MECHANICAL PROPERTIES OF HIGH STRENGTH CONCRETE BY USING M-SAND AS A FINE AGGREGATE

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ABSTRACT

During the past few decades Common River sand has become expensive due to excessive cost of transport from natural sources. Large scale depletions of these sources have led to many environmental impacts. In order to overcome these impacts an alternative has to be found in order to replace sand. The manufactured sand (M-sand) has found to be economical alternative to the river sand. M-sand is obtained as a crushing of granite stones in required grading to be used for construction purposes as a replacement for river sand. M-sand has been used in large scale in highways as surface finishing materials and also used in the manufacture of hollow blocks and in light weight concrete prefabricated elements. In this, investigations were carried out to study the compressive strength and split tensile strength of concrete using M-sand as fine aggregate instead of river sand. And compare the results obtained from both the river sand and the M-sand. In order to achieve the strength, cement is replaced by silica fume by 15% in weight and also 1.2% weight of binder super plasticizer is added to obtain workability. The present investigations mainly focused on the M-sand properties and the strength obtained from both the river sand and m-sand. In order to solve the problem of the granite powder disposal from the industries and also to solve the raw materials shortage problem for concrete, studies are being made to utilize the M-sand in the manufacture of varieties of building and ceramics products. This investigation is also based on the comparison of the compressive strength and split tensile strength achieved by the cubes and cylinders in normal sand and M-sand.

Keywords: High Strength Concrete;Silica Fume;Compressive And Split Tensile Strengths;Water-Cement Ratio.

I. INTRODUCTION

1.1 High Strength Concrete

HSC is the term used for concrete mixes, which possess invariably high strength, high dimensional stability, reasonable workability and high durability. This type of concrete finds application in heavily reinforced sophisticated structural elements in high rise buildings, off-shore platforms, super span bridges, prestressed concrete members and heavy-duty pavements. High strength concrete has compressive strength of up to100 MPa as against conventional concrete which has compressive strength of less than 50 MPa. High strength concrete are same as those used in conventional concrete with the addition of one or two admixture, (both chemical and minerals).

High strength concrete essentially has a low water-binder ratio. A value of 0.3 is suggested as the boundary between normal strength and high strength concrete. The production of high strength concrete requires more

research and more attention of quality control than conventional concrete. High strength concrete (HSC) might be regarded as concrete with strength in excess of 60MPa and such concrete can be produced as relatively normal concrete with a higher cement content and a normal water-reducing admixture. This present investigation evaluates the potential of silica fume and M-sand as filler materials. Measurements of early age properties of fresh concrete including slump test and specific gravity tests and fineness modulus have been examined. Mechanical performances including compressive strength and split tensile strength were evaluated. The aim of the investigation is to investigate the effect of M-sand as a fine aggregate in high strength concrete and compare the results with the River sand. The scope of the present investigation can be summarized as follows:

Ø To study the effect of workability and the strength of concrete with the replacement of M-sand by river sand, at an addition of silica fume with cement.

Ø To achieve 28 days characteristic compressive strength of 70MPa.

Ø To compare the variation of compressive strength at 7 days ,14 days and 28 days strength between M-sand and River sand. In the present investigation more emphasis is given to study the HSC using M-sand replacement by river sand. So as to achieve better concrete composite and to encourage the use of M-sand to overcome the environmental impacts caused due to over depletion of river sand.

1.2 Properties of High Strength Concrete

The properties of high strength concrete are significantly different from those of normal strength concrete. These properties are examined in this section when the concrete is setting and hardening as well as in the hardened state. These properties should be taken into account while designing structures using high-strength concrete.

1.3 Setting and Hardening

When the concrete mixture is in the liquid phase, there are isolated solid grains in a connected structure. Hydration starts from the surfaces of the grain. As the outer crust grows thicker, it retards the hydrations process. The formations of hydrates around each grain change the liquid into a continuous solid. In ordinary concrete, the hydration continuous the anhydrous core remains at the center of the grain for a long time. The post-setting hydration process leads to the internal growth of a skeleton structure and the reduction of the water content in the pores. For high strength concrete with a low water cement ratio, the shrinkage caused by the reduction in the pore water causes internal compression, which is developed due to the surface tension of the pore water at the liquid-vapour interface. The mobility of the fluid state decreases as the water content decreases due to the reaction. High strength concrete with a low water-cement ratio is more sensitive to early drying.

II. EXPERIMENTAL INVESTIGATIONS

2.1 Introduction

This chapter presents the details of the experimental investigations carried out on the test specimens to study the workability and mechanical properties of HSC using silica fume as a constant percentage replacement with cement and to correlate the results between the normal sand and the m-sand. In addition the performance of silica fume in concrete also required to ensure. In present investigation, a specified mix design procedure for HSC using silica fume and m-sand and super plasticizer which was formulated. Based on the above procedure, a

concrete mixture property with a characteristics target compressive strength of 70 MPa is designed with 15% replacement of silica fume with cement and full replacement of normal sand with m-sand and correlates the results obtained in both the sand conditions. Experimental investigation have been carried out on the HSC specimen to ascertain the workability such as slump test and mechanical properties such as compressive strength and split tensile strength of the M70 grade mixes. Minimum three specimens were tested for each trial mix for normal water. All the tests were conducted as per codal specifications.

2.2 Preparation before Tests

The test specimens where cast in cast iron moulds. The inside of the mould were applied with oil to facilitate the easy removal of specimens. For obtaining the binder content, the cement and silica fume were thoroughly mixed with one another in dry condition. The fine aggregate and the binder content should be mixed with in dry condition. The coarse aggregate, fine aggregate and the binder content were placed in a concrete mixer machine and then mixed thoroughly in dry condition. For addition of water initially 75% of the mix water is added to the dry mix and mixed thoroughly. The super plasticizer was added to the remaining 25% of the mix water and added to the mix and then mixing was carried out about 2 to 3 minutes. The concrete was then placed in the moulds in three layers of equal thickness and each layer was vibrator. For each series of test specimens, specimens were cast to study the strength and shear related properties of the HSC mixes. After 24 hours, the test specimens were de-molded and set of specimens was placed in normal water curing, till the age of test.

2.3 Workability Properties

Measurements on workability of HSC are done by slump cone test and compaction factor test. The tests on fresh concrete of all trial mixes were carried out.

2.4 Slump Cone Test

This test is used to determine the workability of concrete. The apparatus is a cone of 10cm top diameter, 20cm bottom diameter and 30 cm height. It has two handles for lifting purposes. Initially, the con is cleaned and oil is applied on the inner surface. Then, the concrete to be tested is placed into the cone in three layers. Each layer is compacted 20 times by a standard tamping rod. After filling the cone, it is lifted slowly and carefully in the vertical direction. Concrete is allowed to subside and this subsidence is called slump. If the slump is even, then it is termed as true slump. If one half of cone slides, it is called shear. If entire concrete slides, it is called as collapse. Shear slump indicates that concrete is non-cohesive and shows a tendency for segregation. Generally, the slump value is measured as the difference between the height of the mould and the average height after subsidence. Slump test is found to be the simple test and is widely used.

2.5 Strength Related Properties

The strength related tests were carried out on hardened conventional cement concrete for 28 days to ascertain the strength related properties such as cube compressive, cylinder compressive strength.

2.6 Compression Tests for Cubes

For cube compression tests on concrete, cube of size 150mm were employed. All the cubes were tested in saturated condition after wiping out the surface moisture from the specimen. For each trial mix, three cubes were tested at the age of 7, 14 and 28 days of carrying 400 tons capacity HELICO compression testing machine referred to BIS: 516-1959. The tests were carried out at a uniform stress after the specimen has been centered in

the testing machine. Loading was continued till the dial gauge needle just reverses its direction of motion. The reversal in the directions of motion of the needle indicates that the specimen has failed. The dial reading at the instant was noted, which is the ultimate load. The ultimate load divided by the cross section area of the specimen is equal to the ultimate cube compressive strength. The test setup for the compressive strength and typical failure pattern is shown in figures.

Compressive strength = load / area (N/mm^2)

2.7 Split Tensile Strength for Cylinders

This is an indirect test to determine the tensile strength of the specimen, splitting tensile tests were carried out on 150mm*300mm sized cylinder specimens at an age of 7, 14 and 28 days, using 400 ton capacity heico compression testing machine as per IS 5816-1970. The load was applied till the specimen split and readings were noted. The splitting tensile strength has been calculated using the following formula.

$$\text{Split tensile strength} = \frac{2*P}{\pi D*L} \ N/mm^2$$

Where,

P – Maximum load in "N" applies to the specimen

D – Measured diameter in "mm" of the specimen

L – Measured length "mm" of the specimen

III. MIX DESIGN-M70

3.1 Design Stipulations

Characteristic compressive strength required in the field of 28 days	=	$70N/mm^2$
Type of coarse aggregate	=	Rock
Typical shape of coarse aggregate particles	=	Angular
Specific gravity of the cement	=	3.15
Specific gravity of silica fume	=	2.20
Specific gravity of fine aggregate	=	2.60
Specific gravity of coarse aggregate	=	2.70
Bulk density of coarse aggregate	=	$1560\ kg/m^3$
Bulk density of fine aggregate	=	$1570\ kg/m^3$
Water absorption of coarse aggregate	=	0.4
Moisture content of coarse aggregate	=	NIL
Water absorption of fine aggregate	=	1.48%
Moisture content of fine aggregate	=	NIL

3.2 Mix Design

1) Target mean compressive strength of concrete

The target mean compressive strength for the specified characteristic cube strength = 70+9.7

= 79.7 N/mm^2

2) Selection of maximum size of coarse aggregate

The maximum size of coarse aggregate selected as 12.5 mm as per table 4.2

3) Estimation of free water content

Since the saturation point of super plasticizer is not known the minimum free water content is selected as 199 l/m^3 as per table 4.3

4) Super plasticizer dosage

The super plasticizer dosage is taken as 1.2%

5) Estimation of air content

The entrapped air content is estimated as 2.0%

6) Selection of coarse aggregate content

Since the coarse aggregate particle shape is angular, the coarse aggregate content is taken as 880 kg/m^3 as per table 4.5

7) Selection of w/b ratio

The water binder ratio is chosen as 0.26 for the target mean compressive strength of 79.7 MPa from fig 4.1 of the proposed w/b ratio Vs compressive strength relationship.

8) Calculations of binder content

Binder content required per unit volume of concrete is

= free water content / (W/B ratio)

= 199/0.26

= 765.38 kg

Let the % replacement of cement by the silica fume is 15%

Silica fume content = (15*765.38)/100

= 114.80 kg

Mass of cement = 765.38-114.80

= 650.58 kg

9) Super plasticizer content

Mass of solids in super plasticizer

M_{sol} = (c*d)/100

Where

'c' is the mass of the cementitious materials in kg

'd' is the dosage expressed as the % of its solid cement

M_{sol} = (1.2*765.38)/100

M_{sol} = 9.18 kg

Volume of the liquid super plasticizer,

V_{liq} = $_{Msol}$*100/(S*Ss)

Where

S is the solid content of the super plasticizer in %

Ss is the specific gravity of the liquid super plasticizer

V_{liq} = (9.18*100)/(40*1.22)

= 18.81 l/m^3

Volume of water in super plasticizer

V_w = V_{liq}*S_s[(100-S)/100]

= 18.81*1.22[(100-40)/100]

= 13.764 l/m^3

Volume of solids in liquid super plasticizer,

V_{sol} = V_{liq}-V_w

= 18.81-13.764

= 5.046 l/m^3

10) Estimation of fine aggregate content

Absolute volume of sand = Vfa

$$Vfa = 1000 - [\left(Vw + \left(\frac{Mc}{Sc}\right) + \left(\frac{Msf}{Ssf}\right) + \left(\frac{Mca}{Sca}\right) + Vsol + Vea\right)]$$

Where,

$Vsol$ is the absolute volume of sand in litres per unit volume of the concrete (m^3)

Vw is the volume of water (litres) per unit volume of concrete

Mc is the mass of cement (kg) per m^3 of concrete

Sc is the specific gravity of cement

Msf, Mca are the total mass of the silica fume and coarse aggregates (kg) per m^3 of concrete respectively.

$Vsol$, Vea are the volume of solids in the super plasticizer and entrapped air (litres) per m^3 of concrete respectively.

Vfa =1000[199+(650.58/3.15)+(114.80/2.2)+(880/2.7)+5.0461+20]

= 216.17 l/m^3

Mass of the sand = 216.17*2.6 = 562.05 kg

11) Moisture adjustment

The actual quantity of the coarse aggregate = 880 kg/m^3

Actual quantity of the fine aggregate = 562.05 kg

The actual quantity of the water content required after deducting the volume of water included in the liquid super plasticizer is

= 199-Vw

= 199-13.764

= 185.23 litres

12) Unit mass of concrete

=185+650.58+114.80+880+309.6+9.18

=2344.16 kg/m^3

The actual quantities of different ingredients required for 1m^3 of the concrete are

Mixing water = (WC-Vw)

= 185 litres taken as 199 liters itself.

Cement = 650.58 kg

Silica fume = 114.80 kg

Fine aggregate = 562.05 kg

Coarse aggregate = 880 kg

Super plasticizer = 18.81litres the mix proportion then becomes,

The mix proportion then becomes,

Water	**:**	**(cement+SF)**	**:**	**FA**	**:**	**CA**
199	**:**	**765.38**	**:**	**562.05**	**:**	**880**
0.26	**:**	**1**	**:**	**0.734**	**:**	**1.15**

Test Results and Discussions

Compression test results for river sand (Curing period – 7 days)

S. No.	**W/C Ratio**	**Age at testing (days)**	**Specimen**	**Weight (kg)**	**Load (kN)**	**Compressive strength (N/mm^2)**	**Average Compressive strength (N/mm^2)**
1	0.26	7	A1	8.45	1019	45.3	45.7
2			A2	8.57	1035	46	
3			A3	8.38	1030	45.8	
4	0.28	7	B1	8.62	954	42.4	42.8
5			B2	7.98	981	43.6	
6			B3	8.65	958	42.6	
7	0.30	7	C1	8.29	893	39.7	39.3
8			C2	8.54	900	40	
9			C3	7.65	859	38.2	

Compression test results for river sand (curing period – 14 days)

S. No.	W/C Ratio	Age at testing (days)	Specimen	Weight (kg)	Load (kN)	Compressive strength (N/mm^2)	Average Compressive strength (N/mm^2)
1	0.26	14	A4	8.32	1282	57	56.1
2			A5	8.54	1271	56.5	
3			A6	8.36	1237	55	
4	0.28	14	B4	7.95	1219	54.2	53
5			B5	8.12	1170	52	
6			B6	7.45	1192	53	
7	0.30	14	C4	8.62	1120	49.8	49
8			C5	9.3	1035	46	
9			C6	8.21	1147	51	

Compression test results for river sand (curing period – 28 days)

S. No.	W/C Ratio	Age at testing (days)	Specimen	Weight (kg)	Load (kN)	Compressive strength (N/mm^2)	Average Compressive strength (N/mm^2)
1	0.26	28	A7	9.32	1545	68.7	68
2			A8	9.21	1552	69	
3			A9	8.98	1496	66.5	
4	0.28	28	B7	8.45	1473	65.5	65
5			B8	7.65	1435	63.8	
6			B9	8.51	1480	65.8	
7	0.30	28	C7	8.26	1395	62	62
8			C8	9.21	1422	63.2	
9			C9	9.12	1361	60.5	

Compression test results for m- sand (curing period – 7 days)

S. No.	W/C Ratio	Age at testing (days)	Specimen	Weight (kg)	Load (kN)	Compressive strength (N/mm^2)	Average Compressive strength (N/mm^2)
1	0.26	7	A1’	8.12	916	40.7	40.5
2			A2’	7.54	952	42.3	
3			A3’	7.12	866	38.5	
4	0.28	7	B1’	7.65	864	38.4	38
5			B2’	8.24	810	36	
6			B3’	7.69	891	39.6	
7	0.30	7	C1’	8.15	769	34.2	34.4
8			C2’	8.23	810	36	
9			C3’	8.54	738	32.8	

Compression test results for m- sand (curing period – 14 days)

S. No.	W/C Ratio	Age at testing (days)	Specimen	Weight (kg)	Load (kN)	Compressive strength (N/mm^2)	Average Compressive strength (N/mm^2)
1	0.26	14	A4'	7.45	1137	50.57	50.5
2			A5'	8.15	1158	51.5	
3			A6'	8.94	1113	49.5	
4	0.28	14	B4'	8.12	1095	48.7	48
5			B5'	8.51	1035	46	
6			B6'	7.45	1102	49	
7	0.30	14	C4'	7.91	1044	46.4	44.2
8			C5'	8.45	945	42	
9			C6'	8.95	990	44	

Compression test results for m- sand (curing period – 28 days)

S. No.	W/C Ratio	Age at testing (days)	Specimen	Weight (kg)	Load (kN)	Compressive strength (N/mm^2)	Average Compressive strength (N/mm^2)
1	0.26	28	A7'	8.65	1525	67.8	69
2			A8'	8.15	1552	69	
3			A9'	9.21	1575	70	
4	0.28	28	B7'	8.45	1467	65.2	67.2
5			B8'	7.15	1530	68	
6			B9'	8.59	1541	68.5	
7	0.30	28	C7'	8.65	1402	62.35	63.3
8			C8'	8.24	1451	64.5	
9			C9'	7.98	1417	63	

Split tensile strength results for river sand (curing period-28 days)

S. No.	W/C Ratio	Age at testing (days)	Specimen	Weight (kg)	Load (kN)	Split strength (N/mm^2)	Average split strength (N/mm^2)

1	0.26	28	A1	13.59	381	5.40	5.5
2			A2	13.54	396	5.6	
4	0.28	28	B1	12.98	339	4.8	4.701
5			B2	13.48	325	4.602	
7	0.30	28	C1	13.98	333	4.706	4.7
8			C2	13.47	329	4.66	

Split tensile strength results for m- sand (curing period-28 days)

S. No.	W/C Ratio	Age at testing (days)	Specimen	Weight (kg)	Load (kN)	Split strength (N/mm^2)	Average split strength (N/mm^2)
1	0.26	28	A1’	12.57	403	5.7	5.67
2			A2’	12.98	399	5.64	
4	0.28	28	B1’	12.51	346	4.9	5.05
5			B2’	12.53	368	5.2	
7	0.30	28	C1’	12.48	329	4.65	4.785
8			C2’	13.57	348	4.92	

Tensile strength is one of the basic and important properties of concrete. The results are required for the design of concrete structural elements subject to transverse shear, torsion, shrinkage and temperature effects. Its value is also used in the design of prestressed concrete structures, liquid retaining structures, roadways and runway slabs. The split tensile strength is generally greater than the direct tensile strength and lower than flexural strength (modulus of rupture). It is used to evaluate the shear resistance provided by concrete and to determine the development length of reinforcement. The split tensile strength of HSC of the tested specimens is presented in the table.

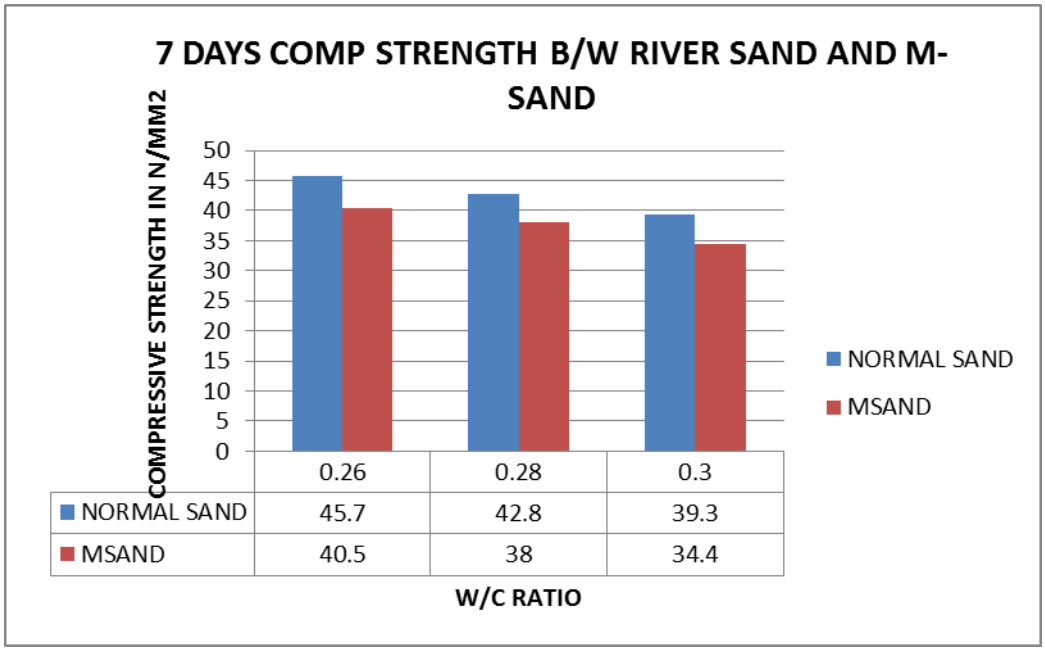
Average compressive strength results for both river sand and m-sand

S.NO	W/C RATIO	RIVER SAND (N/mm^2)			M-SAND (N/mm^2)		
		7 DAYS	14 DAYS	28 DAYS	7 DAYS	14 DAYS	28 DAYS
1	0.26	45.7	56.1	68	40.5	50.5	69
2	0.28	42.8	53	65	38	48	67.2
3	0.30	39.3	49	62	34.4	44.2	63.3

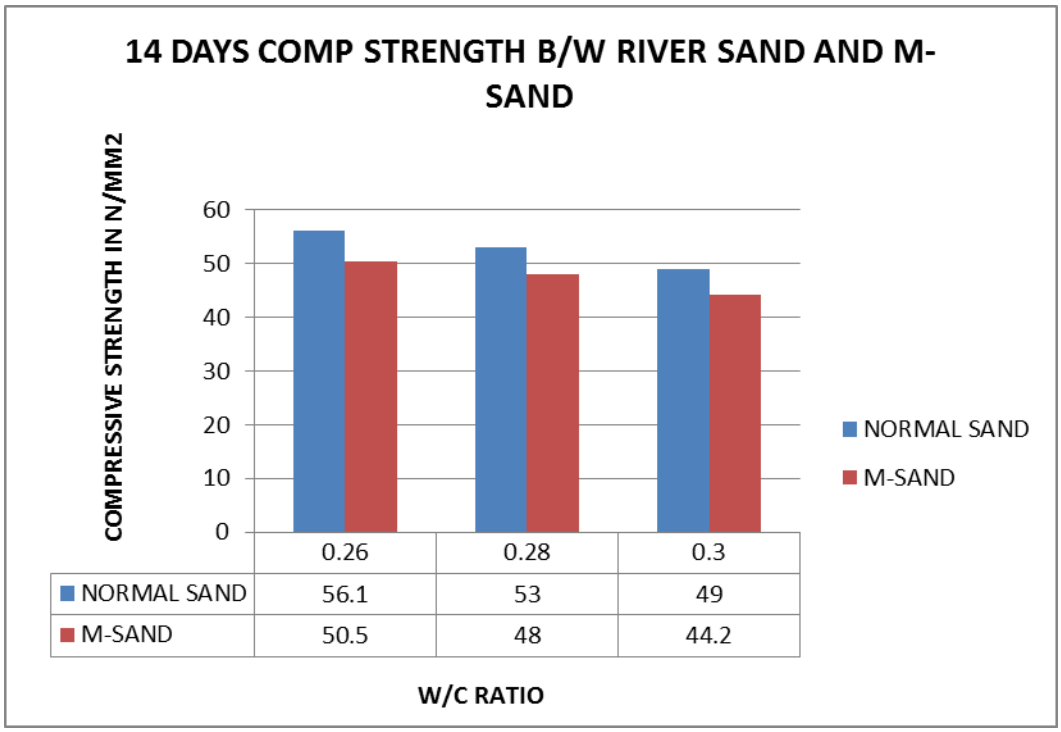
Average split tensile strength results for both river sand and m-sand

S.NO	W/C RATIO	RIVER SAND (N/mm^2)	M-SAND (N/mm^2)
1	0.26	5.5	5.67
2	0.28	4.701	5.05
3	0.30	4.7	4.785

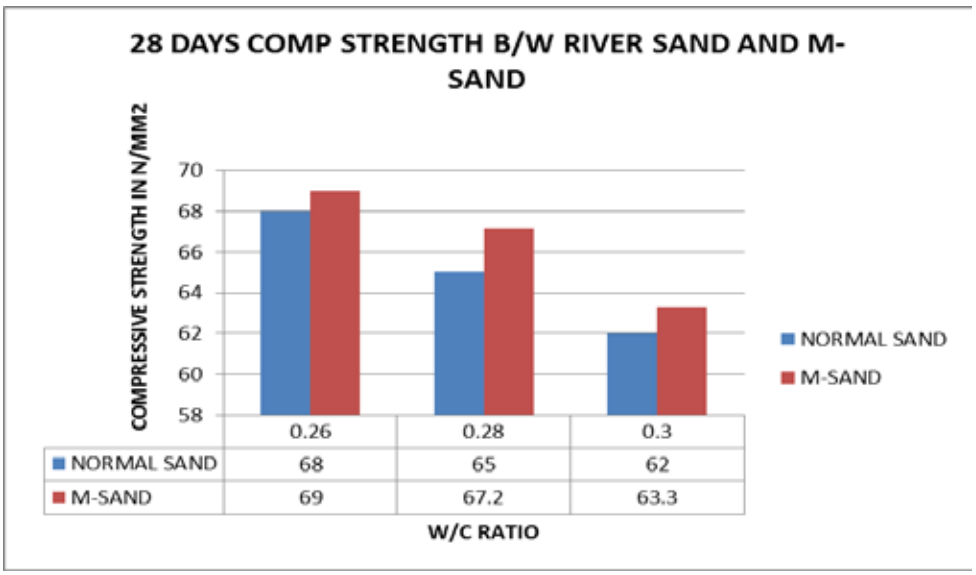
Comparison between the river sand and m-sand (compressive strength for 7 days curing period)



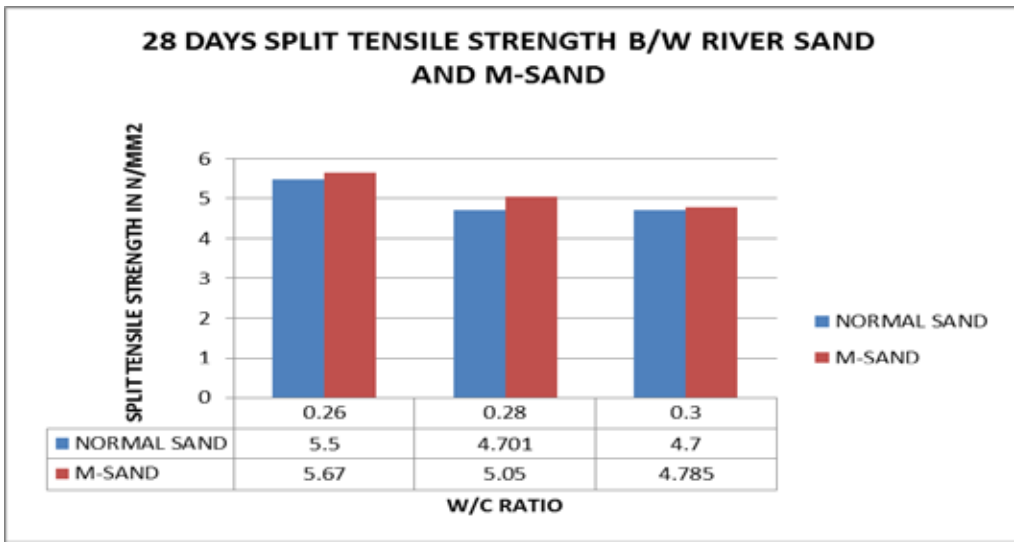
Comparison between the river sand and m-sand (compressive strength for 14 days curing period)



Comparison between the river sand and m-sand (compressive strength for 28 days curing period)



Comparison between the river sand and m-sand (split tensile strength for 28 days curing period)



IV. CONCLUSIONS

Cubes and cylinders of M-70 grade concrete have been cast with river sand as fine aggregate and tested for cube compressive strength and split tensile strength. Cubes and cylinders of M-70 grade concrete have been cast with M-sand as fine aggregate and tested for cube compressive strength and split tensile strength.

Based on the experimental investigation, the following results have been found,

i) 7 days and 14 days strength of concrete with River sand is higher when compared with the strength of concrete with M-sand.

ii) 28 days strength of concrete with M-sand is higher than that of with River sand.

iii) Also, due to the superior gradation of M-sand gave good plasticity to mortar providing excellent workability.

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IDENTIFICATION AND PREVENTION OF MULTIPLE ACCOUNT IN SOCIAL MEDIA

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ABSTRACT

Identity deception has become an increasingly important issue in the social media environment .The past methods for detecting fake profiles have mainly focused on detecting deception through verbal communication (e.g., speech or text).Although these methods yield a high detection accuracy rate, they are computationally inefficient for the social media environment .The work concentrate on detection method based on non-verbal behaviour for identity deception ,which can be applied to many types of social media .The main goal is to yield a high detection accuracy rate and computational efficiency for the social media environment. The number of users registering with social networking sites such as Facebook and Twitter keeps increasing at a rapid pace amounting to 82 percentage of the world's online population. Social network usage has increased by 64% since 2005.. Proposed work to use non verbal behavior to identify and prevent multiple accounts in social media. Thereby security and privacy issues will be decreased with accuracy. The main contributions of this work can be propose a computationally efficient method (applicable to all social media classifications) for detecting identity deception through the use of non-verbal user activity in the social media environment.

Index Terms: Algorithm; Deception; Identity, Performance; Social Media

I. INTRODUCTION

Big data is a set of techniques and technologies that require new forms of integration to uncover large hidden values from large datasets that are diverse complex and of a massive scale. Big data with using concepts of hadoop and Mapreduce.Big Data is all deals finding a needle of value in a haystack of unstructured information[1]. Big data regularly includes data sets with sizes beyond the ability of commonly used software tools to capture and manage and process data within a tolerable elapsed time. Planning a big Data architecture is not about understanding just what is different[5]. It's also deals how to integrate what's new and what you already have – from database-and-BI infrastructure to IT tools and end user applications [3]. Big data specifies to large datasets that are difficult to store, search, share, visualize and analyse. Big Data is sized in peta, hexa and zeta bytes. it's not just about volume the approach to analysis contends with data content and structure that cannot be anticipated [6]. These analytics and the science behind them filter low value or low-density data to reveal high value or high-density data.

1.1 Big Data Characteristics

Volume- It refers to the amount of data. it supports high volume of data even terabytes and beta bytes and so on. The quantity of data that is generated is very important in this context [4]. It defines the size of the data which determines the value and potential of the data.

Variety - It refers to the variety of data. it supports many types of data. For example image, audio, video etc. It helps the people who are closely analysing the data and are associated with it to effectively use the data to their advantage and thus upholding the importance of the Big Data [9].

Velocity – It refers to the speed of generation of data or how fast the data is generated and processed to meet the demands and the challenges [7].

Variability – It refers to the process of being able to handle and manage the data effectively.

Veracity – It refers the quality of the data being captured can vary greatly. Exact analysis depends on the veracity of the source data [2]. Veracity refers to the level of quality and trustworthiness that can be ascribed to a data set.

1.2 Key Areas That Big Data Analytics May Influence Are Detailed Below

Data management — There are potential savings in time and money if agencies implemented smarter data management practices that were conscious of the needs of big data analysis.. For example through better business process management, redundant data collection processes can be reduced by reusing data collected from separate processes [8].

Personalisation of services—Big data analytics may produce value by revealing a clear picture of an individual customer or customer group. Big data is able to achieve this due to its characteristic granularity. This granularity may assist in unlocking the possibility of personalised services tailored to the individual and delivered by government. Problem solving and predictive analytics the unification of multiple datasets from disparate sources in combination with advanced analytics techniques and technologies will advance problem solving capabilities and in turn will improve the ability of predictive analytics to reveal insights that can effectively support decision-making.

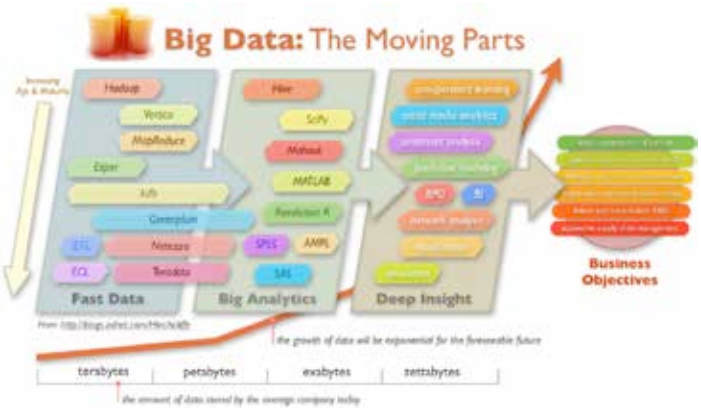

Fig 1.1 Big Data Technology

Productivity and efficiency — The analysis of big data sources can be used to identify cost savings and opportunities to increase efficiency. it will directly contribute to an improvement in productivity. It can in turn help to encourage further innovation.

1.3 What the Future Looks Like

A successful big data strategy is expected to assist in realising each of the priority areas observed in the ICT Strategy. The delivery of better services — big data analytics will allow government agencies to deliver more personalised services that are tailored to meet citizen's needs and preferences. For example the identification of individuals or groups who are eligible for certain entitlements without the need for them to be aware of or

explicitly apply for that benefit. Improved efficiency of government operations — more effective use of big data for predictive analysis will allow government agencies to better assess risk and feasibility and detect fraud and error. Open engagement —These engagements will help to build knowledge, spark ideas, generate growth and better inform decisions and solutions that meet the needs of the government, both on a national and local level.

1.4 Challenges

Meeting the challenges presented by big data will be difficult. The volume of data is already enormous and increasing every day. The velocity of its generation and growth is increasing, driven in part by the proliferation of internet connected devices. Current technology, architecture, management and analysis approaches are unable to cope with the flood of data, and organisations will need to change the way they think about, plan, govern, manage, process and report on data to realise the potential of big data.

1.4.1 Privacy, Security and Trust

Big data sources, the transport and delivery systems within and across agencies, and the end points for this data will all become targets of interest for hackers, both local and international and will need to be protected [11]. The potential value of big data is a function of the number of relevant, disparate datasets that can be linked and analysed to reveal new patterns, trends and insights.

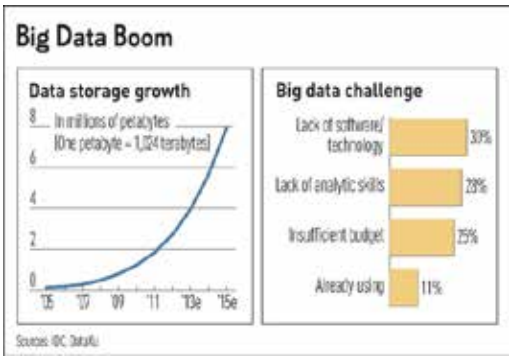

Fig 1.2 Challenges Handled in Big Data

1.4.2 Data Management and Sharing

The processes surrounding the way data is collected, handled, utilised and managed by agencies will need to be aligned with all relevant legislative and regulatory instruments with a focus on making the data available for analysis in a lawful, controlled and meaningful way.

II. HADOOP

IT defined as a framework for running applications on large clusters of commodity hardware which produces huge data (petabytes – zetabytes) and to process it.Open source Apache Software Foundation Project.

2.1 Hadoop Includes

HDFS a distributed file system to distribute data.A File System on multiple machines which sits on native file system .It supports processing incase of any hardware Failure due to usage of Commodity machines, failure is a common phenomenon and designed for failure also it supports simple Coherency Model. it used to write Once and read Many Times. Map/Reduce HDFS implements this programming model. It is an offline computing engine. Handles distributed Applications.

Hadoop Daemons:

1. Name Node- Stores the metadata that means information about the files and blocks.
2. Data Node -Serve read/write requests from clients and Perform replication tasks upon instruction by name node.
3. Secondary Name Node- Copies Fs Image and Transaction Log from Name Node to a temporary directory. Merges FS Image and Transaction Log into a new FS Image in temporary directory.

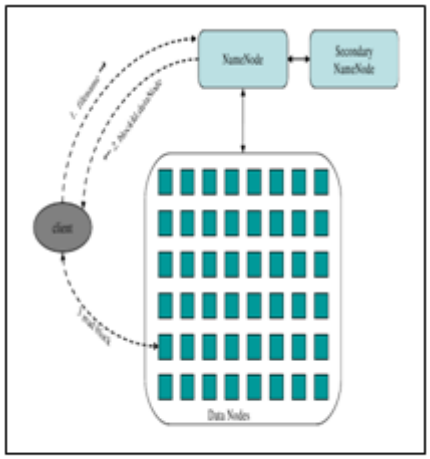

Fig 2.1 HDFS Architecture

1. Job Tracker -Accepts MR jobs submitted by users.Assigns Map and Reduce tasks to Task trackers. Monitors task and task tracker status, re executes tasks upon failure.
2. Task Tracker -Run Map and Reduce tasks upon instruction from the Job tracker. Manage storage and transmission of intermediate output**.**

2.2 Characteristics

Scalable is that new nodes can be added as needed and added without needing to change data formats, how data is loaded, how jobs are written, or the application on top. Cost effective is massively parallel computing to commodity servers. The result is a sizeable decrease in the cost per terabyte of storage, which in turn makes it affordable to model all the data [13]. Flexible is schema-less and can absorb any type of data, structured or not from any number of sources. Data from multiple sources can be joined and aggregated in arbitrary ways enabling deeper analyses than any one system provide [12]. Fault tolerant is the system redirects work to another location of the data and continues processing. It defines high level abstracted framework for distributed processing of large datasets. it supports Fault Tolerant and Parallelization. Computation consists of two phase Map and Reduce.

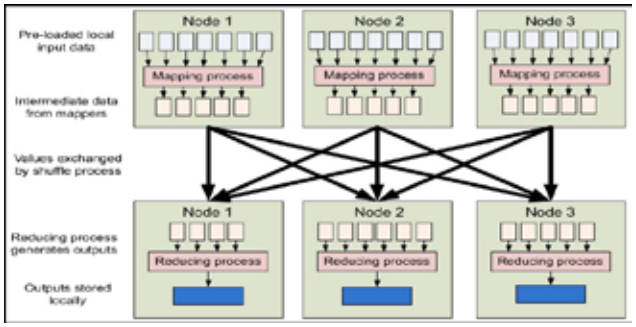

Fig 2.2 Map Reduce Pipeline

It is master-slaves architecture and computations occurs in multiple slave nodes and it tries to provide data locality as much as possible.

III. PROPOSED SYSTEM ARCHITECTURE

This chapter deals with the details of the proposed system. Identity deception is an important issue in the social media environment. The blocked users initiating new accounts, often called sock puppetry is widely known and existing efforts, it have attempted to detect such type of users, have been initially based on verbal behaviour. Although these methods yield a high detection rate of accuracy, they are computationally inefficient for the social media environment, its involving databases with large volumes of data. These past methods have mainly focused on detecting deception through verbal communication (e.g., voice or text). Proposed work to use non verbal behaviour to identify and prevent multiple accounts in social media. Issues of security and privacy will be decreased with accuracy. The main contributions of this work can be summarized as follows: propose a computationally efficient method (applicable to all social media classifications) for detecting identity deception through the use of non-verbal user activity in the social media environment.

3.1 Classification Matrix

The classification matrix is used to find the four metrics those are True positive (TP), True negative (TN), False positive (FP) and False negative (FN).

	Verified identity deception(Sockpuppetry)	Verified legitimate user
Predefined identity deception(sockpuppetry)	True positive (TP)	False positive(FP)
Predicted legitimate user	False negative (FN)	True negative (FN)

Table 3.1 Classification Matrix

3.2 System Architecture

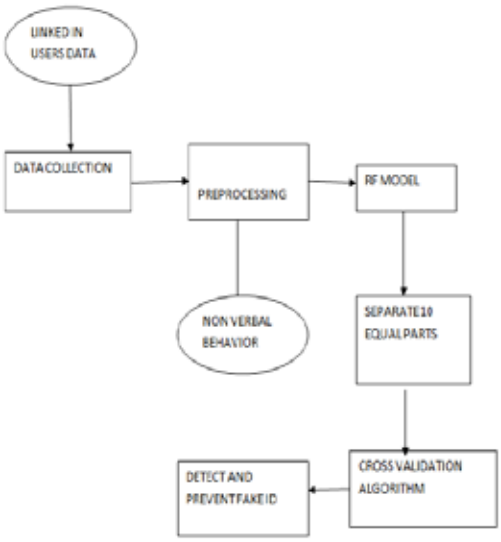

Fig 3.2 System Architecture

The Ten Times Ten Fold Cross Validation Algorithm it contains the following steps:

Step 1: Set a predefined number w

Step 2: Set random seed S= w*n*10

Step 3: Build RF model

Step 4: Classification matrix

Step 5: Calculate Recall, Precision and F-Measure.

Using this matrix, derive results to measure the following performance metrics in order to evaluate the performance of models for proposed method**:** recall (the fraction of valid sock puppet cases that are returned), precision (the amount of returned cases that are valid sock puppet cases), F-measure (the test of a model's accuracy bounded between0 and 1 that combines recall and precision), accuracy (the fraction of true positives and true negatives returned over the total number of cases), false positive rate (indicating the rate of falsely identified sockpuppets), and Matthews Correlation Coefficient (MCC) (a performance metric used in machine learning that provides a balanced result even if cases in the sample vary substantially in size).

These performance metrics are formally defined as follows

Recall= $\frac{TP}{TP+FN}$

Precision = $\frac{TP}{TP+FP}$

F-Measure=$\frac{2*Precision*Recall}{Precision+Recall}$

Accuracy =$\frac{TP+TN}{TP+TN+FP+FN}$

FPR=$\frac{FP}{FP+TN}$

MCC=$\frac{TP*TN-FP*FN}{\sqrt{(TP+FP)(TP+FN)(TN+FP)(TN+FN)}}$

IV. RESULTS

4.1 Deception and Identity Deception

Deception has been defined as the deliberate transfer of false information to a recipient that is not aware that the information received has been falsified [6], [10]. Human deception is motivated by instrumental (goal-driven), relational (relationship-driven) and identity-driven goals [12]. Deception is achieved by manipulating content, the communication channel, the sender information, or any combinations of these three components [9]. Identity deception (a subcategory of deception) focuses on manipulating the sender's information [20] and can be divided into three categories: identity concealment (e.g., concealing or altering part of an individual's identity), identity theft (e.g., mimicking another person's real identity) and identity forgery (e.g., forging a fictional identity).

4.2 The Wikipedia Environment

Wikipedia is a free online encyclopedia in which everyone can contribute without an account (anonymously when only IP address is visible) and with an account using a pseudonym or even real name. Wikipedia operates on the concept of namespaces where each namespace is meant to include a specific type of content (or pages).

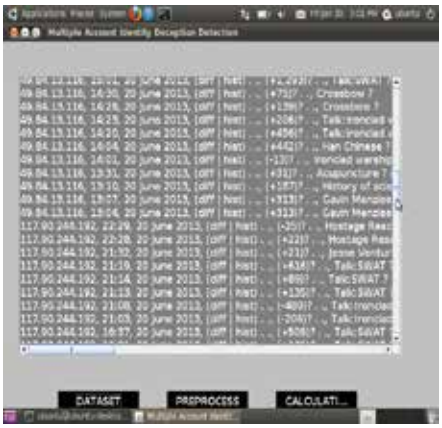

Fig 3.1 Dataset Collection

4.3 Deception Detection

Deception detection theories are divided into those that are based on leakage cues (cues sent by the deceiver unwillingly due to factors such as cognitive overload) and strategic decisions (cues indicative of deception that are willingly transmitted by a deceiver in order to ensure deception success). To detect deception, both categories pick up cues from verbal and non-verbal communications. Three of the most popular theories used in the deception field are Interpersonal Deception Theory (IDT), Leakage Theory (LT), and Expectancy Violations Theory (EVT) [21], [26]. In IDT, deception is seen as a series of exchanges between the deceiver and the victim.

Fig 3.2 Pre-processing

4.4 Contributions of This Work

The main contributions of this work can be summarized as follows:

We propose a computationally efficient method (applicable to all social media classifications [1]) for detecting identity deception through the use of non-verbal user activity in the social media environment. This contribution ensures that a relatively high level of overall detection accuracy is obtained that is comparable to similar methods that make use of verbal communication [5], [6] but with lower computational overheads.

To demonstrate the computational efficiency (to withstand the immense traffic experienced by social media services) of our proposed non-verbal method to deception detection we use publicly available data from Wikipedia and machine learning algorithms. Finally, we present design guidelines for designers and developers interested in implementing this method as an added level of security for their social media communities and additional considerations based on various social media classifications in existence today.

4.5 Non-Verbal Behaviour Variables

We used simple and more complex variables to represent user behaviour. Variables of online non-verbal behaviour fall under two major categories: time-independent and time-dependent (henceforth these variables are denoted with index *t)*.

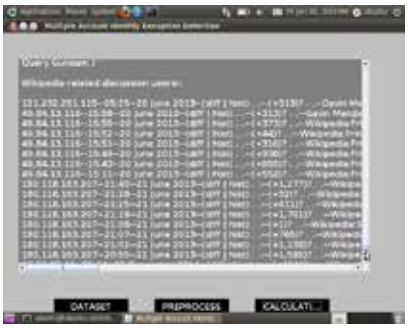

Fig 3.3 Calculation

V. CONCLUSION

Identity deception has become an increasingly important issue in the social media environment using Sock puppet algorithm which have attempted to detect such users, have been initially based on verbal behaviour. These algorithms yield a high detection accuracy rate but they are computationally inefficient for the social media environment, it involves databases with large volumes of data. A detection method based on non-verbal behaviour for identity deception, it can be applied to multiple types of social media. The method gives high detection accuracy and being computationally efficient for the social media environment when compared to previous methods.

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RELIABILITY EVALUATION OF WIND FARMS

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ABSTRACT

The Renewable energy sources, especially wind turbine generators, are considered as important generation alternatives in electric power systems due to their non-exhausted nature and benign environmental effects [1]. The fact that wind power penetration continues to increase has motivated a need to develop more widely applicable methodologies for evaluating the actual benefits of adding wind turbines to conventional generating systems. In this paper reliability evaluation of wind power generation system is carried. Reliability evaluation of generating systems with wind energy sources is a complex process. It requires an accurate wind speed forecasting technique for the wind farm site. The method requires historical wind speed data collected over many years for the wind farm location to determine the necessary parameters of the wind speed models for the particular site [3]. The evaluation process should also accurately model the intermittent nature of power output from the wind farm. For the data analysis excel data analysis tool is used and probability distribution of wind speeds are calculated [10]. This study shows the system availability for the generation of power from wind turbine generators (WTG) installed at the Kappatagudda site near to Gadag of Karnataka State.

Keywords: Excel Data Analysis, Probabilistic Model, Reliability Evaluation, Wind Energy and WTG.

I. INTRODUCTION

The worldwide of the concern about the environmental pollution and a possible energy crisis, there has been a rapid increase in renewable energy sources worldwide in the past decade. Among various renewable sources, wind power is the most rapidly growing one. The wind is a free, clean, and inexhaustible energy source [4]. The kinetic energy of the wind can be changed into other forms of energy, mechanical work in the water pumps and wind mills and electrical power in modern wind power plants. It is predicted that nearly 10% of the world energy needs could be met by the wind energy by the year 2020.

Wind power generation is one of the most important renewable energy technologies. The most common type of wind turbine used to generate electrical power is the fixed-speed wind turbine with the induction generator connected directly to the grid [4]. This system although is the most simple does not allow to perform grid control level and is very sensitive to wind fluctuations. Due to intermittent wind speed, the output power fluctuations lead to not only voltage fluctuations, but also other serious problems [6]. When variable-speed wind turbines are used the dynamic behaviour of the wind turbine, power quality and power compensations are improved. Electrical power generation from the wind is established in India in the 1990s, and has significantly increased in the last few years. Although a relative newcomer to the wind industry compared with Denmark or

the United States, India has the fifth largest installed wind power capacity in the world. In 2009-10 India's growth rate was highest among the other top four countries. India emerged as the second leading wind power market in Asia.

1.1 Generation System Reliability Studies

In the generation system the total system generation is evaluated to find the system adequacy to meet the total system load demand [7]. The system is model in generation is shown in below figure 2.

Fig. 2: Generation System Reliability Model

1.2 Reliability Indices

The most popular generation reliability index [1] is the loss of load expectation (LOLE). In addition to this index expected energy not supplied (EENS) and energy index of reliability (EIR) are used [1]. The energy not supplied can be found using the technique each state of capacity model C_k, the energy not supplied E_k is given numerically by summing all positive values of (L_i-C_k) where L_i is the i-th load level and i = 1 to n. The expected energy not supplied is given in equation (1.1).

$$EENS = \sum_{k=1}^{n} E_k P_k \; \ldots\ldots\ldots\ldots kWh \qquad (1.1)$$

Where, P_k is the probability of capacity state C_k

n is the total capacity states.

The EIR given by the equation (1.2)

$$EIR = 1 - \frac{EENS}{Energy\ Demand} \qquad (1.2)$$

II. METHODOLOGY

2.1 Wind Power Generation System

Renewable energy sources, particularly wind turbine generators, are considered as important generation alternatives in electric power systems due to their unexhausted nature and being environmental friendly. The fact that wind power contribution continues to increase has motivated a need to develop more widely applicable methodologies for evaluating the actual benefits of wind turbine generating systems [9]. Reliability evaluation of wind turbine generating systems is a complex process. It requires an accurate wind speed forecasting technique for the wind farm site. The method requires historical wind speed data collected over many years for the wind farm location to determine the necessary parameters of the wind speed models for the particular site. The evaluation process should also accurately model the intermittent nature of power output from the wind farm [10].

In this process there are many steps are involved, for my work I have considered nine steps those are listed below.

1. Data collection

2. Data analysis
3. Wind speed model for selected geographic location
4. WTG power curve data
5. WTG power generation model
6. Probabilistic evaluation of power generated
7. Three state model for WTG system
8. Evaluation of Cp and Availability
9. Calculation of reliability indices

2.1.1 Data Collection

For the evaluation process the data used is obtained from National Renewable Energy Laboratory (NREL). It consists of hourly basis average wind speed, standard deviation and wind rose data. Wind rose data is the data consists of wind direction with respect to north and it is considered as 0^0.

Wind data is available in hourly basis through the year measured by the anemometers installed at the site location. These measured data are available in the NREL web site; these data are called secondary data. Primary data are the data obtained directly from the wind site through the anemometer. For my work I have used secondary data that is data which is recorded in a system, which is provided by NREL.

Turbine data and the wind site data are obtained from the installed turbine manufacturers. Those data are available in the turbine manufacturer web site. These data contains geographic information about the wind site, turbine power curve, dimension, capacity.

2.1.2 Data Analysis

In the data analysis "Excel wind analysis tool" is used. The raw data obtained from NREL is used as an input to the Excel wind analysis tool. The purpose of this tool is to analyze wind data to prove a wind resource exists at a specific location. The spreadsheet is a program to create a Wind Rose graph, as well as a folder containing power curves for various wind turbines. Some important items calculated by the spreadsheet are the average wind speed, capacity factor, and estimated annual energy production. A report sheet is also included, formatted for printing, which summarizes results and displays graphs.

2.1.3 Wind Speed Model For Selected Geographic Location

This is the estimation of wind speed model for the specific geographic location. In this work one geographic locations is considered. In this step the wind speed model is developed by calculating the average and standard deviation of the discrete wind speeds. With this model frequency of occurrence and probability of the wind speed in that specific site can be obtained. This model also gives the probability distribution of the discrete wind speeds.

Wind speed statistics

The speed of the wind is continuously changing, making it desirable to describe the wind by statistical methods. One statistical quantity which is the average is calculated by a set of measured wind speeds u_i. Standard deviation is calculated by the variance [12].

Average wind speed

The measured wind speeds are in integer values, so that each integer value is observed many times during a year of observations. The numbers of observations of a specific wind speed u_i will be defined as m_i. The mean is then given by the relation 2.1.

$$\bar{u} = \frac{1}{n}\sum_{i=1}^{w} m_i\ u_i \qquad (2.1)$$

Where, w is the number of different values of wind speed observed

n is the total number of observations.

Standard deviation:

To find the deviation of each number from the mean and then find some sort of average of these deviations. The mean of the deviations (u_i – u) is zero, which does not indicate much. Therefore square each deviation to get all positive quantities. The variance of the data is then given by the equation 2.2.

$$\sigma^2 = \frac{1}{n-1}\left[\sum_{i=1}^{w} m_i\, u_i^2 \ - \frac{1}{n}\left(\sum_{i=1}^{w} m_i u_i\right)^2\right] \qquad (2.2)$$

Where, w is the number of different values of wind speed observed

n is the total number of observations.

Standard deviation is given by the equation 2.3

$$Standard\ deviation = \sqrt{variance\ \sigma} \qquad (2.3)$$

Frequency of occurrence:

This is the determination of the number of times in which the recorded wind speed occurred through the measured time. The percent value is given by the equation 2.4.

$$frequency\ (u_i) = \frac{number\ \ of\ hours\ in\ which\ u_i\ is\ occured}{total\ numberb\ of\ hours\ in\ data} \times 100 \qquad (2.4)$$

2.1.4 WTG Power Curve Data

This is the data obtained from the turbine manufacturers installed at the wind site. This data contains the power output of the wind turbine generator at different wind speed and the rated wind speed for the rated power output, cut-in wind speed, cut-out wind speed of the wind turbine. This can be represented in the graphical form by plotting wind speed on x-axis and power output on y-axis.

These power curve data is combined with the wind speed model obtained for specific wind site to obtain power generated at different wind speeds distributed through the year.

2.1.5 WTG Power Generation Model

Wind turbine power generation model is obtained by combining the wind speed distribution and wind turbine generator power curve data. This model includes the total annual power generated; power generated at different wind speeds through the year. This is calculated by combination of subsection 2.1.3 and 2.1.4.

The probability P of the discrete wind speed u_i being observed as,

$$P(u_i) = \frac{m_i}{n} \qquad (2.5)$$

Where, P is probability, u_i is measured wind speed at the interval I, m_i is the hours in which u_i is observed, n is the total number of hours.

The cumulative distribution function F (u_i) as the probability that a measured wind speed will be less than or equal to u_i is given in the equation 2.6

$$F(u_i) = \sum_{j=1}^{i} P(u_j) \qquad (2.6)$$

2.1.6 Probabilistic Evaluation of Power Generated

This includes the probabilistic evaluation of the generated power at different wind speeds through the year. This is calculated by combining distribution of discrete wind speeds. This can be calculated by estimated energy

output by the discrete wind speed and total energy estimated through the year. This is described in the equation 2.7.

$$P_g = \frac{\textit{power output from descrete wind speed}}{\textit{total estimated energy output through year}} \quad (2.7)$$

The power generated can be calculated using the power formula given in equation 2.8.

$$P_m = C_p\left(\frac{1}{2}\rho A u^3\right) \quad (2.8)$$

Where, C_p is the capacity factor given by the turbine manufacturer

ρ is air density at the wind site kg/m^3

A is area swept by the turbine in m^2

u is the wind speed in m/sec

2.1.7 Three State Model for WTG System

The output of a wind turbine generator (WTG) is a function of the wind speed. In this work the WTG is represented by a three-state model. Up1, Up2 and Down are three states, which represent variable, constant and zero outputs, respectively, in terms of wind speeds. A WTG can also suffer a forced outage, which can be represented by Up and Down states. The WTG three-state model is shown in Fig.2.1. A wind farm usually consists of many units and therefore the specified wind velocity is assumed to be the same for all the units in the farm. The power output of a wind farm is the summation of the output of all the available units.

The probability of turbine being in three different states is calculated according to the state representation and it is described by the relation as shown below.

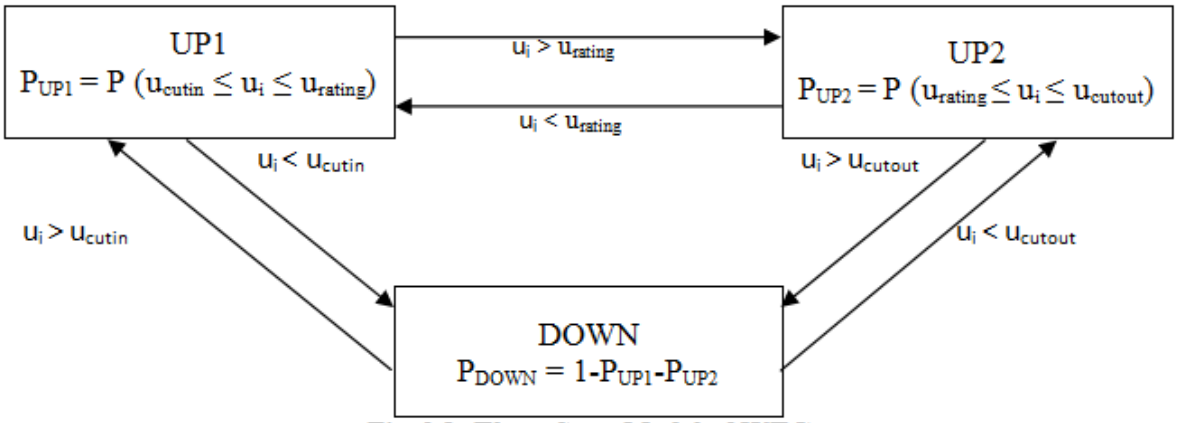

Fig. 2.1: Three State Model of WTG

Probability of WTG in state UP1 is,

$P_{UP1} = P\ (u_{cutin} \le u_i \le u_{rating})$ (2.9)

Probability of WTG in state UP2 is,

$P_{UP2} = P\ (u_{rating} \le u_i \le u_{cutout})$ (2.10)

Probability of WTG in state DOWN is

$P_{DOWN} = 1 - P_{UP1} - P_{UP2}$ (2.11)

Where, u_i is the measured wind speed at the interval i.

2.1.8 Calculation of Plant factor and Plant availability

Since wind speed is not constant, a wind farm's annual energy production is never as much as the sum of the generator nameplate ratings multiplied by the total hours in a year. The ratio of actual productivity in a year to

this theoretical maximum is called the Plant factor. Typical Plant factors [12] are 15–50%; values at the upper end of the range are achieved in favorable sites and are due to wind turbine design improvements.

The plant factor is calculated by the relation 2.12 and it is given by,

$$Plant\ factor = \frac{Actual\ power\ generated\ in\ simulated\ time}{Rated\ power\ generated\ in\ simulated\ time} \times 100 \qquad (2.12)$$

The value of Plant factor between 15 to 50% is good for wind power generation. And if the wind is continuous the Plant factor will be more except for planned and forced outage.

Plant availability is the wind turbine generator which is available to generate power. This is obtained from the relation that is given in equation 2.13.

$$Plant\ avialability = \frac{Plant\ available\ for\ generation\ \ in\ hours}{Total\ hours\ in\ the\ simulated\ data} \times 100 \qquad (2.13)$$

$$Plant\ unavialability = 1 - \ Plant\ avialability \qquad (2.14)$$

2.1.9 Calculation of Reliability Indices

The basic reliability index used in this work is Loss of load expectation; it is the average number of hours for which the load is expected to exceed the available generating capacity. And it is given in the equation 2.15.

$$LOLE = \frac{1}{N}\sum P_i T_i \ \ldots\ldots\ldots\ldots\ldots\ hours/year \qquad (2.15)$$

III. CASE STUDY

3.1 Wind Site Description

This site is located in Kappatagudda at Gadag district of Karnataka state. This site consists of 35 numbers of GE Energy made 1.5MW rated WTG with internal electrical lines connecting the project with local evaluation facility. The elevation of the wind site is 2858.24ft from the sea level. The data obtained is from 01/01/2012 01:00 to 28/12/2012 12:00. Air density at the wind site is 1.118 kg/m^2.

3.2 Features of WTG

Rating- 1.5MW

Blades- 3Numbers

Hub Height- 50 meter (made up of steel tubular tower)

Cut in wind speed- 4 m/sec

Cutout wind speed- 25 m/sec

Rated wind speed- 13 m/sec

Conversion factor- 1Mph = 0.44704m/sec

Average wind speed: This is calculated from the equation 2.1 and it is found ū = 14.24 Mph = 6.3658 m/sec

Standard deviation: It is calculated from the equation 2.2. And it is found σ = 7.8506 Mph = 3.5095 m/sec

The power curve is calculated at air density 1.118 kg/m^3

Cut-In Wind Speed: 4 m/sec

Wind speed (m/sec)	Power (kW)
3	0
4	43
5	162
6	334
7	549
8	783
9	1012
10	1180
11	1290
12	1420
13	1500
14	1500
15	1500
16	1500
17	1500
18	1500
19	1500
20	1500
21	1500
22	1500
23	1500
24	1500
25	1500
>25	0

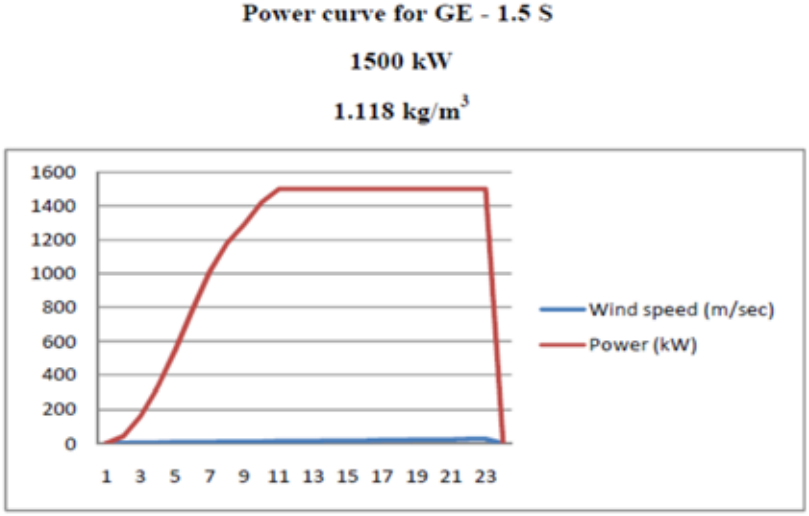

Fig.3.1 WTG Power Curve

Fig. 3.1 shows the turbine power curve to calculate the power output from the WTG at different wind speeds. The power generation model is obtained by combing this power curve and the wind speed distribution. The distribution of the discrete wind speed plot is shown data analysis report in fig.3.2, it shows the distribution of different wind speed through the year and gives probability of wind speeds. From the equation 8 the power generated by WTG is calculated and with the necessary data described in section 3.2 the WTG power output obtained by the average wind speed of 6.3658 m/sec is estimated as 3662862 kWh/Year and annual production is 3854894 kWh/Year.

3.3 Probabilistic Evaluation of Power Generated

With the power output formula the power generated by the WTG is calculated and the probability of generated power at different wind speed is calculated by equation 2.7. This includes the probabilistic evaluation of the generated power at different wind speeds through the year. This is calculated by combing distribution discrete wind speeds.

From equation 2.7, probability of generated power at wind speed 4 m/sec is given by

$$P_g(6) = \frac{15896.821}{366862} = 0.00434$$

The probability of generated power from WTG at different wind speed is calculated in same way.

3.4 Three State Model for WTG System

State UP1:

$P_{UP1} = P\ (4 \le u_i \le 13)$

$P_{UP1} = P\ (4 \le u_i \le 13) = \frac{5963}{8700} = 0.685403$

State UP2:

$P_{UP2} = P\ (13 \le u_i \le 25)$

$P_{UP2} = P\ (13 \le u_i \le 25) = \frac{128}{8700} = 0.014712$

State DOWN:

$P_{DOWN} = 1-P_{UP1}-P_{UP2}$

$P_{DOWN} = 1-0.685403-0.014712 = 0.2972$

The plant factor is calculated by the equation 2.12 and is given by

$$\%\ Plant\ Factor = \frac{3672270\ kWh}{1500 \times 8700} \times 100 = 28.14$$

Plant availability is the wind turbine generator which is available to generate power this is obtained from the relation that is given in equation 2.13

$$Plant\ avialability = \frac{5950\ hours}{8700\ \ hours} \times 100\ = 68.39\ \%$$

$$Plant\ unavialability = (1 - \ 0.6839) \times 100 = 31.61\ \%$$

The basic reliability index used in this work is loss of load expectation; it is the average no of hours for which the load is expected to exceed the available generating capacity and it is calculated by using equation 2.15. The value of LOLE for wind site is found LOLE = 226.36105 hrs/year and reliability index is EENS = 132936.38 kWh. It is the energy which is not supplied by the WTG due to lack of wind speed. Third reliability index is energy index of reliability which is given by

$$EIR = 1 - \frac{132936}{1500 \times 8700} = 0.989813$$

These reliability indices are calculated by considering all operating states of WTG.

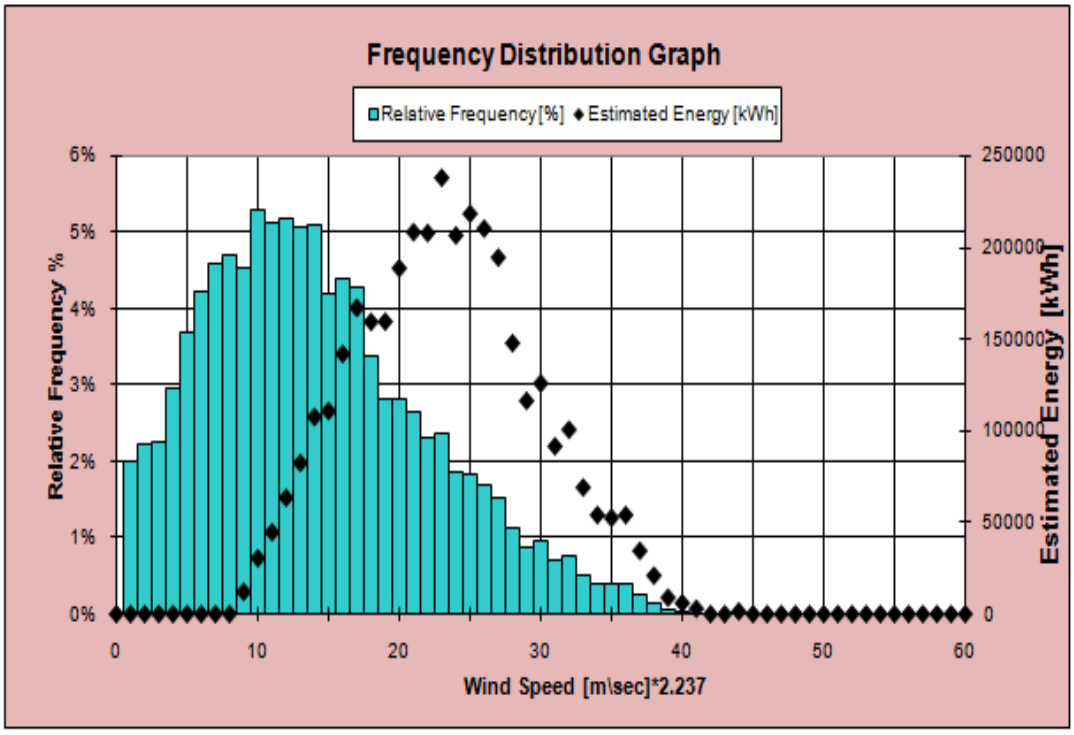

Fig.4 Frequency Distribution of Wind Speed and Estimated Energy

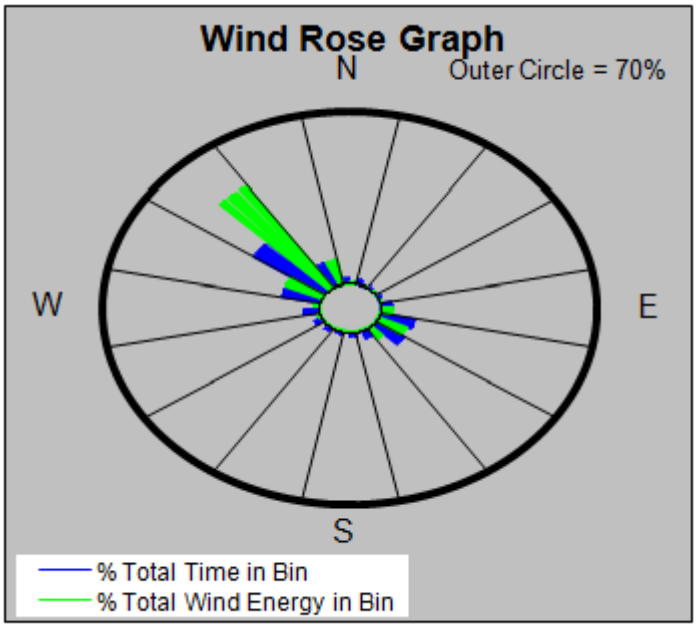

Fig.5 Wind Rose Graph for Wind Site Indicating Direction of Wind

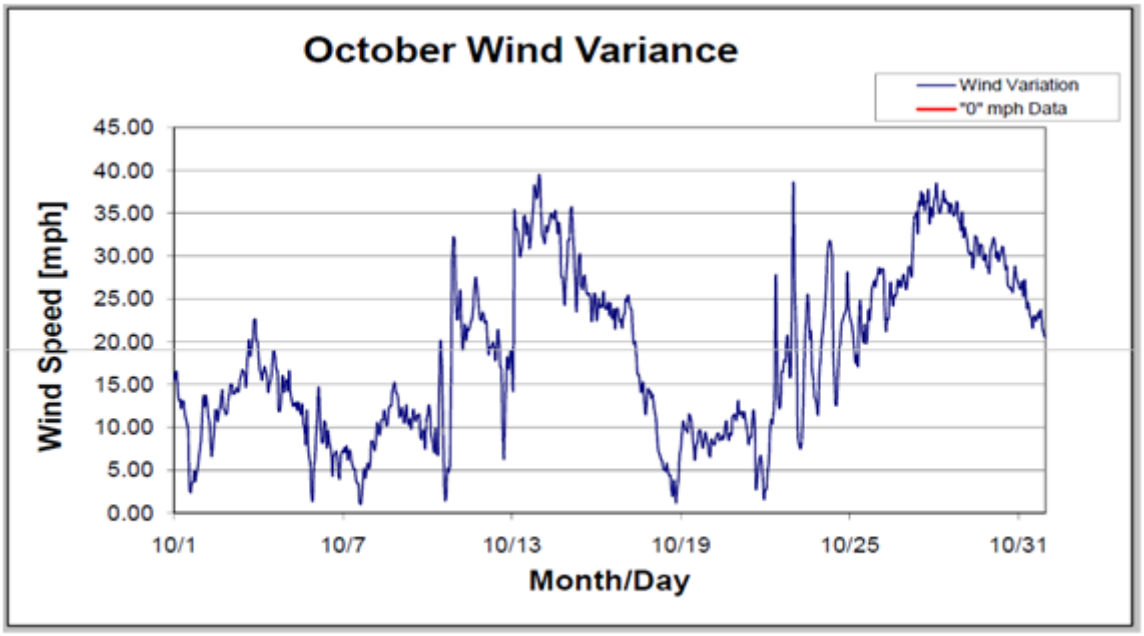

Fig.6 November Wind Variance at the Wind Site

IV. CONCLUSION

It is very important to develop probabilistic reliability evaluation technique useful for electric power industries which are expected to power from wind. It is therefore very important to obtain suitable wind speed simulation models and appropriate techniques to develop power generation model for WTG in reliability evaluation. In this work The Plant Factor is found 28.14 % and is very useful to generate power from the wind in that site. The plant available for generation is found 68.39 %. Reliability indices LOLE, EENS and EIR are found to be 226.36105 hrs/year, 132936.38 kWh and 0.989813 respectively. These indices show that the plant installed at the said site work satisfactorily. This work will come more valuable, when we consider wind turbine generator and turbine outage models.

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MECHANICAL AND IONIC CONDUCTIVITY STUDIES ON POLYMER ELECTROLYTES INCORPORATED WITH CHITIN NANOFIBER FOR RECHARGEABLE MAGNESIUM ION BATTERIES

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ABSTRACT

A novel composition of magnesium ion conducting polymer electrolyte comprising poly (ethylene oxide) PEO complexed with magnesium perchlorate ($(MgClO_4)_2$), chitin nanofiber (CNF) and succinonitrile (SN) was prepared using hot press technique. The complex formation of plasticized nanocomposite polymer electrolyte (PEO-$Mg(ClO_4)_2$-CNF-SN) was confirmed by FTIR analysis. Scanning Electron Microscopy and differential scanning calorimetry suggested a substantial structural modification and decrease in crystallinity in the polymer electrolyte respectively due to incorporation of CNF and SN. The maximum ionic conductivity in the order of 10^{-3} Scm^{-1} was obtained at 60 ^0C for 10 wt% of CNF and showed the dependence of CNF in de-linking the crosslinked polymer chains, thereby increasing the ionic conductivity. The polymer electrolyte with maximum ionic conductivity exhibited tensile strength of 3.9 MPa.

Keywords: Chitin Nanofiber, Ionic Conductivity, Magnesium Ion Battery, Poly (Ethylene Oxide), Tensile Strength

I. INTRODUCTION

The development of compact, light weight, cost effective and high energy density batteries are in great interest and demand in recent years. Magnesium (Mg) anode is identified to be a suitable alternative of the Li anode for the development of rechargeable batteries after the investigation on the electrochemistry of magnesium metal [1]. The performance capabilities of Mg are close to Li-based systems. Magnesium is stable, abundant and cost effective than lithium and it possesses high volumetric capacity of 3,833 m A h cm^{-3} and electrode reduction potential of -2.37 V with respect to standard hydrogen electrode [2-3]. These properties of Mg metal are attractive enough to develop magnesium batteries in combination with suitable electrolyte and cathode materials. Among the polymers, PEO have been widely investigated because of its potential viability in high performance batteries. Having a polar ether group and significant segmental mobility, PEO has an outstanding compatibility as a solid solvent for a wide range of salts especially high magnesium salt [4]. In spite of the advantages of PEO, its room temperature conductivity is too low for practical purposes. There is sharp decreases in ionic conductivity less than 60 ^0C. Thus considerable efforts have been done to improve the ionic conductivity of PEO based electrolytes. Adding low molecular weight plasticizers to the polymer electrolyte

system is a common approach. The plasticization reduces the crystallinity and increases the amorphous phase content of the polymer electrolytes which leads to high conductivity [5]. Even though high conductivity is obtained by plasticization, the mechanical properties of the polymer electrolytes are affected. Therefore, the addition of nanosized fillers in polymer matrix become an attractive approach due to the improved mechanical stability and enhanced ionic conductivity of the polymer electrolytes [6-9]. The nanosized fillers, due to its large surface area, prevent local PEO chain reorganization, and results in flexibility of the polymer chains for ion migration. The nanofillers generally improve the transport properties, resistance to crystallization and the stability of the electrode – electrolyte interface. As a result, the study on combined effect of salt, plasticizer and nanofiller on PEO would be of great interest. In the present study, an attempt has been made to improve ionic conductivity and mechanical strength of the polymer electrolytes by adding succinonitrile and incorporating chitin nanofiber to the PEO matrix.

II. EXPERIMENTAL AND CHARACTERIZATION TECHNIQUES

2.1 Preparation of Plasticized Nanocomposite Polymer Electrolytes

Polyethylene oxide (PEO) (($C_2H_4O_n$); Molecular weight (M_w) :2×10^5 g/mol, Sigma Aldrich) was used as host polymer. Magnesium perchlorate ($Mg(ClO_4)_2$, Sigma Aldrich was the dopant salt. Chitin nanofiber (CNF) (($C_8H_{13}NO_5)_n$) (obtained from our collaborator Dr. Paitip Thiravetyan, King Mongkut's University of Technology, Thailand,) was used as nanofiller. Succinonitrile (SN) ($C_4H_4N_2$, Sigma Aldrich) was used as a plasticizer in the electrolyte. The solvents used were acetonitrile ((C_2H_3N); M_w: 41 g/mol, E-Merck) and tetrahydrofuran (THF) (C_4H_8O; M_w: 72.11 g/mol, E-Merck). All the chemicals were used without any further purification.

The polymer electrolytes were prepared by dissolving polyethylene oxide and magnesium salt in acetonitrile. The solution thus obtained was stirred in a magnetic stirrer for about 4 hours until we get a homogenous translucent gel. To this, the plasticizer, succinonitrile, was added and stirred for about 2 hours. After that, the nanofiller was added to the solution and stirred for about 24 hours so as to make the nanofiller to disperse homogenously in the polymer matrix. The resulting homogenous mixture was then cast onto a glass plate and the solvent was allowed to evaporate at room temperature in a dust free environment. After the solvent had completely evaporated, the films were peeled off from the glass plate and pressed under a membrane hot press at a temperature of 90 ^{0}C. The pressure applied was 2.5 torr/cm^2. By this method, we obtained mechanically, flexible and self-standing polymer electrolytes. The average thickness of the polymer electrolytes prepared was 100 μm. The composition of materials taken for preparing the polymer electrolytes were tabulated in Table 1.

2.2 Materials Characterization

The infrared spectra of prepared polymer electrolytes were recorded using FT-IR spectrometer (JASCO FT-IR L4100, Japan) in the wave number region 4000 cm^{-1} to 400 cm^{-1}. The resolution of the spectrometer at room temperature was 4 cm^{-1}. The spectra were recorded in the transmittance mode. The thermal behaviour of all the prepared polymer electrolytes was determined using DSC analysis (Mettler Toledo DSC 822^e, USA) in the temperature range 30–100 ^{0}C at a heating rate of 10 ^{0}C/min in nitrogen atmosphere. The surface morphology of the prepared polymer electrolytes was studied using Scanning Electron Microscopy (JEOL 6390 LV, USA). The accelerating voltage was 30 kV with a resolution of 4 nm and magnification 300,000 X. The mechanical properties of the prepared polymer electrolytes were determined using Universal Tensile Machine (Instron

Model 5565, Canada) with the constant cross head speed of 10 mm/min. The sample dimensions were 20 mm × 50 mm × 0.1 mm. The conductivity studies were carried out by Zahner IM6 (Germany) AC impedance analyzer with a signal amplitude of 1V and frequency range of 1 Hz to 100 kHz for the temperature range between 30 ^{0}C and 60 ^{0}C.

Table 1: Composition of the materials used

Sample code	PEO (in wt%)	$Mg(ClO_4)_2$ (in wt%)	SN (in wt%)	CNF (in wt%)
S1	90	10	-	-
S2	85	13	2	-
S3	90	5	-	5
S4	83	8	2	7
S5	78	10	2	10

III. RESULTS AND DISCUSSION

3.1 Fourier Transform Infrared Spectroscopy (FT-IR) Studies

The FTIR spectra of PEO, chitin nanofiber, succinonitrile, S1, S3, and S5 were shown in Fig. 1 [panels (a-f)]. In panel (a) the peaks at 2880 cm^{-1}, 1349 cm^{-1} and 1274 cm^{-1} were attributed to CH stretching, CH_2 asymmetric wagging mode and CH_2 twisting band of PEO respectively [10]. The vibrational bands between 1000 and 1200 cm^{-1} corresponded to C-O-C stretching mode of PEO [11]. The peaks at 952 cm^{-1} and 830 cm^{-1} were regarded to CH_2 symmetrical and asymmetrical rocking of pure PEO respectively. They were also related to 'gauche' conformation of O – $[(CH_2)_2]$ – O. The peak obtained at 633 cm^{-1} was attributed to CH wagging mode. In panel (b) the band at 3103 cm^{-1} corresponded to NH stretching mode of chitin [12,13]. The peaks at 1649 cm^{-1} and 1625 cm^{-1} were corresponded to amide I band. The band at 1649 cm^{-1}was assigned to stretching of the C=O group hydrogen bonded to N-H of the neighbouring intrasheet chain of polyamides and proteins [14, 15]. The band at 1626 cm^{-1} was attributed to a specific hydrogen bond of C=O in the hydroxyl methyl group of the next chitin residue of the same chain. The peak at 1563 cm^{-1} referred to NH deformation of amide II band. The peaks at 1114 cm^{-1} and 1065 cm^{-1} were attributed to asymmetric in phase ring and CO stretching of chitin nanofiller respectively [16]. In panel (c) the absorption band at 2253 cm^{-1} was attributed to cyano functional (C≡N) group of succinonitrile. Also the peak at 948 cm^{-1} corresponded to CH_2 twisting band of succinonitrile [17]. In panel (d) (S1), the incorporation of magnesium salt to the polymer host had shifted the ethereal oxygen in C-O band that appeared at 1189 cm^{-1}. This shifting showed the complexation of PEO with $Mg(ClO_4)_2$. The band at 1651 cm^{-1} was attributed to a combined effect of bonding of water molecule with Mg^{2+} ion through the Mg^{2+}- OH and also with ethereal oxygen of PEO through H – O – H bonding. The presence of peaks at 947 cm^{-1} and 621 cm^{-1} which were attributed to stretching vibrations of ClO_4^- showed the complexation of magnesium salt with PEO [18].

In panel (e) (S3), the incorporation of chitin nanofiber to PEO-$Mg(ClO_4)_2$ electrolyte has shifted the band at 1649 cm^{-1} to 1652 cm^{-1}. The peak at 1073 cm^{-1} has shifted to 1092 cm^{-1}. Further, the appearance of peak at 953 cm^{-1} was attributed to CH_3wagging band of chitin. These results were due to the complexation of the PEO, $Mg(ClO_4)_2$ and chitin nanofiber. The addition of succinonitrile to PEO-$Mg(ClO_4)_2$-chitin nanofiber electrolyte

had shifted the band from 953 cm^{-1} to 943 cm^{-1}. The CH_2 twisting band of succinonitrile, 1232 cm^{-1} was decreased to 1201 cm^{-1} which exhibited the complexation of succinonitrile in the nanocomposite polymer electrolyte system. These results were shown in panel (f) (S5). From the results obtained we understood that there was strong complexation between polymer, salt, filler and plasticizer and thereby maintained the amorphicity in the polymer electrolyte by decreasing the crystalline nature of PEO. The results obtained were well support to the conductivity studies.

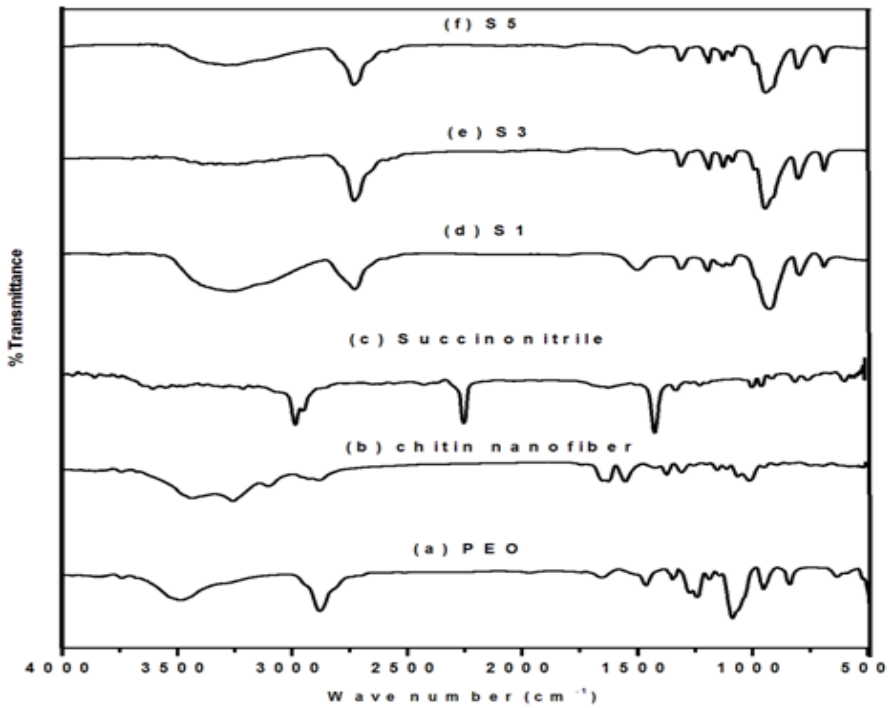

Fig. 1: FTIR spectrum for (a) PEO, (b) Chitin nanofiber, (c) Succinonitrile, (d) S1, (e) S3, (f) S5

3.2 Differential Scanning Calorimetry (DSC) Analysis

The change in transition temperature that is caused by the incorporation of filler and plasticizer to the PEO – Mg $(ClO_4)_2$ complex was studied by DSC analysis. The Fig. 2 (panels (a-e)) showed the DSC thermograms of S1, S2, S3, S4 and S5 respectively. Table 2 summarized the melting temperature (T_m), the corresponding heat enthalpy (ΔH_m) and the percentage of crystallinity (χ_c) of the prepared polymer electrolytes. The percentage of crystallinity was calculated using the equation 1.

$$\chi_c = \frac{\Delta H_m^*}{203\ Jg^{-1}} \qquad (1)$$

where ΔH_m^* is the heat enthalpy of the polymer electrolytes, and 203 Jg^{-1} is the ΔH_m of pure PEO [19].

From the literature [20], it was known that pure PEO has T_g, T_m and ΔH_m of -65 ^{0}C, 70 ^{0}C and 149.7 Jg^{-1} respectively. When magnesium salt was added to the host polymer PEO, it exhibited a clear T_m at 66.02 ^{0}C at which the glassy phase becomes a rubbery amorphous phase upon heating as seen in panel (a). The electrolyte film with succinonitrile in PEO- $Mg(ClO_4)_2$ complex may possess high ionic conductivity since T_m was 63.52 ^{0}C and percentage of crystallinity was 32% as seen in panel (b). Hence it is appreciable to add succinonitrile to the polymer – salt system. Panel (c) showed the DSC scan for 5 wt% chitin nanofiber (S3) in PEO- $Mg(ClO_4)_2$ electrolyte. A sharp endothermic peak appeared at 65.04 ^{0}C and the percentage of crystallinity reduced to 72% comparing to PEO- $Mg(ClO_4)_2$ electrolyte. In panel (d), upon adding 7 wt% chitin nanofiber (S4) to the electrolyte, the melting temperature reduced to 64.42 ^{0}C, and the percentage of crystallinity decreased to 61%.

In panel (e) when 10 wt% chitin nanofiber (S5) was incorporated in the polymer matrix, the melting temperature sharply reduced to 63.33 ^{0}C and the percentage of crystallinity reduced to 52%. These results showed that the addition of 10 wt% chitin nanofiber favoured the mobility of Mg^{2+} ions in the PEO chain by decreasing the cross-linking points. The results obtained indicate that the filler-polymer interaction influenced the speed of magnesium ions in the polymer chain. Similar results were reported in the literature [21-24].

Table 2: T_m, Δh_m, X_c of Pure PEO and the Prepared Polymer Electrolytes

Samples	T_m (^{0}C)	ΔH_m (J/g)	Crystallinity (%)
PEO	70.00	203.00	100.00
S1	66.02	174.31	85
S2	63.52	65.46	32
S3	65.04	146.70	72
S4	64.42	125.25	61
S5	63.33	106.95	52

3.3 Scanning Electron Microscopy (SEM) Analysis

The main aim of dispersing filler and plasticizer to the polymer electrolyte is to enhance the amorphicity of the membrane. This is also having a profound effect on the surface morphology of the polymer electrolytes. Hence a study on the nature of the surface becomes essential for better understanding. The surface morphology of (a) S1, (b) S3 and (c) S5 were examined by SEM and images were displayed in the Fig. 3. In general, the spherulitic texture along with the dark boundaries was observed for PEO indicate the crystalline lamellar structure with partial amorphous content [25]. In the case of PEO – magnesium complex system as shown in Fig. 3 (a), the surface of the film was rough and uneven which indicated that the partial crystalline nature of PEO. The existence of rough texture after the incorporation of the magnesium salt was due to the cross linking of ether oxygen with the magnesium cation.

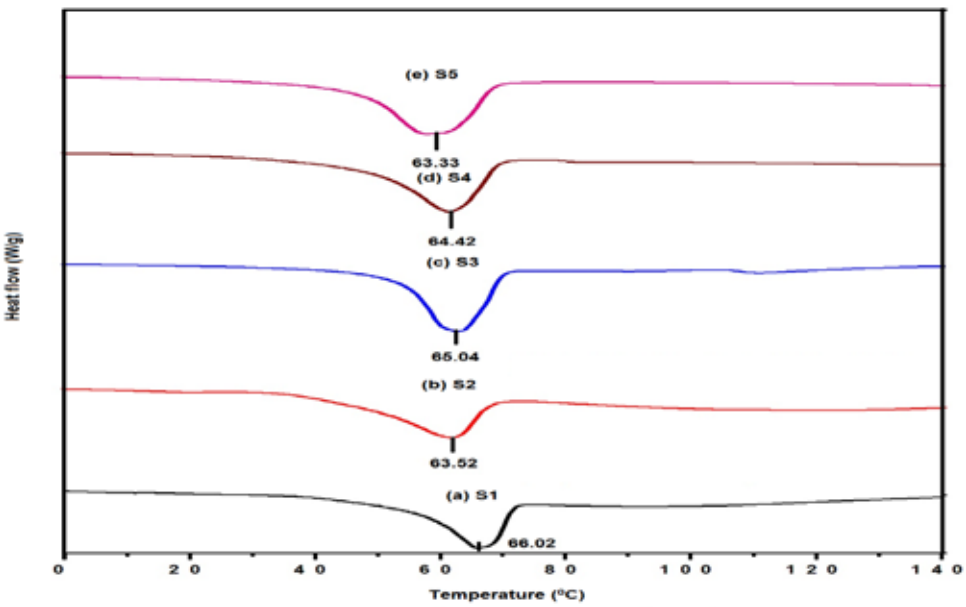

Fig. 2: The DSC thermograms of (a) S1, (b) S2, (c) S3, (d) S4 and (e) S5.

In Fig.3(b), a rough surface and more layered structure with some pores were observed which indicated that the partial crystalline nature of PEO [26,27] after the incorporation of the chitin nanofiber to the PEO- $Mg(ClO_4)_2$ electrolyte. This type of porous structure provides enough channels for ion migration accounting for better ionic conductivity [28]. Fig. 3(c) showed the nanocomposite polymer electrolyte incorporated with succinonitrile. The surface morphology was found to be smooth and homogenous with disappearance of rough texture. These results showed the plasticization effect of succinonitrile in the reduction of crystallinity of the host polymer and enhancement in the overall amorphous proportion in the polymer electrolyte. From the results it was understood that, incorporation of chitin nanofiber and succinonitrile in the PEO-$Mg(ClO_4)_2$ electrolyte gave favourable conduction path for faster migration of Mg^{2+} ions in the electrolyte. These structural modifications result in disordered polymer chain and sustain the degree of amorphicity which improved the ionic conductivity

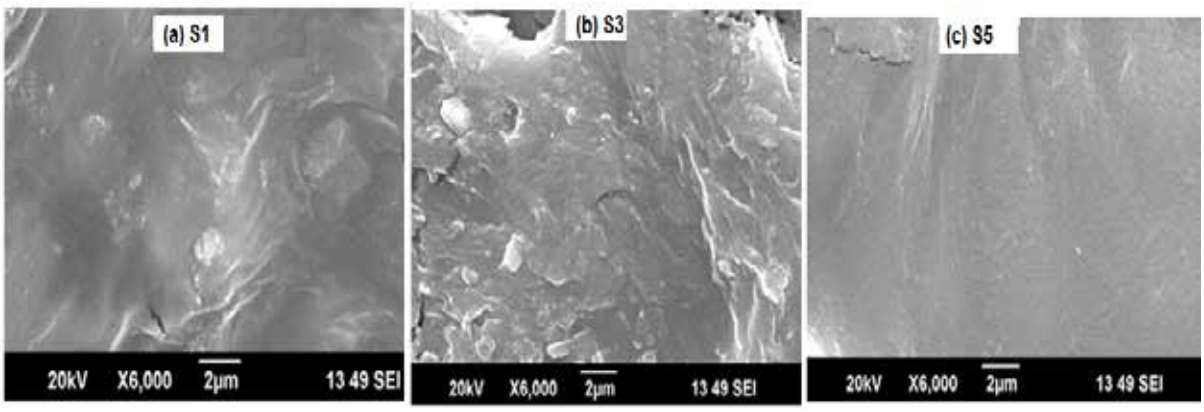

Fig. 3: SEM Images of (A) S1, (B) S3, (C) S5

3.4 Mechanical Studies

In view of the potential practical applications for magnesium rechargeable batteries, it is essential for polymer electrolytes to retain good mechanical properties. To evaluate the mechanical strength of the prepared polymer electrolytes, the stress-strain curve of polymer electrolytes have to be determined. The mechanical behaviour of the polymer electrolytes prepared in the present study was displayed in Fig 4 (a-e). It was observed that all samples show two distinct regions: the initial linear region reflects the elastic characteristic and then the non-linear region showed the plastic deformation. The tensile strength of PEO-$Mg(ClO_4)_2$ (S1) electrolyte was 3.3 MPa which can be seen in Fig. 4(a). In the sample S2, after the plasticizer, succinonitrile was incorporated to polymer-salt complex, the tensile strength decreased to 2.5 MPa and the elongation at break value is 9.7% as seen in Fig. 4(b). The result obtained was attributed to the enhancement of flexibility of PEO chain. From the Fig.4(c-e) it was understood that the increase in filler concentration increased the tensile strength. As the concentration of chitin nanofiber increased to 5 wt% (S3), 7 wt% (S4), and 10 wt% (S5), the tensile strength enhances to 3.3 MPa, 3.7 MPa and 3.9 MPa respectively. This was due to the enhancement of cross linking density of filler in polymer chain, thereby increasing mechanical strength of the polymer electrolyte. The calculated tensile strength, Young's modulus and elongation at break values of the prepared polymer electrolytes were given in Table 2. Fig. 5 showed that the Young's modulus also increased proportionally with filler concentration. The filler concentration of 10 wt% chitin nanofiber (S5) has the highest Young's modulus of 136 MPa. Similar results were reported by Angulakshmi *et al.* when chitin nanofiber was incorporated with PVdF-HFP matrix [29].

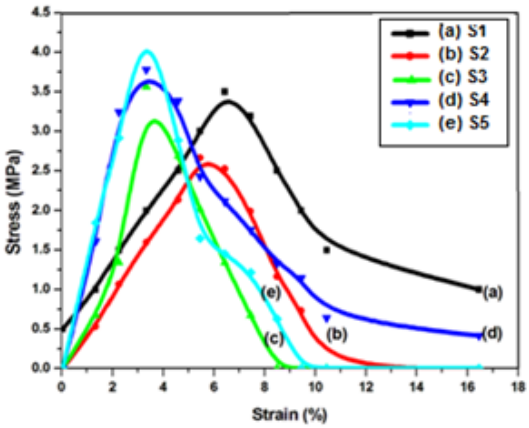

Fig. 4: Stress – Strain curve for (a) S1, (b) S2, (c) S3, (d) S4, (e) S5

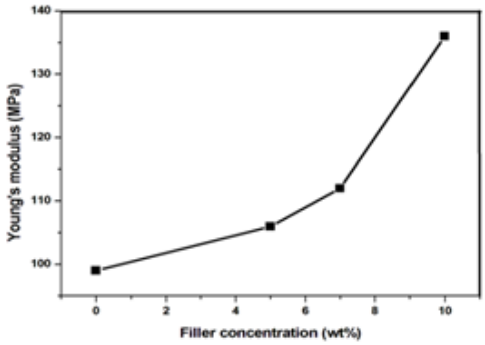

Fig. 5: Variation of Young's modulus with filler concentration

Table 2: Tensile Strength, Young's Modulus and Elongation at Break for S1, S2, S3, S4, S5

Samples	Tensile strength MPa	Young's modulus MPa	Elongation at break %
S1	3.3	99	16.4
S2	2.5	43	9.7
S3	3.3	106	16.4
S4	3.7	112	16.4
S5	3.9	136	16.4

3.5 Ionic Conductivity Studies

The conductivity studies are carried out for all the prepared polymer electrolytes in order to understand the conduction mechanism. Fig. 6 showed the variation of ionic conductivity with temperature for (a) S1, (b) S2, (c) S3, (d) S4 and (e) S5. The ionic conductivity was calculated using the formula given in equation 2,

$$\sigma = \frac{t}{AR_b} \qquad (2)$$

where t and A represents thickness and the area of the electrolyte specimen respectively [30]. R_b is the bulk resistance of the electrolyte obtained from the complex impedance measurement.

The ionic conductivity depends on the overall mobility of ion species present in the electrolyte and the polymer which is determined by the free volume made by filler and plasticizer around the polymer chain. In the present study, the conductivity enhancement was observed when filler chitin nanofiber and plasticizer succinonitrile were incorporated in the polymer – salt system. The polymer electrolytes considered in the present study exhibited Arrhenius type of conduction. The polymer electrolyte containing magnesium salt showed an ionic conductivity of 2.98 $\times 10^{-6}$ Scm^{-1}as seen in Fig. 6(a). It was associated to existence of crystalline phase of PEO in the electrolyte. The polymer chains were rigid and hence the chain mobility was almost negligible and the conductivity was low. Similar behaviour was observed in the ionic conductivity of PEO-$MgClO_4$-Al_2O_3 complex system reported by P.Ekanayake *et al* [31]. Upon incorporation of plasticizer succinonitrile to PEO-$Mg(ClO_4)_2$ complex, the ionic conductivity enhanced to 9.34×10^{-4} Scm^{-1} as seen in Fig. 6(b). The result shows that the plasticizer succinonitrile weakened the columbic force between the cation and anion of the salt which resulted in salt dissociation. Further the Gutmann donor number of the nitrile group of succinonitrile is lower

(~15) as compared with that for PEO (~22) and hence the nitrile group of succinonitrile had also a tendency to coordinate with ether oxygen of PEO. Thus the formation of some PEO – succinonitrile was possible in the present electrolyte [32]. In the PEO – succinonitrile network, further charge separation of the magnesium salt could occur. As a result Mg^{2+} cations along with ClO_4^- anions became free for conduction.

In Fig. 6(c) it was observed that the incorporation of 5 wt% (S3) chitin nanofiber to the polymer-salt system increased the ionic conductivity to two orders of magnitude (7.57×10^{-4} Scm^{-1}) at 333K. This is due to the fact that, as the temperature increased the polymer can expand easily and produce free volume [33,34]. The resulting conductivity represented by the overall mobility of ions and the polymer, is determined by the free volume around polymer chains. Therefore, as temperature increased, ions and polymer segments can move into the free volume. This increased the ion mobility and segmental mobility of the polymer chain. Further with the increase of filler content to 7 wt% (S4) and 10 wt% (S5), the ionic conductivity increased to 8.74×10^{-4} Scm^{-1} and 9.57×10^{-4} Scm^{-1} respectively as seen in Fig. 6(d and e). The results obtained were due to the cationic charges on the surface of chitin nanofiber which acted as Lewis acid centers. They compete with Mg^{2+} cations to form complexes with polymer host. This in turn might result in structural modifications and increase conducting pathways at the surface of the chitin nanofiber. These effects would result in the salt dissociation and promotion of free ions and account for the observed enhancement of the ionic conductivity. The polymer electrolytes in the present system also show conductivity enhancement when chitin nanofiber and succinonitrile were incorporated. The chitin nanofiber acts as a conducting medium where the filler is uniformly distributed throughout the free volume. The incorporation of succinonitrile helps in dissociation of ions in the polymer-filler interface.

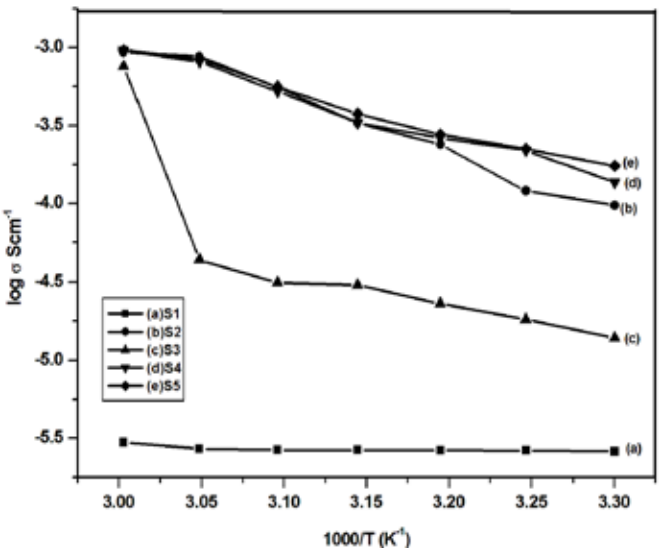

Fig. 6: The Variation Of Ionic Conductivity With Temperature For (A) S1, (B) S2, (C) S3, (D) S4 And (E) S5.

IV. CONCLUSION

Plasticized nanocomposite polymer electrolytes consisting of PEO, $Mg(ClO_4)_2$, nanochitosan and succinonitrile were prepared and characterized. FTIR spectra confirmed the complexation of the polymer host, salt, filler and plasticizer. The reduced degree of crystallinity was observed by SEM analysis and quantified by DSC studies. The highest ionic conductivity was obtained in an order of 10^{-3} Scm^{-1} at 60 ^0C for 10 wt% $Mg(ClO_4)_2$and nanochitosan. The observed increase in ionic conductivity was due to the creation of more conducting pathways, chain flexibility and amorphicity, after incorporating nanochitosan and succinonitrile to the polymer-salt

complex. The tensile strength was increased to 3.9 MPa for the polymer electrolyte with 10 wt% NC compared filler free electrolyte.

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LEAN PRODUCT DEVELOPMENT AS A SYSTEM

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ABSTRACT

A systems view of lean product development is presented integrating people, process, and tools. This systems approach was derived from intensive study of Toyota's product development system. Principles and methods based on this systems model of lean product development were applied with great success at Ford Motor Company helping to bring to market a record number of products that helped fuel a rebuilding of the company to financial success and award winning world-class product quality.

Keywords: Lean Product Development

I. INTRODUCTION

Focus Areas: Innovation &New Product Development, Management of Design &Consulting Engineering Organizations, Organization &Work System Design

The term "lean" was introduced in "The Machine that Changed the World" by Womack, Jones, and Roos(1991), first conceived in 1984, as a new "paradigm" supplanting the prevalent mass production system. Mass production is based on a principle of quantity where more is better. Each process builds to its own schedule and pushes inventory onto the next process resulting in large inventory buffers. The inventory buffers protect processes from each other - if one process shuts down or is slow it will not affect the next process until the buffer runs out. Lean production is based on the principle of just-in-time, building only the parts needed by the next process when they are needed based on a pull system. Processes are tightly coupled so problems in one process have an almost immediate impact on other processes in the linked chain. Mass production emphasizes cost reduction within processes through economies of scale, while lean production emphasizes flexible response to the customer building in quality at every step of the value stream .Lean production has been implemented all over the world and now is the dominant paradigm in manufacturing ,though it is questionable how effectively and consistently it has been implemented (Liker, 2004); however, often ignored were the other chapters in the Womack et al. (1991) book that focused outside of manufacturing ,particularly the chapter on product development. This chapter was based on the research of Clark and Fujimoto(1991) who compared American and Japanese auto companies and found a striking difference in organization and management. American companies had organized product development into silos of expertise, and there was poor flow of information across functions. Information was pushed from concept to detailed design to tool design until it finally reached production. At each step the function involved would have to rework elements of the design from their point of view, e.g., tooling engineers changing design features to make the tooling work at an affordable cost. In the Japanese auto companies, a chief engineer had an overall vision for the product and helped integrate across departments to enable simultaneous engineering .The concept of lean product development has been emerging in practice as companies have some success in manufacturing and find that the design of the product becomes the bottleneck. There are two major advantages in implementing lean product development. First, it is an enabler

to achieve the next level of lean manufacturing. Those trying to implement lean production on the shop floor find various barriers arise such as hard to assemble parts, lack of modularity that could facilitate cell design, lack of error proofing that makes built-in-quality difficult, lack of standard parts or tools required to build the parts, and long lead times when engineering changes are requested. Second, it improves product development performance. New products are the life blood of many companies and often represent major resource investments. Consequently senior executives have grown interested in lean product development in order to improve market responsiveness , reduce costs, design in quality, and dramatically shorten lead times .The challenge then becomes to define lean product development. In manufacturing you can walk the floor and identify inventory buffers and repair bays so the waste is visible. There is not a lot to go and see in product development, and translating the concepts from lean manufacturing to lean product development is challenging .There are at least two different approaches to this challenge. First, start with lean production as the model and extrapolate from that. The original model for lean manufacturing was the Toyota Production System (TPS), and we can seek to draw direct one-for-one analogies between a feature of TPS and a lean product development concept. This has been a common practice in the growing area of "agile" software development. For example, Ladas (2009) introduced to software development the concept of "scrumban" which is a direct application of the TPS tool kanban. Reinertsen (2009) draws on technical concepts of batching and queues from just-in-time using these as analogies for how to make product development flow across steps, rather than being pushed from step to step. He uses concepts like reducing batch size, applying constraints on work-in-process , decentralizing control, and accelerating feedback. These are all common concepts as a company shifts from mass production to lean manufacturing. A second approach is to go back to the original company that became the model for lean manufacturing -Toyota - to see if they also have a model for lean product development. As it turns out, they are in many ways the leaders in the automotive industry in important product development performance measures such as lead time and long-term dependability of vehicles resulting from effective system integration. A series of books and articles have documented various aspects of Toyotas product development system. Ward et al. (1995) first observed what they called "set-based concurrent engineering" considering broad sets of alternatives and even keeping different alternatives open as options until late in the development process. This practice also affected the way they communicated requirements to suppliers who also practiced set-based design (Liker et al, 1996). In general, Toyota has much closer relationships with a close-knit network of systems suppliers who are intimately involved in product development from the early concept stage (Wasti and Liker, 1999). Kamath and Liker (1994) observed that Japanese automakers tend to source complete systems from their largest supplier partners so that the suppliers can work relatively independently. Ro et al. (2007) distinguish systems from modules. Systems, i.e., the electrical system, can run throughout the entire car. Modules are physical chunks of the vehicle that are relatively self contained. They observed a movement toward designing the car as a set of modules in the U.S. and Japanese auto industries, but since the Japanese companies were already more integrated with supplier partners, they were more effective in using this practice in order to allow suppliers to work independently on their modules and take out cost through means like part count reduction and design for manufacturability. These studies have each defined an important aspect of lean product development, but they are described in isolation. Several books that directly analyze Toyotas product development system in its entirety see it as an integrated system (Morgan, 2002; Ward, 2007). Morgan and Liker (2006) describe it as an integrated system of people, processes, and tools defining each of the three subsystems as

1. People: Toyota uses a chief engineer system (Clark and Fujimoto, 1991; Ward, 2007; Morgan and Liker,2006) as the systems integrator from concept to production launch along with a matrix organization that allows technical specialists to reside in functional units. The functional units are led by expert managers who focus on training and developing experts with "towering technical competence" (Morgan and Liker, 2006). A strong customer-based culture is deliberately developed by the most senior management to encourage cross-functional focus on the customer and organizational learning to leverage lessons learned anyplace in the company. A true lean system drives people to continuously improve toward increasingly challenging targets (Rother, 2009), stretching and testing the organization to create a culture of excellence.

2. Process: This fits fairly well with Reinertsens (2009) discussion of making product development flow, but also emphasizes the importance of precise cross-functional synchronization, as opposed to the traditional "waterfall model" of product development where each function does its work independently and then a large batch of work is pushed onto the next process in series. Ward (2007) argues that a better approach is set-based concurrent engineering in which sets of ideas are developed cooperatively across functions and then flow through to downstream processes. Morgan and Liker call this early, set-based process "frontend loading" and show how it allows for a smoother leveled flow of product development. Clark and Fujimoto (1991) illustrated that with proper planning, parts of the design can be released downstream early to allow simultaneous development of the product and processing to the point that tools are actually being cut before the total design of the automobile is complete.

3. Tools and Technology: Toyota has all the usual product development tools such as Computer-Aided Design and Computer- Aided Engineering, but puts a greater emphasis than other companies on standardization and visualization. This includes standardizing skills of engineering experts, the development process, and product and process characteristics (Morgan, 2002). Sobek et al. (1998) see the potential tradeoff between standardization and flexibility as a balancing act. Too much standardization can stifle creativity, but too little standardization means each design project is treated independently of those that come before it and there is non organizational learning. Toyota intentionally limits the amount of innovation in any new vehicle program ,carrying over parts and vehicle architecture, and focusing innovation on specific aspects found to be of high importance to customers (Morgan and Liker, 2006). Visualization is important so that individual engineers can work effectively as a team. One tool to support cross-functional collaboration is the obey a or "big room" methodology. Data is carefully laid out on the walls by functional discipline telling a story of the current status versus targets and problem solving to eliminate gaps. Regular meetings are held with the chief engineer to solve difficult cross-functional problems.

In this article we draw on the Morgan and Liker (2006) view of lean product development for two reasons. First,we believe it is the most comprehensive systems view of lean development. In our experience working with many companies, lean approaches that focus on selected lean tools in isolation have limited success. Second,it was the approach adapted by Ford Motor company, the subject of this case analysis, as one of the authors (Jim Morgan) led one of the teams that helped define Fords lean development system.Liker (2004) argues that both TPS and lean product development are reflections of a deeper philosophy calledthe Toyota Way. The foundation of the Toyota Way is a long-term philosophy of adding value to customers and society. There is a passion for customers that goes beyond short-term financial considerations. This allows Toyota to make large investments in developing people and lean processes simultaneously (Liker and Hoseus,2008). The method for doing this is problem solving based on what Deming (1986) taught as plan-do-check-act (PDCA).

The philosophy behind PDCA is that we can never know everything at the outset of a complex project,so we must thoroughly identify the problem in the planning stage, find the root cause, put in place countermeasures in the do stage, check on what happens, and then learn from this by putting in place further actions based on what we learn. Set-based concurrent engineering can be viewed as an example of PDCA inaction. The entire development process for one program can be viewed as a large PDCA loop in which we learn how to better manage programs, and each individual piece (e.g., designing the muffler, designing a tool, piloting a new manufacturing process) can be viewed as smaller PDCA loops.

The descriptions that have come from studies of Toyota give a rich picture of lean product development as a system. It becomes clear that simply implementing a tool like scrumban, or trying to implement a new process based on controlling work-in process, will not by itself transform product development. It is as much a revolution in how people are managed and developed as a technical methodology. Unfortunately, the cases of actually transforming a company to lean product development outside of Toyota are very limited. Kennedy (2008) wrote a lean novel to illustrate hypothetically what this should look like, though in our experience it provides a simplistic view that suggests much faster and greater impacts than would be expected in practice. Another business novel (Kennedy et al. 2008) includes two actual cases of transformation that do a better job of illustrating the real challenges.

What was transformed in Body and Stamping Engineering?

Based on all the above work, the Body and Stamping leadership team planned and executed a comprehensive overhaul to the way they engineered and tooled exterior bodies. The journey was challenging and progress was certainly not linear, but it resulted in a far more effective process, stronger organization, and, most importantly , greatly improved products for Ford customers. We discuss here some of the more critical enablers.

The Body and Stamping Engineering (BScSE) team started with a critical look in the mirror. It was evident that if they could not get the people, cultural, and organizational part of this right, it would be impossible for them to achieve world-class levels of performance. Great engineering/product development is about people, and all the queuing theory, process optimization workshops, and the latest digital tools in the world cannot make up for lapses in this area. Transformation .

They started with an attitude change. The focus of the BScSE team began a relentless focus on the customer, and they set out to become key enablers to deliver value to the customer. In the past the engineering organizations were often perceived as roadblocks to delivering exciting designs, world-class craftsmanship and best-in-class vehicle attribute performance. Engineering would often reject exciting design proposals, world class craftsmanship standards, and stretch ride and handling attributes as "unfeasible." This led to time consuming, sub- optimizing "negotiations." This painful process typically resulted in vehicles that looked and perform like products designed by committees - which they were - and kept Ford from achieving world-class levels of performance.

The BScSE team set out to change all that. The resulting change in attitude had a very positive impact on interdepartmental relationships, cross-functional team work, and had the additional effect of giving the team more influence - far fewer "negotiations" were required now that they were seen as a key enabler to delivering the exciting products you see on the road today. This in turn created pride and confidence in the group - this operating attitude, while much more challenging in some respects than the old one of just rejecting unfamiliar or difficult tasks was far more gratifying. In fact this new level of pride resulted in widespread ownership of the initiative and drove organic change that was fundamental to success. As GPDS progressed from the first two

years of learning from Mazda to a more advanced state by year five, there was a shift from emulating benchmarked techniques to developing unique and powerful enabling actions that surpassed the originally benchmarked levels of performance. By this point you could sense the teams relentless drive to be the best.

There was a renewed focus on technical competence. Ford had outsourced many critical engineering competencies to suppliers. They lost a good deal of technical knowledge that was critical to developing great vehicle bodies. One of many examples of this was that Ford had no internal tool/ die designers. It was clear that many of the changes needed to implement lean design were reliant on this key functional competence. Since Ford had none, they had to go outside the company and hire experienced engineers. This was not easy considering Ford was in the midst of downsizing and had to justify new hires in a period when long-term employees were losing their jobs. Through the support of the global GVP, they received the required resource allocation. They put a great deal of time and effort into hiring the right engineers for both their technical competence/experience - but equally important they made sure they had the right character to contribute to the hard work to come. For existing engineers and engineering supervisors, Ford developed Technical Maturity Models (TMMs) by engineering discipline and Individual Technical Development Plans (IDTPs) to ensure that Ford engineers were able to gain the appropriate level of technical excellence and ongoing technical development.

Communication was streamlined. One problem in the past was a cumbersome chain of command that separated working level engineers from top management. "Skip-Level Meetings" helped to maintain a clear line of communication between leadership and the engineers. These informal meetings allowed small groups engineers a chance to talk directly to leaders several levels above them. The Body Exterior and Stamping Engineering Director took on assignments to improve tool sets, process flaws, and people system inefficiencies and reported back to these same engineers at future skip-level meetings. Once the organization became global, this gave leadership a chance to have direct dialogue with engineers around the world as they traveled. Many of the global processes error states were addressed very early in the globalization process by getting direct feedback from the engineers in each region.

Global BSeSE All-Hands Meetings were held twice yearly. Similar to "town halls", these events gathered the entire organization to review important initiatives, status of objectives, and updates on the overall business, and ask questions of the BSeSE Director and his leadership team. The meetings included the global team through the use of audio-video equipment. The latest models of vehicles were also on display for the engineers to evaluate. Having these vehicles available started as motivation to improve efforts to become more competitive, and ended up as an invaluable source of pride as the products grew increasingly exciting and competitive - evidence of what the team was accomplishing. Another added attraction of these events started in 2004 with the hiring of Alan Mulally . He demonstrated both his commitment to and the importance of this team by joining every BSeS E All-Hands Meetings to give his view of the business and answer questions since he arrived at Ford - a practice he continues to the time of this writing.

They organized around value streams. Cross-functional feuding was destroying product development effectiveness. Information was tossed over walls like hand grenades and emails flew like scud missiles. They knew they had to create aligned objectives and better teamwork. They did this in stages. It began with North American stamping engineering and tool manufacturing. Within two years it expanded to N.A. Body Exterior Engineering, and a year later the organization was made global. This turned out to be a marvelous migration process. Each step was a major challenge, but the organization could build on success from the earlier stage.

As more and more of the organization was added to the lean transformation process, more of the vision and leadership had to come from the global VP to drive the change. For example, the shift to common vehicle architectures and global platforms had to be led at the VP level.

Supplier relationships moved toward partnerships. Sad to say, but Ford often treated suppliers like the enemy; yet Ford and the suppliers had a common destiny (Liker and Choi, 2004). They knew they had to improve this situation. A key to progressing toward supplier partnerships was a process of dialogues between matched pairs of Ford engineers and buyers in purchasing who were responsible for the commercial side of working with suppliers. In this process engineering and purchasing worked together to create part-by-part plans to improve quality, cost, and sourcing footprints. Based on these plans, and supplier performance/technical capability, the best suppliers were identified, cost models were developed jointly, and plans were jointly executed. This also included regular supplier engagement events and technology reviews. This was later extended to work cross functionally on quality as well .

Process Transformations BScSE mapping and benchmarking revealed a wasteful, uncompetitive development process. There was no denying the data - especially when the technical experts returned from the Mazda benchmarking trips to confirm what the initial fact finding had shown. They had to find ways to not only make initial improvements, but to maintain those improvements while managing the process and building in continuous improvement/ learning mechanisms in order to have a truly world-class development process.

They created process overview maps at a medium level (next level under GPDS) - process comparison maps of current state processes and "ideal state" (including gaps to ideal state) were developed for each major development step. At each of these states, they showed a list of strategic enablers (people/process/ technology improvements) identified to improve that step based on initial benchmarking information. All enablers were then assigned to the initiative teams discussed above

They held value-stream mapping events. Value-stream mapping in product development is especially useful for enabling cross-functional and external organization dialogues. Some of the biggest opportunities surfaced from these events. In fact, so many ideas were generated by these events that the teams had to develop a decision matrix in order to prioritize opportunities. Priorities were set and agreed by listing ideas on a four-quadrant graph with degree of leverage/potential improvement possibility on the Y axis, and degree of difficulty/ cost on the X axis. Those ideas with the most potential payoff and lowest cost were prioritized. These sessions were also key for identifying interdependencies and understanding exactly what information was required by each functional organization - including feedback loops. These sessions were great for identifying waste of rework and instances where functional groups were actually doing too much work (finalizing designs) too soon. One of the key challenges for a large complex system design like cars is properly specifying interfaces of the various subsystems. The new mantra became "compatibility before completion." They also focused on moving as much as they could to the front of the process and then synchronizing the flow of steps to create just-in time knowledge flow.

The teams also found many opportunities in which they could work simultaneously for longer periods and delay key decisions until points in the process that were closer to the customer - with more accurate data. We discussed this earlier as set-based concurrent engineering (Ward et al., 1995). A key enabler for set based engineering was Quality of Event Criteria (QECs) to ensure the quality of the data /information/work required and measured at each milestone in the development process.

They held regular TGW (Things Gone Wrong) meetings between die makers and stamping engineering. This not only caught errors in design/engineering and provided opportunities to improve both process and standards, but was also an important organizational tool. These meetings started out very difficult with both engineering and the die makers being defensive and even aggressive at times; however, in the end, this dramatically strengthened the relationship and cross understanding of these groups. For each of the things gone wrong, they developed countermeasure both for interim containment and as a permanent corrective action, i.e., design rules, process changes, and critical characteristics. This then evolved into joint agreements on standards to be followed in die and stamping engineering.

They held ongoing process dialogues with other organizations both within and outside of Ford, including suppliers in order to get certain processes and expected outcomes aligned. They had many supplier meetings (both large and small) and opened the obey a in the tool shop for visits by suppliers which led to hearty discussions. Through this process some suppliers deselected, others failed, and several (located around the globe) became partners/enablers of Ford in the lean transformation. Intensive involvement of the purchasing department was also critical to this process.

They established Global Design Reviews led by the global functional chiefs. These were detailed, rigorous design evaluations/presentations conducted with the very best technical experts from the global team in order to make sure that the latest standards were met, lessons learned were incorporated, and test criteria were passed. These were perhaps the most important learning events and are fundamental to organizational learning and continuous improvement.

Ford also built in reflection events at critical program milestones in order to learn by reflecting on performance by specific program milestones. They did not wait until the end of the program when much of the knowledge and information might be lost/confused. These in-process reflection events are cross-functional and have the added advantage that they enable real-time course corrections in addition to cross-program, process improvement opportunities. To be successful these events require a significant level of organizational maturity to create a non punitive environment where participants have a learning/ continuous improvement mind set. The outcome of these events is agreement to develop focused countermeasures in order to improve specific parts of the process. Each opportunity has a lead assigned and date when the team or some part of it will regroup to review countermeasures. Finally the process improvements go to the GPDS Steering Committee for final approval and become a permanent part of the next GPDS release.

Ford incorporated functional build, known at Ford as the PCF (Part Coordination Fixture) process, that takes a systems approach to designing and building vehicle bodies (Hammett et al, 1995). In the traditional process, the body engineers for each component expect their component to be built to their specifications. This leads to a great deal of rework on individual dies to make each part perfect. The functional build process allows for some variation on individual parts, but focuses on the overall body meeting the design intent. This "part matching" process allows engineers to make decisions based on system optimization and address critical interface challenges. This process has been proven to reduce total costs and improve overall product quality simultaneously - and this has certainly been the case at Ford.

Very early in the change process they discovered that a great deal of the rework waste and quality issues were driven by an incredible array of differing designs, processes, and component requirements that seemed to be unique to every program. The effort to standardize was particularly enabled by the new global organization

structure. The team standardized the development process, architectures, individual parts, and manufacturing processes.

They created Perfect Drawing Plans (PDPs) which are individual part development plans for every component to be certain that they supported the overall development strategy with quality. These plans take the parts from concept through engineering, manufacturing engineering, tools, and product launch. These define quality of event criteria, design, test, tooling time lines, and critical inputs/ outputs for these individual parts at critical points in time. These are fundamental to delivering the overall vehicle product time line and allowed engineering to "know where they were" at any point in time. Tied to this were the tooling plans that mapped out requirements for each piece of each die as it goes through the internal tooling manufacturing process.

Process Driven Product Design (PDPD) was a standard manufacturing process developed for each part that would guarantee parts would be manufactured with world-class quality and efficiency and become a fundamental part of the design architecture.

They created a standard architecture that embodied the latest knowledge, and simultaneously allowed maximum flexibility in design. We think that it might be helpful to utilize medical analogies to describe the role of Fords standard design architecture strategy. The rigorous evaluation of the vehicle body and learning that takes place is like an autopsy. As mentioned above Ford conducts regular reflection events, TGW meetings, utilizes lessons learned, and creates countermeasure plans. Simple A3 reports (one side of one sheet of paper) are used to represent the problem solving process. By showing only the most critical information on one piece of paper, the key thought processes of engineers can be tracked, and this provides an opportunity to get critical input from others (Shook, 2008).

As the process matures it moves to a prevention stage. Global design reviews, basic engineering disciplines like failure modes and effects analysis, check lists, design rules, digital preassembly events, and simulations ensure that future programs comply with all the best standards and requirements for quality and performance. The latest digital technologies allowed them to embed this knowledge into parametric digital part templates. This can be compared to genetic engineering to build quality and productivity into the very DNA of the product designs. These templates embody the very best/latest standards, specifications, design rules, and manufacturing and quality requirements, and may be efficiently modified by engineers to fit unique design requirements without compromising quality. Standard architecture and the array of associated digital tools are very impressive; however, they are only as good as the knowledge that supports them. The templates are an outcome of the architecture strategy which in turn depends on having detailed standards to achieve high levels of fit and finish. The relationship between these processes is illustrated in Exhibit 2. Foundation engineering disciplines enable standard architectures and standard components that are the basis for common vehicle platforms. At the same time, body styles must, from the customers point of view, differentiate the vehicles. As an example, the 2010 Ford Explorer and Ford Taurus are on the same vehicle underbody even though they look like completely different vehicles to the customer. Many items that do not differentiate the car from the customers point of view are now standardized.

For example, in the past Ford had many different door hinges and now has reduced that number by more than 95%. Additionally, they have moved from unique hood inner architectures for each vehicle to just a single, morphable architecture across all models Technology and Tool Transformations Developing today's incredibly complex vehicles would be nearly impossible without a suite of sophisticated digital tools; however, the quality of the knowledge and the engineers ability to apply it at the right time is still the most important element of lean

product development. The team realized that before they could fully leverage the capability of digital tools, they had to be certain that they fit and supported the people and process, and that critical knowledge was validated, up to date, and that basic engineering disciplines were in place. They then had to be sure that the information was available to body and stamping engineers worldwide. Foundational knowledge is the fundamental information required to design, engineer, tool up, and manufacture parts, sub-assemblies, and whole vehicles (see Exhibit 2). This includes performance specifications, test requirements, design rules, manufacturing requirements, and quality standards for thousands of components and their resulting interfaces. Much of this information is contained in living documents that are updated based on organizational learning, changes in governmental requirements, or new technological developments. The challenge is to keep this information current, valid, and accessible. The BScSE leadership team quickly realized that revitalizing this invaluable knowledge was key to improving the development process, coordinating global engineering activities, providing a foundation for improvement, and developing new engineers. Technical specialists and experienced engineers spent months working through this data, concurring globally, and validating in design review by functional chief engineers. This information is now captured in easy to use databases, check lists, virtual simulations, and embedded in parametric engineering templates - all of which are available to engineers around the globe. Furthermore, several mechanisms have been built into the process to be certain that new knowledge is validated and captured so that repositories remain up-to-date and accurate. The digital value stream extends from the design studio, through engineering, to the tool manufacturing plant and machining centers around the world. The virtual and digital tools available to designers and engineers would have been considered science fiction just a few years earlier. In the design studio where artistic styling is done, ten foot power walls show virtual models with incredible levels of detail. Every element of the design can be evaluated, quickly modified, and reevaluated. This includes virtual craftsmanship reviews where everything from headlamp appearance, to class one surface reflectivity, and fit and finish can be scrutinized at an exacting level of precision and detail. Once approved, three-dimensional surfaces are released directly from the design model into the 3D engineering databases and tool sets. Body Engineers use this data to finish their detailed component engineering utilizing parametric templates, conduct simulation/testing critical performance attributes, check critical attributes like weight, and optimize efficient material utilization - all before the designs are ever released. Simultaneously, the stamping engineers use the same data as the body engineers to run forming simulations, start detailed die designs, machining/ milling verifications, die interference checks, further optimize material utilization, and finally, run press simulations based on the actually press lines the tools will eventually be run in.

At Dearborn Tool and Die (Fords in house tool shop), digital technologies and lean processes have allowed them to move from the old craft based ("black magic") model of tool and die making to a lean, high precision, machine -intensive end of the digital value stream. The tool shop starts solids die designs created from the original 3D design data with every detail of the die contained. The die Construction, Planning and Analysis team evaluates the design and plans/schedules the manufacturing of every detail no matter where in the world it will be built. Precise, high-speed mills machine surfaces within microns eliminating all of the handwork that used to be required in machining and assembling dies. Sophisticated viewing software allows Dearborn Tool and Die technicians to "see" details real-time as they are machined whether the details are in Dearborn, Cologne, or Tianjin. Hourly UAW-represented technicians use and program much of the technology.

Standardized software, machine processes, and incredibly accurate/detailed die designs allow Ford the option to source machining of die components across the planet, bring them together, and have them fit precisely

together. The precise machining and effectiveness of engineering simulation programs have allowed Ford to eliminate much of the press "tryout" (hand grinding by skilled die makers) that used to go on for months. New technologies and processes have allowed the team to get a "first part to gauge" within at most just a few days and often in just a matter of hours. Finally, white light or 3D optical scanning allows technicians to scan dies, parts, or sub-assemblies in point dense, digital medium that can be analyzed, compared back to design all in its original solids environment. This has proven to be an invaluable learning and problem solving tool and has also allowed Ford to "finger print" dies before leaving the tool shop so that any part of the die, or the entire die can be replicated, either for "dual tooling" or for replacing damaged dies/components.

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Developing "physicals-based" cost models was very important to improving development efficiency and supplier relationships. Ford engineers and purchasing managers worked with suppliers to understand the design, process and logistical cost drivers for components and how they can work together to lower costs without cutting into margins. In other words, these cost models leverage data, knowledge, and collaboration instead of negotiation to arrive at the best possible component costs. Once these models are established and agreed on, it saves a great deal of time and money, and most often arrives at a lower total cost for Ford and does not damage the supplier- customer relationship the way traditional negotiations can. The result is that Ford s costs have gone down while their supplier ratings have gone up.

Synchronizing the development value stream becomes ultracritical when thousands of interdependent activities are taking place simultaneously in multiple locations around the world. The team has merged previously disparate scheduling tools into a single, integrated, detailed status view allowing the team to review status to schedule in a holistic way. As mentioned above sophisticated viewing software actually lets the team "see" status regardless of where the work is taking place.

The value stream mapping work done by the team allows them to understand the most critical points in the development, and the process plans show how each step in the development of every component and subassembly fits into the overall development plan. Equipped with this knowledge and a handful of unique tools, the thousands of steps in the development process are far better coordinated and monitored - no matter where they are taking place.

Health charts (status on quality key points like door closing effort) and quality targets helped drive design, process, and content solutions into new programs to ensure year-over-year quality improvements that are best in industry. Specific requirements for component design, manufacturing process, component attributes, and manufacturing plant operating requirements are captured under a large number of categories like craftsmanship, class -one surface requirements, dimensional control, or material handling that are checked at specific points in

the development process to be certain all elements of all components, as well as the overall body, are ready for a high quality launch. These health charts have contributed to a dramatic reduction in launch quality issues and costly re-work.

One powerful tool is the obey a process (Morgan and Liker, 2006). Making problems visible to the team is the key to real-time problem solving and also maintains the cadence of the product development process.

II. RESULTS

The improvements at Ford in this critical element of automotive product development over five years of this transformation process - 2004 to 2009 - have surpassed benchmarked levels of performance for quality, lead time, and cost. Over the past five years they reduced average overall lead time by 40% (nearly 50% reduction in one all-new car body), and reduced internal tool and die construction timing by an average of 50%. For example the average time it takes from body styling to design and build the dies that stamp out the body and get them into production was reduced by 50%. During the same time period, they reduced internal tool investment costs by an average of 45% and decreased average labor hours per tool by more than 50%. Die cost is related to the number of different stamping hits required to make the body part; that has gone from 6-7 hits per part to 3-4 hits. In the Ford Dearborn Tool and Die plant, the largest source of production dies, the number of people making dies was cut in half while output of dies doubled yielding a 400% increase in productivity. Most importantly they have simultaneously improved quality by more than 35% as measured by things gone wrong for the body sub-system, and increased dimensional accuracy by 30% including dramatically improved craftsmanship and body fit and finish that is now among the very best in the world. On measures of things gone wrong in the vehicle body by J.D. Power, Ford went from the worst of any automaker in 2003 to the best in 2008. In fact, body exterior was the most improved element in a recent quality report card.

Finally, morale as measured by Fords annual internal survey also improved by about 30% during this same time period. Engineers fed off early successes, took ownership of the initiative, and developed unique, powerful innovations that allowed Ford to surpass their benchmarks in many key areas. As mentioned earlier, enrolling the talented engineers was crucial. It is also important to note that all of these improvements were accomplished with relatively little investment and during a period of severe downsizing.

III. CONCLUSIONS

Lean product development is a relatively new field of study and there are different perspectives on what it is. Under experienced, knowledgeable leadership Ford began their transformation with a set of lean PD principles derived from extensive studies of Toyotas and Mazda product development processes. Given the shortage of well documented lean PD transformations, there were many questions as to whether or not an existing product development program, with a long-standing tradition, could be transformed based on these principles to become a high performing organization. The results suggest it is possible to make major improvements in results based on major changes in people, processes, and tools.

The systems model for lean product development was based on intensive study of Toyota and Mazda. In Toyotas case the study led to a set of 13 principles that guided the vision for the future state. Mazda, which had a technology sharing agreement with Toyota and shared all of the 13 principles, acted as a source of detailed benchmarking at the operational and tools level. Through gap analysis of people, process, and tools as well as results, cross-functional teams could get a detailed picture of specific opportunities for improvement at Ford.

Mazda also was a key source of inspiration to win people over. They could see in high resolution the difference in methods and processes, and superior performance. This level of technical detail was also important to winning the support of the engineering teams who built on this information to create their own, even better processes

We would definitely not describe the Ford journey as an attempt to copy Toyota. Far from it - Ford has its own culture, unique strengths, and its starting point was very different from Toyotas. On the other hand, we can say that Ford stayed true to the lean product development principles that were derived from the study of Toyota. We believe these principles are generic enough to apply broadly to product-process development across companies and industries.

It would be unreasonable to attempt to generalize from a single case on the one best way to transform an organization to lean product development. Ford is a unique organization and in the period from 2005 to 2010 faced unique circumstances including near bankruptcy. The opportunity for microscopic benchmarking of Mazda is an opportunity few organizations have. It certainly helped that Ford is similar enough to Toyota in product and process to be able to learn directly some of the best practices. Nonetheless, we do believe there are some lessons from Ford that are worth considering by other companies attempting the journey. As we look back at the Ford case, it is clear that lean product development is far more than a toolkit to eliminate waste. In fact, stepping back we see the transformation at Ford as beginning at a global level with the strategy of the company. Had Ford not used the funding obtained by "betting the company" on a product-led revitalization, lean product development would never have been possible. This strategic commitment by the CEO of the company led to a focus on product development that was unprecedented at Ford. Together they followed to a large extent the model of a systems approach to lean product development - global platforms, standardized parts, front-loaded design, and accountable, highly skilled and empowered engineers. Lean processes then enabled this strategy, with the energized engineers, to achieve record product launches and ultimately success in the marketplace (see Exhibit 3).

There Are a Number of Important Lessons to Be Learned From This Case

1. Lean processes can be effective in driving high quality, low cost, and short lead times in product development. A lean process is driven by continuous improvement to eliminate waste, which surfaces problems, reducing the time from problem to solution. The basic principle is to shorten the loops of plan-do-check-act as much as possible. Over time, as the organization matures, it can pull that knowledge up front, front-end loading, functional teams to see the waste in the current process and develop plans for reducing waste in the next design cycle. It is part of the "plan" of PDCA. At the end of the design cycle, there should be a major reflection with further action to complete the big PDCA loop. This should then lead into the plan for the next design program.

2. The transformation requires a long-term commitment and a staging of the transformation process. In the case of Ford, the starting point was an overall transformation model applied to pieces of the development process in pilots. Those who led the pilots and learned from them were then transferred into the operational unit to lead from within. Over time the process was spread, tools were added, organizational changes were made, and progress accelerated.

3. Driven, accountable team members transform lean product development from static tools to a living high performance system. Ford tried lean engineering years earlier and eventually amassed a major bureaucracy maintaining a monstrous phase-gate process that nobody even seemed to be able to understand let alone follow. At some point the tools took on a life of their own and had no relation to what working-level engineers did in

the actual development process. The more recent success at Ford was due to a greatly simplified tool set that was actually used throughout the body engineering organization. It took years of patient and deliberate leadership to get the engineering organization aligned. The benefit of the crisis of Fords near bankruptcy to create a "burning platform" cannot be overstated.

4. The main role of lean tools is to make problems visible and provide a method of solving them at the root cause. Some of the most useful tools were very simple. The obeya process of visual management caused cross-functional teams to quickly see problems and write them down. Putting an actual persons name and an expected completion date drives accountability. The whole team knows in the next meeting when someone has let them down. Peer pressure is a powerful motivator. The A3 process of problem solving makes the thinking process clear and visible, which provides an opportunity for checking and coaching by informed leaders (Shook, 2008). Engineering checklists make decision criteria visible and deviations come to light immediately. Many of the specific lean tools applied, e.g., health charts, were used to set challenging stretch targets that drove teamwork and innovation.

5. Lean implementation is a social, cultural, and political transformation. We have described the transformation of Ford in an admittedly simplistic way. The period of time we are talking about was one of great turmoil. Ford was fighting for its survival. There were many very painful layoffs. There were many managers and engineers who resisted change and had to be won over, or in some cases given an ultimatum to get on board or leave. At times, for those living through the change, it felt like a hopeless struggle. Leadership is much more than managing to a linear plan. Leadership requires a wide range of skills including reading political situations, understanding the culture, building relationships, understanding mass psychology, penetrating the psychology of individuals, and in the end winning over the mass of engineers to work toward the vision. It is messy, frustrating, elating, and a leader must never, ever let up. Particularly in the early stages much of the leadership was brutal and top down. Lean implementation is a leadership process, not a technical process. The original meaning of the term "lean" was to represent a genuine paradigm shift in how to manage a complex organization (Krafcik, 1988). A lean organization is robust, flexible, and healthy, just like aleanbody. The last step in Womack and Jones (1996) Lean Thinking is "striving for perfection." Continuing the motivation for improvement beyond the initial transformation drive may be a greater leadership challenge then managing the change. People and the organization naturally settle into patterns, and when they feel they have been successful there is a tendency for complacency to set in. Failure to improve in lean means entropy will drive you toward decline. Is "lean" the best choice of words? Not necessarily. One could substitute product development excellence for lean product development. Lean product development is striving for excellence - on an individual level and on an organizational level - and the journey never ends.

IV. FUTURE RESEARCH

There are a number of characteristics of lean product development, as we have defined it, that make it challenging to research:

1. Lean as an emergent system. If we are correct that in order to be highly effective lean product development requires the integration of people, processes, and tools, then it will not be possible to test hypotheses about the effectiveness of individual "best practices." The typical linear regression model assumed independent, additive contributions of individual variables, whereas a systems view assumes complex interactions between variables.

A reductionist view of system features in isolation will violate the integrity of the system and lead to misleading conclusions.

2. Lean as a dynamic evolving process. If we view lean as a process that develops over time, then measurements at a slice in time simply represent one stop on the journey. We do not know where the organization has come from or where it is going to from this one data point.

3. Lean as an evolving culture. If a criterion for success is the depth and breadth of engraining lean thinking in the culture, then we cannot judge how lean an organization is based only on the structure of the development process. We must actually measure and capture the culture and way of thinking and acting of engineers. These characteristics suggest that conventional, crosssectional surveys that look at collections of best practices as independent variables predicting outcomes will not be effective in the case of lean product development. Greater insight can be gained by in-depth cases studied over time. It also suggests that it will not be useful to pose research questions in deterministic form such as: If we do these things we will get these results. In reality different organizations can do "these things" and get very different results depending on where they are in the process, what they learn from the things they do, how doing these things shapes the way of thinking of engineers, and the leadership approach when doing these things.

What Then Can Be Useful Research Questions?

We believe for the specific case of lean product development, the most valuable methodology is action research that elucidates ways to approach key issues such as:

1. Culture change. How can we facilitate a change in thinking from finding and fixing problems to designing in quality based on PDCA? At Ford, we observed a change in the way engineers thought about problems. In the past the focus was on reacting to issues as they were discovered which was often late in the development process or even after production launch. After several years of lean development, working level engineers would ask challenging questions like: "Do we really understand what the problem is?" and "Do we know the root cause?"

Research might document these shifts in language through anthropological methods and develop interventions to facilitate cultural transformation.

2. Standardization and innovation. These are often seen as opposites but in lean we see these as two sides of the same coin. Adler (1999) made an important distinction between coercive bureaucracy that treats standards as something to monitor and enforce with rewards and punishments, and enabling bureaucracy that treats standards as todays best known solution upon which we want to build and make improvements. More research is needed to build on this distinction and help understand how we can facilitate standardization as part of enabling bureaucracy to encourage innovation.

3. Front-end loading and innovation. As companies apply lean methods and begin to shift from reacting to problems downstream to designing in solutions in the "fuzzy front end" of the process, there is an opportunity to make intelligent decisions about where to introduce new product technologies and when it is more effective to standardize designs. Research can assist in this thinking process to better understand the tradeoffs between new technology and standard parts and architectures.

4. Use of requirements engineering.. The starting point for defining waste is defining customer value, and we have seen a weakness in the way firms establish targets to meet customer requirements. The first house of quality in quality function deployment is a starting point, but lean firms go much farther in detailing

requirements at the subsystem and component level, and holding teams accountable for delivering on targets they helped develop. Research is needed to better understand the target-setting process at the level of detail required

5. Use of obeya. We have found that the obeya is one of the most powerful lean tools. The power is in visual communication and accountability of functions to work together toward cross-functional objectives. There is a lot of variation in how obeya is used and many questions about its use in other companies. What information should be posted and how should it be used? How can we use the obeya for virtual teams? Is a computer representation as effective as printed out and posted representations? Are there opportunities for computer group support systems? There are tremendous opportunities for research on the obeya alone. One of the challenges of research on lean product development is discovering useful information, while avoiding the "one best way" conundrum. Assuming there is an optimum approach or one best way to implement a tool is antithetical to the continuous improvement underpinnings of lean thinking. As we continue to learn about lean product development, we have to accept that all answers are provisional and there is always a better way that someone will discover. In this spirit, collaborative research to build on ideas is preferred. The Ford case gives us one approach that stays true to the Toyota model and strong evidence that lean product development can be a powerful way to significantly improve business performance.

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FORECASTING USING NEURAL NETWORK AND FUZZY TIME SERIES: A RELATIVE STUDY USING SUGAR PRODUCTION DATA

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ABSTRACT

This paper reflects a neural network approach together with the methods of fuzzy time series of forecasting sugar production data.On behalf of forecsaters , time series forecasting that have varied variations is an important issue.One of the such process is the agriculture production and its productivity and it is not hold by an stoichastic process because of great non-linear due to great non-linear due to different effective parameters like rainfall, disaster, disease, weather etc. This study comprises of fuzzy set theory and uses various models of fuzzy time series for forecasting the sugar production.From FCI , the sugar production past data have been gathered for investigation of the outcomes.Comparison and examination has been done of the sugar production forecasted data.

Keywords: ANN, DSS, Fuzzy Time Series, Fuzzy Set, Forecasting, High Order Model, Production Linguistic Value.

I. INTRODUCTION

Time Series analysis contribute techniques for examining time series data in order to extricate correct statistics and various characteristics of the data.Time series analysis can be excercised to continuous data , real valued and discrete numeric data that are drawn by different methods like integrated moving average , moving average , regression analysis etc. One of the process is of sugar production, which is not observed by stoicism process due to great invariability because of different perceptual production parameters as cultivation area , diseases , disaster etc. Next to textile industry, second largest is the Indian sugar. Similarly, largest consumer of sugar is India.Bagasse and mollases are some of the other generated sweeting products. The current approach is to relate fuzzy time series model, its implementation, testing and comparison of the outcome of different forecasting models. Zadeh introduced fuzzy logic and fuzzy set theory which gives a method for handling unpredictability and ambiguity of data in linguistic terms. Song and Chissom introduced first model on the basis of fuzzy set theory to deploy techniques for fuzzy time series forecasting and bothered the hindrance of forecasting enrollments on the time series data. The major obstacle in fuzzy time series forecasting is the correctness in forecast with the high order fuzzy time series model . This work is analyzing different models and reflects its applicability in the area of agriculture production . The aim of implementing the forecasting model of fuzzy time series is to identify steps of modelling the divination of crop yield i.e. based on different factors.

II. ARTIFICIAL NEURAL NETWORKS

Neural networks have been related to time-series prognostication since many years from forecasting stock prices and point out tasks for analyzing the expansion of tree rings. In substance all anatomy of time series prediction are conceptually alike. The given data **X**= **X**(τ) it differs as a function of time τ, it is practical to learn the function which maps **X**τ+1=**X**τ. Feed-forward networks can be registered straightly to the issues of this pattern in relation that the data is processed apriori. Assume a single variable *x* it differs with time, a customary commence is to sample *x* at equal time intervals to furnish a series of examination *X*τ-2, *X*τ-1,*X*τ and so on. Thus we can collect such observations and reflect them as the input vector and use examination *X*τ+1 as the targeted value. By moving along the time axis ,considering a single sample at a time we can frame the training set for the issue At once we have trained the network we should then be able to reflect an another vector *X'*τ-2, *X'*τ-1, *X'*τ and assume *X'*τ+1. Thus known as *one step ahead* prediction.

2.1 Neural Network Topologies [13]

(A). Feedforward neural network: The simplest of all the ANN is the feedforward. According to this type of network, there are input nodes then hidden nodes and finally output nodes and thus output is received from output nodes. This is free from loops and cycles. Processing can be extended till hierarchichal units but no reversible connections are there.

(B). Recurrent network: Feedback of connections are contained in recurrency of neural network. Recurrency of neural network are bidirectional model of data flow, unlike feedforward network. The data is processed linearly to output from input in feedforward network but in recurrency of neural network data is processed from later to earlier processing stages.

2.2 Training of Artificial Neural Networks [13]

Configuration of neural network directly or via a relaxation process produce a set of desired outputs. A method to set connection strength is to set weight explicitly using prior knowledge . Another approach to train the neural network is by feeding its teaching pattern and allowing it to change weights as per some learning rule.. Classification of learning situations is follows:

(a).*Supervised learning* or Associative learning in which training of network by providing matching input output patterns. These pairs are provided either by system containing neural network .

(b*).Unsupervised learning* or Self-organization in which an (output) unit is prepared to react to clusters of series within the input. In this area , the system is supposed to determine statistically main characteristics of the input population. Apart of supervised learning area, there is no a priori set of classification into which the series are to be characterized; relatively the system must deploy its individual presentation of the input stimuli.

(c). Reinforcement Learning: In this the learning may be defined as a middle type of the above two classification of learning. In this, the learning machine perform some action on the environment and gets a assessment response from the environment. The learning system rank its action nice (rewarding) or poor (punishable) on the basis of the environmental outcome and relatively adjusts the parameters.

III. FUZZY TIME SERIES

3.1 Fuzzy Set Theory

In the fuzzy set theory, the participation of an individual in a fuzzy set is a concern of degree . A function which allocates to each element a number in the closed unit interval [0, 1] which categorize the degree of membership of the element is called membership function where classical relations define only the presence of association between elements of two sets. Strength of association can be done by fuzzy sets.

3.2 Fuzzy Time Series

Here, the fuzzy relationship will be employed to demonstrate fuzzy time series. Accordingly, the values of fuzzy time series are fuzzy sets .There is also an association between the observations at time t and at previous times. At different times of observations, fuzzy relation is developed in three different scenario, in this forecasting have been done on the basis of time series data for the agricultural production.

3.3 Basics of fuzzy time series

Different properties and definitions of fuzzy time series forecasting seen in various papers and reproduced as follows:

Definition 1. With a continuum of grade of membership, a fuzzy set is a class of objects. Assume U be the universe of discourse , $U= \{u1, u2, u3, . . . un\}$,where ui are linguistic values of U, so a fuzzy set of linguistic variables Ai of U is described by

$Ai = \mu Ai\ (u1)/u1+ \mu Ai\ (u2)/u2+ \mu Ai\ (u3)/u3 + . . . + \mu Ai\ (un)/un$ where μAi is the membership function of the fuzzy set Ai, such that $\mu Ai : U = [0, 1]$. If uj is the member of Ai, then $\mu Ai\ (uj)$ is the degree of belonging of uj to Ai.

Definition 2. Assume $Y(t)$ ($t = . . ., 0, 1, 2, 3, . . .$), as a subset of R, be the universe of discourse on which fuzzy sets $fi(t)$ (i=1, 2, 3, . . .) defined , $F(t)$ is the combination of fi, thus $F(t)$ is defined as fuzzy time series on $Y(t)$.

Definition 3(a). Assume $F(t)$ is because only by $F(t-1)$ and is denoted as $F(t-1) \rightarrow F(t)$; thus there is a fuzzy relationship between $F(t-1)$ and $F(t)$ which can be expressed follows: $F(t) = F(t - 1) * R(t, t - 1)$

where " * " is max–min composition operator.

Moreover, if fuzzy relation $R(t, t-1)$ of $F(t)$ is free of time t, i.e. to say at different times $t1$ and $t2$, $R(t1,t1 -1) = R(t2, t2 -1)$, thus $F(t)$ is known a time invariant fuzzy time series.

Definition 3(b). When $F(t)$ is caused by more fuzzy sets,then $F(t-n)$, $F(t-n + 1)$, . . ., $F(t-1)$, the fuzzy relationship is shown as $Ai1, Ai2, . . . , Ain \rightarrow Aj$

where $F(t-n) = Ai1$, $F(t-n+1) = Ai2$, . . ., $F(t-1) = Ain$. The relationship is known as nth order fuzzy time series model.

Definition 4. Assume $F(t)$ is caused by an $F(t-1)$, $F(t-2)$, . . ., and $F(t-m)$ ($m> 0$) the relations are time variant. The $F(t)$ is known as time variant fuzzy time series and the relation can be represented as the fuzzy relational equation: $F(t) = F(t - 1) * Rw(t, t - 1)$

where $w > 1$ is a time (number of years) parameter by which the forecast $F(t)$ has impact.

IV. SUGAR PRODUCTION FORECASTING

4.1 Computational Steps by Fuzzy Time Series

The simulation of the above mentioned algorithm is on the basis of 22 years (1988-89 to 2009-10) time series production data of FCI.

Step 1. To adapt the time series data describe the universe of discourse. Dmin and Dmax productions are required. So, universe of discourse U is described as [Dmin – D1, Dmax - D2], where D, and D2 are two proper positive numbers. According to the current scenario of production forecasting universe of discourse computed as U = [80 , 290]

Step 2. The universes of discourse is divided into 7 equal length intervals U1, U2,...., U7 as U1 = [80-110], U2=[110-140], U3=[140-170], U4=[170-200], U5= [200-230], U6=[230-250], U7=[260-290].

Step 3. Describe seven fuzzy sets A1, A2, ..., A7 having few linguistic values on the universe of discourse U . Linguistic values are as follows:

A1: bad production,

A2: less than average production

A3: average production

A4: good production

A5: great production

A6: superb production

A7: enormous production

According to different intervals,the fuzzy set in respect of its membership are expressed as follows:

A1 : [1/u1,.5/u2,0 u3,0/u4,0/u5,0/u6,0/u7]

A2 : [.5/u1,.l/u2,.5/u3,0/u4,0/u5,0/u6,0/u7]

A3 : [0/u1,.5/u2,l/u3,.5/u4,0/u5,0/u6,0/u7]

A4 : [0/u1,0/u2,.5/u3,1/u4,.5/u5,0/u6,0/u7]

A5 : [0/u1,0/u2,0/u3,.5/u4,l/u5,.5/u6,0/u7]

A6 : [0/u1,0/u2,0/u3,0/u4,.5/u5,l/u6,.5/u7]

A7 : [0/u1,0/u2,0/u3,0/u4,0/u5,.5/u6, l/u7]

Step 4. According to the fuzzy input for various models the time series data are shown in table 1:

Step 5. For various models ,the logical relations have been gathered.

Fuzzy Relationships

$A_1 \rightarrow A_1$, $A_1 \rightarrow A_2$, $A_1 \rightarrow A_1$, $A_1 \rightarrow A_3$,

$A_2 \rightarrow A_4$,$A_2 \rightarrow A_2$, $A_2 \rightarrow A_2$, $A_2 \rightarrow A_1$, $A_2 \rightarrow A_2$,$A_2 \rightarrow A_3$

A3→ A3, A3→A2, A3→A4, A3→A4

A4→ A4, A4→A4, A4→A5, A4→A6

A5→ A2, A6→A7, A7→A3

Groups are as follows:

A1→ A1A1A2A3

A2→ A1A2A2A2A3A4

A3→ A2A3A4A4

A4→ A4 A4A5 A6

A5→ A2

A6→ A7

A7→ A3

According to chen[1] higher order model,FLR group second order is as follows:

A1A1→ A2

A1A2→ A2

A2A2→ A1

A2A1→ A1

A1A1→ A3

A1A3→ A3

A3A3→ A2

A3A2→ A2

A2A2→ A3

A2A3→ A4

A3A4→ A4

A4A4→ A4

A4A5→ A2

A5A2→ A2

A2A2→ A4

A2A4→ A6

A4A6→ A3

A6A7→A3

A7A3→ A4

According to chen[1] higher order model,FLR group second order is as follows:

#A1A1→A2

A1A1A2→ A2

A1A2A2→ A1

A2A2A1→ A1

A2A1A1→ A3

A1A1A3→ A3

A1A3A3→ A2

A3A3A2→ A2

A3A2A2→ A3

A2A2A3→ A4

A2A3A4→ A4

A2A3A4→A4

A3A4A4→ A4

A4A4A4→ A5

A4A4A5→ A2

A4A5A2→ A2

A5A2A2→ A4

A2A2A4→ A6

A2A4A6→ A7

A4A6A7→ A3

A6A7A3→ A4

A7A3A4→ #

According to chen[1] higher order model,FLR group second order is as follows:

#A1A1A2→ A 2

A1A1A2A1→ A1

A1A2A2A1→ A1

A2A2A1A1→ A3

A2A1A1A3→ A3

A1A1A3A3→ A2

A1A3A3A2→ A2

A3A3A2A2→ A3

A3A2A2A3→ A4

A2A2A3A4→ A4

A2A3A4A4→ A4

A3A4A4A4→ A5

A4A4A4A5→ A2

A4A4A5A2→ A2

A4A5A2A2→ A4

A5A2A2A4→ A6

A2A2A4A6→ A7

A2A4A6A7→ A3

A4A6A7A3→ A4

A6A7A3A4→ #

According to chen[1] higher order model,FLR group second order is as follows:

#A1A1A2A2→ A1

A1A1A2A2A1→ A1

A1A2A2A1A1→ A3

A2A2A1A1A3→ A3

A2A1A1A3A3→ A2

A1A1A3A3A2→ A2

A1A3A3A2A2→ A3

A3A3A2A2A3→ A4

A3A2A2A3A4→ A4

A2A2A3A4A4→ A4

A2A3A4A4A4→ A5

A3A4A4A4A5→ A2

A4A4A4A5A2→ A2

A4A4A5A2A2→ A4

A4A5A2A2A4→ A6

A5A2A2A4A6→ A7

A2A2A4A6A7→ A3

A2A4A6A7A3→ A4

A4A6A7A3A4→ #

Sugar Year	Sugar production in Lakh Tons	Fuzzy Production
1988-1989	87.52	A1
1989-1990	109.89	A1
1990-1991	120.47	A2
1991-1992	134.11	A2
1992-1993	106.09	A1
1993-1994	98.24	A1
1994-1995	146.43	A3
1995-1996	164.29	A3
1996-1997	129.05	A2
1997-1998	128.44	A2
1998-1999	154.52	A3
1999-2000	181.93	A4
2000-2001	185.1	A4
2001-2002	184.96	A4
2002-2003	201.32	A5
2003-2004	139.58	A2
2004-2005	130	A2
2005-2006	191	A4
2006-2007	257.54	A6
2007-2008	263	A7
2008-2009	147	A3
2009-2010	188	A4

Table 1 Sugar Production Data's Fuzzification

Step 6:-Calculation of fuzzy forecast of the sugar production have been forwarded by the four different models: Chen[2](Model-1) ,Huang[3](Model-2),S.R. Singh[6] (Model-3) and Chen higher order[1] (Model-4) .

Step 7. Defuzzification is the reversal of Fuzzification.In this process , fuzzy output of model is metamorphose to crisp values for receiving the forecasted values.

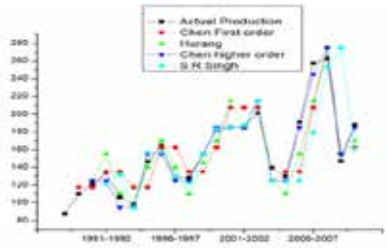

Fig.1 Comparison of Actual and Forecasted Sugar Production by Varios Models

In Fig. 1 we can notice that according to different intervals there are wide ups and downs in sugar production. In cthe scenario of sugar production, same forecast is being reflected by four varius models.We can see in fig 1 that model4 is in close with the actual production while remaining models comprises of large variations.

4.2 Calculative Steps by Artificial Neural Network

Step-by-step for forecasting of neural network:

1. Mention the input instructions (viz. those (Z1, Z2, Z3 …., Zn) ethereal instructions which straightforwardly affect the crop production .
2. Assemble the production data of t years and past years.
3. Tune the production data such that all the value must be in the range of 0 and 1.
4. Form the Artificial Neural Network (ANN) with the remuneration of number of layers.hidden layers and neurons.
5. Choose the most effective training algorithm for ANN.
6. In consideration of the problem describe the transfer function for different layers.
7. Select the number of span and objective for ANN.
8. Choose the procedural tool to note the simulator for the suggested neural network.
9. Then train the ANN in collection with the production data of previous ‘ n’ years for selected instructions (Z1, Z2 , Z3 …., Zn) and actual productions (P(t-1), P(t-2), P(t-3),…….., P(t-m)) .
10. When the ANN is trained for the aim then use the test procdure for the years t + 1, t + 2, t+ 3 ……. t+p .The output of ANN is collected.
11. Perform the relative study with models of fuzzy series forecasting.
12. Perform the error analysis with notified forecasted and actual values to verify the model.

This concept is fine for multi-valued data in which we can notice that what all parameters are affecting the data and what all parameters will help for training,thus this concept is lenghty and not appropriate for a parameter data. Contrary to this, if we have a number of parameter which affects the production thus it will surely reflects great outcomes in comparison to methods of fuzzy time series. In this paper we are explaining steps for the forecasting of sugar production with the help of ANN

V. COMPARITIVE STUDY OF FORECASTING RESULTS

Here, we contrast the results of different forecasting methods on past data of sugar production. A relation of mean square errors (MSE) with various procedures is given in table ,where the mean square error (MSE) is shown below:

MSE=∑ (Actual Production –Forecasted Production)^2/n

Where i=1 to n,

	S.R.Singh[5]	Chen Higher order[1]	Chen [2]	Huarng[3]
MSE	1534.12	63.45	562.78	329.05

Table 2 Relation of MSE

VI. CONCLUSION

The inducement of the application of fuzzy time series in various crop production forecast is to reinforce the expansion of DSS in agricultural production system, one of the actual life issue lies in the group having unpredictability in open and hidden parameters. The previous experiences disclose that the agricultural production system is a multiplex process and tough to model by the statistical formulations, in concern with even all the excellence practices of cropping are inherited; the unpredictability comes in the crop production because of few uncontrolled parameters. Moreover, the sugar production being inflict with the field data, accuracy of data is consistently an impotant issue. The previous time series crop production data used in the current study is gathered from Food Corporation of India. An another scenario was to make a contrast between different techniques of fuzzy time series and neural network method. It is perceived that it gives better results than methods of fuzzy time series As seen in neural network elucidation is done by ANN,thus neural network is considered as objective in comparison to methods of fuzzy time series. It can simply control the imprecision and any degree of intermittent in the data.

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IMPACT OF URBANISATION ON LAKES – A CASE STUDY

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ABSTRACT

This paper describes the studies conducted on the impact of urban development of lakes in Bangalore City. The study investigates the impact of urbanisation on the bird life, aquatic life, reduction of green cover, shrinkage of the water bodied due to encroachments and the study is supported by the limnological characteristics of lakes . For the studies three lakes in Bangalore City namely Puttenahalli Lake in southern Bangalore with a water spread of 13 acres, Yediyur Lake in central Bangalore with a water spread of 15acresand Sankey Lake in northern Bangalore with a water spread of 15 acres. There was a marked reduction in the bird life over the years .The aquatic life in all the lakes was tapering over the years. The satellite imagery of the lakes supported by ground truth checking indicated marked reduction in the water spread. A survey of the existing industries and their nuisance value has been recorded. Water quality analysis indicated marked increasein the sulphate content in all the lake samples,high pH values indicating excess alkalinity in Yediyur Lake and Sankey Tank and excess levels of turbidity reported from all the three lakes under study. High levels of heavy metals like Chromium and Nickel reported from the lakes beyond the permissible levels.All the lakes had high level of pathogenic organisms as demonstrated by the biological analysis. Suitable remedial measures and methods to control pollution has been recommended.

Keywords-Distress, Impact, Limnology, Urban Development, Water Quality

I. INTRODUCTION

Bangalore, capital of the State of Karnataka (South India), is situated on the Deccan Plateau at an altitude of 920m. Traditionally known as the “city of lakes”, Bangalore used to enjoy, till recently, a pleasant and salubrious climate with pure air, due not only to its altitude but also to its numerous green spaces and famous lakes.Water bodies in Bangalore are either natural lakes, man- made lakes or tanks which have been built from the 16th century to meet the water requirements of the population. These lakes are still used by poor sections of the population for both domestic needs (bath and cloth washing) and livelihood activities like agriculture (irrigation), livestock, fishing or commercial washing (dhobi).The lakes help reducing temperature, reducing pollution , prevents flooding , raises the level of groundwater , provides an habitat for aquatic life, supplies drinking water, provides long space and is a source of recreation.

The disappearance of Bangalore’s lakes started in the 80s but has sped up with rapid urbanisation. While in 1961 there were 262 lakes, official statistics today mention 117 lakes, but only 33 lakes are still more or less visible on satellite imagery.The current status of the lakes in Bangakore is that 13lakes have been dried up and leased by the government, 60 lakes are in the advance stage of detoriation,, 28 lakes have been breached by the

Bangalore Development Authority (BDA) for forming extensions and creating public utilities and house sites for the general public, 7 lakes are recognizable as small pools of water and 4 lakes have been fully encroached..

Over the last decades, lakes have been rented to private constructors. The authorities themselves have built their own infrastructures on lakebeds whereas other areas have been illegally encroached upon. Previous lakes have thus been transformed into residential and commercial areas, universities, bus stands, stadium or golf course. Some lakes are now used as rubbish dump for domestic and industrial wastes or open sewage. Fourteen percent of them are surrounded by slums.

The rapid growth of human population, proliferation of buildings ,roads and vehicular traffic congestion has taken a heavy toll on Bangalore's lakes. Further encroachment, illegal waste disposal activities and bad management have threatened the very existence of many of the valuable and productive lakes in the city.

II. STUDY AREA

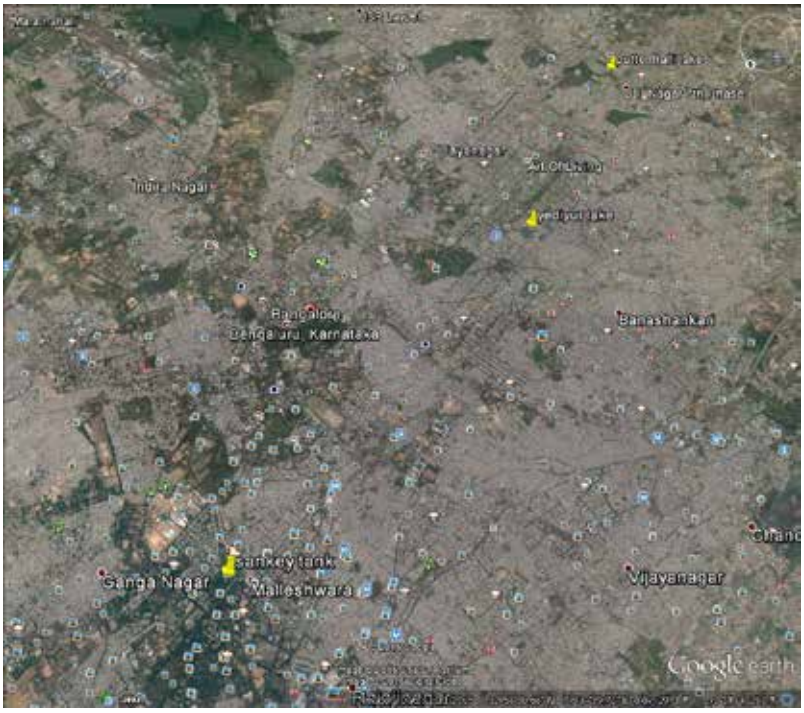


Fig1: Map Of Bangalore Showing The Three Lakes Under Study

PuttenahalliLake is located in South Bangalore having the co-ordinates 12°53'N and 77°35'E. The total area of the lake is 13 acres 25 guntas.The total lake periphery of the lake is 1000m. The catchment area of the lake is 0.23sq.km. The primary inflow into the lake include runoff from urbanised parts mixed with little domestic sewage. The maximum depth of water in the lake was found to be 6.2m.

YediyurLake has co-ordinates 12° 53'N and 77° 34'E. The total area of the lake is 15 acres 23 guntas. The primary inflow into the lake include storm water and runoff from urbanised parts mixed with domestic sewage. The maximum depth of water in the lake was found to be 7.8m.

Sankey Lake is located innorthern Bangalore having coordinates 13°01'N and 77°57'E . The lake type is fresh water. The total catchment area of the lake is 1.254km and surface area is 15 hectres. The primary inflow into the lake is from the rainfall and city drainage. The maximum depth of water in the lake is 9.26m, shore length is 1.7km and paved walkway 1.42km. The volume of the waterbodyis estimated to be 1015680MLD at maximum depth.

III. ANALYSIS

With regard to pH, 57% of the samples in PuttenahalliLake were in the range of 6 to 6.5 and 43% of the samples had pH ranging from 6.5 to 7.86. 42 % of the samples had a pH less than the permissible limits and 58% of the samples were within the permissible limits.

With regard to pH,77% of the samples in YediyurLake were in the range of 7.4 to 7.8 and 23% of the samples were in the range of 7.9 to 8.36. All the samples had pH within the permissible limits.

With regard to pH,71% of samples in SankeyTank were in the range of 7.8-8 and 29% of the samples were in the range of 8.1 to 8.23.All the samples had pH within the permissible limits

With regard to Turbidity, 42% of the samples in PuttenahalliLake were in the range of 5 to 7 NTU and 58% of the samples had turbidity ranging from 8 to 11NTU. 11% of the samples had Turbidity equal to the permissible limit and 89% of the samples had turbidity greater than the permissible limits.

With regard to Turbidity, 55% of the samples in YediyurLake were in the range of 16 to 20 NTU and 45% of the samples had turbidity ranging from 21 to 27 NTU. The turbidity of all the samples was above the permissible limits.

With regard to Turbidity, 57% of the samples in SankeyTank were in the range of 28 to 32 NTU and 43% of the samples had turbidity ranging from 33 to 38 NTU. The turbidity of all the samples was above the permissible limits.

With regard to Alkalinity, 71% of the samples in PuttenahalliLake were in the range of 600 to 640 mg/l and29% of the samples had alkalinity ranging from 641 to772 mg/l. The alkalinity of all the samples was above the permissible limits.

With regard to Alkalinity, 44% of the samples in YediyurLake were in the range of 320 to 350 mg/l and 46% of the samples had alkalinity ranging from 351 to 400 mg/l. The alkalinity of all the samples was above the permissible limits.

With regard to Alkalinity, 57% of the samples in SankeyTank were in the range of 400 to 425 mg/l and 43% of the samples had alkalinity ranging from 430 to 452 mg/l The alkalinity of all the samples was above the permissible limits.

With regard to total hardness, 86% of the samples in PuttenahalliLake were in the range of 180 to 200 mg/l and14% of the samples had total hardness ranging from 201 to 272 mg/l. The total hardness of all the samples were within the permissible limits.

With regard to total hardness,44% of the samples in YediyurLake were in the range of 90 to 110 mg/l and 56% of the samples had total hardness ranging from 120 to 132 mg/l. The total hardness of all the samples was found to be within the permissible limits.

With regard to total hardness,57% of the samples in SankeyTank were in the range of 90 to 110 mg/l and 43% of the samples had total hardness ranging from 120 to 164 mg/l. The total hardness of all the samples was found to be within the permissible limits.

With regard to calcium hardness, 71% of the samples in PuttenahalliLake were in the range of 150 to 160 mg/l and 29% of the samples had total hardness ranging from 175 to 196 mg/l. The total hardness of all the samples was above the permissible limits.

With regard to calcium hardness, 45% of the samples in YediyurLake were in the range of 65 to 75 mg/l and 55% of the samples had total hardness ranging from 80 to 90mg/l.45% of the samples have calcium hardness within the permissible limits and 55% of the samples have calcium hardness above the permissible limits.

With regard to calcium hardness, 71% of the samples in SankeyTank were in the range of 85 to and 100 mg/l and 29% of the samples had total hardness ranging from 101 to 104 mg/l. The calcium hardness of all the samples was above the permissible limits.

With regard to chlorides, 85% of the samples in PuttenahalliLake were in the range of 100 to120 mg/l and 15% of the samples had chlorides ranging from 120 to 130 mg/l. The chloride content of all the samples was found to be within permissible limits.

With regard to chlorides, 33% of the samples inYediyurLake were in the range of 65 to 75 mg/l and 67% of the samples had chlorides ranging from 84 to 92 mg/l. The chloride content of all the samples was found to be within permissible limits.

With regard to chlorides, 28% of the samples inSankeyTank were in the range of 55 to 60 mg/l and 72% of the samples had chlorides ranging from 61 to 69.88 mg/l. The chloride content of all the samples was found to be within permissible limits.

With regard to DO, 57% of the samples in PuttenahalliLake were in the range of 3.9 to 5 mg/l and 43% of the samples had DO ranging from 5.8 to 6.3 mg/l. 14% of the samples have DO less than the permissible limit, 14% of the samples have DO equal to the permissible limits and 72% of the samples had DO greater than the permissible limits.

With regard to DO,55% of the samples inYediyurLake were in the range of 6.5 to 7 mg/l and 45% of the samples had DO ranging from 7.1 to 7.4 mg/l. The DO content of all the samples was found to be above the permissible limits.

With regard to DO,71% of the samples in SankeyTank were in the range of 6.5 to 7 mg/l and 29% of the samples had DO ranging from 7.1 to 7.3 mg/l. The DO content of all the samples was found to be above the permissible limits.

With regard to nitrates, 43% of the samples in PuttenahalliLake were in the range of 10 to 14 mg/l and 57% of the samples had nitrates ranging from 14.1 to 19.4 mg/l. The nitrate content of all the samples was found to be within permissible limits.

With regard to nitrates, 44% of the samples in YediyurLake were in the range of 5 to 8 mg/l and 56% of the samples had nitrates ranging from 8.1 to 10.4mg/l. The nitrate content of all the samples was found to be within permissible limits.

With regard to nitrates, 71% of the samples in SankeyTank were in the range of 8.5 to 8.9 mg/l and 29% of the samples had nitrates ranging from 9 to 9.96mg/l. The nitrate content of all the samples was found to be within permissible limits.

With regard to sulphates, 71% of the samples in PuttenahalliLake were in the range of 185 to 200 mg/l and 29% of the samples had nitrates ranging from 201 to 215.05 mg/l. The sulphate content of 71% of the samples was found to be within permissible limits and 29% samples had sulphate content greater than the permissible limits.

With regard to sulphates, 44% of the samples in YediyurLake were in the range of 180 to 200 mg/l and 56% of the samples had nitrates ranging from 210 to 236.05 mg/l. The sulphate content of 44% of the samples was found to be within permissible limits and 56% samples had sulphate content greater than the permissible limits.

With regard to sulphates, 43% of the samples in SankeyTank were in the range of 176 to 190 mg/l and 57% of the samples had sulphates ranging from 210 to 275 mg/l. The sulphate content of 43% of the samples was found to be within permissible limits and 57% samples had sulphate content greater than the permissible limits.

With regard to iron, 85% of the samples in PuttenahalliLake were in the range of 0.1 to 0.15 mg/l and 15% of the samples had chlorides ranging from 0.16 to 0.18 mg/l. The iron content of all the samples was found to be within permissible limits.

With regard to iron, 66% of the samples in YediyurLake were in the range of 0.1 to 0.13 mg/l and 34% of the samples had chlorides ranging from 0.14 to 0.16 mg/l. The iron content of all the samples was found to be within permissible limits.

With regard to iron, 43% of the samples in SankeyTank were in the range of 0.11 to 0.15 mg/l and 57% of the samples had chlorides ranging from 0.16 to 0.21 mg/l. The iron content of all the samples was found to be within permissible limits.

With regard to copper, 85% of the samples in PuttenahalliLake were in the range of 0.02 to 0.05 mg/l and 15% of the samples had chlorides ranging from 0.05 to 0.06 mg/l. The copper content of 85% of the samples was found to be within permissible limits and 15% samples had sulphate content greater than the permissible limits.

With regard to copper, 89% of the samples in YediyurLake were in the range of 0.01 to 0.05 mg/l and 15% of the samples had chlorides ranging from 0.05 to 0.07 mg/l. The copper content of 88% of the samples was found to be within permissible limits and 12% samples had sulphate content greater than the permissible limits.

With regard to copper, 57% of the samples in SankeyTank were in the range of 0.03 to 0.04 mg/l and 43% of the samples had chlorides ranging from 0.04 to 0.05 mg/l. The copper content of all the samples was found to be within permissible limits.

With regard to nickel,71% of the samples in PuttenahalliLake were in the range of 0.02 to 0.03 mg/l and 29% of the samples had nickel ranging from 0.03 to 0.04 mg/l. The nickel content of 14% of the samples was found to be within the permissible limits and 86% of samples had nickel content greater than the permissible limits.

With regard to nickel, 78% of the samples in YediyurLake were in the range of 0.04 to 0.05 mg/l and 22% of the samples had nickel ranging from 0.05 to 0.06 mg/l. The nickel content of all the samples was found to be above the permissible limits.

With regard to nickel,43% of the samples in SankeyTank were in the range of 0.01 to 0.02 mg/l and 57% of the samples had nickel ranging from 0.03 to 0.04 mg/l. The nickel content of 43% of the samples was found to be within the permissible limits and 57% of the samples had nickel content above the permissible limits.

With regard to chromium, 86% of the samples in PuttenahalliLake were in the range of 0.02 to 0.04 mg/l and 14% of the samples had chromium ranging from 0.0 4to 0.05 mg/l. The chromium content of all the samples was found to be within the permissible limits.

With regard to chromium, 89% of the samples in YediyurLake were in the range of 0.03 to 0.04 mg/l and 11% of the samples had chromium ranging from 0.04to 0.05 mg/l. The chromium content of all the samples was found to be within the permissible limits.

With regard to chromium, 29% of the samples in SankeyTank were in the range of 0.03 to 0.04 mg/l and 11% of the samples had chromium ranging from 0.05 to 0.06 mg/l. The chromium content of 86% of the samples were found to be within the permissible limits and 14% of the samples had chromium content above the permissible limits.

With regard to MPN,43% of the samples in PuttenahalliLake were in the range of 10 to12 per 100 ml and the remaining 57% of the samples had MPN ranging from 14 to 18 per 100 ml. The MPN of 14% of the samples were found to be within the permissible limits and the remaining 86% of the samples had MPN above the permissible limits.

IV. DISCUSSION

With regard to MPN,33% of the samples in YediyurLake were in the range of 9 to12 per 100 ml and the remaining 67% of the samples had MPN ranging from 13 to 15 per 100 ml. The MPN of 22% of the samples were found to be within the permissible limits and the remaining 78% of the samples had MPN above the permissible limits.

With regard to MPN,57% of the samples in SankeyTank were in the range of 9 to14 per 100 ml and the remaining 43% of the samples had MPN ranging from 14 to 17 per 100 ml. The MPN of 14% of the samples were found to be within the permissible limits and the remaining 86% of the samples had MPN above the permissible limits.

According to LakmanRau report (1981), PuttenahalliLake has a water spread of 13 acres,Government records (1994) show the actual water spread as 11.76 acres and from satellite images (1997) we see that 9.5% of the water spread has been encroached.

According to LakmanRau report (1981) , YediyurLake has a water spread of 6 acres,Government records (1994) show the actual water spread as 5.8 acres and from satellite images (1997) we see that 3.2% of the water spread has been encroached.

According to LakmanRau report (1981) , SankeyTank has a water spread of 15 acres,Government records (1994) show the actual water spread as13.77 acres and from satellite images (1997) we see that 8.2% of the water spread has been encroached.

The existing bird life in PuttenahalliLake include Painted Storks, Asian Openbill Storks, Purple Herons, Black-crowned Night Herons, Pond Herons, Darters, Cattle Egret, Little Egret, Eurasian Spoonbills, Little Grebe, Spot billed Pelican, Spot-billed Ducks, Little Cormorant, Common Sandpiper, Purple Moorhen.

Over the last few years , a lot of bird species have disappeared from PuttenahlliLake .These birds include - Common Coot, Pintail Snipe Common Snipe Wood Sandpiper Greater Painted Snipe Pheasant-tailed Jacana . Bronze-winged Jacana . Little Grebe .

The existing bird life in YediyurLake includeSpot billed Pelican, Spot-billed Ducks, Little Cormorant, Common Sandpiper, Purple Moorhen.

The bird species which have disappeared from YediyurLake over the years include Common Coot . Pintail Snipe Common Snipe ,Wood Sandpiper Greater Painted Snipe , Pheasant-tailed Jacana Bronze-winged Jacana , Little Grebe.

The existing bird life in SankeyTank includeNight Herons, Pond Herons, Darters, Cattle Egret, Little Egret, Eurasian Spoonbills, Little Grebe.

The bird species which have disappeared from SankeyTank over the years include White-throated Kingfisher . White-breasted Waterhen Brown Crake Baillon's Crake Ruddy-breasted Crake Slaty-breasted Rail.

The aquatic life in PuttenahalliLake include White-throated Kingfisher . White-breasted Waterhen Brown Crake Baillon's Crake Ruddy-breasted Crake Slaty-breasted Rail.

The aquatic life which has disappeared from PuttenahlliLake include Murrels (Channamarulius), Catfishes (Heteropneustesfossilis), small palaemonid prawns.

The aquatic life in YediyurLake includeCommon carp, Grass carp, Katla, Rohu.

The aquatic life which has disappeared fromYediyurLake include Govankar,Rahu,MurgalKamankar/Labeorohita.

The aquatic life in SankeyTank include Etroplussuratensis, Murrels (Channamarulius), Catfishes (Heteropneustesfossilis), small palaemonid prawns.

The disappeared aquatic life in Sankey Tank includeEutroplussuratensis, Chandaranga, Puntius sp., Nandusnandus and Amblypharyngodonmola.

The sediment analysis of Puttenahalli Lake showedthat pH was 6.90, normal conductivity was 0.09 milli mhos/cm, low available phosphorus (2.068 kg/acre) , low available potassium (19.5 kg/acre), lead quantity was 0.67 ppm, soil lead content was 0.58 ppm and cadmium was 0.08 ppm.

The sediment analysis of Yediyur Lake showed that pH was 7.90,normal conductivity was 0.04 milli mhos/cm, low available phosphorus (1.068 kg/acre), low available potassium (17.5 kg/acre), lead quantity was 0.47 ppm, soil lead content was 0.63 ppm and cadmium content was 0.03 ppm.

The sediment analysis of Sankey Tank showed that pH was 5.90, normal conductivity was 0.07 milli mhos/cm, low available phosphorus (3.068 kg/acre), low available potassium (17.5 kg/acre), lead quantity was 0.47 ppm, soil lead content was 0.55 ppm and cadmium content was 0.05 ppm.

The limnological study of Puttenahalli Lake showed that water temperature was 28°C, water transparency was 29 cm, free carbon di-oxide (FCO2) generally absent, water ph was 6.683 (avg: average) and 0.500 (Sd: standard deviation), water conductivity was 0.597 (avg) and 0.09 (Sd) milli mhos/cm. dissolved oxygen (DO) 1.6 mg/land an average of 2.025 (Sd:0.076) mg/lit during the period of fish-kill, nitrite and nitrate revealed 0.329 (avg) and 0.044 (Sd) and 1.074 (avg) and 0.387 (Sd) mg/lit; Phosphorous was 5.155 (avg) and 3.825 (Sd) mg/lit.

The limnological study of Yediyur Lakeshowed that water temperature was 28°C, water transparency was 27 cm, free carbon di-oxide (FCO2) generally absent, water ph was 6.533 (avg: average) and 0.600 (Sd: standard deviation), water conductivity 0.497 (avg) and 0..06 (Sd) milli mhos/cm. dissolved oxygen (DO)2.1mg/land an average of 2.056 (Sd:0.086) mg/lit during the period of fish-kill, nitrite and nitrate revealed 0.429 (avg) and 0.064 (Sd) and 1.056 (avg) and 0.265 (Sd) mg/lit; Phosphorous was 4.355 (avg) and 4.625 (Sd) mg/lit.

The limnological study of Sankey Tank showed that water temperature was 28°C, water transparency was 31 cm, free carbon di-oxide (FCO2) generally absent, water ph was 7.683 (avg: average) and 0.570 (Sd: standard deviation), water conductivity was 0.397 (avg) and 0.07 (Sd) milli mhos/cm ,dissolved oxygen (DO) was 2.6 mg/land an average of 3.025 (Sd:0.076) mg/lit during the period of fish-kill, nitrite and nitrate revealed was 0.229 (avg) and 0.054 (Sd) and 1.374 (avg) and 0.477 (Sd) mg/lit; Phosphorous was 7.055 (avg) and 2.925 (Sd) mg/lit.

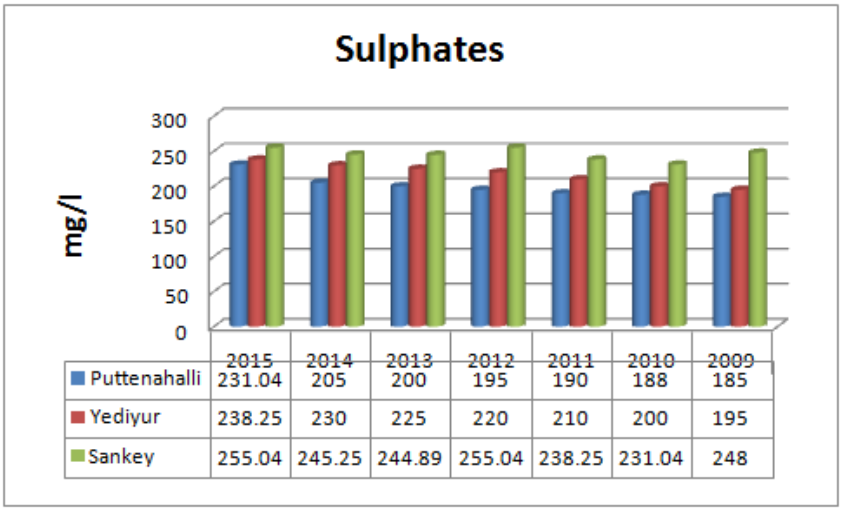
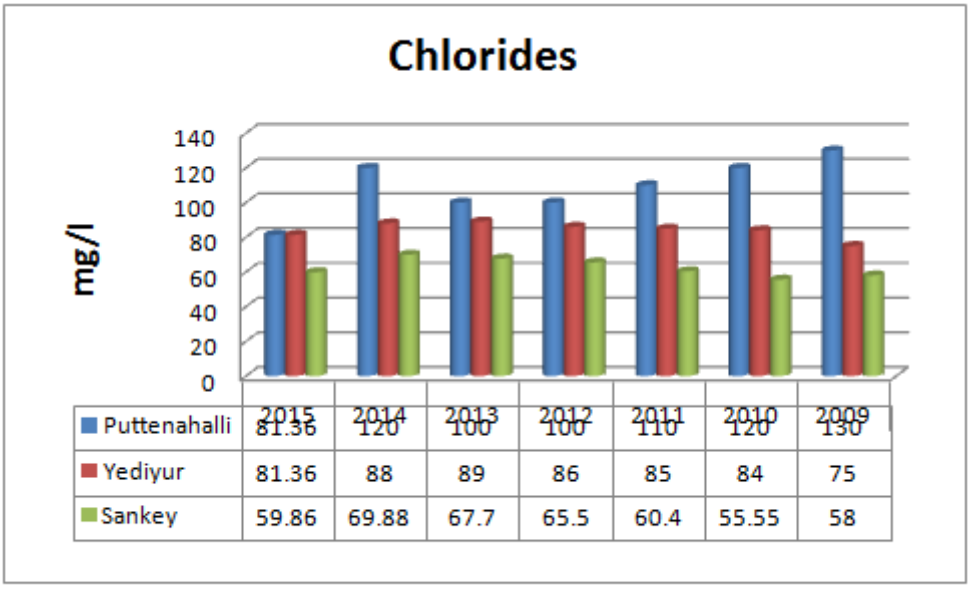
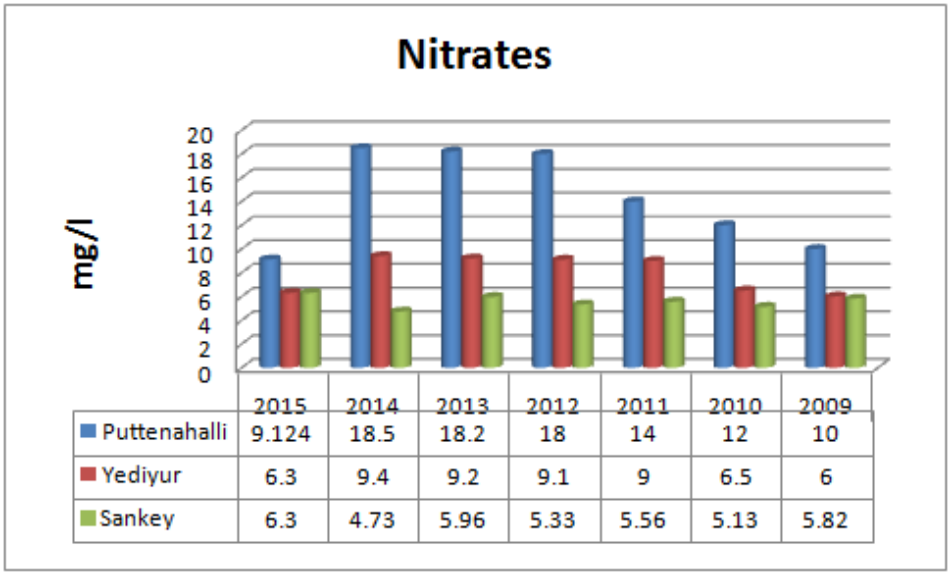


Fig2: The Graph Shows the Variation of Sulphates in All 3 Lakes



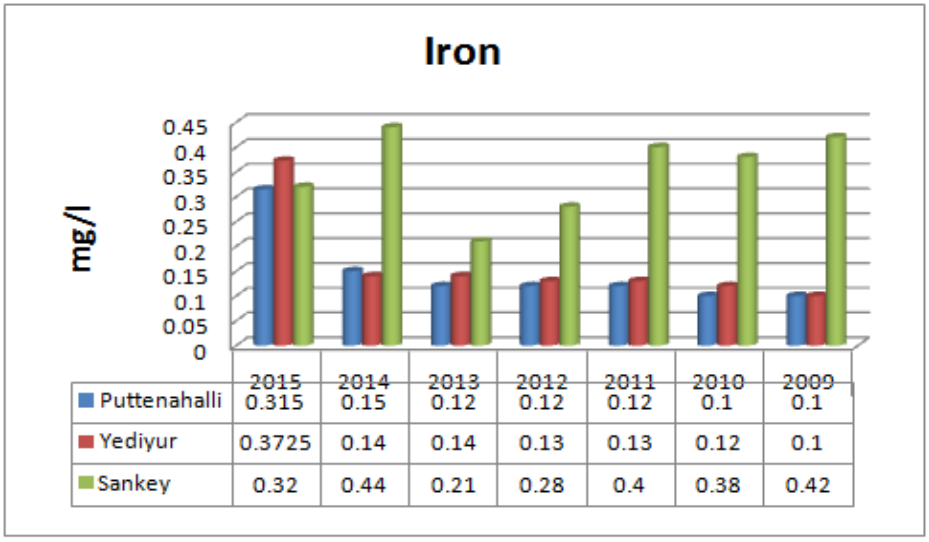
	2015	2014	2013	2012	2011	2010	2009
Puttenahalli	81.36	120	100	100	110	120	130
Yediyur	81.36	88	89	86	85	84	75
Sankey	59.86	69.88	67.7	65.5	60.4	55.55	58

Fig3: The Graph Shows the Variation of Chlorides in All 3 Lakes



	2015	2014	2013	2012	2011	2010	2009
Puttenahalli	9.124	18.5	18.2	18	14	12	10
Yediyur	6.3	9.4	9.2	9.1	9	6.5	6
Sankey	6.3	4.73	5.96	5.33	5.56	5.13	5.82

Fig4: The Graph Shows the Variation of Nitrates in All 3 Lakes



	2015	2014	2013	2012	2011	2010	2009
Puttenahalli	0.315	0.15	0.12	0.12	0.12	0.1	0.1
Yediyur	0.3725	0.14	0.14	0.13	0.13	0.12	0.1
Sankey	0.32	0.44	0.21	0.28	0.4	0.38	0.42

Fig5: The Graph Shows the Variation of Iron in All 3 Lakes

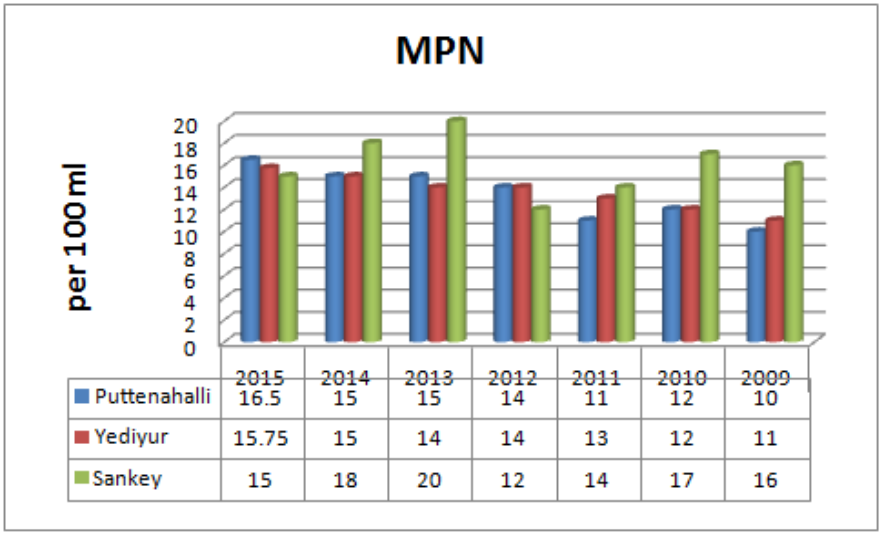


Fig6: The Graph Shows the Variation of MPN in All 3 Lakes

V. CONCLUSIONS

All the three lakes have detoriated in water quality and limnological parameters. All the lakes have suffered disappearance of bird species and extinction of aquatic life. Lake preservation has to be integral to layout development by the concerned authorities. Lake areas should not be diverted for any other purpose. Lake areas to be surveyed and encroachments to be removed. Core operations like survey, fencing, watch and ward, clearing of blocked and encroached main drains and lateral drains. Desilting of lakes to the extent absolutely required to be taken. Desilting should also be minimized to remove only sludge portion with minimum depth near fore shore area reaching maximum at the bund. The entry of untreated sewage into the lakes should be restricted. The present norm of 30m buffer surrounding the legal boundary of lakes is a must to preserve lakes. The effective lake area should not be reduced by converting lake areas intoparks, children's playground, etc.Lake restoration is to be taken up based on lake series/ subseries and not in isolation to have betterresults and impacts. Lakes may bepreserved with minimum disturbance in the area and may be notified under Wetland (Conservation and Management) Rules 2010.Selected lakes to be developed for augmenting water supply to the city.Lake Management Committees should be constituted.

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ACCESS CONTROL AND SECURE DATA RETRIEVAL BASED ON CIPHERTEXT POLICY ATTRIBUTE-BASED ENCRYPTION IN DECENTRALIZED DTNS

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ABSTRACT

Mobile Nodes in some challenging network scenarios such as disaster recovery areas, military battlefields, hostile region or urban sensing applications suffer from intermittent connectivity and frequent partitions. Disruption Tolerant Network (DTN) Technologies are becoming challenging and successful solution for End To End communication between wireless devices. This allow nodes to communicate with each other in extreme terrestrial networking environments, or planned networks in space .In this Scenario Data to be stored and retrieved from the storage nodes ,since the data is sensitive data one needs to consider the security policies. The attribute-based encryption (ABE) is a promising approach that full fills the requirements for secure data retrieval in DTN .the existing system involves some challenging issues like fine grain access control to contents stored in storage nodes within a DTN. In this paper, we propose an access control scheme which is based on the Ciphertext Policy Attributed-Based Encryption (CP-ABE) approach which provides a scalable way of encrypting data such that the encrypter defines the attribute set that the decrypted needs to process for decrypting the cipher text. Since the problem of applying CP-ABE in decentralized structure of DTN results inseveral security and privacy challenges with regards to the attribute revocation of all nodes, key escrow and coordination of attributes issued from various authorities. So, data retrieval scheme must be secured for using CP-ABE for decentralized DTNs where multiple key authorities manage their attributes independently, in addition to that geographical routing is also used for finding the location of the nodes to reduce complexity , communication cost and to increase security. Wealso provide some performance results from our implementation.

Index Terms: Disruption Tolerant Networking (DTN), Node Location, Access Control, Attribute Based Encryption (ABE) Secure Data Retrieval.

I. INTRODUCTION

Now days many computing devices e.g. PDAs, smart-phones, sensors have wireless interfaces and hence can form ad hoc networks. Wireless adhoc networks allow nodes to communicate with one another without relying on any fixed infrastructure. These rapidly deployable networks are very useful in several scenarios e.g. [1] military network environments, connections of wireless devices carried by soldiers may be temporarily disconnected by environmental factors, jamming and mobility, especially when they operate in terrestrial environments. Disruption- tolerant network (DTN) technologies are becoming successful solutions that allow nodes to communicatewith each other in these extreme terrestrial environments [2]-[4]. Typically, when there is no end-to-end connection between asource and a destination pair, the messages from the source node may need

to wait in the intermediate nodes for a substantial amount of time until the connection would be eventually established.For storage and replicate the data storage node is introduced [5][6]where authorized mobile nodes can access the necessary information quickly. Many military applications require increased protection of confidential data including access control methods that are cryptographically enforced [7], [8]. In many cases, it is desirable to provide differentiated access services such that data access policies are defined over user attributes or roles, which are managed by the key authorities. Multiple key authorities manage their attribute independently in DTN [9], [10]. The concept of attribute-based encryption (ABE) [11]–[14] is a promising approach that fulfils the requirements for secure data retrieval in DTNs. ABE features a mechanism that enables an access control over encrypted data using access policies and ascribed attributes among private keys and ciphertexts. Especially, ciphertext-policy ABE (CP-ABE) provides a scalable way of encrypting data such that the encryptor defines the attribute set that the decryptor needs to possess in order to decrypt the ciphertext [13]. Thus, different users are allowed to decrypt different pieces of data per the security policy. However, the problem of applying the ABE to DTNs introduces several security and privacy challenges. Since some users may change their associated attributes at some point (for example, moving their region), or some private keys might be compromised, key revocation (or update) for each attribute is necessary in order to make systems secure. However, this issue is even more difficult, especially in ABE systems, since each attributes conceivably shared by multiple users (henceforth, we refer to such a collection of users as an attribute group). This implies that revocation of any attribute or any single user in an attribute group would affect the other users in the group. For example, if a user joins or leaves an attribute group, the associatedattribute key should be changed and redistributed to all the other members in the same group for backward or forward secrecy. It may result in bottleneck during rekeying procedure or security degradation due to the windows of vulnerability if the previous attribute key is not updated immediately.

One more challenging issue is Key escrow problems ,CP-ABE, authority's master secret key is used to generates private keys of users associated set of attributes. So, the key authority can decrypt every cipher text addressed to specific users by generating their attribute keys. If the key authority is compromised by adversaries when deployed in the hostile environments, this could be a potential threat to the data confidentiality or privacy especially when the data is highly sensitive. The key escrow is an inherent problem even in the multiple-authority systems as long as each key authority has the whole privilege to generate their own attribute keys with their own master secrets. Since such a key generation mechanism based on the single master secret is the basic method for most of the asymmetric encryption systems such as the attribute- based or identity-based encryption protocols removing escrow in single or multiple-authority CP-ABE is a pivotal problem. The last challenge is the coordination of attributes issued from different authorities. When multiple authorities manage and issue attribute keys to users independently with their own master secrets, it is very hard to define fine-grained access policies over attributes issued from different authorities. For example, suppose that attributes “role 1” and “region 1” are managed by the authority A, and “role 2” and “region 2” are managed by the authority B. Then, it is impossible to generate an access policy ((“role 1” OR “role 2”) AND (“region 1” or “region 2”)) in the previous schemes because the OR logic between attributes issued from different authorities cannot be implemented. This is due to the fact that the different authorities generate their own attribute keys using their own independent and individual master secret keys. Therefore, general access policies, such as “ -out-of- ” logic, cannot be expressed in the previous schemes, which is a very practical and commonly required access policy logic.

Objectives: 1.Immediate attribute revocation enhances backward/forward secrecy of confidential data by reducing the windows of vulnerability.

2.Encryptor's can define a fine-grained access policy using any monotone access structure under attributes issued from any chosen set of authorities.

3. The key escrow problem is resolved by an escrow-free key issuing protocol that exploits the characteristic of the decentralized DTN architecture.

4. Location tracking to reduce communication cost.

A. Related Work

ABE comes in two flavors called key-policy ABE (KP-ABE)andciphertext-policy ABE (CP-ABE). In KP-ABE, the encryptor only gets to label a ciphertext with a set of attributes. The key authority chooses a policy for each user that determines which ciphertexts he can decrypt and issues the key to each user by embedding the policy into the user's key. However the roles of the ciphertexts and keys are reversed in CP-ABE. In CP-ABE, the ciphertext is encrypted with an access policy chosen by an encryptor, but a key is simply created with respect to an attributes set. CP-ABE is more appropriate to DTNs than KP-ABE because it enables encryptorssuch as a commander to choose an access policy on attributes and to encrypt confidential data under the access structure via encrypting with the corresponding public keys or attributes [4], [7], [15] location of node tracked to reduce overhead [18].

II. OVERVIEW OF THE SYSTEM

The proposed system to develop the CP-ABE is a promising cryptographic solution to the access control issues shown in Figure 1.

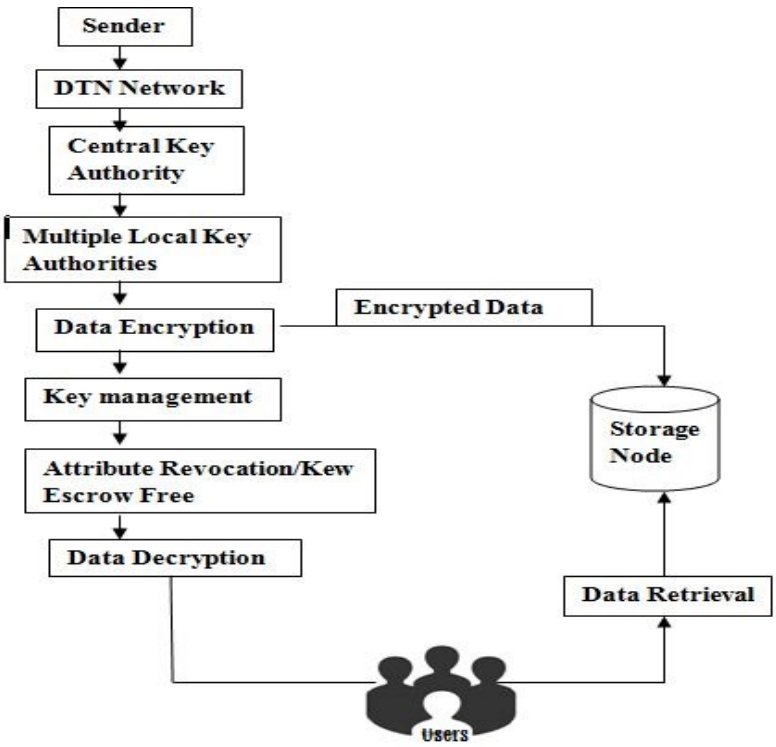

Fig. 1: System Architecture

System Description and Assumptions

Fig. 1 shows the architecture of the DTN. The architecture consists of the following system entities.

1) Key Authorities: They are key generation centres that generate public/secret parameters for CP-ABE. The key authorities consist of a central authority and multiple local authorities. We assume that there are secure and reliable communication channels between a central authority andeach local authority during the initial key setup and generation phase. Each local authority manages different attributes and issues corresponding attribute keys to users.They grant differential access rights to individual users based on the users' attributes. The key authorities are assumed to be honest-but-curious. That is, they will honestly execute the assigned tasks in the system; however they would like to learn information of encrypted contents as much as possible. 2) Storage node: This is an entity that stores data from senders and provide corresponding access to users. It may be mobile or static [4], [5]. Similar to the previous schemes, we also assume the storage node to be semi trusted, that is honest-but-curious.

3) Sender: This is an entity who owns confidential messagesOr data (e.g., a commander) and wishes to store them into the external data storage node for ease of sharing or for reliable delivery to users in the extreme networking environments. A sender is responsible for defining (attribute based) access policy and enforcing it on its own data by encrypting the data under the policy before storing it to the storage node.

4) User: This is a mobile node who wants to access the data stored at the storage node (e.g., a soldier). If a user possesses a set of attributes satisfying the access policy of the encrypted data defined by the sender, and is not revoked in any of the attributes, then he will be able to decrypt theciphertext and obtain the data.

5) Attribute Revocation: Revocation of users in cryptosystems is a well studied but nontrivial problem. Revocation is even more challenging in attribute-based systems, given that each attribute possibly belongs to multiple different users, whereas in traditional PKI systems public/private key pairs are uniquely associated with a single user. In principle, in an ABE system, attributes, not users or keys, are revoked. Backward and forward Secrecy: In the context of ABE, backward secrecy means that any user who comes to hold an attribute (that satisfies the access policy) should be prevented from accessing the plaintext of the previous data exchanged before he holds the attribute. On the other hand, forward secrecy means that any user who drops an attribute should be prevented from accessing the plaintext of the subsequent data exchanged after he drops the attribute, unless the other valid attributes that he is holding satisfy the access policy.

Since the key authorities are semi-trusted, they should be deterred from accessing plaintext of the data in the storage node; meanwhile, they should be still able to issue secret keys to users. In order to realize this somewhat contradictory requirement, the central authority and the local authorities engage in the arithmetic 2PC protocol with master secret keys of their own and issue independent key components to users during the key issuing phase. The 2PC protocol prevents them from knowing each other's master secrets so that none of them can generate the whole set of secret keys of users individually. Thus, we take an assumption that the central authority does not collude with the local authorities (otherwise, they can guess the secret keys of every user by sharing their master secrets).

6) Location Tracking: A simple scheme is presented for geographic forwarding that is similar to Cartesian routing. Each node determines its own geographic position using a mechanism such as GPS; positions consist of latitude and longitude. A node announces its presence, position, and velocity to its neighbours (other nodes within radio range) by broadcasting periodic HELLO packets. Each node maintains a table of its current neighbours‟ identities and geographic positions. The header of a packet destined for a particular node contains the destination's identity as well as its geographic position. When node needs to forward a packet toward location P, the node consults its neighbour table and chooses the neighbour closest to P. It then forwards the

packet to that neighbour, which itself applies the same forwarding algorithm. The packet stops when it reaches the destination.

III. PROPOSED SCHEME

In this section, we provide a multiauthority CP-ABE scheme for secure data retrieval in decentralized DTNs. Each local authority issues partial personalized and attribute key components to a user by performing secure 2PC protocol with the central authority. Each attribute key of a user can be updated individually and immediately. Thus, the scalability and security can be enhanced in the proposed scheme

Scheme Construction

The concept of CP-ABE is

- Private key assigned to "attributes"
- Cipher text associated with "access policy"
- Can decrypt only when attributes satisfy policy.

Central key Authority:

1. Choose a random exponent β∈ R Z*p.

Let h=g β

2. Masters (secret key)/public key

PKCA=h MKCA=β.

Local Key Authority

1. Choose a random exponent αi∈ R Z*p.

2. Masters (secret key)/public key pair is

PKAi=e (g,g)αi,MK Ai=αi.

An efficient and secure data retrieval method using CP-ABE is used for decentralized DTNs where multiple key authorities manage their attributes independently. The inherent key escrow problem is resolved such that the confidentiality of the stored data is guaranteed even under the hostile environment where key authorities local and central might be compromised or not fully trusted.

Key Generation: (MK, L): The key generation algorithm runs by CA. It takes as input the Master key of CA and the set of attributes L for user, then generate the secret key SK

3.1 Algorithm for Key Generation

A trusted party chooses and publishes a (large) prime *p* and an integer *g*having large prime order in F*p

1. Select a large prime number p.

i. Choose a secret integer a.

ii. Compute A ≡ ga(mod p).

iii. Choose a secret integer b.

iv. Compute B ≡ gb(mod p).

2. Masters (secret key)

Compute the number Ba(mod p). Compute the number Ab(mod p).

The shared secret value is Ba ≡ (gb)a ≡ gab ≡ (ga)b ≡ Ab(mod p).

Data Encryption: Here when a sender wants to deliver its confidential data M, he defines the tree access structure T over the universe of attributes L, encrypts the data under to enforce attribute-based access control on the data, and stores it into the storage node. The encryption algorithm takes as input the message M, public

parameter PK and access structure A over the universe of attributes. Generate the output CT such that only those users who had valid set of attributes that satisfy the access policy can only able to decrypt. Assume that the CT implicitly contains access structure A.

Data Decryption: When a user receives the ciphertext from the storage node, the user decrypts the ciphertext with its secret key. The decrypt algorithm run by user takes input the public parameter, the ciphertext CT contains access structure A and the secret key SK contain of user attribute set S. If S satisfies the access tree then algorithm decrypt the CT and give M otherwise gives "ϕ".

Key Update (MK, SK, old value, new value): The key updating algorithm runs by CA. It takes as input the master key of CA, old SK and old attribute value old value, and then updates the secret key SK by updating (add/delete/update) old value with new value.

3.2 CP-ABE for Data Retrieval

We provide a multi authority CP-ABE scheme for secure data retrieval in decentralized DTNs. Each local authority Issues partial personalized and attribute key components to a user by performing secure 2PC protocol with the central authority. Data confidentiality on the stored the data against unauthorized users can be trivially guaranteed .Which shown in Fig.2

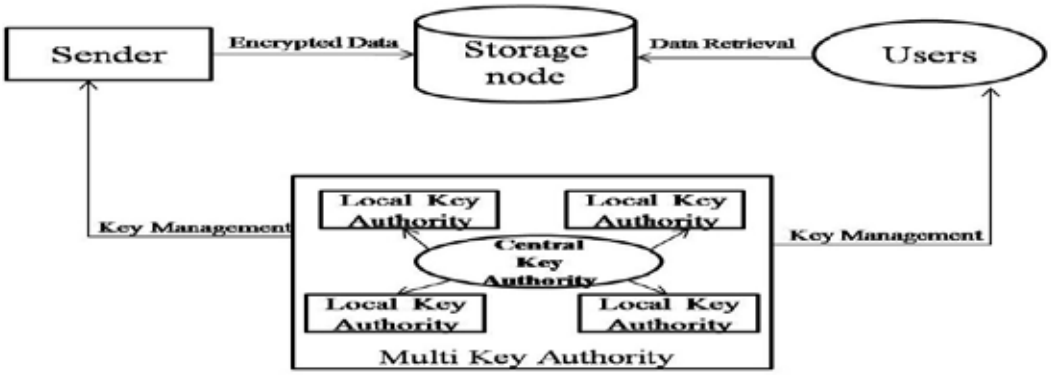

Fig. 2: Data Retrieval

3.3 Location Tracking

Apart from this location of nodes also detected and intimates the position to neighbour nodes. Each node determines its own geographic position using a mechanism such as GPS; positions consist of latitude and longitude. A node announces its presence, position, and velocity to its neighbours by broadcasting periodic HELLO packets. Each node maintains a table of its current neighbour's identities and geographic positions. The header of a packet destined for a particular node contains the destination's identity as well as its geographic position. When node needs to forward a packet toward location, the node consults its neighbour table and chooses the neighbour closest to it. It then forwards the packet to that neighbour, which itself applies the same forwarding algorithm. The packet stops when it reaches the destination.

IV. RESULTS

The proposed system Access control and Secure data retrieval based on CP-ABE implemented in NS2Simulator. Here we perform access control and secure data retrieval by CP-ABE as well as location of node also tracked by using geographical routing protocols .which helps to identify the position on nodes and to control the access of data .Table 1shows all evaluation factors calculated values like communication cost end to end delay, throughput and packet delivery ratio .and in Fig. 4 shows the plotted graph of them.

Table 1(Evaluation Values)

Simulation Time	Throughput(kbps)	Packet Delivery Ratio	End-to-End Delay (Average)	Communication Cost(bits)
30	277.79	0.9844	26.4883	0.662
40	414.18	0.9899	22.7422	0.461
50	496.58	0.9928	21.2545	0.379
60	550.82	0.9963	20.5043	0.335
70	589.42	0.9971	19.9536	0.307

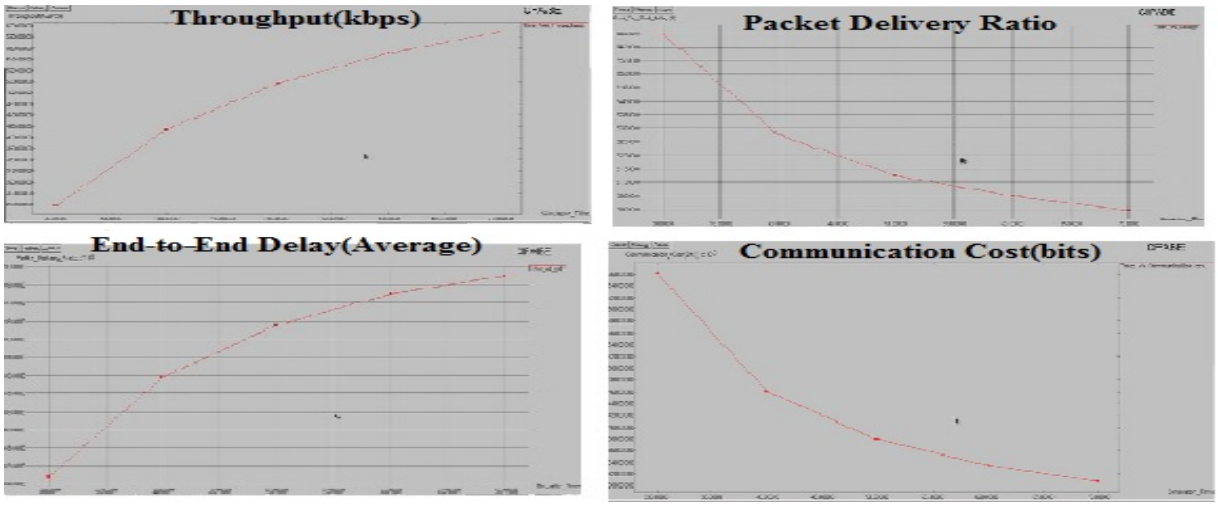

Fig. 4:Performance Graph

V. CONCLUSION

Disruption Tolerant Network (DTN) Technologies are becoming challenging and successful solution for End To End communication between wireless devices. Now DTN are becomes successful solution in hostile area like military applications that allows wireless devices .Confidential data can be access by using external storage nodes .CP-ABE is a successful cryptographic solution to access control and secure data retrieval in decentralized DTN networks where multiple key authorities manage their attributes independently. The inherent key escrow problem is resolved such that the confidentiality of the stored data is guaranteed even under the hostile environment where key authorities might be compromised or not fully trusted. In addition, the fine-grained key revocation can be done for each attribute group. In the proposed system location of node also identified using geographical routing protocol, which improve performance and reduce communication cost.

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AN ENHANCED MECHANISM FOR SECURE DATA TRANSMISSION USING STEGANOGRAPHY MERGED WITH VISUAL CRYPTOGRAPHY

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ABSTRACT

Now a days, people mostly use internet to send and receive data because it is accurate, easier and faster than all other data communication techniques. But the main lacuna of this technique for sharing of information is its security. Different techniques are evolved to overcome this problem. Steganography is one of the most effective technique among them for secure data communication. Steganography is the art and science of invisible communication of secrete data in an appropriate multimedia carrier like within image, audio or video files. This technique follows a simple principle i:e if the feature is not visible, the point of attack could not be identified. Visual cryptography is another very secure method which encrypts visual information in such a way that at the time of decryption, no computation or algorithm is needed. It just divides the image into different share with transparencies. By considering the advantages of both these techniques, we are proposing a new technique which is very simple in comparison to other techniques with better security. Simple is important because many people are getting familiar with this internet data sharing technique and in future this is going to increase in the rate of geometric progression. So to transmit secrete data using a simple technique will become a great issue in near future.

Keywords: Cover Image, Stego Image, Steganography

I. INTRODUCTION

Since many years, people tried to invent and develop innovative methods for secrete communication. Even if in the ancient age, people used to write secrete information on the shaved skull of a man and allow his hair to grow up. Than the person had been sent to the point of destination. At the destination, the secrete information was collected after shaving the hair from the skull of that person. Another method called Cardan Grille was used to transfer secrete information[1]. Here some holes are created in a paper and that is shared among the parties. Than by placing that paper over another paper, the secrete message was written through the holes and rest of the places of the paper are filled by different words. Now receiver get this secrete message by using that same mask on the received paper as shown in fig..[1].

The mass media named the year of 2011 as the "year of hack" because a huge number of data security breaches in private companies as well as in government sectors and the estimated amount of the volume of the stolen data is in petabytes i:e millions of gigabyte[2]. Unaware user are mostly responsible for this as they open specially crafted email message which creates a back door open for the victims computer. Another reason is to

connect a web site and download HTML or JPEG files which was encoded with command earlier time. So these type of files can easily passed through the firewalls.

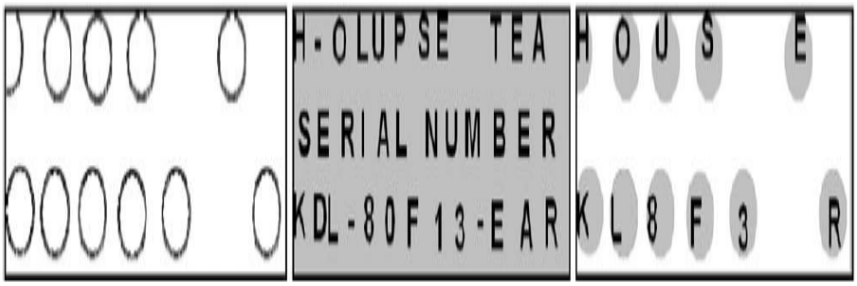

Fig-1: An illustration of Cardan Grille

So as per the requirement, the main aim is should be to hide the secrete information. Steganography is used to do the same i:e it kept existence of the message secrete. It hides the secrete information in the multimedia carrier like image, audio, video etc.

Image is one of the most useful and cost effective carrier for this. An image not only contain the information what the human can able to see in the naked eye, but also it can have different secrete messages or any different secrete image which can be retrieved by using the pixel value through a specific procedure.

Based on using of this multimedia carrier in steganography, a new technique Visual Cryptography was proposed which is comparatively very secure among all other steganographic techniques. Visual cryptography is a technique which allows visual information like image or text to be encrypted in such a way that the decryption can be performed by human without any decryption algorithm and computation. At first the secrete image is divided into shares having transparency. These shares will be sent to receiver. Receiver receives and just need to stacked or overlapped these share to get original image. This is very secure as a single share does not contain information and for a hacker, it is very difficult to get all the shares.

So keeping the advantages and simplicity of Visual Cryptography and considering the advantages and limitation of steganography, we proposed a technique by combining both Visual cryptography and steganography to provide a better security with less complexity in comparison to all other steganographic and visual cryptographic techniques.

II. RELATED WORK

Works have been done specifically on three different methods of steganography. First method is Spatial domain method. Second method is frequency domain method and third one is adaptive method. Spatial domain methods directly deals with the location of the pixel and generally works Least Significant Bit. Frequency domain method use DCT(Discreet Cosine Transform), FT(Fourier Transform) and DWT(Discreet Wavelet Transform) for merging of secrete message. Recently adaptive method is developed. This method can be applied in booth spatial domain and frequency domain.

Different techniques are proposed in this spatial domain method by different authors. Z.Eslami et.al proposed a technique in the year of 2010 for secrete image sharing based on cellular automata[3]. They also used digital signature and hash function with double authentication mechanism. This provides no distortion to original secrete image. At most two bits of the pixel can be changed which maintains its visual quality. He also proposed a new technique in the year of 2011 where the secrete bits are embedded in predetermined fixed size block of

each cover image.[4]. Here all the capacity of cover image is utilised and also it can be use for authentication purpose.

A new good technique is proposed by S.Premkumar et al. for secure banking application in the year of 2012 where the password of the costumer is encoded by using all eight adjacent neighbour pixel around the target pixel and then dividing this into shares using visual cryptographic technique. While transaction, the costumer has to produce their share. From this the costumer is authenticated[5]. Here, this technique provides costumer authentication with better imperceptibility and security.

Anastasia Loannidou et al. proposed a technique in the year of 2012 where the advantages of sharp area of the image is used to hide large amount of data[6]. It includes fuzzy edge detector. Change in smooth areas can easily noticeable in human eye but as it uses sharp areas, it increase imperceptibility.

D.Biswas et al. proposed a steganography technique in 2012 where dithering technique is used which is basically the process of creating an indexed image approximation in the RGB image and the array RGB by dithering the colours in colour map[7]. Here the retrieved image quality is almost same as the original image quality.

Saeed Sarreshtedari et al. proposed a technique of one third embedding in the year of 2013 which reduces the probability of changing the pixel value of each pixel for embedding of data to one third of it with out sacrificing the embedding capacity[8]. This technique offer the embedding capacity of exactly one bit per pixel with improved imperceptibility and higher robustness to the well known LSB detector. It preserves the histogram as much as possible.

V. Nagaraja et al. proposed a technique in the year of 2013 for data hiding by pixel value modification and modulus function in colour image[9]. Here one secrete digit is embedded only in one pixel which increase capacity of embedding. It also provides high visual quality and security in colour images.

Li Fan et al. proposed a technique in the year of 2013 which directly alters the pixel value in the image instead of flipping the binary bit in the LSB plane[10]. For this, adding and subtracting any value to or from the modular sum by changing at most one pixel which increase embedding efficiently to large extend. It provides good performance and better embedding rate.

Qian Mao proposed a technique based on spatial method using matrix embedding in the year of 2014[11].This techniques encodes the cover as well as secrete message with an error correction code and modifies the cover image according to the coding result. Here computational complexity is decreased, increase in efficiency and enhanced security.

On visual cryptography, Debasish Jena et.al.[12] proposed a good technique for security in the year of 2009. This technique divides the cover image into share and then each share will be embedded with secrete message. This is one of the technique which provides best security feature but it is little complex.
A number of different techniques are there on frequency domain and adaptive method. Frequency domain method is a method which give better security but difficult to implement. But spatial method is simple to

implement. But as we used only spatial domain for steganographic operation, we have not consider about those methods. Our proposed mechanism and architecture is described in Section 3, section 4 gives conclusion.

III. PROPOSED MECHANISM

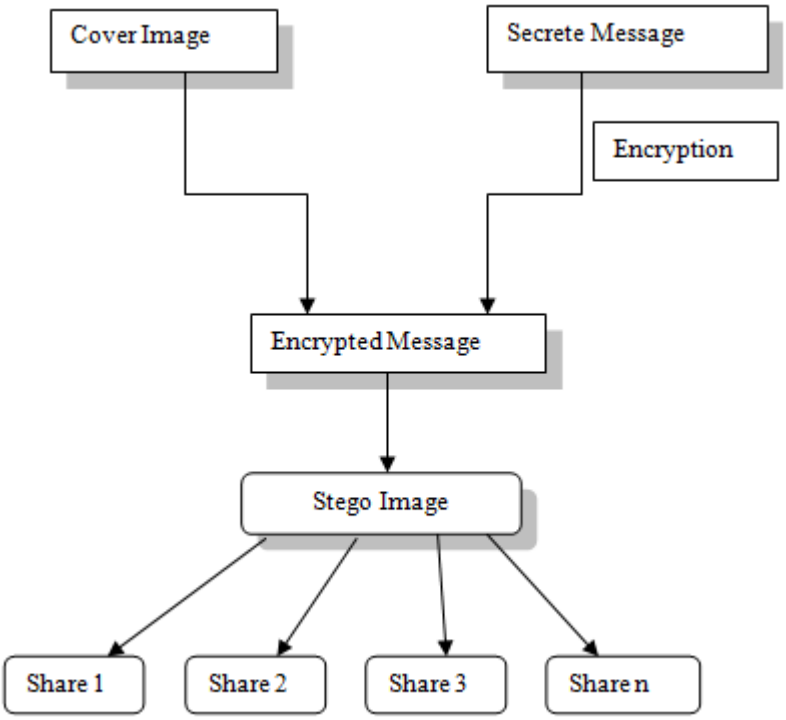

Fig-2: Architecture of the proposed Method

In this proposed method, both steganography as well as visual cryptography is used. At first we will take the secrete message and then encrypt the secrete message as described in the fig-2. For encryption, e will use simple monoalphabetic substitution cipher. Substitution includes all characters, special symbols as well as numbers. Most importantly substitution of alphabet occurs randomly as per the algorithm shared previously between the parties. An example of this type of substitution is given in the Table-1. Then we will take one cover image. Now the secrete encrypted message will be embedded with the cover image by using a simple embedding method(for example-LSB substitution methods). This will generate the stego image. Now we will add some noise to the stego image. This Adding of this noise will be optional and it depends upon the user. Then the stego image will be divided into n share having transparencies. These shares will be generated by using hamming weight concept and by using some particular constraint depending upon the intensity of the target pixel. ' n' will also be decided by the user of this method according to the level of security required for the secrete message. Here security of the secrete message and the number of shares are directly proportional to each other.

To explain mathematically, let 'm' is the secrete message, encrypted secrete message is denoted my €(m).

$m \rightarrow €(m)$ .....(1)

Now cover image is denoted by CI and stego image is denoted by $\dot{S}$ (m).

$\dot{S}(m) = €(m) + CI$ .....(2)

From this stego image $\dot{S}$ (m), shares of stego image $\Delta(\dot{S}(m))_i$ will be generated.

$\dot{S}(m) \rightarrow \Delta(\dot{S}(m))_i$ for i=1,2,3,.....,n .....(3)

m→€(m):

a→A	b→J	c→N	d→o	e→Y	f→s	g→Z	h→U	i→*
j→D	k→n	l→9	m→#	n→6	o→g	p→3	q→&	r→1
s→B	t→!	u→c	v→p	w→x	x→$	y→h	z→2	A→u
B→a	C→I	D→@	E→8	F→y	G→5	H→X	I→t	J→k
K→C	L→b	M→K	N→d	O→f	P→^	Q→4	R→j	S→W
T→E	U→H	V→L	W→e	X→7	Y→q	Z→%	1→T	2→v
3→G	4→m	5→0	6→O	7→z	8→r	9→i	0→V	! →w
@→F	#→l	$→M	%→P	^→R	&→Q	*→S		

Table-1: Example of A Randomly Chosen Monoalphabetic Substitution Cipher

Now at receiver side will do visual cryptographic decryption. As we know that visual cryptographic decryption does not need any type of decryption algorithm or computation. It uses human visual system for decryption. We will have different shares of stego image. Now we can get the stego image by overlapping of shares. From this derived stego image, we will get our secrete message.

Receiver side work are explained mathematically as follows. First step is to overlap the secrete message.

$\sum_{i=1}^{n} \Delta(\dot{S}(m)) \rightarrow \dot{S}(m)$.....(4)

From this stego image, encrypted message will be retrieved.

€(m)= Ṡ (m) – CI .....(5)

Then by applying decryption, receiver will get the original message.

€(x)→m.....(6)

IV. EXPERIMENTAL SETUP

We will use MATLAB to execute our proposed mechanism. MATLAB is being used as a platform for laboratory exercises and the problems classes in the Image Processing half of the Computer Graphics and Image Processing course unit. MATLAB is a data analysis and visualisation tool designed to make matrix manipulation as simple as possible. In addition, it has powerful graphics capabilities and its own programming language. The basic MATLAB distribution can be expanded by adding a range of toolboxes, the one relevant to this course is the image processing toolbox.

V. DISCUSSION

We used simple steganographic method for embedding the data i:e LSB embedding method, it provides a high data hiding capacity with less space and time complexity. Here the stego image is divided into learge number of shares. This increase the security of the secrete message. Because sharing is easy and it is not possible for a hacker to get all the shares.

If hacker able to get some shares, than also, he could not be able to get information. As we are just dividing the stego image and no more operation are included, so this will also reduce space and time complexity. Less space and time complexity refers to a simple technique and now a days more and more people are getting familiar with these data sharing technique and it will increase in a very faster way. So simple technique will be very useful.

So our proposed technique will be a very effective and useful method for secrete transmission of data as well as for authentication.

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AN EMERGING DATA MINING TECHNIQUE OVER CLOUD BASED ON METADATA INDEXING

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ABSTRACT

Research in peer-to-peer file sharing systems has targeted on try the planning constraints encountered in distributed systems, whereas very little attention has been dedicated to the user experience: these systems continually assume the user is aware of the concerning the file they're looking out. Nevertheless average users seldom even apprehend that file exists. File sharing systems that do take into account the user expertise and permit users to go looking for files by their name, usually gift centralized management and that they show many severe vulnerabilities, that build the system unreliable and insecure. the aim of this method is to style a additional complete distributed file sharing system that's not solely trustable, ascendable and secure, however additionally leverages the user's psychological feature employment. We tend to gift a technique that by mining a file's info designates relevant keywords for the file mechanically.

These keywords area unit later utilized for the file search and retrieval. Our system provides smart style principals from previous distributed file sharing systems to supply a trustable, scalable, secure and novel distributed file sharing system that a mean user might utilize for file search.

Search engines usually include a crawler that traverses the net retrieving documents and a hunt frontend that provides the program to the non inheritable info. The evolution of search engines nowadays is fast by provision additional search capabilities like a hunt for data moreover as search inside the content text. linguistics internet standards have provided strategies for augmenting files with data.

Keywords- Cloud Computing, Distributed System, Hygiene Factor , Lookup Problem, Search Engine.

I. INTRODUCTION

Basically evaluation of search engine is the process of making judgment about the value, importance and quality of search engine, after considering search engines carefully. The evaluation of search engines has not been keeping up with the advancement of their development. Web search engines work differently based on different mode of interface, features, coverage of the web, ranking methods, delivery of advertising and many more such factors. It is not easy to evaluate them on a single basis. There are many strategies for evaluating search engines such as automatic evaluation, human relevance judgment based evaluation. The purpose of this paper is to review the search engine evaluation strategies in order to propose an enhanced method for evaluating search engines. Distributed systems are a collection of autonomous computers connected through a network. A distributed system permits the computers to share resources and activities, allowing the end user to perceive the system as a powerful single computing machine. Peer-to-peer systems are a particular type of distributed systems, where all computers, also known as nodes, present identical responsibilities and capabilities. Peer-to-

peer systems have many advantages over traditional centralized systems: they present better availability, scalability, fault tolerance, lower maintenance costs as well as lower operation and deployment costs. The drawback of these systems is that they encounter several design challenges. For example the system must remain functional, despite the varying number of uncontrolled participating nodes. Furthermore the system must be decentralized and symmetric; load should also be balanced among all nodes. Additionally, despite the system's size, data search on peer-to-peer systems must be fast and robust (scalable).

A vast number of researchers have concentrated on solving the design challenges referred above. A problem that has been widely tackled is the lookup problem. The lookup problem assumes that a node A inserts a file x into the system and moments after, a node B seeks to retrieve the file x. Considering that the node A is no longer online, the lookup problem intends to find the location of a node that has a replica of the file x. Examples of novel architecture algorithms that were proposed to solve the lookup problem. Systems that also solved the lookup problem, Because of the characteristics of these systems, it is possible to utilize them as a base for developing more complex distributed systems. PAST is a large scale internet based global storage utility that provided scalability, high availability and security. With PAST users were capable of inserting files into the system and later retrieving them, or retrieving files that other users shared. It is important to note, that to accomplish this operation, the user needed to know the file's public key. PAST looked up files by utilizing Pastry. PAST made several improvements to file sharing but because PAST's lookups were based on the file's public key, the system doubtlessly encountered many usability problems. In specific, new users that were unaware of the existence of the public keys would be incapable of finding their file of interest. To overcome this problem, a centralized web server, that provided the public keys to the files the users were searching for, would be required. But adding a centralized web server to the system would increase the system's vulnerabilities to single points of failure. Additionally PAST did not handle all of the design issues encountered in peer-to-peer systems. Specifically it did not address load balance: PAST made no partition on the files that were inserted. Therefore if a large file was attempted to be added to the system, if it did not fit in one single node, the file would not be inserted, despite the fact that the system as a whole might present sufficient memory.

Another interesting large scale peer-to-peer storage system was Pond an implementation of Ocean Store. Pond presented several improvements and differences over PAST, the only problem was that Pond presented the same usability issue PAST encountered: the system required the user to know the public key of the file they were searching. A file sharing system, which did consider in more detail the user experience when sharing and seeking files is Bit torrent. Bit torrent is a file downloading protocol that together with sites, such as Piratebay.org, Lokotorrent.com and trackers servers provides probably the biggest distributed file-sharing system in the world Web pages supporting Bit torrent function by showing for each available file, its name, size, current numbers of downloader's and seeds, and the name of the person who uploaded the file. To download the file a user clicks on a link those points to a .torrent meta-data file. The .torrent metadata files are stored and distribute among .torrent file servers. This mechanism, permits users to search for files by simply inputting related keywords of the file name and querying a web server. Albeit Bit torrent presented a significant improvement on user experience in file sharing systems, Bit torrent is not a truly distributed system.

II. DEVELOPMENT MODELS OF CLOUD

Cloud computing is the collection of virtualized and scalable resources, capable of hosting application and providing required services to the users with the "pay only for use" strategy where the users pay only for the

number of service units they consume. It allows consumers and businesses to use applications without installation and access their personal files at any computer with internet Access. Cloud Computing has attracted the giant companies like Google, Microsoft, and Amazon and considered as a great influence in today's Information Technology industry.

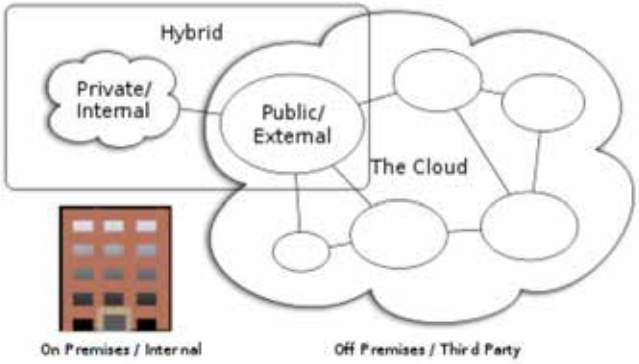

Fig.1 Types of Cloud

2.1 Public Cloud

This infrastructure is available for public use alternatively for a large industry entity and is closely-held by an organization selling cloud services. A Public cloud is one based on the standard cloud computing model, in which a service provider makes resources, such as applications and storage, available to the general public over the Internet. Public cloud services may be free or offered on a pay-per-usage model.

2.2 Private Cloud

The private cloud infrastructure is operated for the exclusive use of an organization. The cloud may be managed by that organization or a third party. Private clouds may be either on- or off premises.

2.3 Hybrid Cloud

A hybrid cloud combines multiple clouds (private, community of public) where those clouds retain their incomparable identities, but are limit together as a unit. A hybrid cloud may pass standardized or ownership access to data and applications, as well as application portability.

III. LITERATURE REVIEW

Maninder et al.(2011) compared and evaluated Five search engines (Google, yahoo, bing, ask, AltaVista) on the basis of their search capabilities into two sections[5]. In the first section, features of five search engines are compared which are available to the user while searching the information. In second section, performance and capability is analyzed from the user's point of view. For this, they had taken a survey in which 263 participants participated and examined their interests in search engines. From this survey, they find out which search engine provides best utility and services to the user and most likely used by the people and they find out that users give highest rank to Google. Ya-Lan et al.(2007) proposed two major factors hygiene factor and motivation factor. Hygiene factors are those more fundamental requirements for a search engine and make users willing to use a search engine, and motivation factors are those more additional services of a search engine and make users willing to keep using the same search engine. The author had surveyed 758 people in Taiwan. The survey had three main components:

1) Demographic questions, the results showed that the age of 95% of the respondent's centers on the range from 18 to 30, and most of the participants are students

2) Experiences of using computer, Internet, and search engine, the results showed that more than 75% of the participants have experiences of using computer and Internet for more than five years. More than 95% of them use computer and surf on the Internet everyday for at least one hour.

3) Perceptions of search engines, test the hygiene-motivation hypothesis of search engine proposed in this research paper. Maninder et al evaluated five search engines but based on limited user review. Whereas Ya-Lan et al have used different factors for user liking and behavior, the results are dependent of various previous studies and the factors ought to take a unidirectional approach[6].

Rashid et al.(2009) devised an automatic web search evaluation system based on rough set based rank aggregation technique. Basically , different ranking results obtained from different techniques are combined. Two phases are used, ranking rules learning phase and rank aggregation phase.Author used 15 queries in rank learning phase. The output of this phase is a set of ranking rules[9].

George et al. (2007) suggested a model to evaluate search engines on the click through data of past users. The model used two variables i.e. A(attractively) and C(consideration) to determine the probability of choosing a snippet out of the list of relevant pages through which he successes to a distance d ; after considering upto distance d-1 portions. The conclusion of evaluation shows that the distance model represents the data better than popularity model. The complete evaluation illustrates that the positional biasing of relevancy can be resolved by click through data. Here it may seem counter-intuitive to use this model to measure performance. This toy model is unable to represent clearly the user behavior but it can be further improved to implement click through data methods [8].

IV. PROPOSED METHODOLOGY

The General idea behind this Paper is to create a system through which we can access the files which are present at different location on the remote systems. We mainly focus on the LAN based systems. The data flow diagram for the systems is shown:

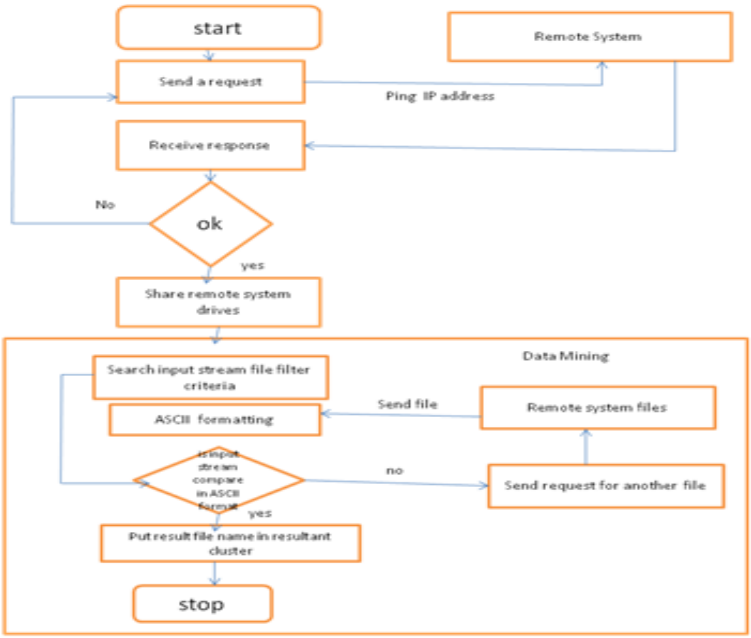

Fig 2: The data flow diagram for the systems

The working can be done in following steps:

1. First we enter inside the systems using proper Username & Password.
2. After entering inside the system we first ping the IP address to the remote systems. This procedure is done with the help of sending request to the Remote Systems.
3. After sending request to the remote systems we are waiting for the response. If the response is valid we share the systems otherwise we retry by sending the request to the remote systems.
4. Once we share the systems it is easy to share the drives of the different systems.
5. After sharing all the drives we start to search the files.
6. For searching the files on the remote systems we are using the concept of Data mining.
7. First we have given the input string which is nothing but the file which we want to search.
8. Remote system sends the files in the ASCII format.
9. Once we get the files from the remote system in the ASCII format we check whether the given input string search contents are in ASCII format or not?
10. After getting the input search contents of file in ASCII format we put the collection of all the resultant files in the form of cluster.

V. CONCLUSION

It has been shown that an LAN Based Search engine collecting full-text and metadata from homogeneously structured information sources can be successfully implemented by integrating a system through which we search the files from the remote systems easily. Content classification and metadata extraction have been shown as valuable methods for enhancing search results. The System architecture provides us the strategies to enhance the retrieving the information from the remote systems. This system makes an attempt to propose a solution to retrieve higher occurrence of the keywords/concepts, within the files that are present on the different systems. Using this system we reduces the effort made by the user, that is, without requiring manual refinement, Where the relation-based metadata, provides a relevance score for a web page into annotated result set on user query, and the page annotation, and also decreases the time complexity.

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