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Total Quality Management Aspects of Implementation and Performance Investigation with a Focus on Higher Education by Using QFD & Statics cal Analysis in Mechanical Engineering - A Case of Private Institute

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ABSTRACT

Education is of numerous types and patterns. There is for example, the arts education, the scientific education, the religious education, the physical education. In India, as in other countries, much stress has been laid on the promotion of technical education since the attainment of independence. India's economic ills are sought to be overcome through a process of Industrialization for which, in turn, technical education is very essential. In other words, technical education is a vital prelude to India's property. The scope of technical education is very comprehensive. It incorporates within itself all subjects of study in engineering and technology. Civil engineering, Mechanical engineering, Electrical engineering, Mining engineering, Aeronautical engineering, Metallurgical engineering, Industrial engineering, Chemical engineering, Agricultural engineering, Production engineering, and a host of other fields of engineering form part of technical education. "Quality in technical education is a complex concept that has eluded clear definition". There are a variety of stakeholders in higher education including students, employers, teaching and non-teaching staff government and its funding agencies, accreditors, valuators', auditors, and assessors (including professional bodies). Each of these stakeholders has a different view on quality, influenced by his or her own interest in higher education. For example, to the committed scholar, the quality of higher education is its ability to produce a steady flow of people with high intelligence and commitment to learning that will continue the process of transmission and advancement of knowledge. To the government, a high quality system is one that produces trained scientists, engineers, and architects, doctors and so on in numbers judged to be required by society. The present work enlightens same path, so as to fulfil the demands of market and to improve quality of education in the present work some quality tools such as LINEAR PROGRAMMING, TQM, QUALITY FUNCTION DEPLOYMENT, with chi square testing and mat lab, have been used. Basic primary tool used is LPP which helps in converting demand of customer to action. It helps in understanding unspoken needs of customer which are desperately needed to be fulfilled. In this improvement work main focus was on improvement of labs and teaching staff, for maintenance of labs & improvement in teaching, use of quality circle is stressed with concept of TPM and Kaizen approach. Most interesting thing of using these tools was that they helped in achievement of desired target without much added resource, only refinement of procedure; moreover maintenance helps in gaining knowledge with saving extra expenditure. This also helps in up gradation of quality of products which satisfies external customer.

Keywords: Chi Square Testing, LPP, MATLAB, Statics cal Analysis

I INTRODUCTION

India's higher education system is the world's third largest in terms of students, next to China and the United States. Unlike China, however, India has the advantage of English being the primary language of higher education and research. India educates approximately11 per cent of its youth in higher education as compared to 20 per cent in China. The main governing body at the tertiary level is the University Grants Commission (India), which enforces its standards, advises the government, and helps coordinate between the centre and the state. Universities and its constituent colleges are the main institutes of higher education in India. At present in 2011, there are 227 government-recognized Universities in India. Out of them 20 are central universities, 109 are deemed universities and 11 are Open Universities and rest are state universities. Most of these universities in India have affiliating colleges where undergraduate courses are being taught. According to the Department of higher Education government of India, 16,885 colleges, including 1800 exclusive women's colleges functioning under these universities and institutions and there are 4.57 lakh teachers and 99.54 lakh students in various higher education institutes in India. Apart from these higher education institutes there are several private institutes in India that offer various

professional courses in India. Distance learning is also a feature of the Indian higher education system.

II REVIEW OF LITERATURE

All of the research review supports the hypothesis that student performance depends on different socio-economic, psychological, environmental factors. The finding of research studies focuses that student performance is affected by different factors such as learning abilities. The new paradigm about learning assumes that all students can and should learn at higher levels but it should not be considered as constraint because there are other factors like race and gender that can affect student's performance. Some of the researchers even tried to explain the link between students achievement, economic circumstances and the risk of becoming a drop-out that proved to be positive (Goldman N., Haney W., and Koffler S., 1988, Pallas A., Natriello G., McDill E., 1989, Levin H., 1986) B.A. Chandrashekhar and A. Mishaeloudis (2001), explained the effects of age, qualification distance from learning place etc. on student performance. The performance of students on the module is not affected by such factors as age, sex and place of residence but is associated with qualification in quantitative subjects. It is also found that those who live near the university perform better than other students. Yvonne Beaumont Walters, kola soyibo, (1998) further elaborated that student performance is very much dependent on SEB (socio economic back ground)as per their statement, "High school students' level of performance is with statistically significant differences, linked to their gender, grade level, school location, school type, student type and socio-economic background (SEB)."Kirby, Winston et al. (2002) focused on student's impatience (his time-discount behaviour) that influences his own academic performance. Goethe found out that weak students do better when grouped with other weak students. (As implied by Zajonc's analysis of older siblings (1976) it shows that students' performance improves if they are with the students of their own kind. There are often different results by gender, as in Hoxby's K-12 results (2000); Sacerdote

III METHODOLOGY

Statistical techniques including regression analysis were used as a methodology. Data collected was of primary nature through a well-defined questionnaire. A sample of private college students was taken where these variables were recognized and response was clear and understandable. Public sector educational institutions were not the focus of the study. A sample of 30 students was taken from a group of colleges. Students were grouped in a classroom they were briefed clearly about the questionnaire and it took on average half an hour to fill this questionnaire. Selection of students was at random. Out of these students only those were selected at random who were voluntarily willing to fill the questionnaires. The data was collected using a questionnaire administrated by the Research team in the 3rd month of 3rd year. The questionnaire dealt mainly with student profile based on his attitude towards Study, Strictness, Attendance, Age, Previous academic achievements, Daily life, etc. All 6 questionnaires were filled with the response rate of 100%.

The sample age composition was from 18 years to 22 years of age at maximum because Rajiv Gandhi Technical University of does not allow students over 22 years of age to be admitted in graduate classes.

Basic Ideology

Student ______ INSTITUTE ______ Finished (O/P) I/P Product

(a) Linear Programming-

Linear programming (LP) techniques consist of a sequence of steps that will lead to an optimal solution to problems, in cases where an optimum exists. There are a number of different linear programming techniques; some are special-purpose (i.e., used to find solutions for specific types of problems) and others are more general in scope. This supplement covers the two generalpurpose solution techniques: graphical linear programming and computer solutions. Graphical linear programming provides a visual portrayal of many of the important concepts of linear programming. However, it is limited to problems with only two variables. In practice, computers are used to obtain solutions for problems, some of which involve a large number of variables. (2001) finds that grades are higher when students have unusually academically strong roommates. The results of Zimmerman (1999, 2001) were somewhat contradictory to Goethe results but again it proved that students performance depends on number of different factors, it says that weak peers might reduce the grades of middling or strong students.

- (i) Read already published work in the same field.
- (ii) Goggling on the topic of your research work.
- (iii) Attend conferences, workshops and symposiums on the same fields or on related counterparts.
- (iv) Understand the scientific terms and jargon related to your research work.

Linear programming is a powerful quantitative tool used by operations managers and other managers to obtain optimal solutions to problems that involve restrictions or limitations, such as the available materials, budgets, and labour and machine time. These problems are referred to as constrained optimization problems. There are numerous examples of linear programming applications to such problems, including:

- (i) Establishing locations for emergency equipment and personnel that will minimize response time
- (ii) Determining optimal schedules for airlines for planes, pilots, and ground personnel
- (iii) Developing financial plans
- (iv) Determining optimal blends of animal feed mixes
- (v) Determining optimal diet plans
- (vi) Identifying the best set of worker-job assignments
- (vii) Developing optimal production schedules
- (viii) Developing shipping plans that will minimize shipping costs
- (ix) Identifying the optimal mix of products in a factory

(b) Linear Programming Models-

Linear programming models are mathematical representations of constrained optimization problems. These models have certain characteristics in common. Knowledge of these characteristics enables us to recognize problems that can be solved using linear programming. In addition, it also can help us formulate LP models. The characteristics can be grouped into two categories: components and assumptions. First, let's consider the components. Four components provide the structure of a linear programming model:

- (i) Objective
- (ii) Decision variables
- (iii) Constraints
- (iv) Parameters.

Linear programming algorithms require that a single goal or objective, such as the maximization of profits, be specified. The two general types of objectives are maximization and minimization. A maximization objective might involve profits, revenues, efficiency, or rate of return. Conversely, a minimization objective might involve cost, time, distance travelled, or scrap. The objective function is a mathematical expression that can be used to determine the total profit (or cost, etc., depending on the objective) for a given solution. Decision variables represent choices available to the decision maker in terms of amounts of either inputs or outputs. For example, some problems require choosing a combination of inputs to minimize total costs, while others require selecting a combination of outputs to maximize profits or revenues.

The Model-

Simple linear regression analysis was used to test the hypothesis-Coefficients are b1, b2, b3, b4, b5, b6

The Data-

VARIABLE

Attendance in Class

Study hours per day after

Family Income

Type of Study

Hosteler/Day Scholar

College Books Referred

A student profile was developed on the basis of information and data collected through survey to explain student's attitude towards explanatory variables. The first variable "attendance in class" explains student's attitude towards class attendance, which reflects his level of interest in learning. Student's attitude towards time management for studies is reflected through number of hours spent in study after college, is taken as second variable. Third variable of the study is family income that reflects the comforts and facilities available for study. The fourth variable is "Question banks/reference book", that is, how many books a student refers for his studies. The fifth variable is "type of study" which shows whether the student studies in a group or studies individually. The last variable shows the residential status of student, describing whether the student is a Day scholar or a Hosteler

Student's performance in intermediate examination is taken as dependent variable and rest of the variables, which construct student profile, are taken as independent variables.

Table 1 explains expected relation of dependent variables these expected relations are also myths p the results of this study are to acco table explains students performan towards studies based on student's of information and data collected. still carrying his profile as it is.

Positive

environment, hence better result

in their studies

Hostelers are found to be more dedicated

Exogenous	(Inc	lepeno	lent)	V	aria	ble-
-----------	------	--------	-------	---	------	------

ATT= Attendance % age, it represents how many classes student attends in a week and that shows seriousness and attitude towards studies.

SH= Study hours, it represents how many hours a student spends on study after attending the class in college again it shows how much serious the student takes the studies.

FI= family income, it represents the level of affluence of the student, how much facilities, comfort the student can acquire.

BR= Book reference, it represents the quality of knowledge student is gaining, whether he is using a quality book or only a question bank.

TS= Type of Study, it represents the type of study like group or individual in which he study with many suggestion or study individual.

RS= Residential status, it represents the status that whether he is a day scholar or hosteller so that how much beneficial time he is getting.

Endogenous (dependent) variables Y= Student's performance

IV DATA ANALYSIS

Table 2

lso myths pervading in I	ndian society so		Attend	dance CGPA R	elationship	
are to accept or reject th	hese myths. The	Students	CGPA	Attendance (in %)	Study hours	Result
student's profile develo	ped on the basis	Student 1	8.83	78	6	Pass
a collected. It is assumed as it is.	d that student is	Student 2	7.98	69	4	Pass
Tabla 1		Student 3	7.92	71	4	Pass
Expected Relationship		Student 4	7.68	69	4	Pass
EXPECT EXPLANATION		Student 5	7.68	66	3	Pass
ELJ RELATI ONSHIP	-	Student 6	7.66	61	3	Pass
Positive A regular studen studies	t is more serious in	Student 7	7.40	59	2	Pass
Positive It is assumed a facilities to learn	affluence gives more	Student 8	7.38	65	3	Pass
Positive It is assumed that r in good grade/divis	nore study hours results sion/ performance	Student 9	7.29	63	2	Pass
Positive More books referre of the concept	ed results in better grasp	Student 10	7.15	58	3	Pass
Positive Group study result	ts in healthier studying					

Sflougandban - AISECT University Journal Vol.VI/Issue XI March 2017

 80

 75

 70

 65

 60

 8.83

 7.98

 7.92

 7.68

CGPA Graph 1 – Attendance to CGA relationship



Graph 2 - Study hours



Graph 3 Ratio of CGPA Distribution among students

Table 2 Comparison of Expected Results and Results of the Study

VARIABLE	RELATIONSHI P	EXPLANATION	Result
Attendance in Class	Positive	A regular student is more serious in studies	Positive
CGPA	Positive	Student with good CGPA perform more good in next exam.	Positive
Study hours per day after College	Positive	It is assumed that more study hours results in good grade/division/ performance	Positive

V RESULT VALIDATION

(a) CHI Square Solution for Validation of Result

Student	А	В	С	D	Е	Total
Attendance	73.5	70	63.5	62	60.5	329.5
Study hr.	5	4	3	2.5	2.5	17
CGPA	8.38	7.8	7.67	7.39	7.22	38.46
Total	86.88	81.8	74.17	71.89	70.22	384.96

(b) Chi Square (X^2) Calculations

 $(X^2) = (o - e)^2/e$ d.o.f.=(m-1)/n-1) Expected frequency calculated as $E = E = (n + e)^2/e^2$

	-) /-			
Expected fi	requency calc	ulated as E_r	$E_c = (n_r * n_r)$	$_{c})/N$
0	e	(o-e)	$(o - e)^2$	$(o - e)^2/e$
73.5	74.36	-0.86	0.7396	9.946*10 ⁻³
70	70.01	-0.01	0.0001	$1.428*10^{-6}$
63.5	63.48	0.02	0.0004	6.299*10 ⁻⁶
62	61.53	0.47	0.2209	$3.59*10^{-3}$
60.5	60.1	0.4	0.16	2.66*10 ⁻³
5	3.83	1.17	1.3689	0.357
4	3.61	0.39	0.1521	0.0464
3	3.28	-0.28	0.0784	0.0240
2.5	3.17	-0.67	0.4489	0.1416
2.5	3.1	-0.6	0.36	0.1161
8.38	8.68	-0.3	0.09	0.0108
7.8	8.17	-0.37	0.1369	0.0168
7.67	7.41	0.26	0.0676	9.123*10 ⁻³
7.39	7.18	0.21	0.0441	6.14*10 ⁻³
7.22	7.01	0.21	0.0414	$6.29*10^{-3}$
(.	.)2			

$$(X^2) = \frac{(0-e)}{1} = 0750 < TABULATED VALUE$$

Therefore Hypotheses is accepted

(c) Analysis to increase the performance of students

Max. performance $(Z_{max}) = x_1 + x_2 + x_3$

 $x_1 = Attendance, x_2 = Study hours, x_3 = CGPA$

 $x_1 \leq 10$

 $\begin{array}{c} x_2 \leq 10 \\ x_3 \leq 10 \end{array}$

	C_j	1	1	1	0	0	0		
C_B	B.V.	<i>x</i> ₁	<i>x</i> ₂	<i>x</i> ₃	<i>s</i> ₁	<i>S</i> ₂	S3	b	
0	<i>S</i> ₁	(1)	0	0	1	0	0	10	104
0	<i>S</i> ₂	0	1	0	0	1	0	10	C
0	S3	0	0	1	0	0	1	10	(
	Z_i	0	0	0	0	0	0	0	
	$C_i - Z_i$	1	1	1	0	0	0		

	C_j	1	1	1	0	0	0		
C_B	B.V.	<i>x</i> ₁	<i>x</i> ₂	<i>x</i> ₃	<i>s</i> ₁	<i>S</i> ₂	<i>S</i> ₃	b	θ
1	<i>x</i> ₁	1	0	0	1	0	0	10	8
0	<i>s</i> ₂	0	(1)	0	0	1	0	10	10
									\leftarrow
0	<i>S</i> ₃	0	0	1	0	0	1	10	8
	Z_j	1	0	0	0	0	0	10	
	C_i	0	1	1	0	0	0		
	$-Z_i$		Ŷ						
	,								

	C_j	1	1	1	0	0	0		
C_B	B.V.	<i>x</i> ₁	<i>x</i> ₂	<i>x</i> ₃	S_1	<i>S</i> ₂	S_3	b	θ
1	<i>x</i> ₁	1	0	0	1	0	0	10	00
1	<i>x</i> ₂	0	1	0	0	1	0	10	00
0	<i>S</i> ₃	0	0	(1)	0	0	1	10	10
									\leftarrow
	Z_j	1	1	0	0	0	0	20	
	C_i	0	0	1	0	0	0		
	$-Z_j$			↑					

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Anuqandban - AISECT University Journal Vol.VI/Issue XI March 2017

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	C_j	1	1	1	0	0	0	
C_B	B.V.	<i>x</i> ₁	<i>x</i> ₂	<i>x</i> ₃	<i>S</i> ₁	S ₂	<i>S</i> ₃	b
1	<i>x</i> ₁	1	0	0	1	0	0	10
1	<i>x</i> ₂	0	1	0	0	1	0	10
1	<i>x</i> ₃	0	0	(1)	0	0	1	10
	Z_j	1	1	1	0	0	0	30
	$C_j - Z_j$	0	0	0	0	0	0	

Value obtained= $x_1 = x_2 = x_3 = 10$

VI CONCLUSION

The objective of this study was to quantify the relationship between the different factors that are considered responsible for affecting the student performance along with providing base for further research regarding student performance. Selecting these combination of variables do have some objectives like, it was expected that relationship between dependent variable and student attitude towards attendance is positive because regularity shows the effort and seriousness of student about his or her studies. It is believed that the relationship between dependent variable and student family income is positive because money can buy you all comfort that you need to concentrate on your studies but the result could not prove this relation because student belonging to more prosperous/affluent family do not give proper weightage to studies. Although this value is very small but still it reflects the insignificance of affluence that is affluence cannot make a student serious about his studies or if a student want to study then affluence is not a prerequisite. It still requires more research to explain the phenomenon. It is still believed strongly that relationship between dependent variable and student attitude towards time allocation for per day after college are positively related but the result could not prove this relation because more study hours are not significant as far as student performance is concerned. It may depend on intelligence level, intellect, memory or method or learning of the student although this value is very small yet it reflects personal characteristics of student. Further research is required to explore this relation. It is believed that book reference also has great effect on performance of students that if students are referring to books it helps in increase of concepts and deep knowledge about the topic, and if one is studying form question banks then he cannot grasp more knowledge; yes but he can touch every topic with little knowledge. Selecting a type of study i.e. between Group and Individual affects the student performance. It is believed that Group studies have more impact over individual studies. If a student is studying in group he is scoring better marks that him who is studying individually. One more important attribute is Day scholar or Hosteller. It is found that student that are Hosteller perform better than Dav scholar.

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Computational and Cold Flow Analysis on Swirler at Vane Angle 55[°] & 62[°]

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ABSTRACT

This paper brings the computational study on geometric swirler of outlet vane angle of 55° and 62° for aerodynamic flow properties and cold flow analysis to be done. At mass flow rate of 0.3 to 0.4 kg/s and equivalence ratio are 0.6 to 0.7, the cold flow study on CFD (computational fluid dynamics) analysis in swirler is done at 55° and 62° are respectively of outlet vane angle and inlet vane angle are usually zero. Also will have found aerodynamics and geometric flow properties in swirler at 55° and 62° vane angles, the swirler numbers are 1.2 and 1.4 respectively is calculated. So purely CFD analysis of aerodynamics properties of flow in swirler at various vane angle(such as 55° and 62°) is investigated and to be designed improvement of swirler with high efficiency of aerodynamics mixing of air and fuel. To support experimental design with CFD analysis will be the key role to predict the improvement of performance and efficiency of swirler.

Keyword: Swirler, CFD, recirculation zone, Atomization flow properties in swirler .

I INTRODUCTION

Many different types of airflow patterns are employed, so introduce new aerodynamics flow pattern through swirler to improve performance of gas turbine combustor such as tubular (can type) and annular combustor. As per combustor view of gas turbine engine, we have to look after the swirler performance and its design. Looking of swirler design and its performance to do the improvement in its aerodynamic properties of its expected geometry and CFD analysis. So improve design of swirler as improve its performance, required new technique rather than experimental, called CFD analysis of flow in swirler.

To do CFD analysis of swirler, to improve design and its performance, so become strong swirler as aerodynamically. To do CFD analysis of various geometry of different swirler vane (such as e, 55° & 62°) at suitable swirl number. As we know swirl number more than 0.6 is good flow mixing in swirler. In CFD analysis of swirler flow, we have to calculate velocity contour and turbulent contour to improve design as experimentally.

II DESIGN PARAMETER OF SWIRLER

In design parameter include swirler geometry dimension $(55^{\circ} \text{ and } 62^{\circ})$, cfd flow condition , boundary condition and swirler number calculation with various vane angle are done.

(a) Flow condition in swirler

 $\begin{array}{l} T_{inlet}(Tempeture \ at \ inlet) = T_{outlet} \ (Temperature \ at \ outlet) = 300 \ K \\ P_{inlet} \ (Pressure \ at \ inlet) = 1 \ bar \\ P_{outlet}(Pressure \ at \ outlet) = 60 \ K \ Pa \\ \Box \ (Mass \ flow \ rate \ at \ inlet \ or \ oulet) = 0.3 \ kg/s \\ \Box \ (Equivalence \ ratio) = 0.6 \ to \ 0.7 \end{array}$

Fuel= CH_4 (Methane) or White Kerosine ($C_{12}H_{23}$)

(b) Assumptions and Boundary conditions of swirler

Condition	Value
Flow regime	Subsonic
Pressure	1 bar
Temperature	300 K
Flow direction	Normal to boundary
Heat transfer	Adiabatic
Wall condition	No slip
Turbulence Intensity	8%

Table-1 for Inlet Boundary Condition of flow parameter as follows:

table:

T	able-2 for Outlet Boundary	y Con	ndition of	flow	parame	ter as	s follow	in
	Condition		W.					

Condition	Value
Flow regime	Subsonic
Pressure	60 k Pa
Temperature	300 K
Turbulence Intensity	10%

(c) Geometric formation:

$$\begin{split} D(D_{sw})(\text{outer diameter}) &= 38 \text{ mm} \\ d(D_{Hub})(\text{inner diameter}) &= 18 \text{ mm} \\ \text{Thickness of vane} &= 1.5 \text{ mm} \\ \text{Height of vane} &= 8 \text{ mm} \\ \text{Length of vane} &= 20 \text{ mm} \\ \text{Number of vane} &= 8 \\ \text{Vane Angles} (\theta) &= 55^{\circ}, 62^{\circ} \\ \text{L}_{SWIR}(\text{length of swirler}) &= 25 \text{ mm} \\ \text{L}_{DOME} (\text{length of dome}) &= 30 \text{ mm} \\ D_{DOME} (\text{Diameter of dome}) &= 50 \text{ mm} \end{split}$$



Fig. 1:- Cross-sectional view of SWIRLER

(d) Calculations of Swirler Number

$$S = \frac{2}{3} \frac{1 - \left(\frac{D_{HUB}}{D_{SWIR}}\right)^{3}}{1 - \left(\frac{D_{HUB}}{D_{SWIR}}\right)^{2}} \tan\theta$$

Where,

S = swirler number θ = outlet angle of vane D_{HUB} = diameter from center line of swirler D_{SWIR} = diameter of outer of swirler d/D = 0.47

The different vane angle of swirler numbers are as follows:

 $S_{40} = 0.6, S_{50} = 0.9, S_{55} = 1.2, S_{60} = 1.3, S_{62} = 1.4, S_{68} = 1.9$

*Note: - swirl number of 0.6 is a good mixing for swirler. Angle will increase swirl number will increase, it's a sign of good swirler but at 68 degree angle there will be geometrical obstacle.

III MODELING OF GEOMETRY

In geometry modeling , we shall see about geometry analysis of swirler design .As we know Radial swirler are more efficient than Axial swirler due to swirl effect of flow and better aerodynamics properties , there will be good recirculation zone to swirl a flow to excellence performance. Per haves our selection is radial swirler. In radial swirler outlet vane will vary the angle with horizontal line of axis or center line of swirler and inlet vane angle starts with is always zero. Here the geometry of 55° and 62° are outlet vane angle of swirler.



Fig. 2:- Isomeric view of Import geometry in ANSYS at 55°

So similarly rest of the geometry draw and processed for analysis.

IV MESHING THE SWIRLER

In meshing part, as mentioned above and shown geometry such as 55° and 62° are each meshed as unstructured tetrahedral mesh shaped. So figure of meshing sample is shown in Fig 3.



Fig. 3 :- Messing of the SWIRLER geometry

Housandbar - AISECT University Journal Vol.VI/Issue XI March 2017

(a) **Grid details**

The three dimensional flow regions along with swirler with appropriate swirl angle were modeled using software solidwork. Three dimensional unstructured grids was generated using tetrahedral mesh in ANSYS work bench. The grid cells were refined in the critical regions, like swirler inlet and exit, in anticipation of high velocity and

pressure gradient. The solutions were predicted by using

ANSYS CFX 16. The grid detail is mentioned in table 3.

Table3: Meshing details as different swirl angle

Swirler angle	Nodes	Elements
55°	5823	25057
62°	6054	26450

V CFD AND COLD FLOW ANALYSIS FOR VARIOUS CONTOUR

CFD analysis of aerodynamics flow properties in swirler with various vane angle with various contour as follows: at 55° and 62° are respective.



z.º L

Fig 4: Turbulence contour for van angle at 55° & 62° respectively.

As Turbulence contour for various vane angle above pasted. The above pasted contour are CFD analyzed flow analysis in swirler with various aerodynamics aspects like more suitable turbulent zone as well as proper recirculation zone should be created to make proper mixing of air-fuel to improve better performance and efficient. Analysis says that as we go increase vane angle more turbulence zone will created as we know swirler number more than 0.6. Viscosity contour is turbulent analysis in ANSYS software.



Chart-1

VI RESULTS & DISCUSSION

After analysis, will shown detail with performance chart with various vane angle and flow analysis of aerodynamic phenomena in swirler. So in chart-1 as viscosity contour performance for vane angle 55° , says about velocity of flow in recirculation zone, similar and chart-2 for vane angle 62° are plotted to say about performance of swirler and aerodynamics of various vane angle as mentioned.



Chart -2

VII CONCLUSION

As per various outlet vane angle flow analysis says about it aerodynamic flow characteristics includes various turbulence zone, recirculation zone etc. Once vane angle increase flow properties increase as per our above analysis contour or charts says and experimental prediction through complete CFD analysis. CFD analysis is improved design and performance and to make new efficient design that give strong aerodynamics flow properties of swirler.

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Review on Custom and Semicustom Designs for Multibit Arithmetic Logic Units Using CMOS

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ABSTRACT

In this paper authors have presented an extensive review on literature on designing of multibit arithmetic logic units based on custom and semicustom techniques. A brief review is carried out for proposed design and will be done using MOSIS C5 process for VLSI. Arithmetic Logic Unit is a digital circuit that performs arithmetic and logical operations. ALU is a fundamental building block of central processing unit of a computer which is used in the simplest microprocessors for purpose of maintaining timers. Previously, many efficient architecture have been introduced for the design of low complexity operation, but we have given attention to custom designing of ALU, where every sub module is designed simulated and verified then routed accordingly. The proposed design of ALU will performs the mathematical, logical, and shifting operations like Addition, Subtraction, Multiplication, Increment, Decrement, Logical AND, Logical OR, Logical XOR etc. in the computer. In this paper, the efficient modules of ALU will be design using Custom Tools like Electric CAD and simulation results will be verified on same platform using test benches and SPICE simulations.

Index Terms-ALU, CAD for VLSI, Process technology, Custom and Non custom VLSI techniques.

I INTRODUCTION

An ALU that can perform: A AND B, A OR B, A + B (addition), and A - B (subtraction) and all possible arithmetic and Logical operations. In most designs as our reference design a bit arithmetic logic unit as shown in the below figure supports addition, 2's complement subtraction, overflow detection, bitwise invert, bitwise logic AND, bitwise logic OR and bitwise logic XOR operations. The high level circuit diagram of the four-bit ALU is as as shown in figure 1.

As we can see from Figure 1, the diagram can be roughly divided into four sections. They are arithmetic section (blue), overflow section (yellow), logical section (red) and selection section (green). The blue section is a chain of full adders. It is responsible for addition (ADD), subtraction (SUB) and invert (INV) operations. The ADD operation requires Binv set to low, such that it functions like a ripple adder. For SUB operation, it uses 2's compliment and thus, A-B becomes A + (-B). The usage of Binv has two folds



Fig. 1: High level circuit diagram of the four-bit ALU

Firstly, when Binv is high, B will be inverted (through the inverter and MUX) before going into the full adder. Secondly, Binv also serves as the initial carryin for 2's complement. To perform bitwise INV, input A needs to be set to zero and Binv set to high to invert input B. As a result, B first got invert to -B and the operation becomes 0 + (-B) = -B. The yellow section reports if there's any overflow occurs throughout an operation. Overflow happens when adding two positive numbers but the result is negative (the most significant bit is 1). For instance, 0101 + 0011 = 1000, the resulting value 1000 is negative in 2's compliment, so overflow has occurred. We want to set the overflow bit (V) to high when such situation happens. The carry out from last two full adders can be XOR together. The result would be the overflow bit. The red section performs bitwise logical operations, including AND, OR and XOR. Since each gate handles only one bit, in order to handle four-bit inputs, we need to place four gates of the same kind in parallel. The green section is select section, which determines which operation results go to the output. There are two bit select line (SEL0, SEL1) that select different operations.

The ALU proposed will implement the AND, OR, Addition, and Subtraction functions for the 8-bit A and B input buses and the result will be output to the 8-bit bus.



Fig. 2 General block diagram of 8 Bit ALU

II RELATED WORK

The designing of high performance analog and digital integrated circuits is becoming most essential with the continuous trend toward the reduced supply voltage and transistor channel length. MOS is the most success among all because it can be scaled down to smaller dimensions for higher performance. The size can be reduced to micrometer or nanometer for getting higher performance

In [1] Kumbhalkar, Snehal, and Sanjay Tembhurne in their paper entitled, " a novel arithmetic logic unit design for delay & area optimization" proposed the design and implementation of an Arithmetic Logic Unit (ALU) using area optimizing techniques such as Gate Diffusion Input (GDI) and transmission Gate (TG). On the bases of review project they are designing 4bit-ALU by mix designing technique to reduce delay then conventional CMOS 4bit-ALU by using TANNER15.0 EDA tool. This 4bit-ALU will design in 0.18µm technology with 1.8V supply voltage.

They concluded that to reduce power consumption GDI is efficient technique it reduces the number of power supply to ground connections which reduces minimum power consumption and minimum area to implement design. This GDI technique used to design Full adder circuits

The advantage of transmissions gate in some circuit can be explained by the fact that one nMOS and one pMOS transistor is conducting at once for each logic state in transmission gates. So TG can be used for designing the multiplexer circuit in the ALU.

In [2] Vivechana Dubey and Raviohan Sairam "An Arithmetic and Logic Unit optimized for Area and Power" 2014IEEE Forth International Conference On Advance Computing & communication technology. This paper based on 0.25µm CMOS technology is used with 1.8V power supply and simulation is done using TANNER EDA 13.0 simulator using TSMC BSIM. In this 4-bit ALU is design to meet the low power and minimum area. In today's CMOS circuit's dynamic power dissipation is the main factor which causes power dissipation in CMOS circuits. So in this paper number of power supply to ground are reduced in GDI implementation which reduces the dynamic power consumption. Whole representation of ALU is design by GDI technique& various topologies of multiplexers and full adder implementation is studied and compared. The 2x1 mux, 4x1 mux, 1-bit full adder with 10-transistor designed using GDI technique is chosen for lowering power consumption and minimum area. After simulation number of transistor for 4bit ALU with CMOS gate- 592, ALU with transmission gate and 10 transistor full adder-416 & Proposed 4bit-ALU with GDI based full adder-232

Power Consumption:- 4bit-ALU, Number of CMOS gate- 4204.5μ W, ALU with transmission gate and 10 transistor full adder- 1197.5 μ W. Proposed 4bit-ALU with GDI based full adder-1030.5 μ W.

In [3] Arvind Kumar "Comparative Study of 4-Bit ALU using CMOS and BiCMOS for 200nm Technology" In this paper, the design of a high performance 4-bit ALU using CMOS & BiCMOS technologies for high speed applications. These were further compared w.r.t. speed, power dissipation and power delay product. The comparison of CMOS to BiCMOS often seen in the literature shows the delay of single stage circuits driving a capacitive load, with the BiCMOS circuit exhibiting a bold advantage. TANNER EDA tools were used for schematic simulation.

The simulation technology used was MOSIS 200nm. This ALU can be used in mixed signal processing like radar system, image recognition, high speed broadband networks etc. The analog input signal must first be sampled and digitized using an ADC (analog to digital converter). The resulting binary numbers, representing successive sampled values of the input signal, were transferred to the processor. The ALU of the processor carried out numerical calculations with them. These

Calculations typically involve multiplying the input values by constants and adding the products together.

Comparative Study on each operation is performed for 4 bit ALU. Delay, number of transistor and power delay product are also compared to CMOS and BiCMOS.

In [4] paper, the multiplication unit of alu is designed using a process of calculation based on set of 16 sutras i.e. (Vedic Mathematics). Based on this technique the structure of 2bit, 4bit and 8 bit multipliers based on vedic approach redisplayed and is encoded in a VHSIC Hardware Description language (VHDL) and synthesized with the aid of EDA tool, XilinxISE12.2i. Finally, an evaluation of differences is made across the results placed by Vedic design with traditional multipliers.

In [5] the prototype and purpose of the various tasks carried out by a reconfigurable ALU are described. On precision presentation representing the location of decimal point by exponent of radix, addition and subtraction of 32 bit is taken. It can be helpful in parallel processing approach and computation intensive applications. The design is for 32 bit input system can be utilised in multimedia applications. As frequency decreases, the power consumption also decreases without taking IO standard into consideration.

In [6] the synchronous crucial algorithm is utilised, where both the transmitter and receiptant utilise a sole principle of encoding as well as decoding is AES. The declared structure is improved as compared to the Look-up table way, as arena filled by Lookup table technique is much farther along the extent of a Xilinx Spartan 3E series of FPGA. In status of timing approach, a contrast in time with LUT way is surplus, taking its major space habitation. When taking the status of logic gates, this technique occupies 46 XOR gates only. In [7] Area Gated Diffusion Input Technique is a latest option for reduction in power dissipation and propagation hold up. There are three inputs in a GDI cell - G (NMOS and PMOS common gate input), P (PMOS, input to the source/drain) and N (NMOS, input to the source/drain). A major part of both NMOS and PMOS are joined to N and P respectively. The design utilise the idea of GDI (Gated diffusion input) approach in the implementation of ALU and its sub areas as Multiplexers and Full adders. Less dynamic power usage as power supply to ground connections is minimum in GDI design technique.

In [8] the Floating point integers are commonly written as ((1)S)(F)(2E), where F shows a digit in fraction value, where E shows a digit in the exponent value. In widespread, mantissa value is assigned by addition of 1 as MSB. In case where the exponent value is big enough that it cannot be handled by exponent field then an overflow flag becomes high. In the situation where the negative exponent is big enough to fit the exponent field, then an overflow flag is shown. IEEE-754 standard started a new method known as NaN (Not a Number), for the functions that are not valid and are condition when zero is divided with zero, subtraction of infinite number from infinite one. Karatsuba algorithm used progressively for the need in such applications is explained. An impressive multiplication algorithm, which helps in accurate usage of input output pins and with reduced delay should be utilized for proper design of floating point processors. In binary system, floating point integers are defined in two ways namely, single and double precision. These formats are characterized by exponent, mantissa and sign fields. On the basis of device usage and output valuation, Vedic multiplier advanced over Karatsuba multiplier both for single and double precision formats. Even though Booth multiplier adapt minimum resources, it is also low in speed.

In [9] there is a new approach used for energy optimization that is low voltage complementary metal technique.LVCMOS12, oxide semiconductor LVCMOS15, LVCMOS18 and LVCMOS25 are various options of LVCMOS relying on their supply voltage of output driver. The output evaluation shows a energy optimization as using LVCMOS12 and LVCMOS15 instead of LVCMOS 25 is 68.34% and 52.51%. All the values are calculated in Verilog language with behavioral simulation and ISim in Xilinx 13.4 ISE and all code can be synthesized on virtex-6 FPGA. Further it also states that in term of power expenditure LVCMOS is one of the best IO standard and Virtex-6 is the well power planned FPGA.

In [10] The Co-existence of CMOS and SET (Single Electron Transistor) is the latest trend in the era of advanced semiconductor industry. In the paper we are given with the robust execution of ALU (Arithmetic Logic Unit) with the help of hybrid SETCMOS, also utilising hybrid SET-CMOS based logic gates that are reversible in nature. The simulation of results of given both cases are made with an estimate of similarities

and dissimilarities made between them by using various approaches. In this paper ALU design of 4 bit hybrid SET-CMOS based ALU and 4 bit hybrid SET-CMOS Reversible logic gate. It can be concluded that hybrid SET-CMOS based Reversible logic is better in operation in contrast to conventional CMOS design and realizes the target of low power expenditure.

In [11] the paper presents a well planned and operational designing the asynchronous ALU with reduction of delay for the execution of instructions on FPGA. With the help of 4 way handshaking protocol we can decrease the delay and get large pliability and execution of the arithmetical and logical unit. The design methodology utilized is asynchronous. The work proposes the ALU, attempts to reduce the fundamental drawbacks of the synchronous design of ALU, viz. clock skew, power expenditure and detention by utilising the asynchronous ALU but the major limitations is large LUT consumption.

In [12] when computation for large number of bits in ALU is required, there is a need of cascading the adder circuit. These Cascaded adders however lead to Carry Propagation Delay (CPD) thereby affecting the speed of operation. 8 Bit, 16 Bit, 32 Bit and 64 Bit ALU is proposed using modified SQRT CSLA and also implemented ALU using modified SQRT CSLA by CLA. For realizing higher bit ALU using regular/modified SQRT CSLA, cascade methodology can be used. The ALU design and implementation using modified SQRT CSLA shown for low power and area-efficient applications. By introducing CLA in ALU better performance is obtained in terms of speed.

In [13] the one to one correspondence is the actual key required for reversible circuits that should count input and output pins equal. In other words every state of input should be consumed for particular output that is output logic will be shared by only one input logics present. A number of AND gates as well as adder units have been used to design a conventional multiplier, which also produces a remarkable delay. A time worthy approach for the resultant by using reduced count of resources is by using vedic algorithm, thereby effective delay decrement while gradual enhancing the rate of execution of output. The proposed implementation overcome power as well as delay hardcore bring forth by Selective Reversal as well as rapid algorithm of Vedic Method.

In [14] to design the two bit multiplication unit i.e. multipliers are proposed to obtain the result of two nbit binary integers and then execute it on a Nexys 3, Spartan 6 FPGA kit is the principal purpose. Binary multiplication units of 32x32 have been evaluated with traditional multipliers depending on their result obtained at the execution after the final design. A list of evaluation is made based on 32-Bit Vedic mathematics based multiplier unit and a Conventional Binary Multiplier. It has been seen that the number110s required for 32-bit Vedic mathematic based multiplier unit and other binary multipliers are 128 out of 232, therefore out of which the requirement becomes 55% for both of the multipliers.

Sflougaodbao - AISECT University Journal Vol.VI/Issue XI March 2017

Table 1Comparison Table for Review

Author	Paper Topic	Remark
Kumbhalkar, Snehal, and	a novel arithmetic logic unit design for delay	GDI technique for power reduction 0.18µm
Sanjay Tembhurne	& area optimization	Tool TANNER15.0 EDA
Vivechana Dubey and	Arithmetic and Logic Unit optimized for Area	ALU is design by GDI technique& various
RaviohanSairam	and Power	topologies of multiplexers, 0.25µm
		Tool : TANNER EDA 13.0 simulator using
		TSMC BSIM
Arvind Kumar	4-Bit ALU using	4 bit ALU. Delay, number of transistor and
	CMOS and BiCMOS	power delay product are also compared to
		CMOS and BiCMOS, MOSIS 200nm
	A DIA DIA DIA DIA DIA DIA DIA DIA DIA DI	Tool : Tanner EDA
Garima Rawat, Khyati	Multiplication unit of ALU	Vedic design with traditional multipliers.
Rathore, Siddharth Goyal,		1 ool Xilinx ISE
Shefali Kala		
Begum, J. Thameema, S.	Design and Implementation of Reconfigurable	Design is for 32 bit input sytem
Harshavardhan Naidu, N.	ALU for Signal Processing Applications.	1 OOI XIIIIIX ISE
Valshilavi, G. Sakana, and N.		
M Southil James Dr S	"High Efficient Medified MixColumns in	Structure is improved as compared to the Look
Rajialakshmi	Advanced Encryption Standard using Vedic	up table way as arena filled by Lookup table
KajjalaKsilili	multiplier	technique
		Tool Xilinx ISE
Pandey Bishwajeet Ivotsana	Energy efficient design and implementation of	in term of power expenditure LVCMOS is one
Yaday Yatendra Kumar	ALU on 40nm FPGA	of the best IO standard and Virtex-6 is the well
Singh, Ravindra Kumar, and		power planned FPGA
Surabhi Patel		Tool Xilinx ISE
Jana, Biswabandhu, Anindya	Design and performance analysis of reversible	Robust execution of ALU with the help of
Jana, Subhramita Basak,	logic based ALU using hybrid single electron	hybrid SETCMOS.
Jamuna Kanta Sing, and Subir	transistor.	hybrid SET-CMOS based Reversible logic is
Kumar Sarkar.		better in operation in contrast to conventional
		CMOS design and realizes the target of low
		power expenditure.
Bhandari, Nikhil, and	FPGA based High Performance Asynchronous	The work illustrates the ALU, that attempts to
Shubhajit Roy Chowdhury	ALU based on Modified 4 Phase Handshaking	reduce the fundamental drawbacks of the
	Protocol with Tapered Buffers	synchronous design of ALU, viz. clock skew,
		power expenditure and detention by utilising
		the asynchronous ALU but the major
		limitations is large LUT consumption.
Nautiyal, Priyanka, Pitchaiah	"Implementation of an ALU using modified	The ALU design and implementation using
Madduri, and Sonam Negi	carry select adder for low power and area-	modified SQRT CSLA shown for low power
	efficient applications	and area-efficient applications. By introducing
		CLA in ALU better performance is obtained in
TZ	V. 1' Mathematics Dans 1 At Harding	terms of speed.
Kunal adav, Aditya vibute and	Vedic Mathematics Based $AL \cup$ using	The proposed implementation overcome power
Snyam Tyer Novel	application specific reversibility	as well as delay hardcore bring forth by
		Vedic Method

Arvind Kumar in his paper [3] presented a study of 4 bit ALU using CMOS and BiCMOS 200 nm process technology. They presented a custom approach to design ALU which will also be our proposed methodology. The simulation technology used was MOSIS 200nm.The proposed work will include

50nm and 300nm MOSIS models for the design of ALU. This ALU can be used in mixed signal processing system

III PROPOSED METHODOLOGY

Defining the requirements and setting the specifications is an important aspect if any VLSI Design. Design of the proposed 8 bit ALU will be according to the Tool flow (EDA based). The proposed methodology will start with the design of the test circuits like basic gates, for example NOT Gate, NAND gate, NOR gate etc followed by simulating the test results and optimization of transient and DC characteristics for the sub circuits. A pad frame is also proposed that will accommodate all ALU sub circuits and will be approximately 40 - 60 pins. The process

technology used here is c5 process provided by MOSIS.

The technology used in Electric is C5 process, 300 nm and is also used for fabrication is with respect to MOSIS design rules. This process has two layers of polysilicon to make a poly1 -poly2 capacitor, 3 layers of metal, and a hi-res layer to Design of Digital ALU. The system in whole is designed in various steps. Firstly, the basic sub modules of the system are designed. The design procedure of these sub modules involves obtaining the Boolean expression for the operation to be performed. When the Boolean expression is obtained, the CMOS schematic is prepared for the same. The sources and drains are marked for the PMOS and NMOS. The step following the schematic design is the layout design. Layout design is very important part of the pad frame digital design. The design uses Euler's Rule for finding the best arrangement of input gates and obtaining minimum number of interconnects. The design of CMOS combinational circuits starts with the very basic design of NMOS and PMOS. The active regions for the MOS, the MOS itself and the wells are positioned based on the design rules and requirements. The design rule checks need to be applied after every step so that errors, if occur, can be removed. As we make progress in design technology, there is a ongoing debate within the design technology community about the importance of new algorithms and tools or new methodologies and associated tool flows. The simple fact is that history of design for microelectronic systems includes the going of both of them hand in hand to get the maximum benefit and in

act these two aspects of the design technology are tightly coupled and correlated in terms of their impact.



Fig. 3 VLSI CAD/EDA design methodology

VLSI Design incorporates both the design methodologies and associated CAD tools because both forms the integral parts and should go hand in hand as they evolve based on the designer's needs.

IV WORK TILL NOW

Designing an ALU and peripheral circuits with the high reliability and yield as well as this must meet the design and performance requirements. Design of a 8 bit digital ALU will use 300 nm and 50nm process technologies, 2 metal layer process for design. Physical design of digital gates and a 40 pin pad frame is also proposed alongside the overall analysis. A part of the proposed work and pad frame is as shown



Fig. 4 Design padframe till now

V CONCLUSION

Arithmetic Logic Unit is a critical component of a microprocessor or digital entity. An efficient module for design of the ALU has been discussed through various literatures. After thoroughly studying these literatures it has been concluded that the techniques which acquired are quite effective to improve the parameters of designed module of multi-bit ALU. These help in optimizing the system by using efficient techniques. The ALU design using carry

look ahead and reversible logic gate approach increase the speed to a great extent but it results in increased hardware complexity. The proposed methodology will provide a systematic way to derive high speed system at a very less area. We have proposed the physical design model of multibit ALU with efficient design approach using less area, high speed methodology. Also, Author efforts will be directed towards implementation of n bit ALU design with different circuit topology. Housandban - AISECT University Journal Vol.VI/Issue XI March 2017

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Organisation Can Get Competitive Advantage Over Their Competitors through Competency Based Management - A Critical Review

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ABSTRACT

Ability, skills and knowledge required to perform a job is known as competency. It may also include attitude and motive, in the area of technical, managerial administrative, behavioral Conceptual or theoretical activities. Technical Competency relates to Technical knowledge for operation and maintenance purpose. Managerial Competency is related to managerial functions i.e. planning, organizing, directing and controlling Theoretical competency is related to models, concept etc. Competencies enable a person to handle the task effectively and give expected results. This paper analyse as to how Competency Based Management is helpful for any organisation to get competitive advantage over their competitors. The method of data collection is Primary (Questionnaire) & secondary sources and was collected through Management Books, Articles and companies website. Data Analysis has been done through Simple Percentage Method.

Key Words: Competency, Management, Competitors, job

I INTRODUCTION

Competency-based management supports the integration of human resources planning with business planning by allowing organizations to assess the current human resource capacity based on their competencies against the capacity needed to achieve the vision, mission and business goals of the organization. Targeted human resource strategies, plans and programs to address the gaps (e.g., hiring and staffing; learning; career development; succession management; etc.) are then designed, developed and implemented which haps in closing the gaps.

This study tries to highlight the cause and the factor who increase the competency among the employee and if there will be some weakness then suggest how to increase by the managerial planning and to create competent environment through knowledge sharing, training process, and organisation development process and to find out some other key factor which is very essential to creat and carry competency based environment for both employee and employer because in modern era only through competency based management organisation can achieve the goal and survive in a long time period with good image within the all.

II LITERATURE REVIEW

The Term "Competence" was used in different area before being used in management these area include skills ,and knowledge of the person -based management which refers to dynamic, systemic, cognitive, and holistic concepts of competence, organizations, and their competence-based interactions (Sanchez & Heene, 1997). Drawing on this and recent thinking about competences, Sanchez (2002) identifies five aspects or "modes" of competences that are expressed through specific kinds of activities and processes. They are distinctive kinds of organizational flexibility to respond to changing and diverse environmental conditions, such as evolving market demands, technological change and competitive development in an industry. Each of these distinctive kinds of flexibility can in turn be described by the kind of portfolio of strategic options that each flexibility brings to an organization. The five modes of competences are:

- (a) cognitive flexibility to imagine alternative strategic logics;
- (b) cognitive flexibility to imagine alternative management processes;
- (c) coordination flexibility to identify, configure and deploy resources;
- (d) resource flexibility to be used in alternative operations; and
- (c) operating flexibility in applying skills and capabilities to available resources.

III OBJECTIVES OF THE STUDY

- (a) To analyze the employee attitude towards the concept of competency based management
- (b) To find out the employee opinion about their management contribution towards competency
- (c) To find out the employee openion about their management contribution towards competency based management
- (d) To find out whether the employee are satisfied with current working environment
- (e) To suggest the way to improve the competency based management in organisation
- (f) To find out organisation can get competitive advantages over their competitors.

IV RESEARCH METHODOLOGY

Despite the growing popularity in the field of social science, question has been raised over the legitimacy and dependability of the research tool. Generally, research is a continuous process of searching knowledge, one can also define research, as a scientific and systematic search for acquiring relevant information on specific topic, and research methodology is an approach to the entire process of the research study (collis and hussey2003)

This section presents the research model &methodology employed in this study including ,type of research ,research approach and research strategy, forth more ,the target population ,sampling size and sampling method, data collection method and data analysis are also discussed in this section

- (a) Research Design-This research is conducted based on the research philosophy devoted to the research strategy employed and utilizing the research instrument for successful accomplishing the goal.
- (b) Type of research This present study is a descriptive research, because it intends to profile, define and estimate predict and examine associated relationship.

A research strategy contains objectives derived from the research questions, forth more ,it specifies the source ,from which the data collection is intended and also focuses on the possible constraints ,there are several research strategies ,including ,surveys ,case studies, The information for this paper will be analysed using questionnaire survey and research design will be qualitative.

(c) Research Questionnaire- In this method a questionnaire with a list of questions related to the field of enquiry has to be prepared with space for the answer to be filled by the respondents.

The questionnaire will be handed in person or mailed to the respondents with a request for quick response within the specific time as the questionnaire is the only media of communication between the investigator and the respondents ,the questionnaire should be designed or drafted with extreme care and caution ,so that all the significant and indispensable information for the enquiry may be collected without any difficulty and vagueness. The research questionnaire for this study consist of two section the first section focuses on the profile of the respondents and second section focuses on the questions related to the variables of the study. For Interpretation Simple Percentage Method has been used with the help of pie Graph.

V RESULT AND INTERPPETANTIORI

Openion of respondent was analysed on various factors of competencies. The results are depicted in figure 1 to 12 given below:-



Fig. 1 Respondents openion on -Production knowledge of material and tools used

Interpretation:

Production Knowledge of Material and tools used Chart shows that 60% Respondent are agreed and 40% Respondent are not agreed.

The no. of Respondents openion about competency factor of



Fig. 2 Respondent openion on Leadership Skills Required

Interpretation:

Leadership Skills Required

Chart shows that 90% Respondent are agreed and 10% Respondent are not agreed. The no. of Respondents openion about competency factor of



Fig. 3 Cooperation between Employee & Employer

Interpretation:

Cooperation between Employee & Employer

Chart shows that 80% Respondent are agreed and 20% Respondent are not agreed.

The no. of Respondents openion about competency factor of



Fig. 4. Level of Attitude to learn new things in short time

Interpretation:

Level of Attitude to learn new things in short time. Chart shows that 95% Respondent are agreed and 5% Respondent are not agreed. The no. of Respondents openion about competency factor of



Fig. 5. Team Sprit Skills

Interpretation:

Team Sprit Required

Chart shows that 70% Respondent are agreed and 30% Respondent are not agreed. The no. of Respondents openion about competency factor of



Fig. 6. Time Management Skills

Interpretation:

Time Management Skills:

Chart shows that 85% Respondent are agreed and 15% Respondent are not agreed. The no. of Respondents openion about competency factor of



Fig. 7. Information about job description

Interpretation:

Information about job description:

Chart shows that 95% Respondent are agreed and 5% Respondent are not agreed $% \mathcal{A}$.

The no. of Respondents openion about competency factor of



Interpretation:

Communication Skills

Chart shows that 95% Respondent are agreed and 5% Respondent are not agreed. The no. of Respondents openion about competency factor of



Fig.9. Decision Making Skills

Interpretation:

Decision Making Skills:

Chart shows that 65% Respondent are agreed and 35% Respondent are not agreed. The no. of Respondents openion about competency factor of



Chart shows that 80% Respondent are agreed and 20% Respondent are not agreed.

The no. of Respondents openion about competency factor of



Fig. 12 Risk Taking Capabilities

Interpretation:

Risk Taking Capability: Chart shows that 90% Respondent are agreed and 10% Respondent are not agreed.

VI FINDING

By the help of Research work it has been found that Every employee in this recent trend, is keen interested to gain Knowledge ,to achieve new hight in career, ready to take more risk ,ready to change attitude ,willingness for learning new things and always ready to do hard work and accept the new challenges. Also found that in recent trends every employer is very well aware about competency based management and its competitive advantage.

VII CONCLUSION

While competencies are not new to most organizations, what is new is their increased application across varied human resource functions (i.e., recruitment/selection; learning and development, performance management, career development and succession planning, human resource planning). Organizations are looking for new ways to acquire, manage and retain the precious talent needed to achieve their business goals.

And it has been also observed by the research work that Organisation can get competitive advantage over their competitors through Competency based Management over their competitor.

VIII SUGGESTION

For employer it should be awareness about properly designed, competencies translate the strategic vision and goals for the organization into behaviors or actions employees must display for the organization to be successful.

Also there is an urgent need to identify the more influencing factor continuously for competency based management for growth of organisation as well employee.

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Edge Detection Techniques- A Critical Study

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ABSTRACT

Edge detection is method of image processing. Edges define the boundaries and helpful to segment the object, registration, feature extraction and identification of objects in a scene and reduces the amount of data and filters out useless information so that edge detection is significant field in image processing. In this paper different method for edge detection are discuss. Edge detection methods for edge detection are Canny's method, Laplacian of Gaussian (LOG), prewitt, Robert, Sobel. The advantages and disadvantages are also studied in this paper. Application area of edge detection is very wide i.e. from astronomy to photography, medicine to war etc.

Keywords- Edge Detection, Canny, LOG, Prewitt, Robert, Sobel.

I INTRODUCTION

Edge detection methods aim to identifying points in a image at which the image intensity changes sharply or more properly, has discontinuities. The points at which image intensity changes sharply are typically planned into a set of curved line segments termed edges. The similar problem of finding discontinuities in 1D signal is recognized as step recognition and the problem of finding signal discontinuities over time is known as change detection^[5]. Edge detection is a primary tool in image processing, machine vision and computer vision, mainly in the areas of feature detection and feature extraction.

Gradient based Edge Detection- The gradient method finds the edges by searching for the maximum and minimum in the first derivative of the image. Laplacian based Edge Detection- The laplasian method looks for for zero crossings in the second derivative of the image to find edges^[5]. An edge has the one-dimensional shape of a ramp and calculating the derivative of the image can highlight its location.

II CANNY'S DETECTION

The traditional Canny edge detection method is broadly used in gray image processing. Although, this traditional algorithm is not capable to deal with color images and the parameters in the algorithm are difficult to be determined adaptively. It was developed by John F. Canny in 1986. Canny also produced a computational theory of edge detection. Canny's aim was to discover the optimal edge and Canny have following criteria during edge detection process.

- (a) Good detection- It means algorithm should mark maximum edges in the image.
- (b) Good Localisation- It means algorithm should be mark as close as possible edge in the real image.

(c) Minimal Response- A given edge in the image only be marked once.

Canny algorithm is a step-by-step process and the steps are shown in figure. 1. In this methods Gaussian filter is applied on original test image to minimize the noise effect. Noise is unwanted information which is associated with test [$^{5,6]}$



Fig. 1 Steps of Canny Algorithm

image during its transmission or others reasons. It degraded the quality of image and produce false edge of image. At second stage calculated the gradient values for finding the maximum value of pixel. After this level thresholding is used to mark the edge in image. Select the particular threshold value and compare others pixel's intensity value with respect to threshold value^[11]. If the pixel value is higher than selected threshold value, than it is called edge of image otherwise that point is not consider as edge. After marking all edge point by comparing with threshold point finally get the edge of test image.

III NOISE REDUCTION

In digital image, pixel is the smallest element of any image or picture represented on the screen. These images have been passed across the Gaussian filter. Because this detector is more susceptible to noise present in original image data, it uses a filter based on a Gaussian, where the unprocessed image is processed with a gaussian filter^[9]. Gaussian fitter is a filter whose impulse response is a Gaussian function. Gaussian filters have the properties of having no overshoot to a step function input while minimizing the rise and fall time.

(a) Finding the intensity gradient

An edge in an image may point in a range of directions, so the Canny algorithm uses four filters to detect horizontal, vertical and diagonal edges in the blurred image. The edge detection operator (Roberts, Prewitt, Sobel for example) returns a value for the first derivative in the horizontal direction (H) and the vertical direction (V). From this the edge gradient and direction can be determined:

$$G = \sqrt{(H^2 + V^2)}$$

 $\theta = a \tan 2(V, H)$

Where atan2 is arctangent function with two arguments. The edge direction angle is rounded to one of four angles representing vertical, horizontal and the two diagonals^[5].

Given estimates of the image gradients, a search is then carried out to determine if the gradient magnitude assumes a local maximum in the gradient direction. From this stage referred to as non-maximum suppression, a set of edge points, in the form of a binary image, is obtained. These are sometimes referred to as "thin edges".

(b) Tracing edges through the image and hysteresis thresholding

High intense and low intense gradient both have equal importance in edge detection. It is in most cases impossible to specify a threshold at which a given intensity gradient switches from corresponding to an edge into not doing so. Therefore Canny uses thresholding with hysteresis.

Thresholding with hysteresis requires two thresholds – high and low. Making the assumption that important edges should be along continuous curves in the image allows us to follow a faint section of a given line and to discard a few noisy pixels that do not constitute a line but have produced large gradients. Therefore we begin by applying a high threshold. This marks out the edges we can be fairly sure are genuine. Starting from these, using the directional information derived earlier, edges can be traced through the image. While tracing an edge, we apply the lower threshold, allowing us to trace faint sections of edges as long as we find a starting point. Once this process is complete we have a binary image where each pixel is marked as either an edge pixel or a non-edge pixel^[5]. From complementary output from the edge tracing step, the binary edge map obtained in this way can also be treated as a set of edge curves, which after further processing can be represented as polygons in the image domain.

(c) Differential geometric formulation of the Canny edge detector

A more refined approach to obtain edges with subpixel accuracy is by using the approach of differential edge detection, where the requirement of non-maximum suppression is formulated in terms of second- and third-order derivatives computed from a scale space representation^[6]. The Canny algorithm contains a number of adjustable parameters, which can affect the computation time and effectiveness of the algorithm.

IV LAPLACIAN OF GAUSIAN

The laplacian is a two- dimensional isotropic measure of the second special derivative of an image. The laplacian of an image highlights regions of rapid intensity change and is therefore often used for edge detection. The laplacian is often applied to an image that has first been smoothed with something appxoximating a Gaussian smoothing filter in order to reduce its sencitivity to noise, and hence the two variants will be described together here. Since the input image is represented as a set of discrete pixels, we have to find a discrete convolution kernel that can approximate the second derivatives in the definition of the laplacian. Two commonly used small kernels are-

0	-1	0	
-1	4	-1	
0	-1	0	
-1	-1	-1	
-1	8	-1	
-1	-1	-1	

Using one of these kernels, the laplacian can calculated using standard convolution methods.

V PREWITT METHOD

The Prewitt operator is used in image processing, particularly within edge detection algorithms. Technically, it is a discrete differentiation operator, computing an approximation of the gradient of the image intensity function^[7]. At each point in the image, the result of the Prewitt operator is either the corresponding gradient vector or the norm of

this vector. The Prewitt operator is based on convolving the image with a small, separable, and^[5] integer valued filter in horizontal and vertical direction and is therefore relatively inexpensive in terms of computations. On the other hand, the gradient approximation which it produces is relatively crude, in particular for high frequency variations in the image. The Prewitt operator was developed by Judith M. S. Prewitt.

(a) Simplified description-In simple terms, the operator calculates the gradient of the image intensity at each point, giving the direction of the largest possible increase from light to dark and the rate of change in that direction^[2]. The result therefore shows how "abruptly" or "smoothly" the image changes at that point, and therefore how likely it is that part of the image represents an edge, as well as how that edge is likely to be oriented. In practice, the magnitude (likelihood of an edge) calculation is more reliable and easier to interpret than the direction calculation.

Mathematically, the gradient of a two-variable function (here the image intensity function) is at each image point a 2D vector with the components given by the derivatives in the horizontal and vertical directions. At each image point, the gradient vector points in the direction of largest possible intensity increase, and the length of the gradient vector corresponds to the rate of change in that direction. This implies that the result of the Prewitt operator at an image point which is in a region of constant image intensity is a zero vector and at a point on an edge is a vector which points across the edge, from darker to brighter values.

(b) Formulation-Mathematically, the operator uses two 3×3 kernels which are convolved with the original image to calculate approximations of the derivatives - one for horizontal changes, and one for vertical. If we define I as the source image, and H and V are two images which at each point contain the horizontal and vertical derivative approximations, the latter are computed as:

$$H = \begin{bmatrix} -1 & 0 & +1 \\ -1 & 0 & +1 \\ -1 & 0 & +1 \end{bmatrix} * I \qquad V = \begin{bmatrix} +1 & +1 & +1 \\ 0 & 0 & 0 \\ -1 & -1 & -1 \end{bmatrix} * I$$

where * here denotes the 2-dimensional convolution operation. Since the Prewitt kernels can be decomposed as the products of an averaging and a differentiation kernel^[3], they compute the gradient with smoothing. For example, H can be written as

$$\begin{bmatrix} -1 & 0 & +1 \\ -1 & 0 & +1 \\ -1 & 0 & +1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} \begin{bmatrix} -1 & 0 & +1 \end{bmatrix}$$

The *x*-coordinate is defined here as increasing in the "right"-direction, and the *y*-coordinate is defined as increasing in the "down"-direction. At each point in the image, the resulting gradient approximations can be combined to give the gradient magnitude, using:

$$G = \sqrt{(H^2 + V^2)}$$

Using this information, we can also calculate the gradient's direction:

 $\Theta = atan2(V,H)$

where, for example, Θ is 0 for a vertical edge which is darker on the right side.

VI ROBERT METHOD

The Roberts cross operator is used in image processing and computer vision for edge detection. It was one of the first edge detectors and was initially proposed by Lawrence Roberts in 1963. As a differential operator, the idea behind the Roberts cross operator is to approximate the gradient of an image through discrete differentiation which is achieved by computing the sum of the squares of the differences between diagonally adjacent pixels. Motivation-According to Roberts, an edge detector should have the following properties: the produced edges should be well-defined, the background should contribute as little noise as possible, and the intensity of edges should correspond as close as possible to what a human would perceive. With these criteria in mind and based on then prevailing psychophysical theory Roberts proposed the following equations:

$$Y_{i,j} = \sqrt{X_{i,j}}$$

 $Z_{i,j} = \sqrt{\left[(Y_{i,j} - Y_{i+1,j+1})^2 + (Y_{i+1,j} - Y_{i,j+1})^2 \right]}$ where x is the initial intensity value in the image, z is the computed derivative and i,j represent the location in the image.

The results of this operation will highlight changes in intensity in a diagonal direction. One of the most appealing aspects of this operation is its simplicity; the kernel is small and contains only integers^[11]. However with the speed of computers today this advantage is negligible and the Roberts cross suffers greatly from sensitivity to noise.

Formulation-In order to perform edge detection with the Roberts operator we first convolve the original image, with the following two kernels:

$$\begin{bmatrix} +1 & 0 \\ 0 & -1 \end{bmatrix} \quad \text{and} \quad \begin{bmatrix} 0 & +1 \\ -1 & 0 \end{bmatrix}$$

Let G(x,y) be a point in the original image and H(x,y) be a point in an image formed by convolving with the first kernel and V(x,y) be a point in an image formed by convolving with the second kernel. The gradient can be defined as-

$$G = \sqrt{(H^2 + V^2)}$$

Gradient direction – $\Theta = atan2(V,H)$

VII SOBEL METHOD

This operator is used in image processing, particularly within edge detection algorithms. Technically, it is a discrete differentiation operator, it computing an approximation of the gradient of the image intensity function. At each point in the image, the result of the Sobel operator is either the corresponding gradient vector or the norm of this vector. The Sobel operator is based on convolving the image with a small, separable, and integer valued filter in horizontal and vertical direction and is therefore relatively inexpensive in terms of computations^[6]. On the other hand, the gradient approximation that it produces is relatively crude, in particular for high frequency variations in the image. The operator uses two 3×3 kernels which are convolved with the original image to calculate approximations of the derivatives - one for horizontal changes, and one for vertical. If we define I as the source image, and H and V are two images which at each point contain the horizontal and vertical derivative approximations, the computations are as follows:

[-1	0	-1]		[+1	+2	+1]	
H= +2	0	-2 * I	V =	0	0	0	* I
l+1	0	-1		l_{-1}	-2	-1	

where *here denotes the 2-dimensional convolution operation.

Since the Sobel kernels can be decomposed as the products of an averaging and a differentiation kernel, they compute the gradient with smoothing. For example, H can be written as

$$\begin{bmatrix} +1 & 0 & -1 \\ +2 & 0 & -2 \\ +1 & 0 & -1 \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix} \begin{bmatrix} +1 & 0 & -1 \end{bmatrix}$$

The *x*-coordinate is defined here as increasing in the "right"-direction, and the *y*-coordinate is defined as increasing in the "down"-direction. At each point in the image, the resulting gradient approximations can be combined to give the gradient magnitude, using:

$$G = \sqrt{(H^2 + V^2)}$$

Using this information, we can also calculate the gradient's direction: $\Theta(x,y) = atan2(H,V)$ where, for example, Θ is 0 for a vertical edge which is darker on the right side.

VIII COMPARISON

In this paper, grayscale or a binary image takes as its input test image and returns a binary image BW of the same size as I (input image), with 1's where the function finds edges in I and 0's elsewhere. Sobel filter Robert filter and Prewitt filter returns edges at those points where the gradient of I (input image) is maximum. The canny method uses two thresholds to detect strong and weak edges and includes the weak edges in the output only if they are connected to strong edges. This method is therefore less likely than the others to be fooled by noise and more likely to detect true weak edges. The output image of proposed work is shows that canny methods gives better results as compare to mentioned methods.





Fig. 1 Original image and output images of different operators

IX CONCLUSION

This paper provides diminutive outline of basic building blocks of edge detection methods. Edge detection methods improve the test image by eliminated the noise and enhance the quality of image and extract information of interest. It is necessary to examine merits and demerits of each edge detection filters at different situation so as to use best option according to situation or condition. Edge detection techniques such as Gradient-based and Laplacian based have been studied. Gradientbased algorithms have major drawbacks in sensitive to noise. The dimension of the kernel filter and its coefficients are static and it cannot be adapted to a given image. A novel edge-detection algorithm is essential to give an errorless solution that is adaptable to the different noise levels in images to help identifying the valid image contents. The performance of the Canny algorithm relies mainly on the changing parameters which are standard deviation for the Gaussian filter, and its threshold values. The size of the Gaussian filter is controlled by the greater value and the larger size. The larger size produces more noise, which is necessary for noisy images, as well as detecting larger edges. We have lesser accuracy of the localization of the edge then the larger scale of the Gaussian. For the smaller values we need a new algorithm to adjust these parameters. The user can modify the algorithm by changing these parameters to suit the different environments. Canny's edge detection algorithm is more costly in comparison to Sobel, Prewitt and Robert's operator. Even though, the Canny's edge detection algorithm has a better performance. The evaluation of the images shows

that under the noisy conditions, Canny, LoG, Sobel, Prewitt, Roberts's exhibit better performance, respectively. When comparing Gradient and Laplacian transformation methodologies it seems that although Laplacian does the better for some features (i.e. the fins), it still suffers from mis-mapping some of the lines.

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Innovative Multipurpose Solar Air Heater Design

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ABSTRACT

The suitable design is the most important key to a cost-effective solar air heater. Although, there are many techniques that have been proposed to improve the solar air heaters performance by means of different turbulence promoters, there is need for a cost effective and efficient heater. The aim of this study is to find simple and tolerable solution to get rid of the inconvenience resulting from the widely adopted heat transfer enhancement techniques by providing an optimized solar air heater design. Proposed design has been quite and efficient with potential for multiple applications. This project consists of new design that will fulfil the necessary energy requirements.

I OBJECTIVE OF PROJECT

(a) The aim of this project is to design and install a more enhanced form of solar air heater. The efficiency of proposed experimental setup is expected to much higher as compare to conventional ones. Many researchers have been investigated on different setup.

(b) Design a heater system for multiple applications for agriculture, hospital, mining and military application.



Fig. 1 (a) Conventional System

The collector is to be mounted on the south oriented face at ground surface in a way to work constantly.

The collector will perform through natural convection. Various characteristic have been studied theoretically, using and original computer algorithm. Performance results evaluated and investigated with the relationship of the constructional factor and their influence on the overall collector efficiency has been quite good.

The Conventional set up shown at fig. 1 (a) is modified with heater design as heater design as shown in fig 1 (b) to reduce losses. Various heat losses like conduction and convection have been reduced a very large extent.

The performance has been evaluated in terms of thermal and effective efficiency for various mass flow rates. The overall efficiency of proposed solar air heater is considerably higher in comparison with the efficiency range of the conventional smooth flat plate heaters.

The proposed design consist triangular duct type solar air heaters. The absorber plate one will locate at horizontal position and another two absorber plate will be located at such a place where it gets tilted with certain angle.



Fig 1 (b) Proposed Collector for better efficiency

III LIST OF MATERIALS FOR EXPERIMENTAL SET UP

The proposed design required items listed at Table 1. The construction was possible in the workshop of the university

S.No	Name of equipment	Specification	Quantity	Tentative Price
1	Centrifugal Compressor	-	1 Nos.	30000
2	Digial manometer	-	1 Nos.	150000
3	Digital DC microvolt meter	-	1 Nos.	2000
4	Heater	1500 W	3 Nos.	30000
5	Selector Switch	-	1 Nos.	5000
6	GI Sheet	-	40 Nos.	12000
7	Wood for Structure	100 feet	-	20000
8	Thermocouples	-	100 Nos.	1000
9	Mercury	500 gm	3 pack	3000
10	GI Pipes	5 cm dia.	5 m	1000
11	Glass Sheet	216mm x 1500mm	3 Nos.	1500
12	Flexible Pipes	5 m	1 Nos.	200
13	Insulator	8" x 4"	2 Nos.	2000
14	Aluminium Sheet	8 " x 4"	2 Nos.	4000
15	MS Pipes	20 m	-	5000
16	Rotameter	-	1	10000
17	Labour Cost	-	-	50000
18	10 A Single phase variable auto transformer	10 mA-2A/50 mA- 5 A/0.1-10 A	-	4000
19	Volt meter & Ammeter	-	-	1000
20	Contingency	Nil	Nil	50000
TOTAL AMOUNT			3,81,700	

 Table 1

 Items used in the configuration

IV APPLICATIONS

- (a) Crop drying: grains, fruits, vegetables, meat.
- (b) Drying minerals, coal, paper, bricks. Especially the drying of brown coal would be very important for power plant.
- (c) Commercial and Industrial uses like Warehouse, Factories and Distribution.
- (d) In Hospital, Recreation centre, Apartments and Schools.

- (e) Sewage treatment plant, Courthouses and Vehicle maintenance garages.
- (f) In Military like Aircraft hangers and Vehicle garages.
- (g) Animal shelter and Poultry coups.
- (h) Space heating
- (i) Heat exchanger
- (j) Air pre-heater or combustion chamber.

Grand Health Insurance- for Sustainable Health Security, Improving Health and Life Expectancy- for People of India.

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Disease is but deficiency or excess of three life forces defined in learned texts as air, fire and water.

The body requires no medicine if you eat Only after the food you have already eaten is digested.

Tiruvalluvar The great Tamil Bard Philosopher

I INTRODUCTION

(a) What is Health

A traditional definition says that Health is a state of **complete** physical, mental and social **well-being**, and not merely an absence of disease or infirmity[1].

A good complexion, a clean skin, bright eyes, lustrous hair with a body well clothed with firm flesh, not too fat, a sweet breath, a good appetite, sound sleep, regular activity of bowels and bladder and smooth, easy, co-ordinated movements. All the organs of the body are of unexceptional size and function normally; all the special senses are intact; the resting pulse rate, blood pressure and exercise tolerance are all within the range of "normality" for the individual's age and sex. In the young and growing individual there is a steady gain in weight and in the mature this weight remains more or less constant at a point about 5 Ibs. more or less than the individual's weight at the age of 25 [1].

The WHO definition of health mentioned above is idealistic rather than realistic. Ideal health will always remain a mirage. Health in this context is to be considered a potentiality — to be promoted, to be supported, for the maximum good of the maximum number. In working for positive health, the role of health experts or doctors is the same as that of a gardener faced with insects, moulds and weeds. Their work is never done [1].

Richard Smith former Editor and Chief of BMJ, in his article pursuing health & fleeing disease, says that doctors are interested in disease and not health and medical text books are massive catalogue of diseases [2].

Thinking in terms of disease has become counterproductive. "The time has come", to abandon disease as the focus of medical care. The changed spectrum of health, the complex interplay of biological and non-biological factors, the aging population, and the inter individual variability in health priorities render medical care that is centered on the diagnosis and treatment of individual diseases at best out of date and at worst harmful. A primary focus on disease may inadvertently lead to under treatment, over treatment, or mistreatment [3].

(b) Health for All and Primary Health Care

In 1977 the 30th World Health Assembly resolved that the main social target in coming decades for Governments, as for the WHO, should be 'the attainment by all citizens of the world by the year 2000 A.D. of a level of health that will permit them to lead a socially and economically productive life'. This goal got coined into a slogan, Health for All by the Year 2000 A.D. Health for all meant that every individual should have access to Primary Health Care [4].

The Alma-Ata Conference held in 1978strongly reaffirms that health, is a fundamental human right and that the attainment of the highest possible level of health is a most important world-wide social goal whose realization requires the action of many other social and economic sectors in addition to the health sector [4,5].

Health For All means that health is to be brought within reach of everyone in the world. And by "health" is meant a personal state of well being, not just the availability of health services – a state of health that enables a person to lead a socially and economically productive life. Health For All implies the removal of the obstacles to health – that is to say, the elimination of malnutrition, ignorance, contaminated drinking water and unhygienic housing[4,5].

Health For All depends on continued progress in medical care and public health. The health services must be accessible to all through primary health care. Medical care alone cannot bring health to in hovels. Health for such people requires a whole new way of life and fresh opportunities to provide themselves with a higher standard of living [6].
The adoption of Health For All by government, implies a commitment to promote the advancement of all citizens on a broad front of development and a resolution to encourage the individual citizen to achieve a higher quality of life[6].

PHC did not achieve Health For All by the Year 2000 or till date!. A considerable part of world's resources, is now spent on armaments and military conflicts. Hence providing sustainable healthcare took the rear seat [7].

II HEALTH PLAN ANDINVESTING IN HEALTH

Food and shelter are both basic human needs, even more critical to survival than health care. Why should health care be any different, then? Sure, health care costs are exorbitantly high, but, once the existing schism between pay or and patient is eliminated, costs will decrease necessarily. In fact, the exorbitant costs are, in part, the direct result of our historical attempts at treating health care differently [8]

Meanwhile as affluent countries got together to form world organizations like the WHO, the medical and pharma lobbies in the USA saw big opportunities in converting Healthcare into Medical(Disease)care and struck upon quick fixes and short-term goals based upon surrogate markers like Blood sugar, HBAIc, Cholesterol/Lipid profile, ideal (desirable)-height/weight(to whom), Blood pressure etc. With advances in Biotech and instrumentation plus improvements of skills in cardiovascular surgery and anesthesiology care came the era of ubiquitous 'CABBAGE' (CABG) and a plethora of secondary and primary coronary artery stentings! Add to this scenario, the drug developments bringing in STATINS as the universal pancake, 'glitazones' as the ultimate answer to euglycaemia (in turn the ultimate goal for diabetes control & complications) all these developments resulted not in improvement in Health-indices but in mortality rates due to ADRs and interventions [9].

Exponential increase in Corporate style Medicare Hospitals, Master Health check-ups, and Health Insurance plans raking in huge profits at the expense of the rich, corporates, and governments; set in motion new promotional forces, and targets which were solely economy-oriented and hardly health oriented; and the plot of Health Care for all became a pipe dream!! [9]

III NATIONAL HEALTH SERVICE (NHS)

(a) NHS in Lik

It was born out of a long-held ideal that good healthcare should be available to all, regardless of wealth .The NHS officially came into being in July 1948, in the wake of World War II, to replace an inadequate system of volunteer hospitals that had, during the war, come to rely on government funding [10].

Each of the four countries of the United Kingdom has a publicly funded health care system referred to as the **National Health Service** (**NHS**). The terms "National Health Service" or "NHS" are also used to refer to the four systems collectively. All of the services were founded in 1948, based on legislation passed in 1946, 1947 and 1948, by the Labour Government that had been elected in 1945 with a manifesto commitment to implement the Beveridge Report recommendation to create "comprehensive health and rehabilitation services for prevention and cure of disease"[11].

The NHS is a rare example of truly socialized medicine. Health care is provided by a single payer — the British government — and is funded by the taxpayer. All appointments and treatments are free to the patient (though paid for through taxes), as are almost all prescription drugs[12].

The NHS was nothing but a "politically controlled state monopoly that is inefficient, outdated, and unsustainable," It sentences thousands of critically ill people to death by putting them on waiting-lists a year or more long, or by denying them life-saving drugs made in Britain and exported elsewhere. Britain has the most nationalised health service in the developed world and suffers the consequence of having the worst health service in the developed world, in never-ending crisis, causing unnecessary misery and premature death [13].

(b) The US Plan

National health care spending is climbing by more than 7 % per year,outpacing economic growth by a substantial margin [14]. As health care costs have climbed,so has the number of people without health insurance in the United States, even during a period of overall economic growth [14]. In 2004, according to U.S. Census data, nearly 46 million people of all ages were uninsured, an increase of 6 million over 2000[14].

Two of five (41%) working-age Americans with incomes between \$20,000 and \$40,000 a year were uninsured for at least part of the past year—a dramatic and rapid increase from 2001 when just over one-quarter (28%) of those with moderate incomes were uninsured . Adults with incomes

under \$20,000 were still the most likely to be uninsured: more than half (53%) had spent time

uninsured in the past year [14].

IV ENVISAGEDSUSTAINABLE GRANDHEALTH ENSURANCE PLAN

This has three functioning modules successfully incorporated in it.



Fig 1 Nano Health Insurance Concept

(a) VHS Chennai

Dr. K.S. Sanjivi was a pioneer in promoting the concepts of community health care and holistic approach to medicine much before they became popular [15].

In 1958 Krishnaswami Srinivas Sanjivi (1903– 1994) was an Indian medical doctor, gandhian, social worker and brilliant physician founded the Voluntary Health Services in Chennai, a medical facility serving the lower and middle-class people of the society, by building up a great institution from nothing more than a dream. Its basic concept was prevention and cure of diseases and an incomebased insurance scheme for the entire family. The institution has grown over the years to become a tertiary care 405 bedded referral hospital [16].

The Voluntary Health Services Model (Chennai, India) which grades its beneficiaries into 4 economic groups and has a premium of a small 0.5% of the annual income of its beneficiaries [16].

This model projects PREVENTIVE, PROMOTIVE as well as CURATIVE aspects of Healthcare and has as its goal, the lessening of the tertiary care burden. It also has a national plan for outreach primary care centres with a central facility to train the personnel (Handpicked from the locality, where the PHC is situated) and mould them into multipurpose community health workers on the lines of what was much later labelled as ANGANWADI HEALTH WORKERS [17,18,19].

The USAID had recognized Voluntary Health Services as the nodal centre in India for spreading its AIDS awareness programme throughout south India for its AIDS prevention programme and entrusted several million \$ for this purpose; which was successfully achieved. This has been followed by the *Bill* Gates foundation which is presently routing a very large donation for helping to treat HIV/AIDS victims as well as for preventive efforts, in this vitally important Public Health problem [20].

(b) Kaiser Permanente – California (USA)

KP is an integrated managed care consortium, based in Oakland, California, United States, founded in 1945 by industrialist Henry J. Kaiser and physician Sidney Garfield. KP is a pre-paid integrated system consisting of three distinctly separate, but related entities: a health plan that bears insurance risk, medical groups of physicians, and a hospital system. The financial incentive is to provide high quality, affordable care and manage population health rather than generating high volume of compensable services. Both the health plan and the medical group are aligned and accountable for a global budget, and only contract directly with one another for the provision of medical services. All three entities share in the goal, reflected in the organization's capitated payment system, of keeping patients healthy while optimizing utilization. This alignment is crucial in KP's effort to maintain affordability for their purchasers and members [21].

KP's quality of care has been highly rated and attributed to a strong emphasis on preventive care, its doctors being salaried rather than paid per service, and an attempt to minimize the time patients spend in high-cost hospitals by carefully planning their stay [21].

KP Model has been studied and admired way back in 2002 by The British Medical Journal who compared it with the National Health Service model of the UK and stated that the Kaiser Permanente model was superior to the National Health Service primarily because of the increased use of the Information technology by the former and it's online personal Health Records that can be accessed by its doctors and nurses in emergencies and other situations, so that the quality of treatment improved considerably because of the background information available at the click of the mouse [22].

This aspect of instant availability of personal Health Records drastically reduces the dangers of Adverse Drug Reactions (ADR) and medical errors which together accounted for more than 200,000 documented deaths in 2007[9]. Thus it can be seen clearly that the success of real health care provider-model should lie in an IT based model that has a comprehensive and validated Online Interactive Electronic Patient Health Record System[9].

(c) The Grameen Model

The Grameen Bank is a Nobel Peace Prize-winning microfinance organization and community development bank founded in Bangladesh in 1976 by Professor Muhammad Yunus at University of Chittagong. It makes small loans (known as microcredit or "grameen credit") to the impoverished without requiring collateral. The name Grameen is derived from the word gram which means "rural" or "village" in the Bengali Language [23].

Grameen Bank is founded on the principle that loans are better than charity to interrupt poverty: they offer people the opportunity to take initiatives in business or agriculture, which provide earnings and enable them to pay off the debt. The bank is founded on the belief that people have endless potential, and unleashing their creativity and initiative helps them end poverty [23,24].

Muhammad Yunus shows the outlook behind why Grameen Bank runs the way it does, saying, " When you hold the world in your palm and inspect it only from a birds eye view, you tend to become arrogant, you do not realize things become blurred when viewed from an enormous distance. I opted instead for the" worms eye view." … The poor taught me an entirely new economics. I learned about the problems they face from their own perspective [23,24].

V HEALTH INSURANCE VS HEALTH ASSURANCE

- (a) Health Insurance is basically profit motivated economic activity (any insurance) [25]. This cannot serve in a universal use in a large population like India with highly varying economic capability.
- (b) Health assurance which is being spoken often by politicians and many non-governmental philanthropic foundations is again by and large rhetoric where the end result is neither audited or evaluated honestly [25].
- (c) The proposed Health Ensurance on the other hand is a scheme in which a parent or grandparent would make sure that their children/grandchildren get at the time it is required. For eg.a parent puts money in the bank for the education of their progeny 10 years later and thus ensures that this specific education is got for their children at the time intended (10 years later) that is ensurance [26].

The Grand Health Ensurance was conceived because of a direly felt need for a world class health insurance facility/model that would be inclusive of all economic sections of any society globally, as well as, exclusively catering to the special needs of the premium groups of the premium payers; in short his concept is a versatile solution resulting from the amalgamation of all the validated, salient features of 3 outstanding experiences in the fields of Community Health Care dispensation and community economic uplift– in India, U.S.A. & Bangladesh [15,16,21,23].

The Grand Health Ensurance concept takes inspiration from all the above 3 efforts in transforming the society's aspirations in to reality by proposing a Health Ensurance concept that would tap as premium 1% of the annual income of the highest economic groups giving them premium care in terms creature of comforts and facilities they expect in their health care needs, while including *GRATIS the* 2 other groups viz. the Subsidized group and smallest economic groupwith each premium group registration[15,16,21, 23,26].

The medical facilities and services however will be the same for all the 3 groups under one roof (The multi specialty e-hospital) In popular parlance the Grand Health Ensurance concept could be compared to an international jetlinemodelwhich takes the premium First class, the business class, the economy plus and the economy class all in the same plane to the same destination successfully [26].



Fig. 2 Jet Liner Model

Grand Health Ensurance is a revolutionary, completely transparent & inclusive Health ensuring model where the affordable persons pay 1% of their total income and this automatically covers the Health Ensuranceof 1 –4 persons of their choice like :

Close relatives (Parents, Siblings)(and) Dependents and Domestic Helpers (Children's Nannies & Drivers, etc...) This concept is Hougandban - AISECT University Journal Vol.VI/Issue XI March 2017

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			and s in manual Ruper.					
Salary / Day	' Salary Month	Fig 5 Grand Health Ensurance Economic Groups						
100 & less	3000	1	1%	Free/ Grand Group (GG)				
500	15000	5	1%	Free/ GrandSubsidised Group (SG)				
1000	30000	10	1%	Premium'D				
3000	90000	30	1%	Premium'C'				
6000	180000	60	1%	Premium 'B'				
10000	300000	100	1%	Premium 'A'				

Envisaged Premium Categories in the Grand Health Ensurance Plan All Values in Indian Rupees (INR)

 Table 2

 Envisaged Revenue from the Grand Health Ensurance Plan

 All Values in Indian Rupees (INR)

Number of Persons	Annual Premium	Annual Income from Premium	Categories
Ensured			
1,00,000	360	3.6 Crores	Free/ Grand Group (GG)
1,00,000	1,800	18 Crores	Free/ GrandSubsidised Group
			(SG)
1,00,000	3,600	36 Crores	Premium'D'
1,00,000	10,800	100 Crores	Premium'C'
1,00,000	21,600	200 Crores	Premium 'B'
1,00,000	36,000	360 Crores	Premium 'A'

Total annual premium collection will be 741.60 Crores.

Note: If 100,000 persons are enrolled in each category the Total Premium will be 741.60 Crores. For groups (F) Free & Subsidized Group & (E) Subsidised& Free Group the total Annual Premium for 100,000 persons each amounting to

21.6 crores can easily be waived & absorbed by groups A to D.

The premium paid by 4,00,000 persons (Group A-D) will be 720 crores can provide full health cover for the other 2,00,000 persons free of cost.

Table 3							
Additional (FREE)	Beneficiaries for Premium	Groups with C	GHE model				

Premium Group	Free Beneficiaries
Premium Group 'A'	2 SG + 2 FG
Premium Group 'B'	1 SG + 2 FG
Premium Group 'C'	1 SG (or) 2 FG
PremiumGroup 'D'	1 FG

F: Free, SG: Subsidized

VI WHAT ARE THE HIGHLIGHTS OF G.H.E.?

- (a) Once you are registered there are no more tedious forms to be filled or permission required; No questions are asked about past, present or future illnesses or diseases. Once registered, all health problems are automatically covered fully. You are treated as a dignified and respected partner in our Health Care Services Venture. Your positive feedbacks and inputs will be sought to be implemented by the organization to better the Quality of service Quotient.
- (b) Unnecessary medical or surgical or other interventions (which cause more harm than good)are scrupulously avoided.
- (c) You get an exclusive, unique and secured online EMR which could be retrieved anywhere in the world, any time you are faced with medical problem or emergency to assist your doctors(a very important life-saving medical tool)not available in most insurance systems in the world.

WHERE WILL THE GHE ModelBE AVAILABLE for view @TAG –VHS Diabetes Research Centre

VII LIMITATIONS OF GHE

- (a) Extensive use of I.T.-Infrastructure needed.
- (b) Training of all the participants in this venture (doctors, Insured persons, administrative staff, etc.)
- (c) Certain contagious diseases like cholera, Pox, HIV/AIDS etc. will be excluded from/cover by GHI. But-customized packages could be worked out for special situations and cases.
- (d) Certain highly specialized medical/surgical modalities (eg. Stem – cell therapy /complex cardiac surgeries etc) would be out-sourced to affiliated and accredited institutions only if recommended by our panel of experts, when the charges will be borne by the G.H.E.
- (e) For GHI concept to become a national success it needs the backing of all participants who should co-operate in improving their own health and also enabling in giving HEALTH CARE FOR their kith and kin [24].

VIII CONCLUSION

The present Indian health sector scenario of governmental efforts supplemented by the failed health care models that are in vogue in countries like U.S.A, U.K, etc., are clearly inadequate and ineffective, to provide health for all at affordable rates or free of charge for the huge bottom layers of the pyramid of our population, totalling nearly 700-800 millions. The efforts of NGOs does not even touch the fringe of the problem. So, presently the private/corporate sectors are ruling the roost and making the public believe that corporate (high-endtech & expensive) health-care is better than the governmental efforts in its general (public) hospitals. The political efforts to appease the vote bank by giving various governmental schemes for Free healthcare programmes for which its own hospitals are ill-equipped has landed huge revenue into the corporate sector by the PPP model.

Grand Health Ensurance is a revolutionary, completely transparent & inclusive Health ensuring model where the affordable persons pay 1% of their total income /annum and this automatically covers the Health Ensurance of 1-2 persons of their choice for 1 year. It also takes in its fold centuries old ancient Indian Wisdom enshrined in the health and healing model of Ayurveda, as well as the authentic Homeopathy and the various forms of Energy Therapies in its armamentarium.

This Health care model is self generating, economically sustainable and can be scaled up or down to cover the entire country and our 1.2 billion plus population for effective improvement of people's Health Expectancy Quotient. The TAG VHS Diabetes Research Centre (unit of VHS Diabetes Department) has been functioning since March 2011, and treating patients based on this Health care model.

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Policy Initiatives and Emerging Technologies for Sustainable Power Generation

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ABSTRACT

Climate change is one of the biggest challenges of 21st century. The primary cause of global warming is the increasing emission of greenhouse gases. As of today, the main source of power generation in India and many other countries is by burning of the fossil fuels which results in emission of green house gases. In India, more than 65% of electrical power is obtained by burning of fossil fuels. Hence, the use of conventional power ought to be minimized for long term sustainability. The paper suggests some policy initiatives and need of adopting emerging green technologies for sustainable power generation.

Index Terms—Supercritical technologies, hybrid power generation, gasification, fuel cell, repowering of windfarms, green technologies.

I INTRODUCTION

In Paris summit-2015, most of the countries agreed to make substantial reduction in emission of greenhouse gases (GHGs). However, there are considerable technological, economic, and political challenges in meeting the ambitious targets. The International Energy Agency has projected that coal-fired power generation will continue to rise globally over the next few decades. Using clean coal energy efficient technologies could be a significant step towards reducing carbon-emissions besides other measures.

II POLICY INITIATIVES

In order to meet the stringent targets to combat climate change, it is necessary to take some policy initiatives as suggested below:

(a) Energy Conservation - Energy conservation by Demand Side Management (DSM) is the most important. The latest example is the large scale distribution of 9 W LED bulbs by the Ministry of New and Renewable Energy (MNRE) at a very low cost. This is a great initiative which will substantially reduce the demand of power, mainly during peak hours after sunset.

(b) Inefficient Old Thermal Power Plants - Most of the coal based old thermal power units have low rated output but they deliver still lower output at poor efficiency, say below 30% with high emissions of Green House Gases. Policy initiative is required to replace such Turbine-Generator (TG) units rated below 200 MW with lesser number of high rating TG units based on super critical technology which operate at higher efficiency but emit less GHGs.

(c) New Thermal Power Plants - India has entered into an era of super critical technology with the commissioning of a 660 MW unit in 2011 at Sipat, Chhattisgarh. The supercritical boilers operate above 221 bars and 274° C at higher efficiency but with lower emissions. The ultra super critical boilers are being developed which will operate at still higher temperature and pressure at higher efficiency but at still lower emissions. In view of serious environmental concerns, no utility should be allowed to install sub-critical boilers any more, as a policy initiative.

(d) **Repowering of Windfarms** - India has come a long way from kW range wind turbines in 1980s to 3 MW units. At present, India stands 4th in the world in terms of installed wind power capacity. A large number of wind turbines have completed 20 years or more. These low rated turbines operate at low utilization factor. As a suggested policy initiative, wind turbines rated upto 500 kW and which have completed 20 years should be replaced by high rating technologically advanced wind turbines. It will enhance the power generation substantially.

(e) Wind-Solar PV Hybrid Power Plants -The wind turbines are sparsely located in a wind farm and so most of the space remains empty. As a policy initiative, the empty space must be utilized either for cultivation or for installation of solar photovoltaic power plant. The output of a wind-solar PV plant is more stable as wind and solar resources are reasonably complementary to each other. Ministry of New and Renewable Energy issued draft National Wind-Solar Hybrid Policy on 14 June 2016. The objective of the policy is to provide a framework for promotion of large grid connected wind-solar PV system for optimal and efficient utilization of land and transmission infrastructure, reducing the variability in renewable power generation and thus improving grid stability. The policy aims to reach wind-solar hybrid capacity of 10,000 MW by 2022.

(f) Captive Power Plants -The power generated in a captive power plant is utilized in the same premises which almost eliminates transmission and distribution losses. Hence, captive power plants, preferably based on renewable energy, must be encouraged more with proper policy support.

III EMERGING TECHNOLOGIES

Some technologies are emerging and are important from the consideration of climate change. These technologies are either based on renewable sources of energy or they are less polluting even though based on burning the fossil fuels.

(a) Integrated Gasification Combined Cycle (IGCC)-IGCC plant gasifies coal into synthetic gas and operates a gas turbine. The heat from the exhaust of gas turbine is used to generate steam to drive a steam turbine. IGCC operates at higher efficiency but emits less GHGs. However, this technology is undergoing development and has yet to be well established techno-economically.

(b) Coal Gasification-Fuel Cell Power Plant [1]- As per the research carried out at Massachusetts Institute of Technology (MIT), USA, electricity from coal can be generated with much higher efficiency with lower emissions by combining two well-known technologies, viz. coal gasification and fuel cells. First, hot steam is passed over pulverized coal. The chemical reaction between coal and steam releases carbon monoxide and hydrogen which can produce electricity in a solid oxide fuel cell which works around a temperature of 800° C. In fact, heat generated in fuel cell is enough for gasification of coal, thus eliminating the need for a separate heating source. In fuel cell, a membrane separates oxygen from carbon monoxide and hydrogen. In an electrochemical reaction, carbon dioxide is produced in a pure and uncontaminated form, from which carbon can be capturing and sequestration can be done easily. This coal gasification-fuel cell power plant could achieve efficiencies in the range of 55 to 60%.

(c) Hybrid Coal-Solar thermal Power Plants- In a thermal power plant, heat contained in the flue gases is recovered and used in heating of air and water before feeding to the boiler. If heat of solar energy is used to preheat air and water before supply to the boiler, overall thermal efficiency is increased. Overall thermal efficiency can be increased by 1% if feed water temperature is raised by 5 to 6° C. Similarly, overall thermal efficiency can be improved by 1% if air temperature is improved by about 20° C. [2]

(d) Thorium Based Fast Breeder Reactor - India is dependent on import of uranium for executing nuclear power program. For self sufficiency in nuclear fuel, it is necessary to develop fast breeder reactors based on thorium which is abundantly available in India. Hence, onus is on India to develop suitable fast breeder reactors. As a first step, India has developed a 500 MWe prototype of fast breeder reactor based on uranium. It is under commissioning at Bhavini project at Kalpakkam, Tamil Nadu. As a part of nuclear power development program in India, thorium fuel based fast breeder reactor is planned to be developed by 2030. (e) Kite Wind Turbines [3] -The power output of a wind turbine increases as a cube of wind velocity. The wind velocity increases with the height above ground. This has given a concept of flying turbine thus eliminating the expensive tower, its foundation, yaw mechanism etc. In a flying wind turbine, the electrical generator can be flying or ground-mounted. When the generator is aloft, a conductive tether can transmit electrical energy to the ground or power can be beamed to receivers using microwave or laser. The challenges include safely suspending and maintaining turbines hundreds of meters above the ground in high winds and storms, transmitting the generated power to earth and interference with aviation etc.



Fig. 1: Kite wind turbine

During insufficient wind or bad weather like lightning or thunderstorms, use of kite turbines could be temporarily suspended by bringing them down to the ground. So far, no commercial airborne wind turbines are in operation.

(f) Satellite Solar Power -The main disadvantage of solar energy is its non-availability in absence of sun light. This situation could be overcome if solar PV power plant is installed on a geo-stationary satellite and power is transmitted to earth. The idea for a satellite solar power was conceived by Dr. Peter Glaser in 1968. Solar Power Satellites placed in geosynchronous equatorial orbit, 35,800 km above earth would remain continuously illuminated. As a result of the orbit location, the amount of sunlight on the satellite during the year is about five times more. At geosynchronous orbit, satellites have the same rotational period as the earth and are therefore fixed over one location at all times, enabling the satellite to deliver almost uninterrupted power to ground. A successful ground test of a system designed to ultimately collect solar power from orbit and beam it to earth was conducted in Japan in 2016 by Mitsubishi Heavy Industries at Kobe works. In this project, 10 kW wireless power transmission was demonstrated using microwaves to a receiver at a distance of 500m. The testing proofed the performance of the control system that will regulate the microwave beam itself.



Fig. 2: Satellite solar power

- It is still a long way to go. Some of the salient points are [4]
 - (i) Successful implementation of such a scheme is still not distinct
 - (ii) Intensive research and experimentation required for any realisation
 - (iii) This appears to be a promising technique
 - (iv) Few nations have started experimental projects

(g) Nuclear Fusion-Huge amount of energy is released in nuclear fission and fusion processes. At present, globally, atomic power generation is based on nuclear fission reaction. The main concern with nuclear fission process is the radiation hazard which becomes disastrous in the event of an accident. This problem can be overcome by nuclear fusion process where two atomic nuclei fuse together to form a single heavier nucleus and release energy. Nuclear fusion takes place in sun where temperature rises to lacs of degree Celsius. This is the biggest challenge as no material can sustain such high temperatures where fusion process could take place. A group of countries have joined to develop magnetic field called 'plasma' in which fusion will take place. International Thermonuclear Experimental Reactor (ITER) is an international nuclear fusion research and engineering megaproject, which will be the world's largest magnetic confinement plasma physics experiment. It is an experimental 'Tokamak' nuclear fusion reactor which is being built in Saint-Paul-lès-Durance, south of France. The ITER project aims to make the long-awaited transition from experimental studies of plasma physics to 500 MW fusion reactor.



Fig. 3: Power generation from nuclear fusion

The ITER project is funded and run by seven nations the European Union, India, Japan, China, Russia, South Korea, and the United States. The EU, as host party for the ITER complex, is contributing about 45% of the cost, with the other six parties contributing approximately 9% each. Construction of the ITER 'Tokamak' complex was started in 2013 and is expected to finish by 2019. It is planned to initiate plasma experiments in 2020 with full deuterium tritium fusion experiments in 2027. The first commercial demonstration fusion power station, named DEMO, is planned to follow after successful completion of ITER project.

IV WATER CONSERVATION

The availability and acquisition of land are the major issues for building of a project. Hence, innovative ways are required in which minimum or no land is required for installation of a project. With the increasing population, per capita availability of water is reducing. Hence, conservation of water is becoming increasingly important. With the installation of floating solar PV power plants on canals, reservoirs and other water bodies, loss of water due to evaporation could be reduced.

(a) Solar PV system on canal top- In India, first Canal Solar Power Pilot Project was launched in Gujarat to utilize 19,000 km long network of Narmada canals across the state for setting up solar panels to generate electricity.



Fig. 4: Canal-top Solar PV Power Project (1MW)

A 1 MW pilot solar PV project on the 750m long stretch on Narmada branch canal near Chandrasan village of Kadi taluka in Mehsana district was commissioned on 24 April 2012. The pilot project was intended to prevent evaporation of 9,000 kilo litres of water annually. It is the first ever such project in India. This project has been commissioned by M/s SunEdison India. The Ministry of New & Renewable Energy (MNRE) had issued guidelines to set up 100 MW solar power capacities over and along the canals in the country. This approach tackles two major challenges simultaneously viz. water conservation and power generation. (b) Floating Solar PV plants on reservoirs [5]-The floating solar power projects are coming-up in Japan, the UK, Brazil, the US and Australia. The floating plants are expected to be at least 50% more efficient than a ground mounted solar power plant due to lower constant temperature of solar panels. The water body has a cooling effect on the solar panels which results in longer life of the photovoltaic panels and their operation at higher efficiency.



Fig. 5: Floating solar panels

It is expected to reduce evaporation upto 90% from the water surface covered by solar panels. It also restricts algae blooms. In a dry climate of South Australia, about 2.5m depth of water can be saved from evaporation annually. The water thus conserved will be available for domestic use, irrigation, industries, power generation etc. India's first floating plant rated 10 kW was commissioned at Smritiban, New Town, Kolkata on 12th December 2014 by M/s Vikram Solar.

V CONCLUSION

For sustainable power, the paper suggests some policy initiatives for conventional as well as renewable power generation. Further, emerging technologies like kite turbine, satellite solar power, nuclear fusion etc. are described which need to be developed, established and adopted for future. They are important as they promise to mitigate the challenges posed by climate change.

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Innovative Approach for Non Conventional Electrical Power Generation Utilizing Solar Heat and Wind Kinetic Energy

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ABSTRACT

This paper presents an integrated approach of electricity generation by combining the kinetic energy of wind and solar thermal energy by using specifically designed wind tunnels and solar thermal energy storage system in a solar chimney power plant. The tunnels are designed to control wind velocity in the vicinity of the solar chimney whereas thermal energy storage system enhances the rate of energy generation. This paper describes the design and working of a prototype. The parameters for the prototype were derived by using simple flow equations. The design incorporates a coaxial turbine installed inside the solar chimney and wind flows through specifically designed static tunnels from all the directions. This Design enables to overcome the drop in power generation capacity of solar energy based power station when cloudy and rainy conditions persist. It was observed that due to tunnels the wind velocity increases and can be controlled, While thermal energy and chimney effect adds to wind velocity. Therefore electricity generation appreciably increases for larger time, besides the ease in maintenance and protection from storm.

Keywords: Solar chimney; solar heat power generation; Renewable energy, Wind energy; up draft tower

I INTRODUCTION

Earth receives energy from Sun as light and heat. This energy is mainly responsible for life on Earth. Most of the solar energy thus received from sun is reflected back to atmosphere and some of its part is absorbed on Earth. Solar thermal energy plays significant role in increasing the kinetic energy of the wind. At present, commercially clean power is generated by using photovoltaic cells or by using wind turbines.

Wind turbines due to large inertia and long blades cannot rotate if wind velocity is below 5 m/sand needs to shut down when wind velocity is in excess of 25 m/s. This restricts the electricity generation by wind turbines only when wind velocity is in the range of 8 m/s to 20 m/s. This further complicates the task of selecting a suitable site for erecting a wind turbine. Very few places are suitable on earth, where these turbines can be installed. Since horizontal wind turbines are to be mounted on a tower of about 40 m height along with generator which makes its maintenance a difficult task.

Earth receives more heat from Sun as compared to light. This fact led to many authors to use heat for generation. The idea of converting heat to electricity is quite old [1]. In 1983 a prototype plant was constructed and tested. It worked for 8 years successfully. Presently, two commercial plants one in China and other in Australia are under construction with a capacity of around 200 MW, using turbines and synchronous generator [2]. These power plants require a very high chimney (around 200m height) and large land area (around 10 hectare per MW) for heat storage. These power plants work for 20 hours a day. If special techniques are used for heat storage such as water or black granules or molten salt, these power plants can work 24x7 supplying base loads in tropical countries and deserts. The need of large land area and height of solar chimney has restricted the wide spread use of the solar chimney based power plants [3] [4].

To overcome this limitation with same capacity of generation a new concept of integrating solar heat and wind energy was given by Nigam et al [5]. However the paper does not describe the heat storage techniques on land. They have used less efficient vertical axis turbine, giving low energy recovery.

An integrated approach can be used to generate power, utilizing wind and solar thermal energy simultaneously, with reduced thermal storage area and chimney height. The proposed power plant should use more efficient coaxial turbine. This approach will reduce the size and cost of the solar chimney power station for the same amount of power generated.

II THE PROPOSED POWER PLANT MODEL

(a) Design outline

The integrated approach described utilizes kinetic energy of wind and solar thermal energy simultaneously to generate clean and green electricity. The power plant based on this integrated approach is termed as Solar Heat and Wind Power Plant (SHWPP). Fig.1 shows a schematic diagram of SHWPP. Its design consists of a hexagonal base with suitably designed wind tunnels in all its six arms. Area of input duct is gradually reduced so that input area of wind tunnel is five times larger than the area of outlet. However it is not

necessary to keep ratio of input to output cross sectional area fixed at five and can be altered suitably as per requirement. The wind velocity is therefore increased five times from inlet to outlet of the tunnel due to this reduction. [5].

Bottom of the tunnels are made of aluminium or steel and rest on black granules and sand which are filled below them as shown in fig(1). Top and side walls of the tunnels are made of glass. These glass panels transmit heat received from sun to bottom metallic plates and then to sand and granules for storage.

All these six tunnels arms are arranged in hexagonal form and thus provide 360° access for wind to enter the chimney from any direction. These tunnels bend upwards and open inside the hexagonal metallic chimney. The use of low friction surface enables to achieve smooth air flow. The chimney is covered all around its periphery by glass panels up to 80% of its height. The air between chimney and glass panels stores the heat which is coming inside through glass panels.

A coaxial wind turbine is preferably mounted at half the height of the chimney. The other end of the shaft is connected to generator located in a control room to generate power as shown in Fig 1.



Granules + sand



(b) Working Principle

Six tunnels are spread around the chimney. The top surface of the tunnels carries solar glass panels owing to which solar heat gets transferred to bottom metallic plate of chimney from where it passes (Through conduction) to sand and granules stored below it. The heat is absorbed by air in the tunnels and by sand and granules on the ground, raising their temperature. Glass panels are provided around chimney up to 80% of its height. The air between glass and chimney stores heat, from where it is conducted to the air flowing through it, thus increasing the draft. Winds blowing in the area from any direction may enter from one or two tunnels. Since tunnels are opening inside the chimney, air will be sucked due to chimney effect .Since, the inlet area A_i is kept 5 times the outlet area A_o . Therefore, the air moving through tunnels will accelerate and final velocity at the outlet of the tunnels will be five times the inlet velocity (see table). The incoming air gets heated while moving through the tunnels (i) due to solar rays falling on it and (ii) via conduction from sand and granules stored at the bottom of the chimney. The ratio of input to output cross sectional area of the tunnels can be varied to regulate the velocity of the air in the chimney. If required, input cross sectional area may be kept smaller than outlet cross-sectional area to reduce the wind velocity. Thus the velocity of air can be kept within desired limit through chimney for smooth functioning of the turbine. Amount of air intake can also be controlled during low and high velocity winds.

The air moving through chimney will further accelerate and gain kinetic energy due to the heat absorbed from solar panels outside chimney and chimney effect. Thus the total kinetic energy of air moving through chimney will be due to combined effects of natural wind velocity, thermal energy received from Sun and chimney effect. Velocity of air inside chimney can be controlled by placing deflectors in tunnels.

The coaxial turbine can be mounted near about 50% of the height of the chimney with one shaft towards ground end connected with the generator. Speed of the generator can be changed by controlling air velocity through tunnels thus enabling stable operation.

III DATA ANALYSIS

(a) Effect of tunnel area reduction

Let Cross-sectional area at input of tunnel = A_i

Cross-sectional area at output of tunnel = A_o

Ratio of Input to output cross-sectional area AR = A_i/A_o

Incoming air velocity at the tunnel = V_i

Outgoing air velocity from the tunnel = V_0

Neglecting friction losses and local currents, energy continuity and mass flow equations have been used to calculate the velocity and other parameters at the end of the tunnel.

Energy continuity equation

Mass flow equation $A_i V_i d_i = A_o V_o d_o$ (2)

Assuming adiabatic process

$$\frac{T_i}{T_o} = \left(\frac{d_i}{d_o}\right)^{\gamma-1} \qquad \dots \dots \dots (3)$$

$$\frac{P_i}{P_o} = \left(\frac{T_i}{T_o}\right)^{\gamma-1} \qquad \dots \dots \dots (4)$$

 P_{i} , T_{i} , d_{i} are the pressure, temperature and density of incoming air at the tunnel and P_{o} , T_{o} , d_{o} are quantities at the outgoing air at the tunnel.

Let the values of the variables at the entry of the tunnel are

 P_i = 1.033 kg/m², T_i = 300 $^{\rm o}K$ and d_i = 1.17 kg/m² and

y = 1.4, $C_p = 0.238$, J = 427 and g = 9.81 m/s.

Assuming area reduction ratio AR = 5 and input velocity $V_i = 5$ m/s

Substituting above values in equations 1 to 4 $(A_iV_id_i)$ 29.25

$$d_o = \frac{1}{(A_o V_0)} = \frac{1}{V_o}$$

Hence
$$T_o = 300 \left(\frac{29.25}{V_o}\right)^{0.4}$$

Substituting the value of T_o and other constants in the equation 1, the polynomial in V_o comes out to be

On resolving equation (5) we get $V_0 = 25.06 \sim 25.00$

Other parameters calculated from above equations at the outlet of tunnel are as follows: $T = 200^{3} V_{c} + 10^{-1} V_{c}^{2} + 10^{-1} V_{c}^$

 $T_o=300^{\circ}K$, $d_o = 1.17 \text{ kg/m}^2$, and $P_o=1.033 \text{ kg/m}^2$

This indicates no change in the conditions when ratio of cross-sectional area reduction and velocity is low. However these parameters changes significantly at larger air velocity and high ratio of cross sectional area reduction. The values calculated at various conditions are shown in the table below.

	Table 1			
Values of various par	rameters for different ratio	of cross-sectional	areas of the tunne	ł

Area ratio (AR)		3			5			8	
V _i m/s	5	10	20	5	10	20	5	10	20
V _o m/s	15	30	60	25	50	104	40	82	185
d _o	1.17	1.17	1.15	1.17	1.17	1.125	1.17	1.14	1.01
To	300	300	300	300	300	295	300	297	283
Po	1.033	1.033	1.033	1.033	1.033	0.970	1.033	0.997	0.842

As Given in Table-1 the lower wind velocity can be increased by suitably choosing the area reduction ratio. If the natural wind velocity is higher, the area reduction ratio can be small or even reversed to suit the system. Thus stable turbine operation is possible in the power plant. These are approximate calculations neglecting friction and local currents hence may not be valid at higher wind velocities, but it signifies the underlying principle. Since wind velocity can be controlled, so this design is suitable for lower wind velocities. Because of heat storage and wider wind velocity operation the system can generate energy for longer time with stable operation.

(b) Chimney effect

The velocity of air at the bottom of the chimney is given by

 $V = [2gHa^{2}]^{1/2}$

Where Ha' is the actual height of the column of the hot gas in meter which would produce the pressure P kg/cm2

If H is the height of the chimney and T2 and T1 are the temperatures at bottom and top of it,

Ha' = 0.8H
$$\left[\frac{T^2}{T_1} - 1\right]$$

Velocity will be somewhat less if friction is also considered.

Therefore velocity of the air at the bottom of the chimney will depend on the physical height of the chimney and ability of the chimney to absorb the heat from outside hot air trapped between solar panels and chimney. Total area of solar panels and ability of chimney to absorb heat are major factors for efficient operation.

IV DISCUSSIONS

Energy of air at the top of the chimney is due to initial energy of air at the entrance of tunnels plus solar thermal energy acquired during transit through tunnels and chimney, fig. 1. As the air passes through tunnels the velocity increases in proportion to input/output area ratio, as shown in table-1. Thus the air velocity at the top of chimney is added effect of initial wind velocity, solar heat, tunnel area ratio and chimney effect, as shown in table-1. Air velocity increases with increase in tunnel area ratio. Very little effect is observed in density and temperature, only at higher velocity. Drop in these parameters will reduce or even may reverse due to solar heat as it is not taken into consideration during calculation. Therefore velocity will increase without drop in density. A coaxial turbine is installed inside the chimney at a height of 80% giving good energy recovery. This power plant will harness both wind and solar heat simultaneously in one power plant as disered.

The integrated approach of utilizing solar thermal energy (stored on the ground and around chimney), kinetic energy of wind and chimney effect in one single power plant has the potential of producing power 24x7 even during cloudy and rainy season. Its design is simple, easy to operate and maintain. The only moving parts are turbine and generator rotors. The complete power plant may be designed to work in semi or full automatic mode. If made to run commercially it will incur very little running cost. Its other benefits are:

- (a) Unlike the solar chimney power plant (using solar chimney and storing heat only at ground, without wind kinetic energy) heat is stored around both the chimney and ground thus reducing the requirement for large land area.
- (b) SHWPP generates more energy as it also simultaneously utilizes wind energy as compared to solar chimney power plant of same size.
- (c) Stable operating conditions are possible to achieve as quantity of incoming air and its velocity can be monitored and controlled in the proposed design.
- (d) 24x7 generation of electricity due to the area under the tunnels and around chimney is effectively used for heat storage. This is unlike other standalone windmills, where generation is totally dependent on the available wind velocity.

V CONCLUSION

This paper describes the simultaneous usage of solar and winds kinetic energy to produce electricity. The outer surface of the chimney used for heat storage enables the user to reduce the land area requirement. It is possible to control the velocity of wind in the chimney by changing the area reduction ratio of the tunnels. Approximate analysis presented in the paper describes operational feasibility of the proposed SHWPP. Detailed analysis of the system should be done including friction and heat flow. It will also need to find better position of turbine.

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Neurodesign; An Art of Product Packaging: Understanding Customer's Psychology of Colour with the help of Neuromarketing- A Review Paper

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ABSTRACT

This paper presents the concept of colour psychology in packaging including those methods used for studying consumer's brain activity. The paper focuses mainly on the role of neuromarketing in product packaging. It attempts to highlight the ways in which neuromarketing can be used by research organizations with reference to colour psychology in packaging. Neuromarketing is that area of marketing that studies the clients and investigate the emotional response to marketing stimulus. Neuromarketing is a superlative method for understanding marketing stimuli, since all business communication is eventually judged in the consumer's brain. This is also the case for product packaging. A new part of this marketing is the color psychology, which is on the whole how colors are used to persuade your mind. In fact some research studies have proved that humans have key response to non-verbal communication and product package designers, marketers, and graphic and industrial designers can find out a lot from neurodesign. Neurodesign focuses how and why our brains are fascinated to some colours more than others, and why do we recognize some features as naturally more aesthetically gratifying than others.

Key Words: Neuromarketing, Psychology of colour, Neurodesign, Neurensics

I INTRODUCTION

Neuromarketing is a field of marketing that connects neuroscience with brand architecture, where neurons meet new products. Though, name neuromarketing can be illusory: it is not a type of marketing, but it is a way to learn the impact of marketing and advertising on consumer's brain. Those techniques that fall under the reign of neuromarketing are based on scientific principles about how humans really believe and come to a decision, which relies on a host of brain processes of which we are mostly unaware.

Measuring consumer reaction and behaviour in a Neuromarketing research might include the following techniques:

- (a) Eye tracking experiments (measuring eye gaze patterns, say, on a landing page)
- (b) Facial Expressions
- (c) Behavioural experiments (for example, considering how changes in the colour of a product impact a customer's attitude of it)
- (d) Biometrics (body signal measures) that measure perspiration, respiration, heart rate, and facial muscle movement
- (e) Neuromeric (brain signal measures) that measure electrical activity (electroencephalography [EEG]), and blood flow (functional magnetic resonance imaging [fMRI]) in the brain

The purpose of neuromarketing has obtained fame over the last decade. The birth of the emerging field of neuromarketing generated wide-ranging, ongoing debates what benefits they take. Ale Smidts first coined the word neuromarketing in 2002. He studied consumer's sensorimotor, cognitive, and emotional response to marketing stimulus.

Author and marketing guru Martin Lindstorm's bestselling book "Buyology - Truth and Lies about Why We Buy" (2010) proves from his investigational studies that subconscious mind plays a chief role in consumer's buying decisions. The Lindstorm seems to be puzzled while the marketers still try to untie the gap between the consumer purpose and accomplishment.

Neuromarketing is a new filed of marketing - it is a new way to marketing research. According to Martin Lindstorm's there are six major areas where neuromarketing is used today: Branding, Product design and innovation, Advertising effectiveness, consumer decision making, On-line experiences, Entertainment effectiveness.

II PSYCHOLOGY OF COLOUR IN PRODUCT PACKAGING

A new part of this marketing is the color psychology, which is on the whole how colors are used to persuade your mind. In fact some research studies have proved that humans have key response to non-verbal communication.

According to Carla Nagel Administrator NMSBA (Neuromarketing Science and Business Administration) quoted in his blog; Neurensics has used neuromarketing to investigate several packaging designs, resulting in a very important insight. The brain reacts much more advantageous to packaging that communicates the brand's image than packaging that communicates brand incongruent information. Perhaps it is better to no longer use the term product packaging, and instead introduce the term brand packaging.

Colour is an exceptional basis of information, It has been observed that 62-90 per cent of consumer's' buying decision is based on colours only (Singh, 2006).

Colours have resonable effect on consumer's feelings, thoughts, and behaviors; so, marketers have engaged colour as a visual mnemonic device to support cognition and thought and grasp consumers' attention (Labrecque, Patrick, & Milne, 2013).

Moriarty (1991) discusses colour, explaining that colour in advertising serve a range of explicit purposes. It creates attention, it draws interest, it drives, and it actions memo ability. Morarity more explains that colour can be used as a indication to either connect with or represent something else. Morarity also claims that the primary function of colour in advertising is to help develop attention and affecting responses.

The idea that colour preferences are identified through relations is a potentially important discovery for marketing researchers concerned in formative colours for products. Rather than examine general colour preferences among consumers, it may be preferable to learn consumer's colour relations as a basis for understanding the emotional aspects of colour. For example, Marketers can also use the theory of associations to create meanings for particular colours or to develop a brand image around a colour (Grossman & Wisenblit 1999).

As Odekerken-Schröder, Ouwersloot, Lemmink, and Semeijn, (2003) rightly stress when consumers involved in purchasing, they generally get several factors and areas into account. There is consent among marketing researchers and marketing managers that product shape or design and product acsthetics are necessary tools to put on leading advantage in cutthroat market (Kreuzbauer & Malter, 2005).

Visual stimuli on packaging create a center for consumer's attention and leads consumers to outline perceptions about various products; these perceptions notably exercise influence on consumer's buying decision (Venter et al., 2011).

Graphics and color are critical parameters in influencing consumer' purchase decision which producers and marketing experts should not turn a blind eye to them in packaging. Graphics includes image layout, color combinations, typography, and product photography (Silayoi & Speece, 2007).

The psychology of colours deals with discovering the impact of each individual colour on different people and the emotional state they provoke in them. This particular field of psychology is very complex since if a person shows a strong adverse emotion towards a particular colour it is often based on a strong psychological reason closely related to their personality. By closely studying each colour, characteristics of personality can be discovered. Colours that cannot be obtained by mixing various pigments are known as basic colours, and they are red, blue and yellow. Secondary colours created by mixing two primary colours such as orange, violet and green colours.

Despite the fact that the experience of a particular colour is very individual, there are two types of colour that carry universal meaning. Red, orange and yellow colours belong to the red spectrum of colours. These colours are warm colours that provoke emotions varying from warmth and comfort to anger and hostility. Blue, violet and green are on the blue side of the spectrum and are called cold colours. They predominantly provoke the feeling of peace, however they can also lead to the feeling of sadness or indifference.



Source: http://www.rewaj.com/wp-content/uploads/2010/10/color-wheel.gif

III RESEARCH OBJECTIVES & METHODOLOGY

(a) Objectives

- (i) To study the neurodesign: stance of neuromarketing in identifying the consumer's psychology of colour.
- (ii) To understand the current product packaging changes with particular reference to colour psychology of products with neuromarketing.

(b) Research Methodology

Study determines the need for the exploratory research to understand the conceptualization of colour psychology of product in the minds of the consumer and marketer through neuromarketing. An exploratory research is also attempt to lay the groundwork that will lead to future studies, or to determine if what is being observed might be explained by and examine in the light of the existing literature. Thus qualitative research is conducted with the help of secondary data, previously existing literature review, facts sheet journals and expert blogs.

IV NEURODESIGN: THE NEW EDGE OF PACKAGING

Neuromarketing has been now days implemented widely in marketing specially in product and package design, because it is very difficult to ascertain customer's likeness and dislikeness towards product and it's designing.

It is Neurensics that applied neuromarketing to scrutinize a number of packaging designs, consequential in a very significant insight. It has been observered that brain reacts more helpful to packaging that communicates the brand's image packaging that communicates brand than incongruent information. Possibly it will be better to shift product packaging to brand packaging. Brand packaging is all about what does create a package differ from competitors? What materials should be applied to gain certain behaviors, perceptions and feelings in the consumer? How can a packaging influence our assessment of its contents? How can a packaging add to brand loyalty?

The newly introduced field of "neurodesign" is now making attempts to respond the above brand packaging related questions. It is all about applying understanding on the operations of the human brain for the design of products and packaging desired by consumers.

On the ground of previous studies conducted till date investigating packaging color, it is accomplished that consumers take benefit of colors as stimulus-based information and packaging color grasps consumers' awareness, affects preferential decisions, and also keep potential to converse the information about the product at the point of purchase (Kauppinen-Räisänen, 2014).

In her most recent research, Kauppinen- Räisänen (2014) suggests a framework which figure out the importance of packaging color at the point of purchase. Figure 1 presents this framework.



Fig. 2 Packaging colors' functions at the point of purchase

Source: (Adapted from Kauppinen- Räisänen, 2014).

Packaging colours play a vital role in establishing consumer's decisions as this has been found that there is a passionate connection between colour and feelings. Colours are like driving force for generating an explicit kind of response in the human brain as well as human body. For example, colour red increases the blood pressure and pulse rates whereas Colour blue lowers the blood pressure and respiration rates. Colours become a source of a brand's identity for a marketer as it associates to consumer's feelings.

It is imperative to stress that colours have major importance in customer's life and particularly in marketing of a product. Table 1 summarizes the connotations and worth of different colors in customer's life and mainly in marketing based on Renvoise and Morin 2007.

As per http://neuromarketingindia.blogspot.in/ on topic neuromarketing in India while marketing of new products, it is crucial to consider that consumers place visual appearance and color above other factors when shopping (1% sound / smell, 6% texture, 93% visual appearance). 85% of shoppers place color as a primary reason for why they buy a particular product. Color increases brand recognition by 80%. Brand recognition directly links to consumer confidence.

Colour	Symbolizes	Used By
Red	Power, Activity, Rescue	Coca- Cola, Red Cross, Business 2.0
Pink	Calm, Feminism	Barbie, Pepto- Bismol, Mary Kay
Orange	Movement, Construction, Energy	Cingular Wireless, SalesBrain, Home Depot
Yellow	Light, Future, Philosophy	Kodak, National Geographic, Best Buy
Green	Money, Growth, Environment	John Deere, Starbucks, British Petroleum
Blue	Trust, Authority, Security	IBM, Microsoft, American Express
Purple	Royalty, Spirituality, New Age	Sun, Yahoo, Barney

Table-1 Importance Colors for Customers

(Source: Renvoise and Morin 2007:141)

V CURRENT TRENDS – PRODUCT PACKAGING

Campbell's Soup The company chosen neuromarketing to get a clear perspective of what the average consumer was looking for: By measuring galvanic skin response, heart rate, and other biometrics of over 1,500 people; triangulating data over two years between three neuromarketing firms; and cross-referencing the data with traditional methods; research definitively showed Campbell's packaging was not appealing to consumers. After studying the effect of packaging using brain scans, ECG, GSR and other biometrics ,they found that the logo of Campbell's at the top deterred the consumers from buying certain soups as it made their search difficult. Additional research concluded that the spoon in the packaging did not elicit much activity in the brain as it had little emotional engagement. They decided to replace the spoon with steam to make it look more realistic and replaced the bowl with a bigger one. Also they placed the Cambell's logo at the bottom instead of keeping it at the top, this change in the design evoked much greater activity in the brain resulting in increase of sales.

Baked Lays Frito-Lay, a division of PepsiCo, has also applied neuromarketing to convert Baked Lays packaging design and colour, with the goal of appealing to female consumers. Research showed women snacked twice as much as men, but were buying Frito-Lay products half as much.

Tropicana by using neuromarketing, could have established the emotional attachment many consumers had to the current packaging, and enhanced the look to leverage loyalty rather than selecting a new, and alien, design.

Sun Chips recently suffered a packaging crisis because of the beginning of 100 percent compostable bags. In addition to being "green," the new bags were very loud Instead of jumping on the environmental bandwagon without considering potential ramifications; Sun Chips had applied the application of Neuromarketing to gather information on consumer preferences regarding colour of product packaging.

Axe deodorant while the original Axe deodorant design had no text, they put two words with white colour on the product packaging: 'seductive', which has a relationship with Axe's brand image, and 'powerful', which is related to the product. Neurensics saw an increase in brain activation in regions that are important in determining purchase intention, when the word 'seductive' was used. Gressingham Foods took help form U.K.-based design consultancy Elmwood for recasting its brand identity as premium but accessible. Elmwood uses biomotive triggers in its designs, arguing that certain graphic elements conjure instinctive responses from consumers. A cusp shape (think a shark fin or horns) conveys fear or caution, while curves represent softness and comfort.

Gerber Baby Food conducted a research that uncovered negative emotional reactions to various graphic elements, including the graphics projected to get across baby stages, the advantage bands and less-prominent health claims. These responses suggest either confusion in explanation and/or difficulty in reading smaller print. On the basis of research they decided that there is a need to "clean up" and simplify the packs with new colours and text, to make them more accessible to shoppers.

Sunsilk in it's advertisement (with the woman's eyes looking at the product), as the heatmarks show, motivates the spectator to get a better glance at the product's packaging, which facilitates visual memory and consequently improves the possibility of a shopper recognizing the brand when glancing at it on a shelf.

Imodium Anti-diarrheal medicine capsules by using neurodesign they have created three designs for their Anti-diarrheal medicine capsules : "On "Packaging 3" the word "Anti-diarrheal" appears in RED colour, this is far from the "relief sought". On "Packaging 2" the word "Anti-diarrheal" appears in BLUE color. Psychologically one of the connotations of the BLUE is peace. On "Packaging 1" is a bit more of what should the packaging of this product be. Indeed, a study conducted concerning the psychological reactions of patients at the sight of medicine capsules showed that the colors would be appropriate turquoise.

VI CONCLUSION

Research reflects and proofs the stance and emergence of nueromarketing as a new tool to design the packaging and colour of product. With the application of neuromarketing a new field has also emerged i.e. Neurodesign: making attempts to respond the above brand packaging related questions as well as cater with the psychology of colours . It is all about applying understanding on the operations of the human brain for the design of products packaging and colour desired by consumers and Packaging colours play a vital role in establishing consumer's decisions as this has been found that there is a passionate connection between colour and feelings. It is imperative to stress that colours have major importance in customer's life and particularly in marketing of a product. Brands as Campbell's Soup ,Baked Lays,

Tropicana, SunChips, Axe deodorant, Gressingham Foods, Gerber Baby Food, Sunsilk, Imodium Antidiarrheal medicine capsules and many othershas already adopted neurodisign as a tool of designing their product's packaging as well as colour of packaging. Managers also need to invade this emerging trend of marketing for positioning there brand in the subconscious mind of their consumers. Thus nuero marketing with neuro design will have a great potential for the marketers to understand the psychology of colours of consumers in the coming years.

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Quantitative Risk Assessment of LPG Bottling Plant

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ABSTRACT

With the development of industries and increase in population the need of LPG has accelerated in recent years. In order to provide an overview of the potential risks in LPG bottling plant, there is the high probability of accidents during handling & storage; various hazards are faced during storage and transportation. As we know LPG is a highly flammable gas, so there are many possibilities of hazards, like explosion, fire, which may results in minor or major or fatality, due to this there is loss of man-power and money will also occur. So a great concern is needed to minimize the occurrence of these hazards and for this purpose it is very necessary to analyse the risk associated in usage and handling of liquefied petroleum gas. Risk assessment is a legal requirement for every chemical and petrochemical industry. It is a formalised method for calculating individual, environmental, employee and public risk levels for comparison with regulatory risk criteria. In this paper we have carried out a careful examination of what could cause harm to people so that we can weigh up whether we have taken enough precautions or should do more.

Key Words: Quantitative Risk Assessment, LPG, Hazards Substances

I INTRODUCTION

The "risk" is the product of consequence and probability of each scenario. The risk for each scenario can be combined by specific areas or for the whole facility to obtain desired risk profiles. Risk assessment is a process where the results of a risk analysis are used to make decisions, either through a risk ranking of hazard reduction strategies or through comparison to target risk levels and cost-benefit analysis [1].Quantitative Risk Assessment is a well-defined procedure to be applied in order to calculate the degree of safety of a plant [2]. It is a systematic procedure for describing and quantifying the risk associated with Hazardous substances, processes, action or event.QRA may be a requirement of applicable legislation and/or internal company governance to show that risks are identified and controlled to an acceptable level [4&5]. The criteria for risk acceptability may be defined by local regulations or company / investor policy. Typically, a QRA can be defined as the formal and systematic approach of identifying potentially hazardous events, estimating the likelihood and consequences of those events, and expressing the results as risk to people, the environment or the business. Quantitative Risk Assessment of the plant includes identification of various credible and non-credible failure scenarios and consequences of those scenarios leading to various phenomena like dispersion, pool fire, jet fire, and unconfined vapour cloud explosion etc.[11] Frequency of the failure cases, magnitude of hazards and hazard distances have also been dealt with. QRA helps in

- (a) Forecasting any unwanted hazardous situation
- (b) Estimating damage potential of such situation

- (c) Modify existing facilities to extend their operational life
- (d) Results of QRA not only increase safety but also improve cost effectiveness and subsequent savings.

II OBJECTIVE

Main objective of this study is to identify, quantify and assess the risk from the facility from the storage and handling of chemical products and to identify, quantify and assess the risk to nearby facilities / installations and suggestion of recommendations in order to reduce the risk to human life, assets, environment and business interruptions to as low as reasonably practicable.

III METHODOLOGY

An inherent property of a substance, agent, source of energy or situation having the potential to cause undesirable consequences. When LPG is released from a storage vessel or a pipeline, a fraction of LPG vaporizes immediately and the other portion forms a pool if the released liquid quantity is more [3]. LPG from the pool vaporizes rapidly entrapping some liquid as droplets as well as considerable amount of air, forming a gas cloud [10]. The gas cloud is relatively heavier than air and forms a thin layer on the ground. The cloud flows into trenches and depressions and in this way travels a considerable distance.

LPG is a highly flammable gas which results in fire and explosion in case if it leaks during the unloading or loading process and from the storage container. The various fire and explosion scenarios associated with LPG are jet fire, pool fire, flash fire, Confined vapour cloud explosion(CVCE), unconfined vapour cloud explosion (UVCE) and Boiling liquid expanding vapour cloud explosion (BLEVE). In LPG storage system fire and explosion accidents are happened due to leakage from tank or pipelines. [4]. QRA is used for different purposes it is one of the most important risk management program. [5] Following are the main steps in QRA studies

- (i) Hazard Analysis
- (ii) Probability evaluation
- (iii) Consequence Analysis
- (iv) Risk Analysis

(a) Hazard Analysis

The knowledge of what can go wrong is the first stage of the risk assessment process. Hazard identification involves the investigation of all the situations that may cause a potential accident, followed by an analysis of the combinations or sequences of events which could produce this. Typical hazard identification techniques are:

- (i) Check lists
- (ii) Statistical analysis
- (iii) FMEA
- (iv) HAZOP

Among these, the Hazard and Operability analysis (HAZOP) is the technique most frequently used for considering, systematically, deviations from the design intent by the application of a series of guide words to process parameters, in order to identify possible problems [3]. In LPG installations no process operations are performed; therefore the expected accidental events can be attributed to random causes (i.e. failure due to material defects, wrong assembly /maintenance), external causes (collisions, fire) and disoperation during transferring operations (incorrect coupling of loading/unloading arm)[9].

(b) Probability evaluation

The probability evaluation requires the determination of the circumstances and conditions which the occurrence of hazardous events is depending on and how those are interrelated. It allows estimating the expected frequency of occurrence of an accidental event. This is frequently performed by Fault Tree analysis, i.e. a logic combination of causes which may induce a specific undesired event (top event) coupled with event tree analysis, to identify the scenarios associated with the top event [4]

(c) Consequence Analysis

Consequence analysis is carried out based on the source model. How the materials are discharged such as from pipeline or tank and the type of failure etc. Then based on source model the fire and explosion outcomes are carried out based on the ignition probability[6]. Usually the event trees are used to identify the different event outcomes from any leakage scenario [7]. The jet fire (immediate ignition), vapour cloud fire (flash fire), pool fire (delayed ignition), vapour cloud explosion (delayed ignition-explosion), toxic cloud (noignition), safe dispersion are the outcome cases of any leak of hazardous material leakage. [9]. All these steps are covered by the modelling software during the analysis the complete assessment is structured as follow.

- (i) Source term characterization is strictly related to the typology of accidental event and allows identifying the characteristics of the release (flow-rate, quantity, physical conditions, etc.)[8]. The substances present in bulk in LPG installations are C3-C4 mixtures ranging from propane to butane which behave as a gas liquefied by pressure.
- (ii) Identification and study of physical phenomena involved is based on the source term characteristics and external conditions like meteorological conditions, presence and type of ignition etc., allows to identify the intermediate i.e. Dispersion and final phenomena like Fire and Explosion.
- (iii) **Damage assessment** of the analysis allows to determine the damage produced by thermal radiation as well as by the overpressure effects on the population and property.

The factors that govern the severity of consequence of the loss of containment are as follows:

- (i) Intrinsic properties e.g. flammability, flash point
- (ii) Dispersive energy e.g. pressure, temperature
- (iii) Quantity present
- (iv) Environment factors e.g. weather

(d) Risk Assessment flow chart



(e) Release Rate Estimation

Contained material may be released to atmosphere as liquid, vapor or a mixture of both. For liquids, a leak below the liquid level in the source of containment will result in a stream of escaping liquid. If the liquid is stored above its atmospheric boiling point, a leak below the Release rate depends on the process parameters and fluid flow characteristics.

DNV PHAST v 6.70 has been used to model the potential release scenarios and release rates. For getting realistic picture of scenarios, unless stated otherwise, a release from different ruptures sizes was modelled for different time periods considering the facility like ROV, GMS etc.

(f) Dispersion and Stability Class

The factors which govern dispersion are mainly Wind Velocity, Stability Class, Temperature as well as surface roughness. One of the characteristics of atmosphere is stability, which plays an important role in dispersion of pollutants. Stability is essentially the extent to which it allows vertical motion by suppressing or assisting turbulence. It is generally a function of vertical temperature profile of the atmosphere. The stability factor directly influences the ability of the atmosphere to disperse pollutants emitted into it from sources in the plant. In most dispersion problems relevant atmospheric layer is that nearest to the ground. Turbulence induced by buoyancy forces in the atmosphere is closely related to the vertical temperature profile.

Temperature of the atmospheric air normally decreases with increase in height it varies from time to time and place to place. This rate of change of temperature with height under adiabatic or neutral condition is approximately 1°C per 100 meters. The atmosphere is said to be stable, neutral or unstable according to the lapse rate is less than, equal or greater than dry adiabatic lapse rate i.e. 1°C per 100 meters.

Pasquill has defined six stability classes ranging from A to F.

A=extremely unstable, B=moderately unstable, C= slightly unstable, D=neutral, E=stable, F= highly stable

(g) Risk Tolerance

After the risk is calculated, the results must be compared to either governmental or company criteria to determine if the risk is tolerable. If the level of risk does not meet the "acceptable" risk criteria, then additional mitigation may be required. One concept that is being used extensively is as low as reasonable practical (ALARP). Figure 1 shows the ALARP concept. This concept suggests that, at some point, the cost to mitigate a hazard is so high that it is no longer practical to implement the option. Cost-benefit analysis can be used to determine if ALARP has been achieved.



Fig. 1: - Tolerance level of Risk.

IV RESULTS AND DISCUSSIONS

In this study we considered different failure of LPG bottling plant and on the basis of simulation studied following finding is listed below

(a) Inlet / Outlet line failure of Mounded Bullets

The Mounded Bullets have been provided with an inlet / outlet line size of 4". In case, leakage / rupture of the inlet / outlet line, liquid LPG will flow out from the Mounded Bullets as jet .The outflow of LPG is large and needs to be stopped at the shortest possible time. The consequence of 1 minute spill of LPG due to rupture or various leakages

- (i) The spilled liquid may catch fire resulting in jet fire.
- (ii) ii) The spill liquid may not catch fire. In that event it shall evaporate forming vapour cloud which may disperse safely beyond its Lower

Explosive Limit (LEL) in the direction of the wind, if there is no ignition source between its upper and lower flammability limits.

 (iii) The dispersing vapor cloud may come in contact with an ignition source between its explosive limits. In that event flash fire will occur and unconfined vapor cloud explosion may result with shock wave. Anything coming within the fire zone will be severely affected.

For consequence analysis following cases has been considered:

Full bore failure, 20% CSA failure, 20mm diameter hole and 10mm diameter hole and Consequence distances due to flash fire, jet fire and overpressure are calculated and presented in Table 4.1.

Table 4.1						
Inl	et / Outlet li	ne failure o	f Mounded	Bullets	5	

	DoloosoDoto(Ka/s)	Mass	Event		Haz	ardDista	nce (m) f	rom
Scenario	Release Kate (Kg/s)	Released(Kg				Releas	e Point	
	& Duration(s))			2F	2 B	3D	5D
			Flash fire (I	LEL)	157	133	135	141
			4.5	125	125	120	115	
Full bore			Jet fire(KW/m ²)	12.5	101	100	95	89
failure	RR:33.72RD : 60	2023	me(Kw/m)	37.5	84	84	78	72
Tanuie			Quantanagauna	0.03	396	406	438	394
			Overpressure (Bar)	0.1	278	305	336	294
				0.3	234	267	298	257
			Flash fire (I	LEL)	46	41	41	40
			Tot	4.5	57	57	54	52
2004 CSA	20% CSA failure RR:5.9RD : 60 355 Jet fire(KW/m²) Overpressure (Ray)	$fina(VW/m^2)$	12.5	46	46	43	40	
2070 CSA failure		355	fire(Kw/m)	37.5	39	39	36	33
Tanuie			Overpressure	0.03	194	165	165	141
				0.1	152	128	128	106
			(Dar)	0.3	136	114	114	93
			Flash fire (I	LEL)	40	36	36	34
			Lat	4.5	51	51	49	47
20 mm dia			$fino(KW/m^2)$	12.5	42	42	39	37
20 mm uia.	RR: 4.72RD: 60	283	me(Kw/m)	37.5	35	35	32	30
noic			Overnmercure	0.03	165	147	147	123
			(Par)	0.1	128	114	114	93
			(Dar)	0.3	114	102	102	81
			Flash fire (I	LEL)	14	13	12	10
			Lat	4.5	27	27	26	25
10 mm dia			$fina(VW/m^2)$	12.5	22	22	21	19
hole	RR: 1.18RD: 60	71	IIre(KW/M)	37.5	19	19	17	16
noie				0.03	67	54	53	41
			(Pow)	0.1	51	40	40	29
			(Dar)	0.3	46	35	35	24

RR: Release Rate; RD: Release Duration

(b) Vapor LPG release from SRV of Mounded Bullets

Each Mounded Bullets are provided with two nos. of Safety Relief Valves of line size 6'' each and their set pressures are 13.6 Kg/cm² and 14.2 Kg/cm² to release the excess pressure which may be build due to overfilling. When the pressure inside the vessel drops, the SRVs close automatically. In case of release of LPG in two-

phase (vapor & liquid) through safety valve, it will be discharged at a height of 12m above ground in vertical direction and dispersed in the direction of wind. For this study we consider following cases and results presented in table 4.2.

Case I: - Single SRV pop-up of 13.6 Kg/cm² pressure

		-							
Scenario	ReleaseRate(Kg/s)&	Mass Released(Event		HazardDistance (m) from Release Point				
	Duration(s)	Kg)			2F	2B	3D	5D	
			Flash fire(LEL)		4	3	4	5	
SRVpop-up	RR : 62.62RD : 180	11272	Jet fire(KW/m ²)	4.5 12.5 37.5	52 NR NR	51 NR NR	61 NR NR	72 NR NR	

Table 4.2 Vapor LPG release from SRV of Mounded Bullets.

(c) Suction line failure of LPG pump for Bottling operation / Tank Lorry filling;

The LPG pump takes its suction from the Mounded Bullet and pumps it to the filling shed for filling of empty LPG cylinders or tank lorry. The details of the pump are as follows:

No. of pumps	:	2
Type of pump	:	Centrifugal
Capacity	:	45m ³ /hr
Suction pressure	:	$6-7 \text{ Kg/cm}^2$
Operating temperature	:	25 °C
Suction line size	:	4″

In case of LPG pump suction line failure, a portion of the leaked liquid will flash off immediately and the remaining liquid will fall and spread on the ground unrestricted. In suction line, gasket failure is one of the foreseeable credible scenarios. Gasket failure of flange joint may be full gasket or partial. Experience shows that gasket failures are mostly partial and segment between two bolt holes mainly fails. The consequences of three minute release of LPG due to rupture or various leakages may be the following:

- (a) The spilled liquid forms jet and catches fire resulting in jet fire.
- (b) The spilled liquid does not catch fire but evaporates forming a vapor cloud and disperse safely to beyond its LEL.
- (c) The evaporating vapor cloud may come in contact with an ignition source between its explosive limit resulting in flash fire and unconfined vapor cloud explosion depending upon the congestion.

For consequence analysis following cases has been considered: Full bore failure,20% CSA failure and 10mm dia. Hole and Consequence distances due to flash fire, jet fire and overpressure are given in Table: -4.3

	Release	Mass				HazardDistance (m) from			
Scenario	Rate(Kg/s)&	Palaasad(Ka)	Event			Releas	e Point		
	Duration (s)	Keleaseu(Kg)		2F	2B	3D	5D		
			Flash fire (LE	L)	41	37	37	35	
				4.5	53	53	50	48	
			Jet fire(KW/m ²)	12.5	43	43	40	37	
Full bore	RR: 5.02 RD:	004		37.5	36	36	33	30	
failure	180	904							
				0.03	177	140	150	125	
			Over	0.03	177	149	115	04	
			pressure(Bar)	0.1	139	103	103	24 82	
				0.5	124	105	105	62	
			Flash fire (LE	L)	37	33	33	31	
				4.5	49	49	47	45	
200/ 05 4			Jet fire(KW/m ²)	12.5	40	40	38	35	
20% CSA	RR: 4.32RD: 180	777		37.5	34	34	31	28	
Tanure			Ouemphagauna/Ban	0.03	192	134	134	120	
			Overpressure(Bar	0.1	126	103	103	91	
)	0.3	113	91	91	81	
			Flash fire (LE	EL)	15	13	12	10	
				4.5	27	27	26	25	
10 mm dia			Jet fire (KW/m ²)	12.5	22	22	21	19	
Hole	RR: 1.18RD: 180	212		37.5	19	19	17	16	
11010			Over	0.03	67	54	53	41	
			Drossuro(Bar)	0.1	51	40	40	29	
			pressure(bar)	0.3	46	35	35	24	

 Table 4.3

 Suction line failure of LPG pump for Bottling operation / Tank Lorry filling

RR: Release Rate; RD: Release Duration

(d) LPG pipeline failure inside the shed

Liquid LPG is coming from the LPG pump to carousel machine through 3" (80mm) dia. pipeline at 15 Kg/cm² pressure and at ambient temperature. In case of this incoming line is leaked .For

consequence analysis following cases has been considered: Full bore failure and 10 mm diameter hole and Consequence distances due to flash fire, jet fire and overpressure are given in Table-4.5Table 4.4:- LPG pipeline failure inside the shed

Scenario	Release Rate(Kg/s)&Duratio n(s)	Mass Released(Kg)	Event		Hazard Distance (m) from Release Point			
					2 F	2 B	3D	5D
Full bore failure	RR : 4.47RD : 180	805	Flash fire (LEL)		38	34	34	32
			Jet fire(KW/m²)	4.5	50	50	48	45
				12.5	40	40	38	36
				37.5	34	34	32	29
			Overpressure (Bar)	0.03	163	135	135	121
				0.1	127	103	103	92
				0.3	113	91	92	81
10 mm dia. hole	RR : 1.87RD : 180	336	Flash fire (LEL)		16	15	15	14
			Jet fire(KW/m²)	4.5	31	31	30	28
				12.5	24	24	22	21
				37.5	17	17	15	13
			Overpressure	0.03	44	42	42	41
				0.1	30	29	29	29
			(Dar)	0.3	25	25	25	24

RR: Release Rate; RD: Release Duration

Iso-risk contour has been plotted by PHAST Risk Micro software v 6.70 (Latest) of M/s DNV Technica which is shown in figure I. Iso-risk contour has been calculated by considering facilities i.e. Mounded bullets, LPG loading/unloading through tank lorry, carousel filling and other facilities. Iso-risk contour of 1×10^{-6} is going outside the plant boundary in North-West direction and in South-West direction with 38m & 10m respectively but it is not harmful as there is no habitation near the plant premises within 0.5 Km.



Fig. 1: Iso-Risk contour of LPG bottling plant

It is also observed from FN curve figure 2 that Societal Risk is in tolerable range for plant personal.



Fig. 2: F/N curve of LPG bottling plant

V CONCLUSION

In this work Quantitative Risk Assessment of LPG storage bullet and its handling system is analysed. From the consequence analysis it was found that jet fire, pool fire, VCE, BLEVE are the potential scenarios. The frequency analysis for a leak and probability of ignition is used to find the overall outcome failure frequency. From the analysis the individual risk is acceptable level and all the effects are within plant premises. The consequence analysis results such as the over pressure distance and radiation intensity is to be used for future planning of facilities adjacent to the storage. More accurate models such as CFD are to be used considering all the wind conditions and for accurate results. Computer modelling used to assess the safety distances are varies however available data are to be further verified by field work to increase the reliability.

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An Overview of Technology intervention for water purification: an Indian Context

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ABSTRACT

In the last decade increasing population and pollution rate have revealed the lapsing picture of drinking water resources in India. Indian Government proactively stepped in to support water technology research by Public and Private sectors and made significant contribution to provide S & T Interventions for water contamination removal and few of them are commercially available. Since for the policy makers it is the efficiency (effectiveness, cost, accessibility, maintenance) of the solutions, rather than their origin, is critical, an in-depth study of water purification technologies options is necessary. This research paper draws insight about the recent water contamination scenario in different States of India and Science and Technology interventions in India at National and International level has been identified.

I INTRODUCTION

Water is not as abundant and readily available as it appears. Various reports published by World Health Organization put forward alarming facts about water availability. 17-19 million people in the world lack access to clean water. 3.4 million People die every year from water scarcity, sanitation and hygiene related problems out of which 99% death occur in developing countries¹. In South Africa alone 5.7 million people lack potable drinking water which adds to the hardship of their lives.

In India 1.2 billion people live with a very minimal per capita consumption of 1820 cubic meter which was 5177 cubic meter in 1951². This decreasing trend of water availability hints to water crisis situations in coming future. It has been reported that only 68% of Indian population has access to safe drinking water. 21% of communicable diseases in India are from unsafe drinking water³. India is ranked at 124th position out of 174 countries in terms of Environmental Pollution Index. This is really an alarming situation and the need of efficient actions can't be overemphasized further. It is essential to have a long term vision for water conservation and management.

The global population expansion or specifically in Indian context has been rapid for the past few decades. This growing population increasingly demands heavy industrialization. In the next forty years half a billion growth in population is expected. Heavy urbanization shifts have been observed by people moving from rural section to urban parts of the country. Out of 1.2 billion 377.1 million people live in cities and it has been predicted that in next two decades 225 million people will be added to this urban population⁴.

It's not just the population alone. Water is not scarce, but the efficient methods to make it available are. 85% of Indian population depends

upon water withdrawn from ground water reserves⁵. In ecological conservation point of view a minimal level of water should be available for sustainable growth in the water ecosystem including rivers, lakes, ponds and ground water. Most of the aquifers suffer declining water levels. Most of them are affected by heavy salt intrusion, surface water contamination and inadequate replenishment.

Major mining and thermo-electricity generation industries withdraw major fraction of water available in natural resources. For USA, in 2000 water withdrawal by thermoelectricity industry was 3% which is expected to surge up rapidly to 28-49% in 2030⁶ to cater the increasing energy demands. Such stresses on current water resources make it essential for us to reuse and recycle of waste water.

Besides this Indian municipal water infrastructure has been under criticism for a very long time. Every heavy rainfall or natural catastrophe like Tsunami (2004) exposes the weak links in age old water channelling systems. Water treatment technologies have to evolve one step ahead of the demands.

II WASTE WATER STATUS

Waste water quality has been degraded due to rapid industrialization in past 4-5 decades. Contaminated waste water can cause severe damage to ecology by eutrophication, GHG emission. The current treatment capacities are not sufficient enough, only 60% of Industrial waste water is treated while as low as just 26% of domestic waste water is treated⁵. The following table shows the difference between our waste water generation capacities and treatment infrastructure availability.

Period	Waste water generation (MLD)	Waste water treated (MLD)
2004-05	26254	7044
2005-06	29129	6190
2007-08	33000	7044
2008-09	38254	11787
2009-10	41131	13066
2010-11	51232	14484

 Table 1:

 Waste water generation and treatment, Source: Jindal ITF 2011⁷

As reported by the State departments dealing with rural drinking water supply into the on-line Integrated Management Information System (IMIS) of the Ministry, Government of India and Rajya Sabha Parliamentary Answer in 2015 by Ministry of Drinking Water & Sanitation, Govt of India the states^{8,9,10,11,12,13} affected by water contamination has been shown:



Fig 1 (a) Arsenic affected status



Fig 1 (b) Salinity affected status



Fig (c) Iron affected status



Fig 1 (d) Floride affected status



Fig 1 Nitrate affected states
Using the data provided by Ministry Of Water Affairs percentage of contaminated sites in different states have been calculated and depending on that we analysed that in Andhra Pradesh and Mizoram more than 90 % tested sources are affected by bacteriological contamination^{14,15} while other states like Kerala, Telangana, Maharashtra, West Bengal, Tripura, Haryana contaminated sample were found in the range 10-90% According to the Indian Standard drinking water-specification (Second Revision) Total Bacteria shall not be detectable in 100ml sample in all water intended for drinking.



0-10 % 10-30% 30-50% 50-70% 70-90% >90%

Fig.2 State wise Biological Contamination Level

This emergent perception of an imminent water crisis in the country entail a pressing need for the best potential use of water as well as technological advances to augment the fresh water by various means like desalination process, water treatments, etc.Emerging technologies have the potential to provide a long term solution for water quality, availability and viability of water resources, such as through the use of advanced filtration materials that make possible greater water reuse, recycling, and desalinization $^{17,18}\,$

III S & T INTERVENTION FOR PURIFICATION

CSIR and other competing institutes have various technologies for specific/multicomponent water contaminant removal (Table2)

Contamination	CSIR S & T	Other S & T Options
	Arsenic Field testing kits :	MERCK-HS
	IMMT, Bhubaneswar	IEHS-China (UNICEF)
Arsenic	NCL, Pune	Jal TARA
	Arsenic Resin membrane –(CSMCRI)	Mini Kit- Arsenic Test Kit (DRDO).
	Ceramic membrane based Arsenic Ren	Filter-Tablet system, Jabalpur University
	Technology- (CGCRI),	Arsenic Filter (Modified Laterite) IITGP
	Sand based technology (NML)	Arsenic Filter -IITK
	Chemo-dearsenification (NEERI),	Arsenic Removal – ARUZIF-IITB
	Tube well attachable arsenic removal u	Arsenic detection - Gold Nanoparticles-HCST-UP
	-CSIR-NEERI	
Fluoride	Fluorine test kits: NEERI, NCL	CPCB-MP MERCK
	Defluoridation-Biopolymer comp	Jal TARA,
	beads-(IMMT)	Jal TARA-MP
	Electro-deionization process- (CSMCR	BARC- Fluorination unit
	Electrolytic fluorination technique	TERI Fluorination unit
	CSIR-NEERI	Defluoridation - Amine based
	Nalgonda Techniques (ci	Mombrane generation ICTP
	MERICAL new adaptions material for	Defluction Magnetic and Nanomagnetic Picebary INU
	fluorination	Delhi
	CSIR-NEERI	Defluoridation-Regeneration of activated alumina-HCS
	RO technology IICT Hyderabad	Rajasthan
	Electrochemical Defuoridation technic	1. CUJHO MIMIL
	CECRI	
	RO based technology and waste treatm	
	CSMCRI	

 Table 2 :

 S & T Intervention for water purification by CSIR and other competing institutes

Iron	Iron Removal Unit :	Membrane Assisted Iron Removal Technology-
	CSIR-NEERI	BARC
	CSIR-NCL	IIT, Madras (Point of Use technology)
	CSIR-IICT	
	Ceramic membrane based Iron Ren	
	Technology (CGCRI)	
	Hand Pump attachable removal unitNE	
	NEERI-ZAR, Red clay based 'Terafil	
	(IMMT)	
Salinity	LTEK-NCL Improved	Field test kits – CPCB
÷	Desalination - RO -CEERI	MERCK-IIS
	Desalination- Indigenous-CSMCRI	LTTD technology t- NIOT, Chennai,
		Desalination Unit-BARC
		Desalinization unit – TERI
		Dolphin desalination unit
Nitrate	LTEK-NCL (NO ₂)-Improved	MERCK (NO ₂)
THHILE	DIER NOD (NO3) imployed	CPCB
		Ion exchange India
		ISED Nitrate Removal System
		Nitrate removal - Bigmuth media-UT/BUUD
		Mulate Temoval - Disintum media-III (BIIO)
Biological	A process for the purification of	Back-washable Spiral Ultrafiltration (UE) technology for
Diological	Escherichia coli contaminated water	domestic and industrial water purification-BARC
	for reusable option -CLRI	concerne and mademan water parmeanon Britte
	A process for recovery of salt from	
	salt laden water containing dissolved	
	organics for reveable ontions- CLRI	
	A novel catalyst useful for the	
	removal of nathogona from waato	
	water CLDI	
Multicomp-	Arsenic & iron -Ceramic Membrane-	Ozone microbubbles - removal of ammonia argenic and
on ont	CCCPI	odorous compounds UTC
onem	Torafil Filters - milet seale	Adapthenta from weate while tire. Meannarous material
	Inon /Horry motols / Gono anonisma	Chromium/Aniling derivatives/Dilat scale for Toxic motal HTD
	INALT	Argonia and Miarahag ramoual using Nanotochnology UTP
	IIVIIVI I	Pio according t/microslaga, Tartiary/Oustarnary tractment
		hoavy motols/toyic organic compound HTD
		Electro coorgilation Amonio/Elucride HTCD
		A stighted and an Multipellutent Jalaman Univ WD
		America in a different and a second Direction of the second secon
		Arsenic, from and fluoride removal – Biosorbants- Guwahati university
		Bionalymers-Multipollutant- Thapar University-Puniah

IV RESULTS AND DISCUSSION

It is interesting and important to note that in terms of impact (number of people and states affected), iron contamination is at the highest place; however, in terms of severity (health impact), it is the fluoride contamination that appears to be more severe, affecting about 8.9 million people across 19 states. The fluoride contamination severity takes increasing importance in view of relatively recent finding of association between fluoride contamination and bone cancer.

It may be also noted that for most of these contaminations technologies are available; however, their deployment status is not always clear. Besides, there are competing institutional (like DRDO and BARC) and commercial technologies available. Since for the policy makers it is the efficiency (effectiveness, cost, accessibility, maintenance) of the solutions, rather than their origin, is critical, an in-depth study of CSIR technologies in relation to the other technology options is necessary.

V CONCLUSION

CSIR and other institutes already have a bunch of potential technologies seems a promising solution for the niche water related problem like Arsenic, fluoride contaminations, salinatisation, monitoring , Waste water treatments, monitoring the water quality etc. Efforts should be make towards screen some useful technologies as per their value proposition and Nation 's priorities and upgraded these technologies to highest technology readiness level i.e. market launch (commercialization)

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Performance Enhancement in a Cognitive Radio Under a High Probability of Detection Constraint

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ABSTRACT

Cognitive radio is a new promising technology that aims to improve the spectrum scarcity problem in wireless communications by allowing use of unlicensed (secondary) users to frequency bands that are provided to licensed (primary) users, in a way which does not affect the quality of service (QoS) of the licensed networks [1], [2]. In this paper we propose to improve the sensingthroughput tradeoff in OSA cognitive radio networks by performing spectrum sensing and data transmission at the same time. We also compare the average achievable throughput of the proposed cognitive radio system with the respective throughput of the conventional opportunistic spectrum access cognitive radio system in [12]. Finally it is shown that the proposed cognitive radio system exhibits improved throughput under a single high target detection probability constraint imposed for the protection of the primary users.

Keywords— Cognitive radio, opportunistic spectrum access,optimal power allocation, spectrum sensing, throughput maximization.

The word "Cognition" means the mental process of acquiring knowledge through thought, experience and the senses. Cognitive radio enables the users to determine portion of the spectrum available and detect the presence of licensed users when a user operates in licensed bands. There are four main cognitive tasks: spectrum sensing, spectrum management, spectrum mobility and spectrum sharing.



Fig. 1. Overview of cognitive radio: a) the spectrum hole concept; b) cognitive radio transceiver architecture.

Two main approaches have been proposed for cognitive radio so far, regarding the way that the cognitive radio users can access the licensed spectrum: (i) through opportunistic spectrum access (OSA) (ii) through spectrum sharing (SS).

The frame structure of the opportunistic spectrum access cognitive radio systems consists of a sensing time slot and a data transmission time slot, as depicted in Fig.2.

Frame n		Frame n+1	
Sensing	Data Transmission	Sensing	Data Transmission
τ ••	Т-т	** T **	Т-т

Fig.2 Frame structure of the conventional opportunistic spectrum access cognitive radio networks.

According to this frame structure, a secondary user ceases transmission at the beginning of each frame and senses for the status of the frequency band (active/idle) for τ units of time, whereas it uses the remaining frame duration $\mathcal{T} - \tau$ for data transmission. Therefore, an inherent tradeoff exists in this frame structure between the duration of spectrum sensing and data transmission, hence the throughput of the cognitive radio system. According to the classical detection theory an increase in the sensing time results in a higher detection probability and lower false alarm probability, which in return leads to improved utilization of the available unused spectrum. However, the increase of the sensing time results in a decrease of the data transmission time, hence the achievable throughput. of the cognitive radio system. This sensing-throughput tradeoff was addressed in [12], where the authors studied the problem of finding the optimal sensing time that maximizes the average achievable throughput of an OSA cognitive radio system under a single high target detection probability constraint for the protection of the QoS of the primary users. In [13], the authors considered the ergodic throughput maximization of an OSA cognitive radio system under an interference power constraint and a single value high target detection probability constraint $(Ptar_d \approx 1)$ and proposed an algorithm that obtains the sensing time and power allocation that maximizes the throughput of the cognitive radio system for Rayleigh fading channels. The paper is organised as follows :

Overcoming the sensing-throughput tradeoff in opportunistic spectrum access cognitive radio networks by performing spectrum sensing and data transmission at the same time. We compare the average achievable throughput of the proposed cognitive radio system with the respective throughput of the conventional opportunistic spectrum access cognitive radio system in [12]. It is shown that the proposed cognitive radio system exhibits improved throughput under a single high target detection probability constraint imposed for the protection of the primary users.

I OVERVIEW OF THE SPECTRUM SENSING MODEL

(a) System Overview-

Let g and h denote the instantaneous channel power gains from the secondary transmitter (SU-Tx) to the secondary receiver (SU-Rx) and the primary receiver (PU-Rx), respectively. The channel power gains g and h are assumed to be ergodic, stationary and known at the secondary users similar to [8], [9], [13], [14], [15], [17], whereas the noise is assumed to be circularly symmetric complex Gaussian (CSCG) with zero mean and variance σ_n^2 namely $\mathcal{CN}(0, \sigma_n^2)$] It should be noted here that knowledge of the precise channel power gain h is very difficult to be obtained in practice and therefore our results serve as upper bounds on the achievable throughput of the cognitive radio system.

The proposed cognitive radio system operates as follows. In the beginning, an initial spectrum sensing is performed, in order to determine the status (active/idle) of the frequency band. When the frequency band is detected to be idle, the secondary transmitter accesses it for the duration of a frame by transmitting information to the secondary receiver. The latter decodes the signal from the secondary transmitter, strips it away from the received signal, and uses the remaining signal for spectrum sensing, in order to determine the action of the cognitive radio system in the next frame. At the end of the frame, if the presence of primary users is detected, namely if the primary users started transmission after the initial spectrum sensing was performed, data transmission will be ceased, in order to protect the primary users from harmful interference. In the opposite case, the secondary users will access the frequency band again in the next frame. Finally, the process is repeated.

(b) Receiver Structure-

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$$y = \theta x_n + x_s + n \tag{1}$$

where θ denotes the actual status of the frequency band ($\theta = 1$ if the frequency band is active and $\theta = 0$ if it is idle), xp and xs represent the received (faded) signal from the primary users and the secondary transmitter, respectively, and finally n denotes the additive noise. The received signal y is initially passed through the decoder, as depicted in Fig. 4, where the signal from the secondary transmitter is obtained. In the following, the signal from the secondary transmitter is cancelled out from the aggregate received signal y, and the remaining signal is used to perform spectrum sensing

 $y = \theta_{X_p} + n$, (2)

This is the same signal that the secondary receiver would receive if the secondary transmitter had ceased data transmission, which is the conventional way that was proposed to perform spectrum sensing.

Here, instead of using a limited amount of time τ , the whole duration of the frame *T* can be used for spectrum sensing.

(c) Frame Structure

The frame structure of the proposed cognitive radio system is presented in Fig. 8 and consists of a single slot during which both spectrum sensing and data transmission are performed at the same time, using the receiver structure presented in the previous subsection. The advantage of the proposed frame structure is that the spectrum sensing and data transmission time are simultaneously maximized, whereas, more specifically, they are equal to the frame duration.



Fig.3 Frame structure of the proposed cognitive radio system.

The second important aspect is that the sensing time slot τ of

the frame structure of Fig.3 is now used for data transmission,





Fig. 4 Flow Chart of the proposed cognitive radio system.

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II AVERAGE ACHIEVABLE THROUGHPUT OF THE PROPOSED COGNITIVE RADIO SYSTEM UNDER A HIGH TARGET DETECTION PROBABILITY CONSTRAINT

In this section, we study the average achievable throughput of the proposed cognitive radio system and compare it with the respective achievable throughput of the cognitive radio system that operates based on the conventional frame structure depicted in Fig. 2. We consider, similar to the work in [12], a single high target detection probability constraint for the protection of the primary users from harmful interference.

Considering the fact that the priority of a cognitive radio system is and should be the protection of the quality of service (QoS) of the primary network, a high target detection probability is required, in order to ensure that no harmful interference is caused to the licensed users by the secondary network. For instance, the target probability of detection in the IEEE 802.22 WRAN standard [5] is chosen to be 90% for a signal-to-noise ratio (SNR) as low as -20 dB for the primary user's signal at the secondary detector. We denote this target detection probability in the following by

$$P_{d} = Q\left(\left(\frac{\epsilon}{\sigma_{n}^{2}} - \gamma - 1\right)\sqrt{\frac{\tau f_{s}}{2\gamma + 1}}\right)$$

$$P_{fa} = Q\left(\left(\frac{\epsilon}{\sigma_{n}^{2}} - 1\right)\sqrt{\tau f_{s}}\right)$$
(3)

$$= Q\left(\sqrt{2\gamma + 1} Q^{-1}(P_d) + \sqrt{\tau f_s \gamma}\right)$$
(4)
we ϵ denotes the decision threshold of the energy detector

where ϵ denotes the decision threshold of the energy detector γ the received signal-to-noise ratio (SNR) from the primary user at the secondary detector,

au denotes the sensing time

fs represents the sampling frequency.

Q is complementary distribution function of the standard Gaussian.

For a given target detection probability $P_d = \overline{P_d}$ the decision threshold ϵ is given by

$$\in = \sigma_n^2 \left(\sqrt{\frac{2\gamma + 1}{\tau_{f_s}}} Q^{-1}(\overline{P_d}) + \gamma + 1 \right)$$
(5)

In the following proposition, we show that the probability of false alarm Pfa of the energy detection given by equation (4) is an increasing and concave function of the probability of detection Pd for $Pd' \ge 0.5$, two properties that will be discussed further in the analysis.

Proposition 1: The probability of false alarm Pfa under the energy detection scheme given by equation (4) is an increasing function of the probability of detection Pd and is also a concave function of the probability of detection Pd for $Pd \ge 0.5$.

By setting $\alpha = \sqrt{2\gamma + 1}$ and $\beta = \sqrt{\tau f_s} \gamma$ in equation (4) the false alarm probability P_{fa} is given by

$$P_{fa}(P_d) = Q(\alpha \ Q^{-1}(P_d) + \beta)$$

In order to prove that the probability of false alarm Pfa is an increasing function of the probability of detection Pd_{2} we take the derivative of the probability of false alarm with respect to the probability of detection. The latter is given by

$$\frac{dP_{fa}}{dP_d} = \frac{d}{dP_d} \left[Q\left(\alpha Q^{-1}(P_d) + \beta\right) \right] \\
= \left\{ -\frac{1}{\sqrt{2\pi}} exp\left(-\frac{\left[\alpha Q^{-1}(P_d) + \beta\right]^2}{2} \right) \right\} \cdot \left[\frac{d}{dP_d} \left[\alpha Q^{-1}(P_d) + \beta \right] \right] \\
= -\frac{\alpha}{\sqrt{2\pi}} exp\left\{ -\frac{\left[\alpha Q^{-1}(P_d) + \beta\right]^2}{2} \right\} \cdot \frac{dQ^{-1}(P_d)}{dP_d} \tag{6}$$

Considering that $Q^{-1}(P_d) = \sqrt{2} erf^{-1}(1 - 2P_d)$

We have
$$\frac{dQ^{-1}(P_d)}{dP_d} = \sqrt{2} \cdot \frac{d[erf^{-1}(1-2P_d)]}{dP_d}$$

=- $\sqrt{2\pi} exp\{[erf^{-1}(1-2P_d)]^2\}$ (7)

$$\frac{dP_{fa}}{dP_d} = \alpha \cdot \exp\left\{ [erf^{-1}(1-2P_d)]^2 - \frac{1}{2} \cdot [\alpha Q^{-1}(P_d) + \beta]^2 \right\}$$
(8)

Since $\alpha = \sqrt{2\gamma + 1} > 0$ it results from (8) that $\frac{dP_{fa}}{dP_d} \ge 0$ And therefore the probability of false alarm $P_{fa}(P_d)$ is an increasing function of the probability of detection P_d .

Now, by taking the second derivative of the false alarm probability P_{fa} with respect to the detection probability P_d , we have

$$\frac{d^{2}P_{fa}}{dP_{d}^{2}} = \alpha^{2} \frac{\left[\alpha Q^{-1}(P_{d}) + \beta\right]}{\sqrt{2\pi}} \left[\frac{dQ^{-1}(P_{d})}{dP_{d}}\right]^{2} \\ \cdot exp\left\{-\frac{\left[\alpha Q^{-1}(P_{d}) + \beta\right]^{2}\right\}}{2} - \frac{d^{2}Q^{-1}(P_{d})}{dP_{d}^{2}} \\ \cdot \frac{\alpha}{\sqrt{2\pi}}exp\left\{-\frac{\left[\alpha Q^{-1}(P_{d}) + \beta\right]^{2}}{2}\right\}.$$
(9)

Where

$$\frac{d^2 Q^{-1}(P_d)}{d P_d^2} = \frac{d}{dP_d} \left(-\sqrt{2\pi} \exp\left\{ [erf^{-1}(1-2P_d)]^2 \right\} \right)$$
$$= -\sqrt{2\pi} \exp\left\{ [erf^{-1}(1-2P_d)]^2 \right\}.$$
$$\cdot \frac{d}{dP_d} \left([erf^{-1}(1-2P_d)]^2 \right)$$

$$= -2\sqrt{2\pi} \ [erf^{-1}(1-2P_d)] \exp\{[erf^{-1}(1-2P_d)]^2\}.$$

$$\cdot \frac{d}{dP_d} (erf^{-1}(1-2P_d))$$

$$= 2\sqrt{2\pi} \ [erf^{-1}(1-2P_d)] \exp\{2[erf^{-1}(1-2P_d)]^2\}.$$

(10)

$$= 2\sqrt{2\pi} \left[erf^{-1}(1-2P_d) \right] \exp\{2\left[erf^{-1}(1-2P_d) \right]^2 \}$$

Thus it results from the equations (7),(9) and (10) that the second derivative of the false alarm probability P_{fa} with respect to the detection probability P_d is finally given by

$$\frac{d^{2}P_{fa}}{dP_{d}^{2}} = \{ \alpha [\alpha Q^{-1}(P_{d}) + \beta] - \sqrt{2} erf^{-1}(1 - 2P_{d}) \}.$$

Hougandhan - AISECT University Journal Vol. VI/Issue XI March 2017

$$\frac{\alpha\sqrt{2\pi} \exp\left\{\frac{4\left[erf^{-1}(1-2P_d)\right]^2 - \left[\alpha Q^{-1}(P_d) + \beta\right]^2}{2}\right\}}{2} = \alpha\sqrt{2\pi}\left[(\alpha^2 - 1)Q^{-1}(P_d) + \alpha\beta\right].$$

$$\cdot exp\left\{\frac{4[erf^{-1}(1-2P_d)]^2 - [aQ^{-1}(P_d) + \beta]^2}{2}\right\}$$
(11)
For a target detection probability

$$P_{d} \ge Q\left(-\frac{\alpha\beta}{\alpha^{2}-1}\right) \ge 0.5$$

The second derivative of the false alarm probability P_{fa} with respect to the detection probability P_d from (11) turns out to be

$$\frac{d^2 P_{fa}}{d P_d^2} \le 0$$

Thus the probability of false alarm $P_{fa}(P_d)$ is a concave function of the detection probability P_d for $P_d \ge 0.5$.

We can now focus on the average achievable throughput of the cognitive radio system. The instantaneous transmission rate of the cognitive radio system when the frequency band is actually idle (H_0) is given by

$$r_0 = \log_2\left(1 + \frac{gP}{\sigma_n^2}\right) \tag{12}$$

However, considering the fact that perfect spectrum sensing may not be achievable in practice due to the nature of wireless communications that includes phenomena such as shadowing and fading, we consider the more realistic scenario of imperfect spectrum sensing, where the actual status of the primary users might be falsely detected. Therefore, in this paper, we also consider the case that the frequency band is falsely detected to be idle, when in fact it is active (H₁). Following the approach in [15], [22], the instantaneous transmission rate in this case is given by

$$r_1 = \log_2\left(1 + \frac{g_P}{\sigma_n^2 + \sigma_p^2}\right) \tag{13}$$

where σ_p^2 denotes the received power from the primary users. The average achievable throughput of the cognitive radio system that operates based on the conventional frame structure of Fig. 2 is given by

$$\overline{R}(\tau) = \overline{R}_0(\tau) + \overline{R}_1(\tau) \tag{14}$$

Where
$$R_0(\tau)$$
 and $R_1(\tau)$ are given by
 $\overline{R}_0(\tau) = \frac{T-\tau}{T} P(H_0) \left(1 - P_{fa}(\tau)\right) r_0$
(15)

$$\overline{R}_1(\tau) = \frac{T-\tau}{T} P(H_1) \left(1 - P_d(\tau) \right) r_1 \tag{16}$$

respectively. In the equations above, \mathcal{T} represents the frame duration, $P(H_0)$ the probability that the frequency band is idle, and $P(H_1)$ the probability that the frequency band is active. Under the proposed cognitive radio system, spectrum sensing is performed simultaneously with data transmission, whereas the sensing time and data transmission time are equal to the frame duration , as seen in Fig. 8. Therefore, the average

achievable throughput of the proposed cognitive radio system is given by

$$\overline{C} = \overline{C_0} + \overline{C_1} \tag{17}$$

where $\overline{C_0}$ and $\overline{C_1}$ denote the average achievable throughput when the frequency band is actually idle and active (but falsely detected to be idle), respectively, and are given by

$$\overline{C_0} = P(H_0) \left(1 - P_{fa}(T) \right) r_0 \tag{18}$$

$$\overline{C_1} = P(H_1) (1 - P_d(T)) r_1$$
(19)

respectively. For a target probability of detection $\overline{P_d}$ we can now show that the proposed cognitive radio system exhibits higher average achievable throughput compared to the cognitive radio system that operates based on the conventional frame structure shown in Fig. 2. Following the FCC requirements in [4], the secondary users should detect a worstcase SNR from the primary users, regardless if the spectrum sensing is performed at the receiver or the transmitter. This worst-case SNR is denoted here by $\overline{\gamma}$ From the classical detection theory [10], [11], it is known that for a target probability of detection $\overline{P_d}$, the higher the sensing time, the lower the probability of false alarm Pfa. Therefore, for a target probability of detection $P_d = \overline{P_d}$ sensing time $0 < \tau \leq T$, it results from the equation (4) that

$$P_{fa}(\tau) = Q\left(\sqrt{2\overline{\gamma}+1} Q^{-1}(P_d) + \sqrt{\tau f_s} \overline{\gamma}\right)$$

$$\geq Q\left(\sqrt{2\overline{\gamma}+1} Q^{-1}(\overline{P}_d) + \sqrt{T f_s} \overline{\gamma}\right)$$

$$= P_{fa}(T)$$
(20)

Considering the fact that the complementary cumulative distribution function of the standard Gaussian (x) is a decreasing function of x. As a result, for a sensing time $0 \le \tau \le T$, it results from the equations (14)-(20) that

$$\overline{R}(\tau) = \overline{R}_0(\tau) + \overline{R}_1(\tau)$$

$$= \frac{T-\tau}{T} P(H_0) \left(1 - P_{fa}(\tau)\right) r_0 + \frac{T-\tau}{T} P(H_1) \left(1 - \overline{P}_d\right) r_1$$

$$< P(H_0) \left(1 - P_{fa}(\tau)\right) r_0 + P(H_1) \left(1 - \overline{P}_d\right) r_1$$

$$\leq P(H_0) \left(1 - P_{fa}(T)\right) r_0 + P(H_1) \left(1 - \overline{P}_d\right) r_1$$

$$= \overline{C_0} + \overline{C_1} = \overline{C}$$
(21)

i.e. that the average achievable throughput of the proposed cognitive radio system for a target detection probability $P_d = \overline{P_d}$ is higher compared to the respective of the cognitive radio system that employs the frame structure depicted in Fig. 2, namely it results that

$$\overline{C} > \overline{R}(\tau) \tag{22}$$

for a sensing time $0 \leq \tau \leq T$.

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III SIMULATION RESULTS

In this section, we present the simulation results for the proposed opportunistic spectrum access cognitive radio system using the energy detection scheme as a spectrum sensing technique. The frame duration is set to T = 100 ms, the probability that the frequency band is idle is considered to be P(H0) = 0.6, whereas the sampling frequency *fs* is assumed to be 6 MHz. The channels g and h are assumed to follow the Rayleigh fading model and more specifically, they are the squared norms of independent CSCG random variables that are distributed as $\mathcal{CN}(0, 1)$ and $\mathcal{CN}(0, 10)$, respectively. The average tolerable interference power at the primary receiver is considered to be $\Gamma = 1$ and the received SNR from the primary user is considered to be $\gamma = -20$ dB. As in [14], an additional channel power gain attenuation is considered here for the channel h between the secondary transmitter and the primary receiver, where an attenuation of 10 dB for example, means that $\{h\} = 1$.

In Fig. 5, the average achievable throughput versus the sensing time τ is presented for the proposed cognitive radio system (solid line) and the cognitive radio system that employs the conventional frame structure of Fig. 2 (dashed line), for the case of a single high target detection probability constraint. The received signal-to-noise ratio (SNR) from the secondary transmitter at the secondary receiver is considered to be SNRs = 20 dB as in [12], the target probability of detection is set to $\overline{P_d}$ = 99.99%, in order to effectively protect the primary users from harmful interference, whereas different values of the target detection signal-to-noise ratio from the primary user (denoted by SNRp) are presented. It can be clearly seen that the average achievable throughput of the proposed cognitive radio system (solid line) is significantly higher compared to the respective achievable throughput of the cognitive radio system that employs the conventional frame structure of Fig. 2 (dashed line). This throughput improvement can be explained by the fact that the whole duration of the frame \mathcal{T} is used for data transmission, as opposed to the conventional frame structure of Fig. 2, where only a part of the frame is used for data transmission (i.e. $T - \tau$). Moreover, the improved sensing capabilities of the proposed cognitive radio system also contribute to the throughput improvement of the cognitive radio system by enabling a more efficient usage of the available unused spectrum. More specifically, it can be seen from Fig. 5 and the equation (4) that for the same target probability of detection $\overline{P_d}$, the probability of false alarm Pfafor the optimal sensing time under the conventional frame structure is higher compared to the respective false alarm probability of the proposed cognitive radio system. The latter remark can be explained by the fact that the whole duration of the frame T is used for spectrum sensing in the proposed system, as opposed to merely a part of the frame under the conventional frame structure. In Fig. 6, the average achievable throughput is presented versus the target probability of detection $\overline{P_d}$, for a target detection signal-to-noise ratio from the primary user equal to SNR_P = -22dB. It can be clearly seen

from Fig. 6 that the average achievable throughput under the proposed cognitive radio system is significantly higher compared to the respective achievable throughput of the system that employs the conventional frame structure whereas the decrease in the average achievable throughput as the target probability of detection $\overline{P_d}$ receives higher values is small, especially compared to the respective of the secondary users that employ the conventional frame structure of Fig. 2. This means that the proposed cognitive radio system can provide better protection for the primary users on the one hand, while achieving an increased throughput for its users on the other, even for very high values of target detection probability and very weak signals from the primary users. This can be further seen from Fig. 7, where the average achievable throughput from the primary users (SNRp), for a target probability of detection equal to $\overline{P_d} = 99.99\%$.



Fig. 5 Simulation Results of Average achievable throughput of the proposed and conventional opportunistic spectrum access cognitive radio system versus the sensing time t, for various values of the target detection SNR from the primary user (SNRp) and for a target detection probability $\overline{P_d} = 99.99\%$.



Fig.6. Average achievable throughput of the proposed and conventional opportunistic spectrum access cognitive radio system versus the target probability of detection $\overline{P_d}$ for various values of the target detection SNR from the primary user (SNRp).

Houzandhan - AISECT University Journal Vol.VI/Issue XI March 2017



Fig. 7. Average achievable throughput of the proposed and conventional opportunistic spectrum access cognitive radio system versus the target detection SNR from the primary user (SNRp) for a target detection probability $\overline{P_d}$ = 99.99%.

IV CONCLUSION

The proposed novel cognitive radio system is expected to improve the achievable throughput of opportunistic spectrum access by performing data transmission and spectrum sensing at the same time. More specifically, the average achievable throughput of the proposed cognitive radio system under a single high target detection probability constraint is expected that it can achieve significantly improved throughput compared to the respective conventional cognitive radio systems.

In addition, we studied the problem of maximizing the ergodic throughput under joint average transmit and interference power constraints, and proposed an algorithm that acquires the optimal target detection probability and power allocation strategy that is expected to maximize the ergodic throughput of the proposed cognitive radio system.

Furthermore, it is expected that for low values of channel power gain attenuation between the secondary transmitter and the primary receiver, a high target detection probability ($\overline{P_d} \square$ 1) will lead to the maximum achievable ergodic throughput, whereas for higher values of channel power gain attenuation, spectrum sensing not only does not provide better protection for the primary users, but it also has a negative effect on the achievable ergodic throughput of the cognitive radio system and should therefore be avoided.

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Design and Implementation of 12 bit Pipeline Analog to Digital Converter

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ABSTRACT

The Power dissipation and chip area of analog and mixed-signal circuits emerged has as a critical design constriction in today's VLSI design systems. This paper presents a multilevel design optimization for reducing the power dissipation and high sampling rates of a pipelined analog-to-digital converter. A 12 b 75-Msample/s analog-to-digital converter has been fabricated in a0.18-um CMOS technology. The converter uses pipelined seven stages and implements 2 bit per stage architecture. It is a fully differential analog circuit with a full-scale sinusoidal input at 20 MHz. It dissipates 3.5mW.

Key Words: - Operational Amplifier, Pipe Line ADC, S/H Circuit, Comparator.

I INTRODUCTION

Enabled by the long-lasting destructive scaling of integrated circuit technology, digital signal processing (DSP) and computing have developed into the main progress drivers in modem electronic circuits. With decreasing number of transistors and transistor dimensions, binary totaling are performed at lower energy levels, low power dissipation and higher speed, resulting in an increasing number of highly sophisticated architectures and algorithms that can be capably implemented using integrated digital electronic Most essentially, the concurrent circuits. requirement of high speed and low distortion and low noise and less chip size in the processing of analog signals often translates into poor power effectiveness and limited accuracy. In addition to decreasing supply voltages and reduced intrinsic transistor gain in modern electronics technologies make the design of highly linear, high energetic range analog edifice of blocks an increasingly challenging role [1].

As an outcome of these tendencies, manufacturing lean towards a system separation with a minimum number of virtually necessary analog parts. Amongst them is the Analog-to-Digital Converter (ADC), which is required to interface digital signal processors to "real life" signals such as radio, satellite, system image and speech waveforms. The exploration for the most part concerned with improving the speed and power efficiency and accuracy of analog to digital converters. In particular, we explored the prospect to overcome analog circuit

In CMOS technology, an easy advance is to use Flash ADC [3]. CMOS flash ADC's with array averaging is reported to realize a 1.3 G samples/s alteration rate. However the complexity and power dissipation of the flash ADC grows exponentially as resolution increases because the number of comparators increases by 2n (where n is the resolution of flash adc). This makes flash ADCs inappropriate for resolutions greater than 8 bits because they consume large area and high power dissipation as well asc. Many high speed ADC architectures have been reported to try and conquer the problems of flash ADCs. Sub-ranging, pipeline and folding & interpolating architectures are illustrations of such efforts and have been successful in many video/image processing and communications , modem medical imaging applications [4],[5]

The Pipeline ADC implemented in this approach is a dynamic approach that combines the ease of a flash with the residue type operation for pipeline implementation. Many novel ideas have been implemented to improve the architecture such as forefront and backdrop calibration [6], [7], [8].

II PIPELINE ADC ARCHITECTURE

Pipeline ADC architecture radically reduces the number of comparators required to realize an n-bit conversion per stage and, hence, increases sampling frequency and requires the analog bandwidth and maximum sample rate of the converter. They also consume considerably less power, less area high throughput thereby reducing linearity problems associated with thermal gradients. This type of architecture proposes the most resolution at high speeds of any accessible ADC architectures. A pipelined analog to digital converter is a good example of a pipelined signal processor. One example of a pipelined analog to digital converter is a pipelined sub ranging analog to digital converter. In a sub-ranging ADC, the conversion operation is alienated into a number of steps. During each stage of the conversion, a certain number of bits of the digital output are resolved. The most significant bits are resolved in the first step, and the least significant bits are resolved in the last stage the pipeline ADC architecture as shown in Figure 1 operates on sample-and-hold (S/H) in every stage to Multi increase the throughput. Each stage consists of an S/H, an N-bit flash ADC, a renewal DAC, a subtractor, and a residue amplifier. Pipelined converters are more frequently used to realize high

conversion rates per stage since they provide effective signal bandwidths equal of 10-100 MHz (sample rates of 20-200 MHz). The conversion method is similar to that of sub-ranging conversion in each bit stage.



Fig 1. Block diagram of a pipelined ADC

This is mathematically described as-

Vi = 2 * Vi-1 - bi-1 * Vref(1)			
Where bi-1 is given by			
bi-1 =	+1 if Vi-1 > 0		
	-1 if Vi $-1 < 0$		

III CIRCUIT IMPLEMENTATION

Each stage consist on this schematic shown in fig 2



Fig. 2 Schematic of Single Stage of Pipeline ADC

For the implementation of each stage of pipeline ADC the need of components are

- (a) Sample and Hold.
- (b) TIQ Comparator.
- (c) 2-bit DAC.
- (d) gain Amplifier of 4.
- (e) to to be encoder
- (f) Operational amplifier
- (g) D flip-flop

IV SAMPLE & HOLD CIRCUIT

The basic elements of a Sample & Hold circuit are a storage element and a switch.



Fig. 3 Schematic of S/ H Circuit

Sample-and-hold circuitry is essential for ADC front-end circuits to permit the ADC to track and then hold the inmost bound signal. (See [8] for argument of sample and hold circuitry.) Once the signal has been tracked, the ADC pitch a switch to disconnect the input signal from the front end it then holds that input signal level long Enough for the ADC to entire its conversion cycle

V DESIGN OF COMPARATOR

Implemented flash ADC features the Threshold Inverter Quantization (TIQ) technique for high speed and low power ADC using typical CMOS technology.



Fig. 4 Schematic of Comparator

Fig. 4 shows the circuit diagram of the TIQ comparator. The use of cascading inverters the same as a voltage comparator is the cause for the technique's name. The voltage comparators compare the input voltage with internal reference voltages, which are decided by the transistor sizes of the inverters. We have supposed that both transistors are in the active region, the gate oxide thickness (Cox) for both transistors will be same, and the lengths of both transistors (Lp and Ln) are also the same fig.

Escalating equation

$$\mathbf{V}_{t} = \frac{\sqrt{\frac{\mu_{p} \mathbf{W}_{p}}{\mu_{n} \mathbf{W}_{n}} (\nabla_{dd} - \nabla_{tp}) + \nabla_{tn}}}{\frac{1 + \sqrt{\frac{\mu_{p} \mathbf{W}_{p}}{\mu_{n} \mathbf{W}_{n}}}}{\mathbf{W}_{n}}}$$

wherever, μp and μn are the electron and hole mobility.

VI DESIGN OF TWO BIT DAC

Nearby various arrangements that can be utilized to design digital to analog converter (DAC) like resistor ladder (voltage divider architecture), charge division principle, current division architecture and many additional, but all of this employ lot of components and are complex in nature. Therefore to digital CMOS technology, multiplexer logic has been utilized to behave like DAC, seeing as the purpose of DAC is to provide an analog voltage analogous to digital bits, as shown in fig 3



Fig. 5 Schematic of 2-Bit DAC

VII DESIGN OF D FLIP-FLOP

Flip-flops are the most traditional storage elements used to realize synchronous logic circuits. It is one of the necessary elements in the pipeline ADC, the major point to elevate here is that, it is used as delay element which will synchronize the bits of the all stages, by configuring the flip-flop as unreliable length shift register. it will synchronize the output of pipeline ADC. For example for 7 bit pipeline ADC, first stage has 7 bit shift register, in the later stage it will be of length 6 and decrementing to 1 in the last stage. The additional use of this flip-flop is in the end of alteration signal generation



Fig. 6 Schematic of D-Flip-Flop

in which it is build up as counter which will set up counting when the ADC get start of conversion signal and will be stopped up after counting seven clock cycles.

VIII TC TO BC ENCODER

The encoder converts the 01 code in to the 1 code in two ladder. The 01 code is changed to the 1-outof-n code, through the '01' generators. This code is then converted to binary code. Shows in fig a single cell optimized '01' generator circuit by signifies of only four transistors, only if full swing output in a small design area.



Fig. 7 Schematic of TC to BC Encoder

IX DESIGN OF INVERTING GAIN AMPLIFIER

Each stage of pipeline ADC stage has one gain block, whose gain depends on the number of output bits per stage. Thus the OPAMP has to be configured in closed loop style



Fig. 8 Inverting Gain Amplifier

X DESIGN OF TWO STAGE OPAMP

Operational Amplifiers are the vertebrae for many analog circuit designs. The speed and accuracy of these circuits depends on the bandwidth and DC gain of the Op-amp, the realization of a CMOS OPAMPs so as to combines a significant dc gain with higher unity gain frequency has been a the majority of difficult problem. There have been several circuits proposed to evaluate this problem. The purpose of the design methodology in this paper is to propose accurate equations the following specification have been used for design of the two stage OPAMP

 $\label{eq:Vd} \begin{array}{l} Vdd = Vss = \pm 1.25 \\ Av = 5000 \ V/V = 73.97 \ dB \\ GBW \geq 100 \ MHz \\ Slew Rate \geq 30 \ V/\mu s; \\ ICMR = \pm 0.8 \ V \\ C_L = 5pF \\ For 60^0 \ phase \ Margin, \ C_C\!\!>\!\!0.22 \ C_L \\ C_C\!\!=\!\!1.5pF \end{array}$



Fig. 9 Schematic of Two Stages Operational Amplifier



Fig. 10 Transient Result of Sample & Hold Circuit



Fig. 11 Gain & Phase Plot Result of Operational Amplifier

Gain=75.94dB,Unity Gain Frequency=100MHz Slew Rate= 200v/us CMRR= 79.397dB



Fig .12 Transient Analysis of Comparator



XI SIMULATION RESULTS





Fig. 17 the plot of 12-bit pipeline ADC with sinusoidal input

XII CONCLUSION

The design of 12-bit Pipeline ADC is implemented in LT SPICE schematic editor using CMOS 180nm technology and the results are Simulation with SWTCHER CAD –III. The Overall Design designed is simulating with various input signals and the results are obtained reasonable for the specifications. This 12-bit pipeline ADC is operate up to 15 MHz input frequencies and the Maximum sampling rate get without any missing codes is up to 75 MHz sampling rates. In this paper power dissipation of 3.7mW from Supply Voltage (-1.8V to 1.8V) using analog input (-0.5V to 0.5V) is achieved.

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Sflougeardben - AISECT University Journal Vol.VI/Issue XI March 2017

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Smart Grids and Other Measures of Renewable Energy Integration–A Status Review

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ABSRACT

The aim of this literature review is to give an overview of recent research works and developments in the area of Renewable Energy Integration. The research papers of last 4 years spanning from 2013 to 2016 have been reviewed. The basics of electrical engineering have not changed much over years. For example, most of the power generation is based on revolving turbines. The turbines may be steam, hydro, wind or any other. Even the solar photo-voltaic power generation is based on photo electric effect discovered by German physicist Heinrich Rudolf Hertz in 1887. Due to climate change issues, renewable sources of energy are gaining importance. Energy efficiency is another area of research work and concepts like green building are evolving. Grid is getting smarter day by day. It can gradually address issues like integration of renewable. Even Grid scale storage systems are thought of. Wireless Transmission of electricity is also researched. The papers which have been reviewed, deal with smart grid and some of them find smart grid useful for Renewable energy (RE) integration. There are other research papers dealing with grid scale energy storage system. Considering the research work in the past and the limitations of such studies, likely future scope has been discussed. For research work, capacity addition of renewable energy sources in Madhya Pradesh is examined in brief based on the projections made by the Government and also the regulatory requirements towards Renewable Power Obligation (RPO). Various features of Renewable energy like uncertainty, volatility of availability of energy, intermittent nature, reactive power requirement, problems of forecasting, 'must run' status in merit order dispatch and impact on conventional plants are involved in respect of further capacity addition of renewable in Madhya Pradesh.

I THE CURRENT STATUS

- (a) India was having total installed capacity of only 1362 MW at the time of independence. Out of this, Thermal capacity was 854 MW and Hydel capacity was 508 MW. It has now increased to 298059 MW as on 31.3.2016 [1]. Out of total installed capacity in 2016, renewable sources of generation contribute 13 % (38821 MW). As against this total installed capacity in Madhya Pradesh is 17644 MW as on 31.3.2016 and contribution of renewable sources of generation is nearly 11 % (1931 MW).
- (b) In a report "India Energy Outlook" [2] released by International Energy Agency in 2015, it is estimated that Installed capacity of India shall grow to 1075000 MW in 2040. Out of this share of Renewable power is estimated at 350000 MW (nearly 33%). Per capita consumption in India was 1075 in 2015, which is likely to reach 2000 kWh in 2040. This would still be below world average. Share of Industry in electrical consumption is projected to fall by 3% and agricultural sector by 6%. However, the domestic consumption is likely to increase in India sharply, due to urbanization and other factors. India's share in the global figure for people without access to electricity is likely to decline from 20% in 2013 to around 8% in 2030.
- (c) Madhya Pradesh has prepared a road map for 24X7 Power for all, as a joint initiative with Government of India. This document is availble at website of Ministry of Power (www.powermin.nic.in). In order to achieve the objective of 24 x 7 power for all, it is estimated that Madhya Pradesh would need to fully meet the increase in peak demand from 9598 MW (at state periphery in Fiscal Year (FY) 2015 to 12,643 MW in FY 2019 with corresponding increase in energy requirement from 55,622 MU in FY 2015 to 80,847 MU in FY 2019. It is estimated that renewable capacity of more than 2120 MW would be added in next 3 years. Madhya Pradesh has potential of renewable cap city of nearly 30000 MW. Madhya Pradesh is already providing 24X7 powers to all consumers other than agricultural. The document provides road map to continue this measure during years to come, at the same time ensuring financial viability of the sector.
- (d) The basics of electrical engineering have not changed much. For example, most of the power generation is based on revolving turbines. The turbines may be steam, hydro, wind or any other. Even the solar photo-voltaic power generation is based on photo electric effect discovered by German physicist Heinrich Rudolf Hertz in 1887. Later, Albert Einstein published a paper that explained experimental data from the photoelectric effect as the result of light energy being carried in discrete quantized packets in 1905.

Transmission over long distances over wires continues to exist. The quest for witricity (wireless electricity) is yet to be fulfilled. Due to climate change issues, renewable sources of energy are gaining importance. Grid is getting smarter day by day. It can gradually address the issue of integration of renewable. Even Grid scale storage systems are being thought of. This study plans to review papers published in last 5 years in the area of advancements in electrical engineering, so as to come out with a way forward for further research work.

II INTEGRATION OF RENEWABLE GENERATORS INCLUDING DISTRIBUTED ENERGY RESOURCES (DERS) INTO THE GRID

- (a) Technological and manufacturing progress along with climate change concerns are transforming electric power systems with the integration of an increasing share of clean renewable generation whose volatility, lack of active dispatch control, and absence of rotating inertia pose great challenges to the feasibility of efficient, resource-adequate, operationally reliable, and secure power systems. Conventional approaches to meeting these challenges with exclusive reliance on building a stronger transmission and distribution (T&D) infrastructure assisted with more flexible centralized generation e.g., combined cycle gas turbine (CCGTs) could fall short of economic and environmental sustainability goals. Recent research published in Proceedings of the IEEE (Vol. 104, No. 4, April 2016) deals with this subject and offers a distributed, massively parallel architecture that enables tractable transmission and distribution vocational marginal price (T&DLMP) discovery along with optimal scheduling of centralized generation, decentralized conventional and flexible loads, and distributed energy resources (DERs) [3].
- (b) In United States, a synergistic development has transformed the consumption side of power systems, particularly in the distribution or retail parts. Broadly construed distributed energy resources (DERs) connected to primary (9–20 kV) and secondary (120–470 V) voltage feeders are rendering the "pay our light bill". DERs include roof top PV, variable speed drives that power HVAC (Heating, Ventilation, Air Conditioning) systems with storage like capabilities, plug-in hybrid electric vehicle (PHEV) and EV battery charging with flexible time-shift-able demand, all with volt/var control capable devices, and data

centers and computing services with millisecond time-scale power management response capabilities. DERs can provide the requisite demand response and reserves for economically sustainable massive renewable energy integration yet to materialize.

- (c) The authors of the research Paper [3] have proposed distributed CPS architecture to-
 - (i) Co-optimize the allocation of conventional and DER capacity among real power, reactive power, and reserves while enforcing transmission line flow and distribution voltage constraints.
 - (ii) Derive transmission and distribution vocational (i.e., bus specific) dynamic marginal prices (T&DLMPs) that are consistent with individual DER capacity allocation optimality.
 - (iii) Drill down to the seconds and real time scale to extend capacity allocation scheduling decisions to optimal-feedback closed-loop policies that allow DERs to deploy in real time the reserves promised or scheduled at the hour-ahead or longer time scale.
 - (iv) Implement functional interfaces between cyber and physical system layers for all systems or sub-systems involved, whether big (the overall transmission or a distribution feeder system) or small [specific DERs and T&D devices such as lines, transformers, smart solid state transformers (SSTs), volt/var control devices such as PV converters–inverters and EV chargers etc.]
 - (d) Research methodology adopted is that of applied research, which inquires into the current problem of massive integration of renewable generation into the grid. One hundred and fifty three (153) references have been cited in the research paper. The main thrust of study is motivated by the realization that the desired provision of efficient and plentiful reserves from DERs is limited by the inability of existing centrally cleared power markets to address without loss of tractability the often nonlinear and inter temporally coupled DER preferences. As a result, existing and emerging centralized power market clearing approaches cannot derive T&DLMPs in a computationally tractable. scalable, and robust manner. Proposed DLMP discovery approach focuses on one type of reserves. Additional reserves can be treated similarly and modeled easily, with straight forward simple modifications in the DER reserve constraints. The reserve type selected to model is secondary or regulation reserves, offered

in the up and down direction, as is the current practice by PJM and NY ISO market operators.

- (e) Mathematical models have been developed by the authors. They have presented a distributed Cyber Physical System (CPS) architecture framework that overcomes existing power market computational tractability and information communication limitations to derive dynamic T&DLMPs, at distribution network buses. Extensive Lagrangian relaxation work specialized to robust and tractable versions of proximal message passing (PMP) algorithms including alternating direction method of multipliers (ADMM) algorithms, predictor corrector proximal multiplier (PCPM) and others are applied to proposed distributed CPS architecture framework. These algorithms can handle convex relaxation ac load flow modeling. Aspects like compatibility with cyber security remedies, operational efficiency and smart islanding and market performance including distribution market malfunction are discussed by the authors. Individual DER sub-problems and their cyber physical interfaces have been dealt with in the study. Illustrative numerical results of a distribution market with active distributed participants who participate in the clearing of DLMPs in a 24-h dayahead market setting are annexed with the study as Appendix.
- (f) The study has proposed an extension of marginal-cost-based wholesale power markets covering today hundreds of participants to include millions of distribution-network connected loads. generators. and distributed energy resources. Most importantly, tractable distributed computation and communication architecture is proposed that renders clearing of this new power market practically implementable. In this manner, cost of securing reserves may be brought down by enabling massive integration of renewable generation into the grid. Overall, this research paper provides solution not only to the issues faced by US but also by the rest of the world.
- (g) It is assumed by the authors that the regulation reserves offered to date primarily by centralized generators can be potentially provided by DERs at a possibly lower cost. The overall cost involved in communication and operational aspects need to be further

studied, as associated distribution feeder line buses number may be in millions.

III TRANSMISSION PLANNING CONSIDERING WIND POWER UNCERTAINITIES

- (a) Renewable including wind powers are adopted worldwide to mitigate climate change issues. However, there are uncertainties involved with the wind power. Sometimes load or wind curtailment is required due to inadequate transmission network. Recent research [4] published in CSEE Journal of Power and Energy Systems (Vol. 2, No. 1, March 2016) investigates a robust transmission planning method using scenarios of wind power uncertainties. Research methodology is experimental and a heuristic moment matching (HMM) method is applied to approximate the stochastic features of wind power. The simulation is carried out capturing various features using a number of scenarios. Twenty one (21) references have been cited by the authors.
- (b) In the opinion of authors, the problem of transmission network expansion planning (TNEP) has become increasingly complex. As per authors, one major challenge is that wind power has stochastic variations, and its stochastic features cannot be accurately formulated using a tractable mathematical equation. Robust TNEP can cope against all possible realizations of the renewable power defined in the uncertainty set. However, the uncertainty set needs to be carefully designed. A small uncertain set may not cover the entire spectrum and can result in solutions that may not correspond to all uncertain situations. On the other hand, the large uncertain set may lead to conservative solutions and thereby reduce the operating profits. Alternatively, a robust TNEP based on scenarios is proposed in the study, which avoids the chosen of uncertainty set.
- (c) Authors have applied an HMM method to generate scenarios to approximate the stochastic features of wind power, including expectation, standard deviation, skewness, kurtosis, and correlation matrix of wind farms. A robust TNEP problem is formulated based on the representative scenarios of wind power and random load. The proposed problem is optimally coordinated between the construction cost and penalty cost of both wind and load curtailment. The factors influencing the TNEP are studied, including the number of scenarios, wind farm capacity, and penalty factors. The results of the

analysis provide the references for flexible choosing parameters.

- (d) An analysis of the influence of the parameters on the planning scheme is shown by the authors in terms of number of wind power scenarios, capacity of wind farm and penalty factors for load or wind curtailments. The study is useful and can provide solution to Transmission planning based on the wind farm capacities and the penalties lay down by the Regulator. As renewable generation capacities are increasing day by day, transmission planning is required to take into account of uncertainties of such generation.
- (e) Study is, however, tested only on three cases: Garver 6-bus system, IEEE24-bus system, and IEEE RTS-96 system. The wind data is taken only from 3 wind farms. There is further scope for considering uncertainties of solar generation. The paper also does not consider the use of hybrid systems to avoid uncertainties of renewable generation. Further study may be conducted in minimising the uncertainties, firstly through hvbrid generation and then the approach suggested in the study may be adopted to further optimize the transmission planning process.

IV RENEWABLE ENERGY DIFFUSION IN THE DEREGULATED TEXAS ELECTRICITY MARKET

(a) All over world measures are being taken to mitigate climate change. In the United States, emission regulations are enacted at a state level; individual states are allowed to define what methods they will use to mitigate their carbon emissions. As a consequence of this, in the state of Texas new legislation has created a "deregulated" electricity market in which endusers are capable of choosing their electricity provider and subsequently the type of electricity they wish to consume (generated by fossil fuels or renewable sources). A research paper [5] published in 2015 in Journal of Power and Energy Engineering (2015, Vol.3) examines Renewable Energy Diffusion in the Deregulated Texas Electricity Market. The study analyzes the effects of carbon tax on the development of renewable generation capacity at the utility level while taking into account expected adoption of rooftop PV systems by individual consumers using agent based modeling techniques. Monte Carlo simulations have been performed to show carbon abatement trends and proffer updated renewable portfolio standards at various levels

of likelihood. Research methodology is experimental in nature. Thirteen (13) references have been cited by the authors.

- (b) In Texas, electricity industry was restructured similar to India in terms of having Generation and Transmission & Distribution sector. However, retail electric providers (REPs) were also mandated in Texas, who purchase the power from the Power Generating Companies (PGCs) and sell it to the end-use customer. Power generated is sent through power lines that belong to the Transmission & Distribution Service Provider (TDSP). The major incentive for the deregulated market is to allow the customers choose their REP as well as sell electricity back to the grid if they opt to do so. Environmental protocols mandates setting up a renewable portfolio standard (RPS) and mandating that half of all new capacity must be natural gas-fired (as opposed to the more traditional coal). The RPS also mandated that all utilities in the state must produce at least 2,000 MW of renewable energy (solar, wind, biomass, tidal, hydroelectric, geothermal, or landfill gas) by 2009. In 2005, the installed renewable capacity was past the 2009 goal and the State Senate Bill 20 updated goal to 5,880 MW (of which at least 500 must be from nonwind resources) for 2015 and a further goal of 10,000 MW was set for 2025. Meanwhile, the RPS allowed for the creation of a Renewable Energy Credit (REC) trading program to help meet the renewable energy capacity goals of the RPS. This program allowed utilities to buy and trade RECs to meet their company's RE capacity goals if, for whatever reason they did not want to install their own RE capacity directly
- (c) To analyze the Texas electricity market a nimble model, is developed by the authors, that combines both an agent-based framework, which characterizes adoptions of renewable power among individual consumers with a decision tree that characterizes the capacity building and electricity purchasing decisions made by energy consumers. The two submodels were coded on the same program to perform an integrated analysis on the diffusion of power generation profiles and the evolution of electricity Because of the high level of detail in the model, different functions are broken up into both functional groups to simplify calculations and into separate locations for a visually manageable and well-defined format. Different consumer segments have been examined and considering various carbon tax levels updated RPS have been proposed for a period upto 2030.

(d) The study has developed a model to analyze the renewable energy potential in the deregulated Texas electricity market, when a carbon tax is introduced. Utilizing data on consumer behavior, this research suggests that the combination of agent-based modeling and decision tree analysis can be a very useful tool for analyzing the future of the deregulated energy market. However, the study is limited to Texas in US and the income distribution data is taken only for the period from2005 to 2009. In US itself different policy is applicable for each State. As such, there is further scope to study the State in US, which has attained maximum RE potential till date.

V INTEGRATING RENEWABLE ENERGY AND SMART GRID TECHNOLOGY INTO THE NIGERIAN ELECTRICITY GRID SYSTEM

- (a) Renewable Energy and smart grid technology is being considered even for the countries having poor infrastructure in the area of power infrastructure. A research paper [6] published in 2014 recommends use of Renewable Energy and smart grid technology in the Nigerian Electricity Grid System. Research Methodology adopted is exploratory in nature. Twenty four (24) references are cited in the study.
- (b) The authors have given an overview of the power sector and current electricity situation in Nigeria. Inadequate generation capacities and poor maintenance thereof, insufficient coverage of transmission network, poor distribution infrastructure, high technical and commercial losses and power deficit conditions are discussed in the paper. Research paper states that Nigeria has huge renewable energy potential, which may be tapped to increase availability. Authors recommend use of Smart grid technology to integrate renewable energy resources. The contradictions between smart grid and the existing Nigerian Grid are also tabulated in the study. Considering the benefits of smart grid technology policy recommendations are made in the study. It is concluded that integration of smart grid technology and renewable into the Nigerian electricity grid system is the only solution to the electricity crisis in that country. As per study, the benefits of the smart grid technology will not only improve electricity production and efficiency in Nigeria, but will also enable electricity consumers to become producers of electricity and enhance Nigeria's international competiveness.

(c) Analysis like cost benefit analysis, Feed-in-Tariffs (FITs), Renewable Portfolio Standards (RPS), Renewable Energy Certificate (REC) are not discussed in order to determine the best policy mechanism for renewable energy and smart grid integration in Nigeria. There is scope of subsequent research in these areas.

VI GRID SCALE ENERGY STORAGE SYSTEM

- (a) Energy storage is recognized as an essential component of significantly increasing the penetration of renewable energy generation. As such, significant government and private efforts are being made in this direction. A research paper [7] included in the proceedings of IEEE (2014) deals with use of advanced lead acid batteries for grid scale energy systems. Research methodology adopted is exploratory in nature. Thirty (30) references are cited in the paper.
- The research paper discusses the 150 years (b) history of lead acid batteries and evolution of valve regulated lead-acid (VRLA) cells at a system level. It is mentioned in the study that Advanced Lead Acid Battery Consortium (ALABC) was formed in 1992 and has been a major sponsor of the advancement of a new generation of lead-acid battery design over the past 20 years. After high carbon content was found to provide benefits, the focus moved onto carbon-enhanced designs. Integrating carbon into the negative electrode of the cell has allowed VRLA cells to enter a new application space, cycling for extended periods at a partial state of charge (pSoC). Various developments in lead acid battery are given chronologically. including thermal management of an Ultra Battery bank (an inverter/charger and smart grid management), which can monitor the state of charge (SoC) and the state of health (SoH) of the battery during system operation.
- Study underlines that as the amount of (c) renewable penetration is increasing, utilities are placing constraints on the output of renewable generation plant. The most common form of constraint is ramp-rate limiting, where a utility would typically specify that a generation facility should not ramp at more than 10% of the maximum output per minute. This tends to exclude residential plant and is more commonly a requirement when plants are of a commercial size. Grid operators need to balance generation and load. On the generation side, the slower generators typically change hourly while generation associated with frequency regulation requires much faster response times. With renewable generation

increasing in US, it is estimated by the authors that the demand for frequency regulation is expected to rise from around 1% of capacity to around 2%–7% of capacity, depending on network constraints, as wind penetration reaches 20% of capacity. The fast response time of battery energy storage compared to gas turbine generators has found promising use in grid frequency regulation (often abbreviated to "regulation").

- (d) It is concluded by the authors that the significant advances in VRLA technology over the past decades have allowed lead-acid batteries to provide power handling performance and longevity competitive with other battery chemistries. This is also based on a technology that is well known in the industry, supported by proven transport, fire codes, building codes, and other safety standards as well as a mature, nearly 100%, recycling process. VRLA cells can now operate for extended periods at a partial charge, facilitating operation in utility applications, where the energy store can be called on to absorb or release energy. Based on the experience gained over the past decade with initial megawatt scale systems, a new generation of VRLA cell designs, system designs, and packaging are now emerging that are both lowering the cost of MW scale systems and improving performance.
- (e) The research paper focuses only on lead acid batteries for energy storage. There could be other approaches such as pumped hydro, thermal energy in storage (such as molten salt), kinetic energy in flywheels, compressed air energy storage (CAES) and electrical energy in capacitors. In batteries, even Lithium batteries may be considered. There is scope of further study in these areas and a comparison of various approaches may also be made by way of cost benefit analysis.

VII A FRAMEWORK FOR QUALIFYING AND EVALUATING SMART GRIDS APPROACHES

(a) Smart Grids (SGs) can efficiently control power flows by means of Information Technology (IT). Technically, a SG consists of a power system and a bi-directional communication system. Multi-Agent Systems (MAS) constitute a possible technology that can be applied to control and monitor the operation of power grids. Moreover, MAS exhibit distribution, adaptive and intelligent features. A research paper [8] published in Journal of Smart Grid and Renewable Energy (2013) proposes a framework of qualification and evaluation for comparison of SG approaches. The research methodology adopted is descriptive in nature. Fifty Nine (59) references have been cited by the authors.

- (b) A smart grid is defined as having the following seven principal characteristics, as specified by the US Department of Energy's National Energy Technology Laboratory in its modern grid strategy [8]. A smart grid:
 - (i) enables active consumer participation
 - (ii) accommodates all generation and storage options
 - (iii) enables new products, services, and markets
 - (iv) provides power quality for the digital economy
 - (v) optimizes asset utilization and operates efficiently
 - (vi) anticipates and responds to system disturbances
 - (vii) operates resiliently against attack and natural disaster
- (c) An overview of an evaluation framework for smart grids is given in the study. It is proposed to evaluate the societal impacts based on the criteria of Green House Gas (GHG) reduction, Energy security, Economic competitiveness & affordability and human integration. Different aspects of the framework are composed by the first (qualification) and second (evaluation) steps. The first step is detailed through two view-points or dimensions (structural and family problems) and the second step is detailed through the societal dimension. In order to evaluate the impact of the incoming smart grids, concepts must be defined, The concept of sustainability usually considered as a composition of Environment, Economy, and Society is integrated and human dimension representing system's control and supervision capabilities is also added in the study. Authors collected them within an assessment framework combining 4 different perspectives grouped under the umbrella term societal dimension, namely environmental, economic, quality of services and human integration approach.
- (d) Finally, a comparative study of the main multiagent approaches for smart grids was conducted using the qualification and evaluation framework previously defined. Evaluations based on Grid Agent, Home bots, Intelligent Distributed Autonomous Power System (IDAPS), Ideas and Power Matcher are tabulated in the study for common criteria. The study [8] aims at defining cartography of the existing contributions to smart grid and analyzes their strengths and weaknesses. As per authors, objective of the study was not to

determine which approach is the best among the chosen ones. Such a choice would be dependent on many conditions specific to the deployment context. However, the survey presented in this paper attempts to help a stakeholder with the comparison of the defined features.

(e) The results presented in the study are only for all chosen approaches based on the available documentation (articles, technical reports and presentations). All the elements could not have been captured. The study is theoretical and no real experimentation was made to test the different approaches. Future works may improve these features and go further. Future directions for this work may consist in deploying a website in order to store the presented results, enable and perform new experiments with addition of new features.

VIII CONCLUSION

Although basics of electrical engineering have not changed much, there are several recent advances mostly in the areas of Renewable energy and Smart grid. Madhya Pradesh has share of renewable grating capacity of 11 % as against all India average of 13 %. States like Tamil Nadu and Gujarat are having higher share of renewable power. Various features of Renewable energy like uncertainty, volatility of availability of energy, intermittent nature, reactive power requirement, problems of forecasting, 'must run' status in merit order dispatch and impact on conventional plants are involved in respect of Renewable capacity addition in Madhya Pradesh. In view of the upcoming regulatory mechanism similar to those applicable in US and other developing countries, suitable model is required for load balancing. Review of the research papers carried out gives a way forward to integration of renewable energy sources into the grid.

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Performance Characteristics of Karanja Biodiesel and Its Blends in a C.I. Engine

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ABSTRACT

In the present investigation experimental work has been carried out to analyze the emission and performance characteristics of a single cylinder 3.67 kW, compression ignition engine fuelled with mineral diesel and dieselbiodiesel blends at an injection pressure of 200 bar. The performance parameters evaluated were break thermal efficiency, break specific energy consumption (BSEC) and the emissions measured were carbon monoxide (CO), carbon dioxide (CO2), hydrocarbon (HC), and oxides of nitrogen (NOx). The results of experimental investigation with biodiesel blends were compared with that of baseline diesel. The results indicate that the CO emissions were slightly higher, HC emissions decreased from 12.8 % for B20 and 2.85 % for B40, NOx emissions decreased up to 39 % for B20 and 28 % for B40. The efficiency decreased slightly for blends in comparison with diesel. The BSEC was slightly more for B20 and B40. From the investigation it can be concluded that biodiesel can be used as an alternative to diesel in a compression ignition engine without any engine modifications. Keywords: diesel engine, karanja biodiesel, engine performance, exhaust emissions, cost comparison.

I INTRODUCTION

The ever increasing number of automobiles has lead to increase in demand of fossil fuels (petroleum). The increasing cost of petroleum is another concern for developing countries as it will increase their import bill. The world is also presently confronted with the twin crisis of fossil fuel depletion and environmental degradation. Fossil fuels have limited life and the ever increasing cost of these fuels has led to the search of alternative renewable fuels for ensuring energy security and environmental protection. For developing countries fuels of bio-origin can provide a feasible solution to this crisis. Certain edible oils such as cottonseed, palm, sunflower, rapeseed, safflower can be used in diesel engines. For longer life of the engines these oils cannot be used straightway. These oils are not cost effective to be used as an alternate fuel in diesel engines at present. Some of the non-edible oils such as mahua, castor, neem (Azadiracta indica), rice bran, linseed, Karanja (Pongamia pinnata), jatropha (Jatropha curcas) etc. can be used in diesel engines after some chemical treatment. The viscosity and volatility of these vegetable oils is higher, and these can be brought down by a process known as "transesterification". Biodiesel has a higher cetane number than petroleum diesel, no aromatics and contains upto 10% oxygen by weight. The characteristics of biodicsel reduce the emissions of carbon monoxide (CO), hydrocarbon (HC) and particulate matter (PM) in the exhaust gas as compared with petroleum diesel [1, 2].

Sanjib Kumar Karmee et al., [3] have prepared biodiesel of Pongamia Pinnata with a yield of 95% using methanol and potassium hydroxide as a catalyst. The viscosity of the oil decreased from 74.14 Cst (at 30°) to 4.8 Cst (at 40°C) on

transesterification and the flash point was 150°C. Both these properties meet the ASTM and German biodiesel standards. Suresh Kumar et al., [4] have investigated the performance and emission characteristics on a single cylinder diesel engine and reported decrease in NOx and HC emissions. A 40% blend (B40) of biodiesel in diesel has been recommended by the authors. Recep Altin et al., [5] have studied the potential of using vegetable oils and their methyl esters in a single cylinder diesel engine. They have used raw sunflower, cottonseed, soybean oils and their methyl esters. Their results indicate a reduction in NOx emission and methyl esters are better than raw oils due to their inherent property of high density, higher viscosity, gumming and lower cetane number. Banapurmath et al., [6] have reported tests on a single cylinder C.I. engine with 3 different biodiesels viz methyl esters of honge, jatropha and sesame. All the fuels gave a slightly lower efficiency. HC and CO emissions were slightly higher and NOx emission decreased by about 10%. They have reported that these oils can be used without any major engine modifications.

Many researches have used Methyl esters of Pongamia pinnata [7,8], mahua oil [9], rapeseed oil [10], linseed oil [11], soybean [12,13], jatropha [14], cottonseed [15,16,17], and palm oil [18] performance the and reported emission characteristics in diesel engines. Barnwal et al., [19] have discussed about prospects of biodiesel production from vegetable oils in India. They have also given the yield and production cost of various methyl esters, in general non-edible oils. The methyl esters of non-edible oil are much cheaper than petroleum diesel. The objective of this paper is to investigate the performance and emission characteristics of a single cylinder, 4 stroke, constant speed, water cooled diesel engine with diesel and blends of bio-diesel and diesel (B20, B40) at a fuel injection pressure of 200 bar.

II EXPERIMENTAL SET-UP

A typical 3.75 kW single cylinder, 4-stroke, constant speed (1500 rpm) diesel engine used for agricultural applications in rural India was selected for investigation to study the performance and emissions. The engine was coupled to an eddy current dynamometer (Make-BENZ SYSTEMS, PUNE, INDIA), Figure-1. The specifications of the engine are given in Table-1. Tests were conducted

using diesel and biodiesel-diesel blends at no load, 33.3%, 66.6% and 100% of rated load of the engine at the rated speed of 1500 rpm. A blend of 20% biodiesel and 80% diesel (by volume) is denoted by B20. The performance parameters, efficiency and brake specific energy consumption (BSEC) are compared. Exhaust gas composition was measured using NDIR based exhaust gas analyzer [Make: AVL Austria; Model: Digas 444]. The analyzer measures CO, CO2, HC, O2 and NOX in the exhaust. The range and accuracy of the 5- gas analyzer is given in Table-2.



Manufacturer	Kirloskar Oil Engines Limited, Pune, India
Model	AVL
Engine type	Vertical, single cylinder, water cooled, 4-stroke, constant speed (1500 rpm),
	Direct injection, compression ignition engine
Power (rated)	3.67 kW at 1500 rpm
Bore/Stroke	80mm/110mm
Displacement volume	553 cc

Fig.1 Experimental setup showing eddy current dynamometer, controller and gas analyzer

Exhaust gas	Measurement range	Resolution	Accuracy
СО	0-10% vol.	0.01% vol.	<0.6% vol.: ± 0.03%,
			$\geq 0.6\%$ vol.: \pm 5% of ind. val
HC	0 - 20000 ppm	0.01% vol.	<2000 ppm vol.:± 10 ppm
			\geq 2000 ppm vol:± 5% of ind. val
CO2	0 - 20%vol.	0.1 % vol.	<10%vol.:± 0.5 %vol.
			$\geq 10\%$ vol.:= 0.5% of ind. val
O2	0-22%vol.	0.01% vol	<2%vol.: ± 0.1%vol.
			\geq 2% vol.:± 5% of ind. val

Table-1Specifications of the engine

III ENVIRONMENTAL BENEFITS

Environmental benefits in comparison to petroleum based fuels include:

- (a) "At the tailpipe, biodiesel emits more CO2 than petroleum diesel". However, if "biomass carbon (is) accounted for separately from fossil-derived carbon", one can conclude that biodiesel reduces emissions of carbon monoxide (CO) by approximately 50% and carbon dioxide by 78% on a net lifecycle basis because the carbon in biodiesel emissions is recycled from carbon that was in the atmosphere, rather than the carbon introduced from petroleum that was sequestered in the earth's crust.
- (b) Biodiesel can reduce by as much as 35 % the direct (tailpipe) emission of particulates, small particles of solid combustion products on vehicles with particulate filters, compared with low-sulfur (< 50 ppm) diesel.</p>
- (c) Particulate emissions as a result of production are reduced by around 50%, compared with fossil-sourced diesel. Biodiesel has a higher cetane rating than petrodiesel, which can improve performance and clean up emissions compared to crude petro-diesel (with cetane number lower than 40)

Biodiesel has a higher cetane rating than petrodiesel, which can improve performance and clean up emissions compared to crude petro-diesel (with cetane number lower than 40).

IV RESULTS AND DISCUSSIONS

To determine performance and emission characteristics of the engine, tests were conducted at no load, 33.3%, 66.6% and 100% of rated load. The results of the engine emissions, carbon monoxide (CO), hydrocarbon (HC), carbon dioxide (CO2), and oxides of nitrogen (NOx), at 200 bar injection pressure and performance parameters efficiency and BSEC are shown in Figure 2 and 3. The emissions are compared with that of diesel. The CO emissions were slightly higher for B20 and B40 blends. HC emissions decreased by upto 12.8 % for B20 and 2.85% B40 compared to diesel at full load. The decrease however was insignificant. The decrease in these emissions can be attributed to the presence of oxygen in biodiesel leading to better utilization of fuel. Depending on load, the NOx emissions decreased by 39% for B20 and 28 % for B40. This reduction may be due to better combustion of fuel. Similar results have been reported by Sureshkumar et al., [4], Banapurmath et al., [7]. The efficiency decreased by 2.8% for B20 and 2.7% for B40. The BSEC value increased by 7% for B20 and 1.9% for B40. The increase in these two values is due to the decrease in heat input at different blends as the heating value of the blend is less than that of diesel (by 3.28 % for B20 and 6.5% for B40). The above results indicate that both B20 and B40 blends can be used in diesel engines without any engine modifications.Better emissions and performance characteristics are obtained at a blend of B40.



Fig. 2 Performance Analysis – CO, HC & PPM



Fig. 3 Performance Analysis – Efficiency & BSFC

V CONCLUSIONS

Tests for emission and performance characteristics were conducted on a single cylinder, 4- stroke, constant speed diesel engine at an injection pressure 200 bar. Based on the tests the following conclusions can be drawn:

- (a) At an injection pressure of 200 bar, HC emissions decreased by 12.8 % for B20 and 3 % for B40 at full load. NOx decreased by 39 % for B20 and 28 % for B40 at full load, BSEC increased by 7 % for B20 and 1.9 % for B40 at full load;
- (b) Hence a blend of 40% biodiesel and 60% diesel (B40) is recommended. There was no significant change in efficiency;
- (c) The results are in line with that reported in literature by different researchers using various biodiesel fuels and their blends; and

(d) Economic analysis shows that Karanja oil biodiesel can be used in an existing diesel engine without any engine modifications which will lead to employment generation and saving in vital foreign exchange. 55 VOL. 5, NO.
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Extraction, Isolation, Preliminary Phytochemical Screening and Chromatography of Marrubium Vulgare Linn

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ABSTRACT

Plants possess several secondary metabolites for their defense. Crude extract of aerial parts i.e. leaves of Marrubium vulgare contain flavonoids, saponins, triterpenoids and essentials oils. This plant is aromatic in nature due to the presence of essential oils. These oils are used as bio-pesticidal agent and for fragrance. In the present study, extracts of powdered material of leaves were isolated in methanol and water solvent by using soxhletion extraction methods and percentage yield of the extract were calculated that is found 11.89% in methanol and 10.42% in distilled water w/w with respect to dried powder. Preliminary phytochemical screening of the extract was done for the confirmation of phytoconstituents present in the extract. Thin layer and column chromatography of the extract was also done by using Methanol: Dichloromethane solvent system in different ratio i.e. 95: 05 and 80:20 ratios, respectively and two fraction of green and yellowish color were obtained with RF value 0.142 and 0.857, respectively.

Key-words - Marrubium vulgare, phytochemical analysis, percentage yield.

I INTRODUCTION

Marrubium vulgare L. is commonly known as White horehound. It is a flowering plant in the family Lamiaceae. Horehound serves as raw material for herbal extracts and beverages industries. The plant has also been used as a substitute for hop in beer-breweries. It can be used as ingredients of cough pastilles. The plant is used for traditional medicine, because of its stimulating action on the flow of bile and gastric actions and it is a laxative, a purgative and a cough soother. It is native to Europe, northern Africa, and southwestern and central Asia. It is also widely naturalized in many places, including most of North and South America. It is a grey-leaved herbaceous perennial plant, somewhat resembling mint in appearance and grows to 25-45 centimeters in height. The leaves are 2-5 centimeters long with a densely crinkled surface and are covered in downy hairs. The flowers are white, borne in clusters on the upper part of the main stem. Several modern scientific studies have been conducted on the usefulness of horehound. A study concluded that the essential oil of Marrubium vulgare contains potent anti-microbial and anticancer properties.¹ while another study has found Marrubium vulgare as one of the primary active compounds to possess anti-diabetic, anti-atherogenic and antiproperties.² inflammatory Phytochemically, Marrubium vulgare is characterized by the presence of a variety of compounds such as alkaloids, steroids, lactones, tannins and flavonoids. Hence, the present study was proposed to explore phytochemical analysis of the extract of Marrubium vulgare.

II EXPERIMENTAL

(a) Extraction and Isolation

Fresh leaves (400gm) of Marrubium vulgare was collected from surrounding areas of Salamatpur Bridge in Raisen district (M.P.), India and washed thoroughly with tap water. It was identified and authenticated by Dr. P.N. Shrivastava (Taxonomist), S.S.L. Jain P.G. College, Vidisha. A voucher specimen was procured which was deposited in Department of Botany, St. Mary P.G. College, Vidisha (M.P.). Plant materials were dried under shade at room temperature in to the laboratory and after drying, it was found 50% less in amount. The obtained materials were finely grinded using electrical mixer grinder and stored in air tight container for further use. A total of 200 gm of the pulverized plant material was extracted in methanol and distilled water through cold percolation technique for 4 days. Separated extracts were then filtered through Whatman's No. 1 filter paper and the filtrate was then separately condensed to dryness using rotary evaporator. The solvent was then removed under reduced pressure and the percentage yield was obtained in methanol (11.89%) and distilled water (10.42%) w/w with respect to dried powder (Table 1). Dried plant extract was collected in air tight containers and stored at 4°C for further analysis. Moreover, extract of methanol and distilled water were subjected separately to phytochemical study for the identification and presence of different phytoconstituents including flavonoids, phenols, triterpenoids, saponins and lipids.3,4

(b) Phytochemical screening methods

In the present study, the presence of different phytoconstituents viz. alkaloids, carbohydrates, glycosides, flavonoids, tannins, phenolic compounds and terpenoid in the extract of Marrubium vulgare were determined, following standard procedure of Peach and Tracy⁵ (Table 2).

- (i) Detection of carbohydrates: Extract was dissolved individually in 5 ml distilled water and filtered. Filtrate was treated with 2 drops of alcoholic α -naphthol solution in a test tube and concentrated Sulphuric acid was added but formation of the violet ring at the junction was not seen which indicates the absence of carbohydrates.
- (ii) Detection of glycosides: Extracts were hydrolyzed with diluted HCl and then subjected to test for glycosides by treated with sodium nitroprusside in pyridine and sodium hydroxide. Formation of pink to blood red color does not see which indicates the absence of cardiac glycosides.
- (iii) Detection of Lipids: Extracts was treated with chloroform and filtered. The filtrate was treated with few drops of acetic anhydride, boiled and cooled. Concentrated Sulphuric acid was added. Formation of brown ring at the junction indicates the presence of lipids.
- (iv) Test for saponins: Extract (300 mg) was boiled with 5 ml water for two minutes; the mixture was cooled and mixed vigorously and left for three minutes. The formation of frothing indicates the presence of saponin.
- (v) Test for tannins: To an aliquot of the extract (dissolved in water) 2 ml of sodium chloride (2%) was added, filtered and mixed with 5 ml 1% gelatin solution. Precipitation indicates the presence of tannins.
- (vi) Test for Triterpenes: Extract (300 mg) was mixed with 5 ml chloroform and warmed for 30 minutes. Few drops of concentrated Sulphuric acid were added and mixed well. The appearance of red color indicates the presence of triterpenes.
- (vii) Test for alkaloids: Extract (300 mg) was digested with 2 M HCl and the acidic filtrate was mixed with amyl alcohol at room temperature. Pink colour of the

alcoholic layer seen which indicates the presence of alkaloids.

(viii) Test for flavonoids: The presence of flavonoids was determined by using 1% aluminum chloride solution in methanol, concentrated HCl, magnesium and potassium hydroxide solution.

(c) Thin layer and column chromatography

Chromatography means color or to write which is originally described by Tswett.⁶ Two types of chromatography were used in the present study viz. TLC and Column. Thin layer chromatography technique was used to determine the number of constituents in the plant extract and to analyze the fractions. In thin-layer chromatography, silica was used as stationary phase. This absorbent was coated on a glass slide creating a thin layer of the silica. Methanol: Dichloromethane (95:05) solvent system was used as the mobile phase. TLC provides a chromatographic measurement known as Rf value. The Rf value was calculated by the formula of Brimley and Barrett⁷ as distance travelled by solutes divided by distance travelled by solvents. This value can be calculated for each spot observed on a TLC plate shown in Table (3). According to Stock and Rice⁸ column was used as a glass cylindrical container and a sample solution that is the substance to be purified, is poured into the column (Table 4). In the present study, silica gel was used as a stationary phase which was poured in to the column then Methanol: Dichloromethane (80:20) solvent system was used as mobile phase and was run two three times for maintaining its flow by removing air bubbles entered during packaging of silica. Then loaded herbal extracts sample on the top of the column. Then, obtained fractions were separated on the basis of their color characterization and were kept in separate vials for further analysis (Table 4).

III RESULTS AND DISCUSSION

In the present study, the good percentage yield of the extract of Marrubium vulgare was found in methanol (11.89%), followed by distilled water (10.2%), respectively. Almost similar observations have been reported by Elberry et al. (2015),⁹ who have isolated successive extract in methanol from the leaves of Marrubium vulgare with a very good percentage yield (12%).

The presence of different phytoconstituents viz. alkaloids, carbohydrates, glycosides, flavonoids, tannins, phenolic compounds and terpenoid in the methanolic extract of Marrubium vulgare were confirmed by following standard procedure of Peach and Tracy⁵. Similarly, a preliminary phytochemical test to identify the chemical

constituents of Marrubium vulgare was carried out according to the methods of Trease and Evans.¹⁰ In the present study, the phytochemical screening of the Marrubium vulgare extract was done for the confirmation of secondary metabolites viz. Flavonoids, saponins, triterpenoids, taanins, alkaloids and lipids and the absence of carbohydrates and glycosides was confirmed. These secondary metabolites are secreted by the plants for their defense which are being used by the peoples for various purposes.

In the present study, thin layer chromatography of the methanolic extract of Marrubium vulgare was done by using Methanol: Dichloromethane (95:05) solvent system and two spots of green and yellowish color with Rf value 0.142 and 0.857, respectively, were obtained. Similarly, the methanolic extract of Marrubium vulgare was analyzed using thin layer chromatography as reported by Wagner and Bladt.¹¹ TLC on silica gel 60 F 254 plates using chloroform: Methanol (95:5) as a solvent system was used for the identification of terpenoid class compounds after spraying with Komarowsky reagent. The extract was also chromatographed on TLC using ethyl acetate: formic acid: acetic acid: water (100:11:11: 26). TLC was observed under UV 254 and 366 nm, before and after spraying with natural products reagent for the detections of flavonoid class compound. Thus, it was confirmed that terpenoid and flavonoid are most important chemical constituents found in methanolic extract of Marrubium vulgare.

Table 1 Extraction and Isolation of leaves of Marrubium vulgare Linn by cold percolation.				
Plant parts used	Wt. of fresh leaves	Wt. of Shade dried leaves	Solvent used	Percentage yield
Marrubium	400 gm	200gm	Methanol	11.89%
vulgare Leaves			Water	10.42%

Table 2

Preliminary Phytochemical screening leaves extract of Marrubium vulgare Linn.

S. No.	Test applied on the extract	Methanol	Distilled water
1	Carbohydrates	_	-
2	Glycosides	-	-
3	Lipids	+	+
4	Saponins	+	+
5	Tannins	+	+
6	Triterpenes	+	+
7	Alkaloids	+	+
8	Flavonoids	+	+

+ (Present), - (Absent)

Table 3 Thin layer chromatography of leaves extract of Marrubium vulgare Linn.						
Plant extract	Solvent system used	Fractions Obtained	Distance travelled by solvent	Distance travelled solute	e by	Rf Value
Marrubium vulgare Leaves Extract	Methanol: Dichloromethane (95:05)	Spot – 1 Spot – 2	7 cm.	1 cm. cm.	6	0.142 0.857

Plar			Column chromatography of leaves extract of Marrubium vulgare Linn.			
	nt extract	Solvent system used	Fra Ob	ections tained	Color characteristics	
Iarrubi ∕eaves F	ium vulgare Extract	Methanol: Dichloromethano (80:20)	e	1 2	Greenish Yellow	
[1]	REFE Zeid Zarai et a antibacterial, properties of essential oil g Health disease	RENCES II. the in-vitro evaluation of antifungal and cytotoxic Marrubium vulgare L. rown in Tunisia. Lipids in , 2011; 10: 161.	[7] [8]	Brimley F Chromato Publicatio Stock, Chromato Hall Publi	R.C. and F.C. Barrette. Practical graphy. Chapman and Hall n, London. 1953, 26. R. and C.B.F. Rice graphic methods. Chapman and cation, London. 1974, 376.	
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[6]	Tswett, M. In Ber. Dtsch. B 323.	vention of chromatography. otan. Gcs. 1906, 24; 316-				

Table 4				
Colum	n chromatography of leaves ext	ract of Marrubium v	vulgare Linn.	
lant extract	Solvent system used	Fractions	Color characte	

Particle Swam Optimization Based Technique for Node Capture Attack in Wireless Sensor Network

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ABSTRACT

To improve the attacking efficiency of node capture attack, we designed a Node Capture Attack Algorithm based on Particle Swarm Optimization (NCPSO). NCPSO takes multiple objectives into consideration, that are: Maximum Node Participation, Maximum Key Participation and Minimum Resource Expenditure to find a set of optimal nodes using PSO that satisfies all the objectives, destroys maximum portion of the network and provides higher attacking efficiency at least attacking cost. The simulation results manifest that NCPSO can provide reduced attacking cost (resource expenditure) than Matrix Algorithm (MA) so the attacking efficiency of NCPSO is considerably improved

Keywords: Attacking Cost, Attacking Efficiency, Node Capture Attack, Particle Swarm Optimization, Wireless Sensor Network.

I INTRODUCTION

It has been observed that Node capture attack [1] is one of the hazardous attacks in the wireless sensor network (WSN) [2], and cannot be avoided in normal circumstances. In this attack, an adversary gains complete control over a sensor node by a direct physical access, and then the adversary can easily extract cryptographic information stored on the memory chip of the captured node using an antithesis engineering process to get to eavesdrop on the transmission of messages between the sensor nodes to destruction of the entire WSN [3]. Investigating the way of mounting an attack to break the security of the wireless sensor network provides deep insights for developing the countermeasures against the node capture attack.

II PROBLEM DEFINITION & PROPOSED WORK

As the node capture attack [4] suffers from the low attacking efficiency [5] and high resource

expenditure, to overcome these problems, various vulnerability evaluation techniques have been developed, and also so many are under process. The aim of the node capture attack is to capture [9] a number of nodes to compromise the different routes of the network. To compromise distinctive routes of the sensor network, all the paths belonging to that route must be compromised. So, the attacker's aim is to compromise maximum possible routes of the network by capturing a set of nodes that satisfy multiple objectives that are maximum node participation in the network through which maximum packets transmitted in the network can be captured by minimum resource expenditure [10] and maximum keys.

III MODELS AND DEFINITIONS

This section includes the proposed models and various definitions related to our work Table 1 summarizes the related symbols and their definitions.

Symbols	Description
N	Set of sensor nodes in the network
Ni	ith sensor node
K	Set of total keys in the key pool
Ki	Set of keys acquired by node ni
L	Set of links between nodes
l (i, j)	Link between node ni and nj
S, D	Set of source and destination nodes
SR	Set of routes in the network
rs,d	A Route from source node s and destination node d
Wi	Capturing cost of Node ni
Cn	Set of Compromised Nodes
P(Ri)	Total number of paths of route Ri
Pk (i, j)	Number of paths in which node nj participates in route Ri
Fi	Objective function for node ni

 Table 1

 A summary of related symbols and their Definitions

Houqandban - AISECT University Journal Vol.VI/Issue XI March 2017

IV PARTICLE SWARM OPTIMIZATION

Particle swarm optimization is a population-based computational technique. It learns from the scenario and uses it to find a potential solution for an optimization problem. PSO is initiated with a group of random particles and looks for an optimum value by updating generations.

In each round, each particle is updated by tracking two best values: first, one is the pbest (personal best) value. This is the value of the fitness function it has achieved so far. Another one is called the gbest (global best). This value is the best value obtained so far by any particle in the population and tracked by the particle swarm optimizer. After finding pbest and gbest, the particles update its velocity and position with the following equations:

v[] = v[] + c1*rand()*(pbest[] - p[]) + c2* rand()*(gbest[] - p[])

p[] = p[] + v[]

Where, v [] represents the particle velocity, p [] is the current position of the particle, rand is the random number between 0 to 1 and c1, c2 are learning factors.

The basic procedure of the PSO algorithm is as follows:

Step 1: Initialize the position and velocity of all particles.

Step 2: Evaluate the fitness of each particle according to the desired optimization. So the optimal value of individuals (pbest) and optimal value of swarm (gbest) can be obtained.

Step 3: Update the velocity and position of the particles.

Step 4: Determining whether the condition meets ends, if not, go o step 2 [20].

V NODE CAPTURE ATTACK ALGORITHM BASED ON PSO (NCPSO) & SIMULATION PARAMETERS

The projected algorithm estimates the optimal nodes for the node capture attack using PSO such as only a limited number of nodes capturing compromises the whole network by providing maximum benefits to an attacker.

To analyze the participation of sensor nodes in the network, we can calculate the Route Node Participation Matrix, which represents the participation of each sensor node in each route through the network at fig. 1, Simulation parameters are tabulated at Table 2



Fig. 1: Node Capture Attack Algorithm: NCPSO

Simulation Parameters						
S.No	Parameter	Value	Meaning			
1.	Ν	200	The number of sensor nodes			
2.	S	5	Number of source nodes			
3.	D	3	Number of destination nodes			
4.	Region Size	100*100	Region Size of the Sensor network			
5.	Sensing Range	20	Maximum Transmission range of the senor network			
6.	Key pool Size	20	The Key pool Size of the sensor nodes			

 Table 2

 Simulation Parameter

 Machine

VI SIMULATION BASED RESULTS & ANALYSIS

To analyze the performance of multiple objectives based node capture attack algorithm, we performed the following simulation. The experimental parameters are shown in the table 2. In the simulation work, 200 nodes are deployed throughout the sensor network. From the total deployed nodes, 5 source sensor nodes and 3 destination nodes are randomly selected. Random key pre-distribution scheme is used to assign keys to different nodes in the sensor network. Keys are assigned randomly from a key pool to each sensor node, when the network is deployed. Key distribution probability is 0.5 that show that number of keys assigned to each sensor node should be less than 50 % of the total keys in the key pool.

(a) Attacking Cost (Resource Expenditure)

In this experiment, we evaluate attacking cost or resource expenditure of each algorithm in compromising the network. If the adversary captures more nodes, the more will be resource expenditure due to utilization of the higher number of resources.

Attacking Cost (Resource Expenditure) = \sum wi

(b) Single Path Routing:

Table 3

Attacking	Cost Vs.	Number of Nodes	Captured for	r Single Path Routing	

Number of Nodes Captured	Attacking Cost			
	NCPSO	MA		
2	0.8925	1.7261		
4	1.5972	3.608		
6	1.9417	4.9223		
8	2.99	6.984		
10	4.9633	8.62		



Fig. 1: Attacking Cost Vs Number of Nodes Captured for Single Path Routing
Figure 2 illustrates the comparison of NCPSO with MA in case of single path routing as the number of nodes captured varies from 0 to 10. At 4 captured nodes in the simulation, the Attacking Cost or Resource Expenditure for NCPSO is 1.5972 whereas the MA has been attacking cost 3.608. Our approach consumes less resource expenditure than

MA. It manifest that attacking cost of NCPSO based technique is lowest. This is due to capture of the minimum number of nodes to compromise the network. Other Algorithms like MA takes comparatively more attacking cost due to the higher number of attacking rounds to compromise the network.

(c) Multipath Routing:

8	Table 5		
Attacking Cost Vs. Number of Nodes Captured for Multipath Routing			
Number of Nodes	Attacking Cost		

Number of Indies	Attacking Cost		
Captured	NCPSO	МА	
2	1.2284	1.8517	
4	1.9330	3.6301	
6	3.5223	5.1599	
8	5.2977	6.5614	
10	6.4789	8.8501	



Fig. 2: Attacking Cost Vs. Number of Nodes Captured for Multipath Routing

Figure 3 shows the comparison of NCPSO with MA in case of multipath routing as the number of nodes captured varies from 0 to 10. When 4 nodes are captured in the simulation, the Attacking Cost or Resource Expenditure for NCPSO is 1.9330 whereas the MA has been attacking cost 3.6301. Our approach consumes less resource expenditure than MA that manifest that attacking cost of NCPSO based technique is lowest. This is due to capture of the minimum number of nodes to compromise the network. Other Algorithms like MA takes comparatively more attacking cost due to the higher number of attacking rounds to compromise the network.

VII CONCLUSION

Here to enhance the attacking efficiency of the node capture attack in the sensor network, a technique have been proposed based on multiple objective's node capture attack algorithms

(NCPSO) it has been designed for random key predistribution in the wireless sensor network.

NCPSO takes three objectives into consideration to capture a node that are maximum node participation, maximum key participation and minimum resource expenditure. NCPSO provides higher attacking efficiency than MA by capturing a limited number of nodes that compromise whole network.

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Full Digitization of Universities- Need of the Hour – An Australian University Experience

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I THE BACKDROP

One of the most important devices in our life is PC - maybe even more important than our coffee machines. We take it to even informal appointments, long car rides, holidays; practically everywhere we normally have some time to use it. It's hard to believe that the very first personal computer was launched just 50 years ago. This innovation laid the foundation for the first digital revolution. The invention of Ethernet followed by the Internet and, eventually, smart phones took personal computing to a whole new level. We take for granted our ability to easily communicate, find and share information around the world. Now, we are at another inflection point, as today's digital transformation is set to once again revolutionize how we work, live, play, and learn. Instead of the PC, the center of today's transformation is any connected device - smart phones, tablets, cars, machines, sensors - the list grows each day.

When we first heard the term digital transformation – or digitization or digital revolution, pick your favourite term – it appeared, what an odd phrase. Isn't everything already digital? What is so different now? The digital transformation we are experiencing today is driven by fundamentally new technologies that are changing at a rapid pace and creating significant new opportunities.

- (a) How do we make it possible to learn and collaborate anywhere, anytime, and on any device?
- (b) To innovate, we need to enable new models of teaching, learning, and research.
- (c) We need to reach new, non-traditional students beyond the classroom and campus.
- (d) The skyrocketing cost of higher education is a burden to our students and a long term risk to the institution. How can we do more with less?
- (e) How can we better answer- what is the value of an education? How can we use analytics and data to show the value of the institution.



II DIGITISATION PROJECT IN THE AUSTRALIA UNIVERSITY

Digital transformation means creating solutions that are powerful, that helps to bring digital technology to the forefront of higher education. In this way University can use technology as differentiator. It is now widely accepted that any modern organization needs a digital strategy if it is to achieve its business objectives; and universities are no exception.

Digital transformation projects are very complex and have many moving parts that need to be connected. You need a foundation that leverages a strong technology portfolio from the cloud to the data center and all the way to the end device. A foundation that is simple, automated, and secure across the board. One that connects people and devices in meaningful and secure ways. So IT can move fast to respond to the business. Network companies like Cisco, Microsoft etc provide the network, security, analytics, automation, and collaboration needed to achieve higher operational efficiency, greater competitive advantage, and increased profits. We are just scratching the surface on what we can do to accelerate digital progress.

Now more than ever, universities must establish digital strategies that bring technology to the forefront of their institutions.

We would like to share one of the case studies here. The first author was closely working with one of the key Universities last year within the most liveable city in the world, Melbourne. It provides education to almost 30,000 students annually covering a diverse range of course from Arts, ICT, Engineering, Science, Health, Law and Sports. It is 100 years old this year and is passionate about delivering an excellent student experience.

Cisco team where the first author is a key member worked tirelessly for approximately 9 months with the University to help it set a 5 year transformation strategy that will enable the university to digitise the campus. Cisco worked directly with the university executives, line of business management and ICT personnel to jointly develop a "Digital Campus" transformation. This project was to see University implementing Cisco's Digital Network Architecture (DNA) along with enabling the Network as a Sensor, transforming the Student learning experience with the use of video and collaboration tools, dramatically improving the student experience and automating application delivery from the data centre.

The effort delivered by the team has been nothing short of outstanding a true example of ONE CISCO covering all elements of Business, especially Security, Collaboration, Data Centre, Enterprise Networking, legal and commercial finance.



III DELIVERED SYSTEM & BENIFITS

The solution provided to the university included the design, and implementation of all of the following elements:

- (a) Deployment of Telepresence Video Conferencing units to approximately 42 lecture theatres.
- (b) IP Phones all video enabled.

- (c) Cisco DX80 Executive desktop units for a full HD video, phone and WebEx
- (d) Conference phones
- (e) Wireless access points High Density WIFI everywhere
- (f) Edge switches that underpins the foundations of a smart and robust network.
- (g) ACI DC Switching resulting in fully automated real time provisioning and orchestration of services.
- (h) An upgrade to the security infrastructure to turn the network into a sensor. Security – ASA's, Source fire IPS, Lancope & ISE for 51,000 devices
- (i) Cisco ONE software across all elements
- (j) Digital Media, and Advance Analytics
- (k) WebEx change management and usage adoption service to migrate existing users off Blackboard Collaborate and expand the usage of WebEx

The full digitization implemented in the university has immensely helped them stay competitive, attract and retain students and faculty, and deliver the best possible academic experiences. It's essential now for any higher education institution to fully digitize their campus in order to improve the quality.

Power Controlled Grid Linked Inverter Using Phase Shifting Technique

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ABSTRACT

In the grid connected photovoltaic system Inverter the essential criteria is the power control both active and reactive required before it is injected into the grid. In this paper a control strategy microcontroller based grid linked PWM inverter has been designed. The strategy is made on the basis of shifting of inverter output voltage with respect to grid. The controlled strategy is done using Simulink blocks, function block, counter, and by generating PWM pulses for synchronization with the grid. The proposed model for single phase PWM inverter grid linked has been simulated using Mat lab/Simulink. The model can be applied for 50/60 Hz frequency. The Inverter model proposed is an easy solution for low power grid linked inverter applications.

Index Terms-Grid connected photovoltaic inverter, Power control, Phase shifting.

I INTRODUCTION

Today the whole world is facing challenge of two major issues, one is energy and the other one is environment [1] To meet the above challenges importance of renewable energy sources has increased. The PV system as the renewable energy source now a days a very important source of energy, because it is pollution less and requires less maintenance and can be easily be applied for residential and commercial purposes [2][3].This has led to increasing use of grid connected PV system for utilization of power.

Most Grid connected inverters based on PV system get useful power from their PV module fitted based on maximum power point tracking analogy along with DC to DC or Boost converters [4][5][6].

The PV Inverters linking with the grid should be properly synchronized. Then only there will be a control on power transfer from Inverter to the grid[7]in present circumstances.

For this the grid connected inverters are to be so designed that they can control active, reactive power and hence control power factor. Then only the system can feed sinusoidal voltage and current into the grid.

Moreover for Grid linked Inverters the various important factors that are to be considered in their designing and execution is, removal of DC part while feeding to the grid, reduction of total harmonic distortion and a proper control so that there is a complete synchronization between the inverter and the grid.

The idea suggested by various researchers is that there should be complete control on current and active power that is injected into the Grid when power factor is unity [7].

The strategy used in this paper is microcontroller based grid linked PWM inverter control system. The approach adopted in this system for linking inverter with the grid is based on a controlled phase shifting, so that the output voltage of inverter with respect to grid voltage is synchronized.

For the above approach the control strategy based on shifting of counter pulse forward or backward is adopted for matching the phase and frequency of the inverter and the grid.

^{PV Array} s designed in Mat lab/Simulink for the controlled approach and can be easily used for single phase grid supply and for frequency variations of 50/60 Hz respectively.

This paper also explains a controlled approach to be used in mat lab/Simulink for generating controlled pulses for the H-Bridge Inverter in order to get a synchronized output generated.

This approach will be able to control voltage and current of PV inverter with respect to the grid. Hence it will control the active and reactive power.

The proposed control approach requires very few components and can be easily applied in hardware circuitry for grid synchronization.

In the paper simulated and experimental results are explained and verified for the controlled approach for grid linked PV inverter.

II DESCRIPTION OF INVERTER CONTROL MODEL

The single phase grid linked inverter model is as shown in fig.1 [4]. The model consists of PV Array, Boost converter, PWM Inverter, Filter, PWM Controller and the Grid. The constant 24V DC supply is used as input to DC to DC Converter (Boost Converter). The Boost Converter based on dual boost concept is designed [8] and utilized to convert firstly the 24 V dc input into 86 V and then it converts the voltage into 312V. This Boost Converter output was then fed to II-Bridge Inverter whose output was then linked with LCL filter circuit [9] which converts the input voltage into 230 V rms. The inverter voltage obtained was then checked for phase and frequency matching before it is fed to the grid. This requires a phase locked loop to be designed. For this a PWM controller was designed using the concept of phase shifting with the help of counter moving either forward or backward. It also generates pulses required for triggering of mosfet's of the H-bridge so that the output of inverter is locked with respect to the grid. Hence phase and frequency are verified easily of inverter and the grid.



Fig. 1. Grid linked Inverter Model

The grid inverter current is obtainable from PV module. The inverter and grid are coupled through either L, LC or LCL filters according to the requirements of smooth output of the inverter.



Fig. 2. Behavioural performance of inverter and grid

Fig.2 represents the behavioural performance of inverter and grid. For the above circuit phasor diagram is as shown in fig. 3.



Fig.3. Phasor diagram

In the phasor diagram where,

V = Grid RMS voltage

E = Inverter output voltage (RMS)

I= Inverter output current (RMS)

 $jX_L I$ =Voltage drop across the inductance

 φ = Angle between grid voltage and inverter output current

 δ = Load angle between grid voltage and inverter output current.

From the phasor diagram shown in fig.3 we have a relation between V, E and X_L as follows,

$$V = E + jX_L I \tag{i}$$

$$ESin(\delta) = X_L ICos(\varphi)$$
(ii)

From above expressions the active power given by inverter to the grid is given by equation as:

$$P = VI \cos(\varphi) = \frac{VESin(\delta)}{X_{I}}$$
(iii)

Hence, reactive power Q is given by the equation as,

$$Q = \frac{VECos(\delta)}{X_L} - \frac{V^2}{X_L}$$
(iv)

From the equations of P and Q it is found that both P and Q are related to load angle δ .

Thus for controlling active and reactive power we need to control angle δ which is the phase difference in between the grid voltage and inverter output voltage. Also at that moment reactive power is also easily controllable as it also depends on angle δ .

Equation (iii) and (iv) also suggest that the output current depends on the amplitude of inverter voltage and on angle δ . Required conditions for a grid inverter are as follows:

- (i) The output voltage magnitude and phase should be same as grid voltage.
- (ii) The inverter output frequency should also be same as that of grid.

Also for maximum power transfer from inverter to the grid the angle δ should be closed to 90°. But for stability condition it should be slightly less than 90°[7][10].

III PROPOSED DESIGN

The proposed system model is as shown in fig.4.



Fig.4. Proposed System Model

In the proposed model microcontroller based PWM controller is designed for grid linked inverter.

The important components of control structure are PWM generating unit, control block consisting of zero crossing detector, counter and a logical array required for phase shifting of pulses for synchronization, Boost converter and H bridge inverter are the main elements of the controlled system required for synchronization of the grid linked inverter. The controlled structure locks the phase and frequency of inverter voltage to the grid voltage as required for the synchronization. Moreover under this condition only active power is transferred to the grid and grid current is also in phase with the inverter current.

The required System control model with blocks is shown in fig. 5 prepared in the environment of Matlab/Simulink.

The logic used for phase and frequency matching of grid linked inverter is based on phase and frequency matching using controlled phase shift either leading or lagging of the inverter output voltage with respect to the grid voltage. For this a system microcontroller based grid linked PWM inverter control system is designed. This model will lock phase and frequency. Hence a new phase locked loop for synchronization between the inverter and the grid is designed.

Hougandban - AISECT University Journal Vol.VI/Issue XI March 2017

SBN: 2278-4187



Fig. 5.Matlab / Simulink model of Grid linked PWM control system

Fig.5 shows the PWM controlled model prepared using Matlab/Simulink. The logic used for the above model is as follows:

Firstly the ramp generator and grid supply voltage is compared by a comparator for generating the triggered pulses required for H Bridge switches i.e. Mosfet's. At the same time the grid voltage is passed through zero crossing detectors to detect the rising edge of the pulse. The pulse is negated and enabled and shifted by one unit delay. At the same time the ramp pulse is also triggered, delayed on rising edge of pulse. Hence a subsystem counter is developed for the two pulses to be enabled and triggered accordingly. In Fig.6 enabled and triggered counter model is shown as a subsystem of PWM control model.



Fig. 6. Enabled and triggered counter subsystem model

In the Model the logic used is as given in fig. 7.



Fig. 7. System Controlled Model Logic

The subsystem forms a counter and it starts storing counter values in accordance with the ramp generator time value. Hence an array is developed which can read or write the counter values.

A logical programme flow chart is shown for the two generated pulses in an array in fig. 8 for the functional block of the system model, in which firstly the values are initialised, than counter values are shifted forward or backward as per inverter output. The counter is shifted as analysed by the functional block in which logic is prepared for shifting of pulses. Then the pulses are passed through zero crossing detector and linked with the grid for phase matching. The whole process continues by passing the two pulses Pls1 and Pls2 generated again through a crossing detector on rising edge of pulses so that a required wave with zero phase shifts is obtained. The pulses generated are used for triggering Mosfet's. Therefore the output of inverter obtained is in phase with the grid as required.

If the grid waveform leads the inverter waveform than counter values is added and if it lags the counter value is subtracted for synchronization of the waveform.



Fig. 8. Logical flow chart for the functional block of the system model

Also in fig.9 the subsystem inverter model is shown in which the boost converter model and H bridge inverter model is designed as per references [8] and [9] respectively.

SBN: 2278-4187



Fig. 9 Inverter model

The boost converter boosts the input voltage. The converter converts PV Array energy into electrical energy and thus it full fills the requirement of linking inverter with the Grid effectively without using transformer[12]. The H Bridge inverter converts dc voltage into alternating voltage so as to link it with the grid or utility purposes. The H bridge inverter output is a square wave. Therefore at the output of Inverter low pass filter, for reducing harmonics and converting the square wave to sinusoidal one, is required [11]. In the fig. 10 LCL filter model is shown in which Vi, Vo are the inverter and grid voltages and L_1 , L_2 , r_1 , r_2 are inductances and resistances of inverter and grid respectively and C is the capacitance.

By applying Kirchhoff's Voltage Law (KVL) in the two loops of LCL filter model following equations are obtained.



Fig. 10. LCL Filter Model $V_i(s) = Z_{L_1}(s)I_1(s) + V_C(s)$

 $V_{C}(s) = Z_{L_{2}}(s)I_{2}(s) + V_{2}(s)$ Where, $Z_{L_{1}}(s) = r_{1} + \Box L_{1}s$, $Z_{L_{2}}(s) = r_{2} + \Box L_{2}s$ and

$$V_{C}(s) = I_{C}(s) \frac{1}{Cs}$$

By KCL we have, $I_C(s) = I_1(s) - I_2(s)$

Therefore, from above equations we have, $A = (L_1s + r_1) Cs + 1$

$$B = (L_1 s + r_1) (r_2 + L_2 s) C_s + (L_1 s + r_1) + (r_2 + L_2 s)$$

$$C = C_s$$

D= {
$$(r_2 + L_2s) + \frac{1}{C_s}$$
}C_s

Where $s = j\omega$

At resonant frequency, (taking resonant frequency, $\omega_r = \omega$),

We have, ω L= ω C

$$\omega^2 = \sqrt{\frac{1}{LC}}, Z_0 = \sqrt{\frac{1}{LC}} \text{ and } Q_1 = \frac{\omega L}{r_1}, Q_2 = \frac{\omega L}{r_2}$$

Where, Q_1 and Q_2 are the quality factors of inductors.
If $L_1 = L_2 = L$ than A B C D parameters becomes

$$A = j\frac{1}{0}$$

$$B = jZ_0[1+j\frac{1}{Q1Q2}]$$

$$C = j\frac{1}{Z_0}$$
$$D = j\frac{1}{Q_2}$$

If Q_1 and Q_2 high then A = D = 0 and BC = 1 which is a property of ideal convertor.

Hence I₂ becomes
$$\cong \frac{V_1}{7}$$

Now taking $\omega_0 = 1$ radian per second, cut off frequency $f_c = 50$ Hz and $Z_0 = 20 \Omega$ the values of L and C of filter circuit can be found.

As
$$C = \frac{1}{2\pi fc Z_0} = \frac{1}{2*\pi*50*20} = 0.159 \text{mF}$$

And L =
$$\frac{Z0}{2\pi fc} = \frac{20}{2*\pi*50} = 63.60 \text{mH}$$

Experimentally the values of L chosen is 55mH and C as .159mF for the LCL filter designed for single phase grid linked Inverter.

Bode plot of LCL Filter

Putting the values of L and C in the transfer function

$$G(s) = \frac{159*10^{-3} + 1000}{480975*10^{-9}s^3 + 17490*10^{-6}s^2 + 110}$$

For above transfer function bode plot is plotted in Mat lab and the output obtained is as shown in fig. 11 and Fig. 12 respectively.

The fig. 12 shows the Bode plot after inserting damping resistance in the capacitor path.



Fig. 11. Bode plot of LCL Filter

In the LCL filter by inserting damping resistance in the capacitor path eliminates spikes and the response is better smooth. From bode diagram the close bandwidth is ≈ 1000 Hz around phase shift of -90°.



Fig. 12. Bode Plot of LCL Filter after damping resistor inserted

IV SIMULATED RESULTS

In the fig. 13 generated results of Simulink model of Grid linked system of PWM Inverter as shown in fig. 5 is obtained using Matlab/Simulink software. The Simulation was run for 1 second with solver discrete type having settling time of 6.17e-06s. The simulated results obtained after simulation are shown as per fig.13. In the fig.13 the first waveform is of reference signal which is a signal generator of 230 volts 50 hertz frequency.

The second waveform is of ramp counter which is a repeating sequence block in Simulink, whose time values taken as [0 .5e-5 1e-5 1.5e-5] and output values as [-230 0 230 0].

The third waveform is of output voltage of inverter after locking with the grid. It is a waveform which is phase locked with a frequency of 50 Hertz and can be supplied to the grid. The output obtained is of 230 volts 50 Hertz.

The fourth waveform is of zero crossing detector which helps to increase or decrease counter value for phase and frequency locking.

Sflougandban - AISECT University Journal Vol.VI/Issue XI March 2017

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Fig. 13. Output of Grid Linked Inverter Model for 50 Hz Frequency

The fifth waveform is of counter as per the zero crossing edge it detects and increases or decreases the counter for locking so that the inverter and grid output are in synchronization. Thus counter helps to control angle δ . Hence active and reactive powers are controlled.



Fig. 14. Output Voltage of Inverter



Fig. 15 Output Current of Inverter

The inverter output voltage obtained from the model as 234 volts RMS and output load current as 5.85Amp with THD of 1.96% as shown in fig. 14 and fig. 15 respectively.

The model was also tested for 60 Hz frequency and results obtained are satisfactory. The fig.16 shows the generated results of model for 60 Hz frequency.



Fig. 16. Output of Grid Linked Inverter Model for 60 Hz Frequency

V CONCLUSION

The paper presents a novel controlled strategy for low voltage and low power transformer less single phase Inverter to be linked with the Grid effectively. In this paper the new and efficient approach to control angle δ is presented and can be used for 50 or 60 Hz frequency with total harmonic distortion in the output of inverter restricted to 1.96%. The Inverter controlled model analysis and experimental simulation have been presented in the paper. The Inverter output is easily controllable by varying delta angle using counter to shift forward or backward as required for controlling the output voltage and current in respect to the grid for locking conditions. The output results obtained are good as expected. The limitations of the model are boost converter output to be a fixed one. The PV Array output is not fixed as it depends on the weather conditions. So it is required to control the Boost Converter output for better performance of the inverter model proposed. Another limitation of the model is the filter which circuit requires large inductance and capacitance but the greatest advantage of the circuit is that it eliminates transformer and hence it overcomes all other disadvantage is of less importance.

The model proposed is a new approach and can be verified easily by implementing it in the hardware circuitry requiring minimum components at much less cost.

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Trust Based Routing Approach to Enhance Received Data Packets by Various Nodes in MANET

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ABSTRACT

In this paper, Trust prediction has been used for checking the trustworthiness of the nodes present in the network. Trust prediction finds the best route for the routing that is free from malicious nodes. DTQR (Distributed Trust based QoS aware routing) is based on AODV (Ad-Hoc on Demand Routing) protocol. We compare the DTQR (Distributed Trust based QoS aware Routing) algorithm with TQR (Trust based QoS aware AODV routing) and Watchdog-DSR. The Simulation results show that the DTQR prevents an attack from malicious nodes and the security performance, the packet delivery ratio has been improved.

Keywords - Trust prediction, trust degree, Watchdog, AODV, Malicious node, QoS constraints

I INTRODUCTION

Mobile Ad hoc Network (MANET) [3] is a set of mobile nodes, with no centralized administration or no fixed infrastructure. MANET is a stand-alone and autonomous communication network. [16] The infrastructure of MANET is unpredictable and due to dynamic change in topology, the routing of data is promising.

Ad-hoc networks have various applications such as in healthcare application, military applications. Battle-field applications where wired connection of fixed infrastructure is impossible or maintained. For example, Wireless fidelity, i.e. Wi-Fi (IEEE 802.11) protocol is capable of ad-hoc networking, where the access point is unavailable. In IEEE 802.11, it restricts the node to receive or send the data packets that do not participate in the network or routing. MANET (Mobile ad hoc network) is an infrastructure-less network which consists of various numbers of mobile nodes. The network in MANET is dynamically established without any centralized administration. In MANET [21], mobile nodes make certain tasks that are challenging since they have limited resources like memory, storage, CPU.

Base on Trust every node contains a pair of public and private keys in Public Key Infrastructure. Public keys are common that is distributed to all nodes evenly. But private key is known only to the node, no other node can access that key that is required for providing security to the system. In Digital Signatures, the Certificate Authority (CA) is used for distributing the public keys and private keys to the sender and receiver for checking the authentication of certificates.

II PROPOSED METHODOLOGY

When sender node (T) wants to communicate with the destination node (R), Transmitter node T checks whether a path to destination node is available.

Step 1: if the legitimate path exists to the destination node then the nodes present in the route must meet the requirements i.e. trust and QoS constraints. If a trusted route exists then go to step 3. If a trusted route is not found, then the sender node initiates a route discovery process using DTQR protocol.

Step 2: While mobile nodes are in the range of network, then node S broadcasts RREQ packets to its intermediate nodes.

Step 3: Each intermediate node (I) is watched by the neighbor nodes Ng and set the suspicious nodes (S)

Step 4: While suspicious nodes (S) is not a receiver then the trust value of suspicious nodes is calculated.

Step 5: If receiver is a suspicious node present in the network, then send acknowledgement to the sender and start data forwarding otherwise receiver is not present in the network range.

Step 6: When the data forwarding is started,

Step 7: If the trusted path exists go to step 9.

Step 8: Else set the nodes as suspicious nodes in the path, and neighbor nodes watch the suspicious nodes.

Step 9: When the packet is sent through the sender, then

Step 10: If suspicious nodes are receiving the packet but does not forward the packets to the next node else go to

step 12.

Step 11: Decrease the trust value by:

Number of packets forwarded by a node New_trust = S_old_trust -Number of packets received by a node

And set new trust value for S Step 12: Increase the trust value by:

> New_trust = S_old_trust + number of packets received by a node

And set new trust value for S.

Step 13: All neighbor nodes calculate the trust value for each node separately.

Step 14: neighbor nodes send trust report to the trust calculator node.

Step 15: trust calculator node D calculates the average trust value for all suspicious nodes (S).

Step 16: While count is less than equal to 2 that is count <= 2, the trust value of suspicious nodes is calculated.

number of packets forwarded by a node

Step 17: Increment count

Step 18: When count=2 and trust value is less than 0.5 then go to step 19 else go to 20.

Step 19: Block the suspicious nodes and set the node as attacker.

Step 20: Enter the suspicious node in the trusted group

Step 21: the packet delivery ratio is calculated.

$PDR = \frac{Number of packets received by a node}{Number of packets sent by a node} * 100$

Step 22: Time Duration of Packet= End-Start;

Step 23: If packet duration is greater than zero then

Step 24: Sum= Packet_duration + Sum

 $Delay = \frac{1}{1 - 1} \frac{1}{1 - 1} \frac{1}{1 + 1} \frac{1}{1 +$ Step 27: Calculate the percentage of malicious attack malicious attacks $\% = 100 - \left(\frac{\text{msends}}{\text{tsend}}\right) * 100$

Where, msends= packets sent through malicious or mistrusted nodes Tsend= packets sent through trusted nodes

III SIMULATION PARAMETERS

In this work, the performance analysis is done in MANET (Mobile ad-hoc Network) that is based on IEEE 802.11b MAC layer. The simulation is done under saturated Condition. The Simulation is performed using NS-2.31. The number of nodes present in the network is defined previously i.e. 50 nodes. When simulation is performed in the simulation area of 800 m *800 m, the mobile nodes move randomly in any direction. The routing protocol used is DTQR that is based on AODV protocol. The routing is performed in presence of malicious nodes under the black hole attack. The UDP/CBR [5] is used as transport protocol/ traffic source. The simulation is performed till 900s. 7 simulations each of 150 s are run during each performance factor. In simulation, the following time has been taken 0 s, 150 s, 300 s, 450 s, 600 s, 750 s, 900 s. The packet size is 512 bytes and uses random way mobility model. The five performance plots is compared i.e. Simulation time vs. packet delivery ratio, Simulation time vs. receiving packets at destination nodes, Simulation time vs. end-to-end delay, Simulation time vs. detection

Step 25: Increase the received num i.e. recvnum++

Step 26: Calculate Delay as

ratio of malicious nodes, Simulation time vs. routing packet overhead.

The trust value update improves the performance of the network and trustworthiness of nodes. The trust table is maintained for every node; hence no malicious nodes enter the network. Each simulation is repeated 50 times and average results are calculated.

Table 1 shows the simulation parameters that have been used in the mobile ad-hoc network for performing the simulation. The performance is analyzed in the network and values have been tabulated

We have compared the DTQR with other protocols: TOR and Watchdog-DSR. TOR is a routing protocol that uses AODV protocol with trust and QoS constraints that improves packet delivery ratio, end-to-end delay. Watchdog DSR uses DSR routing protocol and it is used for detecting the malicious nodes in the network.

Parameters	Values	
Simulation area	800 m *800 m	
Simulation Time	900 s	
Number of nodes	50	
Number of malicious nodes	2	
Connection Type	CBR/UDP	
Packet Size	512 Bytes	
Transmission Radius	250 m	
Mobile Speed	20 m/s	
Trust threshold degree	0.5	
Trust time update	1 s	
Physical, MAC layer	IEEE 802.11b	
Mobility	Random Waypoint Model	

Table 1Table of simulation parameters

Table 2:Table of Send Data Packets

Time (in Secs)	Sent Data Packets
0	0
150	7493.00
300	15112.00
450	22732.00
600	30350.00
750	37969.00
900	45589.00

 Table 3:

 Table of Send Data Packets by Various Nodes

 Passived Packets by Nades

Time(in	Received Packets by Nodes			
secs)	DTQR	TQR	Watch Dog- DSR	
0	0	0	0	
150	3375.00	2997.00	2699.00	
300	8884.00	8247.00	7587.00	
450	17246.00	15095.00	13579.00	
600	25192.00	21110.00	19792.00	
750	33687.00	32721.00	27809.00	
900	44115.00	42120.00	32949.00	

Source nodes send data packets to the destination nodes through routing protocols. In the table 2 & 3, we compare the Data packets received through the routing protocols DTQR, TQR, Watch Dog-DSR.

We can see that the maximum data packets can be received through our proposed algorithm, DTQR.



Fig 1: Variation of Data receiving analysis

IV SIMULATION RESULTS

Figure 1 shows variation in data receiving packets. DTQR shows better performance than Watchdog-DSR and TQR.

The simulation is done under saturated Condition. The saturation condition determines that the sender node S always has a data packet to send to its intermediate nodes, and the buffer is non-empty. The mobile nodes are distributed randomly in the network. The simulation used in the network simulator is random way mobility model. The random way mobility model is used commonly in experiments and simulations. Before simulation is performed the node chooses the area for simulation and chooses x and y coordinates. Once all the nodes are set in the network, the simulation is performed. When the simulation starts, it simulates for various time duration till 900s. The performance of DTQR protocol is performed in the basis of packet delivery ratio, receiving data packets analysis, end-to-end delay analysis and detection ratio of malicious nodes and routing packet analysis with respect to the simulation time. Our approach improves the throughput by. It is analyzed and computed that as the packet delivery ratio increases, the throughput also increases. And hence DTQR is better and provides better packet delivery ratio than TQR and Watchdog-DSR.

V CONCLUSION

In the proposed work, a trust mechanism based on Ad-Hoc on Demand Routing protocol termed as DTQR (Distributed QoS aware Trust based routing protocol) is implemented. The proposed work uses Watchdog mechanism that is a higher implementation of Intrusion Detection System (IDS). DTQR detects the malicious nodes present in the network and improves the packet delivery ratio and packet receiving ratio and computes the trustworthiness of the nodes at various parameters. The DTQR protocol is implemented using NS-2 simulator based on AODV protocol and is compared with Watchdog-DSR and TQR in the presence of malicious nodes in the network. DTQR shows beat performance for the above parameters in the simulation. Through DTQR protocol, we can choose a best trusted path with trusted nodes and **QoS** constraints.

Distributed Trust Based QoS aware routing protocol (DTQR) is compared with the Watchdog-DSR and TQR protocol on the basis of detection ratio, packet delivery ratio, end-to-end delay ratio, packet receiving ratio and routing packet overhead while increasing the mobility of the network as well as increasing the malicious nodes in the network. It is observed that the proposed protocol performs better then Watchdog-DSR and TQR.

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In our future work, we can compare the DTQR protocol with existing protocols and improve the performance using key management techniques and secure routing.

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