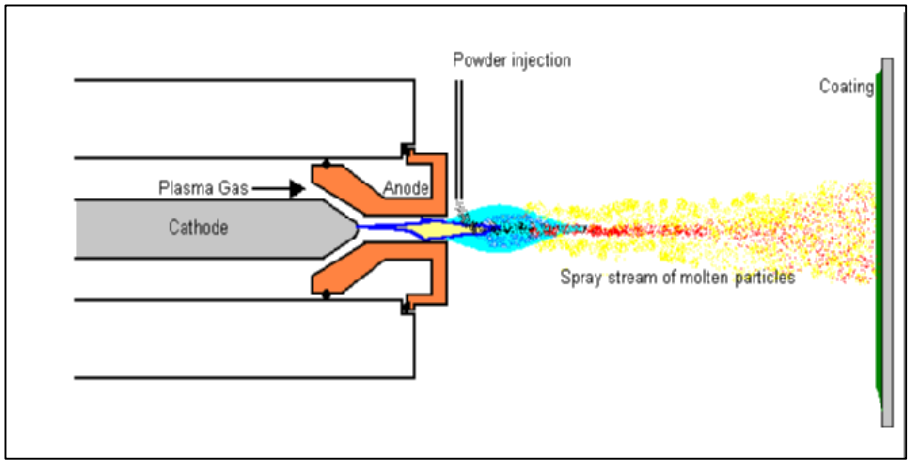

Fig 1 Schematic Diagram of the Plasma Spray Process

Fig 2 Piston with Sic coating using Plasma Spray process

(c) Principle of The PM Engine- The PM engine is defined as an internal combustion engine with the following processes realized in a porus medium: internal heat recuperation, fuel injection, fuel vabourization, mixing with air, homogenization of charge, 3D thermal self ignition followed by a homogeneous combustion PM engine may be classified with respect to the heat recuperation as

- Engine with periodic contact between PM and working gas in a cylinder (closed chamber)
- Engine with permanent contact between PM and working gas in cylinder (open chamber)

On the other hand, positioning of the PM combustion chamber in engine can be used to design different engines.

- Cylinder heads (PM is stationary).
- Cylinder (PM is stationary).
- Piston (PM moves with piston).

One of the most interesting features of PM engine is its multi-fuel performance. Independently of the fuel Used, this engine is a self ignition engine characterized by its 3D-thermal ignition in porus medium. Finally, the PM engine concept may be applied to both two and four stroke cycles. Owing

to the differences in the thermodynamic conditions, the PM engine cycle has to be separately analyzed for closed and open chambers.

(d) Potential of PM Technology In Creating of Adaptive Combustion System- In the PM-engine the liquid fuel is injected directly in to PM-volume and fuel atomization and spray geometry are not critical. A self-homogenization process in PM-volume is observed permitting spatial distribution of the liquid fuel throughout the PM- volume. A strong heat transfer from hot PM-surface and gas to liquid fuel permits fast and complete fuel vaporization. No liquid or gaseous form of the fuel is present in a free volume of the cylinder. Injection timing, spray atomization or spray geometry are not critical in this system.

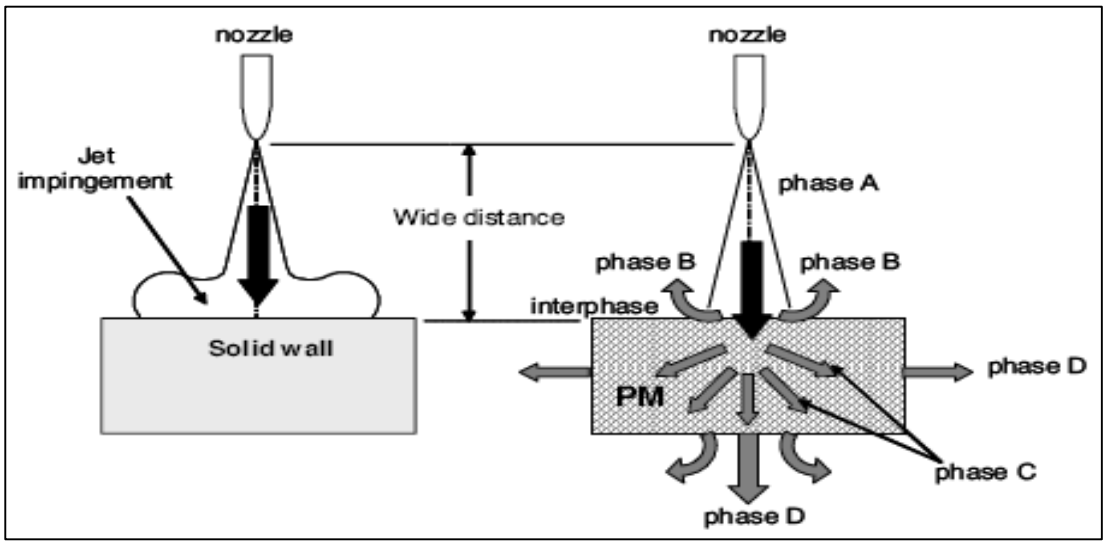

Fig 3 Model Describing Basic Phases of Diesel Jet Interaction with Porous Medium

- Phase A: represents outlet from the nozzle and free jet formation
- Phase B: represents jet interaction with PM interface.
- Phase C: represents liquid distribution throughout the PM-volume
- Phase D: represents liquid leaving the PM- volume

(e) Steady State Porous Medium Combustion-
Generally, Main feature of the stationary combustion process taking place in a porous medium for a pre- mixed gaseous charge are the following:

- Very low NOx emission level due to homogeneous combustion.
- It is possible to (almost) eliminate the soot formation
- Theoretically higher than conventional engine cycle efficiency due to similarity to the Carnot cycle.
- Very low combustion noise due to significantly reduced pressure peaks.
- Mearly constant and homogeneous combustion temperature field.
- Very fast combustion.
- Multi + or – fuel systems.
- May operate with homogeneous charge from stoichiometric to very lean mixture compositions.
- Mixture formation and combustion processes are almost independent of the cylinder flow structure, of turbulence or of spray atomization.

Owing to the ability of PM engine of operating with a homogeneous combustion at all required optional conditions, the system may be called combustion.

II SIMULATION AND RESULT

The results of the experiment carried out on the engine with porous medium is compared with the normal engine and also with 1mm and 2mm layers of SiC and it is found that the efficiency of the engine has improved. Exhaust emissions like NOx, CO, UHCs are reduced drastically, and also it has been recorded that the soot formation is almost neligible.

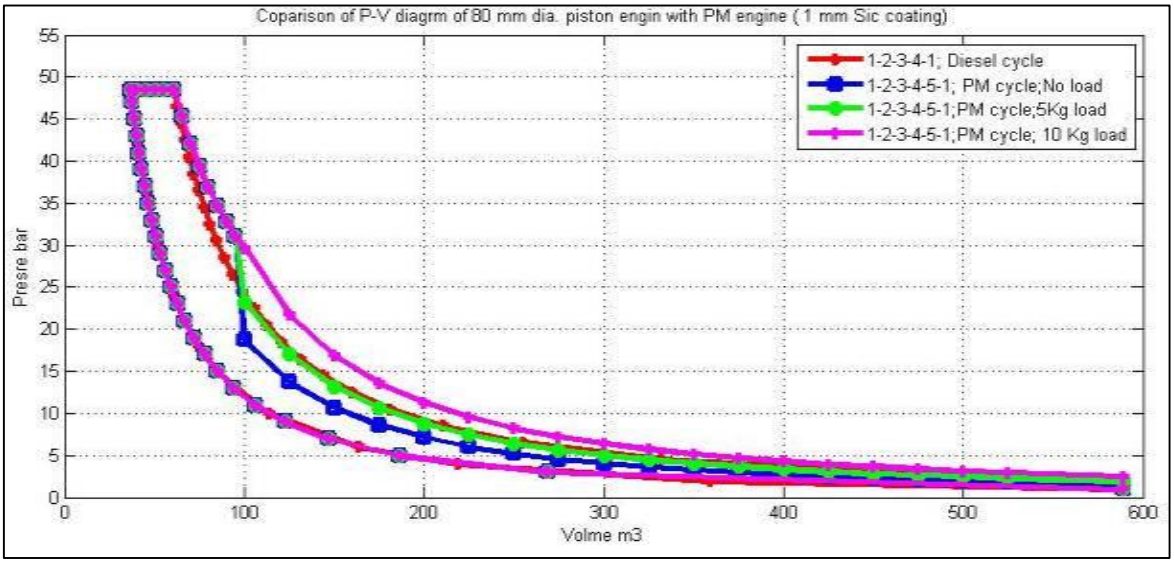

Fig 4 Comparative P-V diagrams for 80 mm dia.piston engine

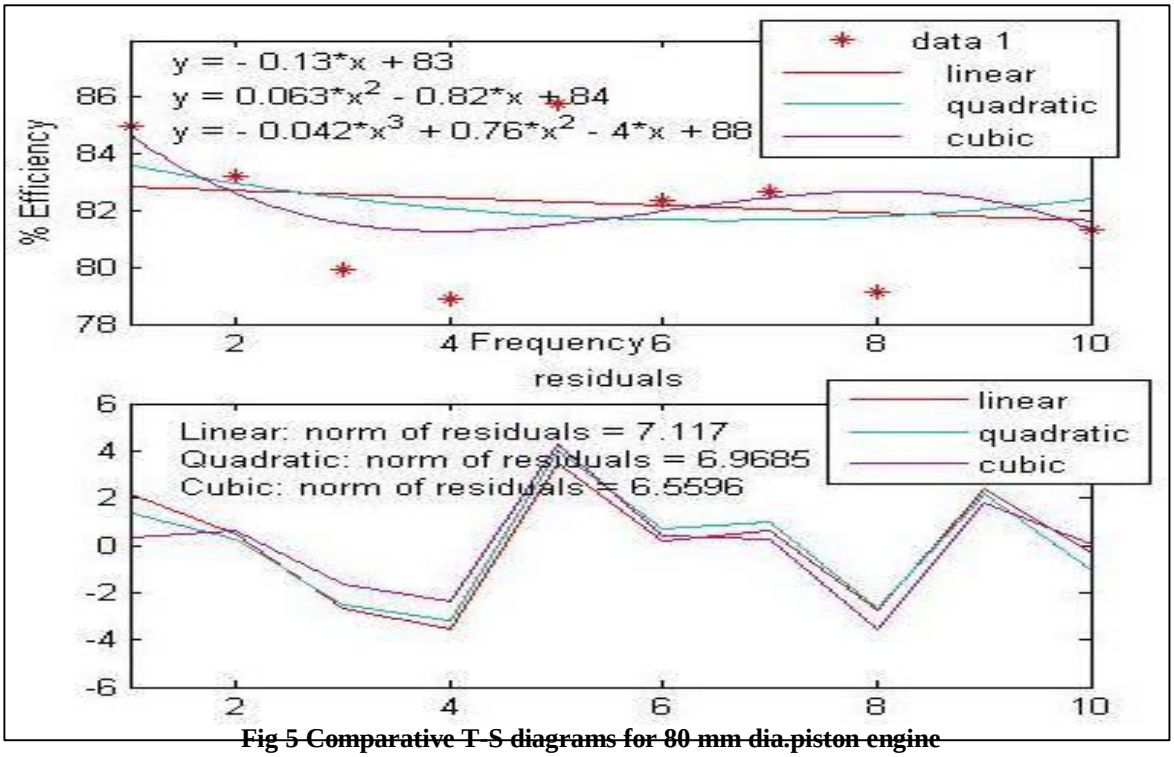

Fig 5 Comparative T-S diagrams for 80 mm dia.piston engine

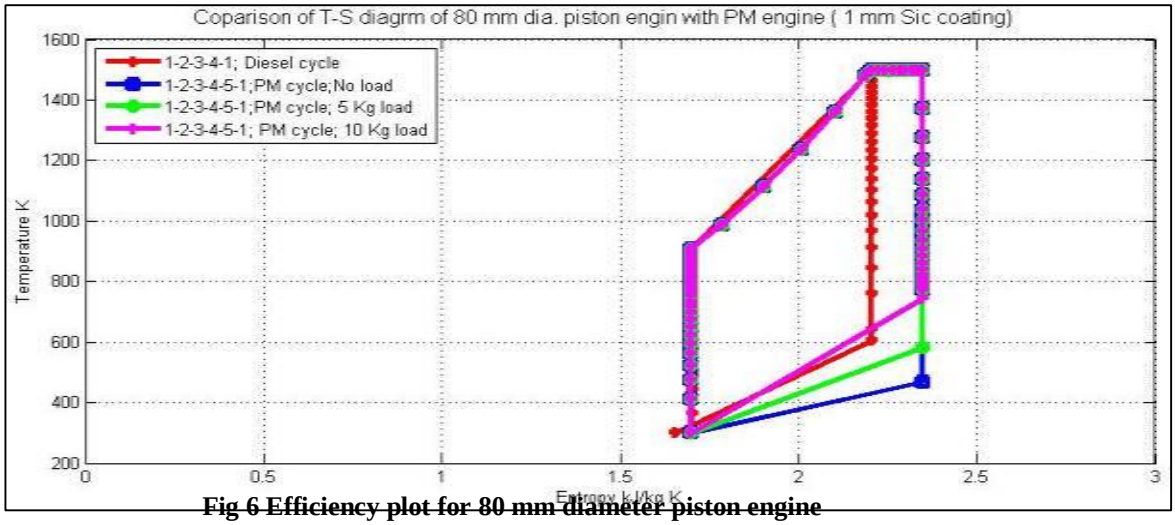

Fig 6 Efficiency plot for 80 mm diameter piston engine

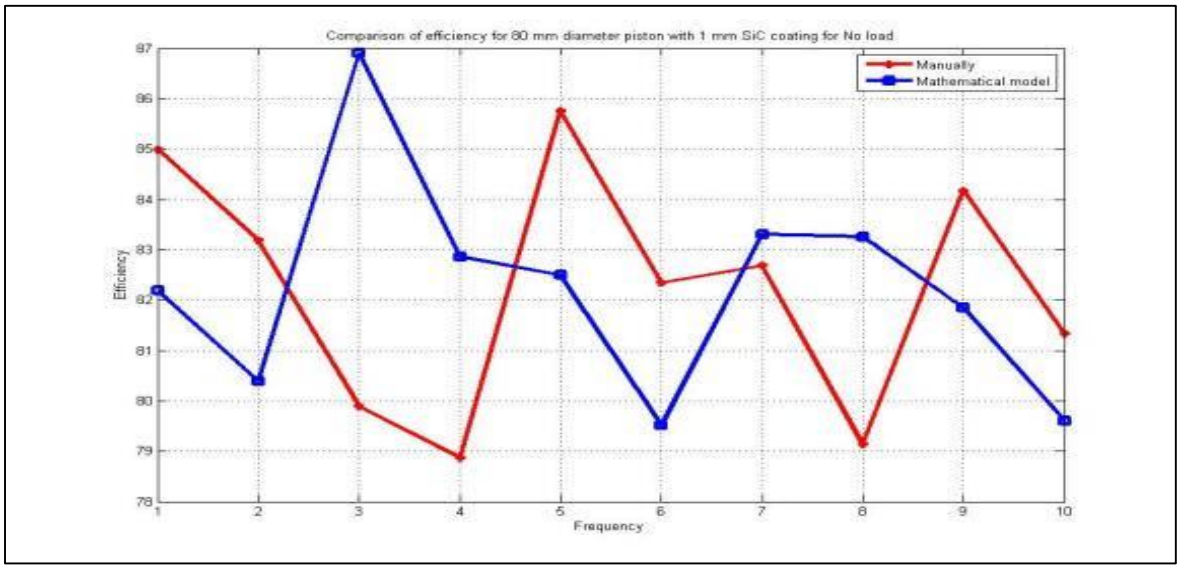

Fig 7 Piston with 1 mm silicon coating for no load condition

The PV diagrams and TS diagrams, individual and comparison of all at different load conditions are shown above. Analysis of the result obtained from the trails concluded that the engine with the engine changes of a piston, indicate the clear enhance meal the overall efficiency and performance of the engine giving improvement in exhaust emissions. The graph plotted shows the comparative improved efficiency with respect to change in design of piston.

III CONCLUSION

A porous medium technology has been defined as utilization of large specific surface area, large heat capacity, high porosity etc. of open cell structures for supporting different processes realized in engine. Especially important is the application of this material for homogeneous mixture formation and compete combustion engines. In this paper novel concepts for combustion engines based on the applications of porous medium technology is presented and discussed. The main attention is focused on the engine concepts having potential for homogeneous combustion process to be controlled or positively influenced with the help of porous media ceramics foams or other structures.

All the above findings are claimed after conducting iterative experimentation and analyzing the experimental data. It is unique approach towards the overall development of the engine efficiency which is the need of the current scenario in the field of Automobile.

ABBREVIATIONS

PM	Porous medium
CO	Carbon monoxide
DI	Direct injection
EGR	Exhaust gas recirculation
GDI	Gas direct injection
MDI	Mixed direct injection
NOx	Oxides of nitrogen
Sic	Silicon carbide
UHCs	Unburned hydrocarbons

REFERENCES

[1] Dhale Ashok A., Dr.Awari G.K., Dr.Singh M.P., Analysis of IC engine with a new concept of porous Medium combustion for the future clean engine. Thermal Science International Scientific Journal , Volume 14, Number 4, Year 2010 , pp. 943-956.

[2] Dhale Ashok A., Dr.Awari G.K., Dr.Singh M.P., New strategy for intelligent engine combustion International Journal of Advancements in Technical Research and Development. Volume 1, Number 4, January 2012 , pp. 29-42.

[3] Weclas, M., Diesel soot (PM) emissions and technologies: state of the art, Internal Report, 2004, institute of vehicle technology, university of nursing applied science in numbers.

[4] Weclas, M., Porous media in internal combustion engines [in] cellular ceramic structure, manufacturing, properties and application scheffler M. Colombo, P. (Eds), Willey-VCH-Publ.2005

[5] Weclas, M., New strategies for homogeneous combustion in I.C. engines based on the porous medium (PM)-technology, ILASS Europe, June2001.

[6] Dhale Ashok A., Dr.Awari G.K., Dr.Singh M.P., Application of porous medium technology to I.C.engines.national conference on nascent Technologies, NCNTE-2012.

Electrochemical Trace Analysis of Valuable Metals in Hematite Ore Samples

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ABSTRACT

Hematite is a main source of iron. Many other metals are also associated with it in different micro and trace level. Polarographic methods i. e. DCP and DPP have been successfully used for simultaneous determination of some metals viz. Au(I) ,Bi(II) ,Pb(II) ,U(VI),Co(II) ,Ni(II) ,Zn(II) ,Mn(II) ,Fe(III) Cr(III). Ammonium Tartrate solution was used as supporting electrolyte and gelatin was used as maximum suppressor at pH 9.0. The method of standard addition was applied for quantitative analysis. Spiked samples were also made and analyzed in same conditions for statistical approach. The obtained polarographic results were compared with those obtained using Atomic Absorption Spectrometry (AAS). The observed results clearly speaks of the superiority of Polarographic methods.

Key words: Hematite ore samples, Polarography, Atomic Absorption Spectroscopy

I INTRODUCTION

Hematite is the most important source of iron. It is an oxide mineral and its chemical formula is Fe_2O_3 . It contains high iron (about 70%) .and is abundant in nature (1). A number of investigations have been performed concerning the determination of elements, similarly geological samples have been studied by flame atomic absorption spectrometry (AAS), radiochemical neutron activation Analysis (2) and electro thermal atomic absorption spectrometry (ETAAS) with inductively coupled plasma(AES-ICP) (3-6). After the separation and concentration of the elements, its analysis have been performed (7-11). Some authors have investigated the possibility of the determination of these elements directly from the sample solution, by FAAS (11-13), and by ETAA (14). Also the influence of interfering elements was of particular interest in the flame or electro thermal methods. AAS determination and, to overcome such interferences, the addition of different matrix modifiers or the separation and concentration methods for the determination of the elements investigated were suggested (15). Neutron activation analysis (NAA), X-ray emission (XRA) (16), are rarely used to determine trace elements due to matrix and inter element interference and background effect (17).

II MATERIALS AND METHODS

Mineral samples was collected from Kanhwar Plateau, Agaria, Bijori, Ghosalpur, Lora hill, Ghoghra, Silondi, Saroli Jabalpur District (M.P.).

Conditions required for the Polarography of the Hematite ore samples

Stock Solution in Double Distilled water	:	0.01M
Supporting Electrolyte Ammonium Tartarate,	:	1M
Scan Rate /Sec.	:	5mV

III INSTRUMENTATION

Elico Pulse Polarograph model CL-90 was coupled with a Polarocard model LR-108 and a three electrode assembly (Elico Private Limited, Hydrabad, India) was used for precise qualitative as well as quantitative analysis of metal ions in samples. The electrode system consisted of a dropping mercury electrode as a working electrode, a coiled platinum wire as an auxiliary electrode and a saturated calomel electrode as a reference electrode.

IV PROCEDURES FOR SAMPLE SOLUTION

1 gm of powdered sample of hematite was dissolved in 12 ml aqua regia. A few drops of H_2O_2 were added and the solution evaporated to near dryness. The residue was then dissolved in 50 ml of 10 N HCl. After dissolution of the mineral samples, the solution was transferred into a separating funnel. Then 10 ml of iso amyl acetate was added and the mixture was shaken for 1 minute. To avoid interferences of chlorides, the inorganic layer was evaporated and the residue was dissolved in 5 ml of

2 N HNO_3 (18).

V RESULT AND DISCUSSION

The DC and DP Polarograms of the sample solution (Fig 4a & 4b) showed ten well defined waves/peaks with E½ /Ep values = -0.06/-0.08, -0.32/-0.46, -0.58/-0.56,-0.68/-0.68,-0.86/-0.84, -0.91/-0.92,-1.14/-1.16,-1.20/-1.25,-1.32/-1.34,-1.40/-1.45, V vs SCE in DCP/DPP mode indicating the presence of Au(II), Bi(II), Pb(II), U(VI) ,Co(II) ,Ni(II) , Zn(II), Mn(II), Fe(III), Cr(III) respectively in the ore sample(19).

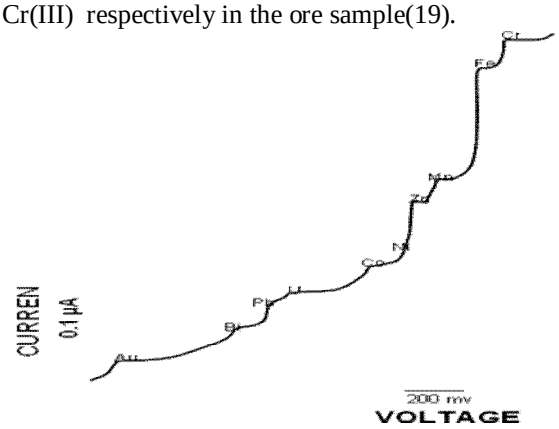

Fig 1a Direct Current Polarogram of Hematite Sample (100mg /100ml) in 1 M Ammonium Tartrate + 0.01% gelatin at pH 9.0 ±0.1.

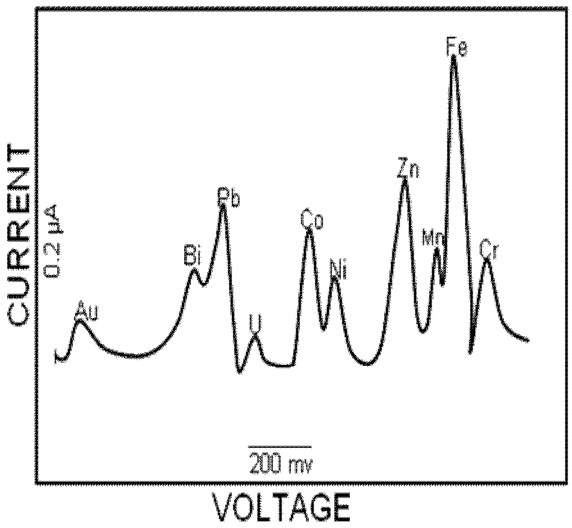

Fig 1b Differential Pulse Polarogram of Hematite Sample (100mg /100ml) in 0.1 M Ammonium Tartrate + 0.01% gelatin at pH 9.0±0.01.

To ascertain the presence of the above mentioned metal ions in the sample, a definite quantity of standard solution of each metal ion was added to the analyte and the resulting polarogram was recorded.

On the basis of above metal ions present in the sample, some synthetic samples of varying concentration of the metal ions were prepared (Table-1.1) and each synthetic samples was analyzed polarographically. The results indicated no change in $E_{½}$ / E_p values of the above mentioned metal ions and also the varying concentration of these metal ions, did not affect the DCP and DPP of each other. Quantitative analysis of the sample using DCP and DPP of Au, Bi, Pb, U, Co, Ni, Zn, Mn, Fe Cr, in the sample were carried out by using DCP and DPP methods. Spiked samples were prepared in order to evaluate the concentrations of each metal ion. The results are given in Table 1.2. The results indicated that the percentage recovery is over 99.7% for all the metal ions, with high accuracy and precision of the determination.

The final analysis of results of the sample is shows in Table 1.3. The results were compared with those obtained using AAS method and were found to be in excellent agreement.

VI CONCLUSION

The proposed polarographic procedure was found to be highly useful for the determination of species in different oxidation state also e.g. Fe may be found in +2 or +3 which is otherwise not possible using AAS method. The comparative and statistical data also proves the superiority of the polarographic method for such type of analysis over the other methods.

Table1.1
Analysis of Synthetic Samples
Compositions of synthetic samples (mg/ 100 ml)

Au	Bi	Pb	U	Co	Ni	Zn	Mn	Fe	Cr
0.01	0.17	1.63	0.27	0.91	0.75	3.59	0.76	5.23	0.32
(0.01)	(0.16)	(1.62)	(0.25)	(0.90)	(0.74	(3.59)	(0.76)	(5.22)	(0.31)
0.02	2.32	2.42	1.04	1.08	1.80	5.17	1.42	3.23	1.95
(0.02)	(2.32)	(2.42)	(1.04)	(1.09)	(1.80)	(5.18)	(1.42)	(3.22)	(1.95)
0.05	3.04	2.83	1.24	4.41	2.09	2.14	1.20	1.96	3.32
(0.05)	(3.02)	(2.8)	(1.23)	(4.41)	(2.07)	(2.13)	(1.2)	(1.96)	(3.32)
1.17	1.83	1.07	2.12	0.77	2.81	4.56	2.63	7.13	9.82
(1.16)	(1.82)	(1.05)	(2.12)	(0.78)	(2.92)	(4.64)	(2.62)	(7.13)	(19.82)
1.10	1.67	2.71	2.88	2.15	2.63	5.34	3.71	8.25	9.32
(1.12)	(1.67)	(2.72)	(2.88)	(2.99)	(2.62)	(5.44)	(3.72)	(8.25)	(9.32)
2.2	3.66	1.10	3.92	3.05	3.06	3.84	3.79	6.99	5.65
(2.2)	(3.67)	(1.10)	(3.95)	(3.06)	(3.09)	(3.88)	(3.8)	(6.99)	(5.65)

( ) Amount Found * Using DPP
Average of four determinations

Table 1.2:
Polarographic Analysis Results of the Hematite Sample (Mg/100 mg)*for its metal content

Metal Ion	Parameter	By DCP			By DPP		
		Added		Found	Added		Found
Au(I)	Amount	-		0.012	-		0.013
		0.014		26	0.011		0.024
	% Rec		95.5			98	
	SD **		0.002			0.001	
Bi(II)	Amount	-		0 .27	-		
		0.26		0.53			1.27
	% Rec		99.2		1.29	99.2	2.56
	SD **		0.011			0.001	
Pb (II)	Amount	-		3.36	-		
		3.46		6.82	2.96		2.99
	% Rec		99.5			99.4	5.95
	SD **		0.02			0.02	
U(VI)	Amount	-		0.145	-		
		0.134		0.279			0.125

	% Rec SD **		99 0.003		0.124	99.5 0.003	0.249
CO(II)	Amount % Rec SD **	- 0.425	96.2 0.006	0.426 0.851	- 0.825	99.1 0.007	0.826 1.651
Ni(II)	Amount % Rec SD **	- 8.03	99.8 0.004	8.025 16.05	- 8.04	99.6 0.003	8.04 16.08
Zn(II)	Amount % Rec SD **	- 3.065	97 0.004	3.015 6.08	- 1.095	97.2 0.002	1.094 2.189
Mn(III)	Amount % Rec SD **	- 10.05	100 0.005	10.02 20.07	- 10.15	100 0.006	10.17 20.32
Fe(III)	Amount % Rec SD **	- 20.34	98.5 0.003	21.34 41.68	- 16.33	98.5 0.003	16.35 32.68
Cr(III)	Amount % Rec SD **	- 9.87	97.7 0.004	9.85 19.72	- 9.87	97.7 0.004	9.89 19.76

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Table –1.3
Final Analysis Results on Hematite Ore Sample and Their Comparison with AAS

Metal ion	Polarographic	AAS
	(mg g^{-1} of the sample)	
Au (I)	0.012	0.013
Bi (II)	0.27	0.28
Pb (II)	3.36	3.44
U (VI)	0.145	0.16
Co(II)	0.426	0.425
Ni (II)	8.25	8.35
Zn(II)	3.015	3.017
Mn(II)	10.02	10.06
Fe(III)	213.4	214.6
Cr(III)	9.85	9.83

REFERENCES

[1] Lyons T, ReinhardW, CT 461(7261): 179–181, (2009).

[2] Makreski P, Jaćimović R, Stibilj V, Stafilov T, Jovanovski G , Radiochim. Acta, 96, 855–861, (2008).

[3] Castillo,J.R.,MIR,M.J.,Martinez, M.LGomez,T: AT Pectroscopy.9, 9,(1998).

[4] Barros,J.S,Analyst 114,369 ,(1989).

[5] Stafilov,T, Spectrochim Acta., B55,893,(2000).

[6] Makreski,P,Jovanovski,KaitnerB,StafilovT,Boav,cibrev,D:Neues Jb.Miner.Abh.180,215, (2004).

[7] Kabil, M.A, El- Kourashy A.G, El-Hagrasy ,J.Anal At ,Spectrol. 11, 379(1996).

[8] ZendelovskaD, ,Stafilov T,Anal Sci. 17, 425,(2001).

[9] StafilovT, Zendelovska,TurkD ,J.Chem.,26,271,(2002).

[10] Taseska,M, StafiloveT, Makreski P, Jovanovski G, Ovidius Univ .Ann .Chem.16, 43, (2005).

[11] Taseska M, stafilov T, Makreski,P, Jacimovic R., StibiljV., Jovanovski G, Geol. Maced . 20,33, (2006)

[12] CastilloJ.R, MirM.J,. Martinez M.L, T. Gomez, At. Spectrosc. 9, 9-12 (1988).

[13] Barros J.S, Analyst 114, 369-373, (1989).

[14] LazaruA, StafilovT, Geologica Macedonica, 7, 73-80, (1993).

[15] DonaldsonE.M, Talanta 27, 779-786, (1980).

[16] Webb S.M , Fuller C.C , Tebo B.M, and BargarJ.R Environ., Sci. Technol., 40 (3), pp 771(2006)

[17] Tomura K., Tomuro , H.J.Radioanal Nucl. Chem. 247,147,(1999).

[18] StafilovT_, Dragica zendelovska y, 26, 271, 280, (2002).

[19] EdmondsT.E, Ji Guoliang Anal.ChemActa, 151, 99, (1983).

Rare earth doped upconverting Nanoparticles: Synthesis and application in Bio-Imaging

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ABSTRACT
Upconversion luminescence, a nonlinear process, which re-emits a photon at a shorter wavelength by the absorption of more than one photon, successively at longer wavelengths via long-lived intermediate energy states, is useful for important applications in various fields like fluorescence bio-imaging and lasers. This NIR-to-NIR up-conversion process provides deeper light penetration into biological specimen and results in high contrast optical imaging due to absence of an auto fluorescence background and decreased light scattering. Excitation at long wavelengths also minimizes damage to biological materials. Herein, we report, the different mechanisms responsible for the Upconversion process of rare-earth (Er^{3+}, Ho^{3+}, Tm^{3+}) doped nanoparticle and methods that are used to synthesize and decorate up converting nanoparticle.

Keywards:- *Upconversion, Nanoparticles, chemical, etc.*

I INTRODUCTION

Upconversion is an optical process that involves the conversion of lower-energy photons into higher-energy photons. It has been extensively studied since mid-1960s and widely applied in optical devices. Over the past decade, high-quality rare earth-doped Upconversion Nanoparticles have been successfully synthesized with the rapid development of nanotechnology and are becoming more prominent in biological sciences. The main difference between the Upconversion Nanoparticles and other nonmaterial's is that they can emit visible light under near infrared irradiation. Upconversion nanoparticle (UCNPs), particularly lanthanide-doped nanocrystals, which emit high energy photons under excitation by the near-infrared (NIR) light. These nanoparticles have been found potential applications in many fields, including biomedicine and is found improved tissue penetration and higher photochemical stability as compared with traditional down-conversion fluorescence imaging. The unique Upconversion process of upconverting nanoparticles may be utilized to activate photosensitive therapeutic agents for applications in cancer treatment. Upconversion luminescence imaging in vivo is expected to be the next generation photoluminescence imaging technique since it provides high sensitivity and spatial resolution. Due to some special properties such as their multicolour emission, high brightness and long lifetime, lanthanide ions based luminescent nonmaterial have tremendous promise as indicators and photon sources for numerous application such as boilable, light-emitting devices, sensor technology, and low-threshold lasers. So it is very important to successfully prepare the rare-earth doped inorganic nanocrystals with good dispensability in organic solvents and also prepare water soluble upconversion nanoparticle.

In the Up conversion phenomenon has been transition metals, actinides, but mainly in the rare earth elements, which contain the lanthanide (Ln) series, Yttrium, and scandium. Ln^{3+} ions heave special $4f^n$ $5d^{0-1}$inner shell configurations that are well – shielded by outer shell and have unique energy level structures. The Ln^{3+} ions can exhibit sharp luminescence emission via intra-4f or 4f-5d transitions. These luminescence properties, as narrow bandwidth, long-time emission, and anti-stokes emission, they have been widely applied in lasers, solar cell, analytical sensors, optical imaging, and photodynamic therapy.

Most of the fluorescent materials are generally excited by ultraviolet (UV) or visible light, which may induce auto fluorescence and photo damage to biological samples, resulting in low signal-to-noise ratio and limited sensitivity. These limitations prompted the development of a new type of high-quality and well-shaped nonmaterial's known as up conversion nonmaterial's (UCNs [1-7].

Lanthanide-doped Upconversion (UC) nanophosphor are promising optical Contrast agents for biomedical applications due to their photo stability, sharp emission peaks, and long emission lifetime [8, 9]. For *in vitro* or *in vivo* imaging, the use of NIR excitation minimizes absorbance, scattering, and fluorescence from cells and tissues, allowing imaging against a dark background [13]. In contrast, commercially available labels, such as organic dyes and quantum dots, typically must be imaged against a background of Stokes-shifted tissue auto fluorescence induced by UV, blue, or green excitation [14]. In addition, because of the existence of real intermediate energy levels in

lanthanide ions, this Upconversion process can be much more efficient than in conventional multiphoton-absorption-induced fluorescence of organic dyes or quantum dots, where the intermediate levels are virtual.

Bio-imaging the term that covers the complex chain of acquiring, processing and visualizing structural or functional images of living objects or systems, including extraction and processing of image-related information**.** The upconversion nanoparticles used in bioimaging due to their small physical dimensions and biocompatibility, UCNPs can be easily coupled to proteins or other biological macromolecular systems and used in a variety of assay formats ranging from bio-detection to Cancer Therapy.

For bioimaging the Anti-Stokes luminescence offers key advantages over traditional down conversion emission observed with organic fluorphores. Bio-imaging advantage of UCNPs is their low background fluorescence and high signal-to-noise ratio.

Fluorescence targeted bio-imaging in vivo has proven very useful in tumour recognition and drug delivery

II MOTIVATION FOR THE WORK

Lanthanide-doped upconversion-luminescent nanoparticles (UCNPs), have been very useful for *in vitro* and *in vivo* molecular imaging studies. In comparison with the conventionally used down-conversion fluorescence imaging strategies, the NIR light excited luminescence of UCNPs displays high photo stability, low cytotoxicity, little background auto-fluorescence, which allows for deep tissue penetration, making them attractive as contrast agents for biomedical imaging applications. In this review, we will mainly focus on the latest development of a new type of lanthanide-doped UCNP material and its main applications for *in vitro* and *in vivo* molecular imaging and we will also discuss the challenges and future perspectives.

New materials with high Biocompatibility and more intense emission spectra are needed to be developed so for deep tissue imaging. And also synthesis of water soluble UCNP, with functionalized surface by Ligand Engineering, with high emission intensity. ssynthesis of UCNP of narrow-size distribution with controlled shape.

III CONCLUSION

The past decade a large number of scientists have investigated the potential application of UCNPs in bioimaging. A variety of Upconversion nanophosphor have been developed for bioimaging, and most of them are based on rare earth doped $NaYF_4$. Other kinds of RE doped nanoparticles, such as $NaGdF_4$, $NaLaF_4$, Y_2O_3, GdF_3, CeO_2, $LiNaF_4$, $Ca_3(PO_4)_2$, ZrO_2 and GdOF etc. have also been considered as excellent UCNPs in recent years due to their strong Upconversion luminescence intensity and good photo stability**.** But due to some limitation and drawbacks development of new upconversion nanoparticle is more important in application of bioimaging.

REFERENCES

[1] F. Auzel, Chem. Rev. 2004, 104, 139;

[2] F. Wang, X Liu, Chem. Soc. Rev. 2009, 38, 976;

[3] D. K. Chatterjee, M. K. Gnanasammandhan, Y. Zhang, Small 2010, 6, 278

[4] M. Haase, H. Schafer, Angew. Chem. Int. Ed. 2011, 50, 5808.

[5] D. K. Chatterjee, A. J. Rufaihah, Y. Zhang, Biomaterials 2008, 29, 937

[6] J. Zhou, Y. Sun, X. Du, L. Xiong, H. Hu, F. Li, Biomaterials 2010, 31, 3287;

[7] L. Xiong, T. Yang, Y. Yang, C. Xu, F. Li, Biomaterials 2010, 31, 7078.

[8] Wu SW, Han G, Milliron DJ, Aloni 8 S, Altoe V, Talapin DV, et al. Proceedings of the National Academy of Sciences of the United States of America. 2009; 106: 10917-21. doi:DOI 10.1073/pnas.0904792106.

[9] Mai H-X, Zhang Y-W, Si R, Yan Z-G, Sun L-d, You L-P, et al. J Am Chem Soc. 2006; 128: 6426. doi:10.1021/ja060212h.

[10] Boyer J-C, Cuccia LA, Capobianco JA. Nano Letters. 2007; 7: 847-52. doi:10.1021/nl070235

[11] Heer S, Kömpe K, Güdel HU, Haase M..Advanced Materials. 2004; 16: 2102-5. doi:10.1002/adma.200400772.

[12] Chen GY, Ohulchanskyy TY, Kumar R, Agren H, Prasad PN. ACS Nano. 2010; 4: 3163-8. doi:Doi 10.1021/Nn100457j.

[13] Nyk M, Kumar R, Ohulchanskyy TY, Bergey EJ, Prasad PN. Nano Letters. 2008; 8: 3834-8. doi:10.1021/nl802223f.

[14] Wang M, Mi CC, Wang WX, Liu CH, Wu YF, Xu ZR, et al.. ACS Nano. 2009; 3: 1580-6. doi:Doi 10.1021/Nn900491j.

Curcumin analogues and their logPo/w Prediction

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ABSTRACT
A quantitative structure–activity relationship (QSAR) study was performed to develop models those relate the structures of 41 curcumin compounds to their n-octanol–water partition coefficients (log $P_{o/w}$). The analogues were studied under different quantum-chemical descriptors, electrostatic, constitutional, topological, geometrical that were considered as inputs to the model. The models were constructed using 20 molecules as training set, and predictive ability tested using 11 compounds. Modelling of log $P_{o/w}$ of these compounds as a function of the theoretically derived descriptors was established by multiple linear regression (MLR). The usefulness of the quantum chemical descriptors, calculated at the level of the HF theories using 6-31G basis set for QSAR study of anti-cancer drugs was examined. A multi-parametric equation containing maximum eight descriptors at HF/6-31G* method with good statistical qualities (R2train=0.838, Ftrain=22.93, Q^2_{LOO}=0.843,R^2_{adj}=0.862,Q^2_{LGO}=0.729) was obtained by Multiple Linear Regression using stepwise method. The accuracy of the proposed MLR model was illustrated using the following evaluation techniques: cross-validation, validation through an external test set, and Y randomisation. The predictive ability of the model was found to be satisfactory and could be used for designing a similar group of compounds.*

***Keywords*:** curcumin and its analogues, n-Octanol–water partition coefficients, Quantitative structure–activity relationship (QSAR), Multiple linear regression (MLR).

I INTRODUCTION

Curcumin is an alkaloid produced from the turmeric plant *Curcuma longa*, which is a member of the ginger family (Zingiberaceae). Historically the turmeric has been used as a major component of Indian Ayurvedic medicine to treat a wide variety of health problems [1]. Current research has also identified the Curcumin as responsible molecule for most of the biological activity of turmeric. The Curcumin molecules are chemically polyphenols and are responsible for the yellow color of turmeric and can exist in at least two tautomeric forms, keto and enol [2].Curcumin incorporates several functional groups and the aromatic ring systems the carbonyl groups form a diketone [3].Recently numerous clinical trials in humans are going on, investigating the effect of Curcumin on various diseases including multiple myeloma, pancreatic cancer, myelodysplastic syndromes, colon cancer, psoriasis, and Alzheimer's disease, and also deadliest Swine flu [4-5-6-7].

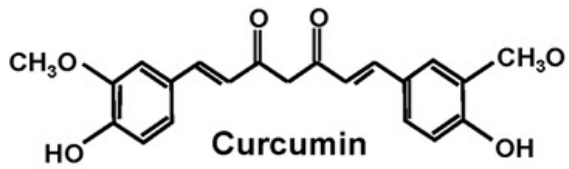


Fig 2 A curcumin molecule

To analyse different potential drug molecules the quantitative structure-activity relationship (QSAR) method is a useful approach. QSAR is basically used to study the biological activities with various properties associated with the structures, which is helpful to explain how structural features in a drug molecule influence the biological activities. The analysis also gathers information that is very much useful for molecular drug design and medicinal Chemistry. Therefore correlating the physicochemical properties or structural features of the important compounds with their biological activity is essential. Here one of the major aspects of the studies in QSAR is according to Lipinski rule of 5 [8, 9, 10]. In addition to this a successful in silico based QSAR analysis also provides the advantages of higher speed and lower costs for bioactivity evaluation of drug as compared to experimental testing [11].

The **partition coefficient** is a ratio of concentrations of un-ionized compound between the two solutions. To measure the **partition coefficient** of ionizable solutes, the pH of the aqueous phase is adjusted such that the predominant form of the compound is un-ionized. The logarithm of the ratio of the concentrations of the un-ionized solute in the solvents is called **log *P***: The log P value is also known as a measure of lipophilicity[12].

$$\log P_{oct/wat} = \log \left(\frac{[\text{solute}]_{\text{octanol}}}{[\text{solute}]^{\text{un-ionized}}_{\text{water}}} \right)$$

The drug's distribution coefficient strongly affects the ease of any drug that can reach its intended target in the body and how strong an effect it will have once it reaches its target, and how long it will remain in the body in an active form.

LogP is one criterion used in medicinal chemistry to assess the druglikeness of a given molecule, and used to calculate lipophilic efficiency, a function of potency and LogP that evaluate the quality of research compounds.[12][13] For a given compound lipophilic efficiency is defined as the pIC_{50} (or pEC_{50}) of interest minus the LogP of the compound. Here we have used 20 different curcumin analogues to study their logP characters. Experimental determination of log *P*o/w is often complex and timeconsuming and can be done only for already synthesized compounds. For this reason, a number of computational methods for the prediction of this parameter have been proposed. In this work a QSAR study is performed, to develop models that relate the structures of a heterogeneous group of 41 drug compounds to their *n*-octanol–water partition coefficients. However, using *in vivo* methods to measure the logarithmic values of partition coefficient drug concentration ratios (log P) in humans is not possible, and to do so in animal models is expensive and time consuming. Finally, the accuracy of the proposed model was illustrated using the following: leave one out, bootstrapping and external test set, cross-validations and Y-randomisation techniques [14-22].

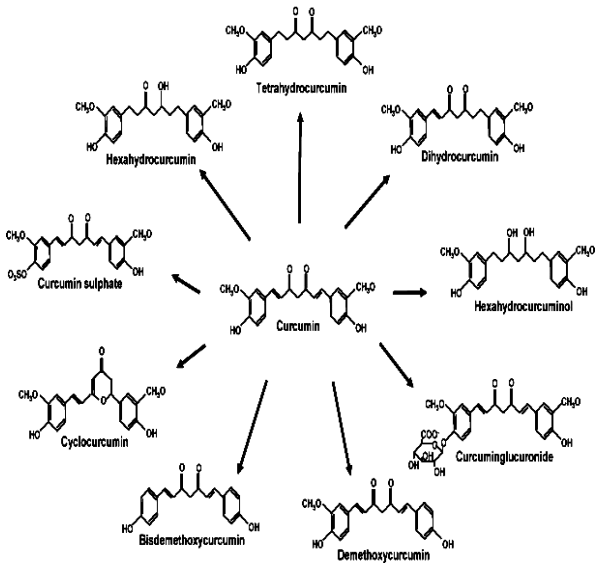


Fig 2 The different curcumin analogues

II EXPERIMENTAL SECTION

The molecular structure of Curcumin derivatives were collected from Pubchem database available in the NCBI server (http://pubchem.ncbi.nlm.nih.gov/).The structure were drawn by ACDchemsketch tool (http://www.acdlabs.com) and corresponding logP of each structure was obtained. DRAGON and GAUSSIAN 05 were used for the descriptor study [23-28,32].

(a) Data Set- The properties data used in this study are the LogPo/w of the set of 20 curcumin derivatives [37-49]. The data set was randomly divided into two subsets: the training set containing 20 compounds (80%) and the test set containing ? compounds (20%). The training set was used to build a regression model, and the test set was used to evaluate the predictive ability of the model obtained. The properties data for the complete set of compounds are presented in Table 2,to derive QSAR models, an appropriate representation of the chemical structure is necessary. For this purpose, descriptors of the structure are commonly used is shown in table-1.

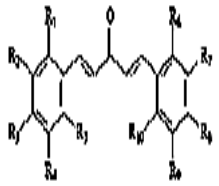
Table 1
The descriptors used in the present study

Descriptors	Symbol	Abbreviation
Quantum chemical descriptors	Molecular Dipole Moment	MDP
	Molecular Polarizability	MP
	Natural Population Analysis	NPA
	Electrostatic Potential	EP
	Highest Occupied Molecular Orbital	HOMO
	Lowest Unoccupied Molecular Orbital	LUMO
	difference between LUMO and HOMO	E GAP
	Electro negativity [χ= -1/2 (HOMO–LUMO)]	X
	El Electro philicity ($\omega=\chi$ 2/2 η)	Ω
	Mulliken E GAPCharge	MC
Chemical properties	Partition Coefficient	Log P
	Mass	M
	Molecule volume	V
	Molecule surface area	MSA
	Hydration Energy	HE
	Refractivity	REF

III RESULTS AND DISCUSSION

Overall 20 Curcumin analogues were retrieved from Pubchem data base and the same were used for the QSAR analysis by the following descriptor studies (Table 2).

Table2
variations considered in the R_1-R_{10} positions of curcumin



Compounds	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}
1	-OH	-H	-H	-H	-H	-OH	-H	-H	-H	-H
2	-H	-OH	-H	-H	-H	-H	-OH	-H	-H	-H
3	-H	-H	-OH	-H	-H	-H	-H	-OH	-H	-H
4	-H	-H	-H	-F	-H	-H	-H	-F	-H	-H
5	-H	-OCH_3	-OCH_2OCH_3	-OCH_3	-H	-H	-OCH_3	-OCH_2OCH_3	-OCH_3	-H
6	-H	-OCH_2OCH_3	-H	-OCH_2OCH_3	-H	-H	-OCH_2OCH_3	-H	-OCH_2OCH_3	-H
7	-H	-H	-OH	-OCH_3	-H	-H	-OH	-OCH_3	-H	-H
8	-H	-OCH_3		-OCH_3	-H	-H	-OCH_3		-OCH_3	-H
9	-H	-OCH_3		-H	-H	-H	-OCH_3		-H	-H
10	-H	-H		-H	-H	-H	-H		-H	-H
11	-H	-CH_3		-CH_3	-H	-H	-CH_3		-CH_3	-H

(a)Data-All log*P*o/w data for all 41 compounds was taken from the literature.The data set was split into a training set (13compounds) and a prediction set (7 compounds). The log *P*o/w of these compounds are deposited in Journal log as supporting material (see Tables 2). Chemical structure of drugs that illustrated in this study is shown in Table 2.

(b) Molecular descriptor generation-All of the molecules were drawn into the Chemsketch. The Gaussian 03 and DRAGON packages were used for calculating the molecular descriptors(Table 1). Some of the descriptors are obtained directly from the chemical structure, e. g. constitutional, geometrical, and topological descriptors. Other chemical and physicochemical properties were determined by the chemical structure (lipophilicity, hydrophilicity descriptors, electronic descriptors, energies of interaction). In this work, we used Gaussian 03 for ab initio calculations.DFT method at 6-31G* were applied for optimization of anti-cancer drugs and calculation of many of the descriptors. Software hyper Chem and some of the descriptors such as partition coefficient, surface area, hydration energy, and refractivity were calculated through it. The rest of the descriptors were obtained of Gaussian calculations.

A large number of descriptors were calculated by Gaussian package and Chemsketch software. One way to avoid data redundancy is to exclude descriptors that are highly intercorrelated with each other before performing statistical analysis. The molecular structures were saved by the HIN extension and entered on the DRAGON software for the calculation of the 18 different types of theoretical descriptors for each molecule. They included (a) 0D-constitutional (atom and group counts); (b) 1D-functional groups, 1D-atom centered fragments; (c) 2D-topological, 2DBCUTs, 2D-walk and path counts, 2D-autocorrelations, 2D-connectivity indices, 2Dinformation indices, 2D-topological charge indices, and 2D-eigenvalue-based indices; and (d) 3D-Randic molecular profiles from the geometry matrix, 3D-geometrical, 3D-WHIM, and 3DGETAWAY descriptors. A stepwise technique was employed that only one parameter at a time was added to a model and always in the order of most significant to least significant in terms of F-test values. Statistical parameters were calculated subsequently for each step in the process, so the significance of the added parameter could be verified. The goodness of the correlation is tested by the regression coefficient (R^2), the F-test and the standard error of the estimate (SEE). The test and the level of significance, as well as the confidence limits of the regression coefficient, are also reported. The squared correlation coefficient, R^2, is a measure of the fit of the regression model. Correspondingly, it represents the part of the variation in the observed (experimental) data that is explained by the model.

(c) Genetic algorithm for descriptor selection- Genetic algorithm variable selection is a technique that helps identify a subset of the measured variables that are, for a given problem, the most useful for a precise and accurate regression model. The selection of relevant descriptors, which relate the log *P*o/w to the molecular structure, is an important step to construct predictive models. The genetic algorithm was applied to the input set of 53 molecular descriptors for each chemical of the studied data sets and the related response, in order to extract the best set of molecular descriptors, which are, in combination, the most relevant variables in modeling the response of the training set chemicals.

Genetic algorithm (GA), included in the PLS Toolbox version 2.0, was used for variables selection (based on the training set). Using GA-based MLR variable selection procedures, the dependent variables, i.e., the log *P*o/w, were used to find subsets of molecular descriptors that provide a good relationship to the log *P*o/w. Given an X-matrix of descriptors data and a log *P*o/w of

values to be predicted, one can choose a random subset of variables from **X** and, through the use of cross-validation and MLR regression method, determine the root-mean-square error ofcross-validation (RMSECV)[31,33] obtained when using only that subset of variables in a regression model. Genetic algorithms use this approach iteratively to locate the variable subset (or subsets) which gives the lowest RMSECV. The first step of the GA is to generate a large number (e.g., 32, 64, 128) of random selections of the variables and calculate the RMSECV for each of the given subsets. Each subset of variables is called an individual (or chromosome) and the yes/no flags indicating which variables are used by that individual is the gene for that individual. The pool of all tested individuals is the population. The RMSECV values, described as the fitness of the individual, indicate how predictive each individual's selection of variables is for the log *P*o/w [39].

The diversity of the training set and the test set was analyzed using the principal component analysis (PCA) method[40,41]. The PCA was performed with the calculated structure descriptors for the whole data set to detect the homogeneities in the data set[42], and also to show the spatial location of the samples to assist the separation of the data into the training and test sets. The PCA results showed that three principal components (PC1and PC2) described 24.39% of the overall variables, as follows: PC1 = 16.79% and PC2 =7.6.%. Since almost all the variables can be accounted for by the first three PCs, their score plot is a reliable representation of the spatial distribution of the points for the data set. The multi-collinearity between the above seven descriptors were detected by calculating their variation inflation factors (VIF)[43-45], which can be calculated as follows:

$$VIF = \frac{1}{1-r2}$$

Where r is the correlation coefficient of the multiple regression between the variables in the model. If VIF equals to 1, then no inter-correlation exists for each variable; if VIF falls into the range of 1–5, the related model is acceptable; and if VIF is larger than 10, the related model is unstable and a recheck is necessary [30]. The corresponding VIF values of the seven descriptors are shown in Table 2. As can be seen from this table, most of the variables had VIF values of less than 5, indicating hat the obtained model has statistic significance. To examine the relative importance as well as the contribution of each descriptor in the model, the value of the mean effect (MF)[46-50] was calculated for each descriptor. This calculation was performed with the equation below:

$$MFj = \frac{\beta \sum_{i=n}^{i=n} dij}{\sum_{j}^{m} \beta j \sum_{i}^{n} \beta ij}$$

Where *MFj*represents the mean effect for the considered descriptor *j, βj* is the coefficient of the descriptor *j*, *dij*stands for the value of the target descriptors for each molecule and, eventually, *m* is the descriptors number for the model. The MF value indicates the relative importance of a descriptor, compared with the other descriptors in the model. Its sign indicates the variation direction in the values of the activities as a result of the increase (or reduction) of the descriptor values. The mean effect values are shown in Table 3. All descriptors were calculated for the neutral species. The log *P*o/w is assumed to be highly dependent upon the EP26, NPA13, SAPAC22,PW3 ,Mor16m,Mor18m,Mor24m and G2u.

In the present study, the QSAR model was generated using a training set of 33 molecules (Table 2).

Table 3.The linear model based on the eight parameters selected by the GA-MLR method

Descriptor	Chemical meaning	MFa	VIFb
Constant	Intercept	0	0
EP26	Electrostatic potential 26	1.260265	1.148737
NPA13	Natural population analysis 13	-0.15876	1.182888
SAPAC22	Surface area approx atomic charg22	0.00414	1.105926
PW3	Path/walk3-randic shape index	-0.07902	1.284402
Mor16m	3D-MoRSE-signal16/weighted by atomic masses	0.005628	1.321815
Mor18m	3D-MoRSE-signal18/weighted by atomic masses	0.002912	1.105745
Mor24m	3D-MoRSE-signal24/weighted by atomic masses	-0.00102	1.226363
G2u	1st component symmetry directional WHIM index/unweighted	-0.03414	1.099806

a Mean effect
b Variation inflation factors

The test set of 8 molecules (Table 2) with regularly distributed log *P*o/w values was used to assess the predictive ability of the QSARmodels produced in the regression.

(d) MLR analysis-The software package used for conducting MLR analysis was Spss 16. Multiple linear regression (MLR) analysis has been carried out to derive the best QSAR model. The MLR technique was performed on the molecules of the trainingset shown in Table 2.A small number of molecular descriptors (EP26,NPA13,SAPAC22,PW3 ,Mor16m,Mor18m ,Mor24m and G2u) proposed were used to establish a QSAR model. Additional validation was performed on an external data set consisting of 8 drug compounds. Multiple linear regression analysis provided a useful equation that can be used to predict the log *P*o/w of drug based upon these parameters. The best equation obtained for the Lipophilicity of the drug compounds is

LogP=150.269(±37.396)-12.787(±2.570)EP26+3.882(±0.762)NPA13-0.097(±0.025)SAPAC22+30.446(±9.409)PW31.056(±0.236)Mor16m+0.445(±0.168)Mor18m-1.418(±0.258)Mor24m +34.976(±7.513)G2u

N=41 N train=33 N test=8 R^2 train=0.893 F train=24.934 R^2test=0.541 Ftest=-0.045 R^2adj= 0.857 Q^2_{LOO}=0.816 Q^2_{LGO}=0.730.

In this equation, N is the number of compounds; R^2 is the squared correlation coefficient, $Q^2_{LOO,}$ Q^2_{LGO} are the squared cross-validation coefficients for leave one out, bootstrapping and external test set respectively, F is the Fisher F statistic. The figures in parentheses are the standard deviations. The built model was used to predict the test set data and the prediction results are given in Table 1. As can be seen from Table 1, the calculated values for the LogP are in good agreement with those of the experimental values. The predicted values for LogP for the compounds in the training and test sets using equation 1 were plotted against the experimental LogP values in Figure 1. A plot of the residual for the predicted values of LogP for both the training and test sets against the experimental LogP values are shown in Figure 2.

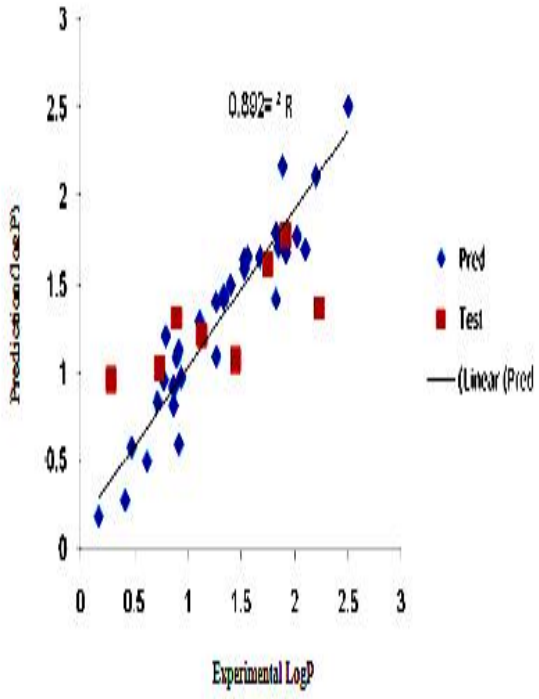


Fig.1 the predicted logP value versus experimental logP by MLR

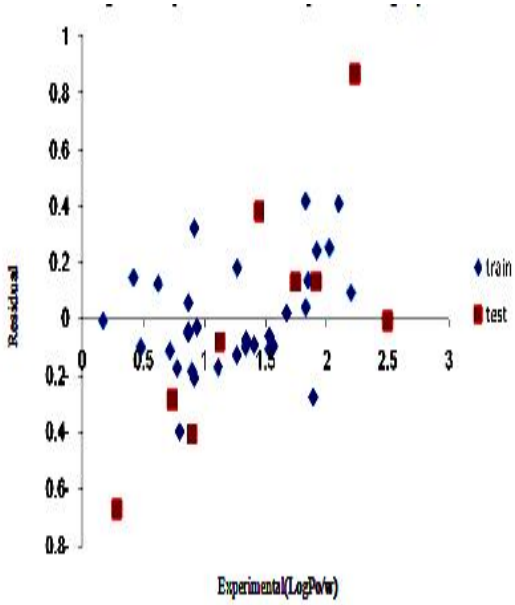


Fig 2 The residual logP versus experimental logP by GA-MLR

Also, in order to assess the robustness of the model, the Y-randomisation test was applied in this study [25–28]. The dependent variable vector (LogP) was randomly shuffled and The new QSAR models (after several repetitions) would be expected to have low R2 and Q2 LOO values (Table 4). If the opposite happens then an acceptable QSAR model cannot be obtained for the specific modeling method and data.

Table 4.
The R^2_{train} and Q^2_{LOO} values after several Y-randomisation tests

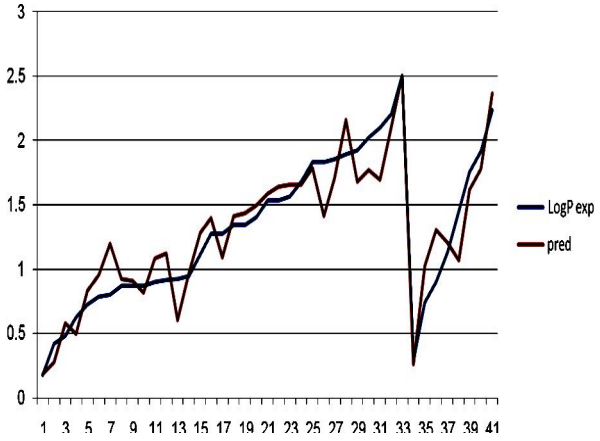
No	Q^2	R^2
1	0.113284	0.472045
2	0.048896	0.230775
3	0.003785	0.234683
4	0.012186	0.31958
5	0.042953	0.180091
6	0.042723	0.320828
7	0.019219	0.21774
8	0.083071	0.279033
9	0.005137	0.320529
10	0.059051	0.166103

The MLR analysis was employed to derive the QSAR models for different Nucleoside analogues. MLR and correlation analyses were carried out by the statistics software SPSS (Table 5). Figure 2 has showed that results were obtained from equation HF/6-31G* to the experimental values.

Table 5. The correlation coefficient existing between the variables used in different MLR and equations with HF/6-31G* method

	EP26	NPA13	SAPAC22	PW3	Mor16m	Mor18m	Mor24m
EP26	1	0	0	0	0	0	0
NPA13	0.054065	1	0	0	0	0	0
SAPAC22	-0.2344	-0.12944	1	0	0	0	0
PW3	0.012593	0.236561	-0.34562	1	0	0	0
Mor16m	-0.33313	-0.24288	-0.00361	-0.23044	1	0	0
Mor18m	0.177918	0.081215	-0.13201	0.061633	-0.19956	1	0
Mor24m	0.157028	0.378326	-0.18368	0.073222	-0.35014	0.252322	1
G2u	.047641	0.049852	-0.17016	0.322559	-0.04335	0.01788	-0.08377

(e) Interpretation of descriptors- The QSAR developed indicated that electrostatic properties (EP), natural population analysis (NPA), surface area approx atomic charge 22 (SAPAC), Path/walk3-randic shape index(PW3) 3D-MoRSE-signal(16,18,24)/weighted by atomic masses (Mor16m,Mor18m, Mor24m), 1st component symmetry directional WHIM index/unweighted (G2u)drug *n*-octanol/water partition coefficients.Positive values in the regression coefficients indicate that the indicated descriptor contributes positively to the value of log *P*o/w, whereas negative values indicate that the greater the value of the descriptor the lower the value of log*P*o/w.In other words, increasing the EP26 and Mor24mwill decrease log *P*o/w and increasing the NPA13,SAPAC22,PW3,Mor16m,G2u and Mor18m increases extent of log *P*o/w of the curcumin. The standardized regression coefficient reveals the significance of an individual descriptor presented in the regression model.



Series 1: the values of log P were obtained by using prediction.
Series 2: the values of log P were obtained by using Experimental methods

Fig 3 The comparison between biological activity (log p) using experimental and prediction

The greater the absolute value of a coefficient, the greater the weight of the variable in the model. Mor16m is the forth descriptor, appearing in the model. It is one of the 3D-molecule representations of structuresbased on electron diffraction (3D-MoRSE) descriptors. The 3DMoRSE descriptors are derived from infrared spectral simulation using a generalised scattering function [31]. Thisdescriptor was proposed as signal (16, 24)/weighted by the atomicmasses which relates to the atomic masses of the molecule.The Mor(16,24)m displays a positive sign, which indicates that theLogPo/wis directly related to this descriptor.The next descriptor is the path/walk 3Randic shape index (PW3), which is one of the topological descriptors. The atomic path/walk indices are defined for each atom as the ratio between the atomic path count and the atomic walk count of the same length. Whereas the number of paths in a molecule is bounded and determined by the molecule's diameter, the number of walks is unbounded. However, being interested only in quotients, the walk count is terminated when it exceeds the maximum allowed length of the corresponding path [31]. The molecular path/walk indices are defined as the average sum of atomic path/walk indices of equal length. As the path/walk count ratio is independent of molecular size, these descriptors can be considered as shape descriptors. As is apparent from Table 2, the PW3 mean effect has a negative sign which indicates that the LogPo/wis inversely related to this descriptor; therefore, increasing the PW3 of molecules leads to a decrease in its LogPo/w values.

IV CONCLUSION

In this article, a QSAR study of 20 curcumin analogues was performed based on the theoretical molecular descriptors calculated by the DRAGON and GAUSSIAN software and selected. The built model was assessed comprehensively (internal and external validation) and all the validations indicated that the QSAR model built was robust and satisfactory, and that the selected descriptors could account for the structural features responsible for the anti-cancer drugs activity of the compounds. The QSAR model developed in this study can provide a useful tool to predict the activity of new compounds and also to design new compounds with high activity.

REFERENCES

[1] Aggarwal BB; Sundaram C; Malani N; Ichikawa H. *Adv. Exp. Med. Biol.* 2007, 595: 1–75.

[2] Tsonko M. Kolev; Evelina A.; Velcheva; Bistra A; Stamboliyska; Michael Spiteller. *International Journal of Quantum Chemistry*, 2005, 102 (6), 1069–79.

[3] Albena T.; Dinkova-Kostova; Paul Talalay *Carcinogenesis*, 1999, 20 (5), 911-914.

[4] Aggarwal BB; Shishodia S. *Biochemical Pharmacology*, 2006, 71 (10), 1397–1421.

[5] Hyunsung Choi; Yang-Sook Chun; Seung-Won Kim; Myung-Suk Kim; Jong-Wan Park.
   a. *Molecular Pharmacology*, 2006, 70 (5), 1664–71.

[6] Hatcher H; Planalp R; Cho J; Torti FM; Torti SV. *Cell. Mol. Life Sci.*, 2008, 65 (11), 1631–1652.

[7] Da-Yuan Chen ; Jui-Hung Shien ; Laurence Tiley ; Shyan-Song Chiou ; Sheng-Yang
   a. Wang; Tien-Jye Chang ; Ya-Jane Lee ; Kun-Wei Chan ; Wei-Li Hsu. *FoodChemistry*,
   b. 2010, 119 (4), 1346–1351.

[8] Lipinski CA, Lombardo F, Dominy BW, Feeney PJ "Experimental and computational approaches to estimate solubility and permeability in drug discovery and development settings". *Adv. Drug Deliv. Rev.* 46 (1-3): 3–26. 2001. doi:10.1016/S0169-409X(00)00129-0. PMID 11259830.

[9] Lipinski CA "Lead- and drug-like compounds: the rule-of-five revolution". *Drug Discovery Today: Technologies* 1(4): 337–341. 2004. doi:10.1016/j.ddtec.2004.11.007.

[10] Oprea TI, Davis AM, Teague SJ, Leeson PD. "Is there a difference between leads and drugs? A historical perspective". *J Chem Inf Comput Sci* 41 (5): 30815.2001) doi:10.1021/ci010366a. PMID 11604031.

[11] Edwards MP, Price DA (2010). "Role of Physicochemical Properties and Ligand Lipophilicity Efficiency in Addressing Drug Safety Risks". *Annual Reports in Medicinal Chemistry*. Annual Reports in Medicinal Chemistry 45: 381–391.doi:10.1016/S0065-7743(10)45023-X. ISBN 978-0-12-380902-5.

[12] Jump up^ Leeson PD, Springthorpe B (November 2007). "The influence of drug-like concepts on decision-making in medicinal chemistry". *Nat Rev Drug Discov* 6 (11): 881–90.doi:10.1038/nrd2445. PMID 17971784.

[13] David A. Winkler. *Briefings in Bioinformatics*, 2002, 3(1), 73-86.

[14] Schuettelkopf AW; D.M.F VanAalten. *Acta Crystallographica*, 2004, D60: 1355-1363.

[15] David J.; Wild J. *Chem. Inf. Model*, 2005, 459(1), 212

[16] Andrews PR; Craik DJ; Martin JL. *J Med Chem*. 1984, 27(12), 1648-1657.

[17] www.pubchem.com

[18] Shahlaei M; Fassihi A; Saghaie L. *Eur J Med Chem.*, 2010, 45(4), 1572-1582.

[19] Zahra Garkani-Nejad; Fereshteh Saneie. *Bull. Chem. Soc. Ethiop.*, 2010, 24(3), 317-325.

[20] Du Q, Mezey PG; Chou KC. *J Comput Chem.*, 2005, 26(5):461-470.

[21] Huuskonen J., Salo M., Taskinen J., *J. Pharm. Sci.*, 86, 450—454 (1997).

[22] P.J. Taylor, C. Hansch, P.G. Sammes, J.B. Taylor, Comprehensive Medicinal Chemistry, Pergamon Press, Oxford, 1990.

[23] I. Moriguchi, S. Hirono, I. Nakagome, H. Hirano, *Chem. Pharm. Bull.* 42 (1994) 976.

[24] W.M. Meylan, P.H. Howard, J. Pharm. Sci. 84 (1995) 83.

[25] V.K. Gombar, K. Enslein, *J. Chem. Inf. Comput. Sci.* 36 (1996) 1127.

[26] S.C. Basak, B.D. Gute, G.D. Grunwald, *J. Chem. Inf. Comput. Sci.* 36 (1996) 1054.

[27] J.J. Huuskonen, D.J. Livingstone, I.V. Tetko, *J. Chem. Inf. Comput. Sci.* 40 (2000) 947.

[28] I.V. Tetko, V.Y. Tanchuk, A.E.P. Villa, *J. Chem. Inf. Comput. Sci.* 41 (2001) 1407.

[29] L. Molnar, G.M. Keseru, A. Papp, Z. Gulyas, F. Darvas, *Bioorg. Med. Chem. Lett*. 14 (2004) 851.

[30] A.F. Duprat, T. Huynh, G. Dreyfus, *J. Chem. Inf. Comput. Sci*. 38 (1998) 586.

[31] J. Ghasemi, S. Shahmirani, E.V. Farahani, *Anal. Chim.*96 (2006) 327.

[32] J. Ghasemi, S. Saaidpour, S.D. Brown, *J. Mol. Struct*. (Theochem.)805 (2007) 27.

[33] J. Ghasemi, S. Saaidpour, *Chem. Pharm. Bull*.55 (2007) 669.

[34] J. Ghasemi, Sh. Ahmadi, *Anal. Chim*.97 (2007) 69.

[35] J. Ghasemi, S. Asadpour, A. Abdolmaleki, *Anal. Chim.Acta* 588 (2007) 200.

[36] S. Qanei Nassab, Z. Bayat, J. Movaffagh, *J. Chem. Pharm. Res.*, 2011, 3(1):64-71

[37] Z. Bayat and S. Vahdani, *J. Chem. Pharm. Res*., 2011, 3(1):93-102

[38] D.C. Young, Computational Chemistry, John Wiley & SonsInc., 2001.

[39] Pomona college medicinal chemistry project, Claremont, CA91711, LogP database, (C.Hansh and A.Leo), july 1987 edition

[40] E. Frich, P.B. Jones, M.Roed, T.Skovsgaard and N.I.Nissen, *Biochem, pharmacol*, 39(11),
   a. 1721-1726(1990) [41] I.Faccheti and A.Vigevani, *pharmacochem.library* 10,138-140(1987)

[41] C.Hansh, A.Leo and D.Hokman, American chemical society,Washington(1995)

[42] E.M.Action, G.L.Tong, D.L.Taylor, D.G.Streeter,J.A.Fillibi and R.L.Wolgemuth, *J.Med.Chem*, 29(10),2074-2079(1986)

[43] Z. Bayat and M. Fakoor Yazdan Abad, *J. Chem. Pharm. Res.*, 2011, *3(1):48-55*

[44] Z. Bayat, S. Qanei Nassab, *J. Chem. Pharm. Res.*, 2010, 2(6):306-315

[45] C.j.Coulson, and V.J. Smith, *J.Pharm.Sci*, 69(7),799-801(1980)

[46] Hoffman, H.G.Berscheid, D.Borttger, H.H.Sedlacek an H.P.Kraemer,*j.med.chem*,33(1),166-171(1990)

[47] E.L.Gabbay, D.Grier, R.E.Fingerle, R.Reimer, R.LevyW.D.Wilson, Biochemistry, 15(10), 2062-2070(1976)

[48] G. Espinosa, D. Yaffe, Y. Cohen, A. Arenas, F. Giralt, *J. Chem. Inf. Comput. Sci*. 2000, 40,859–879.

[49] Todeschini R, Consonni V. Handbook of Molecular Descriptors. Weinheim, Germany: Wiley-VCH, 2000;1–667.

Fuzzy Logic and Energy based Routing in Wireless Mesh Networks

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ABSTRACT
Wireless Mesh Networks (WMNs) is an emerging trend in wireless communication more flexible, reliable and effective than the other competitive wireless technologies. In this paper, I present a generalized fuzzy logic and cluster based architecture based scheme for energy aware routing in wireless mesh networks. Here, I have considered a cluster-based architecture for WMN, where a group of nodes is managed by a gateway. To determine the value of cost for a link between two mesh nodes, a fuzzy logic approach has been used. Six input variables are applied to find out the one output variable cost in our proposed fuzzy rule system. In recent years, many approaches and techniques have been explored for the optimization of energy usage in wireless mesh networks. In this paper a novel routing scheme for 802.11 based wireless mesh networks called Energy aware Routing Scheme (ERS) has been proposed. The design objective of ERS is to minimize the overall energy consumption in the mesh network. Routing is one of these areas in which attempts for efficient utilization of energy have been made. In this paper, A generalized fuzzy logic based approach for energy-aware routing in wireless mesh networks is about presented.The proposed approach is thoroughly evaluated and shown to outperform previous approaches very substantially in terms of energy consumption.

Keywords— Wireless Mesh Networks, fuzzy logic, routing.

I INTRODUCTION

Wireless Mesh networks (WMNs) are dynamically self organized and self organized with the nodes in the network automatically establishing an ad hoc network and maintaining the mesh connectivity. The fundamental features of WMN are large in capacity, wide area coverage and high transmission speed. Wireless mesh networks configures itself and because of its cost effectiveness, it therefore seen as a solution for the next generation networks. In wireless mesh networks, each mesh node operates both as router and forwarding node for the delivery of packet to desired destination. All nodes maintain profile information of all the others nodes in the network for further processing of routing of packets. These mesh nodes have limited battery energy that is contineously decaying during the process of transmission, forwarding and receiving of packets. Most of the time capacity of these nodes. Various approaches for optimizing the energy usage in wireless mesh networks have been proposed.

In this paper, we present a fuzzy model for energy aware routing in wireless mesh networks. Existing proposed routing protocols for WMNs use fixed (crisp) metrics for making energy-aware routing decisions. This has the disadvantage of not being easily adaptive to changes in mesh node types because energy metrics vary widely with the type of mesh node implementation platform. Moreover, some of the factors for calculating routing metric are conflicting. For example, short multiple-hops reduces transmission power but results in greater number of hops thereby reducing the energy of a larger number of nodes involved in relaying. Fuzzy logic, on the other hand, has potential for dealing with conflicting situations and imprecision in data using heuristic human reasoning without needing complex mathematical modeling. The potential of fuzzy logic is being fully explored in the fields of signal processing, speech recognition, aerospace, robotics, embedded controllers, networking, business and marketing.

Here, we present a soft computing based approach to energy optimized routing using fuzzy variables and rule base. This results in soft accommodating way of routing in WMNs capable of handling a wide range of energy metrics of different mesh node implementation platform.

We have assumed a cluster-based architecture for WMN, where a group of nodes is managed by a gateway. Various criteria for cluster-formulation have been proposed but in this paper our focus is on routing within a cluster. The gateway is responsible for the management of nodes in its cluster, communicating with other gateways, processing of data received from mesh nodes and transmitting the processed data to the command center. We have assumed that the gateway is much powerful as compared to mesh nodes and has no energy limitation. Moreover, the routing is centralized, i.e., the gateway sets routes for mesh nodes. All mesh nodes have one destination namely the gateway, reachable via various routes through multiple-hops over mesh nodes. The remaining of this paper is structured as follows. Section II summarizes the related work. In section III we describe our system model. We present our fuzzy model in section IV. Simulation results are

presented in section V. Section VI concludes our paper.

II LITERATURE SURVEY

Sara MAMECHAOUI et al. [11] proposed energy efficiency cross layer protocol for wireless mesh network. This protocol is based on Green Networking. This proposed cross layer protocol is implemented in time division multiplex (TDM) access based WMN MAC protocol. Also a comparative analysis of AODV, DSDV, AOMDV in respect of routing categories, route maintained in, discovery of necessary route, necessary periodic update, update from, uses 'Hello' message, route inserted into the header of the packet, uses timer route, multiple route available. Keeping in view the limitations in these protocols, a new cross- layer protocol for WMN has been proposed. For simulation purposes, network simulation-2 has been applied.S.P. Shiva Prakash, T.N. Nagabhushan, Kirill Krinkin has proposed energy aware power save mode in wireless mesh networks [12]. The proposed EAPSM (energy aware power save mode) comprise of energy consumption calculator, transmission mode identifier, PSM (power save mode) Scheduler. Also an algorithm used to schedule PSM of a node has been presented. T.N. Naabhshan et al have proposed a new routing scheme named "minimum battery draining rate aware OLSR (Optimized Link State Routing) scheme for WMNs (Wireless Mesh Networks). In this proposed research work [8], each node declares its willingness value by calculating its own energy status. Based on two metrics named as 'Residual Energy' and 'Draining Rate', MPR Selector works i.e. select the MPRs (Multipoint Relays). In MPR selection process, some of the modules are: create network, install OLSR routing to each node, install RV battery model to each node, calculate available energy, calculate energy draining rate, MPR/Route selection etc. for simulation purposes, network simulator-2 has been used. Also a comparison work of OLSR algorithm and proposed MDRA-OLSR algorithm has been taken out. Tarique Haider and Marian Yusuf have argued a fuzzy approach for energy optimized routing in WSN (wireless sensor network). The proposed approach [4] is based on cluster technique and fuzzy logic system. The gateway is responsible for the management of nodes in its cluster. The one gateway can communicate to another gateway. Cluster based architecture has been assumed for wireless sensor network. To calculate the cost for a link between two sensor nodes, fuzzy model approach has been applied. For the proposed fuzzy model, 144 rules have been generated. Here six input variables transmission energy, remaining energy, rate of energy consumption, queue size, distance from gateway and weight are used to find out one output variable 'cost'. MatLab 7.2 has been used for simulation purposes. Adeel Akram and Mariam Shafqat have proposed a modified AODV protocol [7] for wireless mesh network. To optimize the battery and frequency, AODV protocol has been modified. To remove the conflicts between channel re-use, an algorithm has been implemented in this work. At the last of this research work, a comparison between AODV and proposed modified AODV has been taken. S.P. Shiva Prakash, T.N. Nagaabhushan, and Kirill Krinkin [12] have proposed an energy aware power save mode scheme WMN (wireless mesh network). In this proposed work, EAPSM (Energy Aware Power Save Mode) has been generated to overcome the deficiency of low PDR. Remaining energy calculator, transmission mode identifier and PSM scheduler are the three modules for EAPSM. The researcher argued that the EAPSM enhance the quality of service (QoS) by the increase of PDR when compared to conventional (Power Supply Mode) PSM. Maria Zogkon et al. have proposed a energy aware new metric in IEEE 802.11s Wireless Mesh Networks. The proposed metric takes into account the residual energy of a node by calculating the total energy consumed by a node. K.Sasikala and V.Rajamani [2] have proposed a fuzzy logic based routing approach for wireless mesh network. Here, a fuzzy logic system based algorithm has been proposed to provide the best optimal best case performance. For simulation purposes, network simulator-2 has been applied. A comparison between proposed routing protocol and obvious routing protocol has been done.

III SYSTEM MODEL

Cluster-based routing has been shown to be quite effective in wireless mesh networks. WMN is usually formed for a specific application; gateways can be chosen to be much powerful as compared to the mesh nodes. This relieves the energy-constrained mesh nodes of communicating directly with the remote sink. In this paper, we have assumed a cluster-based architecture for WMN, where a group of nodes is managed by a gateway. The gateway can communicate directly with all the mesh nodes and can retrieve their status. All mesh nodes have one destination namely the gateway to which they send their received data. Nodes can communicate directly with the gateway but this will be very costly for those nodes which are not close to the gateway. Therefore, the gateway is also reachable via various routes through multiple-hops over mesh nodes in the network. The gateway is responsible for setting up of routes for mesh nodes and for the maintenance of the centralized routing

table that indicates the next hop for each mesh node. Gateway periodically invokes the fuzzy routine to determine the cost of link between any two mesh nodes. Once the costs of all possible links to the single destination (gateway) are computed using fuzzy logic, the route can then be determined using any shortest path algorithm. We have used Dijkstra's algorithm for our simulation. Routing table entries are periodically refreshed to reflect the updated state of the network. We have further assumed that the gateway is much powerful as compared to mesh nodes and has no energy limitation. In this paper, we have not considered the issues of cluster formation, routing between gateways and energy optimization of gateways as our main focus is on effective energy optimized routing within the cluster. We have used Heinzelman's energy model for sensor networks.

IV UZZY MODEL

(a) Overview of Fuzzy Logic-Fuzzy Logic is used in this work as main implementation of perceptive reasoning. Fuzzy logic imitates the logic of human thought, which is much less rigid than the calculations computers generally perform. Fuzzy Logic offers several unique features that make it a particularly good alternative for many control problems. It is inherently robust since it does not require precise, noise-free inputs and can be programmed to fail safely. The output control is a smooth control function despite a wide range of input variations. Since the FL controller processes user defined rules governing the target control system, it can be modified and tweaked easily to improve or drastically alter system performance. Fuzzy Logic deals with the analysis of information by using fuzzy sets, each of which may represent a linguistic term like "Warm", "High" *etc.* Fuzzy sets are described by the range of real values over which the set is mapped, called domain, and the membership function. A membership function assigns a truth value between 0 and 1 to each point in the fuzzy set's domain. Depending upon the shape of the membership function, various types of fuzzy set can be used such as triangular, beta, PI, Gaussian, sigmoid *etc*. A Fuzzy system basically consists of three parts: fuzzifier, inference engine, and defuzzifier. The fuzzifier maps each crisp input value to the corresponding fuzzy sets and thus assigns it a truth value or degree of membership for each fuzzy set. The fuzzified values are processed by the inference engine, which consists of a rule base and various methods for inferring the rules. The rule base is simply a series of IF-THEN rules that relate the input fuzzy variables with the output fuzzy variables using linguistic variables, each of which is described by a fuzzy set, and fuzzy implication operators AND, OR *etc*. The part of a fuzzy rule before THEN is called predicate or antecedent, while the part following THEN is referred to as consequent. The combined truth of the predicate is determined by implication rules such as MIN-MAX (Zadeh) and bounded arithmetic sums. All the rules in the rule-base are processed in a parallel manner by the fuzzy inference engine. Any rule that fires contributes to the final fuzzy solution space. The inference rules govern the manner in which the consequent fuzzy sets are copied to the final fuzzy solution space. Example, techniques are MIN-MAX and fuzzy adaptive method. The defuzzifier performs defuzzification on the fuzzy solution space. That is, it finds a single crisp output value from the solution fuzzy space. Common defuzzification techniques are centroid, composite maximum, composite mass, *etc.*

(b) Description- The objective of our fuzzy routine is to determine the value of cost for a link between two mesh nodes such that the life of a mesh network is maximized. The lifetime of wireless mesh networks is generally defined as the time when the energy level of the first mesh node becomes zero. The fuzzy rule base has been tuned so as to not only extend the life time of the mesh network but also to balance the routing load among mesh nodes effectively so that a maximum number of nodes have sufficient energy to continue performing their own receiving tasks.
The input fuzzy variables are:

(i) Transmission Energy--low, high
(ii) Remaining Energy--low, medium, high
(iii) Rate of Energy Consumption—low, medium, high
(iv) Queue Size—small, large
(v) Distance from gateway –small, large
(vi) and weight—small, large
(vii) The rule base therefore consists of 2^4 x3^2 =144 rules.
(viii) Output variable Cost—svery low, low, low medium, high medium, high, very high
(ix) There is a single output fuzzy variable, namely cost the defuzzified value of which determines the cost of link between two mesh nodes.

In determining the cost of link from node *x* to node *y*,
"Transmission Energy" represents the energy needed to transmit a data packet from node *x* to *y*. Lower value of transmission energy leads to lower link cost.
"Remaining Energy" indicates the energy level of node *y*. Nodes with less value of remaining energy should be avoided in being selected as next-hop. Consequently, it slower value results in a higher link cost.

"Energy Consumption rate" of node *y* is another important parameter. It is possible to have a node with a high value of initial energy, resulting in a higher value of remaining energy in spite of its high rate of energy consumption. Nodes with high rate of energy consumption are, therefore, assigned higher link costs.

The fuzzy input variable ***"Distance from the gateway"*** enables selection of routes with minimum hops. Nodes nearer to the gateway are thus assigned lower link cost.

Each mesh node is assigned a dynamic ***weight*** depending upon its current status. This parameter helps in selecting nodes which are either inactive or are only in the receiving state. Thus, a high value of weight makes the node favorable for next-hop, resulting in a lower value of link cost. The input fuzzy variable ***"queue size"*** indicates the buffer capacity at node *y*. This parameter helps avoid packet drops due to congestion at the receiver. The output fuzzy variable consists of six membership functions. A cost between 0 and 1 is assigned to each link. The domains of input fuzzy variables have been selected according to our simulation environment, but they can be easily modified to make them general purpose. MIN-MAX inference technique has been used in the fuzzy controller. To find a crisp output value from a solution fuzzy region, the controller uses Centroid Defuzzification method. Centroid defuzzification finds the balance point of the solution fuzzy region by calculating the weighted mean of the fuzzyregion.

Our rule base consists of 144 rules. A few rules are explained as below:

Rule 1: If TE is Low and RE is High and EC is Low and QS is Small and DG is Small and Weight is Large Then Cost is VL.

Rule 2: If TE is Low and RE is High and EC is Medium and QS is Small and DG is Small and Weight is Large Then Cost is VL.

Rule 3: If TE is Low and RE is High and EC is Medium and QS is Small and DG is Large and Weight is Large Then Cost is L.

Rule 4: If TE is Low and RE is High and EC is Low and QS is Small and DG is Large and Weight is Large Then Cost is L.

Rule 5: If TE is Low and RE is High and EC is Low and QS is Large and DG is Large and Weight is Large Then Cost is LM.

Rule 6: If TE is Low and RE is Medium and EC is High and QS is Small and DG is Small and Weight is Large Then Cost is LM.

Rule 7: If TE is Low and RE is Medium and EC is Medium and QS is Large and DG is Small and Weight is Small Then Cost is HM.

Rule 8: If TE is High and RE is Medium and EC is Low and QS is Small and DG is Small and Weight is Small Then Cost is HM.

Rule 9: If TE is High and RE is Medium and EC is Medium and QS is Large and DG is Small and Weight is Small Then Cost is H.

Rule 10: If TE is High and RE is Medium and EC is Medium and QS is Large and DG is Large and Weight is Large Then Cost is H.

Rule 11: If TE is High and RE is Low and EC is Low and QS is Small and DG is Small and Weight is Large Then Cost is VH.

Rule 12: If TE is High and RE is Low and EC is Medium and QS is Small and DG is Large and Weight is Small Then Cost is VH.

Rule 13: If TE is High and RE is Low and EC is High and QS is Large and DG is Small and Weight is Large Then Cost is H.

Rule 14: If TE is High and RE is Low and EC is Low and QS is Small and DG is Large and Weight is Large Then Cost is HM.

The rules have been formulated according to the criteria described above. The input fuzzy variables have been denoted by TE, RE, EC, QS, DG and WEIGHT. These represent the input fuzzy variables viz., transmission energy, remaining energy, rate of energy consumption, queue size, distance from gateway and weight respectively. The output fuzzy variable is denoted by COST.

V SIMULATION RESULTS

The Proposed fuzzy system and clustered routing approach in wireless mesh network is implemented in Matlab 7.0. We used dynamically created network topology based on arbitrary number nodes. All links are bi-directional with different parameters (explaining the links status and network topology) for different directions. Network topology, connectivity and number of nodes are changeable and user can define them through appropriate Graphic User Interface. Each link is described with six parameters: transmission energy, remaining energy, rate of energy consumption, queue size, distance from gateway, weight. All values for all parameters are randomly generated and scaled to the interval [0-1].

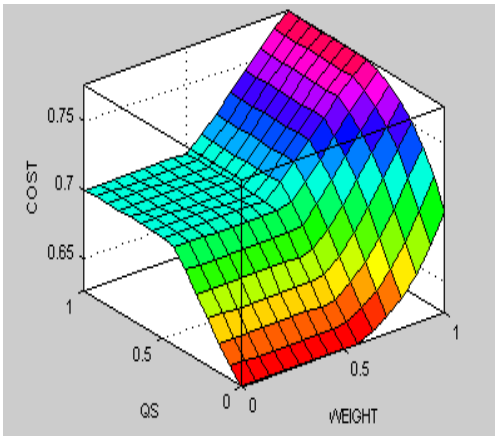

Fig.1: 'COST' O/P w.r.t. 'QS' and 'WEIGHT'

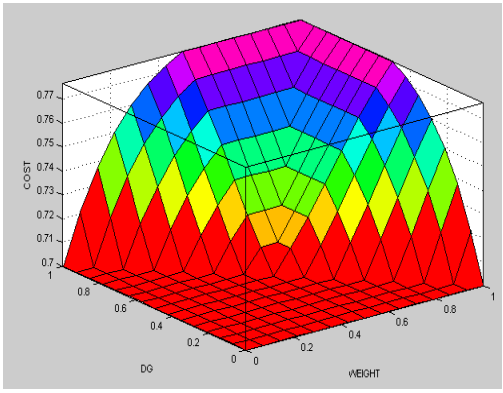

Fig. 2 : 'COST' O/P w.r.t. 'DG' and 'WEIGHT'

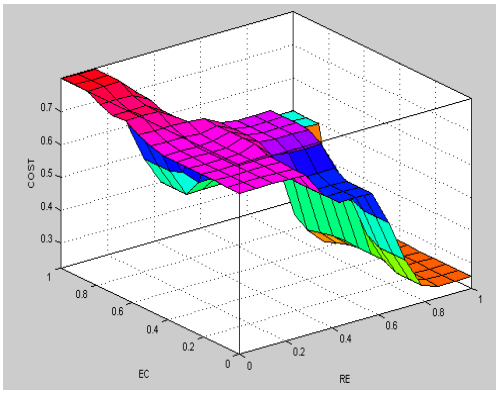

Fig. 3 : 'COST' O/P w.r.t. 'EC' and 'RE'

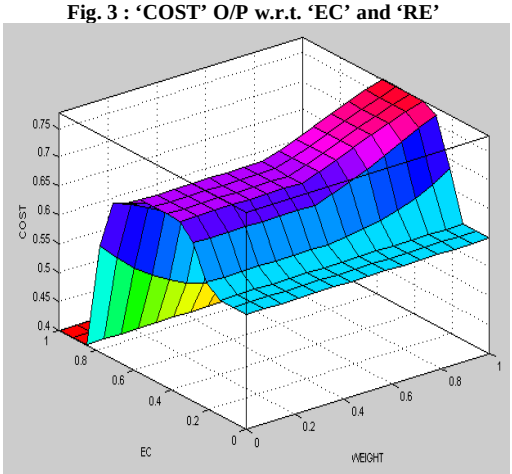

Fig.4 : 'COST' O/P w.r.t. 'EC' and 'WEIGHT'

In **figure 1** the inputs of the protocol (queue size and weight) are on the horizontal axes and the output (cost) is on the vertical axis. In **figure 2** the inputs of the protocol (distance from gateway and weight) are on the horizontal axes and the output (cost) is on the vertical axis. In **figure 3** the inputs of the protocol (rate of energy consumption and remaining energy) are on the horizontal axes and the output (cost) is on the vertical axis. In **figure 4** the inputs of the protocol (rate of energy consumption and weight) are on the horizontal axes and the output (cost) is on the vertical axis.

A number of test cases have conducted. Some of them have been explained with their respective parameters:

Table 1
Test Cases

Test Case No.	TE	RE	EC	QS	DG	WEIGHT	COST
1.	0.891	0.121	0.914	0.11	0.856	0.362	0.80
2.	0.0862	0.925	0.511	0.715	0.983	0.0617	0.281
3.	0.054	0.814	0.471	0.678	0.83	0.051	0.195

(a) The simulation results shows that when value of transmission energy is high, remaining energy is low, rate of energy consumption is high, queue size is small, distance from gateway is high, weight is small then as a result cost of link between mesh nodes is high.

(b) Also simulation indicates that when transmission energy is low, remaining energy is high, rate of energy consumption is medium, queue size is large, distance from gateway is high, weight is small, and then as a result cost of link between mesh nodes is low.

(c) Also it has been analyzed that cost of link between mesh nodes is very low when remaining energy is high, but when remaining energy is low, the link cost between mesh nodes is high and very high and so on.

VI CONCLUSION

WMN is a novel emerging technology that will change the world more efficiently. It is regarded as a highly promising wireless technology. In this paper we introduced a novel approach for energy aware routing based on fuzzy system for WMN. We have presented a novel fuzzy model for energy optimized routing in wireless mesh networks. Our simulation work has been implemented in

MATLab 7.0. Our simulation results represent the reliability and efficiency of this approach.

REFERENCES

[1] M.Nasim Faruque, Dr. S.N. Ahmad, Dr. Manoj Kumar, "Performance of QoS in Wireless Ad hoc Network for AODV Protocol Using Fuzzy Based Techniques", IJECT, Volume 2, Issue 2, June, 2011, pp.41-45.

[2] K.Sasikala, V.Rajamani, "A Modified Fuzzy Logic Routing for Wireless Mesh Network", International Journal of Computer Applications, Voluume 60, No. 2, December, 2012, pp. 28-34.

[3] Faraneh Zarafshan, Abbas Karimi, S.A.R.Al-Haddad, "A Noval Fuzzy Diffusion Approach for Improving Energy Efficiency in Wireless Sensor Networks", International Journal of Machine Learning and Computing, Vol. 2, No.4,August, 2012, pp,506-510.

[4] Tarique Haider and Marian Yusuf, " A Fuzzy Approach to Energy optimized Routing for Wireless Sensor Networks", The International Arab Journal of Information Technology, Vol.6, No.2, April, 2009, pp.179-184.

[5] Antonio De la oliva, Albert Banchs, Pablo Serrano, "Throughput and energy-aware routing for 802.11 based mesh networks", Computer Communications, Elsevier, Volume 4, Issue 4, 2012, pp. 1-14.

[6] Aggeliki Sgera, "Energy Aware Routing in IEEE 802.11s Wireless Mesh Networks".http://www.academia.edu/5991153/Energy_Aware_Routing_in_IEEE802.11s Wireless Mesh Networks.

[7] Addel Akram Shafqat, "Battery and Frequency optimized AODV for Wireless Mesh Networks", Canadian Journla on Multimedia and wireless Networks , Vol. 1, No. 3, April 2010, pp. 31-37.

[8] T.N. Nagabhushan, S. P. Shiva Prakash, Kirill Krinkin, "Minimum Battery Draining Rate Aware Optimized Link State Routing in Wireless Mesh Networks", Proceeding of the 13th Conference of FRUCT Association, pp. 111-120.

[9] Thuy Tran Vinh, Thu Ngo Quynh, Mai Banh Thi Quynh, "EMRP: Energy-Aware Mesh Routing Protocol for Wireless Sensor Networks", IEEE Xplore, 2010.

[10] Saeed Rasouli Heikalalabad, Hossein Rasoull, Farhad Nematy and Maeim Rahmani, "QEMPAR: QoS and Energy Aware Multi-Path Routing Algorithm for Real-Time Applications in Wireless Sensor Networks", IJCSI International Journal of Computer Science Issues, Vol. 2, Issue 1, Jan, 2011.

[11] Sarra Mamechaoui, Fedoua Didi and Guy Puiolle, "Energy Efficiency Cross Layer Protocol for Wireless Mesh Network", International Journal of Computer Networks & Communications (IJCNC) Vol. 6, No. 3, May, 2014, pp. 29-39.

[12] S.P. Shiva Prakash, T. N. Nagabhushan, Kirill Krinkin, "Energy Aware Power Save Management in Wireless Mesh Networks", Proceeding of the 14th Conference of FRUCT Association, pp. 121-131.

Design of an Efficient Middle Access Point (MAP) in Wireless Sensor Networks (WSN)

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ABSTRACT
The idea of implementing Middle access point in the Wireless Sensor Networks has been examined. The information from the sensor nodes are collected by the access points that are transferred to the sink node. In chain based structure model, each sensor in the coverage area sends information to the neighboring node by forming the chain. The main disadvantage in chain structure network is latency. In order to overcome this latency, both chain and cluster by forming group has been implement. Information from each sensor is transferred to the head sensor in the form of chain. Information from the group head sensor is sent to the access point which is centralized to all the groups. Access point means a sensor with high potential i.e., high battery. It receives data from all the group heads. On comparing to the earlier models, this approach proposes the smallest latency while transferring information from sensor to the drop node.

Index Terms- WSN, MAP, Group Head, Latency, Centralized Access Point, Sink Nodes, Chain Architecture, Sensors, Potential.

I INTRODUCTION

Wireless Sensor Network is used in many fields today. In WSN, the sensors used to collect the information and sent it to the base station for further processing. Sensors are used to collect information within a specific coverage area, this is based on the efficiency of the sensor. Sink nodes collect all the information from the sensor nodes. A sink node is also a sensor which collects information and sends to the base station. These sensors can be used in many fields, such as military, hospitals and in many other areas. For example if a fire accident occurs in huge building we can sprinkle few sensors into the building to know the temperature and condition. So that we can make further steps to put off the fire.

The main issue in the WSN is that hot spot issue, which means the traffic between the sensor nodes to the sink node. The sensor nodes nearer to the sink node need high potential to transfer the information to the sink node. After sensing the information, the main thing to consider is efficiently transferring the information from the group head to the sink node. The efficient data transfer is achieved by placing the sensor on the right place, to transfer information to the sink node. Further discussions will be on related works, proposal of the model, phases involved in the prototype, features.

II RELATED WORKS

In [1], Cluster architecture is used to transfer information from the group head to sink node. The mobility sink node to send the information to the base station. Each cluster in the wireless sensor network has the cluster head which has all the collected information from the sensor nodes in the clusters. In this model we find more latency and less energy efficient. The circle based wireless sensor network with mobile sink [2] tells that a hot spot issue in the WSN, which means the data load in the sensors nearer to the sink node. To overcome this issue the circle based architecture is used to collect data from the sensor nodes nearer to the sink node.

On referring the concept of PEGASIS algorithm [4] the sensors transfer the information in the form of chain. In chain architecture, the chain node directs the information directly to the sink node. In a chain if one sensor fails then the information is bypassed through the nearby sensor. The disadvantage in chain architecture is that there is the problem of transferring the data by sensors with low potential rate. The double cluster concept tells that a sensor which can transfer information to the other sensor with less energy is the cluster head . The cluster head transfer the information from the nodes to the sink node. To overcome this, we implemented the centralized access point in our proposed model.

III PROPOSED SYSTEM

In our proposal, the main concept is to cut the latency and to increase the life time of the sensor. To do this, the spreader sensors are made into group, each group has group head. Group head is used to send information to the access point. Sensors in the group send information to the group head in the chain structure. In this proposal, we use both chain and cluster structure for the information transfer. The diagram (1) represents the architecture of implementing centralized access point in WSN.

Sensors are formed into groups, each group has a head node. Head node is a node which is nearer to the access point. The node which act as access point is elected based on its potential (i.e., high battery backup) since it is needed to receive information from all the group head nodes and send it to the sink node. The access point and sink used here is static. A group may even contain 50 or more and it may be even less. Within a group each node collects information and the collected information has to be transferred to the group head .This is done by chain structure. A node that collects information sends it to the neighbour node, this is done still it reaches the group head. And finally group head sends these information to the access point.

By this proposal, life time is increased to the some extend. Sensors send information to the neighbour node, so the energy consumed is very less and also with minimum latency.

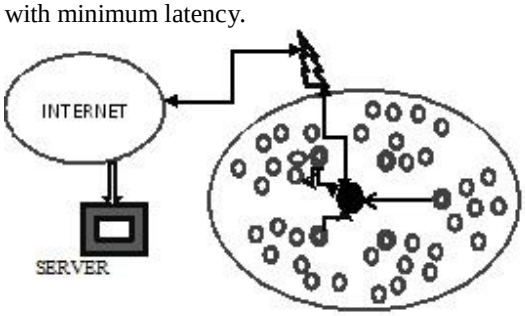

Fig 1 Architecture of Middle **access point in WSN**
-Sensor nodes

-Group Heads (GHs)

-Access Point (AP)

-Sink NODE (SN)

IV PHASES INVOLVED

(a) Grouping of sensors- In Wireless Sensor Network, placing the sensors at the right place plays a major role. Sensors are grouped based on their positions in the coverage area. Assume that there are around 200 sensors in a coverage area, we can group them into 50 in each. By grouping like this the information transfer speed is made high. Each group has the group head (GH).

(b) Choosing Access point and Group Head - Group head is also a sensor that holds the information that is collected by its group nodes. Group head is choosed based on its position nearer to the access point. Hence information can be transferred easily and faster. Access point is also a sensor which is chosen with high potential (i.e., with high battery backup and high bandwidth)[5]. Since it acts as the main node between group head and sink node. It is used only to receive and transfer information from group head and sink node. If we use this for the sensing purposes like the other nodes its life time will get reduced[6]. These are the main things considered while choosing the access point and the group head.

(c) Group Head(GH) to Access Point(AP) -GH is used to receive information from the group nodes and send it to the access point. Let us discuss how the information is send from the group nodes to the group heads. Sensor that collects information sends it to the neighbour node. Then that information is transferred to its neighbour node by forming a chain structure. The chain structured architecture improves the lifetime of the sensor. Because, the information is transferred only to its neighbouring node. This process is done still the information is transferred to the group head. The group head collects the information from its group nodes. Access point (AP) receives the information from GHs.

The information is received by the access point from all the group heads(GH) . The information is effectively received because the access point is high potential and high bandwidth. After receiving all the information from the group heads then that information is transferred to the sink node which is closure to the coverage area.
If we want to transfer an information from sensor 'A' to server it transfers in a chain architecture by choosing their neighbour nodes.
i.e.;
A=>B=>C=>D=>E=>GH
Only GH can transfer information to AP
GH=>AP

The AP transfer that information to sink and to the server.

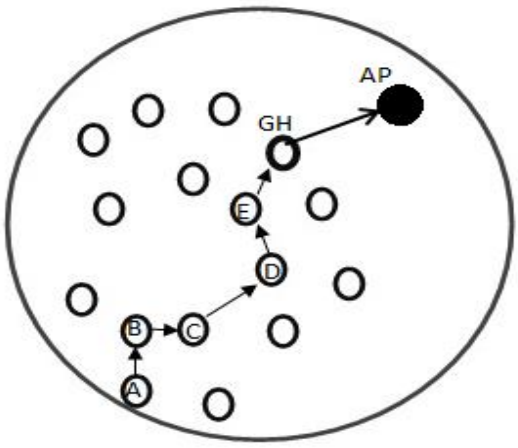

Fig 2 Data transfer from a sensor in a group to AP

V FEATURES

In our Middle Access Point (MAP), the information transfer is made faster with high efficiency. Data loss is also reduced to the maximum extends by using Access Point (AP). This is because the information is transferred by both chain and cluster architecture. The access point is capable of collecting and transmitting the information to the sink node with high energy.

The sensor nodes in the group forms the chain, so that the data transfer between the nodes in the group requires less energy to transfer the information and also the collision between the nodes are reduced.

PEGASIS algorithm deals only with the chain architecture. To improve its efficiency we have grouped the sensors within the coverage area and the data is transferred in the chain architecture within the group. This also reduces the latency and data traffic.
In Chain Based Routing Protocol ,it increases only the life time of the sensor. But our MAP model increases the lifetime of the sensor as well as the data transfer bit rate[7]. This is done by placing the AP in the centre of the of groups.

VI CONCLUSION

In this paper we have proposed a model by using the Middle Access Point (MAP). The AP is chosen with high potential, we make the data rate efficiently. By implementing this MAP model we can increase the data rate and cut the data loss .As we use chain architecture inside a group and only Group Head (GH) can communicate with AP latency is reduced. The server will receive all the transferred information from the sensor without any collision through the sink node

REFERENCES

[1] Suchita R.Wankhade1 and Nekita A.Chavhan2 topic was "*A Review On Data Collection Method With Sink Node In Wireless Sensor Network*" published in "International Journal of Distributed and Parallel Systems (IJDPS) Vol.4, No.1, January 2013".

[2] Lu Li, Sai Ji, Tinghuai Ma and Jin Wang on topic "*A Circle-Based Data Dissemination Algorithm for Wireless Sensor Networks with Mobile Sink*" published on "International Journal of Smart Home Vol. 7, No. 1, January, 2013".

[3] I. F. Akyildiz, W. Su, Y. Sankarasubramaniam and E. Cayirci, "Wireless Sensor Networks: A Survey," *Com- puter Networks* (*Elsevier*), Vol. 38, No. 4, 2002, pp. 393- 422. doi:10.1016/S1389-1286(01)00302-4

[4] Lindsey and C. S. Raghavendra, "PEGASIS: Power Efficient Gathering in Sensor Information Systems," *Pro- ceedings of the IEEE Aerospace Conference*, Vol. 3, Big Sky, 2002, pp. 1125-1130

[5] Yanbin Weng; Weijia Jia; Guojun Wang (Sept 2010), "*Energy efficient data gathering scheme for wireless sensor networks with static and mobile sinks*", Network Infrastructure and Digital Content, 2010, pp 748 – 752.

[6] Xiaobing Wu, Nanjing Univ., Nanjing Guihai Chen (Aug. 2007),"*Dual-Sink: Using Mobile and Static Sinks for Lifetime Improvement in Wireless Sensor Networks* ",Computer Communications and Networks, ICCCN 2007, pp 1297 – 1302.

[7] Chao Wang, Huadong Ma, Member, IEEE, Yuan He, Member, IEEE, and Shuguagn Xiong (June 2012), "*Adaptive Approximate Data Collection for Wireless Sensor Networks*", IEEE Transactions on Parallel and Distributed Systems, Vol 23, no.6, pp 1004-1016.

[8] Seino, W., Sakashita, S., Yoshihisa, T., Hara, T. and Nishio, S.(March 2012), "*A Sensor Data Collection Method with a Mobile Sink for Communication Traffic Reduction by Delivering Predicted Values*", pp 613 – 618.

[9] Xu Xu , Sch. of Comput. Sci., Australian Nat. Univ., Canberra, ACT, Australia, Weifa Liang; Wark, T (June 2010), "*Data Quality Maximization in Sensor Networks With a Mobile Sink*", "Distributed Computing in Sensor Systems and Workshops (DCOSS), 2011 "

Computational Forensics: A Vision of 21st Century

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ABSTRACT
In recent years, computational methods have been utilized in various disciplines as diverse as linguistics, chemistry, advertising, vision and many more. Forensic science is also one of the parts of this diverse family which is utilizing computational methods. Although computational forensics as a discipline is at a premature stage, there are lots of possibilities in forensics where this particular discipline can help to cope with new challenges which have arises in the last 2-3 decades. These challenges may be in terms of forged biometric data, incapability of conventional methods, scientific validation of various forensic disciplines after Dauberts hearing or a huge data which is difficult to process by human experts. The list of challenges continues. Fortunately, computational forensics which in nutshell concerns the investigation of forensic problems employing computational methods has potential to address all these challenges. This paper addresses the emerging field of computational forensics, its scope and the various challenging problems of forensics that we have attempted using computational methods.

Keywords: - Computational forensics, computational methods, forensic science.

I INTRODUCTION

In recent years, increasing trends of crime and usage of smarter modus operandi has forced crime investigators and forensic scientists to think unconventionally. Failure of conventional techniques in solving most of these crimes has made the situation even worst. Moreover, some of these conventional techniques have also been criticized by the court of law due to lack of proper scientific basis. Computational Forensics seems to be a solution in such a scenario which facilitates a human expert with a smarter way to combat with the upcoming challenges.

Computational Forensics is one of the emerging fields of Forensic Science, which utilizes computational methods for combating challenges of various forensic problems. From computation methods, we mean the theory and algorithms of mathematics, statistics and computer sciences. Thus Computation Forensics involves modeling, simulation, computer based analysis and recognition in context of forensic problems. The problems of forensics may range from crime scene reconstruction to analysis of evidences and their comparison and identification. Computation Forensics can address all of these problems in much efficient and smarter way than it could be solved through a conventional technique. Computational methods are advantageous in the sense that it utilizes human experts' domain knowledge to train a machine to develop reasoning ability and recognition task.

II CONVENTIONAL FORENSICS VERSUS COMPUTATION FORENSICS

Forensics or forensic science is the application of science and technology for the purpose of court of law. Depending on the area of application forensics may be termed as forensic physics, forensic chemistry, forensic biology or forensics with any other discipline. The field of forensics is challenging in the sense that, there may be very less information or evidences available at scene of crime. Moreover, the available evidence may be the only available evidence which could lead it to the crime, that too in chaotic environment. Other challenges may include subjectivity of opinion, intra product variation of the same source and its differences with inter product variation and lack of proper databases.

Most of the conventional forensic techniques are based on manual examination of evidences. Some tools are though available for examination but that too needs advancement, especially in the disciplines of forensic document examination, forensic fingerprint examination and forensic physics. Computational Forensics, on the other hand, does not aim to replace human intervention during examination but to assist in basic and applied research, for instance, in providing scientific basis to the examination and to support forensic examiner in daily case examination as well as better representation of evidences for court testimony [1]. Moreover, Computational Forensics helps a forensic examiner in following ways [1]

(a) Analyze and identify traces in an objective and reproducible manner.
(b) Assess the quality of an examination method.
(c) Report and standardize investigative procedure.
(d) Search large volumes of data efficiently.
(e) Visualize and document the results of analysis.
(f) Assist in the interpretation of results and their argumentation.

III THE GAMUT OF COMPUTATION FORENSICS

Computation methods may be applied in various disciplines of forensic science including forensic document examination, forensic physics, crime scene reconstruction and digital forensics. We have successfully applied it in the following disciplines

(a) Forensic Examination of Fraudulent Alteration- Alteration in document is an old age problem but in the era of digital technology too, alteration in documents like cheque, contracts and will are frequent. In [2], we have proposed an algorithm to detect such an alteration made by ball-point pens having ink of similar color. The problem of alteration detection was addressed in the framework of image processing and pattern recognition. Image of the ink strokes in question was captured and enlarged to some extent using an image processing workstation coupled with microscope. After preprocessing, color and texture features were extracted from both the strokes to know whether the two strokes are made with same pen or different pens. After analysis of quality features for the targeted task, it is subjected to classification or detection. Three classifiers, namely, nearest neighbor, Multilayer Perceptron and Support Vector Machine have been utilized for detection task. Results have been summarized in Table 1.

Table 1
Performance of different systems for alteration detection

System	Accuracy	False Acceptance Rate	False Rejection Rate
Nearest Neighbor	85.51	05.55	21.89
Multilayer Perceptron	86.43	12.18	14.96
Support Vector Machine	89.36	06.72	14.56

(b) Forensic Signature Verification- Signature is one of the oldest means of person identification. It is originated much before the concepts of Biometrics. Problem of signature verification is popular in both the fields of forensics and biometrics due to its vast area of applications. In [3, 4], we have proposed two different systems for signature verification proposing two novel features, namely, signature morphology and surroundedness feature. These features are capable of capturing geometric shapes and line quality specific to the writer. We have utilized two popular databases, namely, CEDAR and GPDS databases to examine the efficacy of the proposed systems. Results have been summarized in Table 2 and Table 3.

Table 2
Performance of signature verification system on CEDAR database

System	Number of Signer	Accuracy	False Acceptance Rate	False Rejection Rate
Signature Morphology	55	88.41	11.59	11.59
Surroundedness Feature	55	91.67	08.33	08.33

Table 3
Performance of signature verification system on GPDS database

System	Number of Signer	Accuracy	False Acceptance Rate	False Rejection Rate
Surroundedness Feature	300	86.24	13.76	13.76

(c) Forensic Writer Identification- Identification of writer is an important forensic problem. Identification of writer based on handwriting on anonymous letters and other documents may directly link the commission of crime with perpetrator. In [5], we have proposed text independent writer recognition system based on sparse model. A dictionary of all possible curves, we call it, fraglets have been learned and writers have been idendified based on the distribution of fraglets specific to an individual writer. The system has been tested on a popular database, namely, IAM database of 657 writers and results are summarized in Table 4

Table 4
Performance of writer identification system

System	Size of dictionary	Accuracy (Top 1)	Accuracy (Top 10)
Sparse model based system	200	88.43	99.24

(d) Other Forensic Disciplines- We have also proposed a few systems for detection of counterfeit cheques and other security documents. Moreover, a system was designed for particle size distribution of soil based on the concepts of mathematical morphology.

IV CONCLUSION

Computation Forensics as a discipline though is not in mature form, its potential in solving complex forensic problems cannot be ignored. Moreover, it provides scientific basis to various conventional concepts of forensics. Using the techniques of Computational Forensics, various existing concepts may be statistically validated. However, there is need to work forensic scientists and computer engineers together for the advancements of the field. Though in some of the disciplines of forensics, the concepts of computational methods have been utilized, new areas need to be explored.

REFERENCES

[1] Katrine Franke and S. N. Srihari, Computational Forensics: Towards Hybrid-Intelligent Crime Investigation, In: IWCF, Manchester, Englad, 2007.

[2] Rajesh Kumar, Nikhil R. Pal, J. D. Sharma and Bhabatosh Chanda, Forensic Detection of Fraudulent Alterations in Ball-Point Pen Strokes. In: IEEE Transactions on Information Forensics and Security. IEEE Computer Society Press, Washington D.C., USA, 7 (2), 809- 820 (2012).

[3] Rajesh Kumar, Bhabatosh Chanda and J D Sharma, Writer-Independent Off-line Signature Verification using Surroundedness Feature. In: Pattern Recognition Letters, Elsevier Publisher 33 (2), 301-308 (2012).

[4] Rajesh Kumar, Lopamudra Kundu, Bhabatosh Chanda and J D Sharma, A Writer-Independent Off-line Signature Verification System Based on Signature Morphology In: IITM, ACM, New York, USA , 261-265 (2010).

[5] Rajesh Kumar, Bhabatosh Chanda and J D Sharma: A novel sparse model based forensic writer identification. Pattern Identification Letters, 35, 105-112, 2014.

Efficiency Improvements in Transformers by Adoption of New Magnetic Material

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ABSTRACT
Since independence in India there has always been shortage of electricity and at no point of time we have been able to meet the peak demand. The gap between the demand and generation can be bridged/minimized by either improving the installed capacity or reducing the consumer demand. The gap between availability & demand is of order 6% as on date. If we take into account the issues like environment pollution and global warming, the preferred option is to increase the energy efficiency or minimize the consumer demand, as in the other alternative particularly in India, where thermal generation dominates, increased environmental pollution is inevitable [1].The paper covers design of transformer using a new technology superior magnetic material with thin sheets of lazer grade or amorphous core. Iron Boron Silicon amorphous alloy is a unique alloy whose structure of metal atoms occurs in random patters as opposed to conventional CRGO steel which has an organized crystalline structure. The paper covers design of distribution transformer using conventional material and the new technology improved core materials. The reflection on the no-load and load losses due to change in the material have been worked out. Commercial and technical feasibility for adoption of new technology core material has been detailed out and the payback period is quite attractive. By reducing the regular power loss in the transformer, economy of the power sector and global environmental impact can be improved.[8] The paper also covers the working of quantum of electrical power that can be saved if adopted in the state of M.P. The reduced Electrical Power generation requirements due to lower losses have also been translated to reduction in the CO2 emissions polluting the environment.

Keywords- Core, Copper, Tank, Steel Radiator, Transformer Oil, Power Factor, Losses, Load Factor, Insulation Material, CRGO, Lazer Grade, Amorphous core

I DEFINITION OF THE PROBLEM

The demand for electricity in India is enormous and is growing steadily. This growth has been slower than country's economic growth. To balance this demand and supply of electricity, it is the time to go for improvement in energy efficiency electrical equipment in use by the utilities and also by the consumers. Ways to improve energy efficiency of one of the electrical equipment used by utilities has been discussed in coming pages.

The power plant generates electricity at low voltage rating and the generated power has to be transmitted through long transmission line at extra high voltage i.e. 440, 220 & 132 KV to reduce the line losses and conductor size. This extra high voltage power is then stepped down to the desired voltage which is then used in the industrial, commercial, transportation & domestic sectors.

The voltage in the entire system can only be steped up & down by using transformers of different capacity. The power passes through the transformers involving transformer losses i.e. no-load and load losses.

These transformer losses impose heavy financial losses and impact the environment globally. By reducing these losses in the transformer, economy of the power sector and global environmental impact can be improved. [2]

Thus our objective is to design an energy efficient transformer which reduces the total transformer loss by 60%.

II ENERGY EFFIC IENT TRANSFORMERS

No – load loss resulted from the magnetization of core laminations, depends upon the following parameters of core: -

(i) Thickness varies from 0.23 to 3.0 mm
(ii) Quality - CRGO, HI-B Grade, Lazer Grade, Amorphous
(iii) Flux density
(iv) Specific gravity of core

Reduction in No-load losses can be achieved by
(i) Using better quality core
(ii) Sharpening the edges of the core at appropriate angle
(iii) Building Single strip core building for reduced the air gap.
(iv) Annealing the core so as to

- Reduce mechanical stress in the lamination to a minimum to yield optimum magnetic proprieties
- Prevent contamination of the steel with oxygen and or carbon
- Retain or enhance the insulation quality of the lamination coating.

Iron Boron Silicon amorphous alloy is a unique alloy whose structure of metal atoms occurs in random patters as opposed to conventional CRGO steel which has an organized crystalline structure. The higher resistance to magnetization and demagnetization through the crystalline structure leads to higher core losses in CRGO.

Load loss of transformer depends on the load on the transformer. [6]

(i) Load Current (I)
(ii) Resistance of the Wire and strips used to construct the coils.
(iii) Gap between Cores - Coil with tank.

Reduction in load losses can be achieved by

(i) Using higher size of the conductor.
(ii) Reducing size of core
(iii) Reducing Winding Temperature.
(iv) Improving conductor resistivity.

Annealing of Wires & Strips for better performance and life of the transformer as it

- Improve the machine-ability
- Obtain grain size and produce uniformity.
- Increase activity of metal
- Modify and improve electric & magnetic properties.
- Release internal stresses
- Help to produce a definite micro structure

III DESIGN OF ENERGY EFFICIENT TRANSFORMERS

(a) Cost Benefit- For techno commercial study a practical size of 200 KVA,11/0.433KV distribution transformer has been considered. For comparison purpose 200KVA distribution has been designed using three different core materials CRGO M-4,HiB and lazer grade stampings. The thickness of stampings in case of M-4 and HiB grades has been taken as 0.27mm & that of lazer grade as 0.23mm based on availability of these core materials in the market. The working flux density before approaching the Knee point in case of all the materials and also watt loss/Kg are different .This amounts to that the weight of the core and also losses particularly iron losses are going to be different when designed considering these three cores. Transformers with three cores under consideration have been designed and weight of core, iron losses 7 also load losses have been detailed out in table –I. Due to variation in total weight of transformers and due to variation in the rate of different cores, the initial cost of the transformers for the three designs works out to be different as indicated in table-I. Here it is pertinate that the initial cost alone cannot be taken for ensuring commercial viability but we need to take into account the variation in the iron and load losses as well.

In case we consider/assume

(i) Rate of interest (@ 10 %)
(ii) rate of electrical energy as Rs 3/kwh
(iii) life of transformer (as 25 years)
(iv) Load factor of distribution transformer as 60%

The iron and copper losses can be capitalized for working out the commercial feasibility. The capitalized cost of iron losses (Wi),Copper losses (Wc) and total cost (Ct) including initial cost as worked out as indicated in table-I A 200 KVA 11/0.433 KV Transformer with different three core materials:

Table -1

Parameters	**Conven.**	**EET I**	**EET II**
Core material	CRGO M-4	HiB	Lazer Grade
Thickness	0.27	0.27	0.23
Watt/Kg	1	0.56	0.3
Weight of core	396Kg	457Kg	465Kg
Iron Losses	500 Watts	300 Watts	180 Watts
Load Losses	2800 Watts	2300 Watts	2300 Watts
Initial Cost	200000	230000	260000
Wi	119272	71563	42938
Wc	291979	243316	243316
Ct	611251	544879	546254
Saving per transformer		66372	64997

Saving in respect of KW Total Saving in Losses = 0.82 KW Number of Transformer required to save one number 25

KVA transformer will be 25/0.82 = 30 nos. Thus for every 30 installation of 200 KVA EET, one number 25 KVA transformer will be saved.[10]

Case OF MP State Utility

The total installed distribution transformers in M.P. state as on feb 2012 are [15]:

Table 2

	MP Distribution				
Capacity in KVA(a)	East zone	Central zone	West zone	Total(b)	KVA(axb)
16KVA	3927	375	5756	10058	160928
25KVA	17797	26603	6981	51381	1284525
63KVA	23177	30893	31222	85292	5373396
100KVA	18467	21740	36490	76697	7669700
200KVA	5426	9457	12101	26984	5396800
					19885345

CALCULATION OF ENERGY SAVING IN MWH: -

Energy saving by Energy Efficient 200 KVA Transformer = 0.82 KW per hour

Thus saving for 1 KVA = (0.82 / 200) KWh

Net saving by replacing entire transformers of the system will be

19885345 * 0.82 / 200 KWh = 81530 KWh

≈ 81.5 MW per hour

(b) Environmental benefit

- The heat dissipation by the Tank Surface & Radiators can be reduced by designing better energy efficient transformer thus will be beneficial to the global environment.
- This reduction in the heat dissipation will improves the life of insulations of the core, oil & winding and thus save the wastage in the form of burning or heating.
- For every 25 installation of 200 KVA Energy Efficient transformer, one number 25 KVA transformer will be saved thus this will save natural resources, metal & alloy, conversion & processing energy.
- Since Generation of power lost in terms of transformer losses will be reduce, the emission of CO2 will be reduced.[12]

Calculation of co2 emission reduction: -

60 W of electricity emits Co2 @ 60 grams/hr[14]

i.e. 1 W will emit Co2 @ 1 gram /hr

thus, 81530000 W will emit Co2 81530000 grams /hour i.e. 81530 Kg / hour Co2 emission will be reduced in the environment.

Calculation of reduction in coal consumption: -

Coal require to generate 1 unit i.e. 1KWh = 0.75 Kg

Coal require to generate 81530KWh = 81530 * 0.75

= 61148 Kg / h

i.e. coal require in a year will be 61148 * 24 * 365 =

535656480 Kg / yr

Net Saving in Coal Consumption will be 535657 Tons per year

IV ELECTRICAL UTILITY BENEFITS

(a) Demand side management-Installation of our design energy efficient transformer will help in improving the demand side management since the power lost in the form of transformer losses will be reduced and more power can be delivered from the same capacity of transformer in the distribution system.

(b) Reduction in the rate of failure- The agricultural consumers imposes load more than 100% of the capacity of the transformer which is uncontrolled during the Rabi Season. The maximum failure of the transformer occurred during this season in the rural areas.

Energy efficient transformer will help in reducing rate of failure in normal course and in Rabi season since

(i) The core of our designed transformer will saturate on 125% loading and conductor is designed with relatively lower current density to bear additional current and thus 25 % additional loading can be sustain by this transformer.
(ii) Since the heat dissipation of the transformer is reduced, the life of insulation in the core, oil & windings will be improved which reduces the failure of the transformers.
(iii) The reduction in the winding temperature will reduce the resistance of the coil which in turn reduces the load losses.
(iv) The losses of Energy Efficient Transformer will be reduced as compare to the conventional transformer and thus the generation of saved power will be reduced and this will save generation as well as the consumption of fossil fuel and emission of harmful gases in the environment.

V CONCLUSION

There is enormous potential for saving energy and increasing efficiency by employing these transformers, and paper intends to promote higher standards to govern their use. There is also potential for improvements through capacity building with manufacturers and the end-users.

A transformer was designed to find the better quality core to reduce the losses and improve the efficiency of the transformer as well as entire transmission & distribution system for a greener future. Since independence there is power shortage of Electrical energy. Despite all out efforts by state/Central government we have not been able to meet the electrical energy demand .The gap between availability & demand is of order 6% as on date. The proposed low loss transformer will bridge the gap between supply & demand. Since the reduction will be at the load end, it is a more beneficial than adding at generation side.

REFERENCES

[1] T. J. Hammons, B. Kennedy, R. Lorand, S. Thigpen, B. W. Mc Connel, S. Rouse, T. A. Prevost, C. Pruess, S. J. Dale, V. R. Ramanan, T. L. Baldwin, “Future trends in energy-efficient transformers”, IEEE Power Engineering Review, vol. 18, no. 7, pp. 5-16, 1998.

[2] M J McDermott and Associates, Impact of Purchasing Energy- Efficient Transformers, European Copper Institute, July 2001.

[3] B. Kennedy, Energy Efficient Transformers, Mc Graw - Hill, 1998.

[4] W. T. J. Hulshorst and J. F. Groeman, Energy Saving in Industrial Distribution Transformers, KEMA report, May 2002.

[5] P. R. Barnes, J. W. Van Dyke, B. W. McConnell, S. Das, “Determination Analysisi of Energy Conservation Standards for Distribution Transformers,” Oak Ridge National Laboratory, ORNL-6847, July 1996.

[6] S. Merritt, S. Chaitkin, “No Load versus Load Loss,” IEEE Industry Applications Magazine, vol. 9, no 6, pp. 21-28, Nov.2003.

[7] P. S. Georgilakis, “Decision support system for evaluating transformer investments in the industrial sector,” Journal of Materials Processing Technology, vol. 181, no. 1-3, pp. 307-312, 2007.

[8] B. W. McConnell, "Increasing Distribution Transformer Efficiency:Potential for Energy Savings," IEEE Power Engineering Review, vol.18, no 7, pp. 8-10, July 1998.

[9] R. Targosz (ed) et al., The Potential for Global Energy Savings from High Energy Efficiency Distribution Transformers, Leonardo Energy, European Copper Institute, February 2005.

[10] European Copper Institute, The Scope for Energy Saving in the EU Through the Use of Energy-Efficient Electricity Distribution Transformers, December 1999.

[11] Loss Evaluation Guide for Power Transformers and Reactors, ANSI/IEEE Standard C57.120, August 1992.

[12] European Commission, External Costs: Research results on socio- environmental damages due to electricity and transport, Directorate-General for Research, Brussels, Study 20198, 2003.

[13] NEMA, Guide for Determining Energy Efficiency for Distribution Transformers, NEMA Standards Publication TP 1-2002.

[14] Ministry of Environment and Forest, Govt. of India

[15] www.mppmcl.com

Paptode: An Analytical Tool Proceeding towards Green Chemistry

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ABSTRACT
Green chemistry is carrying out chemical activities, including chemical design, manufacture, use, and disposal, such that hazardous substances will not be used and generated. It is a tool in accomplishing Pollution Prevention. It encompasses all aspects and types of chemical processes to reduce impacts of hazardous substances. Green chemistry is the use of chemistry for pollution prevention, design of chemical products and processes that are more environmentally benign and reduction or elimination of the use or generation of hazardous substances associated with a particular synthesis or process. Green chemistry shifts financial resources from costs to research & development. It promises to lower overall energy consumption and costs associated with environmental health and safety. Paptode developed for detection and removal of heavy metals also work on the principles of green chemistry. It is highly cheap and user friendly device. It is prepared simply by dipping green substrate such as paper, clay, TLC (thin layer chromatographic) paper, cotton or any absorbing material into suitable reagent system. A colored reaction product can be produced on the surface of reagent impregnated inert support, by a single drop of solution of analyte, producing distinct flecks or rings. This local accumulation accompanying spot reaction enhances discernibility of colored reaction products. The degree of color of the spot was found to be proportional. The proportionality in intensity of the spot color on the paptode loaded with varying amounts of analyte suggests its potential applications for environmental monitoring and hence waste management. The paptode can also be used for pollutant check at home. Thus the paper optode has great potential for this purpose and is progressing towards green chemistry.

Index Terms—Paptode, green chemistry, hazardous substances and green substrate.

I INTRODUCTION

Environment is a heritage for all. Each of us has a role to play in a rehabilitating our environment. . It should be the duty of every citizen to protect and improve the natural environment. It is thus constitutional obligation of the state and of every citizen of the country to preserve and protect the natural environment [1]. Pollution is the introduction of contaminants into a natural environment that causes instability, disorder, harm or discomfort to the ecosystem i.e. physical systems or living organisms. There are a number of chemicals present in the environment. They get into human food chain from the environment. Once they enter our biological system they disturb the biochemical process, leading in some cases to fatal results [2]. To protect our environment and human race from these fatal chemicals and prevent this pollution it is necessary to search some new materials and process which are alternatively used without harming the environment. For this environmental movement, alternative synthetic pathways for Pollution Prevention are used such as, design synthesis of chemicals for PP and collaborations, voluntary partnerships. Approaches which are utilized in recent past include reduction of risk of manufacturing, use of innovative chemistries to treat wastes and remediate sites, new monitoring and **analytical tools** for detection in air, water, soils and new handling and containment procedures to minimize exposure.

Green chemistry acts as a **tool** in accomplishing Pollution Prevention. Green chemistry is the use of chemistry for pollution prevention, design of chemical products and processes that are more environmentally benign, reduction or elimination of the use or generation of hazardous substances associated with a particular synthesis or process.
It encompasses all aspects and types of chemical processes to reduce impacts of pollution on environment. Green chemistry carries out chemical activities, including chemical design, manufacture, use, and disposal, such that hazardous substances will not be used and generated [1].

II PAPTODES

The paptodes are also an optical chemo sensor where reagents are immobilized on an adsorbent material which could be clay, simple filter paper, chalk powder, Whatman filter paper or even thin layer chromatographic paper and are advantageous over optodes [3].

(a) Advantages over optodes

(i) The immobilization of reagent is very easy in case of paptode

(ii) In this method, we can introduce several reagents on a single strip. Therefore, by using a series of non-specific (or even low-selective) reagents, we can estimate the quantity and quality of multiple analyte in

the solution by applying of mathematical methods, exactly similar to the analysis of **tongue's signals in our brain**.

(iii) Since diffusion in a porous material is higher than in polymeric membrane the **response time in paptodes is shorter** than typical optodes.

(iv) The uniformity pattern is not important in paptodes.

(v) These are portable.

Paper, which is relatively cheap, abundant, sustainable, disposable and easy to use, store, transport, and modify, has recently re-emerged as an attractive substrate material for sensing. The sensors on paper are considered as user-friendly alternative to conventional analytical instrumentations for 'point of-care' medical diagnosis, environmental monitoring, and food quality control. In fact, paper-based analysis has been widely used in our daily lives such as pH test paper [4].

III CONSTRUCTION OF PAPTODE

Construction of paptode is a very simple process. Before preparation of paptode for a particular metal ion, the new reagent system is developed to check its sensitivity and linearity to determine the toxic heavy metal ion. Then disposable paptode is prepared by immobilizing the same reagent on any reagent support substrate such as Whatman filter paper, clay, sand, chalk powder, TLC paper and even ordinary filter paper followed by drying in oven. In present study; immobilization of reagents is carried out on TLC paper.

IV STORAGE OF PAPTODE

The developed paptodes were stored in dry glass or plastic boxes preferably in dark to avoid environmental exposure. The storage period differs for different reagent system.

V DUAL NATURE OF PAPTODE

The developed paptodes serve as sensor as well as filter. When the interest is to detect heavy metal present in the sample below TLV it acts as sensor and detects much lower than standard TLV. When we know the concentration of particular toxic metal ion in aqueous sample and would like to bring down its concentration below TLV and thus to make the sample safe for use; the paptode can be used as filter and serves the purpose by batch removal till the concentration in aqueous sample reaches as desired. Nevertheless of our best knowledge; such dual nature paptodes have been developed.

VI METHODOLOGY

A new optical analytical method, "digital RGB Analysis" based on MATLAB image processing tool is utilized to use paptode as an analytical tool**.** MATLAB image processing tool can transform the color information into digital RGB values, color library data that can be treated as analytical information. Image processing tool can simulate the optimum color variations by optimization of visual color sensor with computer assistance. By utilizing color as digital information, colorimetric analysis can serve as an accurate quantitative determination method instead of semi quantitative analysis.

Colored spots were scanned using a commercially available flatbed scanner and the obtained images have been transferred to a computer for **RGB analysis** through **MATLAB** and the intensity of the color-spots was determined. The RGB color model is an additive color model in which red, green and blue light are added in various ways to produce a broad array of colors. Any color can be analyzed to obtain its corresponding R, G and B value. The effective intensity for any color values of color spots was calculated as follows:

$\mathbf{A_r = - \log(R_s/R_b)}$**---------- (1);** $\mathbf{A_g = - \log(G_s/G_b)}$**---------- (2);** $\mathbf{A_b = - \log(B_s/B_b)}$**---------- (3)**

where $\mathbf{A_r}$, $\mathbf{A_g}$, $\mathbf{A_b}$ are effective intensities of the red, green and blue color respectively, $\mathbf{R_s}$, $\mathbf{G_s}$, $\mathbf{B_s}$ and $\mathbf{R_b}$, $\mathbf{G_b}$, $\mathbf{B_b}$ refer to R, G and B values of the sample and blank respectively.

VII RESULT AND DISCUSSION

We have developed paptodes for As, Se, Hg, Pb, Zn, Cd and Cu [5-11]. Out of which As, Hg, Pb and Cd are considered highly toxic

Parameters like injection volume, reagent concentration, effect of temperature, drying methods, response time, reproducibility, effect of interfering species and application of paptode for detection and removal have been tested. The paptodes for different entities have been found successful to detect the species below the TLV (threshold limit value or toxic limit value) and to remove effectively [5-11]. Table I summarizes the parameters and removal percentage of various paptodes developed by us. Photograph 1 shows the developed paptodes.

Table 1
Detailed Parameter of Developed Paptode

Parameter	Toxic Element						
	As	**Hg**	**Se**	**Zn**	**Cd**	**Pb**	**Cu**
Injection Volume	18 µl	18 µl	24 µl	6 µl	18 µl	24 µl	12 µl
Drying Method	RT	RT	RT	RT	RT	RT	RT
Temperature Dependence	No Effect	No Effect	Gentle heat	No Effect	60-70^{0}C	No Effect	70-80^{0}C
Range of Determination	0.18-1.8 µg mL^{-1}	0.18-18 µg mL^{-1}	0.24-240 µg mL^{-1}	0.8-6.0 µg mL^{-1}	µg mL^{-1}	0.024-11 µg mL^{-1}	0.012-8.4 µg mL^{-1}
Limit of Detection	18 ng	6 ng	120 ng	15 ng	3 ng	3 ng	15 ng
Stability of Paptode	10 days	20 days	10 days	15 days	20 days	15 days	40 days
Stability of spot	24 hours	3 days	2 days	3 hours	2 days	2 days	2 days
Response Time	25-30 min	Instant	Depends on Conc.	Instant	15 min	Instant	15 min
% Removal	95%	90%	90%	98%	95.5 %	95%	90%

Fig 1 Photograph showing developed Paptodes

VIII CONCLUSION

The paptodes developed have utilized very little reagents, use paper as a cheaper substrate. These not only detect the presence of toxic entity and determine but also effectively remove heavy metal ions without using any costly instrument. The dyes so formed on paptode by complexation can be further recovered. These are user friendly and are potential device to be commercialized for routine health and pollution analysis. Looking to these benefits and dimensions of use, the developed paptodes are certainly an analytical tool proceeding towards green chemistry.

REFERENCES

[1] Rashmi Sanghi and M M Shrivastava, Green Chemistry Environment Friendly Alternatives, Narosa publishing house, New Delhi, India, 20, 216, 2008, pp 220--223.

[2] A K De, Environmental Chemistry, New Age International, 7th edition, 110-111, 2010, pp 130.

[3] H Tavallali and E Nike, Asian Journal of Biochemical and Pharmaceutical Research 1, 3, 2011, pp 91-97.

[4] M Ornatska, E Sharpe, D Andreescu and S Andreescu, Anal.Chem., 83, 2011, pp 4273-7280.

[5] Ruchi Dubey Sharma, Smita Joshi and Sulbha Amlathe, anal. Methods, 3, 2011, pp 352-356.

[6] Ruchi Dubey Sharma, Sulbha Amlathe, Int. J. Res. Chem. Environ., .2, 2 2012, pp 88-95

[7] Ruchi Dubey Sharma, Smita Joshi and Sulbha Amlathe AJPBR, 2, 3, 2012, pp 161-168.

[8] Ruchi Dubey Sharma and Sulbha Amlathe, J. Chem. Pharm. Res., 4, 2, 2012, pp 1097-1105

[9] Ruchi Dubey Sharma, and Sulbha Amlathe, IOSR-JBPS, 3, 4 2012, pp 41-48

[10] Ruchi Dubey Sharma, Anita Baghel and Sulbha Amlathe, Chemical and Process Engineering Research, 11, 2013, pp 32-34.

Review of Hardware on Fractal Image Compression

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ABSTRACT
Fractal Image Compression is a promising compression technique in terms of its high compression ratios and fidelity. It has fast decoding, independent resolution and good image quality at low bit-rates which is useful for offline applications. Large encoding time has limited the use of this compression technique. In fractal based image encoding an image is divided into sub-blocks and the root mean square metrics among them are calculated. To reduce the encoding time various hardware are being implemented. In this paper we are studying most significant hardware implementations in Fractal Image Compression. The hardware design are aimed at substantially speeding up the encoding process by performing many of the repetitive tasks involved in finding transformations in parallel.

Index Terms—Hardware, Image, Pixel

I INTRODUCTION

The basic idea of fractal compression is to search the similarities between larger and smaller portions of an image by partitioning the original image into blocks of fixed size, called range and creating a shape codebook from the original image of double size of the range, called domain. Range blocks partition the image so that every pixel is included while the domain blocks can be overlapped and/or to not contain every pixel. The number of pixels remains unchanged even while extrapolating the image. Fractal image compression algorithms represent an image as a series of contractive transformations, each of which maps a large domain block to a smaller range block. Given only this set of transformations, it is possible to reconstruct an approximation of the original image by iteratively applying the transformations to an arbitrary image. Different hardware implementation are done in Fractal image compression to reduce the large number of comparisons yielding a substantial speed up and make it more flexible to make it applicable for different applications.

II HARDWARE IMPLEMENTATION IN FRACTAL IMAGE COMPRESSION

(a) Fractal Compression implemented with SIMD (Single Instruction Multiple Data)- Xue, M., Hanson, T., Merigot (1994) used a pixel-based parallelization scheme on a pyramidal SIMD architecture for a non-adaptive version of fractal compression.

Giordano, S., Pagano, M., Russo, F., Sparano, D.: (1996) gave a multi-scale fractal image coding algorithm based on SIMD parallel hardware [4]. An image-block parallelization scheme is used on a SIMD array processor.

Palazzari, P., Coli, M., Lulli, G (1999) massively parallel processing approach has been used on an APE100/Quadrics SIMD machine. For testing, 512 floating point processors has been used, offering a peak power of 25.6 GFLOPS. A gray level image of 512x512 has been compressed using a scalar quantization technique in about 2 seconds.

(b) Fractal Compression implemented with GPU (Graphics Processing Unit)- William A.Stapleton,Wagdy Mahmoud and David Jeff Jackson (1996) enhanced the computational speed through an parallel super computer implementation of the fractal image compression on a SIMD parallel machine the nCube-2. The fractal image compression process exhibits algorithmic modification employing a quad tree recomposition approach. The fractal iterated function system (IFS) calculations exhibit a high natural parallelism.

Tai-Chi Lee, Patrick Robinson, Michael Gubody and Erik Henne in (1999). A specialized hardware/software co-processor to improve the performance of encoding/decoding of images using fractal techniques can be used to increase the speed of data compression. A specialized processor is developed using a combination of VHDL logic synthesis, FPGA (Field Programmable Gate Array) hardware, and the C programming language to create a re-configurable hardware co-processor solution that can be adapted to the fractal compression algorithm.

Hidehisa Nagano, Akihiro Matsuura, and Akira Nagoya proposed a method of implementing Fractal Image Compression on dynamically reconfigurable architecture.

Processing Elements (PEs) configured for each image block perform these computations in a pipeline manner. By configuring PEs these computations and the number of address are reduced by half even in the worst case. This reduction increases the number of PEs that work in parallel. In addition, dynamic re-configurability of hardware is employed to omit useless metric computations. Experimental results show that the resources for implementing the PEs are reduced to 60 to70% and the omission of useless metric computations reduces the encoding time to10 to55%.

Ugo Erra presented a parallel fractal image compression using the programmable graphics hardware. It exploits SIMD architecture and inherent parallelism of graphic boards to speed-up baseline approach of fractal encoding. The results are achieved on cheap and available graphics boards. It uses the GPU for image compression. uses the GPU for image compression. Using programmable capabilities of the GPUs the large amount of inherent parallelism and memory bandwidth to perform fast pairing search between portions of the image is exploited. GPUs are an effective co-processors for fractal image processor. For the text image of 256 x 256 pixels range size of 4 x 4 and domain is of 8 x 8 pixels GPU takes about 1 sec while the CPU version takes about 280seconds to perform all pairing. The amount of paring test that the GPU is capable to perform is about 21 millions per second, the CPU performs about 220 thousands paring test per second. Ugo Erra work shows its advantages when compared with expensive parallel architecture as for instance in [3] which use 512 floating-point processors with performance comparable to this GPU implementation

Munesh Singh Chauhan and Ashish Negi (2012) presented a new approach for fractal image compression [1]. They modified and supported with advanced parallel hardware in the form of Graphical Processor Units. The GPUs consist of many cores thus providing SIMD parallel processing capability at an un-imaginable rate of around 24 GFLOPS. This processing speed was not possible earlier before the advent of GPUs except in some selected highly evolved Super computers. The rendering of image and its compression is implemented using OpenCL library. The benefits of faster fractal compression lie in the realm of medical imaging, satellite reconnaissance, gaming & film media.GPU time is considerably lower than CPU timing.

GPU can be used for parallel applications that require intensive computation and have complex algorithmic structures. The graphical units have revolutionized the way scientific computations are done and provide an inexpensive alternative for everyday commodity computing. GPUs have a more affordable avenue for desktop computing. It can also be used in finding self-similarities using IFS in sound waves akin to fractals. The only change being to replace contrast & brightness variables in fractals to that of Fourier transforms for sound waves. Another aspect that is being researched using GPU is the pattern recognition in gene encodings. The Encoding time using GPU clearly shows that it is possible to use fractals for resolution independent video capture format. In an ideal high definition (HD) television, the frame rate required for high fidelity display is 16.67 millisec. Using this rate the content can be rendered on any type of display panel that supports the experiment clearly shows the frame rate below 9 milliseconds which is extremely ideal.

Munesh Singh Chauhan, Sharmi S and Abeer Marhoon Al-Sideiri (2013) did on-board Implementation of Fractal Compression of Satellite Images using Distributed Networked GPUs. Satellite imageries are treated as fractals and then encoding them provides an efficient way of conserving bandwidth and per-bit storage costs.

III CONCLUSION

Fractal image compression using hardware implementation uses inherent parallelism and speeds up the process. It has a great scope in future. Other fast fractal image compression methods can be implemented further on hardware which will increase its speed up more effectively.

REFERENCES

[1] Munesh Singh Chauhan and Ashish Negi,"Fractals Image Rendering and Compression using GPUs", International Journal of Digital Information and Wireless Communications (IJDIWC) 2(1): 1-6 The Society of Digital Information and Wireless Communications, 2012(ISSN 2225-658X)

[2] Xue, M., Hanson, T., Merigot, A.: A massively parallel implementation of fractal image compression. In: Proc. ICIP-94 IEEE International Conference on Image Processing, Austin, Texas (1994)B. Smith, "An approach to graphs of linear forms (Unpublished work style)," unpublished.

[3] Palazzari, P., Coli, M., Lulli, G.: Massively parallel processing approach to fractal image compression with near-optimal coefficient quantization. J. Syst. Archit.45 (1999) 765–779

[4] Giordano, S., Pagano, M., Russo, F., Sparano, D.: A novel multiscale fractal image coding algorithm based on simd parallel hardware. In: Proceedings of the International Picture Coding Symposium PCS'96, Melbourne (1996)

[5] M.F.Barnsley, Fractals Everywhere, AK Peters, 1993.

[6] Y.Fisher, Fractal Image Compression, SIGGRAPH CourseNotes,1992.

[7] Y.Fisher(Ed.), Fractal Image Compression: Theory and Application, Springer,1996.

Harmonic Mitigation Techniques for Shunt Active Power Filter using Synchronous Reference Frame

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ABSTRACT
A shunt active filter injects a suitable non-sinusoidal current (compensating current) into the system at the point of common coupling and makes the source current sinusoidal. This paper presents a method for obtaining the desired reference current for Voltage Source Converter (VSC) of the Shunt Active Power Filter (SAPF) using Synchronous Reference Frame Theory. The method relies on the performance of the Proportional-Integral (PI) controller for obtaining the best control performance of the SAPF. To improve the performance of the PI controller, the feedback path to the integral term is introduced to compensate the winding up phenomenon due to integrator. Using Reference Frame Transformation, reference signals are transformed from $a - b - c$ stationery frame to $0 - d - q$ rotating frame. Using the PI controller, the reference signals in the $0 - d - q$ rotating frame are controlled to get the desired reference signals for the Pulse Width Modulation. The synchronizer, the Phase Locked Loop (PLL) with PI filter is used for synchronization, with much emphasis on minimizing delays. The system performance is examined with Shunt Active Power Filter simulation model. The use of active power filters is widely accepted and implemented as a solution to the power quality problems in utility, industry and commercial applications. In this paper, three of the three-phase shunt active filtering algorithms in time-domain have been compared for a non-linear load. The non-linear load chosen here is a soft-start for a three-phase induction motor. The comparison of the simulation results show the effectiveness of both the algorithms although the time domain current detection modified algorithm is more complex in terms of its implementation aspects.

***Keywords*—**Phase Locked Loop (PLL), Voltage Source Converter (VSC), Shunt Active Power Filter (SAPF), PI, Pulse Width Modulation (PWM).

I INTRODUCTION

The proliferation of power electronic converters has led to the degradation of the power quality. The performance of SAPF depends on the method of extraction of the reference compensating current. This reference current and the actual SAPF current is given to a hysteresis based, carrier-less PWM current controller to generate the switching signals of the inverter. Figure 1 shows the SAPF, which is controlled to supply a compensating current ic at the point of common coupling (PCC) and cancels current harmonics on the supply side.

Now, the source current is will be sinusoidal and in-phase with the supply voltage Vs. The organization of this paper is as follows. The different methods of estimating reference compensating current are discussed and their performance is compared under ideal and non ideal mains voltage at different load conditions.

THE ever increasing use of power semiconductor switching devices in power supply for DC motors, computers and other microprocessor based equipment causes harmonics in electric power system. Harmonics may cause serious problems such as excessive heating of electric motors and malfunction of sensitive electronic gadgets. Filtering of harmonics can be effected by using either passive or active power filters.

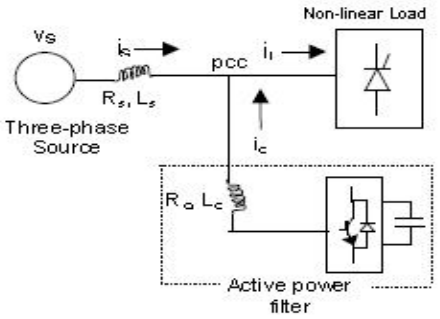


Fig. 1 Basic compensation principle of SAPF

Traditionally, passive filters have been used for harmonic mitigation purposes. Active filters have been alternatively proposed as an adequate alternative to eliminate harmonic currents generated by nonlinear loads as well as for reactive power compensation. Active Power Filter consists of Voltage Source Converter operating at relatively high frequency to give the output which is used for cancelling low order harmonics in the power system network. With Shunt Active Power Filter, crucial part involves generation of the reference signal used to generate gating signals for the VSC. Fig. 2 shows Block Diagram of PWM Controlled VSC operated as APF.

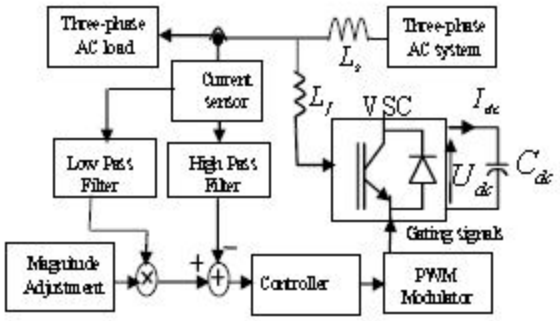


Fig.2 Block Diagram of PWM Controlled VSC operated as APF

II HARMONIC CURRENT REFERENCE

To get the reference harmonic current, first the load current is measured. The load current consists of fundamental component 1 *i* and harmonic component *h i* . Using the band pass filter, with appropriate cut-off frequencies the fundamental current is extracted from the measured system load current. Using comparator, as shown in Fig.3, the load current is compared to the fundamental component and the

error is the reference harmonics signals.

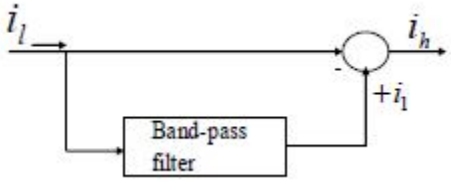


Fig. 3 Harmonic reference extraction

Where $i_h = \sqrt{i_{ha}^2 + i_{hb}^2 + i_{hc}^2}$, the instantaneous magnitudes of the three phase harmonic currents. i_l = load current and $_{i1}$ = fundamental component of the load current.

III REFERENCE FRAME TRANSFORMATION

Reference Frame transformation is the transformation of coordinates from a three-phase *a* − *b* − *c* stationery coordinate system to the 0 − *d* − *q* rotating coordinate system as shown in Fig.4

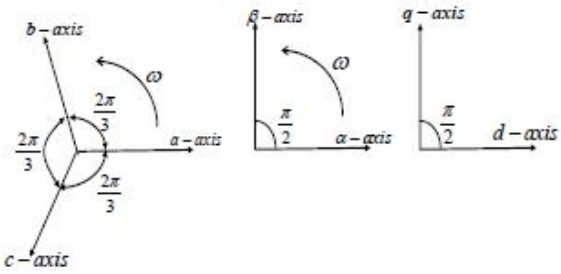


Fig. 4 Reference Frame Transformation

This transformation is important because it is in 0 − *d* – *q* reference frame the signal can effectively be controlled to get the desired reference signal. Transformation is made in two steps: First a transformation from the three-phase stationery coordinate system to the two-phase so-called 0 −α – β stationery coordinate system is done. Load currents and voltages at Point of Common Coupling (PCC) are transformed to 0 −α − β coordinates. The three-phase signal with maximum voltage *V m* , at 120 degrees apart from each other is as given by (1):

$$f_{abc} = V_m \begin{bmatrix} \cos \omega t \\ \cos\left(\omega t - \frac{2\pi}{3}\right) \\ \cos\left(\omega t + \frac{2\pi}{3}\right) \end{bmatrix} \quad (1)$$

TABLE I
NOMENCLATURE

L_s, L_f	Line inductance, filter inductance
I_{dc}, V_{dc}	Dc current, dc voltage
$i_{liad}, i_{harmonics}$	Load current, harmonics current
i_{sa}, i_{sb}, i_{sc}	Three-phase currents
i_d, i_q	Component currents in $dq-frame$
$v_{aref}, v_{bref}, v_{cref}$	Three-phase reference voltage
K_p, K_i	Proportional constant, integral constant
e_s	Error signal
u_c, u	Controller output, actuator output
T_i, T_t	Integral time constant, tracking time constant
D_1, D_2	Anti-parallel diodes
T_1, T_2	Switches
p, n, z	Positive rail, negative rail and neutral point respectively.
ω_0	Target output frequency
θ_0	Arbitrary output phase

The signal *f* abc in the *a* − *b* − *c* stationery frame is rotating with the frequency of ω in radians /sec. The signals in 0 −α − β stationery frame are obtained using (2). Fig. 5 shows the reference signal calculation using the Synchronous Reference Frame Theory. The desired controlled signals

obtained are used for PWM processes to generate the switching signals for the VSC.

$$f_{0\alpha\beta} = V_m\sqrt{\frac{2}{3}}\begin{bmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ 1 & -\frac{1}{2} & -\frac{1}{2} \\ 0 & \frac{\sqrt{3}}{2} & -\frac{\sqrt{3}}{2} \end{bmatrix}\begin{bmatrix} \cos\omega t \\ \cos\left(\omega t - \frac{2\pi}{3}\right) \\ \cos\left(\omega t + \frac{2\pi}{3}\right) \end{bmatrix} \quad (2)$$

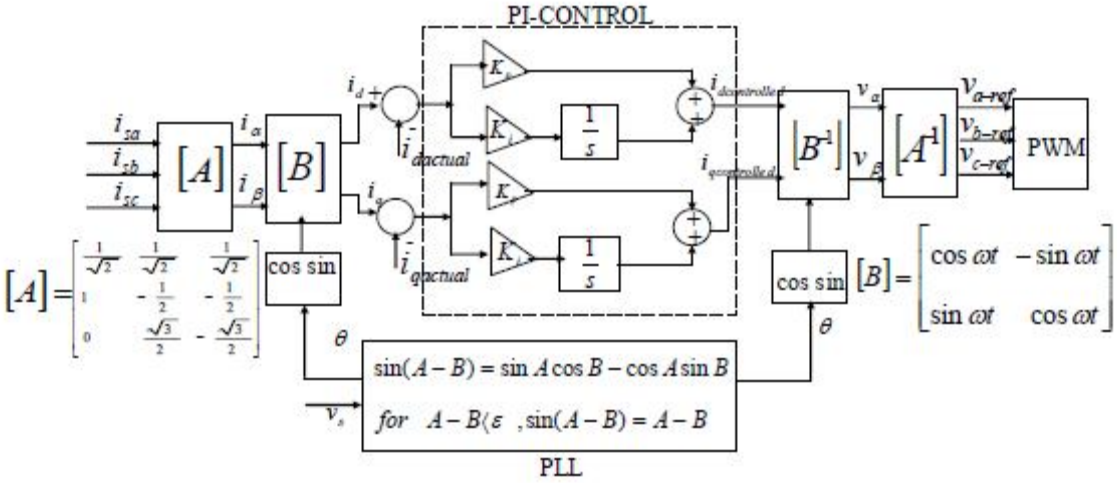


Fig. 5 Block diagram of reference signals calculation for the PWM

The axes a, *b*, and *c* are fixed on the same plane and are separated from each other by ⅔ π radians. 0 −α − β are orthogonal axes with the α − *axis* being synchronized with the *a* − *axis* of *a* − *b* − *c* plane and the β − *axis* being orthogonal to the α −*axis* . *f*0αβ in (2) is still rotating with the frequency of ω radians/second. To eliminate this frequency, a step further is taken, a transformation from the 0 −α − β stationery coordinate system to the 0 − *d* – *q* rotating coordinate system is performed using (3)

$$\begin{bmatrix} B \end{bmatrix} = \begin{bmatrix} \cos\omega t & \sin\omega t \\ -\sin\omega t & \cos\omega t \end{bmatrix} \quad (3)$$

Equation (3) is assigned such that when it is multiplied by *f*0αβ , the 0 −α − β coordinates which are in stationery frame achieves the same frequency as that in 0 − *d* – *q* rotating frame as given in (4)

$$f_{0dq} = \begin{bmatrix} \cos\omega t & \sin\omega t \\ -\sin\omega t & \cos\omega t \end{bmatrix}\begin{bmatrix} f_{0\alpha\beta} \end{bmatrix} \quad (4)$$

IV THE PROPORTIONAL INTEGRAL (PI) CONTROLLER

The PI controller is very important part for the SAPF. It consists of proportional term and integral term. With this element, the best control performance of the SAPF is obtained. PI focuses on the difference (error) between the process variable (PV) and the set-point (SP), the difference between harmonics current reference signal *ih* and the filter current *i f* . In this paper the PI controller has been implemented. PI controller algorithm involves two separate parameters; the Proportional and the Integral. The Proportional value determines the reaction to the current error; the Integral determines the reaction based on the sum of recent errors.

V PHASE LOCKED LOOP (PLL)

The PLL circuit with the PI control scheme controls the oscillation frequency of the VCO with the sum of a voltage proportional to the error signal and a voltage proportional to the time integral of the error signal as shown in Fig 6.

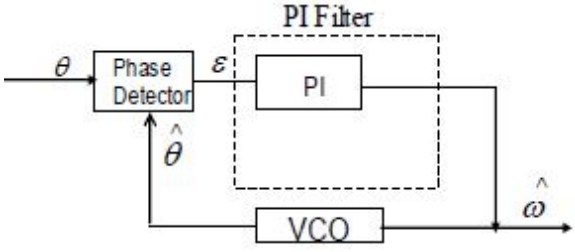


Fig 6 Conventional PLL

When the source for synchronization, i. e. the phase of the input signal frequency of the PLL is lost, a control voltage corresponding to a difference between the input signal frequency and the self-running frequency of the VCO must be memorized as the output voltage signal of an integrator so as to maintain the output frequency of the VCO despite absence of the input signal. Therefore the PI control scheme of the conventional PLL is provided with the second integrator which helps to minimize delays that may affect synchronization.

VI THE P-Q THEORY APPLIED TO ACTIVE FILTERS

It is also possible to see in Fig. 7 that the active filter capacitor is only necessary to compensate $\tilde{p}$ and $\tilde{p}$ 0 , since these quantities must be stored in this component at one moment to be later delivered to the load. The instantaneous imaginary power (q), which includes the conventional reactive power, can be compensated without any capacitor.

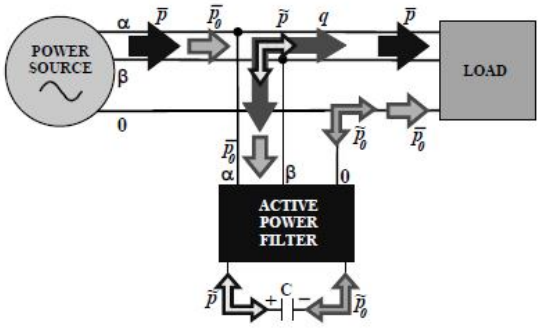


Fig.7 - Compensation of power components $\tilde{p}$, *q*, $\tilde{p}$ 0 and *p*0 in *α*-β-*0* coordinates.

VII SINUSOIDAL PULSE WIDTH MODULATION (SPWM) SCHEME

SPWM scheme is used to determine the switching instants of the VSC for the purpose of maintaining Input/Output linearity especially for Active Power Filter Applications. Fig. 8 shows the basic principle of SPWM . All modulation schemes in principle aim to create trains of switched pulses which have the same fundamental volt-second average (i.e. the integral of the voltage waveform over time) as a target reference waveform at any instant. There are several ways in which switching instants can be decided, at the same time maintaining the minimum harmonics content for the switched waveform. In this paper natural sampling is used, where the switching instants are determined by the intersection of the carrier waveform and the reference waveform. The more common form of naturally sampled PWM uses a triangular carrier instead of saw-tooth carrier to compare against the reference waveform. Naturally sampled PWM compares a low frequency target reference waveform *V ref* (usually a sinusoid) against a high frequency carrier waveform *V tri* . Fig. 9 shows one phase leg of an inverter driven by a triangular wave carrier. The phase leg is switched to the upper DC rail when the reference waveform is greater than the triangular carrier and to the lower DC rail when the carrier waveform is greater than the reference waveform.

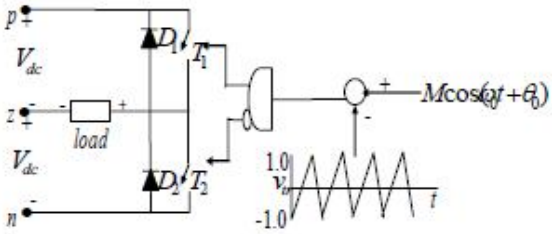


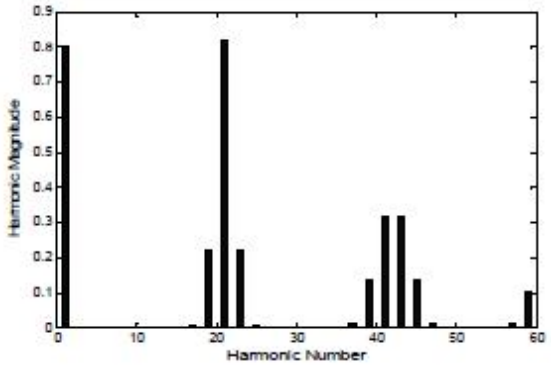
Fig. 8 Double-edge naturally sampled PWM with half bridge (one phase leg) voltage source converter

VIII SIMULATION TOOLS

Simulation is a powerful way to reduce development time and ensure the proper fulfilment of critical steps.

During the development process of the shunt active filter, simulations were performed, which allowed the study of its behaviour under different operation conditions, and permitted the tuning of some controller parameters together with the optimisation of the active filter components values. There are not many simulation tools that allow working with electrical systems, power electronics and control systems, in the same integrated environment. *Matlab/Simulink* and the *Power System Blockset* were used as simulation tools in this case .

Fig 9 shows simulation results for single-phase full bridge, using the triangular carrier method. The theoretical phase leg “a” voltage harmonics are shown in Fig. 9 (a) together with the l-l output voltage in Fig 9(b) for particular operating conditions of a carrier ratio of 21 and modulation index M of 0.8.



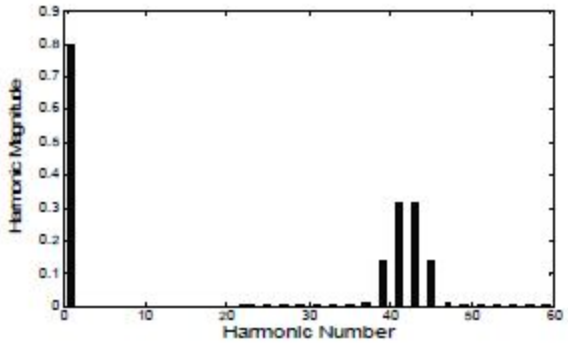
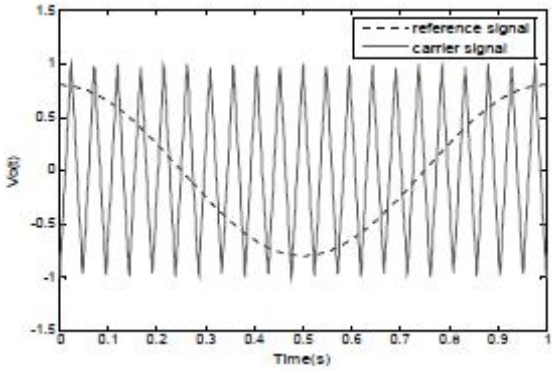


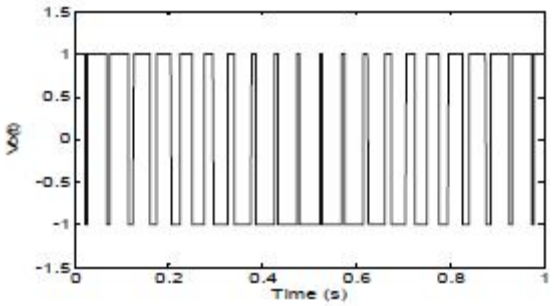
Fig 9 Harmonic spectra during PWM process

(a) Spectrum of the phase to neutral voltage
(b) Spectrum of line to line voltage

MATLAB/SIMULINK software has been used to generate the switching signals. Simulation results for SPWM process is shown in fig 10. Fig.10 (a) shows the comparison between the sinusoidal reference voltage with triangular carrier signal and Fig 10 (b) shows the switching signals generated as a result of
comparison between the carrier signal and reference signal.



(a)



(b)

Fig. 10 PWM Process

(a) Simulation Results- Simulations based on MATLAB/SIMULINK were implemented to verify the proposed Shunt Active Power Filter with anti-windup scheme. The circuit parameters of the equivalent power system based on Fig. 1 are as follows: Vrms = 380V, Vdc = 450V, Ls = 1.0 mH, Lf = 0.3 mH. The power converter is switched at a frequency of 10 kHz. The 5th, 7th, and 11th harmonics were used to test the proposed Active Power Filter.

IX CONCLUSION

This paper presents a shunt active power filter as a reliable and cost-effective solution to power quality problems.

The filter presents good dynamic and steady-state response and it can be a much better solution for power factor and current harmonics compensation than the conventional approach (capacitors to correct the power factor and passive filters to compensate for current harmonics). Besides, the shunt active filter can also compensate for load current unbalances, eliminating the neutral wire current in the power lines. Therefore, this active filter allows the power source to see an unbalanced reactive non-linear load, as a symmetrical resistive load.

The proposed low-cost solution allows the use of a large number low-power active filters in the same facility,close to each problematic load (or group of loads), avoiding the circulation of current harmonics, reactive currents and neutral currents through the facility power lines. This solution reduces the power lines losses and voltage drops, and avoids voltage distortions at the loads terminals.

REFERENCES

[1] H. Akagi, Y. Kanazawa, A. Nabae, Generalized Theory of the Instantaneous Reactive Power in Three-Phase Circuits, *IPEC'83 - Int. Power Electronics Conf.*, Tokyo, Japan, 1983, pp. 1375-1386.

[2] H. Akagi, Y. Kanazawa, A. Nabae, Instanataneous Reactive Power Compensator Comprising Switching Devices without Energy Storage Compenents", *IEEE Trans. Industry Applic.*, vol. 20, May/June 1984.

[3] E. H. Watanabe, R. M. Stephan, M. Aredes, New Concepts of Instantaneous Active and Reactive Powers in Electrical Systems with Generic Loads, *IEEE Trans. Power Delivery*, vol. 8, no. 2, April 1993, pp. 697, 703.

[4] M. Aredes, E. H. Watanabe, New Control Algorithms for Series and Shunt Three-Phase Four-Wire Active Power Filters, *IEEE Trans. Power Delivery*, vol 10, no. 3, July 1995, pp. 1649-1656.

[5] MATLAB: High-Performance Numeric Computation and Visualization Software – Reference Guide, The MathWorks Inc., April 1993.

[6] SIMULINK: The Dynamic System Simulation Software-User's Guide, MathWorks Inc., April 1993.

[7] Power System Blockset User's Guide, TEQSIM International Inc. and Mathworks Inc., 1998.

[8] C. Qiao, K. M. Smedley, "Three-phase Active Power Filters with Unified Constant-frequency Integration control", www.eng.uci.edu/~smedley/IPEMC-A185.PDF.

[9] C. Collombet, J. Lupin, J. Schonek, (1999), Harmonic disturbances in networks, and their treatment, Schneider Electric's "Collection Technique", Cahier technique no.152, http://www.schneiderelectric.com/cahier_technique/ee/pdf/ect202. pdf. Available online.

[10] U. Abdurrahman, R. Annette, L. S. Virginia, "A DSP Controlled Resonant Filter for Power Conditioning in Three-Phase Industrial Power'', System. Signal Processing, Volume 82, Issue 11, November 2002, pp 1743-1752.

[11] P. Fabiana, Pottker and B. Ivo, "Single-Phase Active Power Filters for Distributed Power Factor Correction", PESC 2000.

[12] F. F. Gene, J. D. Powell, A. Emami-Naeini, Feedback Control ofDynamic system, Pearson Education. Inc.1986, pp 186-190

[13] G. Masataka, S. Yasuhiro, "Method of stabilizing holdover of a PLL circuit" US Patent , November 7, 2000

[14] D. G. Holmes T. Lipo, "Pulse width modulation for power converters-principles and practice" IEEE series on Power Engineering, pp 114-119.

Breaking the boundaries: Increasing demands of digital technologies & IT for teaching and learning English language

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ABSTRACT
Technology has a transformative power and Language is a powerful means of communication. It is the vital component in education by which we acquire all kinds of knowledge. The interconnectedness of digital technologies has created new contexts for language learning and new labels have emerged for teaching and learning in the digital context: Computer Assisted Learning; Web-based Learning; Online Learning; Distance Learning; E-Learning; MOOCs (Massive Open Online Courses) Mobile Learning etc. As a result of the application of cyber technologies, both teaching and learning are facilitated, Students learn faster and easier than before. Internet, ICT, VLE, digital media and software as such have heralded a new era in many aspects of our lives, to which education is no exception. The rapid rising and development of information technology has offered a better pattern to explore the new teaching and learning ways. Learning English through the web and using new trends in education make students willing to learn effectively. This paper focuses on the role of digital technology and IT for teaching and learning English language effectively and internet communication tools in use.

Keywords- English language learning, E-learning, ELT, ICT, VLE

I INTRODUCTION

The new era assigns new challenges and duties on the modern teacher and learner. The tradition of English teaching and learning has been drastically changed with the remarkable entry of technology. Technology provides so many options as making it interesting and also making it more productive in terms of improvements. Technology is one of the most significant drivers of both social and linguistic change. Graddol: (1997:16) states that" technology lies at the heart of the globalization process; affecting education work and culture. At present, the role and status of English is that it is the language of social context, political, socio cultural, business, education, industries, media, library, communication across borders, and key subject in curriculum and language of imparting education". It is also a crucial determinant for university entrance and processing well paid jobs in the commercial sector. Since, there are more and more English learners in India. Web based technologies and powerful internet connections provide various new possibilities and latest trends for teachers and learners. In fact as the electronic media as internet and the use of cyber space in education are the inseparable elements of education in the global atmosphere today, special attention must be paid on how to use the information communication technology (ICT) and virtual learning environments (VLE) to meet the demands of the era, as information and communication technology has become a crucial part of the modern world. Now most of the countries emphasize learning and applying the information and communication technology as the base of their educational systems. Students and teachers are increasingly using accessing information online to support their learning and teaching.

II THE GROWTH OF ELT THROUGH TECHNOLOGY

When you speak of globalization, the first language that comes to mind is English. English Language Teaching has been with us for many years and its Significance continues to grow, fuelled, partially by the Internet. Graddol's study (2000) suggests that in the year 2000 there were about a billion English learners- but a decade later the numbers doubled. The forecast points to a surge in English learning, which has peaked in 2010. The same study indicates that over 80% of information stored on the internet is in English. For the first time there are more Non-Native than Native users of the language. For ESL students who learn the language for more than just fun. For them to keep pace with ELT and gain more confidence they have to stride into the world of multimedia technology.

With the rapid development of technology, the emerging and developing of multimedia technology and its application to teaching, featuring audio, visual, animation effects comes into full play in English class teaching . It's proved that multimedia technology plays a positive role in promoting activities and initiatives of student and teaching effect in English class. Technological innovations have gone hand –in hand with the growth of English and are changing the way in which we communicate. It is true to say that the growth of the internet has facilitated the growth of the English language and that this has occurred at a time when computers are no longer the exclusive domains of the dedicated few, but rather available to many. With this there has been a very significant proliferation of literature regarding the use of technology in teaching English language. Teachers

can use Multimedia Technology to give more colorful, stimulating lectures (new Horizons).

III MULTIMEDIA LANGUAGE LAB AND TEACHING ENGLISH COMMUNICATION SKILLS

In the modern age of technology, role of multimedia language lab occupies a significant place and is in resonance with modern pedagogical practices. The concept of multimedia language lab brought in a cost-effective, user-friendly and 100% digital methodology of learning language at your own time and convenience. It can bridge between language and technology and acts as the advanced step for using computers in the language field. The computer software will 'teach' students the knowledge that teachers are supposed to teach. As a result, a teacher must transform his role from a instructor under the communicative framework to a coordinator. The teacher coordinates the flow of communication between the teacher and student as well as between the student and computer. The choice of appropriate language software that fits into the setting of multimedia lab is one of the key factors to success. They are the most useful component of language lab. However, the medium of teaching ought to go along with the language software. The other dimensions that should be taken into consideration are that chalk and board are totally obsolete in language lab. The appropriate teaching tools are computers, OHP, and power point slides. Accordingly, using computer software in multimedia lab should be fun and interactive.

IV POSSIBLE APPLICATION OF THE LATEST TRENDS IN E-LEARNING

(a) Web-Based Learning- Many of us use the internet or the "web" (World Wide Web) as a source of information and as a learning tool. Web is used effectively to support both, their own learning and that of their students. A variety of basic language skills can be developed with the help of web-based language learning activities. It is known that; there are four basic skills in English which are listening, speaking, writing, and reading. These skills can be put on the web and made interactive in a variety of ways. One of these ways is internet communication tools such as E-learning, m-learning, e-mail, blogs, and chat. These tools provide integrated environment for teachers and students. Students generally feel positive about web-based learning tools, when they are:

- Well-designed, user friendly and easy to learn.
- When the tool is well as support, not as replacement of lectures.
- When the use of diverse tool features, i.e. chat, bulletin board, is relevant and tied into the specific course structure and content (Storey et al., 2002)

(b) Portals and Web Tools- In an era of the Internet and Information Technology, there has been an intend demand for numerous website portals for teaching English and learning activities. These Portals has emerged as an online education program with sole purpose is to conduct classes for the students through E-learning mode which is simplified for online learning and teaching purpose. Here, students and teachers interact through online audio and video sessions, online forums and posts, online projects, course materials, practical sessions and numerous other resources. It is a tool in which online training classes are conducted. Site now offers multiple beginner and advanced courses and the online practice test, a daily online magazine, and Universal Translator. As an example for learning English online newly expanded portal are www.GlobalEnglish.com,http://www.englishpond.com/ EnglishForum.com and ESLpoint.com etc.

(c) e-mail - E-mail is a communication tool which is being used in language learning. E-mail is probably the most commonly used Internet application. By getting a single e-mail account both foreign teachers and students can join e-mail assisted language activities. For learners of English e-mail is an excellent way to communicate with their instructors because of its usefulness and easiness. With a single e-mail account, "foreign teachers and students can integrate e-mail based activities into their curriculum" (LeLoup, 1997, p.37). The teacher can assign a debate topic and then ask the students to start to discuss it via e-mail. When the time comes to form debate teams in class, the students will already have a satisfactory understanding of both sides of the issue and they will be able to make better and relevant decisions. English teachers can benefit from web sites which include e-mail accounts so teachers can create a discussion topic and send it to students via e-mail when receiving the e-mail students start to write compositions or essays in English and discuss a work and then send back to teacher. This helps them to improve their writing skills and vocabulary as well as their ability to practice analyzing a literary work.

(d) Web Blogs- Academically, a blog is a website on which teachers and students can post and share their thoughts and ideas. Effectively, it is like a notice board, school magazine and book club, all rolled into one. Nardi et al. (2004) states:

"Blogs are well suited to serve as on-line personal journals for students, particularly since they normally enable uploading and linking of files"(p.41). Language learners could use a personal blog, linked to a course, as an electronic portfolio, to authors' website or weblogs and other open access sources providing students with both reading resources as well as helping them discover the hidden layers of meaning in a work of art. Moreover students can publish weblogs too which improves their writing abilities. As an example a practical site to be introduced to the students to use it as a role model is: http://blog-assisted-language-learning.blogspot.com/. In which students discuss any topics to develop their writing and reading English language skills. One of the useful articles that discuss using blogs in teaching English is for ELT:teachingenglish.org.uk/think/articles/blogging-elt.

(e) Instant Messenger- CQ was the first general messenger service in the early 1996 (www.worldstart.com/tips/tips.php/1498). During the years a variety of messenger services such as Yahoo Messenger, MSN Messenger, etc. began to serve to people. Newly more services are added to such technologies. Among the most important new ones, one can name: www.oovoo.com and www.qq.com

Students writing, listening and speaking could be improved if the above websites are used. Moreover, students of English can have better interaction with teachers in these virtual environments; they can communicate with teachers and share information. For example when it is talked about MSN Messenger, it provides several features beyond audio, video, text, and file transfer. Messenger is used with a Webcam and allows users to see each other in a small video window while talking. So students can talk with their teachers in English in order to develop their listening and at the same time speaking skills.

(f) Skype-Nowadays almost all messenger services have technological equipments such as computer, laptop, and also have cameras on them. So students can talk with their teachers far away. "Skype is a relatively newly emerging technology and the potential application of it to language and literature learning and teaching needs to be further explored" (Wu, 2005, p.13). Learners can speak with native language teacher and compare their pronunciation, and they can improve their grammar and understanding of the language. In addition to improving their literary knowledge by discussing intended literary works with university professors, they can improve their speaking too. Students can develop their English language skills in positive, enjoyable and memorable way. Speaking skills can be developed by using this application.

(g) Mobile Devices- Mobile learning is one of those technologies which have been used for a few years. Mobile learning means that people are learning whenever and wherever they want with their mobile phones, PDA's and other technological devices. Mobile learning is also defined as "any service or facility that supplies learner with general electronic information and educational content that aids in acquisition of knowledge regardless of location and time. Mobile learning system is available for delivering education to learners anywhere and anytime they need it. Nowadays Mobile phones are the most popular devices among people. Mobile devices could be used in teaching both Language and literature: for e.g. IPODS, SMARTPHONES, TABLETS are the mobile media devices which enable users to produce, organize, deliver the learning material and also users can share texts, images, audio or video with their English teachers. The technology and pedagogy of using podcasting and iPod could be in improving listening skills in case of English language learning.

V POSITIVE IMPACT OF E-LEARNING ON SOCIETY & ECONOMY PROGRESS

ICT and human life cannot be separated; society has a cyclical co-dependence on technology. Technology has improved education and learning process and Education is the backbone of every economy and it has a great social importance. Effective eLearning comes from using information and communication technologies (ICT). To broaden educational opportunity and to help students develop their English language skills eLearning can deliver substantial positive effects. Family interaction and parental involvement may increase. Communities benefit from bridging the digital divide. Economic progress can result from direct job creation in the technology industry as well as from developing a better educated workforce.

VI CONCLUSION

The use of information and communication technology (ICT) cannot be underestimated in language teaching and learning process because emerging technologies make it pertinent and practical to approach learning in ways that have been advocated by theorist scientist and educational psychologists. The development of Web-based language teaching and learning activities continue to be an exciting and growing field. Language teachers can create their own web based language activities and use the communication tools. In order to provide an

interaction between language learners and teachers, internet connections and mobile devices are of the most popular and useful ways in language learning. Concerning the development of technology, we believe that in future, the use of multimedia English teaching and E learning will be further developed. The Development of the learner as a professional person requires that the teaching-learning process be perceived and understood as a dynamic human interactional growth process, in order to fulfill its obligations to the society it serves, learning through latest technology must be a continuing, ongoing process.

REFERENCES

[1] Cooney, G., & Keogh, K. A., (2007). Use of mobile phones for language learning and assessment for learning. A Pilot Project St. Johns, Beamore Road, Drogheda, Co. Louth, Ireland National Council for Curriculum and Assessment. Retrieved on 2 January 2007 from www.ncca.ie.

[2] Chinnery, G. M., (January, 2006). Emerging technologies going to the MALL: Mobile assisted language learning. Language Learning & Technology, 10 (1), 9-16.

[3] Eisa Amiri,(5, june 2012) Lecturer, Lamerd Branch, Islamic Azad University, Iran. A Study of The Application of Digital Technologies In Teaching And Learning English Language And Literature. International journal of scientific & technology research volume 1.

[4] Houser, C., Thornton P., & Kluge, D., (2002). Mobile learning: Cell phones and PDA's for education. Proceedings of the International Conference on Computers in Education. Publication Date: 3-6 Dec. 2002

On page(s):1149- 1150 vol.2 ISSN: ISBN: 0-7695-1509-6 INSPEC Accession Number: 7679063 Current Versions Published: 20 March, 2003.

[5] Khan, B. H., (2005). Managing e-learning: Design, delivery, implementation, and evaluation. Hershey, PA: Information Science Publishing retrieved on 6th January from http://BooksToRead.com/elearning)

[6] Levy, Michael (1997) Computer- assisted Language Learning, Oxford, Clarendon Paperback

[7] Littlewood, W. (1981) Communicative Language Teaching, New York, Cambridge University Press.

[8] Solanki D. Shyamlee "Use of Technology in English Language Teaching and Learning": An Analysis. 2012 International Conference on Language, Medias and Culture IPEDR vol.33 (2012) © (2012) IACSIT Press, Singapore