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Small Scale Pulse Processing Machinery and Byproduct Utilization – A Good Source of Income Generation

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Abstract – Agriculture is the backbone of Indian economy as it provides livelihood to 70 % of our population. It is, therefore, very essential that all out effort is made for rural development through increased production, productivity and proper post harvest care for farm produce which supply us food and raw material for different agro-based industries. Suitable strategy should be developed for generating additional income and employment in rural areas so as to check migration of rural people to urban areas in search of jobs. One such pertinent strategy and perhaps the most important could be to provide additional income and employment to farmers by way of encouraging them to process their produce at rural level. Pulse milling at rural level is an important activity to achieve this goal.

Key words: IIPR Dal Chakki, IIPR Mini Dal Mill, IIPR Multipurpose grinding mill, value added pulse products.

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1. INTRODUCTION

An estimated 75 % of pulses production goes to commercial mills, mostly located in urban areas, for processing into dal. Farmers sell their raw grain just after harvest at a very low price (presently around Rs. 55.00 per kg for pigeonpea) and purchase dal at a rate of around Rs. 100.00 per kg. There exists, therefore, a wide price gap between the price of raw material and processed dal. The major chunk of this profit is taken away by the middlemen and the processors. This imbalance can be corrected if small scale dal mill (Mini Dal Mill) is made available at rural level and farmers are encouraged to become processor of their produce. In order to provide employment to rural people and making farmers the processor of their produce, a concerted effort has been made at the Indian Institute of Pulses Research, Kanpur to develop low capacity pulse processing machinery suitable for being used at cottage scale level. As a result two such machines, briefly described below, have been developed at the Institute which has great commercial potential.

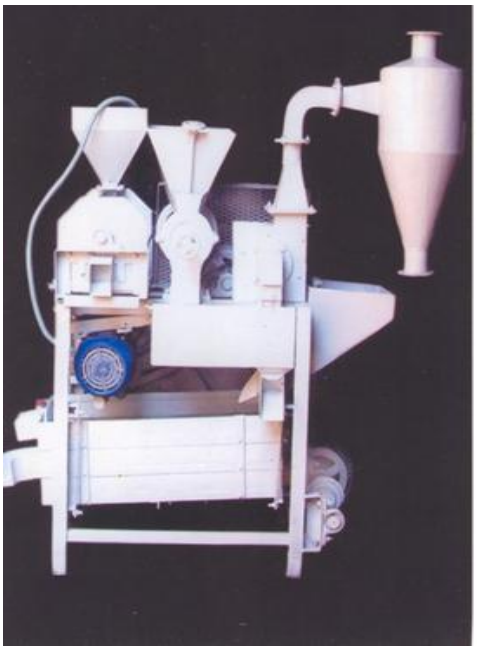
2. IIPR DAL CHAKKI

A low capacity dal mill, popularly known as IIPR Dal Chakki has been developed. About 175 commercial prototype of this mill are working in different parts of the country. This mill works on principle of dehusking of grains using rubber and steel disk. Use of rubber disk, instead of commonly used emery rolls, reduces the scouring loss and increases the dal recovery. Chunni and bhunsi is separated with the help of cyclone separator. Operated by a single phase, 1.5 hp motor this mill can be used to mill most of the pulses. Its capacity varies from 80 to 125 kg/h. for different pulses. This gives a recovery of 75 to 79 % in case of pigeon pea and 78 to 84 % in case of chickpea with suitable pretreatments. The recovery in the other pulses is also in this range. The dehusking, splitting and cleaning operations are done simultaneously in this mill.

II PR Dal Chakki

3. IIPR MINI DAL MILL

A good number of farmers and entrepreneurs are using the above mill. However, based on the feedback received from the user of this machine and other prospective entrepreneurs, an upgraded model of this dal mill has been developed. This model has the provision of grading the raw grains as well as finished product. In the earlier model, a separate grader was used for grading of raw grains. Apart from this an emery roller attachment has also been incorporated in the mill, which makes the pitting process easier and this enables the production of dehusked whole i.e. gota also, like malka masoor, which was not possible in earlier models. Incorporation of these units in upgraded model, along with refinement in other components like disc holding mechanism and quality of rubber disc, has made this mill a complete mini dal mill, wherein grading of raw grain, pitting of grains, milling of all types of pulses like dehusked splits (pigeonpea, chickpea, pea, lathyrus etc.), unhusked splits (greengram and blackgram), and dehusked gota (malka masoor), cleaning and separation of husks etc., and grading of finished products (dal) are done in the same machine and all the operations can be done simultaneously. The commercial prototype of this mill costs around 100000/= only. The product quality obtained from this mill is similar to the quality of dal available in the market.

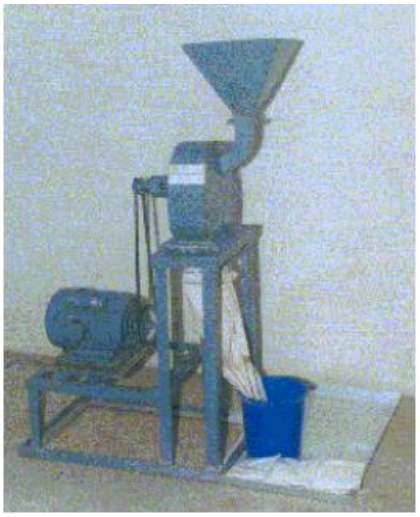


IIPR Mini Dal Mill

In a very short span of its development a large number of units of this mill have been established at commercial level in different states and are working satisfactorily. Use of this machine can easily generate a monthly income of Rs. 20,000 to 25,000/=. This machine has, therefore, a good potential for being exploited as cottage scale industry for the benefit of rural entrepreneurs, unemployed youths and progressive farmers.

4. IIPR MULTIPURPOSE GRINDING MILL

This is a low capacity multipurpose grinding mill. Powered by a 1 hp single phase motor, this mill can be used for converting dehusked split pulses (dal) to beasn, wheat to wheat flour, chickpea dal to sattu and whole spices to powder. Its capacity varies from 40 to 50 kg/h in case beasn and sattu , 25 to 30 kg/h in case of wheat flour and 4 to 10 kg/h in case of spice grinding depending upon the type of raw material. This mill has the potential to generate Rs. 40000 to 50000.00 income per month when used on entrepreneurship basis and thus, has a very good potential for supplementing income of farmers.



IIPR Multipurpose Grinding Mill

(a) Value Added Products from Pigeon pea Milling By-products :

Pigeon pea grain is consumed only after dehusking and splitting. During the milling process, about 30% of grain mass is lost in form of husk and cotyledon powder. This milling by-product is utilized as cattle feed. At IIPR efforts have been made to use this low value by-product for development of edible products. In this direction several homemade recipes (barfi, ladoo, sev, kachri, sweet puries, kachauri masala) and for commercial exploitation biscuit had been developed incorporating husk and cotyledon powder mixture in different proportions. Value added products developed by incorporation of pigeon pea milling by-product are rich in protein, fiber and phenols, thus, have higher food value. Fractional separation of pigeon pea milling by-product yielded 25% cotyledon powder, which was used for making dal analogue by unheated extrusion. Powder fraction can directly be poured into boiling water to make dal. Though due to presence of husk in the mixture, colour of dal is a bit brownish, but in protein content it is no way inferior to dal. Alternatively it can be used for soup, gravy thickener and protein enhancer.

Biscuits prepared from by-products of pigeon pea

Another product prepared from pigeon pea by products

5. TARGET GROUPS OF THESE TECHNOLOGIES

(a) Farmers who wish to become primary processor of their produce i.e. they can sell finished dal instead of selling raw pulse grains, thus getting better price for their produce.

(b) Flour mill (atta chakki) owners who can make dal from different pulse grains on custom basis i.e. on the same basis as is being used for conversion of wheat into wheat flour.

(c) Small scale entrepreneurs, who may purchase raw pulse and grains and spices, convert into dal and their byproducts and raw spices to powdered spices and sell it to consumers, thus enabling them to have a good source of income.

(d) Small scale manufacturers willing to manufacture and sell the mill.

6. CONCLUSION

It is envisaged that at least one Mini Dal Mill and one IIPR Multipurpose Grinding Mill should be available in every block or Panchayat level to cater to the needs of farmers of that area and this leaves a vast area open for the manufacturer of these machinery to capture this open space. This will give a big boost to the small scale manufacturing sector thereby creating huge employment opportunities for the skilled artisans. This will also create opportunities for entrepreneurs. Ultimate beneficiaries will be farmers who will get added income from their farm produce.

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Ethno taxonomical Importance of the Plants near Tapti River at Historical Shahi Qila Fort in District Burhanpur, Madhya Pradesh, India

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Abstract – The Tapti River flows in central India from East to West, between the Godavari and Narmada Rivers. The River is supposedly named after the goddess Tapti, the daughter of Surya Deva, the Sun God, who according to legend founded the kuru Dynasty when she married king samvarna. It inters East Nimar at a distance of 12mile (193Km). From the sources (Multai near Betul). A total of 94 species belonging to 90 genera and 41 families have been reported from near Tapti River at historical Shahi Qila fort in District Burhanpur, Madhya Pradesh, India. Ethnotaxonomically most important families are Monocots-2(Liliaceae- 3 species and poaceae- 3 species) and dicots families – 37 (Apocynaceae- 4 species, Asclepidaceae – 2 species, Annonaceae – 1 species, Amaryllidaceae – 1 species, Asteraceae – 2 species, Arecaceae – 1 species, Amarnthaceae – 1 species, Acanthaceae – 1 species, Anacardaceae – 1 species, Caesalpinoideae – 5 species, Casurinaceae – 1 species, Cactaceae – 1species, Convolvulaceae -2 species, Combretaceae – 1species, Cruciferae- 1 species, Caricaceae – 1 species, Cupressaceae -1 species, Cannaceae-1 species, Euphorbiaceae-8 species, Labiatae-2 species, lamiaceae-1 species, Lythraceae-1 species, Leguminosae-1 species, Mimosodeae-3 species, Myrtaceae-3 species, Malvaceae-2 species, Nymphiceae-2species, Orchidaceae-1 species, Moraceae-2 species, papilionaceae-2 species, Moringaceae-1 species, Rhanaceae-1 species, Solanaceae-5 species, Umbelliferae-1 species, Verbenaceae-2 species, Malphigaceae-2 species, Magnoliaceae-1 species, Zygophyllaceae-1 species,Piperaceae-1species etc.) (see images of Ethnotaxanomic flora 1-9 4 , Table no. 1-2 & Graph no.1) Tapti River is under increasing pressure due to drought, erosion and over exploitation, pollution, enchroachment by human activity. The above factors have causes reduction in number of Ethnotaxanomical species as well as wetland area. So these area need conservation of aquatic and wetland species, because wetland is the are which supports aquatic, amphibians and terrestrial life forms. Present study signifies Ethnotaxanomical importance of the plants species occur near Tapti River at historical Shahi Qila fort in district Burhanpur, Madhya Pradesh, India.

Keywords: Ethnotaxonomy, Historical Shahi Qila fort Flora, Tapti River, Burhanpur, Madhya Pradesh, India.

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1. INTRODUCTION

A number of terms are used in varied areas of Ethnobotanical research, such as Ethnotaxanomy, deals with the naming and classification of plants and their cultivators by human societies in their language. The Ethnobotany was first coined by Harsh berger in 1895. The abstract relationship of man with plants includes faith in the good or bad powers of plants, taboos, avoidances, sacred plants, workship and folklore. The Shahi Qila was a majestic palace in Burhanpur, located to the east of the Tapti River. Little except ruins remain of the palace. However, the parts that still stand display amazing works of sculpture and exquisite carvings. History of the Shahi Qila states that it was originally built by the Farooqui rulers and resided by Shah Jahan, at a time when he was the governor of Burhanpur. Shah Jahan became so fond of the fort that it was here, in Shahi Qila that he establishes his court for the first three years of his ascending the throne.Shah Jahan spent a considerable time in this city, and helped add to the Shahi Qila. Diwan-i-Aam and Diwan-i-Khas were built on the terrace of the Qila. (images 1-6).

Images 1-6: Burhanpur the cultural heritage city, study area & location near Tapti River at Historical Shahi Qila in District Burhanpur, M.P., India.

The Surya Putri Kuwari Holy Tpti River flows to the west from Historical Burhnapur. Burhanpur is glorified by nature having various holy ponds (Triveni sangam of Tapti , Utawali and Mona River) and elevated satpura hills. The entire forest area , exquisite water falls (Mahal Gurara, Jammupani) and rich biodiversity make this place a great destination for both religious place a great destination for both religious minded people and the researchers. Little attention has been paid to the systemic study of aquatic and wetland plants of india. An account of Hydrophytic plants of India was published by Biswas and Calder (1936) and Subramanyam (1962). Recently Cooke (1966) published a volume on aquatic and wetland plants of India. In Madhya Pradesh Maheswari (1960), Tiwari (1960), Choudhary and Upadhyay (2009) and Annand et al,(2012) undertook the taxanomic study of aquatic angiosperms.

2. MATERIALS AND METHODS

In The present study monthly field observations were undertaken in near Tapti River at Historical Shahi Qila fort in Disrict Burhanpur, Madhya Pradesh, India from 2015-16. Plain are is also studied here. Qualitative and quantitative analysis of ethinotaxanomical important plants was done by following the methodology of Mishra (1974). The

collected specimens were identified with the aid of floras (Cook ,1966), Khanna (1993-2001)and other sources. The collected specimens were pressed and herbarium was prepared followed (Jain and Rao ,1977). All specimens were deposited in the department of Botany , S.G.J.Quaderia College, Burhanpur, (M.P), india. (see images of ethnotaxonomic flora 1-94, table no.1-2 & Graph no.01)

Image no.1 – Amaltas (Cassia fistula)

Image no.2 – Arandi (Ricinus communis)

Image no.3 – Babool (Acacia arobica)

Image no.4 – Imli (Tamarindus Indica)

Image no.5 – Casurina (Casurina-equisitifolia)

Image no. 6 – Jamun (Syzygium cuminii)

Image no.7 Aak (Calotropis procera)

Image no.8 Karonda (Carissa spinarum)

Image no.9 – Ashwgand (Withania somnifera)

Image no.10 – Lazwanti (Minosa pudica)

Image no.11 – Satawar (Asparagus recemosus)

Image no.12 – Gudhal (Hibiscus rosa synansis)

Image no.13 – Kala datura (Stramonium alba)

Image no.14 – Amarbel (Cuscuta reflexa)

Image no.15 – Gokru (Tribulus terresteris)

Image no.16 – Tulsi (Ocimum sanctum

Image no.17 – Bhata (Solanum melongena)

Image no.18 – Safed Musli (Chlorophytum tuberosum)

Image no.19 – Kankarwa (Clitoria turnata)

Image no.20 – Baas (Dendrocalamus strictus

Image no.21 – Doob ghass Cynadon dactylon

Image no.22 – Ghass (Pennicum Indiccum)

Image no.23 – Gulmohar (Delonix regia)

Image no.24 – Neebu (Citrus lemonia)

Image no.25 – Nagfani (Opuntia dillenii)

Image no.26 – Ber (Zizyphus moureitiana)

Image no.27 – Mithi Neem (Murraya koenigii)

Image no.28 – Willayati Babool (Parkinsonia aculeota)

Image no.29 – Willayati Imli (Pithecolobium dulce)

Image no.30 – Shehtoot (Morus alba)

Image no.31 – Munga (Moringa elleffera)

Image no.32 – Sitafal (Annona squamosa)

Image no.33 – Selfund (Euphorbia nivulia)

Image no.34 – Sheeshum (Dalbergia latifolia)

Image no.35 – Deshi Badam (Terminalia catappa)

Image no.36 – Neem (Azadirachta Indica)

Image no.37 – Neelgiri (Eucalyptus teretecornis)

Image no.38 – Peepal (Ficus religiosa)

Image no.39 – Badh (Ficus bengalensis)

Image no.40 – Sagoon (Tectona grandis)

Image no.41 – Jangli Tulsi (Ocimum basilicum)

Image no.42 – Bhatkattiya (Solanum zanthocarpum)

Image no. 43 – Bhindi (Abelmoscus esculentus)

Image no. 44 – Pudina (Mentha species)

Image no.45 – Gulab (Rosa damascene)

Image no.46 – Pyaz (Allium sepa)

Image no.47 – Pili Sarsoo (Brassica campestris)

Image no.48 – Bottle brush (Callistemon species)

Image no.49 – Firebus (Hamelia patiens)

Image no.50 – Sadabahar (Vinka rosea)

Image no.51 – Euphorbia (Euphorbia pulchrryma)

Image no.52 – Kaner (Thevelia peruviana)

Image no.53 – Kamal (Nymphia species)

Image no. 54 – Genda (Tagetes erecta)

Image no.55 – Petunia (Petunia species)

Image no.56 – Kagaz ke phool (Polygonum species)

Image no.57 – Mehndi (Lewsonia inermus)

Image no.58 – Satyanashi (Argimone mexikiana

Image no.59 – Makoi (Solanum nigram)

Image no. 60 – Dhaniya (Coriandrum sativum)

Image no.61 – Peeli kaner (Casebella thevetia)

Image no.62 – Palm (Chanaerops humilis)

Image no.63 – Eupohorbia (Euphorbia hirta)

Image no.64 – Papita (Carica papaya)

Image no.65 – Khatti buti (Oxalis cormiculata)

Image no.66 – Chaulai (Amaranthus spinosus)

Image no.67 – Sitab (Ruta graviens)

Image no.68 – Aadusa (Adhatoda vasica)

Image no.69 – Champa (Michelia Champaeca)

Image no.70 – Aam (Mangifera Indica)

Image no.71 – Jaam (Psidium gujava)

Image no.72 – Aaula (Phyllanthus fraternas)

Image no. 73 – Beel (Aegle marnelos)

Image no.74 – Gwarpatha (Aloe vera)

Image no.75 – Nirgundi (Vitex migundol)

Image no.76 – Croton (Codicum varigatum)

Image no.77 – Vidhya (Platyeladus orienpalis)

Image no.78 – Desi Gulab (Rosa Indica)

Image no.79 – Gulab (Rosa domoscena)

Image no.80 – Gulab (Rosa multiflora)

Image no.81 – Lilly (Zephyranthes citring)

Image no.82 – Madhumati (Gelphimia gracilis)

Image no.83 – Falseagave (Furcraea gracilis)

Image no.84 – Kelly (Canna Indica)

Image no.85 – Sultan (Acalypha hispida)

Image no.86 – Kamal (Nymphaea nouchali)

Image no.87 – Hydrilla (Hydrilla verticillata)

Image no.88 Dawal (Pephrosia purpurea)

Image no.89 – Paan (Piper bettle)

Image no.90 – White Dathura (Dathura alwa)

Image no.91 – Ageratum (Ageratum colyzoides)

Image no.92 – Ashoka (Saraca Indica)

Image no.93 – (Phuli, Tridex procumbens)

Image no.94 Suryamukhi (Helianthus annus)

3. RESULT AND DISCUSSION

A total of 94 species belonging to 90 genera and 41 families have been reported from near Tapti River at historical Shahi Qila fort in District Burhanpur, Madhya Pradesh, India. Ethnotaxonomically most important families are Monocots-2 (Liliaceae- 3 species and poaceae- 3 species) and dicots families – 37 (Apocynaceae- 4 species, Asclepidaceae – 2 species, Annonaceae – 1 species, Amaryllidaceae – 1 species, Asteraceae – 2 species, Arecaceae – 1 species, Amarnthaceae – 1 species, Acanthaceae – 1 species, Anacardaceae – 1 species, Caesalpinoideae – 5 species, Casurinaceae – 1 species, Cactaceae – 1species, Convolvulaceae -2 species, Combretaceae – 1species, Cruciferae- 1 species, Caricaceae -1 species, Cupressaceae -1 species, Cannaceae-1 species, Euphorbiaceae-8 species, Labiatae-2 species, lamiaceae-1 species, Lythraceae-1 species, Leguminosae-1 species, Mimosodeae-3 species, Myrtaceae-3 species, Malvaceae-2 species, Nymphiceae-2species, Orchidaceae-1 species, Moraceae-2 species, papilionaceae-2 species, Moringaceae-1 species, Rhanaceae-1 species, Solanaceae-5 species, Umbelliferae-1 species, Verbenaceae-2 species, Malphigaceae-2 species, Magnoliaceae-1 species, Zygophyllaceae-1 species, piperaceae 1 species etc.) (see images of Ethnotaxanomic flora 1-9 4 , Table no. 1-2 & Graph no.1).

4. CONCLUSION

Ethnotaxonomical flora near Tapti River at Historical Shahi Qila fort exhibited a heterogenous assemblage of 94 species belonging to 90 genera and 41 families from the area , out of them Euphorbiaceae turned out as dominant family having 08-species followed by Solanaceae with 05-species and Apocynaceae with 04-species (see graph no.01) Tapti River is under increasing pressure due to drought , erosion and over exploitation, pollution , enchroachment by human activity. The above factors have causes reduction in the number of flora as well as wetland area. These area need conservation of aquatic and wetland flora .

The present study provides information in ethnotaxonomical importance of the plant species in burhanpur region. It is clear from the investigation date local people have great expertise with the plants of their own environment.

The occurrence of a number of economically important species has enhanced the conservation as well as socio economic values of the area particularly in view of religious aspect of the area. Furthermore, the over exploitation of species for fuel, medicine, wild edibles and house building may lead to decline of these species from the area. So conservation and cultivation of these plants species with help to maintain the ecological balance, traditional knowledge as well as livelihood security of local inhabitants.

Table 1

Ethnotaxonomically important family found near Tapti River

S. No	Flora Local Name	Total No of Plants	Popular Name Famous Name	Botanical Name	Family
Small Size Trees					
1	Amaltas	02	Amaltas	Cassia fistula	Caesalpinoideae
2	Arandi	01	Arandi	Ricinus communis	Euphorbiaceae
Medium Size Tress					
3	Babool	02	Babool	Acacia arobica	Mimosoideae
Large Size Tress					
4	Imli	01	Imli	Tamarindus Indica	Caesalpinoideae
5	Casurina	20	Casurina	Casurina equisitifolia	Casurinaceae
6	Jamun	01	Jamun	Syzygium Cuminii	Myrtaceae
Bushes					
7	Aak	02	Aak	Calotropis Procera	Aselepiadaceae
8	Karonda(Kakronda)	01	Karonda	Carissa Spinarum	Apocynaeeae
Undergrowth					
9	Ashwgandha	05	Ashwgandha	Withania Somnifera	Solanaeae
10	Lazni	10	Lazwanti	Mimosa Pudica	Mimosoidae
11	satawari	01	Satawar	Asparagus recemosus	Liliaceae
12	Gudhal	01	Gudhal	Hibiscus rosa, Synansis L.sp.pl.	Malvaceae
Small Bushes					
13	Kala Datura	04	Datura	Motel	Solanaceae
14	Amarbel Herbs	01	Amarbel	Cuscuta reflexa	Convolvulaceae
15	Gokru	10	Gokru	Tribulus terresteris terresteris	Zygophyllaceae
16	Tulsi	10	Tulsi	Ocimum Sanctum	Labiatae
17	Bhata (Brinjal)	05	Began	Solanum Melongena	Solanaceae
18	Safed Musli	05	Safed Musli	Chlorophytum tuberosum	Orchidaceae
Climbers					
19	Kankarwa	04	Kankarwa	Clitoria turnata	Papilionaeeae
Bamboo					
20	Bamboo	01	Bamboo	Dendrocalamus strictus	Poaceae
Grass					
21	Duba	-	Doob	Cynadon dactylon	Graminae(poaceae)
22	Common Ghass	-	Ghass	Pennicum Indicum	Poaceae

Small Size Tress					
23	Gul Mohar	07	Gul Mohar	Delonix regia	Caesalpinoideae
24	Nimbu (citrno)	03	Neebu	Citrus Lemonia	Rutaceae
25	Nagfani	04	Nagfani	Opuntia Dillenii	Cactaceae
26	Baer (Zizipus)	01	Ber	Zizyphus moureitiana	Rhanaceae
27	Mithi Neem	05	Mithi neem	Murraya Koenigii	Miliaceae
28	Willayati Babool	01	Willayati Babool	Parkinsonia Aculeota	Caesalpinoideae
29	Willayati Imli	01	Willayati Imli	Pithecolobium dulce	Papilionaceae
30	Shehtoot	01	Shehtoot	Morus alba	Moraceae
31	Sejha	01	Munga	Moringa elleffera	Moringaceae
32	Sitafal	10	Sitafal	Annona squamosa	Annonaceae
33	Selfund	01	Nivarang	Euphorbia nivulia	Euphorbiaeeae
Medium Size Trees					
34	Sheeshum	08	Sheeshum	Dalberia Latifolia	Papilionateae
35	Deshi Badam	06	Deshi Badam	Terminala catappa	Combretaceae
36	Neem	20	Neem	Azadirachta indica	Meliaeeae
37	Neelgiri	01	Neelgiri	Eucalyptus teretecornis	Myrtaeeae
38	Peepal	20	Peepal	Ficus religiosa	Moraceae
39	Badh	01	Bargad	Ficus bengalensis	Moraceae
40	Saggon	01	Sagoon	Teetona Grandis	Verbenaceae
Medicinal Plants					
41	Jangli Tulsi	10	Jangli Tulsi	Ocimum basilicum	Labiateae
42	Bhat Kattiya	04	Bhat Kattiya	Solanum zanthoearpum	Solanaeeae
43	Bhindi	10	Okra	Abelmosecus eseulentus	Malvaceae
44	Pudina	10	Mentha	Mentha sp.	Lamiaceae
45	Rose	05	Gulab	Rosa damascena	Rosaceae
46	Pyaz	10	Onion	Allium Sepa	Liliaeeae
47	Pili Sarsoo	05	Yellow mustard	Brassica campestris	Cruciferae
Ornamental Plants					
48	Bottle Brush	01	Bottle brush	Callistemon sp.	Myrtaeeae
49	Firebush	03	Firebush	Hamelia patiens	Rubiaceae
50	Sadabahar	10	Sadasuhagan	Vinka rosea	Apoeynaeeae
51	Euphorbia	04	Euphorbia	Euphorbia pulchrryma	Euphorbiaeeae
52	Kaner	13	Kaner	Thevelia peruviana(pers)schum	Apocynaeeae
53	Kamal	04	Lotus	Nymphia sp.	Nymphiceae
54	Genda	10	Genda	Tagetes erecta	Asteraceae
55	Petunia	10	Petunia	Petunia sp.	Solanaeeae
56	Kagaz ke phool	10	Kagaz ke phool	Polygonum sp.	Polygoniaceae
57	Mehndi	04	Mehndi Heena	Lewsonia inermus(L.)	Lythraceae
Family					
58	Satyanashi	10	Pilicatai	Arqimone mexsikiana	Papaveraceae
59	Makoli	10	Makoli	Solanum nigram	Solanaceae
60	Dhaniya	02	Dhaniya	Coriandrum sativum	Umbelliferae
61	Peeli Kaner	13	Peeli Kaner	Casebella thevetia (L.)	Apocynaeeae
62	Palm	03	Palm	Chamaerops humilis L.	Arecaceae
63	Euphorbia	04	Euphorbia	Euphorbia hirta	Euphorbiaceae
64	Papita	06	Papaya	Carica Papaya	Caricaceae
65	Khatti Buttti	05	Khatti Butti	Oxalis cormiculata	Euphorbiaceae
66	Chaullai	10	Chaulai	Amaranthus spinosus	Amaranthaeeae
67	Sitab	04	Sitab	Ruta graviens	Rutaeeae
68	Andosa	05	Aadusa	Adhatoda vasica	Aconthaeeae
69	Champa	01	Champa	Michelia champaea Linn	Magnoliaceae
70	Mango	01	Aam	Mangifera indica L.	Myrtaeeae
71	Amrood	02	Jaam	Psidium gujava L.	Anacardiaceae
72	Aaula	02	Aaula	Phyllanthus fraternas	Enphorbiaeeae
73	Beel	01	Beel	Aegle marmelos (L.)	Rutaeeae
74	Gwarpatha	10	Gwarpatha	Aloe vera L. Burm L.	Liliaceae
75	Nirgundi	01	Nirgundi	Vitex- migundol	Verbenaeeae
76	Croton	03	Croton	Codicum Varigatum(L.)BLBijp.	Euphorbiaeeae
77	Vidhya	20	Thuja(Morpankh)	Platy eladus orientalis(L.)	Cupressaceae
78	Gulab	2	Gulab	Rosa indica L.sp.	Rosaceaae
79	Gulab	1	Gulab	Rosa domoscena Mill.	Rosaceae
80	Gulab	1	Gulab	Rosa multiflora thunb.	Rosaceae
81	Yellow rain lily	20	Yellow rain lily	Zephyranthes citring baker.bot.	Amaryllidaceae
82	Madhumati	04	Madhumati	Gelphimia Gracilis (Bart c)	Malphigaceae
83	Giant	02	False agave	Furcraea gracilis(Barti)	Malphigaceae
84	Kelly	02	Kardal	Canna indica L.sp.pl.	Cannaceae
85	Sultan	05	Sultan	Aealypha hispida Jpg.	Euphorbiaceae
86	Kamal	04	Kamal ka phool	Nymphaea nouchali burm	Nympheae
87	Hydrilla	10	Hydrilla	Hydrilla Verticillata(L.f.)Royle	Hydrocharitaceae
88	Dawal	02	Anjan Lokariya	Tephrosia purpurea(L.) Pres.	Liguminosae
89	Paan	10	Paan	Piper bettle	Piperaceae
90	White Dathura	05	White Dathura	Dathura alba	Solanaceae
91	Ageratum	10	Ageratum	Ageratum colyzoides	Asteraceae
92	Ashoka	05	Ashoka	Saraca Indica	Leguminosae
93	Phuli	20	Phuli	Tridex procumbens	Asteraceae
94	Suryamukhi	01	Suryamukhi	Helianthus annus	Asteraceae

Table 2

Statistical analysis of Flora near Tapti River at Historical Shahi Qila fort Burhanpur, M.P., India.

S. No.	Group	Families	Genera	Species
1	Dicots	39	84	88
2	Monocots	02	06	06
G.t.		41	90	94

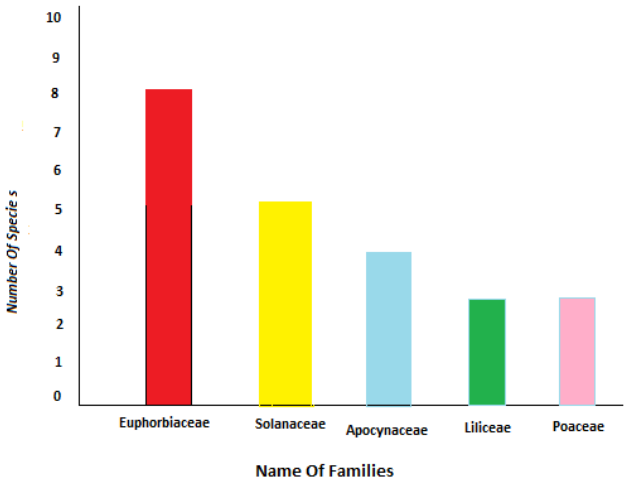

Fig.1 – Dominant families of the sampling sites

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Effect of Coloured Shade Nets on Vegetable Production – A Review

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Abstract – The colour shade net approach aims at combining physical protection to the crop wtih modifications in spectro radiometric properties inside the net house which in turn promotes desired physiological responses. The experimental investigations indicated that under clear sunny and cloudy conditions the radiometric properties depends mostly on both net porosity and its' colour. Net reflectance strongly depends on net colour. Transmittance and absorption of electromagnetic spectrum by a particular net primarily depends on colour and secondarily on porosity. Since the nets are composed of holes, in addition to the translucent-photo-selective plastic threads, they actually create mixtures of natural, unmodified light, which is passing through the holes, together with the diffused, spectrally modified light, which is emitted by the photo-selective threads. This changes in electromagnetic spectrum helps in enhancing the crop performance under a particular colour of a net. In this paper a comprehensive review of research work carried out on influence of shade net colour on vegetable production are being presented and the recommendation of a particular colour net for a particular crop is are being presented.

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I. INTRODUCTION

Plants react to changes that occur in the spectrum of electromagnetic radiation to which they are exposed through alterations in morphology and physiological functions that result in adaptation to different environmental conditions (Kasperbauer and Hamilton, 1984). Such alterations are mediated by pigments, known as phytochromes, which have absorption peaks in the red and blue/ultraviolet regions of the spectrum (LI et al., 2000). These photoreceptors are able to detect variations in light composition and induce photo morphogenetic responses, either in vivo or in vitro (Kim et al., 2004; Macedo et al., 2004) that influence growth and development.

More recently, coloured shade netting (shade cloth) designed specifically for manipulating plant development and growth has become available. These nets can be used outdoors as well as in greenhouses. They can provide physical protection (birds, hail, insects, excessive radiation), affect environmental modification (humidity, shade, temperature) (Pe´rez et al., 2006), and increase the relative proportion of diffuse (scattered) light as well as absorb various spectral bands, thereby affecting light quality. The shading of crops results in number of changes on both local microclimate and crop activity. These changes on local microclimate modify CO_2 assimilation and consequently crop growth and development. Further, under shading nets the air temperature is lower than that of the ambient air, depending on the shading intensity and is negatively associated with the rate of shading and is variably affected by the quality of light filtered through the different colored shade nets (Elad et al., 2007). Photo-selective, light-dispersive shade nets provide a unique tool that can be further implemented within protected cultivation practices (Shahak et al., 2008). The effects of light quality on plants are well known, the response of different species to light management is variable (Kim et al., 2004), and it is clearly important to treat plants with the correct type of light filters (Mcmahon and Kelly, 1995), especially medicinal plants with economical interests.

A common light quality management is the supplementation with artificial light sources (Brown et al., 1995) through the use of coloured plastic films (Oyaert et al., 1999), spectral filters (Rajapakse et al., 1992) and reflective coloured mulches (Loughrin and Kasperbauer, 2001) to induce physiological

responses in plants. Cromatinet coloured netting modifies the spectrum of the incident radiation in the visible region and enriches the relative content of scattered light such that \transmittance of light by the blue netting is in the 400-540 nm region, whilst that of the red netting is in the 590-760 nm region (Oren-Shamir et al., 2001). Although the red: far red ratio (R: FR), which is the main regulatory factor leading to a phytochrome response, is not greatly modified by the use of such nets, the blue: red ratio (B: R) is enhanced by blue netting and reduced by red netting (Shahak et. al., 2004). Nets have three major uses in agriculture: (i) shading, for protection from too much solar radiation; (ii) protection from environmental hazards such as strong winds, hail and sand storms; (iii) protection from flying pests like birds, fruit bats, etc. Black nets were commonly used so far for shading, while clear, transparent nets are used for environmental-hazard or pest-protection. In collaboration with Poly-sack Plastic Industries, Israel, developed a new group of protective nets, which can alter both the quality as well as quantity of the light intercepted by the plants growing underneath, in addition to providing the desired protection (Shahak et al., 2004).

II. INFLUENCE OF WEATHER UNDER SHADE NET

Among environmental factors, light intensity, temperature and relative humidity influence crop growth and development. Solar radiation consists of different wave-lengths of light, in which the visible portion is useful for crop growth; ultra-violet and infrared radiations are not beneficial for crop growth, as they change molecular levels which lead to cellular disorganization. Temperature is the major regulator of development processes. Higher temperatures have more adverse influence on net photosynthesis than lower temperatures leading to decreased production of photosynthesis above a certain temperature (Reddy et al., 1999). Relative humidity increases availability of net energy for crop growth and improves survival of crops under moisture stress conditions. Relative humidity reduces evaporation loss from plants which lead to optimum utilization of nutrients. It also maintains turgidity of cells which is useful in enzyme activity leading to a higher yield (Reddy et al., 1999).

Fig: 1 Shade net house

The yield of sweet pepper was higher under shade net house due to high relative humidity, which enhanced vegetative growth and improved fruit production. These results agree with findings of (Priya et al. 2002). Tomato, eggplant, capsicum, radish, amaranthus and coriander had higher yield under shade net house due to light compensation for higher photosynthesis. Similar results were reported by (Quaglitto 1976) in sweet pepper. Since, cluster bean, ladies finger and cucumber are tropical crops; the requirement for light is more than chilli. This agrees with findings of (Krishna.M et al. 1993), who suggested that under 25% shade formation of photosynthates and their partitioning and distribution for the final sink were reduced resulting in poor yield in chilli.

III. INFLUENCE OF GROWTH AND DEVELOPMENT OF VEGETABLES

The plant height, number of branches, number of leaves per plant, intermodal length, leaf area and leaf area index were influenced in shade net house due to favourable environment conditions. Studies conducted by Precision Farming Development Centre, Bangalore (Anonymous, 2014) on different colours of shade net recommended that for cultivation of Bombi (red) and Orabella (yellow) coloured capsicum varieties under white coloured shade net, 75% shade factor gave higher yields of (77 & 81 t/ha respectively) during the summer months with drip irrigation as compared to black and green colour shade nets in Bangalore region. (Ramana Rao et.al. 2013) found out that the under 50% shade factor, white coloured shade net the capsicum crop yield was increased by 80 per cent over open field cultivation along with water saving of about 40 per cent. Studies also conducted on different colours (red, white, black and green coloured monofilament nets) and shade factors (35, 50 and 75%) at this centre on tomato crop. The findings of the study includes in green colour shade net (35 % SF) highest UV radiation (0.96 mw/cm^2), light intensity (76843 lux) and air temperature (25.7°c) were observed. And in black colour shade net (75% SF) exhibited the lowest UV radiation (0.34 mw/cm^2), light intensity (29170 lux) and air temperature (22.1°c), where as in red coloured shade net (50% SF) higher yields of 9, 15 and 45% as compared to white, black and green shade nets respectively was obtained for the same shade factor. Among the different shade factors of red coloured net houses, 50% shade factor gave highest tomato yield of 72.7 t/ha, followed by 75% shade factor net (68.79 t/ha) and 35% shade factor net (65.85 t/ha). Patil and Bhagat (2014) conducted a field experiment at Instructional farm of department of Irrigation and Drainage Engineering, Mahatma Phule Krishi Vidyapitha, Rahuri to study the yield response of cucumber grown under shade net house to 35%, 50% and 75% shading and in open field condition. Irrespective of nutrient sources applied, the performance of crop grown inside the shade net was comparatively better than open field condition.

IV. FRUIT YIELD

Bell pepper yields depend on the total number of fruits and fruit size. The number of fruits produced declined with increasing shade level. Thus, increased total fruit yield under moderate shading was caused by increased fruit size. Red and pearl shade-nets significantly increased the total yield by 30% which was associated with both higher productivity per plant and larger fruits. The major response to the photo selective filtration was the production of more fruits per plant, with essentially no reduction of fruit size or quality. Increased fruit size was likely the result of reduced transpiration and improved plant water status and net photosynthesis under shaded conditions.

Shahak 2008 reported that the production of three cultivars of bell pepper increased by 16% to 32% under pearl and red compared with black netting. With roughly 50% shade, commercial production was greater than in full sunlight, although less than with 26% (Rylski, Spigelman, 1986). Shade can increase total and marketable yields of pepper grown in the open field in hot climates, but shade is far more deleterious in a cool and cloudy environment. These studies suggest that shade is more beneficial under high compared with low sunlight intensity on both a daily and a seasonal basis. Tomato plants grown in Egypt fewer than 30% to 40% shade nets over the entire season produced more fruit, thereby giving a higher yield than from plants grown without shade (Abdel Mawgoud et al., 1996).

V. CONCLUSION

The experimental investigations reviewed indicated that the colour and shade factor of shade nets has propounding affect on the vegetable crop production. However, the studies conducted at different locations across the globe concluded the application of particular colour net for a selected crop for a particular purpose. This also varied with the shade factor. It is therefore, wide spread location specific research is need to optimize the photo selective net colour and its shade factor for gaining additional benefits from a particular crop.

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Phytoremediation of Water and Soil, Heavy Metal and Other Contaminants in Excess Uptake by Plants, Effect and Plant Biologically Active Compounds or Active Chemical Constituents in Maintaining Human Health

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Abstract – Phytoremediation a green technology consists of process phytoextraction, rhizofiltration, phytostabilization, phytovolatifization, phytodegradation with increasing industrialization mining pesticides sewage disposal, heavy metal deposition and other contaminants are added in water and soil through human activities. These interfere with the metabolic functions of plants, inhibition phytosynthesis, respiration, crop yield, sometimes intracellular compartments of cell. Mining include crushing, grinding, washing, smelting. There are biologically active chemical constituents in plants. Catachins, Isoflavones, Isothiocyanate, Indoles, Caffeic acid, Apigenin, Lignins, Reveratrol etc which are helpful in certain diseases like arthritis, cancer, cardiovascular problems, acute respiratory damages etc.

Keywords: Phytoremediation, Rhizofiltration, Phytodegradation, Isoflavones, Arthritis, Green technology

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I. INTRODUCTION

Phytoremediation is a group of technologies that use plants to reduce, degrade or immobilize environmental toxins. Phytoextraction is also known as phytoaccumulation, phytoabsorption and phytosequestration. This process reduces soil metal concentration by cultivating plants with a high capacity for metal accumulation in shoots. Plants extract large concentrations of heavy metals into their roots, translocate the heavy metals to above ground shoots or leaves and produce large quantity of plant biomass that can be easily harvested.

Rhizofiltration technique is used in cleaning contaminated waste water or acid mine drainage by absorption or precipitation. Phytostabilization is phytoimmobilization, holding of contaminated soil and sediments in place of vegetation and to immobilize toxic contaminants in soils. It occurs through the sorption, precipitation, complexation or metal valance reduction. For example, grasses, sedges, forage and reeds. Phytovolatization involves the use of plants to take up contaminants from the soil transforming them into volatile form and transpiring them into the atmosphere. Eg. Selenium.

Phytodegradation, also known as phytotransformation, involves uptake, metabolization, degradation of contaminants within the plant or the degradation of contaminants in the soil sediments, sludges, groundwater or surface water by enzymes produced and released by the plant.

II. BRIEF DESCRIPTION

Phytoremedition is a new "green technology" by IJAAER (2017) Dumping of raw industrial waste and by sludge application to agricultural soils have contributed significantly to deterioration of land and water resources as is clear from changes in ecosystem processes (Jan et al 2017)

(**Hyperaccumulator or Hypertolerance** Some plants which grow on metalliferous soils have developed the ability to accumulate massive amount of indigenous metals in their tissues without exhibiting symptoms of toxicity are hyper accumulator or hypertolerance.)

(a) Active chemical constitution and application: Alkaloid Lignins,Indoles, Cafficacid, Catechine, Apigenin,Reveratrol Rosmaric acid flavanoide etc. helpful

tohuman health in treating arthritis, cancer and cardiovascular diseases etc.

(b) **Phytoremediation Plants :** Helianthus annus (Sunflower), Hibiscus moscheutos, spinach, Rye plant lycopersicum esculentum, Hydrilla, Cabbage plant, vetiver grass, Mustard etc.Water hyacinth(Eicchornia crassipes)

(c) **Application of Phytoremediation :** Helpful in cleaning water and soil and environment. Mining activities such as crushing, grinding, washing, smelting and all other processes used to extract and concentrate metals generate a large amount of waste rocks and tailings are often very unstable and make elements environmentally labile through normal biogeochemical pathways, to sink such as sediments, soils or biomass. The direct effect will be loss of cultivatd land, forest or grazing land and the overall loss of production. Establishment of vegetation cover can fulfill the objectives of stabilization pollution control, visual improvement and removal of threats to human beings. However adverse factors such as acidity nutrient deficiencies, toxic heavy metal ions and poor physical structure and their interaction with most mine tailings inhibit plant establishment and growth on the tailings. Evaluation of metal concentration in plants growing in contaminated sites can be used to get information about specific plant behavior in that environment, metal dispersion and mobility with reference to their biomass. Metal concentration in plants is a function not only of the total soil concentrations but depend also on the chemical speciation of metals in soil solutions and on the involvement of the metal in biological functions. Plant species found in metal polluted/contaminated soils are expected to take up metals and eventually accumulate them. Some plants phytostabilize heavy metals in the rhizosphere through root exudates immobilization whilst other species incorporate them into root tissues. Some plants also transfer metals to their above ground tissues, potentially allowing the oil to be decontaminated by harvesting the above ground parts. Therefore plant community established on mine waste could be useful to minimize the impact of mining, thus considering the diversity of plant responses in contaminated sites with different metals and toxicity levels, it is important to study the composition of plant community established on mine waste, which serve as a basic tool of mine remediation. More information about plant community that can grow on metal enriched soil is essential to determine their potential for mine reclamation/remediation and for biological exploration.

Heavy metals such as cd, cu, PB, Hg+, cr are major environmental pollutants particularly in areas with high anthropogenic pressure. Heavy metal accumulation in soils is of concern in agricultural production due to adverse effect on food safety and marketability, crop growth plant toxicity and environmental health of soil organisms. The influence of plants and their metabolic activities affects the geological and biological redistribution of heavy metals through pollution of air water and soil. Metal contamination has high impact and relevance to plants and consequently it affects the ecosystem, where the plants form an integral component. Plants growing in metal polluted sites exhibit altered metabolism and growth reduction, lower biomass production and metal accumulation. The current worldwide mine production of cu, cd, Pb, Hg+ is considerable (Pinto et all 2004.) Anthropogenic sources that contaminate soil and fly ash produced due to coal burning and corrosion of commercial waste products, which adds cr, cu, Pb, and galvanized metals primarily Zn into the environment. Oil burning contributes Fe Pb, Ni to the environment. Metal emission during transport of vehicles includes Ni and Zn from tires, Al from catalyst, cd and cu primarily from diesel engines and Ni and Zn from aerosol emissions. Lubricants which are anti-wear protestants for vehicles emit cd, cr, Hg+, Ni Pb and Zn particularly in case of inefficient engines. Hydrilla verticillata is a submerged rooted aquatic plant. Eicchornia crassipes (Water hyacinth)is also a aquatic macrophyte. Tomato, Mustard are soil and rooted plant.

III. RESEARCH OBJECTIVE

Research Objective of Phytoremediation technology is the use of plants to remediate selected contaminants in the contaminated soils, sludge ground water and waste water It has a number of different methods that can lead to contaminant degradation, removal of metals through accumulation dissipation and immobilization. A variety of plants have been identified which are capable of accumulating high concentrations of metals in their aerial parts and roots or stabilizing the metals in soils and thus restricting their translocation to the shoots and removing the metals from the soil through synthesis of volatile compound

Biologically active naturally occurring chemical compounds found in plants provide health benefits for human. They protect plant cells from environmental hazards such as pollution, stress, drought, UV exposure and pathogenic effect. Helps in protection of human health, when their dietary intake is significant.

Research Objective is to study the processes of Phytoremediation technique, to elucidate the physical, chemical, physiological and metabolic mechanisms of contaminated uptake, translocation, sequestration/ detoxification, partitioning and bioaccumulation in

phytoremediation plants, to demonstrate the plant based cleanup systems for heavy metals.

IV. RESEARCH APPROACH

Research Objective is the cleanup technology advancement and Phytoremediation processes along with the study of biologically active compounds of plants. Phytoremediation concept is based on well-known ability of plants and their associated rhizosphere to concentrate and/or degrade highly dilute contaminants. Critical components of rhizosphere, in addition to a variety of free living microorganisms include root exudates. These complex root secretions which feed the microorganisms by providing carbohydrates, also contained by providing carbohydrates also contain natural chelating agents (citric acid and other organic acids) that make the ions of both nutrients and contaminants more mobile in the soil. Root exudates may also include enzymes such as nitroreductase, dehallogenase and laccases. These enzymes have imp natural functions, but they may also degrade organic contaminants that contain nitro groups (eg., chlorinated hydrocarbons ,many pesticides). Plant roots and rhizsosphere microorganisms "sense" the immediate soil environment in which they are growing and have complex feedback mechanisms that permit them to adapt to changing conditions as they grow. In some plants growing in phosphorus-deficient soil the root exudates contain large amounts of citric acid, in an attempt to mobilize and make available for uptake any phosphorus compounds present. Some rhizosphere microorganism secretes plant hormones that 7increase root growth and thereby the secretion of root exudates that contain metabolites they use as an energy source. Large green plants have the capability of moving large amount of soil solution into the plant body through roots and evaporate by transpiration. Plants transpire water to move nutrients from soil solution to leaves and stems, where photosynthesis occurs and to cool the plant. During this process contaminants present in soil water are also taken up and sequestered metabolized or vaporized out of the leaves along with the transpired water. However, some plants are poor at water conservation usually because they normally grow in moist environments.

When we grow selected adapted plants in contaminated substrates, the root system is highly dispersed, fibrous uptake system. Contaminants over a large range of concentrations are taken up along with the water and degraded metabolized and/sequestered in the plant body, while evapotranspiration from aerial parts maximizes the movement of soil solution or wastewater through the plant. Through the process of bioaccumulation, contaminants can be concentrated thousands of times higher in plant than in the soil or wastewater. The contaminated plant biomass can be digested or ashed to reduce its volume 95%and the resulting small volume of material can be processed as an "ore" to recover the contaminant (eg., valuable heavy metals, radionuclides).

The present study deals with the phytoremediation processes, phytoremediator plants, hyperaccumulators and various processes of phytoremediation including transpiration by plants, here roots play an important part in passive uptake via micropores in the root cell walls where sequestration and degradation takes place. Study includes contaminant uptake mechanisms, study of root physiology, morphology, uptake kinetics, translocation in root stem leaves, total contaminant removal. For this plant leaves and branches are collected from different heavy metal polluted sites, statistical analysis is done. Further research plan includes the use of more and more plants taken for phytoremediation processes and study of more and more active chemical constituents of plants.

V. RESEARCH GAP

Phytoremediation and Plant Biologically active compounds are very vast topics of unlimited resources of study Phytoremediation technology very much closed the research gap. Present study shows the processes of phytoremediation for cleaning the environment and Active chemical constituents of plants eg., lignin caffeic acid , alkaloids, tannins, spooning for maintaining human health. For this the collection of plant and its study is very important. It is the study of heavy metal uptake and translocation by plants and the contamination which creates pollution problem at different sites.

The present research aim is to clean the environment by this technique and study plant active chemical constituents for fighting of various diseases eg., cancer, arthritis, cardiovascular problems etc.

This technique is limited to surface area and depth occupied by roots. Slow growth and low biomass require a long time commitment. It is not possible to completely leaching of contaminants into the groundwater. Survival of plants is affected by contaminants. Slow pace, it requires long time. Data collection problem because it has unlimited resources. Besides this the present study has very large amount of benefits, it is cost effective low cost, ecofriiendly environmental friendly technique. The present research gives fruitful and useful results in future. Latest technologies in this research shows advancement in near future. Furthur researches along with applied aspects will show benefits to the whole world.

VI. MATERIAL AND METHOD

Collection of plants from different sites. Comparison with the control plant stock solution of Cr, Cd is prepared by K2Cr2O3 and CdCl2+H2O. Solution was prepared in 1000 ml of water. After 11 days on keeping in this solution wiped out with 0.01NHCl and washed with water, then statistical analysis is done Mean + SD. **For soil**: For this metal mine, contamination soil, leaves and twigs taken. For digestion acid oxidizing agent, HNO3, HClO4, Cu, Zn, Cd, and Pb are used.

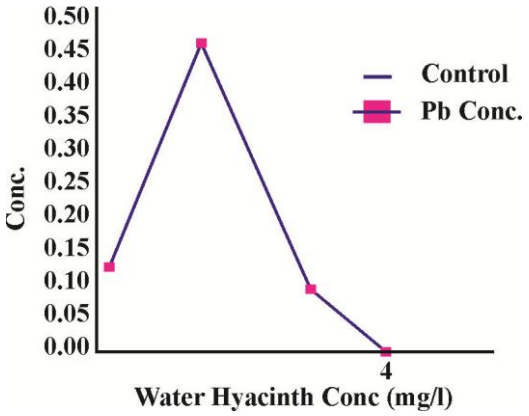
(a) Test for Alkaloids

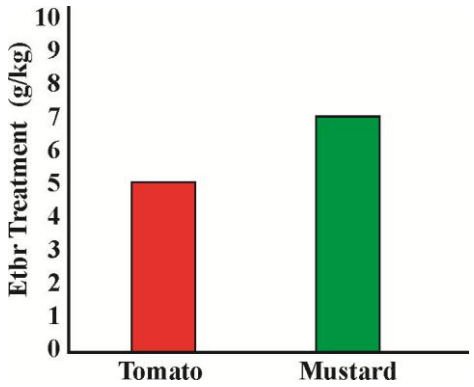
(i) Mayer's Test: Take few ml of plant sample extract, add mayer's reagent, white ppt occurs.

(ii) Saponin Test: Extract (50mg) is diluted with water and made upto 20ml. Suspension is shaken. The 2cm layer of foam indicates the presence of spooning.

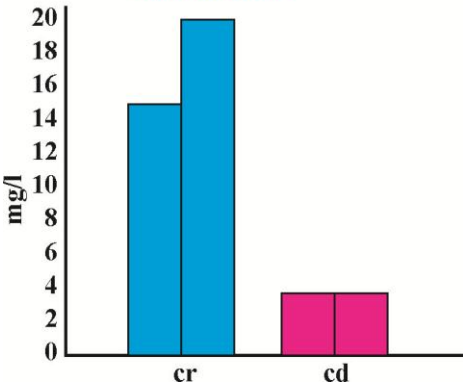
VII. RESULTS AND DISCUSSION

Heavy metals and contaminants present in water, soil due to industrialization, sewage disposal, and mining are hazardous and when plants collected from different sites shows uptake of contaminants at different conc. in roots, shoots and whole plant. In water plants shows removal of Cr, Cd, and in soil shows uptake and acts as phytoremediator. Different test shows the presence of biologically active chemical constituents of plants. **Tomato and Mustard: On treatment with etBr g/kg, mustard shows more uptake of etBr than tomato. (p< 0.05)**





Hydrilla plant



VIII. CONCLUSION

High contaminants and metal concentration increases water and soil acidity. Fast growing high biomass with improved metal uptake are effective for phytomediation. Cu, Zn, Ni, Pb, Cr, As, Cd shows toxicity.

IX. ACKNOWLEDGEMENT

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Phytoremediation of cadmium by mustard on March 23, 2017

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Mining of Microarray Databases for Categorizing the Genes for Various Diseases

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Abstract – Presently researchers show lot interest in microarray gene expression dataset. Recently huge library of biological information mining algorithm has been developed for the analytical evaluation of gene expression. Mining microarray gene expression is an imperative subject in bioinformatics in diagnosis of disease. This research paper analyzes how microarray data sets are used to predict the various diseases that spread through gene. The paper mainly focuses on prediction of heart disease, obesity and diabetes. These are the diseases that are deadly in nature.

Keywords: Data Mining, Microarray Gene, Bioinformatics

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I. INTRODUCTION

Data Mining is one of the most vital and motivating area of research with the objective of clinical diagnosis and prognosis requires efficient and fast classification techniques, which in turn requires a large amount of genetic data generation and analyzing these huge data. The large amount of genetic data generated is obtained using the microarray technique in which expression of thousands of genes is concurrently measured and we are in the need of an efficient data mining technique for these huge data.

In Bioinformatics, mining micro-array gene expression data is an imperative technique in the diagnosis of disease, drug development, genetic functional interpretation and gene metamorphisms etc. Recently biological information mining plays an

Key role in the disease predication. There are diverse types of disease predicated by microarray database mining using clustering techniques, namely Hepatitis, Lung Cancer, Liver disorder, Breast cancer, Thyroid disease, Obesity Diabetes etc.

A microarray is a massive collection of spots that contain massive amounts of compressed data. Researchers in the bioinformatics use microarray because DNA contains so much information on a micro-scale. Each spot of a microarray thus could contain a unique DNA sequence. So, it is extremely useful to reduce the dataset to those genes that are best distinguished between the two cases or classes (e.g. normal vs. diseased). Such analyses produce a list of genes whose expression is considered to transform and such genes are known as differentially expressed genes. Identification of differential gene expression is the first task of an in-depth microarray analysis. There are two common methods for in depth microarray data analysis, i.e. clustering and classification (Mutch et. al. 2001). Clustering is a unsupervised approach that classifies data into groups of genes or samples with similar patterns that are characteristic to the group. Classification is supervised learning and known as class prediction or discriminate analysis (Dinger et. al., 2012). Generally, classification is a process of learning-from-examples.

Given a set of pre-classified examples, the classifier learns to assign an unseen test case to one of the classes.

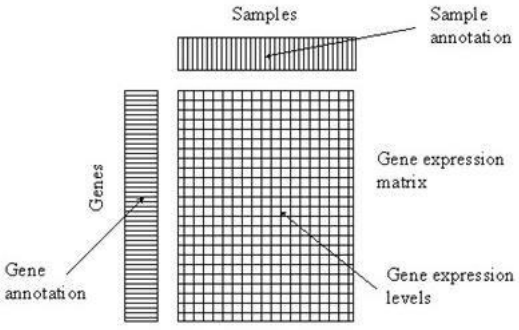

Fig. 1 a microarray

II. CHALLENGES FOR MICROARRAY DATA MINING

Analysis of microarrays presents many unique challenges for data mining. Typical data mining applications in domains like banking or web, have many records (thousands and sometimes millions), while the number of fields is much smaller (at most several hundred). In contrast, a typical microarray data analysis study may have only a small number of records (less than a hundred), while the number of fields, corresponding to the number of genes, is typically in thousands. Given the difficulty of collecting microarray samples, the number of samples is likely to remain small in many interesting cases.

However, having so many fields relative to so few samples creates a high likelihood of finding "false positives" that are due to chance – both in finding differentially expressed genes, and in building predictive models. We need especially robust methods to validate the models and assess their likelihood.

The main types of data analysis needed to for biomedical applications include:

(a) **Gene Selection –** in data mining terms this is a process of attribute selection, which finds the genes most strongly related to a particular class.

(b) **Classification –** classifying diseases or predicting outcomes based on gene expression patterns, and perhaps even identifying the best treatment for given genetic signature.

(c) **Clustering –** finding new biological classes or refining existing ones.

Attempts to find invariant or differential molecular behavior relevant to a given biological problem are also limited by the fact that in many cases little is known about the normal biological variation expected in a given tissue or biological state.

Their analysis applied to six mouse tissues resulted in several genes which showed significant biological variations even among identical mice and provides a valuable compendium of normal variation in gene expression for mouse models.

Another approach to determining variability in small samples is taken by S. Mukherjee, P. Sykacek, S. Roberts, and S. Gurr, who propose a gene-ranking algorithm using bootstrapped P-values. This approach is especially beneficial for considering small -sample variability in observed values of the test statistic. They show that this method outperforms widely used two-sample T-test on artificial data and apply the method to two real datasets.

Most of the current gene selection methods in use today evaluate each gene in isolation and ignore the gene to gene correlations. From a biological viewpoint, however, we are aware that groups of genes working together as pathway components and reflecting the states of the cell are the real atomic units, or features, by which we might be more likely to predict the character or type of a particular sample and its corresponding biological state. It is these patterns of coherent gene expression that must form the input data on which sophisticated computational methods should operate. In this context B. Hanczar, M. Courtine, A. Bennis, C. Hennegar, K. Clément, and J. Zucker suggest to increase the accuracy of microarray classification by selecting appropriate "prototype" genes that represent a group of genes that share a profile and better represent the phenotypic class of interest. They present interesting results of the advantages of using prototype-based feature selection to classify adenocarcinomas.

III. CARDIOVASCULAR DISEASE

Cardiovascular disease (CVD) is one of the leading causes of death in human life, and is influenced by both environmental and genetic factors. With the recent advances in micro array tools and technologies there is potential to predict and diagnose heart disease using micro array DNA data from analysis of blood cells. It is not a single disease but is a combination of many individual diseases as listed under the 9thRevision of the International Classification of Diseases (1975). It includes acute myocardial infarction and angina pectoris among others. It is a complex multi factorial process that involves lipid deposition on arteries of the heart, macrophages, blood pressure, and rheology of blood flow, smooth muscle proliferation, thermogenesis, platelet aggregation, insulin resistance and other factors. Every year, millions of deaths worldwide are attributed to cardiovascular diseases and more than half of them are found in developed countries.

Table 1

Results Obtained from IHDPS

Technique	Accuracy
NAVIE BAYES	86.55%
DECISION TREE	89%
KNN	85.53%

Chronic degenerative diseases such as cancer and cardiovascular disease have emerged as the major causes of death and hence, finding cost effective methods to control CVD is one of the challenges for public health in day today life the risk factors for CVD had been documented and among the more

established ones are: family history (genetic factors), plasma lipid, lipoprotein, plasma lipoprotein (a), diet, gender, elevated blood pressure, physical inactivity etc. (Heng, 1999).

IV. DIABETES MELLITUS

Insulin is one of the most important hormones in the body. It aids the body in converting sugar, starches and other food items into the energy needed for daily life. However, if the body does not produce or properly use insulin, the redundant amount of sugar will be driven out by urination. This disease referred to diabetes. Diabetes is a chronic disease that is associated with considerable morbidity and mortality. Molecular Biology research involves in this area through the development of the technologies used for carrying them out. DNA Microarray is one such technology which enables the researchers to investigate and address issues which were once thought to be non-traceable

(a) Related Work for Prediction of Diabetes Mellitus Microarray techniques using cDNAs are much high throughput approaches for large scale gene expression analysis and enable the investigation of mechanisms of fundamental processes and the molecular basis of disease on a genomic scale. Several clustering techniques have been used to analyze the microarray data. As gene chips become more routine in basic research, it is important for biologists to understand the biostatistical methods used to analyze these data so that they can better interpret the biological meaning of the results. Strategies for analyzing gene chip data can be broadly grouped into two categories: Discrimination and clustering. Discrimination requires that the data consist of two components. The first is the gene expression measurements from the chips run on a set of samples. The second component is data characterizing. For this method, the goal is to use a mathematical model to predict a sample characteristic, from the expression values. There are a large number of statistical and computational approaches for discrimination ranging from classical statistical linear discriminate analysis to modern machine learning approaches and Pattern recognition

In clustering, the data consists only of the gene expression values. The analytical goal is to find clusters of samples or clusters of genes such that observations within a cluster are more similar to each other than to observations in different clusters. Cluster analysis can be viewed as a data reduction method in that the observations in a cluster can be represented by an 'average' of the observations in that cluster. There are a large number of statistical and computational approaches available for clustering. These include hierarchical clustering and k-means clustering for the analyze the clusters of genes expression.

In hierarchical clustering, individuals are successively integrated based on the dissimilarity matrix computed by data, to obtain a dendrogram which contains inclusive clusters. In the context of microarray analysis, it is used to classify unknown genes or cases of disease. Several different algorithms will produce a hierarchical clustering from a pair-wise distance matrix. The algorithms begin with each gene by itself a separate c luster. These clusters correspond to the tips of the clustering tree (dendrogrm). The algorithms search the distance matrix for the pair of genes that have the smallest distance between them and merge these two genes into a cluster. Many algorithms follow this series of steps to produce hierarchical clustering of data. Average linkage is one of many hierarchical clustering algorithms that operate by iteratively merging the genes or gene clusters with the smallest distance between them followed by an updating of the distance matrix.

An overview of the literary review, hierarchical clustering of microarray data, emphasizing the relationship between a dendrogram and spatial representations of genes. Consideration of this relationship provides an intuitive understanding of how to analyze microarray data and can make it is easier to interpret the results of a cluster analysis in a **biological framework. The fact that the 'heat maps'** found in most of the microarray publications are based on hierarchical clustering indicates that an understanding of this general method is valuable to those who are just beginning to read the microarray literature and even to those who are using supervised methods

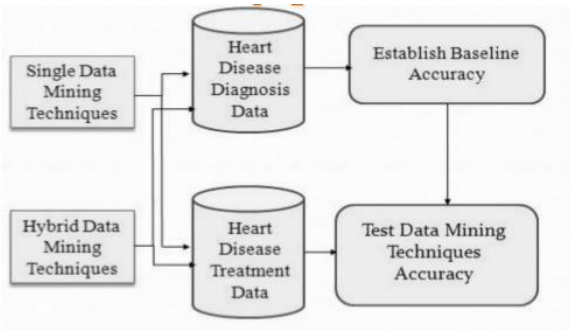

Fig. 2 Data Mining

V. CONCLUSION

Microarrays are a new technology revolutionary in nature. This technology has great potential to provide medical diagnostics with a great degree of accuracy.

Microarrays assist to find the right treatment and cure for several diseases and provide a detailed genome-wide molecular portrait of cellular states. This paper contains a description of second generation methodologies and techniques that are being used or are presently under the phase of development. As it can be seen from the results, they are very promising and extend the possibilities of applying computational analysis and data mining to aid research in biology and medicinal science. We have underlined to emphasize the large potential payoff of these analytical efforts and pointed out the huge challenges ahead as well.

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Fibre Optic Probe for Measurement of Local Hydrodynamic Parameters of Trickle Bed Reactor

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Abstract – Trickle bed reactors are widely used in chemical industries. Trickle bed reactor implies a reactor in which a liquid phase and a gas phase flow counter currently or co-currently downward or upward through a fixed bed of catalyst particles while reaction takes place. These reactors are widely used in chemical industries like petrochemicals, pharmaceuticals etc. A lot of research has been done to measure their average hydrodynamic parameters but there is very less development in the field of measurement of local hydrodynamic parameters, which is very important to understand what is really happening inside the reactor and to design it more efficiently. Investigations are aimed at developing an optical fibre probe setup which may measure the local hydrodynamic parameters of these reactors.

Keywords- Trichel bed reactor, Optical fiber probe, Hydrodynamic parameters, gas hold up, bubble frequency

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I. INTRODUCTION

A light reflection probe detects the light reflected at probe tip or in phase around the probe tip. Optical fibre probe is made from optical fibre, a part of cladding is peeled off and fibre is bent to make a U shaped tip probe. This tip is inserted into the reactor to measure hydrodynamic parameters. From one side of fibre light is made to enter. It is then totally internally reflected multiple times, until it reaches the probe tip. From tip light is reflected back or is refracted on the basis whether gas or liquid respectively is present around the tip. Then the reflected light again undergoes through multiple TIR and is then received at the other end of the fibre.

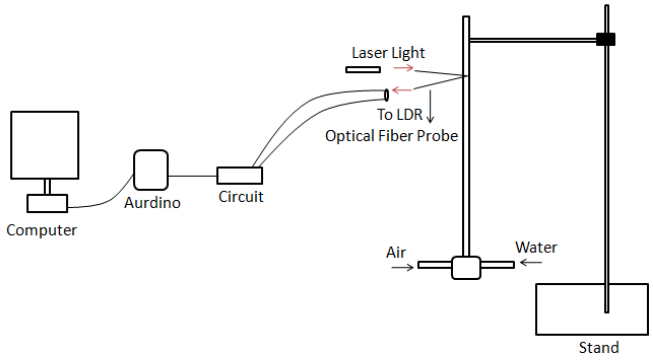

Fig. 1: Line Diagram of Setup for Analysis of Optical Fibre Probe

The experimental setup was made with a 1 meter long and 4.5 mm internal diameter capillary, and water & air inlets were provided at the bottom. The setup was operated in co-current up-flow and continuous mode, using air as gas phase and water as liquid phase. Water and air together entered the capillary at the bottom and were discharged to drain from top which is open to atmosphere. Figure 1 shows the line diagram for the Experimental Set up constructed for investigation.

II. MEASUREMENTS

For measuring the hydrodynamics of the system, optical probe technique is adopted. Two probes were inserted into the capillary at a distance of 4.7 cm from each other. One end of fibre probe is attached to laser and other end to LDR which is connected to the electronic unit.

Graphs obtained were saved in computer for analysis. Camera was used for video recording the experiments.

Fig. 2: picture showing slug flow regime in capillary at a liquid glow rate of 2LPH and gas flow rate of 0.5 LPH

III. RESULTS

Many readings were taken for different air and water flow rates and video were also made for the same experiment simultaneously. Both were compared and it was seen that the peak was obtained at the same time when bubbles cross the probe and depths were obtained when liquid flows through the probe. Local velocity, gas holdup, bubble frequency etc. were calculated with the use of those graphs. So it can be concluded that optical fibre probe works efficiently for the given experimental conditions. Figure 3 shows the graphs obtained for 2.5 LPH Liquid flow rate and 20 LPH air flow rate.

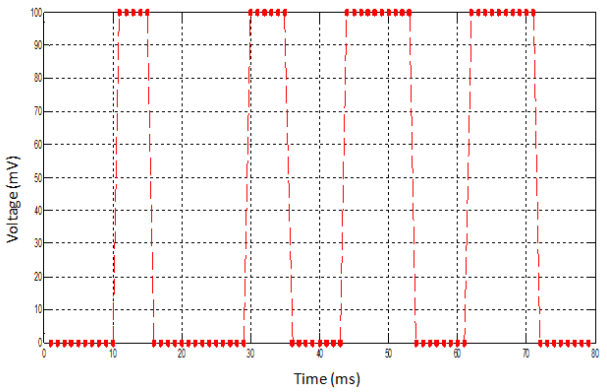

Fig. 3: Graph obtained between voltage signal and time for 2.5 LPH liquid flow rate and 20 LPH air flow rate

IV. CONCLUSION

We saw that there is a difference in voltage signal when probe faces bubbles and when it faces liquid. Hence this probe has been positively used to detect slug bubbles in capillary setup and calculate various hydrodynamic parameters like bubble velocity, bubble frequency and gas hold up. When probe was incorporated in trickle bed reactor it also showed difference in voltage signal but was not able to capture them efficiently so no germane inference could be made. An optical fibre probe with more sophisticated electronic unit may have the potential to measure local hydrodynamic parameters of trickle bed reactor and hence it offers scope for future work.

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Design and Performance Analysis of Integrated Solar Heat and Wind Power Plant

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Abstract – In the recent trends in application of renewable energy sources, integrated solar chimney wind power plant has been designed with different geometrical parameter for increase the accessibility of solar and wind energy due to increasing the rate of environmental pollution and lake of non- renewable energy resources. A solar chimney wind power plant (SCWPP) is a type of solar thermal system that use the thermal energy generated by solar and convert it into the electrical energy. In the recent few years there are many researcher have exposed strongest attention for exploration the performances of solar chimney wind power plant due to its economic, environmental and huge potential application. There are different geometrical parameters and operating conditions like chimney height, collector radius, throat radius, solar radiation, wind velocity, solar absorption coefficient, solar loss coefficient, chimney shapes which are play vital role for optimize the performances of solar chimney wind power plant. In this numerical investigation a computational model of Manzanares pilot solar chimney win power plant, Spain has been created with help of commercially availableness 14.5 software. The temperature, velocity, pressure and vector distribution were plotted and evaluated for examine the influence of chimney height, collector radius, throat radius, solar radiation, solar absorption coefficient, solar loss coefficient, and collector percentage and fraction factor on the performance of solar chimney wind power plant when other parameters are constant. The obtained result is illustrated that, the power of SCWPP has enhances as increases the chimney height, collector radius, collector percentage and solar absorption coefficient but throat radius and solar loss coefficient it gives inversely effect on the power. It has been also illustrated that the throat radius gives more effect on the power of SCWPP while the effect of collector percentage on power negligible. This study is also suggested a solar chimney wind power plant at chimney height 24.4 m with collector radius 38. 92 m and throat radius 0.7m,collector absorption coefficient 0.66 and collector loss coefficient 15it gives approximately 5.4 KW power output at Indian operating conditions means ambient temperature should be 303.15 K and solar radiation is 1000W/m2. From the study it can also revealed that for further improvement in power increase the solar absorption coefficient and reduce the solar loss coefficient in same working condition.

Index Terms— Renewable energy sources, SCWPP, Wind Power plant, Solar chimney, Electrical energy.

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I. INTRODUCTION

With the decrease of fossil fuel resources and increasing worldwide pollution problems, there is a growing need for an environmentally friendly renewable energy source.

It is vital that the utilization of this energy source be economically viable, especially for its possible use in third world countries. Engineers and scientists are increasingly looking to solar energy as a potential answer to this problem.

Man has already tried to harness energy from the sun in various different ways. These include parabolic trough solar power plant, Central Receiver power plants, Dish-Stirling systems, solar pond power plants and Photovoltaic power plant.

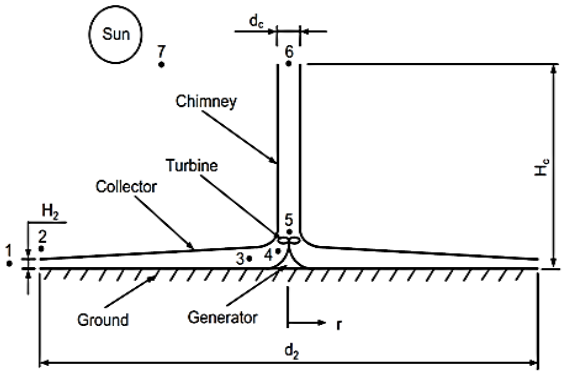


Fig. 1Schematic illustration of a solar tower power plant

Since the 1970's, the development of solar tower power plant have been investigated and have since become a good prospect for large scale energy generation. The solar tower power plant consists of a translucent collector (located a few meters above ground level) with a central tower which houses a turbo-generator at its base, as shown schematically in fig. 1.1

The operation of such a solar power plant is relatively simple. Solar radiation heats the ground beneath a clear glass collector. Underneath the collector, the heated ground heats the air, causing the air to rise. The warm air is trapped under the collector but rises through the central tower, driving the turbine and consequently generating electricity.

Solar tower power plants have some advantage over the above mentioned power generation schemes, such as the Parabolic Trough and Central Receiver solar power plants. These include the use of both beam and diffuse radiation, while energy is stored naturally in the ground during the day is released at nighttime, thus producing electricity over a twenty –four hour period. Solar tower makes use of simple technologies, are built from low cost materials and have no water requirements.

II. LITERATURE REVIEW

Solar energy has important role in aspects of accessibility of resources and diversity of energy conversion. Renewable energy are none as the best option for solving the energy shortage and CO2 emissions trouble due to increase the rate of environmental pollution and control on fossil fuel resources , the use of sustainable energies seem to be inevitable and absolute need for the world. Solar chimney wind power plant is best option for utilize the renewable energy resources so it is important factor to analysis the behaviour of the SCWPP in different running parameter. There are many investigator have done the experiments for optimize the performances of solar chimney wind power plant.

Some of the important paper related to analysis of solar chimney wind power plant have been reviewed and discuss here.

A.Asnaghi et al.[1] in their report a solar chimney power plant (SCPP) is proposed to be built as the first national SCPP in central regions of Iran. Studies of DLR MED-CSP project show that Iran can be a part of the Mediterranean solar power generation chain in 2050 to provide electrical power demand of Europe.

Fei Cao et al.[2] studied the solar chimney power plant (SCPP that it is a promising technology for the large-scale utilization of solar energy. Due to the significant difference of weather conditions, the performance of SCPPs varies from one place to another, and thus specific design work is required for different regions.

Wei Chen et al. [3] in their paper, the chimney is assembled with porous absorber for the indirect-mode solar dryer. Local thermal non-equilibrium (LTNE) exists in the porous absorber, so the double energy equations and Brinkman-Forchheimer extended Darcy model are employed to analyze the heat transfer and flow in the solar porous absorber, and the k-ε turbulent model coupled with the above equations are also used to investigate the influences of the porous absorber inclination and the height of drying system on the heat transfer in the solar dryer.

Y.J. Dai et al. [4] analyzed a solar chimney power plant, which is expected to provide electric power for remote villages in northwestern China, in this paper. The solar power plant chimney, in which the height and diameter of the chimney are 200 m and 10 m, respectively, and the diameter of the solar collector cover is 500 m, is able to produce 110~190kW electric power on a monthly average all year.

Saeed Dehghani et al.[5]In their communication, a multi-objective optimization method is implemented using evolutionary algorithm techniques in order to determine optimum configuration of solar chimney power plant. Power output of the system is maximizing while capital cost of the component in minimized. The result shows that, power output of the plant increases linearly when solar irradiation increases and increase in ambient temperature causes slight decrease in power output of the plant.

F. Denantes al.[6]developed an efficiency model at design performance for counter-rotating turbine and validated. Based on the efficiency equation, an off-design performance model for counter-rotating turbines is developed. Combined with a thermodynamic model for a solar chimney system and a solar radiation model, annual energy output of solar chimney systems is determined. Based on the output torque versus power for various turbine layouts, advantageous operational conditions of counter-rotating turbines are demonstrated.

Hermann F. Fasel et al. [7] in their study investigated solar chimney power plants numerically using ANSYS Fluent and an-in house developed Computational Fluid Dynamics (CFD) code. Analytical scaling laws are verified by considering a large range of scales with tower heights between 1 m (sub-scale laboratory model) and 1000 m (largest envisioned plant). A model with approximately 6 m tower height is currently under construction at the University of Arizona. The flow inside the chimney is fully turbulent.

D.G.Kroger et al. [8] studied that several cost models for large-scale solar chimney power plants are available in the literature. However, the results presented vary significantly, even in cases where the input parameters and the used models are supposedly very similar. The main objective of this paper is to clarify this matter by comparing previous cost models to a newly developed alternative model. It is also shown that carbon credits significantly reduce the levelised electricity cost for such a plant.

Mehran Ghalamchi et al. [9] A solar chimney pilot power plant with 3 m collector diameter and 2 m chimney height was designed and constructed in university of Tehran, Iran. The report shows that reducing the inlet size has a positive effect on the solar chimney power production performance. The maximum air velocity of 1.3m/s was recorded inside the chimney. While the collector entrance velocity was around zero.

Ehsan Gholamalizadeh et al.[10]In their study developed a triple-objective design method for a solar chimney power plant system that simultaneously optimizes the expenditure, total efficiency, and power output. This paper provides a very useful design and optimization methodology for solar chimney power plant systems.

Ehsan Gholamalizadeh et al.[11] in their study underline the importance of the greenhouse effect on the buoyancy-driven flow and heat transfer characteristics through the system. The analysis showed that simulating the greenhouse effect has an important role to accurately predict the characteristics of the flow and heat transfer in solar chimney power plant systems.

BabakGhorbani et al.[12]in their study presented an improved concept design to increase the thermal efficiency of the rankine cycle of a typical steam power plant by combining a solar chimney and a dry cooling tower. Calculation have been iterated for different angle of chimney walls, slopes of collectors and the base ground to find their effects on the output power. A range of 360 kW to more than 4.4 MW power is captured by the wind turbine by changing the hybrid tower geometrical parameters. Obtained results reveal a maximum of0.538% increases for the thermal efficiency of the fossil fuel power plant.

Penghua Guo et al.[13]observed that in a solar chimney power plant, only a fraction of the available total pressure difference can be used to run the turbine to generate electric power. The optimal ratio of the turbine pressure drop to available total pressure difference in a solar chimney system is investigated using theoretical analysis and 3D numerical simulations. The values found in the literature for the optimal ratio vary between 2/3 and 0.97. This study may be useful for the preliminary estimation of power plant performance and the power-regulating strategy option for solar chimney turbines.

Peng-Hua Guo et al. [14] a three-dimensional numerical approach incorporating the radiation, solar load, and turbine models proposed in this paper was first verified by the experimental data of the Spanish prototype. The power output of the SCPP within the common diurnal temperature range was also found to be insensitive to ambient temperature.

Mohammad O. Hamdan [15] his work presents a mathematical thermal model for steady state airflow inside a solar chimney power plant using modified Bernoulli equation with buoyancy effect and ideal gas equation. The results show that the chimney height, the collector radius, the solar irradiance, and the turbine head are essential parameters for the design of solar chimney. The maximum power generation depends on the turbine head and the relation is not monotonic.

Atit Koonsrisuk et al.[16] in their study compared the prediction of performance of solar chimney plants by using five simple theoretical models that have been proposed in the literature. The power out and the efficiency of the solar chimney plants as functions of the studied parameters were used to compare relative merits of the five theoretical models. Models that performed better than the rest are finally recommended.

Atit Koonsrisuk et al. [17] in their study, a solar collector, chimney and turbine are modeled together theoretically, and the iteration techniques are carried out to solve the resulting mathematical model. Results are validated by measurements from an actual physical plant. Furthermore, it is shown that the optimum ratio between the turbine extraction pressure and the available driving pressure for the proposed plant is approximately 0.84. a simple method to evaluate the turbine power output for solar chimney systems is also proposed in the study using dimensional analysis.

Atit Koonsrisuk [18] in his present paper the performance of solar chimney power plants based on

second law analysis is investigated for various configurations. A comparison is made between the conventional solar chimney power plant (CSCPP) and the sloped solar chimney power plant (SCSPP). The results obtained here are expected to provide information that will assist in improving the overall efficiency of the solar chimney power plant.

Haorong Li et al.[19] in his work studied that Buildings represent nearly 40 percent of total energy use in the U.S. and about 50 percent of this energy is used for heating, ventilating, and cooling the space. Conventional heating and cooling systems are having a great impact on security of energy supply and greenhouse gas emissions. Unlike conventional approach, this paper investigates an innovative passive air conditioning system coupling earth-to-air heat exchangers (EAHEs) with solar collector enhanced solar chimneys. The cooling capacities reached their peak during the day time when the solar radiation intensity as strong. The results show that the coupled system can maintain the indoor thermal environmental comfort conditions at a favorable range that complies with ASHRAE standard for thermal comfort. The findings in this research provide the foundation for design and application of the coupled system.

Jing-Yin Li et al.[20] proposed acomprehensive theoretical model is for the performance evaluation of a solar chimney power plant (SCPP), and has been verified by the experimental data of the Spanish prototype.

Weibing Li et al.[21]their paper develops a model different from existing models to analyze the cost and benefit of a reinforced concrete solar chimney power plant (RCSCPP) built in northwest china. Based on the model and some assumptions for values of parameters, this work calculates total net present value (TNPV) and the minimum electricity price in each phase by dividing the whole service period into four phases.

C.B. Maia et al. [22] found that Sustainable development is closely associated with the use of renewable energy resources. In order to achieve a viable development, from an environmental point of view, the energy efficiencies of processes can be increased using renewable energy resources.

ChiemekaOnyekaOkoye et al. [23] his present work investigates the feasibility of installing a solar chimney power plant (SCPP) under north Cyprus (NC) condition. The method utilized for the simulation of electricity production was compared and verified by the experimental recording of the prototype in Manzanares, Spain, before carrying out performance predictions for different plant sizes, collector diameter and chimney heights. The results showed that SCPP investment cost, capacity of the plant and chimney height are critical in assessing the project viability.

Sandeep K. Patel et al. [24] their present work is aimed at optimizing the geometry of the major components of the SCPP using a computational fluid dynamics (CFD) software ANSYS-CFX to study and improve the flow characteristics inside the SCPP. The overall chimney height and the collector diameter of the SCPP were kept constant at 10 m and 8 m respectively. The temperature inside the collector is higher for the lower opening resulting in a higher flow rate and power.

RoozbehSangi [25] in his study evaluate the performance of solar chimney power plants in some parts of Iran theoretically and to estimate the quantity of the produce electric energy the solar chimney power plantis a simple solar thermal power plant that is capable of converting solar energy into thermal energy in the solar collector. The solar chimney power plant with 350m chimney height and 1000m collector diameter is capable of producing monthly average 1-2MW electric power over a year.

Ming Tingzhen et al.[26] have carried out Numerical simulations on the solar chimney power plant system coupled with turbine. The whole system has been divided into three regions: the collector, the chimney and the turbine, and the mathematical models of heat transfer and flow have been set up for these regions. Using the Spanish prototype as a practical example, numerical simulation results for the prototype with a 3 blade turbine show that the maximum power output of the system is a little higher than 50kW.

Xinping Zhou et al. [28] in their study the maximum chimney height for convection avoiding negative buoyancy at the latter chimney and the optimal chimney height for maximum power output are presented and analyzed using a theoretical model validated with the measurements of the only one prototype in Manzanares. Current in a solar chimney power plant that drives turbine generators to generate electricity is driven by buoyancy resulting from higher temperature than the surroundings at different heights. The result based on Manzanares prototype show that as standard lapse rate of atmospheric temperature is used, the maximum power output of 102.2kW is obtained for the optimal chimney height of 615m, which is lower than the maximum chimney height with a power output of 92.3kW. Sensitivity analyses are also performed to examine the influence of various lapse rates of atmospheric temperatures and collector radii on maximum height of chimney. The result shows that the maximum height gradually increases with the lapse rate increasing and go to infinity at a value of around 0.0098K m-1 and that the maximum height for convection and optimal height for maximum power output increase with large collector radius.

III. COMPUTATIONAL FLUID DYNAMICS (CFD)

Computational fluid dynamics (CFD) is a computer based simulation method for analyzing fluid flow, heat transfer, and related phenomena such as chemical reactions. This project uses CFD for analysis of flow and heat transfer. Some examples of application areas are: aerodynamic lift and drag (i.e. airplanes or windmill wings), power plant combustion, chemical processes, heating/ventilation, and even biomedical engineering (simulating blood flow through arteries and veins). CFD analyses carried out in the various industries are used in R&D and manufacture of aircraft, combustion engines, as well as many other industrial products.

It can be advantageous to use CFD over traditional experimental based analyses, since experiments have a cost directly proportional to the number of configurations desired for testing, unlike with CFD, where large amounts of results can be produced at practically no added expense. In this way, parametric studies to optimise equipment are very inexpensive with CFD when compared to experiments.

The work for this project was carried out on a HP Pavilion laptop with dual processors totaling 2 GHz RAM, running on Linux Operating System downloaded free from Caelinux. The download from Caelinux included open-source software Salomé for geometry construction and meshing, Open FOAM for the CFD calculations, preview for visualization of results, along with other useful scientific and mathematics related software. Calculations for this project were carried out for approximately 50,000 cells (CFD calculations are often made for 12 million cells – or more). On my system, the steady state solvers took between 13 hours to finish calculations, while the transient simulation took 23 days running in parallel on both processors.

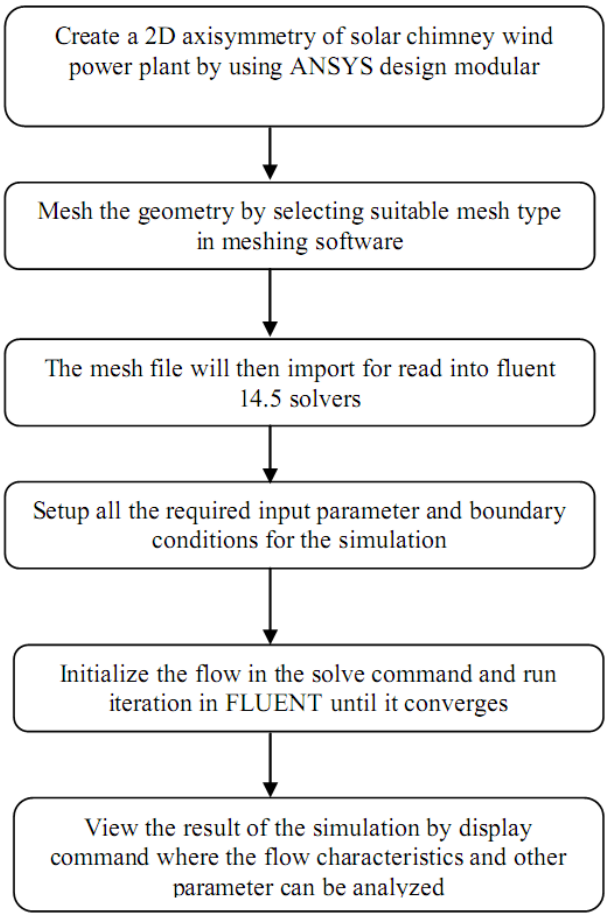
One of the purposes of this project is to use all open source CFD software instead of commercial software for the simulations. This type of software is advantageous for smaller companies to use, as the cost of commercial CFD package licenses can be prohibitive

IV. METHODOLOGY

(a) Algorithm - Basic Steps Corporate for the Investigation are tabulated at Table 1

Table 1

Block diagram of procedure



(b) CFD Analysis of solar chimney wind power plant by using Ansys Fluent:

2D axisymmetry model of solar chimney wind power plant new generated by using Ansys Design modeler. The solar chimney and the solar air collector were modeled for CFD Analysis. The model was created on the x-y plane on 2D axisymmetry. The overall height of the SCWPP was 194.6m and the solar air collector was 122 m in radius and chimney radius is 5.08m.

Generation of the model of solar chimney wind power plant was done at different chimney height 194.6, 400, 600, 800, 1000 (m) respectively at constant collector radius 122 m and chimney radius 5.08 m. Two samples are shown at fig 1 and 2.

The model of solar chimney wind power plant at different collector radius 122,150,200 (m), at constant

chimney height 194.6 m and chimney radius 5.08 m were generated Samples shown at fig 3 & 4.

Generation of the model of solar chimney wind power plant at different throat radius, 4.75, 4.5, 4(m) at constant chimney height 194.6 m and collector radius 122 m was done and analysed Samples are shown at fig 5 & 6.

The model of solar chimney wind power plant was generated at different R.F, 0.18, 0.20, 0.25. Samples are shown at fig 9 and 10.

The meshing of solar chimney wind power plant at different chimney height was analysed at 194.6, 400, 600, 800, 1000 (m). At constant collector radius 122 m and chimney radius 5.08 m. Samples are shown at fig 9 & 10.

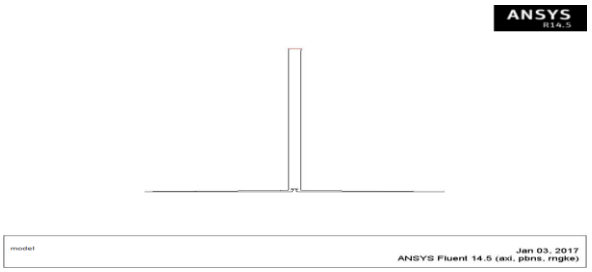


Fig.1 Chimney hight at 194.6 m

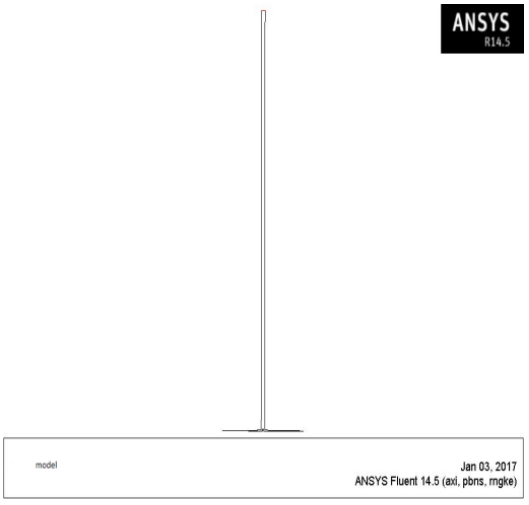


Fig.2 Chimney hight at 1000 m

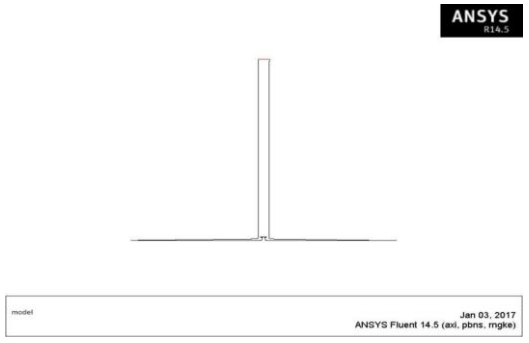


Fig 3. Collector radiuses at 122 m

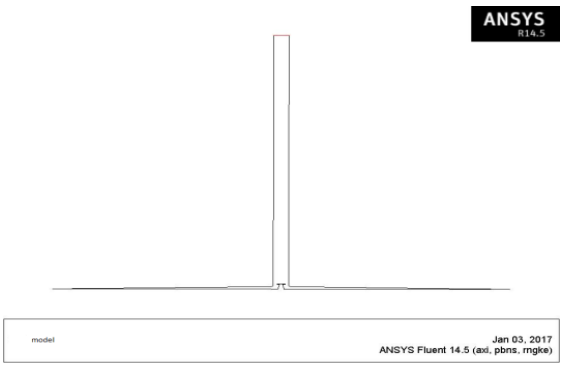


Fig. 4 Collector radius at 200 m

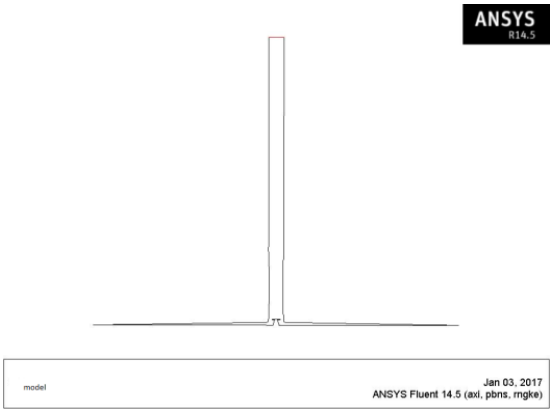


Fig. 5 Throat diameters at 4.75m

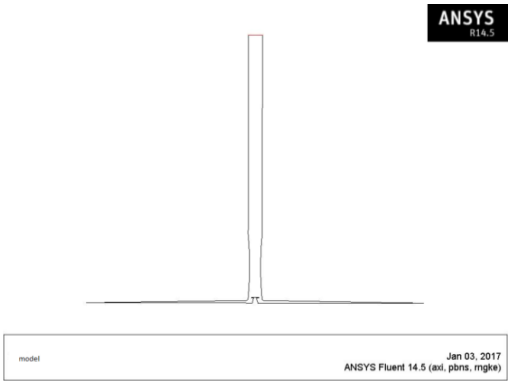


Fig. 6 Throat diameter at 4 m

Fig 7 at R.F= 0.18

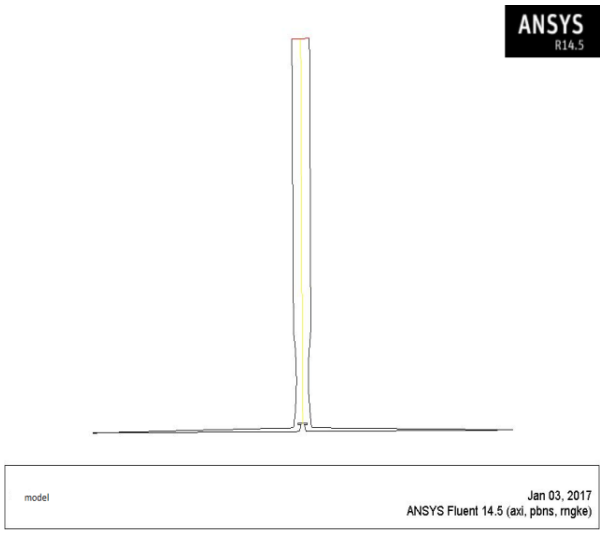


Fig. 8 at R.F= 0.25

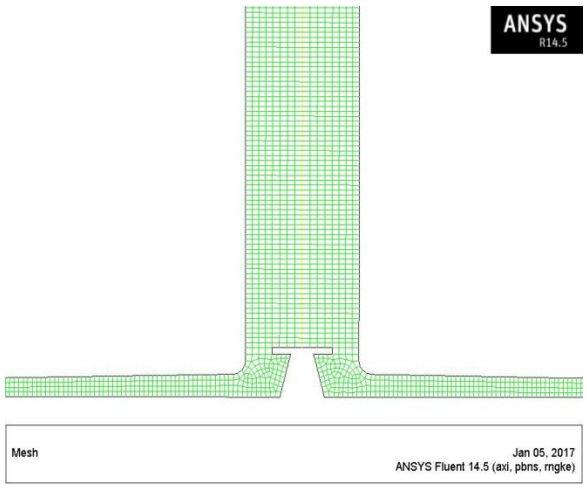


Fig.9 (b) Magnify view of Chimney height at 194.6 m

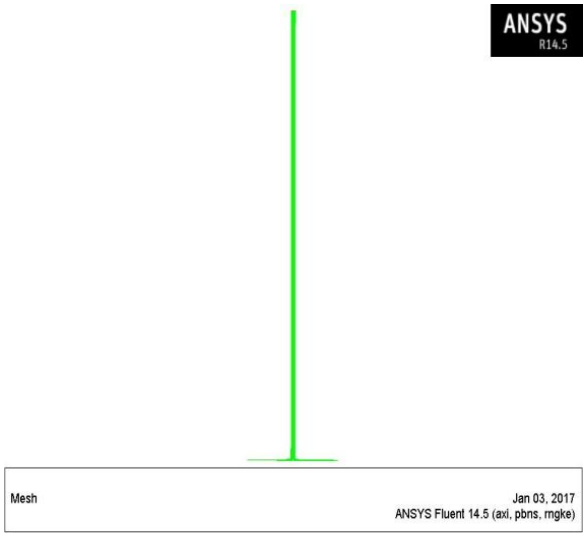


Fig 10 Chimney Height at 1000 m

5. PROBLEM SETUP IN FLUENT

(a) Problem Type: 2D axisymmetry

(b) Type of Solver: Pressure-based solver

(c) Physical model: Energy

1. Viscous-RNG k-e, standard wall function

(i) **Material Property**: Flowing fluid is air.

: Density of air= boussinesq: 1.225 kg /m3

: Specific heat: 1006.43j/kgK

: Thermal conductivity: .0242W/mK

: Viscosity: 1.7894e-05kg/ms

: Thermal expansion coefficient: .00331/k

(ii) Boundary condition:

(a) Boundary condition of existing SCWPP model with different chimney height, different collector radius, different collector percentage with respect to chimney height, different throat radius is same i.e.

Operating condition: pressure: 101325pa

: Temperature: 291.65k

Inlet: pressure inlet: gauge total pressure: 0 pa

: Turbulent intensity: 1%

: Hydraulic Dia.: .04

: Temperature: 291.65k

Outlet: Pressure outlet: Define the same outlet condition for all the fan outlet Gauge pressure = 0 Pa

: Turbulent intensity: 1%

: Hydraulic Dia.: 10.16

Axis: axis

Collector: wall: heat flux: 367.5 W/m2

Ground: wall-temp: 300.15 k

Boundary condition for Indian condition SCWPP model with optimize throat radius (3.5 m) at different solar radiation is

Operating condition: pressure: 101325pa

: Temperature: 303.15k

Inlet: pressure inlet: gauge total pressure: 0 pa

: Turbulent intensity: 1%

: Hydraulic Dia.: .04

: Temperature: 303.15

Outlet: Pressure outlet: Define the same outlet condition for all the fan outlet Gauge pressure = 0 Pa

: Turbulent intensity: 1%

: Hydraulic Dia.: 10.16

Axis: axis

Collector: wall: heat flux: 103.5, 235.5, 367.5, 499.5, 631.5 (W/m2) respectively

Ground: wall-temp: 311.65 k

Boundary condition of SCWPP at Indian condition with different fraction factor is:

Operating condition: pressure: 101325pa

: Temperature: 303.15k

Inlet: pressure inlet: gauge total pressure: 0 pa

: Turbulent intensity: 1%

: Hydraulic Dia.: .04

: Temperature: 303.15k

Outlet: Pressure outlet: Define the same outlet condition for all the fan outlet Gauge pressure = 0 Pa

: Turbulent intensity: 1%

: Hydraulic Dia.: 10.16

Axis: axis

Collector: wall: heat flux: 367.5 W/m2

Ground: wall-temp: 311.65 k

Boundary condition of SCWPP at Indian condition at fraction factor (.20) with different collector absorption coefficient (α) is.

Operating condition: pressure: 101325pa

: Temperature: 303.15k

Inlet: pressure inlet: gauge total pressure: 0 pa

: Turbulent intensity: 1%

: Hydraulic Dia.: .04

: Temperature: 303.15

Outlet: Pressure outlet: Define the same outlet condition for all the fan outlet Gauge pressure = 0 Pa

: Turbulent intensity: 1%

: Hydraulic Dia.: 10.16

Axis: axis

Collector: wall: heat flux: 367.5, 407.5, 457.5, 507.5(W/m2) respectively

Ground: wall-temp: 311.65 k

(b) Boundary condition of SCWPP at Indian condition at fraction factor (.20) with different collector loss coefficient (U)

Operating condition: pressure: 101325pa

: Temperature: 303.15k

Inlet: pressure inlet: gauge total pressure: 0 pa

: Turbulent intensity: 1%

: Hydraulic Dia.: .04

: Temperature: 303.15

Outlet: Pressure outlet: Define the same outlet condition for all the fan outlet Gauge pressure = 0 Pa

: Turbulent intensity: 1%

: Hydraulic Dia.: 10.16

Axis: axis

Collector: wall: heat flux: 367.5, 406.5, 445.5, 484.5(W/m2) respectively

Ground: wall-temp: 311.65 k

(iii) Solution:

Solution method: Pressure- velocity coupling – Scheme SIMPLE

: Pressure – Standard

: Momentum – Second order

: Turbulent Kinetic Energy (k) – First order

: Turbulent Dissipation Rate (e) - First order

: Energy: Second order

Solution Initialization: Initialized the solution to get the initial solution for the problem

Run Solution: Run the solution by giving 2000 no of iteration for solution to converge and to find out the required results.

VI. RESULT & DISCUSSION

For analysis the performance of SCWPP the result can be viewed and interpretation in various format of images like temperature distribution, pressure distribution, velocity distribution, vector profile, and various graphs and tables.

(a) Computed Value of Different Parameter of Solar Chimney Wind Power Plant

The Value of Pressure drop, mass flow rate, turbine inlet velocity, chimney height, collector radius, collector percentage, throat radius ,solar radiation, fraction factor, collector absorption coefficient, collector loss coefficient, power are computed using function in post-processor. Then these values are put in tabular form and also plotted by using Microsoft excel software.

(b) Result of existing SCWPP model with different chimney height

Table 1

Chimney Height(m)	Mass Flow Inlet(kg/s)	Turbine-Pressure Drop (pa)	Turbine Inlet Velocity (m/s)	Power (W)
194.66	794.0054	63.4439	11.68162	48044.0938
400	1038.593	115.7378	15.24137	114352.6645
600	1205.413	148.3987	17.58019	169122.2394
800	1351.519	203.057	19.86091	261435.2646
1000	1458.723	217.9338	21.28376	300690.7056

The table 1 shows the result obtain form the fluent solver for Solar chimney wind power plant with different chimney height (194.66m – 1000m) at constant collector radius (122m), average roof height (1.85m), ambient temperature (291.65),and solar radiation 1000(W/m2). In table result of mass flow rate turbine pressure drop, turbine inlet velocity and power is calculated. From the table 5.1 it has been observed that the power is enhance as increases the chimney height. It also has been observed that Mass flow inlet; turbine pressure drop and turbine inlet velocity also increases as the Chimney Height increases.

(c) Result of existing SCWPP model with different collector radius

Table 2

collector radius(m)	Mass flow inlet(kg/s)	turbine-pressure drop (pa)	turbine inlet velocity (m/s)	Power(W)
122	794.0054	63.4439	11.68162	48044.0938
150	900.985	86.3839	13.26227	74267.31657
200	1006.212	107.8849	14.83184	103729.6123
250	1092.522	125.2797	15.97944	129774.4867
300	1101.818	138.5214	16.25754	145988.5392
350	1110.307	137.369	16.44059	146404.0852
400	1122.617	139.7278	16.47706	149248.3725

The table 2 show the result obtain form the fluent solver for Solar chimney wind power plant with different collector radius(122m - 400m) at constant chimney height (194.6m), average roof height (1.85m), ambient temperature (291.65), and solar radiation 1000(W/m2). In table result of mass flow rate turbine pressure drop, turbine inlet velocity and power is calculated. From the table 2 it has been observed that the power is enhance as increases the collector radius. It also has been observed that Mass flow inlet; turbine pressure drop and turbine inlet velocity also increases as the Collector radius increases.

(d) Result of existing SCWPP model with collector percentage with respect to chimney height

Table 3

Collector percentage (%)	Chimney height with %	Mass flow inlet(kg/s)	turbine-pressure drop (pa)	turbine inlet velocity (m/s)	Power(W)
0%	0	794.0054	63.4439	11.68162	48044.0938
10%	19.46	794.0979	63.3374	11.67878	48951.78393
20%	38.92	797.9033	64.134	11.83947	49222.95119
30%	58.38	800.2995	64.3931	11.76823	49124.43186
40%	77.84	802.7017	64.8049	11.804	49588.85781
50%	97.3	805.8514	65.4775	11.95649	50750.79547

(e) Result of SCWPP at Indian condition with different fraction factor

Table 6

R.F.	Chimney height(m)	collector radius(m)	Mass flow inlet(kg/s)	turbine-pressure drop (pa)	turbine inlet velocity (m/s)	power
0.18	21	35.028	9.322625	13.52778	4.413589	3870.485814
0.20	24.4	38.92	12.36664	15.77164	4.812185	4920.012771
0.25	30.5	48.65	22.44221	21.60471	5.61153	7859.171933

The table 6 shows the result obtains form the fluent solver for solar chimney wind power plant at different R.F. at constant throat radius (.7m), ambient temperature (303.15) and solar radiation 1000W/m2. In table result of mass flow rate turbine pressure drop, turbine inlet velocity and power is calculated. From the table 5.6 it has been observed that the power is enhance as increases R.F. It also has been observed that Mass flow inlet; turbine pressure drop and turbine inlet velocity also increases as the fraction factor increases.

(f) Result of SCWPP at Indian condition at fraction factor (.20) with different collector absorption coefficient ($\propto$)

Table 7

collector absorption coefficient ($\propto$)	Mass flow inlet(kg/s)	turbine-pressure drop (pa)	turbine inlet velocity (m/s)	Power(W)
0.66	12.36664	15.77164	4.812185	4920.012771
0.70	12.78653	16.87063	4.97741	5443.544485
0.75	13.27674	18.20035	5.170282	6100.157253
0.80	13.73818	19.49833	5.352036	6764.933036

The table 7 shows the result obtains form the fluent solver for solar chimney wind power plant at different collector absorption coefficient ($\propto$) at constant R.F(.20), throat radius (.7m), collector radius (24.4m), chimney height (38.92m) ambient temperature (303.15) and solar radiation 1000W/m2. In table result of mass flow rate turbine pressure drop, turbine inlet velocity and power is calculated. From the table 5.7 it has been observed that the power is enhance as increases R.F. It also has been observed that Mass flow inlet; turbine pressure drop and turbine inlet velocity also increases as the collector absorption coefficient ($\propto$) increases.

(g) Result of SCWPP at Indian condition at fraction factor (.20) with different collector loss coefficient ($\cup$)

Table 8

collector loss coefficient ($\cup$) W/m^{2}K	Mass flow inlet(kg/s)	turbine-pressure drop (pa)	turbine inlet velocity (m/s)	Power(W)
15	12.36664	15.77164	4.812185	4920.012771
13	12.77802	16.84758	4.973957	5432.335867
11	13.16299	17.88765	5.1256	5943.538213
9	13.5301	18.90786	5.270134	6459.681354

The table 8 shows the result obtains form the fluent solver for solar chimney wind power plant at different collector loss coefficient ($\cup$) W/m2K at constant R.F (.20), throat radius (.7m), collector radius (24.4m), chimney height (38.92m) ambient temperature (303.15) and solar radiation 1000(W/m2).In table result of mass flow rate turbine pressure drop, turbine inlet velocity and power is calculated. From the table 5.8 it has been observed that the power is enhance as decreases collector loss coefficient ($\cup$).It also has been observed that Mass flow inlet; turbine pressure drop and turbine inlet velocity also increases as the collector loss coefficient ($\cup$) decreases.

(a) Graphical Plots of SCWPP with Different Geometrical Parameter and Running Condition

Validation of Result of Presented Model with Reference [20] for Chimney Height and Collector Radius.

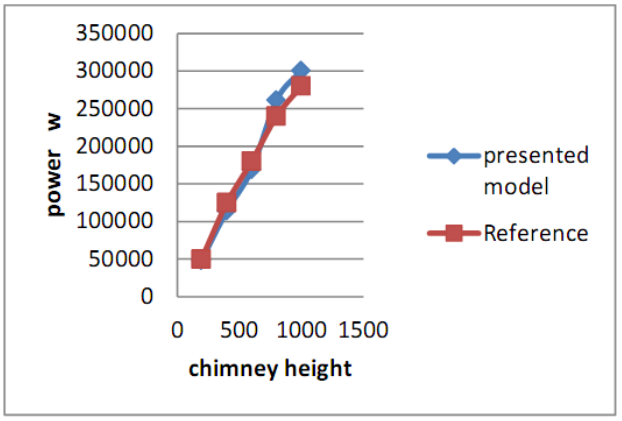


Fig 22(i) Comparison of chimney height versus power between presented model and reference of [20]

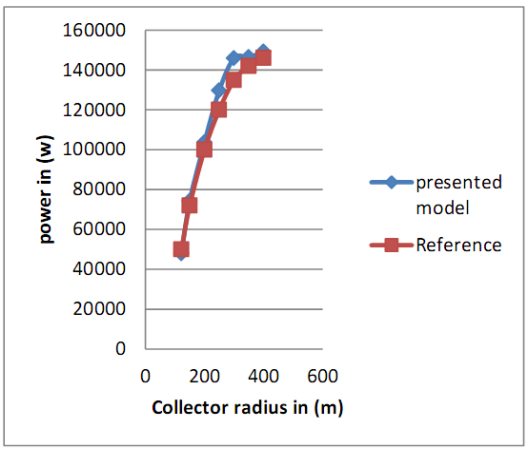


Fig 23(ii) Comparison of Collector radius (m) versus power between presented model and reference of [20]

Fig 23(i),(ii) show the comparison between result of presented numerical model and the data of [20] for chimney height and collector radius versus power respectively. From these two figures it can be observed that the value of presented model and data of [20] is very near to close. The negligible difference between both the parameter (chimney height and collector radius) due to the mesh and solving control method. There for the present numerical model is reliable and can be used to study the effect of different geometrical parameter and running conditions of solar chimney wind power plant.

(b) Graphical representation existing SCWPP model with different chimney height

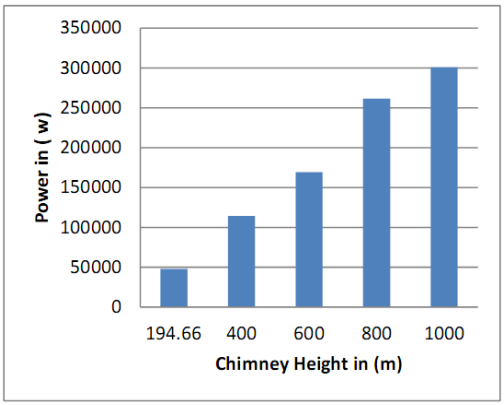


Fig. 24 Variation of chimney height with power in existing SCWPP model with different chimney height

Fig. 24 shows the variation of chimney height with power in existing solar chimney wind power plant at same running condition from the entire figure it has been observed that At constant collector radius, average roof height, and same boundary condition of ambient temperature and solar radiation, power of SCWPP is enhance as increases the chimney height in existing model of Manzanares pilot plant.

(c) Graphical representation existing SCWPP model with different collector radius

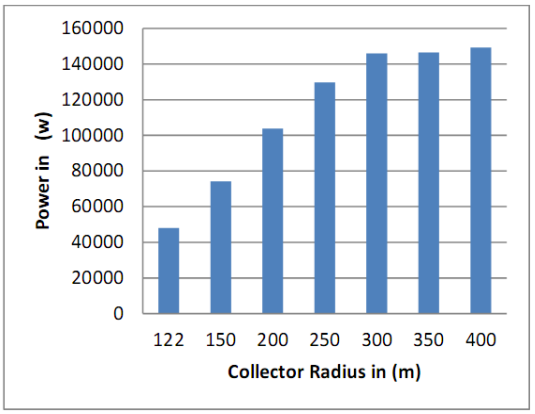


Fig 25 Variation of collector radius with power in existing SCWPP model with different collector radius

Fig 25 shows the variation of collector radius with power in existing solar chimney wind power plant at same running condition from the entire figure it has been observed that. At constant chimney height, average roof height and same boundary condition of ambient temperature and solar radiation. Power of SCWPP is enhance as increase the collector radius in existing model of manzanares pilot plant.

(d) Graphical representation existing SCWPP model with collector percentage with respect to chimney height

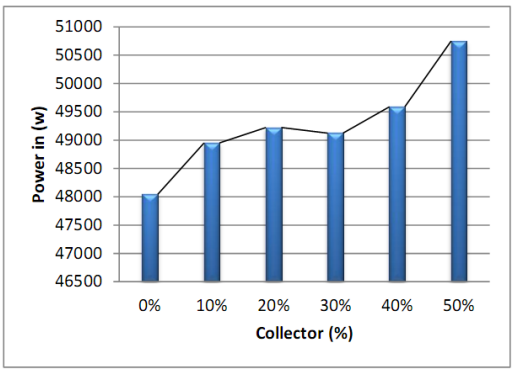


Fig 26 Variation of collector (%) with respect to chimney height with power in existing SCWPP model

Fig 26 shows the variation of collector percentage with power in existing solar chimney wind power plant at same running condition from the entire figure it has been observed that At same boundary condition of ambient temperature, solar radiation and constant collector radius, chimney height, average roof height,

the power of SCWPP is slightly enhance as the percentage of collector covering is increases in existing model of manzanares pilot plant.

(e) Graphical representation of existing SCWPP model with different throat radius

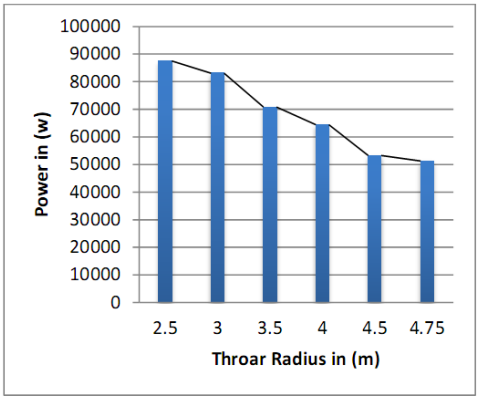


Fig 27 Variation of throat radius with power in existing SCWPP model

Fig 27 shows the variation of throat radius with power in existing solar chimney wind power plant at same running condition from the entire figure it has been observed that At constant chimney height, collector radius, average roof height, and same boundary condition of ambient temperature, and solar radiation the power of SCWPP is enhance as reducing the throat radius but it gives the best performance at throat radius is 3.5 m due to after this there is chance of chocking in existing model of manzanares pilot plant.

(f) Graphical representation of Indian condition SCWPP model with optimize throat radius (3.5 m) at different solar radiation

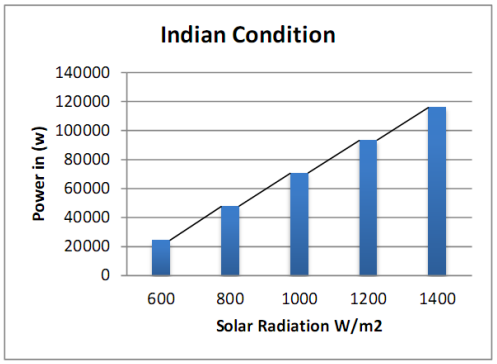


Fig 28 Variation of solar radiation with power in Indian condition SCWPP

Fig 28 shows the variation of throat radius with power in Indian condition solar chimney wind power plant at same running condition from the entire figure it has been observed that In Indian condition at optimize throat radius (3.5m) and constant collector radius, chimney height, average roof height the power of SCWPP is enhances as the solar radiation is increases in existing model of manzanares pilot plant.

(g) Graphical representation of SCWPP at Indian condition with different fraction factor

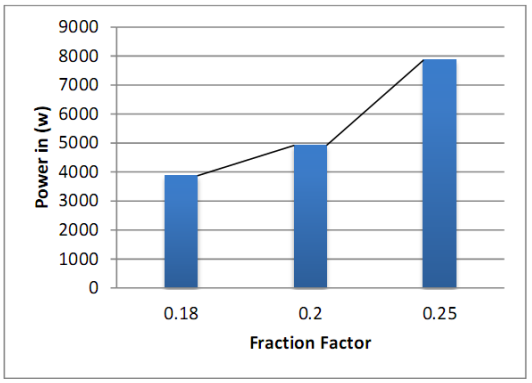


Fig 29 Variation of R.F. with power in Indian condition SCWPP

Fig 29 shows the variation of R.F. with power in Indian condition solar chimney wind power plant at same running condition from the entire figure it has been observed that In Indian condition at constant throat radius and same boundary condition of ambient temperature and solar radiation, the power of SCWPP is enhance as fraction factor is increases. And also observed that at the R.F. = 0.2 it gives power approximately 5 KW.

(h) Graphical representation of SCWPP at Indian condition at fraction factor (.20) with different collector absorption coefficient (α)

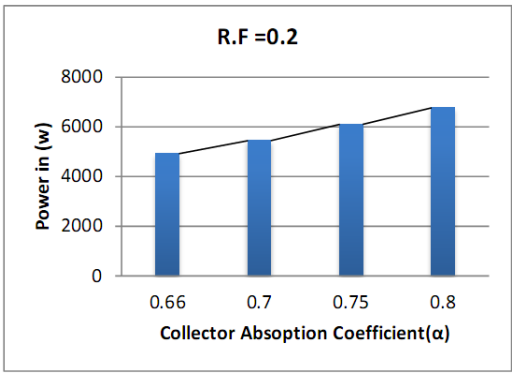


Fig 30 Variation of collector absorption coefficient (α) with power at Indian condition SCWPP

Fig 30 shows the variation of collector absorption coefficient (α) With power in Indian condition solar chimney wind power plant at same running condition from the entire figure it has been observed that In India condition at constant R.F, throat radius, collector radius, chimney height and same boundary condition of ambient temperature and solar radiation, the power of SCWPP is enhances as the collector absorption coefficient (α) is increases.

(i) Graphical representation of SCWPP at Indian condition at fraction factor (.20) with different collector loss coefficient (^{U})

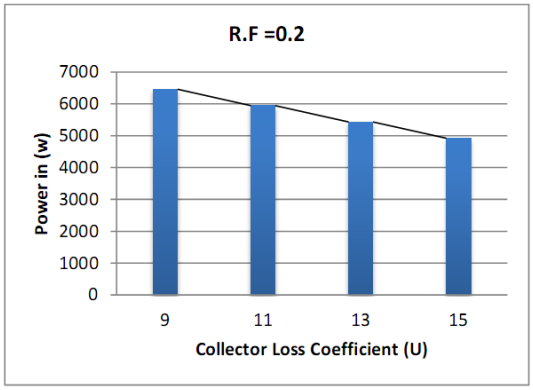


Fig 31 Variation of collector loss coefficient (^{U}) with power in Indian condition SCWPP

Fig 31 shows the variation of collector loss coefficient (^{U}) With power in Indian condition solar chimney wind power plant at same running condition from the entire figure it has been observed that In India condition at constant R.F, throat radius, collector radius, chimney height and same boundary condition of ambient temperature and solar radiation, the power of SCWPP is enhances as the collector loss coefficient (^{U}) is decreasing.

VII. CONCLUSION

Following points worth noting from the present exploration on computational analysis form performances characteristics of different geometrical parameter and running condition of solar chimney wind power plant.

(a) At constant collector radius, average roof height, and same boundary condition of ambient temperature and solar radiation, power of SCWPP is enhance as increases the chimney height in existing model of manzanares pilot plant.

(b) At constant chimney height, average roof height and same boundary condition of ambient temperature and solar radiation. power of SCWPP is enhance as increase the collector radius in existing model of manzanares pilot plant.

(c) At same boundary condition of ambient temperature, solar radiation and constant collector radius, chimney height, average roof height, the power of SCWPP is slightly enhance as the percentage of collector covering is increases in existing model of manzanares pilot plant.

(d) At constant chimney height, collector radius, average roof height, and same boundary condition of ambient temperature, and solar radiation the power of SCWPP is enhance as reducing the throat radius, but it gives the best performance at throat radius is 3.5 m due to after this there is chance of chocking in existing model of manzanares pilot plant.

(e) In Indian condition at optimize throat radius (3.5m) and constant collector radius, chimney height, average roof height the power of SCWPP is enhances as the solar radiation is increases in existing model of manzanares pilot plant.

(f) In Indian condition at constant throat radius and same boundary condition of ambient temperature and solar radiation, the power of SCWPP is enhance as fraction factor is increases. And also observed that at the R.F. = 0.2 it gives power approximately 5 KW.

(g) In India condition at constant R.F, throat radius , collector radius, chimney height and same boundary condition of ambient temperature and solar radiation, the power of SCWPP is enhances as the collector absorption coefficient ($^{\alpha}$) is increases.

(h) In India condition at constant R.F, throat radius , collector radius, chimney height and same boundary condition of ambient temperature and solar radiation, the power of SCWPP is enhances as the collector loss coefficient (^{U}) is decreasing.

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Simulation of Thermal Environment of a Conditioned Space at Different Air Supply Conditions by CFD Analysis

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Abstract – Human comfort in conditioned spaces is the prime objective of air conditioning system design engineer. Air distribution in the conditioned spaces affects the human comfort. Several researchers have examined this human comfort in the conditioned spaces for various parameters of air conditioning and proposed the modifications in the system design and operation. Several new technologies have also been proposed by the researchers for it. Research is also reported in literature for the scope of energy savings through alternative technology of air distribution. It is this objective of the present work to simulate the indoor temperature distribution in a typical conditioned room in which air is supplied at a particular typical value of temperature and velocity most commonly used in practice through three case of supply air vent location. For this analysis numerical technique widely used by the researchers in present time, Computational Fluid Dynamics (CFD) has been used. The geometrical model is prepared is prepared in GAMBIT and Fluent is used for analysis purpose. The results are presented in the form of temperature and velocity contours in the room at three planes taken in the conditioned space. Vertical temperature and velocity distribution is shown with the help of plots at various location of the room. For comparison purpose the temperature and velocity plots have been compared for the three different cases of location of supply air vent

Key Words: Air conditioning, CFD, GAMBIT, Temperature, Temperature distribution, Velocity.

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I. INTRODUCTION

Thermal comfort is a combination of a subjective sensation and several objective interactions with the environment. Comfort depends on several physical magnitudes. Person -related. Deep body temperature, always close to 37 ºC Metabolic dissipation rate; we must evacuate by unit body mass some 0.5 W/kg - 5 W/kg, depending on activity (around 100 W for an adult in office-work). Skin temperature is usually below 33 ºC, allowing the heat evacuation, but it depends a lot on external conditions, clothing, and actual and previous activity levels.

II. AIR CONDITIONING

(a) **Principles of Air Conditioning-** Air conditioning is the process whereby the condition of air, as defined by its temperature and moisture content, is changed. Note that in practice other factors must also be taken into account especially cleanliness; odor; velocity & distribution pattern.

(b) **Simple Air Conditioning-** A fan draws air from the room first through a cooling device, consisting of metal fins extending from a pipe through which cooling fluid circulates, at a rate determined by the thermostat or by the humidistat. The air next passes over a heater, usually electrical, which is energized on instructions from the room.

(c) **Air Distribution-**Central heating and cooling systems use an air distribution or duct system to circulate heated and/or cooled air to all the conditioned rooms in a house. Properly designed duct systems can maintain uniform temperatures throughout the house, efficiently and quietly.

(d) **Duct Design and its Objective-** The efficiency of air distribution systems has been found to be 60-75% or less in many houses because of insufficient and/or poorly installed duct insulation and leaks in the duct system. The objectives of good duct design are occupant comfort, proper air distribution, economical heating and cooling system operation and economical duct installation.

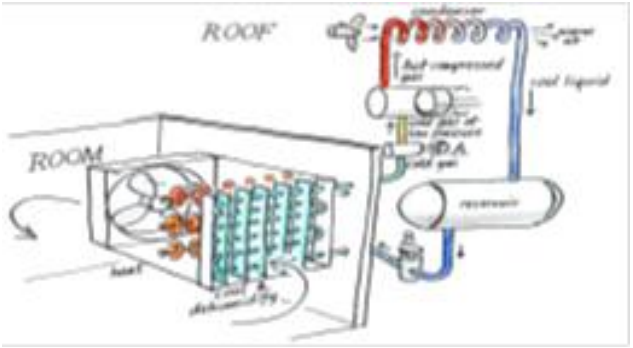


Fig. 1 Simple Air Conditioning System

(e) **Duct and Register Location -**Locating the air handler unit and air distribution system inside the conditioned space of the house is the best way to improve duct system efficiency and is highly recommended. With this design, any duct leakage will be to the inside of the house. It will not significantly affect the energy efficiency of the heating and cooling system because the conditioned air remains inside the house, although air distribution may suffer. Also, ducts located inside the conditioned space need minimal insulation (in hot and humid climates), if any at all. The cost of moving ducts into the conditioned space can be offset by smaller heating and cooling equipment, smaller and less duct work, reduced duct insulation, and lower operating costs.

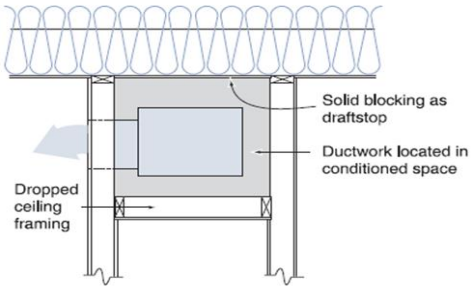


Fig. 2 Registered Locations

III. METHODOLOGY

Computational Fluid Dynamics (CFD) is the simulation of fluids engineering systems using modeling (mathematical physical problem formulation) and numerical methods (discretization methods, solvers, numerical parameters, and grid generations, etc.).

(a) **Importance of Computational Fluid Dynamics-** There are three methods in study of Fluid: theory analysis, experiment and simulation (CFD). As a new method, CFD has many advantages compared to experiments. Please refer table 1.

Table 1

Comparison of Simulation and Experiment

	Simulation (CFD)	Experiment
Cost	Cheap	Expensive
Time	Short	Long
Scale	Any	Small/Middle
Information	All	Measured Point
Repeatable	Yes	Some
Safety	Yes	Some Dangerous

(b) **Applications of CFD-** CFD is useful in a wide variety of applications and here we note a few to give you an idea of its use in industry. The simulations shown below have been performed using the FLUENT software.

(c) **CFD Simulation-** In the present research work numerical simulation of the temperature and velocity variation in an air conditioned space is simulated. Three cases have been taken into consideration for three different locations of the Air supplied diffuser. The conditioned air is supplied through one of the wall of the room through an opening. The location of the supply air vent is changed in three different cases, at the lower side, middle side and upper side.

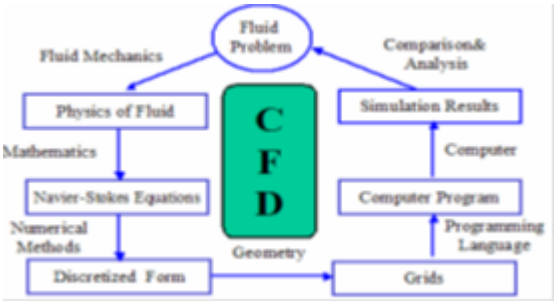


Fig. 3: Simulation Method

The air is returned through the return vent placed on the opposite side of the wall were the air is supplied through. The air is removed through two vents.

Experimental Data Obtained For C F D Analysis:

Table 1

Boundary Conditions

Velocity of supply air	0.7 m/s
Temperature of supply air	$297^{O}K$
Heat input value	$283^{O}K$
Heat input source	Sun Light

Table 2

Wall, Roof, and Floor Temperature:

Floor:	293^{O}K
Side Walls	297^{O}K
Ceiling	304^{O}K

Table 3

Room Dimension

Length	5 meters
Breadth	3.2 meters
Height	3 meters

(i) **Dimensions of supply duct:** 0.25 m x 0.25 m

(ii) **Dimensions of return duct:** 0.20 m x 0.20 m

Respective Temperature Recorded, while doing the Experiment:

Case I: AC is 0.8 meter from the bottom of the ground:

(a) Distance from AC is 1.8 meter:

Temperature at the distance 0.6 meter from the bottom	295^{O}K
Temperature at the distance 1.2 meter from the bottom	296^{O}K
Temperature at the distance 1.8 meter from the bottom	297^{O}K

(b) Distance from AC is 2.7 meter:

Temperature at the distance 0.6 meter from the bottom	295.5^{O}K
Temperature at the distance 1.2 meter from the bottom	296.5^{O}K
Temperature at the distance 1.8 meter from the bottom	297.5^{O}K

(c) Distance from AC is 3.6 meter:

Temperature at the distance 0.6 meter from the bottom	296^{O}K
Temperature at the distance 1.2 meter from the bottom	297^{O}K
Temperature at the distance 1.8 meter from the bottom	298^{O}K

Case II: AC is 1.0 meter from the bottom of the ground:

(a) Distance from AC is 1.8 meter:

Temperature at the distance 0.6 meter from the bottom	297^{O}K
Temperature at the distance 1.2 meter from the bottom	296^{O}K
Temperature at the distance 1.8 meter from the bottom	297^{O}K

(b) Distance from AC is 2.7 meter:

Temperature at the distance 0.6 meter from the bottom	297.5^{O}K
Temperature at the distance 1.2 meter from the bottom	296.5^{O}K
Temperature at the distance 1.8 meter from the bottom	297.5^{O}K

(c) Distance from AC is 3.6 meter:

Temperature at the distance 0.6 meter from the bottom	298^{O}K
Temperature at the distance 1.2 meter from the bottom	297^{O}K
Temperature at the distance 1.8 meter from the bottom	298^{O}K

Case III: AC is 2.3 meter from the bottom of the ground:

(a) Distance from AC is 1.8 meter:

Temperature at the distance 0.6 meter from the bottom	297^{O}K
Temperature at the distance 1.2 meter from the bottom	296.5^{O}K
Temperature at the distance 1.8 meter from the bottom	296^{O}K

(b) Distance from Air conditioner is 2.7 meter:

Temperature at the distance 0.6 meter from the bottom	297^{O}K
Temperature at the distance 1.2 meter from the bottom	296.5^{O}K
Temperature at the distance 1.8 meter from the bottom	296^{O}K

(c) Distance from AC is 3.6 meter:

Temperature at the distance 0.6 meter from the bottom	297^{O}K
Temperature at the distance 1.2 meter from the bottom	297^{O}K
Temperature at the distance 1.8 meter from the bottom	296^{O}K

Table 3:

The Three Cases Are Summarized in the Following:

Case	Supply air Vent Location	Return air vent Location
I	0.8 meters above the floor	0.5 meter below the ceiling
II	1.0 meters above the floor	0.5 meter below the ceiling
III	2.3 meters above the floor	0.5 meter below the ceiling

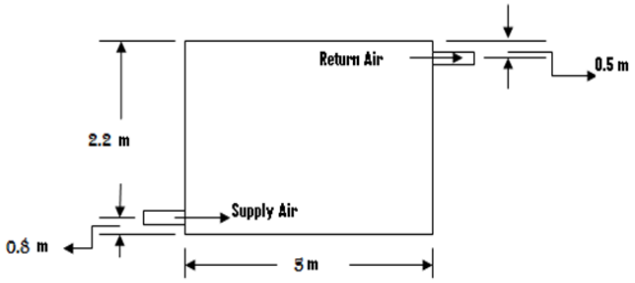


Fig. 4: Room Dimension

For the analysis of these cases, the numerical technique Computational Fluid Dynamics (CFD) has been used. The geometrical model for the three cases is prepared using GAMBIT 2.4.6 and numerical solution is obtained using ANSYS-FLUENT 6.3.26.

The Boundary Conditions Used Are Shown In The Following

Table 4:

Sr. No.	Boundary	Boundary Condition Used
1	Inlet	Velocity Inlet
2.	Outlet	Pressure outlet
3.	Room walls	Wall

In this simulation the different walls of the room are set at different temperatures and the values at the boundaries are tabulated in the following table.5:

Sr. No.	Boundary	Value
1.	Velocity of supply air	0.7 m/s
2.	Temperature of Supply air	297 K
3.	Temperature of Ceiling	304 K
4.	Temperature of side walls	297 K
5.	Temperature of floor	293 K

The results are shown below for the above mentioned three cases as under:

Case I: The supply air vent is at a position of 0.8 meter above the floor and return air vent is kept at 0.5 meter below the ceiling.

Case 2: The supply air vent is at a position of 1.0 meter above the floor and return air vent is kept at 0.5 meter below the ceiling.

Case3: The supply air vent is at a position of 2.3 meter above the floor and return air vent is kept at 0.5 meter below the ceiling.

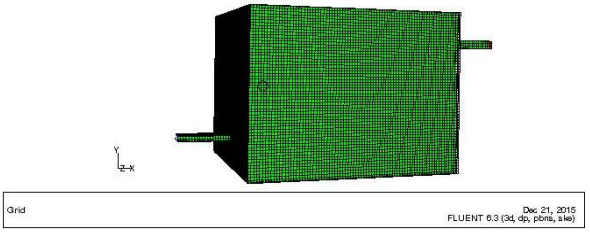
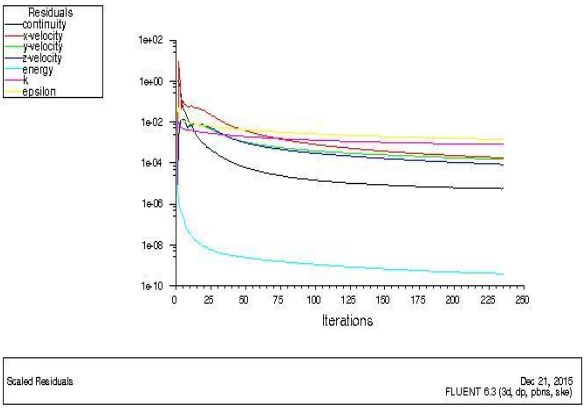
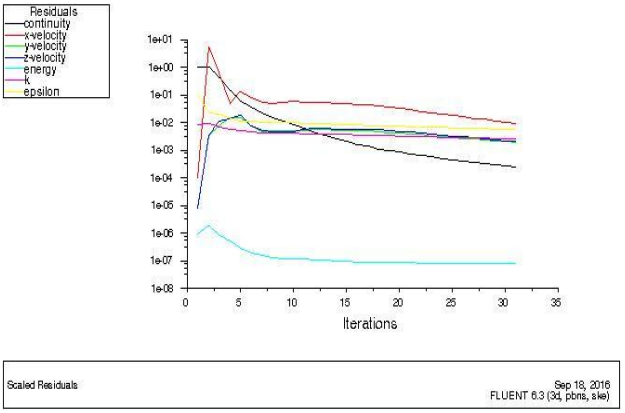


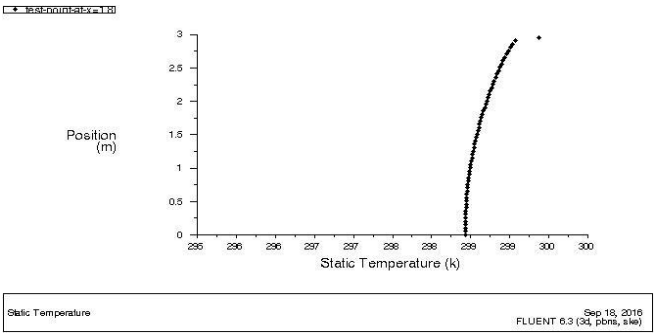
Fig. 5: Model



Graph: 1



Graph: 2



Graph: 3

IV. CONCLUSION

The results of the simulation obtained for the three cases in which air is supplied to the conditioned space through three different locations show the temperature and velocity variations. The results show that the indoor temperature and velocity is changing as the supply air diffuser location is changed. It is desired that the conditioned space should have uniform temperature and velocity for the better comfort in the conditioned space.

V. SCOPE FOR FUTURE WORK

It is hereby suggested by the authors that the following work may be performed in future:

(a) Experimental analysis may be performed for the above particular cases. Although the CFD methodology used in the present work is validated as the same numerical technique is found in the literature for providing results with best agreement with experimental results.

(b) Other locations of the supply air diffuser or vent may be taken into consideration for finding optimum location of the supply air vent.

(c) Supply air conditions may be optimised for the specific case of supply air vent location.

(d) The analysis may be performed for different return air vent location in future.

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Spiral Bevel Gear Design and Development - Generation and Simulation of Meshing and Tooth Contact Analysis (TCA) for Improved Performance

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Abstract – Computer-based design analysis is nowadays a common activity in most development projects. When new software and manufacturing processes are introduced, traditional empirical knowledge is unavailable and considerable effort is required to find starting design concepts. This forces gear designers to go beyond the traditional standards-based design methods. The transformation has had a vast influence on gear manufacturing as well, providing process improvements that lead to higher gear quality and lower manufacturing costs. However, in the case of the gear industry, the critical process of Generation and Simulation of Meshing and Tooth Contact Analysis (TCA) of Spiral bevel gears for improved performance remains relatively unchanged.

Keywords: Spiral Bevel Gear, Design, Development, Generation, Simulation, Meshing Tooth Contact Analysis (TCA).

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I. INTRODUCTION

The purpose of gear is to transmit motion and torque from one shaft to another. That transmission normally has to occur with a constant ratio, the lowest possible disturbances and the highest possible efficiency. Tooth profile, length and shape are derived from those requirements.

Gearing is one of the most critical components in a mechanical power transmission system, and in most industrial rotating machinery. A gear is a mechanical part often used for transmission systems which allows rotational motion to be transferred to another gear or device. The gear teeth allow motion to be fully transmitted slippage less and depending as per their configuration, can transmit forces at different speeds, torques, and even in a different direction. Generation of spiral bevel gear teeth depends upon the theory of derivation of gear and pinion tooth surface. The accurate geometrical representation of gear tooth surface is the first step to design a successful gear drive.

Generation of spiral bevel gears depends upon the theory of derivation of gear and pinion tooth surface. The accurate geometrical representation of gear tooth surface is the first step to design a successful gear drive.

Spiral bevel gears are crucial to power transmission systems, power generation machines and automobiles. However, the design and manufacturing of spiral bevel gears are quite difficult. Currently, the major parameters of spiral bevel gears are calculated, but the geometries of the gears are not fully defined.

The procedures needed to develop spiral bevel gear sets for a new product can require months of trial-and-error work and thousands of dollars. In view of increasing global competition for lower priced products, spiral bevel gears are a prime target for the next generation of computerization. Answering this challenge, it has realized a new modified method through a shift in the way spiral bevel gear development is performed.

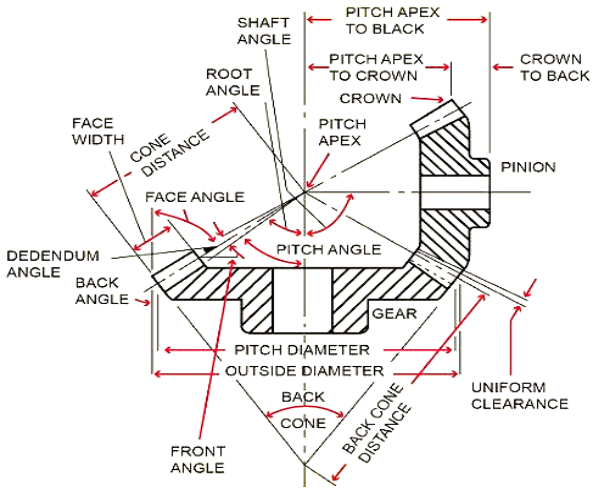


Fig 1.1 Bevel Gear Terminologies

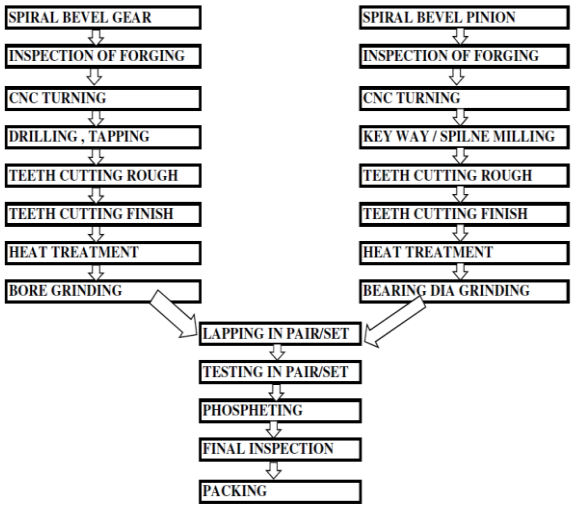


Fig 1.2 Spiral Bevel Gear Manufacturing Process

II. TEETH GENERATION PROCESS

$$\frac{\omega_t}{\omega_c} = \frac{N_c}{N_t}$$

In the spiral bevel gear generation process, two sets of related motions are generally defined. The first set of related motion is the rotation of the tool (cutter head) and rotation of the work piece, namely,

$$\frac{\omega_t}{\omega_c} = \frac{N_c}{N_t} \qquad \textit{Eq. 2.1}$$

Here *ωt* and *ωc* denote the angular velocities of the tool and the work piece; *Nc* and *Nt* denote the number of the blade groups and the number of teeth of the work piece, respectively. This related motion provides the continuous indexing between the tool and the work for the face hobbing process. The indexing relationship also exists between the rotation of the tool and the generating gear as,

$$\frac{\omega_t}{\omega_c} = \frac{N_c}{N_t} \qquad \textit{Eq. 2.2}$$

Where *ωc* and *Nc* denote the angular velocity and the number of teeth of the generating gear respectively. In the face hobbing process, the indexing motion between the tool and the generating gear kinematically forms the tooth surface of the generating gear with an extended-epicycloid lengthwise tooth curve.

$$\frac{\omega_w}{\omega_c} = \frac{N_c}{N_w} = R_a$$

The second set of related motions is the rotation of the generating gear and rotation of the work piece. Such a related motion is called rolling or generating motion and is represented as

$$\frac{\omega_w}{\omega_c} = \frac{N_c}{N_w} = R_a \qquad \textit{Eq 2.3}$$

Where *Ra* is called the ratio of roll the generating motion is provided for both face milling and face hobbing processes when the gear or pinion is cut in the generating method. In the non-generating (FORMATE) process, which is usually applied to the gear, both the generating gear and the work piece are held at rest, and only the cutter rotation is provided. Therefore, the gear tooth surfaces are actually the complementary copy of the generating tooth surfaces, which are formed by the cutter motion described here.

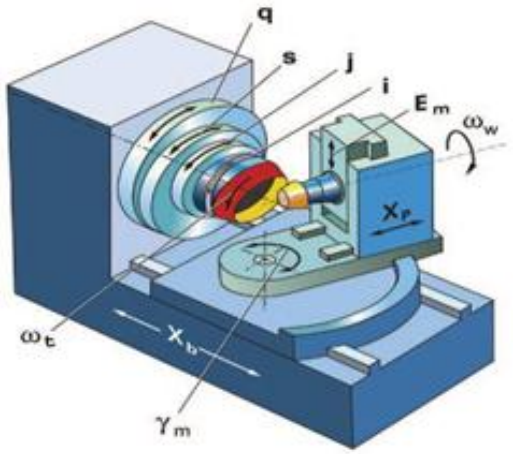


Fig 2.1 Kinematical model of a spiral bevel generator

III. MOTIVATION AND OBJECTIVES

Motivation

The fundamental motives for doing this research were following:

(i) To get a robust and computerized tooth generation approach along with the tooth contact analysis to provide a better way to reduce the wear, noise and vibration problems related to spiral bevel gears.

(ii) Using the proposed mathematical model, the tooth surface sensitivity matrix to the variations in machine–tool settings is investigated.

(iii) To investigate surface deviations of a real cut pinion and gear with respect to the theoretical tooth surfaces.

(iv) An optimization procedure for finding corrective machine–tool settings to minimize surface deviations of real cut pinion and gear-tooth surfaces.

(v) Therefore, the proposed method for obtaining corrective machine–tool settings can improve the conventional development process and can also be applied to different manufacturing machines and methods for bevel gear generation.

(vi) To plan in cutting the noise. Experimental research centered on the investigation into the relation between the gear error and noise.

(b) Objectives

If the gears were perfectly rigid and no geometrical errors or modifications were present, the gears would transmit the rotational motion perfectly, which means that a constant speed at the input shaft would result in a constant speed at the output shaft. The assumption of no friction – leads, that the gears would transmit the torque perfectly, which means that a constant torque at the input shaft would result in a constant torque at the output shaft. No force variations would exist and hence no vibrations and no sound (noise) could be created. Of course, in reality, there are geometrical errors, deflections and friction present, and accordingly, gears sometimes create noise to such an extent that it becomes a problem.

The overall research objectives:

(i) To develop an automated process for spiral bevel gear to reduce design and development time and to improve tooth contact analysis (TCA) by computer programs for the analysis of meshing and tooth bearing contact.

(ii) To develop a framework flexible to interfaces, fast and accurate, with integration and automation capability by improving understanding of optimization techniques for spiral bevel gear design and development.

(iii) To formulate a mathematical model of universal spiral bevel gear tooth surfaces generator based on Gleason's approach by taking into account all the kinematic motions of common Gleason CNC machine tools dedicated to spiral bevel gears machining.

(iv) To create Spiral Bevel Gear Gleason Dimension in MASTA by entering the details from the Gleason Dimension Sheet by comparing the geometry in MASTA with that in the Dimension Sheet. Based upon the developed theory, an advanced tooth surface generation and TCA program is to be developed and integrated into Gleason.

IV. DESIGNING AND MACHINE SETTING

Design Considerations accuracy of the output of a gear depends on the accuracy of its design and manufacturing. The correct manufacturing of a gear requires a number of prerequisite calculations and design considerations. The design considerations are taken into account before manufacturing of gears.

Smart Manufacturing Technology's premier full-system transmission design and analysis software MASTA is used to address within the context of the full system from an integrated workflow that fully considers the design geometry of bevel tooth flanks via the manufacturing machine settings.

Modern design practices provide a new design-to-manufacture solution for spiral bevel gears with significant performance advantages and cost savings over current processes.

This improved virtual analysis and testing helps avoid the costs associated with repeated manufacturing and testing of prototype gears, saving customers both time and money.

There are following benefits of using MASTA.

(i) Accurately and rapidly design transmission systems from scratch or imported concepts,

(ii) Rapidly predict key performance characteristics at the design stage,

(iii) Easily explore changes in transmission layout, component selection and/or design, materials and manufacturing processes in the convenience of a virtual environment,

(iv) Perform full system simulations for any transmission or driveline configuration,

(v) Incorporate manufacturing simulation at the design stage to reduce process development time & cost,

(vi) Design entire transmission and driveline systems using a comprehensive selection of components and design databases,

(vii) Gear tooth geometry optimization.

(viii) Enhanced Computer Program for Simulation of Meshing and Contact

Dimension Sheet is created in MASTA by entering the details from the following Gleason Dimension Sheet and compared the resulting geometry in MASTA with that in the Dimension Sheet.

Table 4.1

Gleason Dimension Sheet

Note: When entering data from a Gleason Dimension Sheet care should be taken with units. It is common to see Gleason Dimension Sheets where the gear properties are in mm while the cutter properties are in inches. In the below sheet all length dimensions are in mm.

SPIRAL BEVEL GEAR DIMENSIONS NO. M Input a Name VERSION:1.0.4.7 2/20/2013 17:12

Input a Customer ID

	PINION	GEAR
NUMBER OF TEETH.	14	39
PART NUMBER.		
MODULE		4.536
FACE WIDTH	25.40	25.40
PRESSURE ANGLE - PIN CONCAVE	20D 0M	
PRESSURE ANGLE - PIN CONVEX.	20D 0M	
SHAFT ANGLE.	90D 0M	
TRANSVERSE CONTACT RATIO		1.181
FACE CONTACT RATIO		1.454
MODIFIED CONTACT RATIO		1.873
OUTER CONE DISTANCE.		93.98
MEAN CONE DISTANCE		81.28
PITCH DIAMETER	63.50	176.90
CIRCULAR PITCH	14.25	
WORKING DEPTH.	7.71	
WHOLE DEPTH.	8.56	8.56
CLEARANCE.	0.85	0.85
ADDENDUM	5.40	2.31
DEDENDUM	3.17	6.25
OUTSIDE DIAMETER	73.66	178.47
THEORETICAL CUTTER RADIUS. *	76.93	
CUTTER RADIUS.	114.30	
CALC. GEAR FINISH. PT. WIDTH		2.10
GEAR FINISHING POINT WIDTH		2.10
ROUGHING POINT WIDTH	1.60	2.10
OUTER SLOT WIDTH	2.58	2.10
MEAN SLOT WIDTH.	2.19	2.10
INNER SLOT WIDTH	1.63	2.10
FINISHING CUTTER BLADE POINT	1.60	1.25
STOCK ALLOWANCE.	0.03	0.00
MAX. RADIUS - CUTTER BLADES.	1.16	1.49
MAX. RADIUS - MUTILATION	0.13	1.88
MAX. RADIUS - INTERFERENCE	1.04	2.23
CUTTER EDGE RADIUS	0.30	1.40
CALC. CUTTER NUMBER.	6	13
MAX. NO. OF BLADES IN CUTTER		19.733
CUTTER BLADES REQUIRED STD DEPTH		STD DEPTH
*CUTTER SPECIFICATIONS ARE IN METRIC UNITS		
GEAR ANGULAR FACE - CONCAVE		15D 7M
GEAR ANGULAR FACE - CONVEX		16D 3M
GEAR ANGULAR FACE - TOTAL.		18D 15M

ALL DIMENSIONS ARE METRIC UNLESS OTHERWISE SPECIFIED
RELEASED BY - Engi

	PINION		GEAR
PITCH APEX TO CROWN.	66.63		29.57
FACE ANG OUNCT TO PITCH APEX			
MEAN CIRCULAR THICKNESS.	7.16		4.96
OUTER NORMAL TOPLAND	1.51		3.00
MEAN NORMAL TOPLAND.	1.72		2.67
INNER NORMAL TOPLAND	1.96		2.09
PITCH ANGLE.	19D 45M		70D 15M
FACE ANGLE OF BLANK.	23D 33M		72D 11M
ROOT ANGLE	17D 49M		66D 27M
DEDENDUM ANGLE	1D 56M		3D 48M
OUTER SPIRAL ANGLE			36D 51M
MEAN SPIRAL ANGLE.			35D 0M
INNER SPIRAL ANGLE			33D 57M
HAND OF SPIRAL	LH		RH
DRIVING MEMBER	PIN		
DIRECTION OF ROTATION-DRIVER	REV		
OUTER NORMAL BACKLASH. MIN	0.13	MAX	0.18
DEPTHWISE TOOTH TAPER.	STD		
GEAR TYPE.			GENERATED
FACE WIDTH IN PCT CONE DIST.			27.027
DEPTH FACTOR - K			
ADDENDUM FACTOR - Ci			
GEOMETRY FACTOR-STRENGTH-J	0.2296		0.2736
STRENGTH FACTOR - Q.	12.688		3.82019
EDGE RADIUS USED IN STRENGTH	1.00		1.40
CUTTER RADIUS FACTOR - KX.	1.000		
FACTOR KI	1.0676		
STRENGTH BALANCE DESIRED	GIVN		
STRENGTH BALANCE OBTAINED. GIVN			- 0.172
GEOMETRY FACTOR-DURABILITY-I	0.1134		
DURABILITY FACTOR - Z.	4751.18		2846.64
GEOMETRY FACTOR-SCORING -G	0.006230		
SCORING FACTOR - X	0.4579		
ROOT LINE FACE WIDTH	25.40		25.40
PROFILE SLIDING FACTOR	0.00222		0.00463
RATIO OF INVOLUTE/OUTER CONE			1.581
RATIO OF INVOLUTE/MEAN CONE.			1.828
AXIAL FACTOR - DRIVER CW OUT	0.748	OUT	0.060
AXIAL FACTOR - DRIVER CCW. IN	0.471	OUT	0.217
SEPARATING FACTOR-DRIVER CW. SEP	0.168	SEP	0.269
SEPARATING FACTOR-DRIVER CCW SEP	0.606	ATT	0.169
DUPLEX SUM OF DEDENDUM ANG	8D 38M		
ROUGHING RADIAL	3.738"		
INPUT DATA - KIT	1		
INPUT DATA - CUTM			1
NUMBER OF BLADE GROUPS			
EFFECTIVE CUTTER RADIUS.			
SLOT WIDTH PCT FOR BLADE PT.			

V. CUTTING TOOL GEOMETRY AND RELATIVE MOTION

Fig 4.1 shows a typical FH blade with its geometry along its cutting edge is defined by the blade angle a_b, the rake angle τ, the hook angle μ the blade offset angle the cutter radius r_c, and the distance from the tip of blade to reference point *hf*.

The cutting edge is divided into four different sections as the *edge* (or tip radius), *toprem, profile* and *flankrem*that are all shown in Fig 4 (c). The edge and flankrem are usually circular arcs while toprem is usually a straight line at a slight angle from the profile section. Most of the cutting is done by the profile section of the blade that is usually a straight line or a circular arc. For a typical FM cutter, $\tau = \mu = \delta_b = 0$

Referring to Fig 4, an arbitrary point *A* on cutting edge is at position r=r(S) relative to the local coordinate system X*b* fixed to the cutter head (with its origin at reference point *M*) where *s* is the distance of point *A* to point *M* along the blade edge. With this, the unit tangent vector is $t=\frac{\partial r}{\partial s}$, and if the cutting edge is a line, it can be reduced to

$$t=[-\sin\alpha_b \; 0 \; -\cos\alpha_b]^T$$

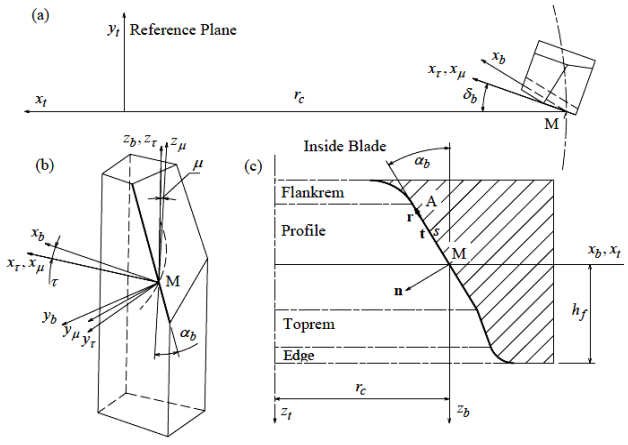


Fig 4.1: (a) Cutter head, (b) blade and (c) cutting edge geometry

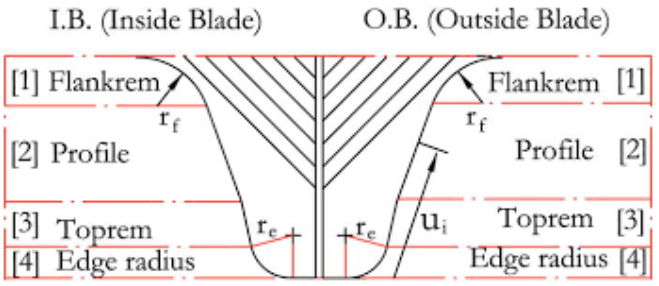


Fig 4.1: (d) Inside blade and Outside blade

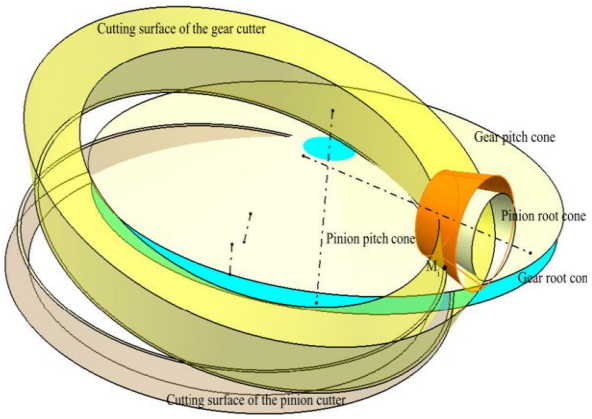


Fig 4.2 Local synthesis between gear cutting surface, gear, pinion and pinion cutting surface

VI. EXPERIMENTS EXECUTION

(a) Experiments Execution

The most conclusive test of spiral bevel gears is their operation under normal running conditions in their final mountings. Testing not only maintains quality and uniformity during manufacture, but also determines if the gears will be satisfactory for their intended applications.

MASTA is an automated designing soft-ware that creates an optimized model of the gear tooth profile just by inputting the basic parameters. A mathematical model of an ideal spiral bevel gear-tooth surfaces based on the Gleason gear generator mechanism is used.

Using this mathematical model, the tooth surface sensitivity matrix to the variations in machine–tool settings is investigated. Surface deviations of a real cut pinion and gear with respect to the theoretical tooth surfaces are also investigated. An optimization procedure for finding corrective machine–tool settings is then proposed to minimize surface deviations of real cut pinion and gear-tooth surfaces.

The results are revealed that surface deviations of real cut gear-tooth surfaces with respect to the ideal ones are reduced. Therefore, the proposed method for obtaining corrective machine–tool settings improves the conventional development process and can also be applied to different manufacturing machines and methods for spiral bevel gear generation.

First of all, to get the relative position of contact pattern and tooth profile of the boundary, we need to locate tooth profile and contact pattern as well as their respective centric. In the meanwhile, it requires the guide, which can help to check whether the tooth profile on which the spiral bevel gear meets with the contact pattern is on its right position.

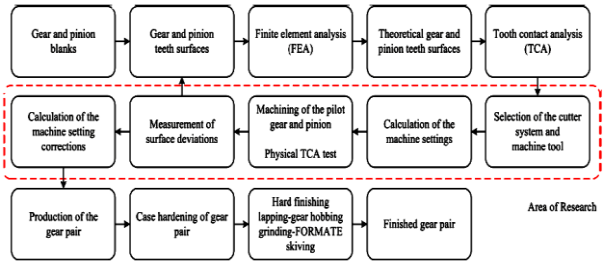


Fig 5.1 Analysis and machining cycle of spiral bevel bevel gears

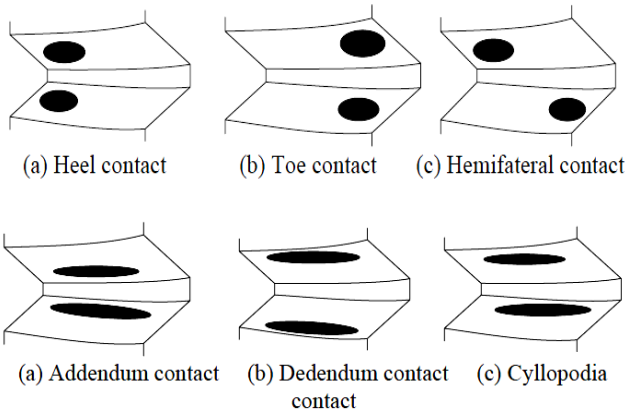


Fig 5.2 Various Contact Positions

VII. SIMULATIONS, RESULT AND ANALYSIS

A sound system design techniques developed based on literature survey and research done in the area of spiral bevel gear design and development, on the basis of following design framework.

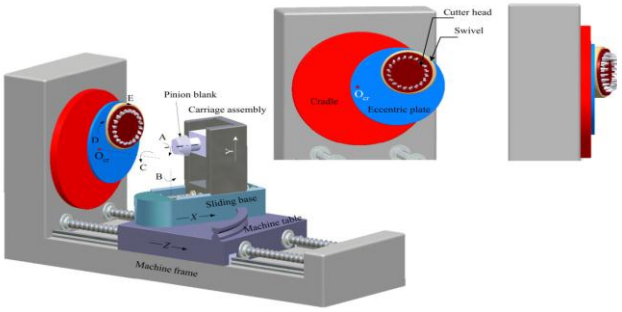


Fig 6.1 Structure of the multi-axis pinion generation machine

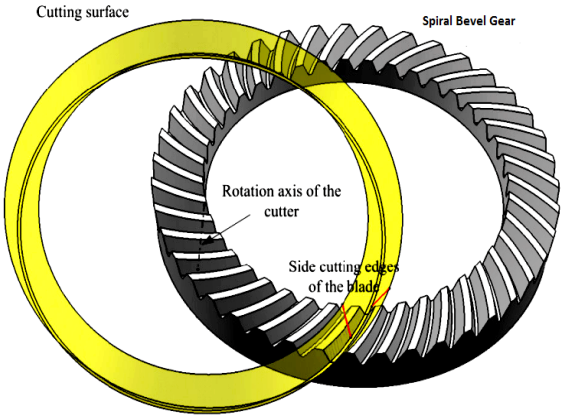


Fig 6.2 Gear tooth formed by non-generated machining process

VIII. INTRODUCTION TO MASTA

MASTA is capable of modelling a variety of gear types. Instructions for the creation spiral bevel gear pair models is found in the MASTA. This describes to use to input and design face milled spiral bevel gear sets.

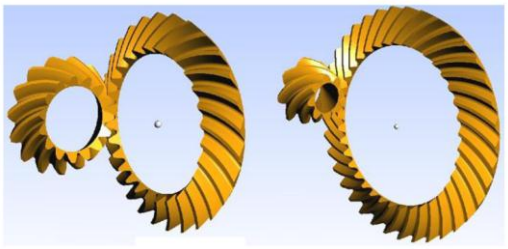
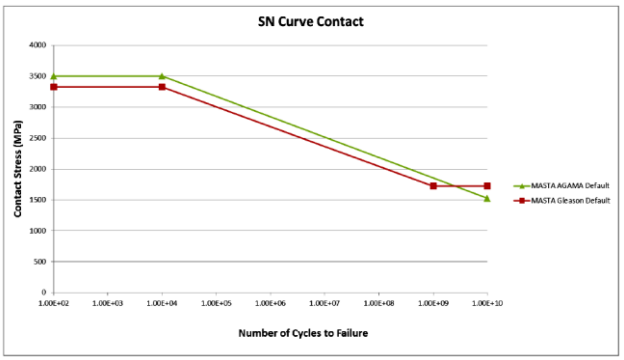


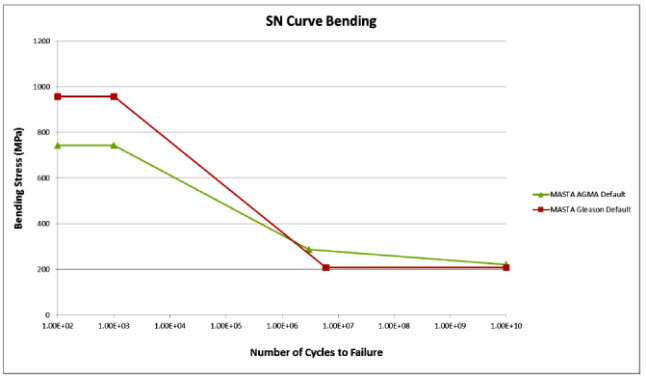
Fig 7.1 MASTA Spiral bevel gear pair models

Following MASTA modules functionality were used in this thesis.

- MC302 – AGMA/Gleason Spiral Bevel Gear Design and Rating
- MC303 – AGMA/Gleason Spiral Bevel Gear Macro Geometry Optimisation
- MC401 - AGMA / Gleason Spiral Gear Design and Rating
- MC402 - AGMA / Gleason Spiral Gear Macro Geometry Optimisation
- For AGMA the relevant life factor expressions can be found in, Figures 5 and 6 p 21 of ANSI/AGMA 2003-C10. Note that the corresponding AGMA Technical Report for Spiral Gears, AGMA 932-A05, also refers to the 2003-C10 graphs.
- This above process leads to the following default S/N curves for contact:



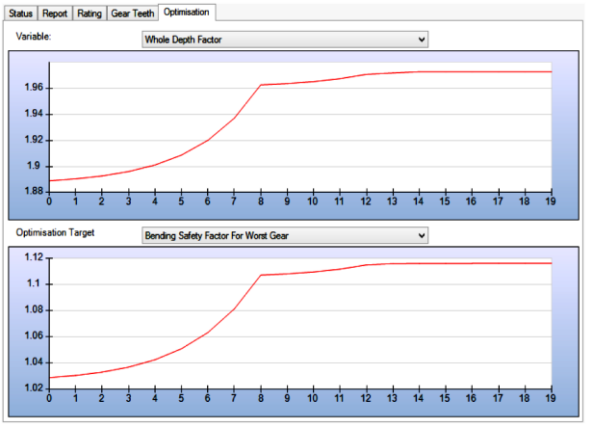
- and the following default S/N curves for bending:



(a) Notes:

- There is a significant difference between Gleason and AGMA S/N curves for Bending due to the significant differences in the Life Factor charts.
- Default materials cannot be edited or deleted but they can be duplicated.

(b) **Optimization**: Displays the progress of optimization variables and targets in the form of line charts. Note that the x axis for these charts is not the number of iterations in the analysis but relates to the number of positive steps made during the optimization.



IX. SUMMARY

(a) On the basis of un-modified roll and modified roll for traditional local synthesis, incomplete un-modified roll and incomplete modified roll are defined as new generation scopes of pinion.

(b) Tooth contact analysis (TCA) based on local synthesis is carried out to obtain contact pattern and transmission error function. The degrees of symmetry and agreement are defined as evaluation indexes of gear meshing performances. For symmetry and agreement degrees, two corresponding sub-objective functions are found and linear weighted combination method is applied to solve the dual objective optimization model.

(c) As for a pair of automobile spiral bevel gears, programs are studied to analyze meshing performances of gear pair for all typical generation scopes. Considering the stability and convergence of algorithm and optimization results, the optimal generation scope of pinion was determined among all.

(d) An optimization process able to design in an automated way the shape of spiral bevel gear flanks has been presented. It leads to a significant reduction of the development time, while allowing a strengthening of the quality of contact patterns by the reduction of the contact pressure. Its extension to the minimization of tooth contact errors made possible, in order to contribute to the reduction of noise and vibration levels and therefore a higher durability.

(d) Achieved in cutting the noise from an average 81-83 dB to 79-81 dB by both experimental and theoretical research. Experimental research was centered on the investigation into the relation between the gear error and noise. Theoretical research was centered on the geometry and kinematics of the meshing process of gears with geometric error.

X. CONCLUSION

(a) Developed an automated process for spiral bevel gear to reduce design and development time and improved tooth contact analysis (TCA) by MASTA program for the analysis of meshing and tooth bearing contact. Tooth contact analysis (TCA) based on local synthesis is carried out to obtain contact pattern and transmission error function. The degrees of symmetry and agreement are defined as evaluation indexes of gear meshing performances. For symmetry and agreement degrees, two corresponding sub-objective functions are found and linear weighted combination method is applied to solve the dual objective optimization model.

(b) Developed a framework flexible to interfaces, fast and accurate, with integration and automation capability improving optimization techniques for spiral bevel gear design and development. A method for tooth contact analysis in modified face-hobbed spiral bevel gears is presented.

(c) The method is applied to study the influence of tooth modifications on tooth contact in face-hobbed spiral bevel gears. On the basis of the obtained results the following conclusions can be made.

(d) A spiral bevel gear has been designed and analyzed using modern industry specifications combined with the implementation of known methodology through years of design and development experience and experiments results. Spiral bevel gears for a new model have been designed using the developed method and an appropriate tooth flank form has been designed and prototyped using the developed method.

(e) Formulated a mathematical model for spiral bevel gear tooth surfaces generator based on Gleason's approach taking into account all the kinematic motions of common Gleason CNC machine tools dedicated to spiral bevel gears machining such as Gl 116 / Gl 118 Pinion Generators. On the basis of un-modified roll and modified roll for traditional local synthesis, incomplete un-modified roll and incomplete modified roll are defined as new generation scopes of pinion. Tooth flank form measurement of spiral bevel gears and tooth contact technology promoted mainly by automotive manufacturers have been applied to large bevel gears and a gear design method based on the tooth flank form standard instead of the conventional tooth contact standard has been developed.

(f) Created Spiral Bevel Gear Gleason Dimension in MASTA by entering the details from the Gleason Dimension Sheet and compared the geometry in MASTA with that in the Dimension Sheet. Based upon the developed theory, an advanced tooth surface generation and TCA program developed and

integrated into Gleason Gear Cutting System. As for a pair of automobile spiral bevel gears, programs are modified to analyze meshing performances of gear pair for all typical generation scopes. Considering the stability and convergence of algorithm and optimization results, the optimal generation scope of pinion can be determined among all.

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Fuzzy Speed Control Method in Three Phase Induction Motor

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Abstract – This paper presents the theory, design and simulation of a controller based on fuzzy logic artificial intelligence techniques used for the speed control of three-phase induction motor. The motor model is designed and membership functions are chosen according to the parameters of the motor model. This technique adjusts the speed of the motor by controlling the frequency and amplitude of the stator voltage, keeping the ratio V/f constant. The simulations have been done by Simulink Toolbox in Matlab and the results are interesting considering the presence of non-linearity in the IM model. Torque-speed response of the proposed control system is investigated. The simulation results demonstrate that the performance of the FLC is better than that of the conventional one. When fuzzy logic based intelligent controller is used instead of the PI controller, excellent performance can be achieved even in the presence of parameter variations and non-linearity. The proposed FLC requiring less circuitry can control speed with fast response and good stability. Fuzzy logic technique is a replacement of the conventional method in the machine control applications for efficient control. The fuzzy logic has advantages compared to conventional methods such as simplicity of control, low cost, and the possibility to control without knowing the exact mathematical model of plant The main advantage of using fuzzy logic controller is that, without having deep knowledge of the induction motor, it is easier to design a well-performing speed control system.

Keywords- Induction motor, Scalar, FLC, Matlab, Simulink.

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I. INTRODUCTION

In the industries, approximately 60% of the total electricity is consumed by A.C motors, mostly induction motors. Three-phase induction motors are the most common and frequently employed machines in industry because these have simple design, high power to weight ratio, easy maintenance, high robustness, reliability, lower cost, high efficiency and good self-starting capability. However, induction motor has disadvantages, such as nonlinear characteristics and having complex mathematical model (Senthilkumar and Vijayan, 2012).

The induction motor was considered as actuator privileged in the applications of nearly constant speed and it is not inherently capable of providing variable speed operation. These limitations have been solved through the use of motor controllers and adjustable speed controllers (Basem et. al., 2010).

The conventional approaches need a complex mathematical model of the motor to develop controllers for quantities such as speed, torque, and position. Hence, to avoid the inherent undesirable characteristics of conventional methods, Fuzzy Logic Controller (FLC) is being developed. FLC offers a simple linguistic approach to develop control system. It maps the input-output relationship based on the knowledge of experts and hence, does not require an accurate mathematical model of the system and can handle the nonlinearities that are difficult to model (Basem et. al., 2010).

II. MODEL OF INDUCTION MOTOR

The dynamic modeling of Induction Motor is done through SIMULINK/ MATLAB software by using its mathematical equations. Synchronous frame of reference is used where:

w_0 = base frequency

w_m = rotor frame frequency

w_k = dq frame frequency

w_s = synchronous frame frequency;

(rad/sec)

λ_s = stator flux

λr = rotor flux

R_s, R_r =stator and rotor resistance

v_s , v_r = stator and rotor voltage

i_s , i_r = stator and rotor current

L_s , L_r = stator and rotor inductance

L_m = magnetizing inductance

L_{sl} = stator leakage inductance

L_{rl} = rotor leakage inductance

T_e = electromagnetic torque

T_L = load torque

B_m = viscous friction coefficient;

(pu)

d,q = direct, quadrature axis

p = number of poles

H = inertia constant(s)

Operators: $\otimes$ = cross product, • = dot product

1. Electrical system equations :

$$v_s = R_s\, i_s + \frac{1}{w_0}\frac{d\lambda_s}{dt} + w_k\, M_{\frac{\pi}{2}}\, \lambda_s \qquad (i)$$

$$v_r = R_r\, i_r + \frac{1}{w_0}\frac{d\lambda_r}{dt} + (w_k - w_m)\, M_{\frac{\pi}{2}}\, \lambda_r \qquad (ii)$$

where

$$\lambda = \begin{bmatrix}\lambda_d \\ \lambda_q\end{bmatrix}$$

$$i = \begin{bmatrix}i_d \\ i_q\end{bmatrix}$$

$$M_{(\frac{\pi}{2})} = \begin{bmatrix}0 & -1 \\ 1 & 0\end{bmatrix}$$

2. Flux linkage current relations –

For d axis :

$$\lambda_{sd} = L_s\, i_{sd} + L_m\, i_{rd} \qquad (iii)$$

$$\lambda_{rd} = L_m\, i_{sd} + L_r\, i_{rd} \qquad (iv)$$

For q axis:

$$\lambda_{sq} = L_s\, i_{sq} + L_m\, i_{rq} \qquad (v)$$

$$\lambda_{rq} = L_s\, i_{sq} + L_m\, i_{rq} \qquad (vi)$$

3- Mechanical system equations-

$$T_s = 2H\frac{dw_{mech}}{dx} + B_m w_{mech} + T_L \qquad (vii)$$

$$T_e = \lambda_s \otimes i_s = M_{\frac{\pi}{2}}\, \lambda_s \bullet i_s \qquad (viii)$$

$$w_{mech} = \frac{2}{p} w_m \qquad (ix)$$

III. FUZZY LOGIC CONTROLLER

Fuzzy logic controller works on control system based on fuzzy logic. Just as fuzzy logic can be described simply as "computing with words rather than numbers", fuzzy logic control can be described as "controlling with sentences rather than (mathematical) equations". The function of a fuzzy logic controller is to convert linguistic control rules based on expert's knowledge into control strategy. Fuzzy logic is useful when systems are too complex (Fuzzy Logic Toolbox)

These control systems are based on artificial intelligence theory as well as conventional control theory.

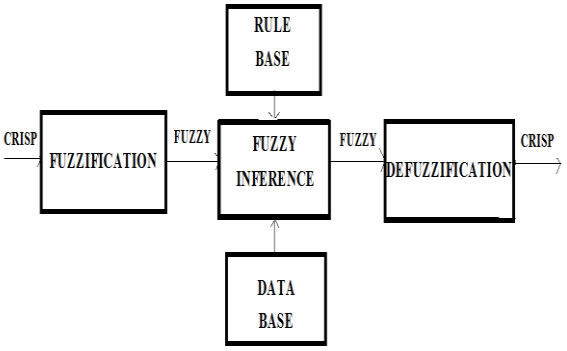

Fig. No.1 Fuzzy control system

Fuzzification converts a crisp input signals into fuzzy signals that can be identified by its level of membership into the fuzzy sets. The inference mechanism uses the linguistic control rules to convert the input conditions into the fuzzy output. Finally, the defuzzification converts the fuzzy outputs into crisp signals, which is the change in frequency for driving the induction motor (Mao-Fu et. al., 2002).

The flowchart representing fuzzy logic control algorithm is-

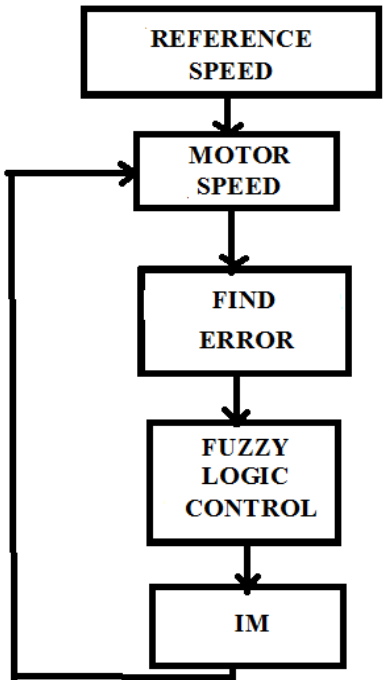

Fig. No.2 Flowchart (Mao-Fu et. al., 2002).

IV. SCALAR CONTROL OR V/F CONTROL OF IM

Variable frequency control is normally associated with change in voltage in order to make the flux constant. This method of speed control is called V/f control. With constant supply voltage, if frequency is increased then the synchronous speed and hence the motor speed increases, but flux and torque gets reduced. Hence along with frequency, voltage must be changed so as to make V/f ratio constant. This maintains constant air gap flux giving speed control without affecting the performance of the motor (Bose, 2002).

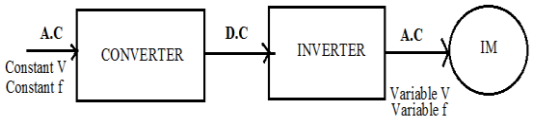

Fig. No.3 Scheme for V/f Control

The speed control of the induction motor was carried out by keeping constant the voltage- frequency ratio in order to maintain the air-gap flux constant. If the supply voltage is varied without adjusting frequency, the induction motor can operate in the flux saturation region or with a weakened field (Senthilkumar and Vijayan, 2012).

The scalar control method based on the constant volt per hertz (V/f) method employs the highly efficient fuzzy controller to reduce the speed error.

5. FUZZY CONTROLLER USING MAMDANI FIS IN MATLAB

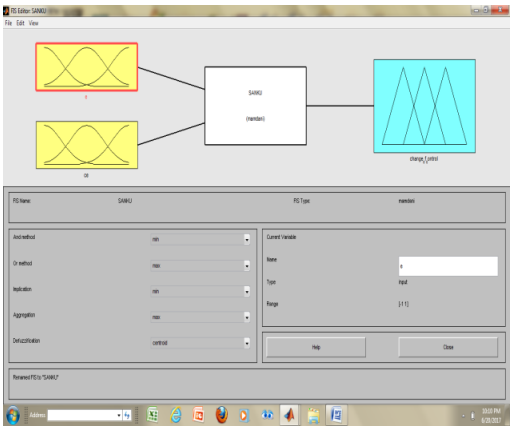

Fig. No. 4(a) FIS Editor

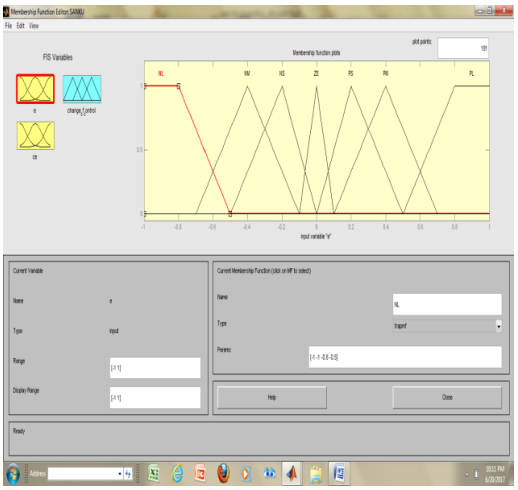

Fig. No.4(b) Membership functions for inputs – error and change in error.

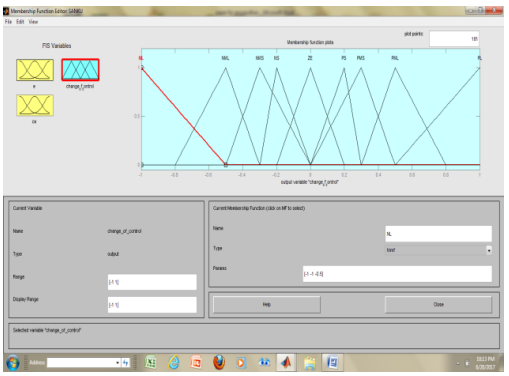

Fig No.4(c) Membership functions for output- control of slip.

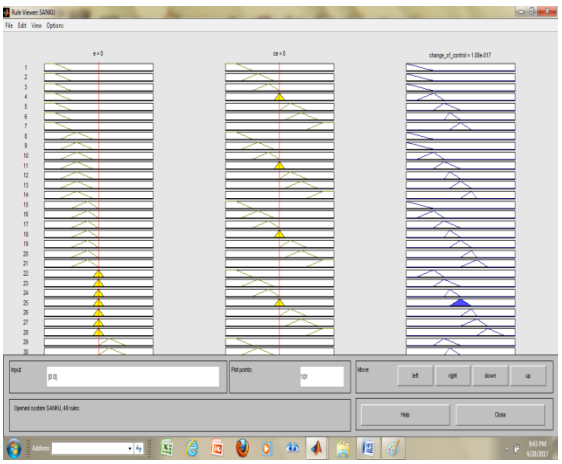

Fig No.4(d) Rule view of fuzzy logic controller

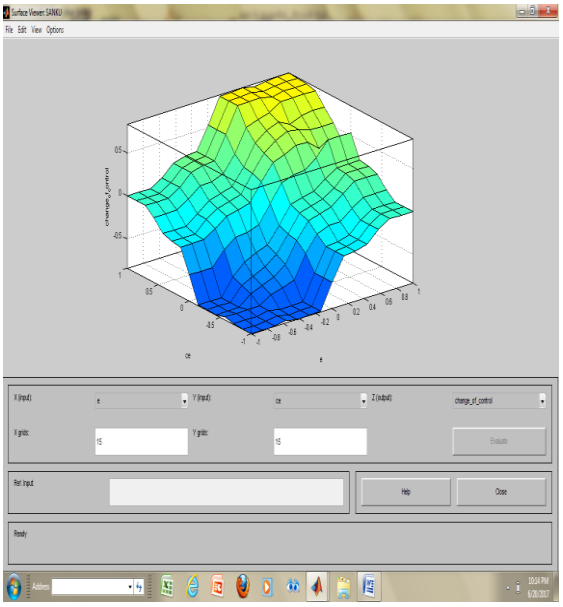

Fig No.4(e) Surface view of fuzzy logic controller

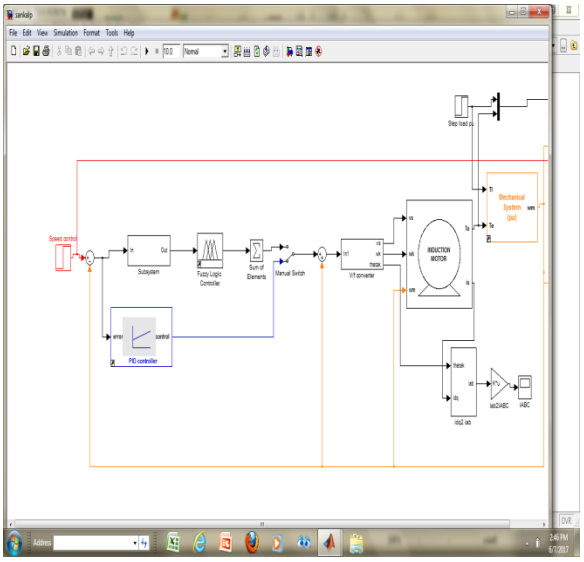

Fig No.5 Simulink Model of Scalar speed control of three phase IM using FLC.

6. SIMULATION RESULTS

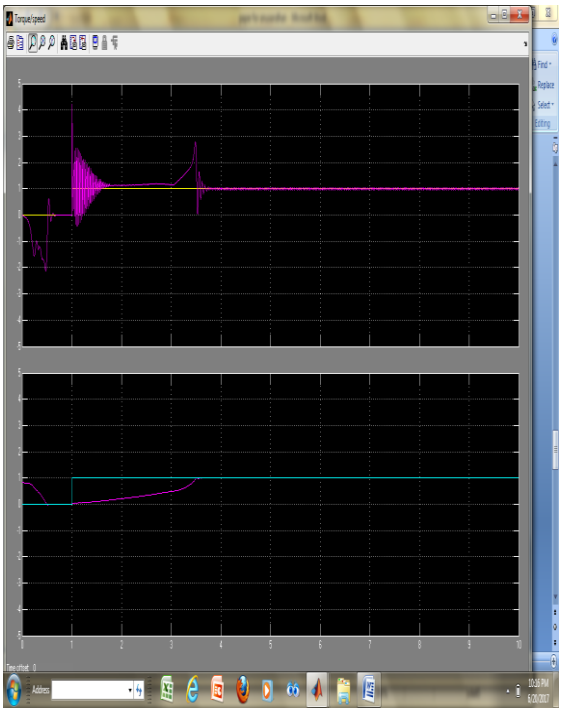

Fig No. 6 Torque / speed response of FLC

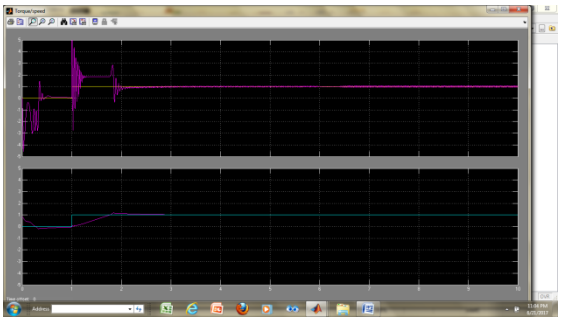

Fig No.7 Torque/speed response of PI controller

7. CONCLUSION

The proposed controller demonstrates that the performance of scalar IM speed drives can be improved by using fuzzy logic. This FLC gives maximum torque over the entire speed range. This technique uses the linguistic if-then rules based on expert's knowledge for adjusting the speed. PI Fuzzy Logic controller can be implemented instead of traditional PI controller.

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A Literature Review on the Executive Performance Management System of Sail Employees

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Abstract – This paper proposes the framework of Executive Performance Management System in SAIL. The framework relates to online Performance management process at executive level. With the help of performance management System Employees are able to know their concrete and tangible particulars about their work and assessment of their performance .This paper is also designed to explore the loopholes of old appraisal system and improvisation in the new Management system.

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I. INTRODUCTION

SAIL has introduced new Executive Performance Management System w.e.f 1.4.2008 which has been implemented for the appraisal year 2008-09. The Performance Appraisal System for Executives in SAIL is designed to assess the Performance and competencies to plan for their development. Before EPMS, they were following Executive Performance Appraisal System (EPAS). It is an online System for Performance Management. It helps in Leadership development and Competency building through 360 degree and through Assessment and Development Centre (ADC).It envisages that there will be two grades for individual executives during a year-one grading based on his performance during the year and the other grading on CPV (Competencies, Potentials & Values) factors as judged by supervisors. The executive would be graded as Exceptional Performer (EP), High Performer (HP), average Performer(AP) & Low Performer(LP) on both Performance as well as CPV factors.

II. EXECUTIVE PERFORMANCE MANAGEMENT SYSTEM

The EPMS will cover promotion of Executives from E1 to E8 grade. Since E8 & E9 grades follow the PSEB format of appraisal which is followed by all public sector enterprises as they are feeder cadre for Directional positions in PSUs.

III. LEVELS OF MAMANGEMENT (E-EXECUTIVE)

E1-E3 : Junior Management (shift level)

E4-E5 : Middle Management (Sectional level)

E6-E7 : Senior Management (HOD/Functional Head level)

E8-E9: Top Management (Strategic Leadership level)

IV. ON-LINE PERFORMANCE MANAGEMENT PROCESS

Step 1: Finalization of KPAs (Key performance areas) by employees

Step 2 : Filling up Performance Diary daily

Step 3 : Self Assessment

Step 4 : Assessment by Reporting Officer

Step 5 : Assessment by Reviewing Officer

Step 6 : Final assessment & grading by PMC(Performance management Committee)

Step 7 : Development and training needs plan

Step 8 : Communicating the grades to employees

V. KEY PERFORMANCE AREAS

Employees themselves have to describe their Key Performance Areas online. Three types of tasks and targets are categorized: Routine, Non-Routine and Special.

VI. PERFORMANCE DIARY

A Performance Diary is maintained daily (online) to record individual executive's performance highlights /constraints which are assessed by both Reporting and Reviewing Officer. Each executive's entry is intimated to his reporting officer and every reporting officer's remarks /entries are intimated to the individual executive concerned. The reviewing officer is able to view the executive's concerned performance diary whenever he desires. The diaries are expected to facilitate the effort of tracking key performance activities and are used as support during performance discussions. Only significant events , accomplishments and constraints faced are recorded in the diary.

VII. PERFORMANCE REVIEW DISCUSSION

It is conducted twice a year in the month of April and October. It is categorized as Mid-year review and Year-End review and assessment. During the PRD session, the reporting officer will ensure a conducive climate for discussion. In this session the reporting officer and appraise will discuss:

(a) The extent of task and target fulfilled

(b) Major strength of appraise

(c) Development needs

(d) Suggestions for improvement of the individual and team performance

In the first PRD session i.e , the Midterm PRD held in October , the discussion will be based on completion of the tasks /targets up to mid year and changes in the tasks/targets for the remaining six months. In the second PRD session i.e. annual PRD held in April, the discussion will be based on fulfilment of tasks/targets of the assessment year.

VIII. WEIGHTAGES OF VARIOUS COMPONENTS OF EPMS

Components	E1-E5	E6-E7	E8-E9
Performance	60	50	50
Competencies	15	20	20
Values	15	15	15
Potential	10	15	15
Total	100	100	100

IX. PERFORMANCE MANAGEMENT COMMITTEE

PMC is constituted of HOD, Reporting and Reviewing Officer. It decides the final grading. The final assessment sheet will then be communicated to the concerned Personnel Executive. It reduces subjectivity and recognizes good performers. HOD is responsible for completion of assessment. He plays a rationalization role taking into account the performance of the departments along with the performance of various sections. PMC categorize each executive's performance for the year into four categories. High level PMC has to decide exceptional performers and low performers by recording two regions for the same. Basically there are two categorization of assessments are done: Performance & Competencies (includes both Potential & Values).Individual assessment by PMC is done into four categories:

(a) EP (Exceptional Performer)-to be given very sparingly for role model , unquestionable , all agree consensus.

(b) HP(High Performer)- Exceeds all targets , agreed by all as an excellent performer

(c) AP(Average Performer)- Meets minimum target requirements

(d) LP(Low Performer)- Not able to complete targets and needs to improve delivery of results.

X. COMPOSITION OF PERFORMANCE MANAGEMENT COMMITTEE

Level	Reporting Officer	Reviewing Officer	PMC Chairman	PMC Members
E1/E2	E3/E4	E5	Zonal Head	Departmental Head
E3/E4	E5	E6	Functional Head	Zonal Heads
E5	E6	E7	Director	Functional Heads
E6	E7	E8	Chairman	Director
E7	E8	E9	Chairman	Director
E8	E9	DIRECTOR	Chairman	Director

XI. DIFFERENCE BETWEEN OLD EMPLOYEE PERFORMANCE APPRAISAL SYSTEM and NEW PERFORMANCE MANAGEMENT SYSTEM

Performance Appraisal System	Performance Management System
Paper form	Online system
No Goal Alignment	Goal Alignment cascade workshop
Key Performance Areas	Weighted , quantifiable KPA's with evaluation criteria (Routine, Non-Routine, Special)
No Performance Diary	Performance diary
No self Assessment	Self Assessment
Performance and Potential assessments are merged	Separate grading for performance and competencies
Reporting and Reviewing officers' assessment are inter dependent	Reporting and Reviewing Officer's assessment are dependent
No transparency as grading are confidential	Transparency through communication of performance grading
Forced distribution	No Forced distribution
Reporting/Reviewing officer and HOD are not the part of Performance Reviewing Committee	Reporting /reviewing Officer and HOD are part of Performance Reviewing Committee
Role of HOD is not defined	Defined role of HOD
No incentives for High Performers	Incentives for High performers
No reasoning was given while identifying Executives as Outstanding or Low performers	PMC identifies EP & LP by recording two major achievements/shortcomings for categorizing executives as EP or LP
No Development Pan for low Performers	Training and Development plans for Low Performers
No assessment of Assessors	Assessment of Assessors
No 360 degree feedback	Presence of 360 degree feedback
No assessment and development centres	There is an assessment and development centre
No Technical committee	KPAs directly prepared by technical Committee
No audit system	PMS audit is there
No team appraisal	Presence of Team appraisal
No performance Linked pay	Performance linked pay to be introduced

XII. CONCLUSION

Not a single employee can be forced or directed to do a work but can only be encouraged or motivated for its accomplishment. The company has great concerns to make it a successful company and also for this it really requires skilled human resource at highest levels of management and to achieve such goal there should be transparency in performance appraisal of executives' .Moreover the executives should be well trained with latest technologies. By providing required facilities and periodic training every employee will be satisfied with the organization which will lead to high job involvement and high productivity.

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Modelling and Simulation of Radial Drilling Machine and Analysis of Drill Bit

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Abstract – In this paper, firstly we have used CATIA V5 R20 software to design parts and developed the model of Radial Drilling Machine and assembled it. Then we did simulation of the model to check the functions of various parts. Later, we have designed the drill bit in CATIA and did analysis of drill bit in ANSYS. In present analysis we have taken three different rake and relief angles to find out the variation in values of total deformation and equivalent stresses for the applied moment. We have done meshing and give boundary conditions for proper result. The purpose of our project is to design such a drill bit which can withstand for long time and give high accurate result and increases productivity.

Keywords– Radial Drilling, CATIA V5 R20, Modeling, Simulation, Drill Bit, Ansys 2014

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I. INTRODUCTION

Drilling machine is one of the most important machine tools in a workshop. It was designed to produce a cylindrical hole of required diameter and depth on metal work-pieces. Though hole can be made by different machine tools in a shop, drilling machine is designed specifically to perform the operation of drilling and similar operations. There are various types of drilling machines:-

(a) Portable drilling machine

(b) Sensitive drilling machine

(c) Radial drilling machine

(d) Gang drilling machine

(e) Multiple drilling machine

(f) Multiple spindle drilling machine

(g) Deep hole drilling machine

II. REDIAL DRILLING MECHINE

(a) Features of Radial Drilling Machine:-

(i) It has largest and most versatile used for drilling medium to large and heavy work-piece.

(ii) Radial drilling machine belong to power feed type.

(iii) The column and radial drilling machine supports the radial arm, drill head and motor.

(iv) The radial arm slides up and down on the column with the help of elevating screw provided on the side of the column, which is driven by a motor.

(v) The drill head is mounted on the radial arm and moves on the guide ways provided radial arm can also be swiveled around the column.

(b) Main components of Redial Drilling Machine:-

(i) Base

(ii) Radial arm

(iii) Colum

(iv) Working Table

(v) Motor

(vi) Spindle

(vii) Tool Holder

(viii) Base Holder

(ix) Tool Bit

(x) Handle

(xi) Sleeve

(xii) Rotor

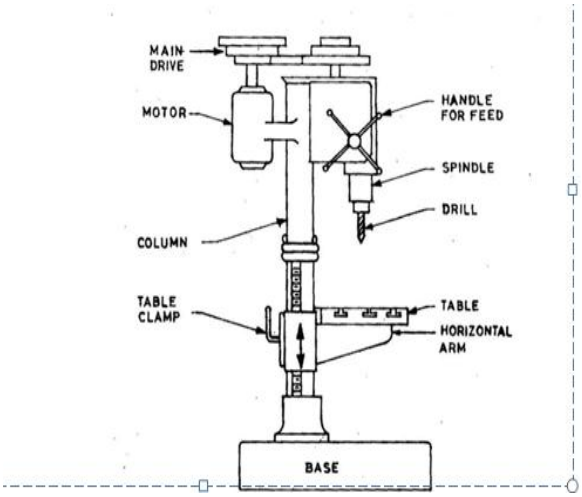


Fig. 1

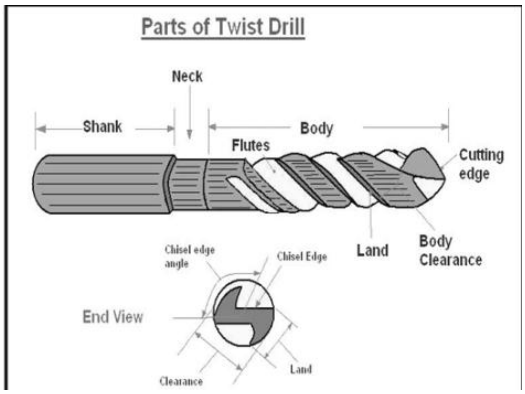


Fig. 2

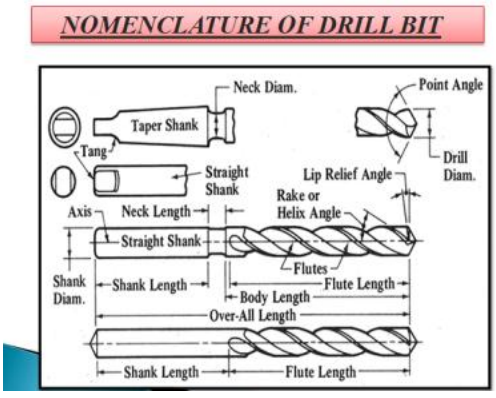


Fig. 3

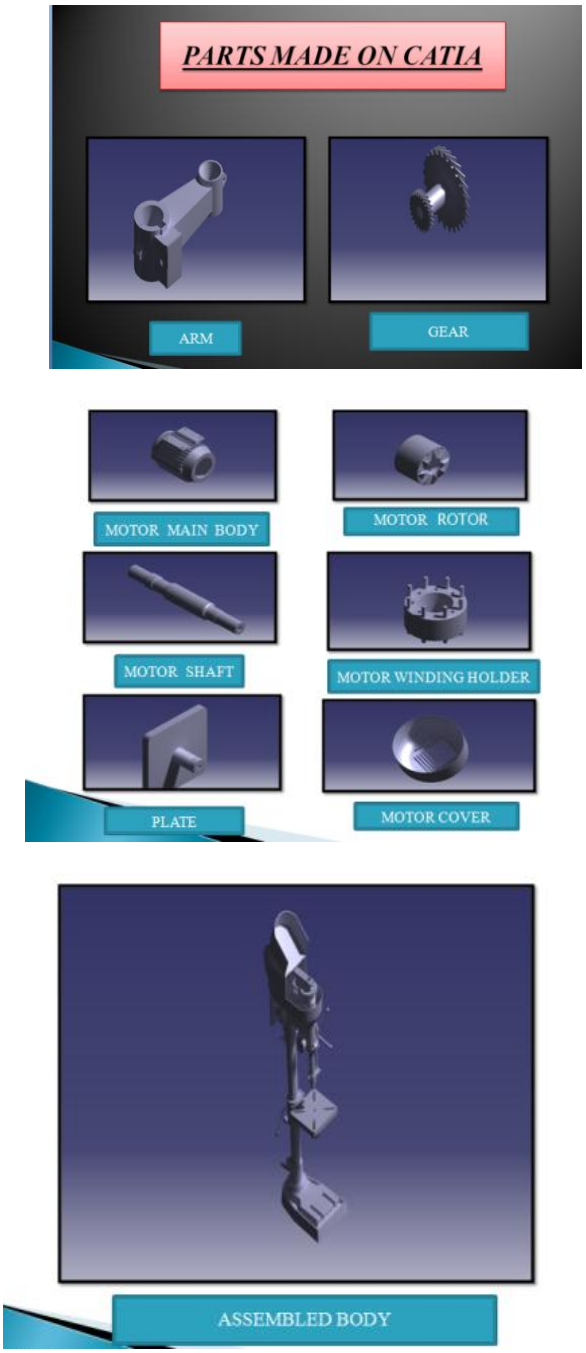


Fig. 4

III. SIMULATION

The act of simulating something first requires that a model be developed then this model represents the key characteristics, behaviors or function s of the selected physical or abstract system or process.

In simulation we have to do fix some parts using fixed joints likes foundations, base etc. And we have to apply different joints in different parts according to degree of freedom of that parts which have relative motion to each other.

IV. JOINTS USED DURING SIMULATION

(a) **Revolute joint** (pin joint or hinge joint) is a one-degree-of-freedom kinematic pair used in mechanisms. Revolute joints provide rotation function used in many places such as door hinges.

(b) **Prismatic joint** provides a linear sliding movement between two bodies, and is often called a slider, as in the slider-crank linkage.

(c) **Rack and pinion** that comprises a pair of gears which convert rotational motion into linear motion. A circular gear called "the pinion" engages teeth on a linear "gear" called "the rack"; rotational motion applied to the pinion causes the rack to move relative to the pinion thereby translating the rotational motion of the pinion into linear motion.

(d) **Cylindrical joint** is a two-degrees-of-freedom kinematic pair used in mechanisms. Cylindrical joints provide sliding function as well as rotation, providing a way for two rigid bodies to translate and rotate freely.

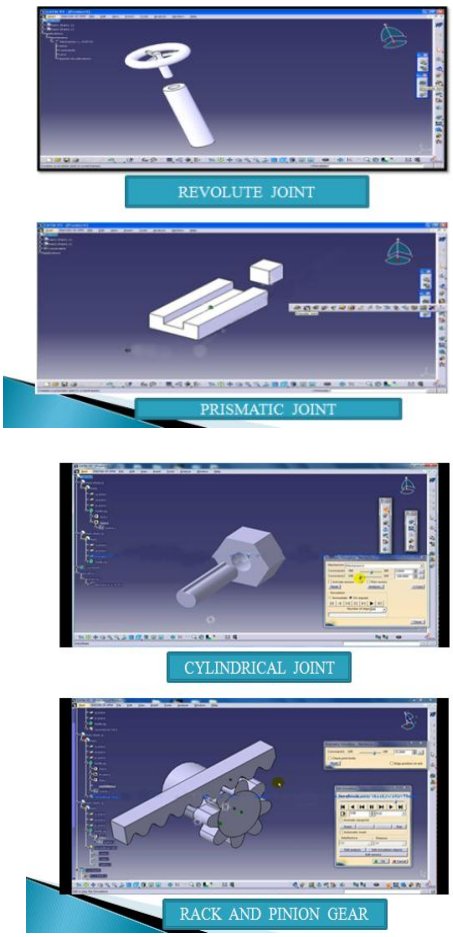


Fig. 5

V. ANALYSIS OF DRILL BIT

The analysis of drill bit has been done in various processes. In analysis, firstly we have to save the CAD file into .step or .its format. Import the geometry in static structural module of Ansys workbench.

After that we add material like high speed steel (HSS) and aluminum alloy from engineering data sources. Now, going to the model & apply different boundary conditions.

Following are the steps of analysis of drill bit are as follows:-

➢Apply the material high speed steel for drill bit and alluminium alloy for work-piece in model .

➢After that give the contact between drill bit and work-piece as frictionless.

➢Now we have done meshing the drill bit and work-piece as shown in fig(a).

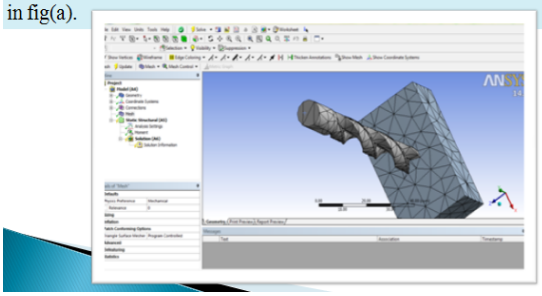
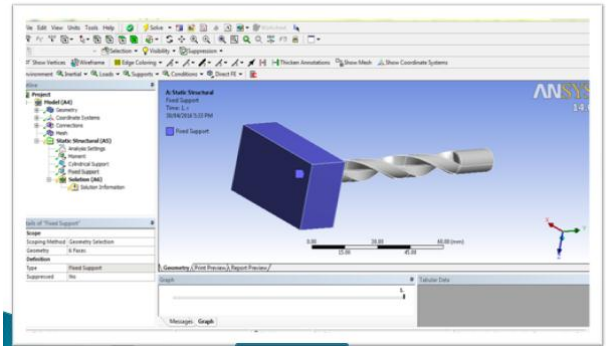
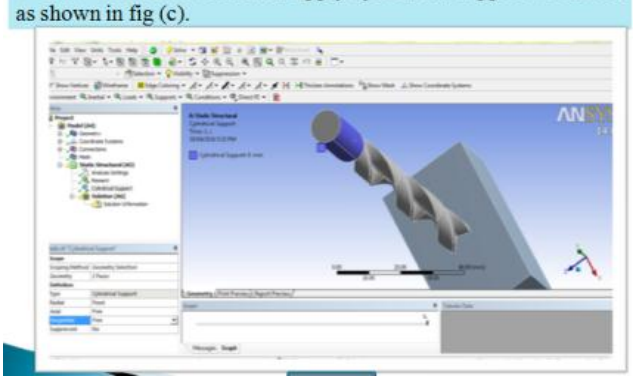


Fig (a)

➢ In static structural we have to apply fixed support for work-piece as shown in fig (b).



➢ Now from static structural apply cylindrical support in drill bit as shown in fig (c).



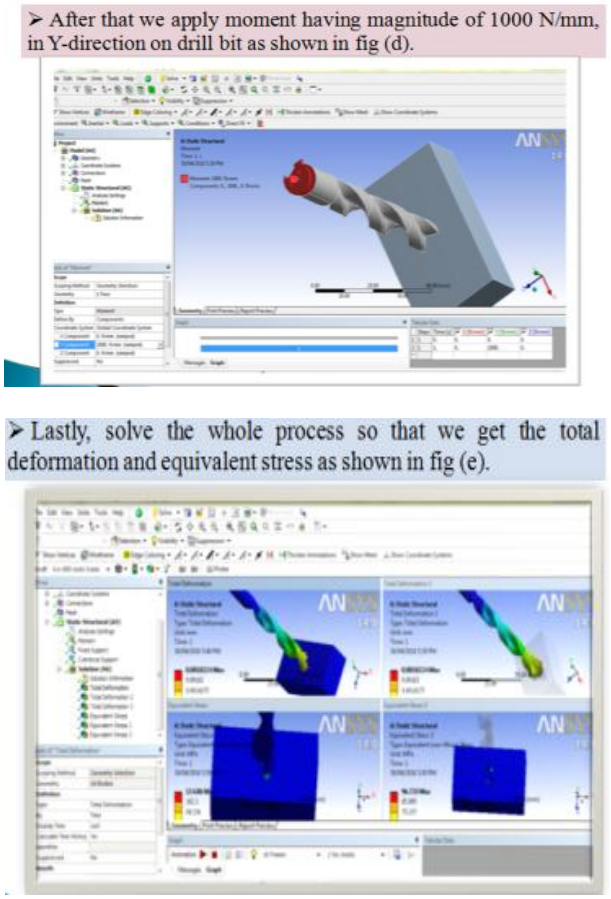


Fig. 6

IV. RESULT

As drill bit have been analyzed under various rack & relief angle and the best result is generated from that we have done the fine meshing of drill bit for proper results. As we have shown the stress and deformation generated at each drill bit with different geometries condition. In the best result i.e. at rack angle 4` and relief angle 10`. In this the colour of the analysis bit shows that the stress & deformation is more in the point angle of the drill bit where it is in contact with the work piece. The moment of 1000N had been given on the drill bit. And the result has been taken out after that.

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Global Reporting Initiative: A Study on Global Reporting Initiative Standards as an Important Tool of Corporate Social Responsibility and an Improvement over Sustainability Reporting Standards

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Abstract – This paper aims to explain the theoretical exposure of Global reporting Initiative as a standardised sustainability protocol which is world widely accepted by companies. Corporate sustainability reporting is becoming very popular now days but in India it is at sprouting stage. But earlier researches prove that its importance is growing year after year. As far as Indian scenario is concerned there is only limited number of companies which are showcasing their sustainability plans and performance to the various stakeholders. Indian corporations are following Global Reporting Initiative (GRI) guidelines to prepare the sustainability reports. Furthermore, the current study tries to find out that GRI guidelines set as a good basis for the sustainability reporting. In India, the Sustainability Reporting Initiative was started in 2001 but it has shown a very slow progress. The paper expounds the GRI reporting guidelines so as to apply CSR principles, and explains the key elements of the economic, environmental, social, society, and Governance issues. The paper aims to provide general level information on corporate responsibility reporting and sustainability initiatives by National Voluntary Guidelines for India Industries from CSR to Responsible Business and Business Responsibility Report by SEBI. The aim of present study is to show the analysis of famous sustainability reporting framework GRI. The theoretical part is constructed and explained by thorough research of available literature on the topic, therefore the paper uses qualitative research methods as research methodology.

Key Words: Global Reporting Initiative, Corporate Social Responsibility, National Voluntary Guidelines, Business Responsibility Report, SEBI, Sustainability Report

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I. INTRODUCTION

The Conceptualisation and notion towards Corporate Sustainability Reporting is becoming very popular now days. But the recent research & surveys proves that its importance is growing year after year. As far as Indian scenario is concerned there is only limited number of companies which are publishing their sustainability reports for their various stakeholders and working towards the welfare of society by financial investments. Most large firms in India and worldwide have been focusing on developing sustainable business practices and reducing environmental impact of their activities. These activities include reduction in emissions to diminish the impact of climate change, waste and water management and a move towards renewable sources of energy. This is particularly important now since India has committed a 35% reduction in emissions by 2030. National voluntary Guidelines on Social, Environmental and Economic Responsibilities of Business, Business Responsibility Report' as per Securities and Exchange Board of India from the perspective of Environment, Social and Governance (ESG), Global Reporting Initiative (GRI) guidelines.

GRI is an international, independent standards organization that helps businesses, governments and other organizations understand and report on their impacts on issues such as climate change, human rights and corruption. Founded in 1997, GRI has from time to time issued guidelines that businesses can use to report non-financial information. It has 95 member countries that follow the GRI guidelines in reporting. These are a set of 36 modular Standards that facilitate corporate reporting on topics such as greenhouse gas emissions, energy and water use, and labour practices. (Live Mint, Feb 15, 2017). The latest GRI-G4 guidelines have been in use for the last two years, which have been taken as the basis for the new standards. In India these are the basis of the

National Voluntary Guidelines (NVGs) drafted by the ministry of corporate affairs in 2012. Under NVGs, as per the 2012 directive by **Securities Exchange Board of India (SEBI**), top 100 companies as per market capitalisation are required to release Business Responsibility Reports (BRRs) based on the NVGs; this has been extended to 500 companies beginning April 2017. The new GRI-Sustainability Reporting Standards are aimed at enabling companies around the world to be more transparent about their impacts on the economy, the environment and society - and use similar reporting formats for disclosures.

II. OBJECTIVE

The focus of this paper is to study & compare the sustainability reporting practices according to the globally accepted GRI with National Voluntary Guidelines on Social, Environmental and Economic Responsibility of Business (NVGs) & SEBI's Business Responsibility Report (BRR).

III. RESEARCH METHOD

This study is based on secondary data. The Data has been collected by way of extensive documentary analysis. The present research uses qualitative research methods, based on the secondary data sourced from journals, magazines, articles and media reports. It's a type of Conceptual paper & the sustainability initiatives taken up & disclosed by companies under study on their Websites and in their annual reports, sustainability reports, policies, codes, and so on were considered for analysis.

IV. SUSTAINABILITY REPORTING FRAMEWORKS IN INDIA AND GLOBAL REPORTING INITIATIVE

(a) National Voluntary Guidelines on Social, Environmental and Economic Responsibility of Business (NVGs)

National Voluntary Guidelines on Social, Environmental and Economic Responsibilities of Business (NVGs) were released by the Ministry of Corporate Affairs (MCA), Government of India, in July 2011 by Mr. Murli Deora, the former Honourable Minister for Corporate Affairs. National Voluntary Guidelines were an improvement over the Corporate Social Responsibility Voluntary Guidelines 2009, released by the Ministry of Corporate Affairs in December 2009.

These guidelines are for all businesses irrespective of their size, ownership, geography, location and sector to achieve the triple bottom line. It is also expected that all business organisations in India, whether Multi-National Companies that operate in the country or indigenous companies, would consciously work according to the said Guidelines.

The Guidelines also provide a suggestive framework for responsible business & are also encouraged to work beyond the recommended provisions that are being explained in the document. These guidelines are compatible with globally acceptable guidelines on sustainability reporting. NVGs are principle-based and encourage companies to report under the Triple Bottom Line (TBL).

Business Responsibility is based on the 'triple bottom line approach', considering environmental, social and economic concerns in the core of businesses' operations, unlike 'Corporate Social Responsibility', which is often associated with corporate philanthropy.

A four year project (2008-2012) was initially started as Indian Institute of Cost Accountants IICA-GIZ Corporate Social Responsibility project, but later came to be known as the IICA-GIZ Business Responsibility Initiative. The IICA GIZ Business Responsibility Initiative began in 2008 in this context aiming to provide a comprehensive Indian perspective on business responsibility that is on three levels - social, economic and environmental (ESG). These guidelines were drafted through an extensive consultative process done through a Guidelines Drafting Committee (GDC) comprising of competent and experienced professionals representing diverse stakeholder groups.

These guidelines are applicable to large and small scale businesses alike. Even though an argument keeps on going that MSMEs do not have that much of capacity or resources to implement the changes or amendments, to adopt the Guidelines.

MSMEs would lose out on future business opportunities and their ability to remain responsible and socially active. Keeping in consideration such aspect the reporting framework is designed on the 'Apply-or-Explain' principle which is also the fundamental basis of these Guidelines.

One of the main achievements of this initiative has been the development of the National Voluntary Guidelines (NVGs), consisting of 9 core principles. By going through each Principle with its Core Elements will give a clear picture for putting that Principle into practice.

(i) **Principle 1:** Businesses should conduct and govern themselves with ethics, transparency and accountability

(ii) **Principle 2:** Businesses should provide goods and services that are safe and

contribute to sustainability throughout their life cycle

(iii) **Principle 3:** Businesses should promote the wellbeing of all employees

(iv) **Principle 4:** Businesses should respect the interests of, and be responsive towards all stakeholders, especially those who are disadvantaged, vulnerable and marginalised

(v) **Principle 5:** Businesses should respect and promote human rights

(vi) **Principle 6:** Businesses should respect, protect, and make efforts to restore the environment

(vii) **Principle 7:** Businesses, when engaged in influencing public and regulatory policy, should do so in a responsible manner

(viii) **Principle 8:** Businesses should support inclusive growth and equitable development

(ix) **Principle 9:** Businesses should engage with and provide value to their customers and consumers in a responsible manner

(a) SEBI Business Responsibility Report (BRR)

On August 8 2013, the Parliament passed the Companies Bill replacing the nearly 50 year old Companies Act. The Companies' Act 2012 contains a clause on CSR (Section 135) which makes it mandatory for companies within a certain threshold to spend 2 percent profit on CSR activities.

This has shifted priority amongst business communities from the mandate of responsible business conduct, of which CSR is a part, to the mandatory 2 percent spend and its subsequent reporting. The challenge, now, is to mainstream the NVGs while simultaneously addressing concerns relating to the 2% spend.

The Securities and Exchange Board of India (SEBI)– as a part of its circular on 13th August 2012, makes it mandatory for top 100 BSE and NSE listed companies (as on March 2012) to disclose their Business Responsibility Practices through a report adhering to the NVG framework. The provisions of circular are compulsory for top 100 listed entities based on market capitalization at BSE and NSE as on March 31, 2012, and are applicable with effect from financial year ending on or after December 31, 2012 (SEBI, 2012).

(b) BSE extends business responsibility reporting to top 500 firms, 2015

BSE signed an MOU with international not-for-profit Global Reporting Initiative to this effect. SE signed a pact with international not-for-profit Global Reporting Initiative (GRI) to extend **business responsibility reporting (BRR) from top 100 to the top 500 listed companies**. The memorandum of understanding (MoU) was signed at the fifth global conference of **GRI in Amsterdam**, which was attended by 20 stock exchanges, multinational corporations, Indian companies, officials from regulatory authorities and sustainability experts.

BSE, with over 5,000 firms, is one of the largest exchanges in the world and the first from Asia to join the United Nations' Sustainable Stock Exchanges (SSE) initiative. **BRR** is a voluntary disclosure of the extent of adoption of responsible business practices, in line with those mentioned in the **National Voluntary Guidelines** (NVGs) drawn up by the Securities and Exchange Board of India (SEBI) in 2012 & now, the top 500 firms will need to do the same starting 1 April.

Table-1

Sustainability in India- Recent Events/Establishments

Year	Description
2009	Ministry of Corporate Affairs (MCA) of the Government of India established Voluntary Guidelines on Corporate Social Responsibility
2011	India's new National Voluntary Guidelines (NVGs) based on a revision of the Voluntary Guidelines was launched
2012	The Securities Exchange Board of India (SEBI) releases a circular which mandates the inclusion of Business Responsibility Reports (BRR) as part of the Annual Reports of top 100 listed companies based on market capitalization of the NSE and BSE
2013	Ministry of Corporate Affairs has notified Section 135 and Schedule VII of the Companies Act 2013 as well as the provisions of the Companies (Corporate Social Responsibility Policy) Rules, 2014 to come into effect from April 1, 2014 notifies that all companies that have a "net worth of more than Rs. 500 crore / turnover of more than Rs. 1,000 crore / Net profit of more than Rs. 5 crore will be required to spend at least 2% of the average net profits on CSR activities."

Source: Global Reporting Initiative, Focal Point India (2013)

(c) Global Reporting Initiative (GRI)

GRI formed by Ceres and the Tellus Institute, with support from the United Nations Environment Programme, produces one of the world's most prevalent standards for sustainability reporting. GRI convenes a network of over 600 organisational

stakeholders from over 60 countries. In India the Global Reporting Initiative (GRI) launched its first global standards for sustainability reporting in Mumbai in collaboration with BSE Ltd, Confederation of Indian Industry (CII) and Yes Bank Ltd. GRI is an international independent non-profit organization that has pioneered corporate sustainability reporting since 1997. GRI helps all businesses, governments and other organizations to understand and report on their impacts on issues such as climate change, human rights, upliftment of society, education, environment and corruption and many others. GRI Standards emphasize the organizations to focus their reporting on the areas that reflect their economic, environmental and social impacts and also, its Sustainability Reporting Guidelines (Global Reporting Initiative 2006) identify four categories of social performance indicators: labour practices and decent work, human rights, society and product responsibility. GRI provides most standardised and widely used guidelines on sustainability reporting with thousands of reporters in over 90 countries.

According to a survey by KPMG, 'Almost 80 percent of the largest 100 companies in 41 countries worldwide issuing corporate responsibility (CR) reports now use the Global Reporting Initiative's Sustainability Reporting Guideline'. (2013).Out of the world's largest 250 corporation, 92% report on their sustainability performance and 82% of these use GRI's Standards to do so. Currently, 39 countries and regions reference GRI in their sustainability reporting policies. Out of 14864 companies only 80 Indian companies are presenting handful report on sustainability reporting as GRI guidelines (GRI database, 2012). More than 5,000 organizations have used the GRI Guidelines for their sustainability reporting across more than 90 countries. More than 20,000 reports have been registered in GRI's Sustainability Disclosure Database and 23 countries reference GRI's Guidelines in policies and look at GRI for guidance as the world's most widely used sustainability reporting standards. In addition GRI's having long-standing collaborations with over 20 international organizations such as the UNGC, OECD, the ILO Conventions and the UN Working Group on Business & Human Rights (2015). Also there has been a dramatic increase in Corporate Responsibility Reporting rates in Asia Pacific Region and the highest growth has been in India (+53 % points)followed by Chile, Singapore, Australia, Taiwan and China.

According to a 2006study by GRI data partner the Governance & Accountability Institute, Fortune 500 participation in GRI reporting was 5%. GRI's mission is to empower decision-makers worldwide, through its standards and multi-stakeholder network, to take action towards a more sustainable economy and world. GRI is committed towards continuously improving and increasing the use of the standards, which are freely available to the public as a whole. The GRI institution describes itself as "a multi-stakeholder governed institution collaborating to provide the global standards in sustainability reporting" (GRI, 2009b). The GRI is one of the most comprehensive documents which guide organization on how to report their CSR activities. It can be used as a supplementary tool by companies which are implementing NVG in India. To increase global accessibility, a variety of GRI publications are available in different languages. The greatest number of reporters using the GRI Guidelines is from the Financial Services sector, followed by organizations from the Energy, and Food and Beverage Products sectors. Organizations from almost 40 different sectors use the GRI Reporting Framework. These contain a wide range of performance indicators split into three categories:

(i) Economic (economic performance; market presence; indirect economic impacts),

(ii) Environmental (materials; energy; water; biodiversity; emissions, effluence and waste; products and services; compliance; transport)

(iii) Social (labour; human rights; society; product responsibility).

GRI recommends (but does not mandate) that reporting organisations use external assurance to verify claims made in their reports. While not recommending particular assurance providers (auditors), it does set criteria on acceptable providers. The practice of Corporate Social Reporting has been encouraged by the establishment of the GRI in 1997 and the launch of the Global Compact in 1999 (Antal et al. 2002). Almost 400 instruments in 64 countries documented in 2016 and 33,828 sustainability reports registered in the GRI Database as of 30 June 2016. As of 2015, 7,500 organizations used GRI Guidelines for the sustainability reports.

(a) GRI Reporting Guidelines – G4 recommends the use of external assurance for sustainability reports, but does not require it to prepare a report 'in accordance' with the G4 Guidelines "GRI recommends the use of external assurance for sustainability reports in addition to any internal resources, but does not require it", page 51 of the G4 Guidelines – Implementation Manual. Trends in external assurance of sustainability reports based on the GRI Framework from India reveals a rise in external assurance from 30% in 2006 to more than 75% in 2013. It is worthwhile to note that GRI recommends the use of external assurance which is complementary to GRI's Application Level Check that indicates the extent to which the GRI Guidelines have been applied but does not comment on the content or quality of the reporting (The External Assurance of Sustainability Reporting, 2013).

Table-2. Orientation

Year	Establishments/Major Events
1997	➢ GRI was founded in Boston, USA. CERES, the Tellus Institute and UNEP all played a role in GRI's establishment
2000	➢ GRI launched the first version of the GRI Guidelines – the first global framework for comprehensive sustainability reporting.
2001	➢ GRI became an independent organization On the advice of the GRI Steering Committee, CERES formed GRI into a separate, independent non-profit institution.
2002	➢ GRI relocated to Amsterdam, the Netherlands and was formally inaugurated as a UNEP ➢ The second generation of the Guidelines, G2, was launched, incorporating public feedback from the first version of the guidelines in Johannesburg. ➢ GRI was referenced in the World Summit's Plan of Implementation.
2003	➢ GRI's Organizational Stakeholders Program was launched, enabling core supporters to champion GRI's mission and contribute their expertise to GRI's work. ➢ The GRI Stakeholder Council (SC) was formed – the formal stakeholder policy forum to advise the Board of Directors
2005	➢ The Technical Advisory Committee (TAC) was formed to provide high-level technical advice and expertise to maintain the overall quality of the Framework.
2006	➢ The G3 Guidelines were launched with greater emphasis on the materiality principle. ➢ GRI's first Global Conference on Sustainability and Transparency took place: 'Reporting: A measure of Sustainability'. ➢ Formal partnerships were entered into with the UNGC and the OECD
2007	➢ GRI also launched the UNGC GRI linkage document: Making the Connection. ➢ GRI began setting up regional offices, known as **Focal Points**. The first Focal Point was launched this year in Brazil. ➢ GRI also launched its Application Level Service
2008	➢ GRI held its second Global Conference: 'Sustainability Reporting Today: The Readers' verdict', attracted over 1000 participants from 58 countries and 148 speakers. ➢ GRI Certified Training Partner Program was launched. ➢ GRI Governmental Advisory Group established ➢ GRI's regional reach also expanded with the opening of GRI's second Focal Point in Australia.
2009	➢ GRI also launched the Global Action Network for Transparency in the Supply Chain (GANTSCh) Program (later renamed Business Transparency Program – BTP) ➢ A third Focal Point opened in China. ➢ GRI released a new Sector Guideline: Electric Utilities.
2010	➢ GRI also released two new Sector Guidelines: Food Processing and NGO ➢ GRI's third Global Conference on Sustainability and Transparency: "Rethink – Rebuild – Report" took place attracting 1200 attendees from 77 different countries. ➢ **GRI also expanded its regional reach by opening a fourth Focal Point in India**
2011	➢ GRI opened its fifth Focal Point in the USA. ➢ The G3.1 Guidelines were released, providing expanded guidance on local community impacts, human rights, and gender. ➢ GRI's Sustainability Disclosure Database was launched. ➢ Three new Sector Guidelines were also released: Mining and Metals, Airport Operators, Construction and Real Estate.
2012	➢ GRI hosted its first Australian Conference in Melbourne in 2012, attracting 250 attendees from 11 difference countries. In the same year, the GRI US Focal Point held two North American conferences, one in St Louis, Missouri, and one in Toronto, Canada ➢ Three new Sector Supplements were produced: Oil and Gas, Media, and Event Organizers
2013	➢ GRI's fourth Global Conference: 'Innovation, Information, Integration' took place. ➢ GRI released the latest version of its Guidelines, G4, developed through a multistakeholder approach, with greater emphasis on material aspects ➢ GRI's sixth Focal Point in South Africa was launched.
2014	➢ GRI launched the Global Sustainability Standards Board (GSSB) to strengthen the independence of the standards aspect of GRI's work. ➢ GRI held its 'Sustainability Reporting for Sustainable Development' conference in Mumbai ➢ Latest version of Taxonomy covering G4, G3.1 and G3 Guidelines was launched.
2015	➢ G4 Exam was launched & was available in more than 70 countries ➢ Reporting 2025 was launched ➢ GRI also held its first African regional conference in South Africa
2016	➢ In October, GRI launched the first global standards for sustainability reporting. Developed by the Global Sustainability Standards Board (GSSB) ➢ GRI also held its 5th Global Conference

Source: www.globalreporting.org - A handbook on GRI: Empowering Sustainable Decisions Our five-year focus 2015-2020

V. ADOPTION OF GRI SUSTAINABILITY REPORTING VERSIONS

The GRI Sustainability Reporting Framework provides a direction to organisation and businesses on how they should & can report their sustainability performances as per the guidelines set. The Reporting Framework by GRI sets out principles and standard disclosure items, including performance indicators that organisations can use to measure and report their economic, environmental, and social performance. It is the most widespread framework which covers the specific performance indicators on Environmental, Social and Governance (ESG) issues. The first version of the GRI Guidelines was issued in 2000. A second generation of the Guidelines, known as **G2**, was unveiled in 2002 at the World Summit on Sustainable Development in Johannesburg. Some of the Indian companies started reporting on the G2 framework from the year of its inception in 2002. Since then, the number of reporting companies has increased steadily over the years. The GRI-G2, acknowledged that addressing sustainability in terms of pillars of economic, environmental and social indicators "can sometimes lead to thinking about each element in isolation rather than in an integrated manner" (GRI, 2002, p. 2). The G2 even encouraged organizations to pursue their own integrated performance indicators in consultation with their stakeholders (GRI, 2002, p. 44–45).

(a) G3/G3.1 Guidelines

GRI launched the third generation of its Guidelines, G3, in 2006 and Indian companies adopted this transition in 2007, therefore all reports since 2009 are based on the G3 Guidelines. In a recent analysis by GRI, it has been observed that Indian companies are producing the highest proportion of complete reports globally, implying the disclosure of a complete set of information that is relevant to the reporting organisation and external assurance. G3 Guidelines feature sustainability disclosures that organizations can adopt flexibly and incrementally, enabling them to be transparent about their performance in key sustainability areas.

In March 2011 GRI published the next version G3.1 Guidelines – an updation and completion of G3, with expanded guidance on reporting gender, local community impacts, human rights-related performance & introduce the **Technical Protocol - Applying Report Content** – and Indian companies are adapting these new changes in the Reporting Framework. Most of these reports disclose information on almost all aspects of performance indicators ranging from environment, social and governance, although the rigour and details vary. Also it contains a separate section titled "Human Rights" with nine performance indicators.

According to G3.1 Sustainability Reporting guidelines developed by Global Reporting Initiative (2011) - "The environmental dimension of sustainability concerns an organization's impacts on living and non-living natural systems, including ecosystems, land, air, and water. The 'social dimension' of sustainability concerns the impacts an organization has on the social systems within which it operates. The 'economic dimension' of sustainability concerns the organization's impacts on the economic conditions of its stakeholders and on economic systems at local, national, and global levels."

The G3.1 Guidelines are made up of two parts.

(i) **Part 1 - Reporting Principles and Guidance** features guidance on **how** to report.

(ii) **Part 2 - Standard Disclosures** features guidance on **what** should be reported, in the form of Disclosures on Management Approach and Performance Indicators

G3.1's Performance Indicators are organized into categories: Economic, Environment and Social. The Social category is broken down further by Labour, Human Rights, Society and Product Responsibility sub-categories (www.globalreporting.org).

(b) G4 Guidelines:

GRI launched the fourth generation of Guidelines, named G4 launched at GRI's 2013 Global Conference which was held on 22nd May, 2013. Reporting organisations who were using the third version guideline G3 or G3.1 were supposed to publish their sustainability reports in accordance with the G4 Guidelines after 31 December 2015. GRI recommends that first time reporting organizations use the G4 Guidelines, even if they do not fulfill the requirements of the 'in accordance' options in the first reporting cycles. The G4 version is the recent, novel, and user-friendly version. It is more recommended and accessible for new reporters. The Materiality Principle in the G4 version of the GRI Guidelines states: "The report should cover Aspects that reflect the organization's significant economic, environmental and social impacts; or substantively influence the assessments and decisions of stakeholders." The new set of guidelines G4 which is being developed by GRI, is hopefully going to change the level application system to a better direction. (Minna Jokinen, Dec 2012).

(c) The structure and format of G4

G4 is presented in two separate documents:

(i) Reporting Principles and Standard Disclosures: GRI's Reporting Principles are the criteria that should be used to guide your choices, in order to achieve effective GRI reporting. Standard Disclosures are the GRI 'questions' you answer in your report. On Governance the G4 Guidelines contain 10 new standard disclosures on governance. Most of the new disclosures relate to information on the composition, involvement and authority of the reporting organization's highest governance body.

(ii) Implementation Manual: This is the 'how to' section, and provides detailed advice and recommendations for reporting with G4.

(d) Information to include in a Report:

(i) General Standard Disclosures: There are 7 types of Standard disclosures which cover up to 58 indicators and classify specific items of information in three categories: Economic, Environmental and Social.

(ii) Specific Standard Disclosures: These are divided into two areas:

- **Management Approach (DMA):** The Disclosures on Management Approach (DMA) provide the organization with an opportunity to explain how it is managing its material economic, environmental or social impacts (Aspects), thus providing an overview of its approach to sustainability issues.

- **Indicators:** Indicators allow companies to provide comparable information on their economic, environmental and social impacts and performance. Much of this is in the form of quantitative data.

Source: GRI, G4 Sustainability Reporting Guidelines, Implementation Manual (p. 32), 2013

As compared to G3.1 guidelines G4 introduces 27 new disclosures, a new structure for the guidance documents and two levels for reporting 'in accordance' with the Guidelines. Sustainability reports based in G4 guidelines should contain material aspects, the process for defining material aspects, stakeholders' involvement in this process and the method to manage these aspects. This should be given in 'Disclosure on Management Approach' (DMA).

VI. GRI APPLICATION LEVELS

The **GRI Application Levels** were introduced in 2006, with the launch of the G3 Guidelines. A key point to note is that a report's Application Level is self-declared by the reporting organization. Organizations can choose to sign up for the GRI Application Level Check to confirm their understanding of the Application Level system.

There are three types of **GRI disclosure items** –

(i) Profile Disclosures,

(ii) Disclosure on Management Approach (DMA)

(iii) Indicators

There are also three **Application Levels**: A, B and C.

(i) When a '+' is added to the Application Level - for example, Application Level A+: it shows that a report has been externally assured.

(ii) Application Level A represents the largest number of GRI disclosure items that can be addressed in a report, and Level C the smallest.

In essence, the Application Level system provides organizations with a way to objectively display their use of GRI's Framework. In short, the level of loyalty to the GRI disclosure guidelines is monitored through three application `level, starting from C (for beginners) to A (for advanced). Furthermore, organizations can evaluate their performance by denoting a "plus" (+) next to their levels, if an external assurance provider (GRI or other) offered an independent opinion with regard to their self-declaration. GRI has set of core metric and GRI guidelines are as per the industry specific. In general way there are 90 indicator of GRI index.

VII. GRI FOCAL POINT INDIA, SUSTAINABILITY REPORTING PRACTICES AND TRENDS IN INDIA 2012

GRI Focal Points are national offices that drive GRI activity in particular countries and regions. The various GRI regional hubs or Focal Points are in North America (New York), AFRICA, Australia, China, Latin America, Brazil, South Asia, South East Asia. GRI's Focal Point India was established in January 2010 in New Delhi hosted by the German International Corporation, India (GIZ) until December 2013. It provides guidance and support to local organizations, to make sustainability reporting standard practice. The Focal Point has an important strategic collaboration with the Indian Institute of Corporate Affairs (IICA), an independent think tank under the Ministry of Corporate Affairs, Government of India through the IICA-GIZ CSR initiative. The support of the GRI Focal Point India provides Indian corporations a chance to shape GRI's continuously developing Sustainability Reporting Framework, as well as standards and the emerging regulatory landscape for sustainability reporting in India. The GRI Focal Point India and the GIZ India have supported and promoted the creation of the NVG through the IICA-GIZ CSR Initiative. GRI announces that BSI Group India has been selected to host the Focal Point India Office in New Delhi for the period January 2014 - December 2015. This two year collaboration between the two organizations will enhance the presence of the Global Reporting Initiative in India on a national and regional level.

"The key objective of the Focal Point in India is mainstreaming of sustainability reporting, enhance and expand the technical features of the GRI Reporting Framework, offer a platform and supporting materials for Report or Explain why not and contribute to the development of Integrated Reporting."

Corporate responsibility reporting on the rise, where India tops when it comes to the number of firms reporting on corporate responsibility, finds a KPMG International survey, (Nov 25, 2015). The key findings of the survey suggest that globally, 1 in every 5 high-carbon-footprint companies, like those in the mining or chemicals sectors, do not report on carbon. And, "less than 1 in 10 companies reports on carbon emissions from the use or disposal of their products". "We also analysed the quality of carbon disclosures in India. It was found that 62% of Indian companies identify climate change as a material issue and 42% of N 100 companies report on carbon emissions as compared to 80% of G 250 companies," said Santhosh Jayaram, director-sustainability at KPMG India. Indian companies are producing the highest proportion of complete reports globally on their sustainability performance, according to the Global Reporting Initiative (GRI). Around 78 percent of GRI sustainability reports from India contain a complete set of information that is relevant to the reporting organization and externally assured, compared to just 24 percent globally. (2011)

As per the report by John Deere (2012, Dec 11) - number of Indian companies who report as per framework developed by Global Reporting Initiative (GRI) has increased significantly from only 34 at the end of year 2011 to about 80 Indian companies at the end of 2012 are now doing sustainability reporting using the framework developed by the Global Reporting Initiative (GRI). Wipro, Infosys, TCS, ITC Infosys, HUL, L&T, Tata Steel are among those doing GRI-based sustainability reporting (2012) and there are about 60 companies that publicly declare that they use the GRI Guidelines while only 51 sustainability reports are registered on the GRI database.

The Annual India GRI, organized by the Global Real Estate Institute took place from 30th November to the 1st December 2016 in Mumbai, India. The conference will discussions on where the market is going, where the opportunities are and most importantly, to develop business friendships and discuss business opportunities together.

"My vision is that through linking GRI's Guidelines with India's NVGs and BRR framework, we will unburden existing Indian reporters from the difficulties

of using multiple frameworks, and encourage new Indian reporters to take the first steps in reporting, safe in the knowledge that they are using all available guidance. Sustainability reporting is fairly new to most companies in India and South Asia. We are encouraged by the fact that India has the highest percentage of companies that submit their reports for external assurance, giving them more credibility in the market." Dr. Aditi Haldar, Director, GRI Focal Point India.

VIII. GRI BASED SUSTAINABILITY REPORTING IN INDIA (2011)

As per the report by Green Clean Guide by September 2011, 44 corporate sustainability reports published by different organizations in India. TATA (Automotive) is pioneer in sustainability reporting in India. It has started reporting their sustainability performance from year 2001 based on GRI protocol. Following table shows the list of Indian companies with GRI based sustainability reports:

Table-3

List of Indian companies with GRI based sustainability reports

Sr. No	Organization	Sector	Starting Year
1	Mumbai International Airport Private Limited	Airport operator	2012
2	Ambuja Cements	Construction	2011
3	JSW Steel	Metals Products	2011
4	Jubilant Industries Limited	Chemicals	2011
5	Transport Corporation of India (TCI)	Logistics	2011
6	UltraTech Cement	Construction Materials	2011
7	HCC	Construction	2010
8	Jain Irrigation Systems	Agriculture	2010
9	JSW	Conglomerates	2010
10	KOEL	Energy	2010
11	Maruti-Suzuki	Automotive	2010
12	Multi Commodity Exchange of India (MCX)	Financial Services	2010
13	Oil and Natural Gas Corporation (ONGC)	Energy	2010
14	Small Industries Development Bank of India (SIDBI)	Financial Services	2010
15	Sree Santhosh Garments (SSG)	Textiles and Apparel	2010
16	Grasim Industries	Construction Materials	2009
17	Moser Baer India	Other	2009
18	V. S. Dempo & Co.	Mining	2009
19	Wipro Ltd	Computers	2009
20	ABN AMRO INDIA	Financial Services	2008
21	BPCL	Energy	2008
22	Chemplast Sanmar	Chemicals	2008
23	Dr. Reddy's Laboratories India	Healthcare Products	2008
24	Indian Oil	Energy Utilities	2008
25	Infosys Technologies India	Computers	2008
26	Larsen & Toubro	Conglomerates	2008
27	Mahindra	Conglomerates	2008
28	MSPL	Mining	2008
29	SRF	Conglomerates	2008
30	Sterlite Industries	Mining	2008
31	Tata Motors	Automotive	2008
32	Tata Tea	Food and Beverage Products	2008
33	Varroc Engineering	Equipment	2008
34	Tata Consultancy Services (TCS)	Computers	2007
35	Sesa Goa	Mining	2006
36	Shree Cement	Construction Materials	2005
37	ITC	Conglomerates	2004
38	Jubilant Life Sciences Ltd	Chemicals	2004
39	Reliance Industries Limited	Conglomerates	2004
40	Tata International	Conglomerates	2004
41	Ford India	Automotive	2002
42	Paharpur Business Centre	Commercial Services	2002
43	Tata Steel	Metals Products	2002
44	TATA	Automotive	2001

Source: www.GreenCleanGuide.com - Green Clean Guide based sustainability Report

IX. CONCLUSION

In this study, it has been observed that the Indian corporations are also now actively participating in the corporate sustainability reporting practices and the companies under study all are following GRI guidelines for the reporting. In 2016 a survey was conducted jointly by KPMG International, GRI, United Nations Environment Programme (UNEP) and The Centre for Corporate Governance in Africa which provides an overview of the growth trend in Asia Pacific echoes the findings of KPMG's 2015 Survey of Corporate Responsibility Reporting which reported that many Asia Pacific countries have high rates of sustainability reporting driven by regulation. These countries include India, Indonesia, Malaysia and South Korea.

"Currently, GRI is referenced in policy on sustainability disclosures in 41 countries. This includes references at the national level such as in Norway and India". However the most globally accepted best practice of environmental reporting are the Global Reporting Initiative (GRI) guidelines.

GRI has pioneered the development of world's most widely used sustainability reporting framework. Its vision is progress oriented. Indian companies which prepare their sustainability reports based on GRI have started disclosing their impacts on the environment and society as whole. Sustainability reporting in country is becoming a mandatory practice for Indian companies after Government made CSR spending mandatory under Companies Bill (2013) in India. It's also a world's first in introducing a mandatory requirement for companies with a certain net worth (including foreign multinationals operating in India). Companies reporting in accordance with the GRI Guidelines are considered to be well managed companies. This is important as sustainability reporting creates confidence among shareholders/stakeholders, improves corporate image, reduces risks, and builds competitive advantage through transparency and accountability

Amongst all GRI has become an important and powerful tool for sustainability reporting as it provides a standardised base for corporate reporting worldwide. If Indian companies want to be a Competitive with their global counterparts; need to adopt GRI based sustainability reporting framework positively. In order to improve and achieve overall transparency in sustainability reporting pattern in India, the companies and orgnisations should adopt GRI as an important tool of CSR.

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A Classical Cipher Approach for Securing Web User Data

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Abstract – In Cryptography, when the data is converted in other form, some methods are required to convert the data. This method is using encryption and decryption technique and the converted data is called cipher text. In this paper, three methods of cipher are discussed with solution. The understanding of decryption techniques such as functional analysis, security attack and classical cipher attack has studied and also focused on how these techniques work and how they differ with each other. The study shows the cipher techniques are safe but time consuming as compared to other encryption and decryption techniques.

Keywords: Cipher, Shift Cipher, Affine Cipher, Transposition Cipher

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I. INTRODUCTION

When a user send the message to another web user over the network, the data or text is converted in secure form for the security purposes. The text which a user sends over the network is treated as plain text and when it is converted in another form, call cipher text. Cipher text is also being referred as encrypted text. Before encryption the text is called plaintext. In cryptography, cipher is an algorithm which is applied over the plain text to get the cipher text. Other name for cipher text is encrypted or encoded information because it is unreadable or not understandable by a user or computer without the proper algorithm. The reverse of encryption is called decryption. It is the process of turning the cipher text into readable form which is called plaintext. Coded text and cipher text are completely different. Coded text is a result of a code, but not a cipher.

Plain text is not mandatory text only. It can be another form of media like an audio, video, an image also. The plain text and cipher text is a generic name for the input to the Encryption algorithm. The Encryption algorithm is suggested a short name like Cipher. The output of this cipher is called cipher text. Cipher text is generally in hexadecimal notation or in binary.

When a user sends any text using any media software or application, it is first be encrypted. So, no other third party or person can read the text. Whereas the receiver for whom a user sends the message or text can read the message in its original form of text.

II. AN OVERVIEW OF CIPHER TECHNIQUES

The simple data is known as Plain text and data after encryption is known as Cipher text. The process of encryption hides the data in such a way that an attacker cannot hack the data. The main purpose of encryption is to hide the data from unauthorized parties from viewing and altering the data. Encryption techniques occur or used by using shifting techniques and mathematical operations over the data.

A transposition cipher can easily be recognized by an analysing the character frequencies. Some of the iterating transposition ciphers greatly increase the security, but as with substitution ciphers, almost all such ciphers can be studied and can be broken. However, many modern cryptosystems incorporate transposition cipher in which the operation on large data sets has the disadvantage of requiring enough memory that consumes time.

One of the cipher techniques called polyalphabetic were invented in the year 1467 by the Florentine architect Alberti, who devised a cipher disk with a larger outer and smaller inner wheel respectively and indexed it by plaintext and cipher text characters. In this technique, letter alignments are defined with a simple substitution and modified by rotating the disk after enciphering few words. In the year 1918, the first

printed book on cryptography was published on this technique Polygraphia, written by the German monk Trithemius. This book demonstrate the concept of polyalphabetic in which a square tableau is proposed with 24 characters listing all shift substitutions for a fixed ordering of plain text alphabet characters. The tableau rows were used sequentially to substitute one plain text character each for 24 letters. In the year 1553 a researcher Belaso suggested the use of easily changing key to define the fixed alphabetic (shift) substitutions in a polyalphabetic substitution. A Polyalphabetic cipher has many advantages over simple substitution ciphers. However, it is also noticed that the polyalphabetic ciphers are not significantly more difficult to crypt analyze, because the approach is very much similar to the simple substitution cipher. Once the block length is determined in this cipher, the cipher text letters can be divided into groups and a frequency analysis can be done on each group.

Following are the most popular techniques for converting the plain text into cipher text. These are Shift Cipher, Affine Cipher and Transposition Cipher. The detailed description of these techniques is as given below:

(a) **Shift Cipher-** Shift Ciphers work with the use of modulo operator to encrypt and decrypt the messages. The Shift Cipher uses a key K, which contains an integer from 0 to 25. The shift cipher can be checked by sharing this key K with the person to whom we want to see the sending message.

Following is the procedure of encrypting the message:

For every letter in the message say M :

(i) Convert the letter in the form of numbers that matches its order in the alphabet and that should be started from 0; say this number X.

[A = 0, B = 1, C = 2, D = 3, ...,Y = 24, Z = 25]

(ii) Than calculate: Y = (X + K) mod 26 where K is key

(iii) Convert the number **Y** into its equivalent letter that matches its order in the alphabet which starts from 0. [i.e. A = 0, B = 1, C = 2, D = 3, …….,Y = 24, Z = 25]

When user A is sending some message to user B on the network, the data of A can be encrypted using key K (suppose K = 19) in the following way;

The user A is sending message KHAS to user B, which can be encrypted as follows:

K H A S

10 7 0 18

+ 19 19 19 19

(29 26 19 37) mod 26

3 0 19 11

D A T L

So, after applying the Shift Cipher with key K = 19 the message of user A "KHAS" produce the cipher text “DATL”. This encrypted date is sent to user B. This encrypted data is decrypted using decryption process in which the cipher text is converted in plaintext.

Following is the procedure of decrypting the encrypted message:

For every letter in the cipher text C :

Convert the letter into its corresponding number that matches its order in the alphabet which starts from 0, and say this number Y.

(i) [A = 0, B = 1, C = 2, D = 3, ..., Y = 24, Z = 25]

(ii) Than Calculate : X = (Y - K) mod 26 where K is a Key

(iii) Convert the number X into a letter that matches its order in the alphabet which starts from 0.

(iv) [A = 0, B = 1, C = 2, D = 3, ..., Y = 24, Z = 25]

With the same key K having value 19, user B can decrypt the encrypted message in the following way:

D A T L

3 0 19 11

- 19 19 19 19

(-16 -19 0 -8) mod 26

10 7 0 18

K H A S

So, after decrypting the Shift Cipher with the use of same key value K = 19, the user B deciphers the cipher text "DATL" with the message text "KHAS".

This process of encryption and decryption is very simple and having single stage to convert plain text into cipher text and vice-versa. The limitation of this cipher technique is the fix letter numbers (i.e. 26 always for key). Someone can easily try all the 26 letters one by one until the recovery of the user message. This is one of the types of brute force attack.

(b) Affine Cipher

As seen in the above procedure of cipher, a shift cipher can produce only 25 different transformations for the given text. This type of encryption method is not called secure method. The affine cipher method is a generalization of the shift cipher which provides a little bit additional security. The affine ciphers do apply multiplication and addition to each character using the following function:

$y = (ax + b) \text{ MOD } m$

here x is the numerical value of the letter in the plain text, m is assigned as the number of letters in the plain text alphabets, a and b which are the secret numbers in the process and y is the output of the transformation. The letter y can be decrypted again to x by using following formula:

$x = \text{inverse}(a)\ (y - b) \text{ MOD } m$

here inverse(a) is a value such that if it is multiplied with a MOD m the output would be 1, which mean a * inverse(a) MOD m = 1

Let the secret numbers are a = 11 and b = 4. Applying these numbers in the above equation that gives encryption function

$y = 11x + 4 \text{ MOD } 26$

here letter E and S will be encoded to W and U as shown in example below. Since the computation involves modulo 26 arithmetic, several letters may fail to be uniquely decoded if the multiplier has a common divisor with 26. Therefore, the greatest common divisor of a and m must be 1.

Encipher Process

Assume the message is encrypted by the function $y = (11x + 4)$ MOD 26 To encrypt the plaintext MONKEY, we first convert each letter in plaintext into a numerical value between 0 and 25 according to following list

A - 0

B - 1

C - 2

D - 3

.

.

.

Z - 25

Thus, the numerical values corresponding to the plaintext MONKEY are 12, 14, 13, 10, 4, and 24.

Applying the given function for each numerical value, we have

M : y = (11*12 + 4) MOD 26 = 6

O : y = (11*14 + 4) MOD 26 = 2

N : y = (11*13 + 4) MOD 26 = 17

K : y = (11*10 + 4) MOD 26 = 10

E : y = (11*4 + 4) MOD 26 = 22

Y : y = (11*24 + 4) MOD 26 = 8

The corresponding letters are **GCRLWI,** which is the cipher text.

Decipher Process

To decipher, we transform the function y as:

$x = \text{inverse}(a)\ (y - b) \text{ MOD } m$

Then we have, $x = \text{inverse}(11)\ (y - 4) \text{ MOD } 26$

Inverse (11) MOD 26 = 19, and the decryption function will be $x = 19\ (y - 4) \text{ MOD } 26$

We now decipher the cipher text GCRLWI by applying the decryption function. We have:

G : y = 19* (6 - 4) MOD 26 = 12

C : y = 19* (2 - 4) MOD 26 = 14

R : y = 19* (17 - 4) MOD 26 = 13

L : y = 19* (10 - 4) MOD 26 = 10

W : y = 19* (22 - 4) MOD 26 = 4

I : y = 19* (8 - 4) MOD 26 = 24

The corresponding plaintext letters are **MONKEY**.

Since each letter in plaintext is enciphered in this algorithm using function of $y = (ax + b)$ MOD m, the user can break the affine cipher by solving two linear mathematical equations with two examples of variable x and y. Once the values of a and b is obtained, the plain text can be decipher the entire cipher text.

The above concept can be explained in following way,

Assume that the word "**IF**" is enciphered as "**PQ**".

I → P : 8a + b = 15 MOD 26

F → Q : 5a + b = 16 MOD 26

After solving the above equations, the value of a and b would be 17 and 9 respectively.

(c) **Transposition Cipher-** The transposition cipher is one another kind of cipher technique in which Instead of replacing characters with other characters, it just change the order of the characters. Generally, the text to be encrypted is set in a number of columns. These columns are again reordered and produce encrypted text. Here to decrypt a cipher text using a transposition cipher, we need to find the number of columns and then rearrange the columns according to that.

The Columnar Transposition is one of the best examples of a Transposition Cipher. To understand the concept of transposition cipher, take a message (plaintext) and arrange it into some columns. Suppose the phrase is "WE ARE DISCOVERED FLY AT ONCE" – and add a bit of padding (random characters) to the end to make each column equal.

W E A R E D

I S C O V E

R E D F L Y

A T O N C E

Q K J E U

Now, each column can be converted vertically to create the cipher text.

In this way, we can reach at a relatively secure cipher text. In order to decrypt and read the message, there can be two options: Either read through the message letter by letter (by skipping to the next word) or rearrange the letters in columns. The key can be decided by watching the number of columns and how many letters fit into each column. With this information in hand, decrypting this message is easy.

One more explanation of a transposition cipher is as follows;

A transposition cipher is a method in which letters are rearranged in an order in the cipher text (encoded text), according to some predetermined procedure without making any substitution.

Let us encrypt the following text message;

"Now run along and do not get into mischief, I am going out". In this sentence, remove the punctuation and the blank spaces between words. Finally, the following sentence is obtained.

"now run a long and do not get in to mischief i am going out".

These are 46 letters in length. Now add 4 extra padding characters, suppose "a", at the end to now get:

"now run a long and do not get in to mischief i am going out a a a a".

We can now write this message in 4 rows, having each 12 letters long.

n o w r u n a l o n g a

n d d o n o t g e t i n t

o m i s c h i e f i a m

g o i n g o u t a a a a

By taking the letters in a order down the columns, instead of along the rows, the following sentence is obtained :

"nnog odmo wdii rosh uncg ntho agiu leet otfx niix gnax atmx"

Now this sentence can be sent to another user with removing the spaces, and the message is "hidden".

Suppose the hacker try to intercept and wants to decipher the above message. Let's check to how to decipher a message encoded in this way:

48 characters can be encoded using grids of one of these dimensions:

1 × 48, 2 × 24, 3 × 16, 4 × 12, 6 × 8, 8×6, 12×4 ...

The first of these doesn't rearrange the message at all.

The second size gives:

n n o g o d m o w d i i r o s n u n c g n t h o

a g i u l e e t o t f x n i i x g n a x a t m x

Reading down the columns gives "nangoigu....". Definitely not English!

The next arrangement is a 3 by 16 grid:

n n o g o d m o w d i i r o s n

u n c g n t h o a g i u l e e t

o t f x n i l x g n a x a t m x

A 4 by 12 grid gives:

n n o g o d m o w d i i

r o s n u n c g n t h o

a g i u l e e t o t f x "nrannogi..."

n i l x g n a x a t m x

and a 6 by 8 grid gives:

n n o g o d m o

w d i i r o s n

u n c g n t h o "nwuaog.."

a g i u l e e t

o t f x n i l x

g n a x a t m x

An 8 by 6 arrangement gives:

n n o g o d

m o w d i i

r o s n u n "nmrcaena...."

c g n t h o

a g i u l e

e t o t f x

n i l x g n

a x a t m x

A 12 by 4 sized grid gives:

n n o g

o d m o

w d i i

r o s n

u n c g

n t h o

In the above procedure, a plain text can be converted into cipher text using different ways of arrangement. But this is a very simple substitution ciphers which uses a single mapping from plaintext to cipher text letters. Also the same plaintext is having the same cipher text. This characteristic is not always better in cryptography from the security point of view.

III. LITERATURE REVIEW

To protect the user from unauthorized access and data hacking, several encryption and decryption methods have been proposed by researcher.

In cryptography, an Attribute-based encryption (ABE) scheme in proposed in which messages are encrypted and the decryption keys are calculated according to the given set of attributes and an access structure on the set of attributes. In a traditional KP-ABE method, the characteristics of specified attributes have been treated at the same level. In real environment applications, each attribute has a different weight according to its significance (Liu, et. al., 2014).

In the current time, web technology has become faster and stronger. Large number of users are using it to store sensitive data on third party servers, either for cost saving or for simplicity of sharing of data (Wan, et. al., 2012).

The applications which run in clouds can balance several factors including load balancing, bandwidth, size of data and security. One of the major problems to cloud adoption is data security and privacy. Because the data owner and the service provider do not remains within the same trusted domain (Balamurugan and Venkata Krishna, 2014).

Attribute-Based Encryption (ABE) is proposed as public key cryptographic technique that works in one-to-many fashion and it is also called fuzzy encryption technique. Public key encryption methods store encrypted data on third party servers, while distributing decryption keys to authorized users. But this concept is having many drawbacks. First, it is difficult to efficiently manage the distribution of secret keys for authorized user. Secondly there is a lack of flexibility and scalability in the system. Third, data owners should be online, whenever encrypting or re-encrypting the data or during the distribution of the secret keys. The proposed algorithm ABE minimizes these limitations by reducing the communication overhead of the internet and increasing scalability, flexibility for large scale systems (Li, et. al., 2013).

In the cloud environment, the data security is crucial to protect against inside attack, denial of service attack and collision attack. Additionally, the different expressive access control policies are used to protect user data stored locally and the data stored remotely (Purushothama and Amberker, 2012).

The enormous number of transfer of data and the information takes place using web that is considered to be the most efficient even though it is definitely a public access medium. To counterpart this limitation, many researchers have come up with emerging algorithms to encrypt the information from plain text into cipher text (Kester, 2013. Kester, & Paul, 2012).

In the field of information security, the encryption is the process of transforming information using an algorithm to make it unreadable to anyone except those are having good knowledge, usually referred to as a security key. The result of this process is called encrypted message. The reverse process of this is referred to as decryption (Sinkov, 1966).

There are two main algorithmic approaches are there for encryption, symmetric and asymmetric. Symmetric-key algorithms (Courtois & Pieprzyk (2002). are a special type of algorithms under cryptography that uses the same cryptographic keys for both encryption of plaintext and decryption of cipher text. These security keys may be identical or not. The keys, in practice, represent shared secret information between two or more parties that can be used to maintain private information links (Hans & Helmut (2007). This requirement that both parties have access to the secret key is one of the main drawbacks of the symmetric key encryption method as compared to public-key encryption. Typical examples of symmetrical algorithms are Advanced Encryption Standard (AES), Blowfish, Triple Data Encryption Standard (3DES) and Serpent (Gary & Carl, 2007).

On the other hand, Asymmetric or Public key encryption is an encryption method where a message is encrypted with a recipient's public key that cannot be decrypted by anyone except a possessor of having private key and the person associated with the public key used. This is used for confidentiality purposes (Kester & Koumadi, 2012).

In present days, the cryptography entails complex and advance mathematical algorithms that are applied for encryption of text and cryptographic techniques for image encryption based on the RGB pixel displacement where pixels of image are shuffled to obtained a cipher image (Aiden & Mario, 2011).

According to one of the researcher, in case of all single alphabet substitution ciphers, the Caesar cipher is easily broken and the present study offers essentially no communication security (Encryption, 2011).

The Vigenère cipher is one of the security methods of encrypting alphabetic text by using a series of different Caesar ciphers based on the letters of a keyword. This is a simple form of polyalphabetic substitution (Aiden & Mario, 2011). (Martin, 2012). This type of Cipher spoils the statistics of a simple Caesar cipher by using multiple Caesar ciphers. The technique is named for its inventor, Blaise de Vigenère from the court of Henry III of France in the sixteenth century, and was considered unbreakable for around 300 years (Reinhard, 2001).

According to Wobst and Reinhard, the greater character set allows more type of messages to be encrypted like passwords. It is also increases the key domain and hence provides more security (Rahmani, et. al., 2012).

Alfred Tennyson has encrypted the text according to the keyword "Emily", which is the first name of Tennyson's wife. Studies of Babbage's notes reveal that he had used the method later published by Kasiski (Hans & Helmut (2007). [20]. In the field of cryptography, a transposition cipher is a process of encryption by which the positions of the text is altered by units of plaintext and shifted according to a regular pattern, so that the cipher text constitutes a permutation of that plaintext. Mathematically, an objective function is used to change the characters' positions to encrypt the text and an inverse function to decrypt it. The letters themselves are kept unchanged, which implies that the effect is only on their positions only. Making of their order within the

message scrambled according to some well-defined scheme. A number of transposition ciphers are done according to a geometrical design (Rahmani, et. al., 2012). Franksen, 1985).

In a columnar transposition approach, the message is written out in rows of a fixed length and then it is read out again column by column, and the columns are also chosen in some scrambled order wise. In this case, both the width of the rows and the permutation of the columns are usually defined by a keyword (i.e. key) The advanced form of columnar encryption technique is used for encryption purposes in a matrix representation form (Kester, 2012).

IV. DISCUSSION

After studying various cipher techniques, cryptanalysis and cryptography proposed by many researchers, it is found that the study of cryptanalysis is very much needed for securing the web user data over the network.

By applying already proposed algorithms of cipher over the data, almost same result is found and by applying same algorithm over different types of data items, the algorithm performed differently.

It is also noticed that how Symmetric and Asymmetric ciphers differ and how they both have pros and cons. An example is taken in the study of cipher to get the proper understanding of encryption and decryption. In some cases, the studied cipher techniques don't found good result. So these techniques have been implemented in the current study and found satisfactorily outcomes.

The researcher has gained knowledge and better understanding of encryption/decryption techniques and its most popular algorithms like Transposition, Hill, Affine, Shift cipher algorithms and the researcher states that further study is required to protect user data using implementation in above proposed techniques to decrypt substitution.

V. CONCLUSION

Three cipher techniques; shift cipher, affine cipher and transposition cipher are explained with the example to show how much cipher data is secured over the network. The security in cipher should have keywords (password) that should be easy to remember and understand, should be easy to apply without errors and offer a good security. Different stages and procedures are required like substitution, transposition as well as fractionation to resist cryptanalysis. The user must determine whether he is eager on security, applicability or speed on the net. The cipher techniques as described in this study provide the latest and strongest encryption combinations before the era of digitalization in networking cryptography and providing a guideline to the development of encryption scheme. Many combinations, extensions and adaptations has been taken in the above explained techniques are possible. It is noticed that although attacking some of these ciphers requires extensive and complex cryptanalytic techniques, the modern computational system can break them by a powerful brute force.

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Regional Rural Banks in India: A Comparison of the Assam Gramin Vikas Bank and the Meghalaya Rural Bank

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Abstract – The Assam Gramin Vikas Bank (AGVB) and the Meghalaya Rural Bank (MRB) are currently functioning in the State of Assam and Meghalaya. Over all the motto of both the Banks are similar as per the working guidelines of the Regional Rural Banks in India. As the two states are nearby states and therefore in the current study it is tried to see the working position of the AGVB and the MRB. For the study purpose available data have been collected from period 2007 to 2016, and necessary calculations are made to see the comparative picture of both the Banks. In the study important areas compared for the study are branch network, employees' strength, per branch & employee income and expenditure etc. The calculated value of the various parameters taken for the study of both the Banks are put in the various tables so that the picture of the comparison can be easily grasped.

Key Words: AGVB, MRB, Branch Network, Staffs, Income, Expenditure, Profit, CD Ratio.

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I. INTRODUCTION

The Govt. of India established the Regional Rural Banks (RRBs) in the year 1975. The main objective of the creation of RRBs in the country was to make the banking available to all the people residing in the various nooks and corners of the country. The backward areas and villages which were not getting the facilities of banking could ultimately access the banking facilities like credit & deposit etc. The poor farmers and the tiny artisans in the various remote areas could avail the umbrella of banking. Overall RRBs were created to help backward areas and utilize its resources and thereby the village small and marginal farmers, artisans, crafts and tiny industries could actually be benefited from the new banking organization of RRB and the overall of economic progress to the region and the country as a whole.

In line with the RRBs in India, as per provision under section 23(A) of RRB Act 1976, the Assam Gramin Bank came into existence in Assam in 2006 by amalgamating the erstwhile Pragjyotish Gaonlia Bank, Lakhimi Gaonlia Bank, Cachar Gramin Bank & Subansiri Gaonlia Bank. Again in the state of Meghalaya in 1981 there established a regional rural bank with local name Ka Bank Nonkyndong Ri Khasi Jaintia which name is substituted to Megha1aya Rural Banking May 2007.

II. OBJECTIVES OF THE STUDY

The prime objectives of the study are the following.

(a) To see the branch network of AGVB and MRB.

(b) To see the employee strength in AGVB and in MRB.

(c) To know the efficiency status in some of the areas like productivity per employee & productivity per branch and the CD ratio.

(d) To see the per branch & per employee income and expenditure status in AGVB and MRB

III. METHODOLOGY

In order to make a fruitful study on the given objectives secondary sources of data are collected for the last ten years i.e from period 2006 to 2016. The major source of data collection is done from the annual reports of the Assam Gramin Vikas Bank (AGVB) and the Meghalaya Rural Bank (MRB) of the given years. On the basis of available data required calculations are done by the researcher. To comprehend the comparison easily calculated figures on various parameters are put in separate tables so that the reader can easily have the performance

comparative picture of the Assam Gramin Vikas Bank and the Meghalaya Rural Bank in aggregate.

IV. LITERATURE REVIEW

There are very few literature available on the RRBs located in the North-East Region of India. Simultaneously no such comparative study is done on the two neighborhood RRBs of the country. Therefore the current study found this gap and tried to see the comparative picture of the RRBs located in the state of Assam (i.e the Assam Gramin Vikas Bank) and the Meghalaya (i.e the Meghalaya Rural Bank). Some of the literatures reviewed for purpose of the current study are the following.

According to Pati (2005) in his study in reference to Subansiri Gaonlia Bank of Assam and RRBs in India, he observed these banks are finding the problem of loan recovery and fresh accretion in NPA's and as well as such banks are having low profitability and management problem. He advised for suitable management to improve the performance level.

Singh and Singh (2009) in their study on Manipur Rural Bank made an assessment that loan repayment mainly depends on right utilization of loan by the consumer and generation of sufficient income. Again this also highly depends on accessibility of infrastructural facilities, marketing facilities and good supervision etc. from and Bank side.

Sarma and Barman (2014) in their study observed that the creation of RRBs in the country was an important step for financial inclusiveness in providing various services by the RRBs like savings, loans, insurance etc.

The Assam Gramin Vikas Bank has been playing a pivotal role to bring financial inclusiveness. Its role as the largest RRB in the region is taking many initiatives for financial inclusiveness in the region. Similarly, as far audited balance sheet report of MRB as on (31st march 2014), it is observed that out of 91 branches, only 90 have earned profit. It also mentions that out of total advance portfolio of Rs. 503.10 crores, non-performance asset (NPA) figures stands at Rs. 22.37 crores.

Also mention about steps to be taken to bring the NPA level below 3 per cent against the total advance portfolio. Again to increase the productivity AGVB is paying attention for good training to its staffs. As far annual report of AGVB (2013-14), AGVB has been giving importance to promote the knowledge and skills of its staffs by assigning them to various training programmes within and outside the State. During the year 2013-14, altogether 1019 officials attended such training.

The Bank has been giving much emphasis on training of its employee to upgrade their skills so that they could well accommodate themselves in the current situation.

(a) **Branch Network of AGVB and MRB:** Table-1 demonstrates the branch network of AGVB and MRB. It is observed that there were 355 branches of AGVB in 2007and were covering the 25 districts of Assam. In 2016 it increased to 410 branches covering 31 numbers of districts in the State. The average number of branches covered by the Bank is in an around 14 branches per district. On the other hand in case of MRB, there were 51 branches in 2007 which increased to 93 branches in 2016. The numbers of districts covered in 2007 were 4 districts and in2016 it increased to 93 branches covering the 11 districts of Meghalaya with an average of around 8.45 branches per district.

Table-1

Branch Network of AGVB and MRB

Year	Assam Gramin Vikas Bank			Meghalaya Rural Bank		
	Number of Branches	Number of Districts	Number of Branches Per District	Number of Branches	Number of Districts	Number of Branches Per Districts
2007	355	25	14.2	51	4	12.75
2008	355	25	14.2	51	5	10.2
2009	355	25	14.2	51	6	8.5
2010	356	25	14.24	55	6	9.17
2011	362	25	14.48	58	6	9.67
2012	369	25	14.76	64	7	9.14
2013	374	25	14.96	76	7	10.86
2014	396	25	15.84	91	11	8.27
2015	406	25	16.24	92	11	8.36
2016	410	31	13.23	93	11	8.45

Source: 1. Data collected and calculated from the annual reports of AGVB & MRB (Various Issues)

(b) **Employee Strength in AGVB and MRB:** Table-2 shows the employee status in AGVB and MRB. In 2007 there were 1761 number of staffs in AGVB with the average of around 5 number of staffs per branch. In 2016 it increased to 2123 number of staffs and retaining almost the same number of staffs per branch. In case of MRB there were 179 numbers of staffs in 2004 with the average of around 3 staffs per branch. In 2013 total number of staffs in MRB increased to 318 number of staffs showing the average of around 4 staffs per branch.

Table-2

Staffs Strength in AGVB and MRB

Year	Assam Gramin Vikas Bank			Meghalaya Rural Bank		
	Number of Branches	Number of Staffs	Staffs Per Branch	Number of Branches	Number of Staffs	Staffs Per Branch
2007	355	1761	4.96	51	179	3.5
2008	355	1736	4.89	51	209	4.1
2009	355	1719	4.84	51	194	3.8
2010	356	1701	4.77	55	215	3.9
2011	362	1733	4.79	58	255	4.4
2012	369	1748	4.74	64	243	3.80
2013	374	1884	5.04	76	318	4.18
2014	396	2039	5.15	91	346	3.80
2015	406	2145	5.28	92	372	4.04
2016	410	2123	5.18	93	399	4.29

Source: 1. Data collected and calculated from the annual reports of AGVB & MRB (Various Issues)

(c) Productivity and Credit Deposit Ratio: Table-3 demonstrates the productivity and credit deposit status of the AGVB and MRB. In productivity factors taken are per branch and per employee production. It is observed that in 2007 productivity per employee in the AGVB was Rs.17106 thousands which increased to Rs.54235 thousands in 2016. In case of productivity per branch, during the same period quantum amount has increased from Rs.84856 thousands to Rs.280833 thousands. Similarly in case of CD ratio over the years it increased from 53.32 per cent to 55.98 per cent. Correspondingly, in the MRB productivity per employee in the year 2007 was Rs.28784 thousands which increased to the amount of Rs.48096 thousands per employee. During the same time, in regard to productivity per branch it has increased from Rs.71112 thousands to Rs.206346thousands.In case of CD ratio it was 29.36 per cent in 2007 which increased to 51.19 per cent 2016.

Table-3

Productivity and Credit Deposit Ratio in AGVB and MRB

(Amount in Thousands)

Year	Assam Gramin Vikas Bank			Meghalaya Rural Bank		
	Productivity Per Employee	Productivity Per Branch	CD Ratio in AGVB	Productivity Per Employee	Productivity Per Branch	CD Ratio in MRB
2007	17106	84856	53.32	28784	71112	29.36
2008	20686	101157	51.72	25354	79475	30.80
2009	24902	120580	48.55	33286	96776	29.67
2010	29868	142713	46.74	45579	125963	30.15
2011	37214	178155	47.36	47785	154064	31.91
2012	42819	202839	53.28	61335	169631	34.46
2013	45885	231145	56.29	57496	180810	38.07
2014	49523	254992	57.04	60575	169742	48.30
2015	52821	279069	52.72	74421	196569	51.64
2016	54235	280833	55.98	48096	206346	51.19

Source: 1. Data collected and calculated from the annual reports of AGVB & MRB (Various Issues)

(d) Branch Level Income, Expenditure& Profit Scenario in AGVB and MRB: To see the income and expenditure picture of AGVB and MRB various parameters considered are income per branch, expenditure per branch and as well the profit trend per branch during the corresponding period is also presented which is shown in table-4. It is revealed that in AGVB income per branch in 2007 was Rs.4634.79 thousands which increased to Rs.18042.07 thousands per branch in 2016. During the same period the corresponding figures for MRB were Rs. 4089.31thousands income per branch which increased to Rs.13892.46 thousand per branch in 2016. In case of expenditure per branch, quantum amount in 2007 was Rs.4578.32 thousands per branch in AGVB and Rs. 3405.02thousands per branch in MRB. In 2016 it increased to the size of Rs.17104.51 thousands per branch in AGVB and Rs.20702.41 thousand per branch in MRB respectively. Similarly profit per branch of AGVB in 2007 was Rs.4578.32thousands per branch and increased to Rs.17104.51thousands per branch in 2016. On the other hand in 2007 profit per branch in MRB was Rs.684 thousands which actually decreased to the negative figure of Rs.6809.95 thousands per branch in 2016.

Table-4

Per Branch Income, Expenditure& Profit in AGVB and MRB

(Amount in Thousands)

Year	Assam Gramin Vikas Bank			Meghalaya Rural Bank		
	Income Per Branch	Expenditure Per Branch	Profit Per Branch	Income Per Branch	Expenditure Per Branch	Profit Per Branch
2007	4634.79	4578.32	56.47	4089.31	3405.02	684.29
2008	5355.51	4813.63	541.88	5275.35	4114.24	1161.11
2009	6854.75	6135.76	718.98	7685.20	5420.14	2265.06
2010	8092.44	7040.37	1052.07	7690.44	5574.76	2115.68
2011	9382.06	7972.98	1409.07	9869.59	7802.05	2067.54
2012	12992.98	10874.72	2118.27	11664.83	9245.45	2419.38
2013	15087.51	12205.14	2882.36	12438.32	8716.54	3721.78
2014	16158.26	15196.44	961.81	11755.63	8273.92	3481.71
2015	12079.67	15391.31	-3311.65	13444.87	10177.25	3267.62
2016	18042.07	17104.51	937.56	13892.46	20702.41	-6809.95

Source: 1. Data collected and calculated from the annual reports of AGVB & MRB (Various Issues)

(e) Employee Level Income, Expenditure and Profit in AGVB and MRB: From table -5 it is observed that income per employee in the AGVB in 2007 was Rs.934.3271 thousand per employee which increased to the size of Rs.3484.34thousands per employee in 2016. Similarly in case of expenditure per employee during the same period it increased from

Rs.922.9432 thousands per employee to Rs.3303.27thousand per employee in 2016. As far as profit is concern in AGVB it was Rs11.38 thousands per employee in 2007 which increased to the tune of Rs.181.06 thousands per employee in 2016. In case of MRB income per employee in 2007 was Rs. 1165.11thousand which increased to the extent of Rs.3238.09 thousand per employee in 2016. At the same time expenditure per employee in MRB in 2007 was Rs.970.15 thousands which increased to the amount of Rs. 4825.37 thousands per employee in 2016. Again the profit per employee of MRB in 2007 was Rs.194.97 thousands but declined to the negative figure of Rs1587.28 thousands per employee in the staid period.

Table-5

Per Employee Income, Expenditure and Profit in AGVB and MRB

(Amount in Thousands)

Year	Assam Gramin Vikas Bank			Meghalaya Rural Bank		
	Income Per Employee	Expenditure Per Employee	Profit Per Employee	Income Per Employee	Expenditure Per Employee	Profit Per Employee
2007	934.33	922.94	11.38	1165.11	970.15	194.97
2008	1095.16	984.35	110.81	1287.29	1003.95	283.33
2009	1415.61	1267.13	148.48	2020.34	1424.88	595.45
2010	1693.66	1473.47	220.19	1967.32	1426.10	541.22
2011	1959.79	1665.45	294.34	2244.85	1774.58	470.26
2012	2742.80	2295.64	447.16	3072.22	2435.02	637.20
2013	2995.08	2422.89	572.19	2972.68	2083.20	889.48
2014	3138.14	2951.35	186.80	3091.80	2176.09	915.71
2015	2286.41	2913.23	-626.82	3325.06	2516.95	808.121
2016	3484.34	3303.27	181.06	3238.09	4825.37	-1587.28

Source: 1. Data collected and calculated from the annual reports of AGVB & MRB (Various Issues)

V. CONCLUSION

From the above study it can be concluded that overall the progress of the AGVB and MRB is not that satisfactory if we compare the performance picture of such banks with other commercial banks of the country in the current context. Still the importance of banking institutions like the AGVB and the MRB has highly significant. As other commercial banks may not like to extend their branches in the remote areas of the North Eastern States like the Assam and the Meghalaya, therefore the financial institution like AGVB and the MRB must be more effective to enhance especially the credit picture in the region. The tribal economy of Assam and the Meghalaya has to be done lot by such financial institutions. The govt. must have more focused to the institution like AGVB and the MRB for the overall banking scenario progress to all the backward regions and the poor people of both the States.

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CSR Activities and Its Impact on Socioeconomic Upliftment: an Integrated Literature Review

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Abstract – Earning more and more profits is a natural phenomenon of every business unit. The first and foremost goal of any business enterprise is to maximize the returns with minimal investment. Parallel to it the enterprises have social obligations to fulfill as they draw maximum resources from the society itself. CSR has become one of the catchphrases of new millennium across the world and the corporate as well as government must take care of it. Today, Government has also come as an initiative to control those business activities which makes a harmful effect on the society. The government suggested time to time to the business units that the corporate should enact a framework related to CSR i.e. its areas, investment, activities etc. and include them in the vision, mission and strategic planning. The present study is a critical analysis of various research papers publsihed on the studies related to CSR activities and its various impacts on society. The nature of data used for this is purely from library research. The study has shown that over the last years an increasing number of companies worldwide started promoting their business through CSR strategies because the customers, the public and the investors expect them to act sustainable and responsible. The government also suggests to the business units that the corporate should enact a framework related to CSR and include them in their vision, mission and strategic planning. CSR initiatives, if being implemented by all the corporations for rural development will have a positive impact in overall development of the society and their business.

Keywords: - Corporate Social Responsibility, Social Upliftment, Society, Government Initiative

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I. INTRODUCTION

Businesses are no longer viewed as only the economic entities but are perceived to be an inseparable part of the society. Corporate Social Responsibility (CSR) is basically a concept whereby companies decide voluntarily to contribute to a better society and a cleaner environment. Over the last few years an increasing number of companies worldwide started promoting their business through CSR strategies because the customers, the public and the investors expect them to act sustainable and responsible. The government also suggests to the business units that the corporate should enact a framework related to CSR and include them in their vision, mission and strategic planning. CSR initiatives, if being implemented by all the corporations for rural development will have a positive impact in overall development of the society and their business.

In the present society the public education faces many challenges of standardized testing, strained budgets, teacher retention and basic quality. These demands have given way to new opportunities for businesses to support education in a win-win situation that benefits everyone. Corporate Social Responsibility is a concept to introduce a variety of policies and Practices aimed at reducing the negative impacts of the company operations and improving their contribution to the society. The concept of CSR is adopted by a number of companies in a variety of industries. CSR programme address a wide array of socioeconomic & Environmental issues from human rights to education and climate change. The present study focusing on Corporate Social Responsibility initiatives taken up by various companies over a period of time and its impact on development, for upliftment of children of common masses by providing better education and mainstreaming them into education.

II. OBJECTIVES

(a) The aim of this paper is to have a review over the work so far published towards the field of CSR (Corporate Social Responsibility) and its

various impact on society and socioeconomic development observed by various authors.

(b) For this purpose secondary data has been gathered from authentic resources and database.

III. LITERATURE REVIEW

Over the past decades, the concept of CSR has become an important concept in the study of researchers, scholars and industrialists etc. So, the researchers have made an effort with this review paper for those researchers, analysts and industrialists who are connected with CSR (whether social responsibility, social accounting, social reporting or any other area related to CSR).

Windsor (2001) examined the future of Corporate Social Responsibility or the relationship between business and society in long run. The researcher tries to find out that whether the organization and society will come closer to each other in future or not and what will be the changing phase of CSR. With the help of history or past trend of CSR, Caroll's model analysis and in global context, the researcher found three emerging alternatives of CSR i.e. conception of responsibility, global corporate citizenship, stakeholder management practices.

Vaaland, Heide (2008), paper based on a case study methodology. The paper purpose was to handle the CSR critical incidents and utilize this experience in enforcing the CSR activities. The study concluded that CSR should be managed by handling unexpected incidents, long term reduction of gap between stakeholders and their expectations and company performance and finally maintaining relationship with society through interplay between actor, resources and activities.

Gond, Crane (2008), made an analysis on the distortion of corporate social performance concept. The researcher analyzed the past researches and found some reason of emerging fall in the interest of corporate social performance research among the scholars. The paper also suggested models on the basis of which the researcher explained that why the CSP concept has lost its importance and development. Further, the researcher depicted some model which the researcher can used in their research related to corporate social performance. The paper argued that tensions and contradictions are the starting point to develop the CSP concept. CSP has an umbrella of activities which need to measure differently in order to move the researches from a simple concept to development.

Truscott, Bartlett, Trwoniak (2009), paper "The reputation of Corporate Social Responsibility industry in Australia" in Australian marketing journal, based on case study methodology. On the basis of the interview of key persons of industries in Australia, the term CSR has been explained. The industrialist revealed that CSR increasingly has become significant. They shared their views of CSR in economic, legal and ethical roles of business in society. Beside this, the industrialist viewed CSR as a model of corporate reputation.

Shah, Bhaskar (2010), has taken a case study of public sector undertaking i.e. Bharat Petroleum Corporation Ltd. in their research work. The research has discussed that there is a broad relationship between the organization and society. Organization has its existence only with the society. Organization used the resources/inputs of the society like material and human etc. In reverse, the organization provides services to the society. From the case study of the BPCL, it was found that company has taken a lot of initiatives in order to serve the society.

An article published in The Economic Times named as "CSR: A cloak for crooks" on 21 Oct. 2012 explored that there are so many companies which have engaged in Corporate Social Responsibility yet they are suffering from financial crisis, fraud and other unsocial causes. In this article, an example has been taken about the company Satyam Computer Services. The company has won several awards in the area of CSR which includes rural communities' commitment and services like healthcare, education and water.

Bhattacharyya & Chaturvedi (2012), article entitled "CSR looks set to emerge as an independent stream with measurable output on India CSR site, stated about the proposed bill of CSR that how the bill will affect the company's policies. The researchers presented their views and said that due to this bill, company's activities will change a lot the companies who has not engaged in CSR activities till now will start investing on society. Further, who has already engaged in these areas will get a strong foundation or bond with the society.

Bibhu Parshed (2012), article presented that CSR is the face of industry doing trade. Bibhu said that today, corporate houses took CSR as a medium fulfillment of profit greed of corporate houses. Further the article explored that companies today invests in a lot of areas like child labour, ground water, food, education, employment etc. but nobody is aware about the essential need of world's poor. The article suggested that profit earning is a natural fact of companies but CSR is beyond the natural and statutory obligation of the companies. At last it was concluded in the article that sustainable development is the development of society as well as the company in a balanced way.

Bansal, Parida, Kumar (2012), paper entitled "Emerging trends of Corporate Social Responsibility in India" in KAIM Journal of Management and Research analyzed 30 companies of 11 sectors listed in the Bombay Stock Exchange with the help of their annual reports. Some of these sectors were Transport Equipment sector, Finance and Metal Mining sector,

IT & Power, Capital goods, Telecom, Housing, FMCG, Oil & Gas and Cipla. The paper considered the nature and areas of society in which the companies are investing. By considering all those areas it was concluded in the paper that today companies are not working only to earn profit but also have realized the importance of being social friendly. So, on the basis of the paper it can be said that social responsibility has now started taking a turn in the new direction.

Sharma and Kiran (2013) have shown various driving forces and challenges of CSR activity through number of articles and research base review. The trend study has been done from 1975 to 2011 time series.

Dr. M. Ramana Kumar (2013) in his study on CSR (Analysis of select Indian Private and Public sector companies) tries to analyze the CSR activities carried out by Indian Private (Reliance Industries Ltd.) and public sector companies (ONGC) and also study the Indian government policies and programmes of CSR. The study revealed that though the Indian public and private firms are making efforts in the CSR areas, still there is a requirement of more emphasis on CSR. The study found that there is a significant difference in the CSR practices of RIL and ONGC as the CSR budget of ONGC is more than RIL during the year 2009-10, 2010-11, and 2011-12 and average CSR score of ONGC is more than that of RIL during 2009 to 2013.

Bahman saeidi pour et al, (2014) has studied through the literature review of Corporate Social Responsibility that, CSR was independent variable; whereas financial performance was dependent variable. Through the analysis they found that 53% showed the positive relationship, and 5% showed negative between them and 24% showed no relationship also. They dig out some of forms like CSP corporate social performance CFP corporate financial performance as they were related to the CSR that is corporate social responsibility or not. They concluded their study with that CSP has no direct effect on CFP under various theories like slack resources theory and good management theory.

Yemokhya fakay et al. (2015) also studied the through the various literature review of CSR that across the globe, business enterprises have accepted the concept of CSR as an element of success and survival of business along with fulfilling social objectives. However, the challenge for the companies is to determine a strong and innovative CSR strategy which should deliver high performance in ethical, environmental and social areas and meet all the stakeholders' objectives

After reviewing the literature, it can be summarized that the corporate social responsibility concept has taken the prominence over a period of time and has supported the upliftment of the backward parts of the society upto an extent. Moreover the involvement of the corporates towards the CSR is still scanty. Referring to Indian corporate; the companies are still focusing on philanthropic approach and has to work on innovative strategy.

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Smart phones Impacting Customer Mobile Behaviour in India

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Abstract – Data User has in India grown 109% in year 2016 when compared to year 2014 and in year 2017 this is further expected to grow more than 40%.There are various predictions across telecom industry when we try to discuss the reason of such overblown growth year on year. Few people say this is a result of paradigm shift of customers from traditional 2G to 3G and further 4G technology while some people says this is been contributed by the abundance of App based way of working where people migrating their traditional voice usage to data usage. Also there are few theories also confirm about how rural and urban gap is narrowed and various factors like telecom/internet connectivity, increased literacy level, increased virtual social life etc. These theories explain ushow all these factors impact customer's mobile behaviourbut in this paper will discuss on changes in mobile phone use and its impact on customer telecom behaviour.

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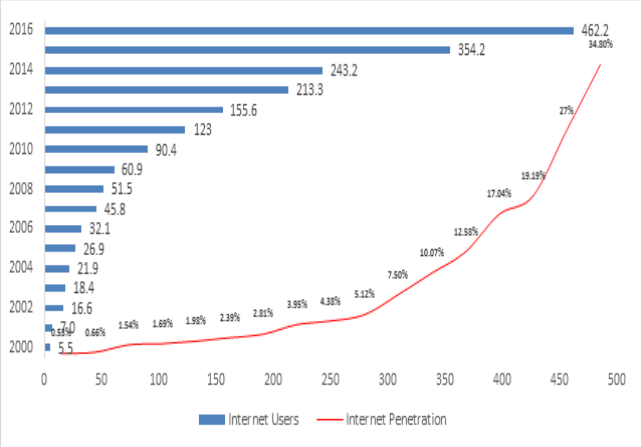
I. INTRODUCTION

Indian internet usage is growing multi-fold with increasing penetration of smartphone in mobile eco system and increased availability of advance service like 4G, 3G across rural and urban India from older 2G services. Recent launched 4G from various operators is also fuelling usage of data and also bridging the rural and urban dived gap within India. Few figures in recent years are evident to prove the future potential that is lying with Indian mobile market.



Data usage grew 114 percent in 2014 when compared with year 2013 also 3G data usage per user per month grew 41% showed a paradigm shift in the preference of Indian subscribers and also technology role in consumers usage behaviour. Average, 3G data usage reached to 688 MB per month in 2014, indicating a 29%growth compared with 2013 which further close to 1GB/sub in recent year i.e. 2017. 2G Usage/sub also grewby 48% indicating improvements in 2G network and customer's habit to stay connected. A surge in 3G and 4G compatible smartphone use underlines the greater need for operators to expand the 3G network coverage and selectively rollout 4G services for higher speeds across all the circles while modernizing the existing 2G networks which can lead to further growth in data consumption.

II. DRIVERS TO DATA USAGE EVOLUTION

There are primarily 4drivers:

(a) **Technology Upgrade:** There is an exemplar shift in the speed Indian costumers were browsing with shift of technology from 2G to 3G to further now 4G. Better speed result into better customer experience hence usage has grown multi-folds. The number of Internet users in India will reach close to 460 million by June, which is almost 7% growth from December 2016. Internet users from 19% penetration rate in 2014-15 has reached to around 31%.

(b) **Mobile First Generation:** There is a paradigm shift in the way consumers are using internet. Majority of the Indian consumers are using internet for the first time through mobile mode and a lot more are

shifting their internet usage to mobiles.Use of social networking and their influence on new generation has led to a huge growth in customer data usage.

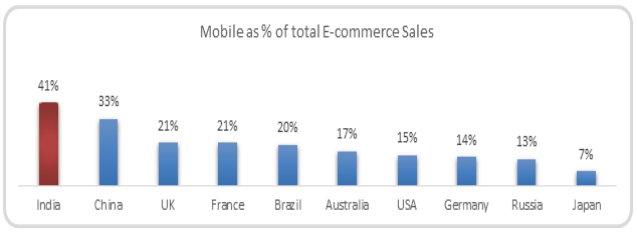
(c) **Smartphone Penetration:** India market offers huge potential to both smart phone & telecom operators, with millions of customers enthusiastic to upgrade their mobile phones. India's smartphone market is expected to double in next 2-3 years, with annual smartphone sales growth of around 40% for the next five years.

(d) **Price intensive Offerings:** Services and devicepricing will be crucial for further growth: of smartphones shipped in 2015-16, the sub-US$200 category contributed 81%. India is a price-sensitive market and the biggest opportunity comes from the millions of low-end customers eager to upgrade in device and service offerings both.

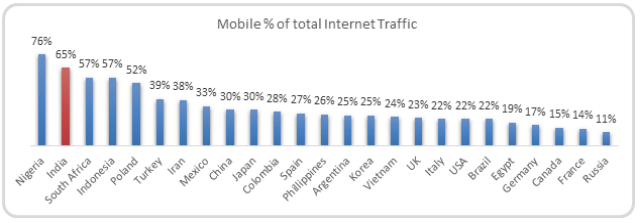
III. DATA GROWTH IN INDIA

Because India is known as land of world's largest youth population with this increasing opportunities and more and more disposable income the emerging growth story for data penetration will surely will be coming from these sections.

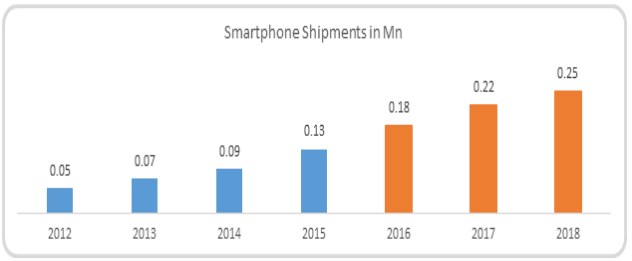
Trends has witnessed that in online shopping as well, with 75% of the amazon sales are coming through mobile mode. Mobile sales are contributing to 45% of the e-bay overall sales. Myntra, which reportedly generates more than 90% of its traffic and 70% of its orders from its mobile app, closed down its website and moved to a mobile-only platform. Which has experienced an initial drop of 10% on total sales, after shifting 20% of desktop sales to mobile mode.



Realising this fact,mobile handset makers such as VIVO, OPPO, Karbonn, Samsung, Lava and Spice Mobiles have brought in a range of mobiles at various price points. Local companies are breaching a new entry-level price point every financial quarter. India's cheapest smartphones now sell at Rs2,000, down from Rs15,000 two years ago.



With raising smartphone adoption, the rural growth story is a factor of 2G-3G technology upgrade. 3G and 4G issurely an urban phenomenon for upcoming years. Increased internet enabled device penetration, decreasing handset prices and lower data plans tariffs are helping to create a suitable environment for a rapid growth of mobile internet in India, with rural India now set to take big leap. As of June 2014, nearly 50% of the Active Internet Users in rural areas accessed internet using mobile phones, community service centers and cyber cafes. 38% of the Active internet Users use mobile phone as the main access point. Rural India is steadily moving towards a more internet friendly and exploratory mind-set. As of 2014, the Active Internet User base in rural India was 6.7% of the overall rural population of 905 million and accounted for 61 million users. 4.4% of the total rural population used a mobile device to access the Internet compared to 0.4% in the year 2012.



India one among largest Internet user base in the world out of which more than 50% are mobile-only internet users. However, the Internet penetration in India at 31% is quite low compared to other developed and developing economies. In India, the number of people who own mobile phones is much higher than the number who own personal computers.

Mobile handset manufacturers playing a major contribution towards mobile internet growth by manufacturing affordable handsets which also supportvernacular content. The median price of mobile device has dropped significantly making internet enabled devices affordable for the masses. Several handset manufacturers are now contributing to increasing trend of smartphone usage by selling high end phones at lower entry price points. Customer's experience on smartphonesdefinitelydeliver a better user experience and have the potential to accelerate the adoption.

IV. KEY FACTORS DRIVING INDIAN DATA GROWTH STORY

(a) Technology upgrade 2G/3G/4G

(b) Increasing penetration of Smartphones

(c) Reducing internet cost

(d) Mobile penetration

(e) App ecosystem

(f) Young generation

(g) Increased Network Coverage

(h) Better Speeds

(i) Hyper competition in service providers

(j) Telecom policies

V. TOP 10 ACTIVITIES ON E-COMMERCE

(a) Social Networking

(b) E-mail

(c) Browsing

(d) Online Shopping

(e) Travel/Ticket Booking

(f) Banking

(g) Music/Video Download

(h) Apps

(i) News

(j) Navigation

VI. WHAT IS NEXT?

Going forward Internet is the key to success which has already evolved from the level what it was 10 years ago. Consumer's dependency on internet has increased ominously for different routine activities like banking, social networking, emailing, shopping, and searching for information etc. The adoption of high speed internet including broadband, 3G and most awaited 4G which offers high speed internet on move, along with introduction of low cost smartphones, all this will further lead to raise internet penetration and usage in India.

We are in a time where every industriesare going more and more digital and making their all product range available in e-markets. Starting from daily groceries to real estate everything is now made available online and the sales are happening with just a touch on the smart screens. Also with increasing domestic start-up culture in recent times which is completing with international players are also boosting the data usage with Apps that are made available in regional language and content. All these are creating a right set of eco-system where each of this will be boosting the growth of others.

VII. CONCLUSION

With the increasing smartphone penetration and raising network quality has made a greater impact on the increasing data consumption. The first leap towards the data growth started when India migrated from 2G to 3G technology and further development of handset eco system with the entrance of multiple international and domestic handset manufacturers which has attempted to make smartphone available in wide price range especially as per Indian markets. India being the country aiming to digitalize all its services and benefits across every departments to ensure the benefits reach till all beneficiaries directly. Govt. also putting additional efforts to connect all the villages across the country with its fiber network and planning various programs to educate the rural population which will also help in increasing the digital literacy. With sudden upgrade of telecom networks from 2G to 4G and rapid increasing of smartphone penetration will further make inroads for the next big leap in the data growth story for India.

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Hacker's Hacking Technique

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Abstract – Today Hacking has been one of the common practices made by the computer expert in order to try and find vulnerabilities in a network infrastructure. In this paper I have mentioned types of Hackers and types of technique used by them. The word "hacking" has two definitions. The first definition refers to the hobby/profession of working with computers. The second definition refers to modifies computer hardware or software in a way that changes the creator's original intent. Traditionally, a Hacker is someone who likes to play with Software or Electronic Systems. Hackers enjoy exploring and learning how computer systems operate. They love discovering new ways to work electronically. Recently, Hacker has taken on a new meaning that someone who finds weaknesses in a computer or computer network, though the term can also refer to someone with advanced understanding of computers and computer networks. Finanly I recommend that hacking is the skill miracle so everyone want to become hacker but please used this skill to destroy the crime from society but not to become a criminal.

Keywords: Hackers, Vulnerabilities, Attacks, Black Hat hacker

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I. INTRODUCTION

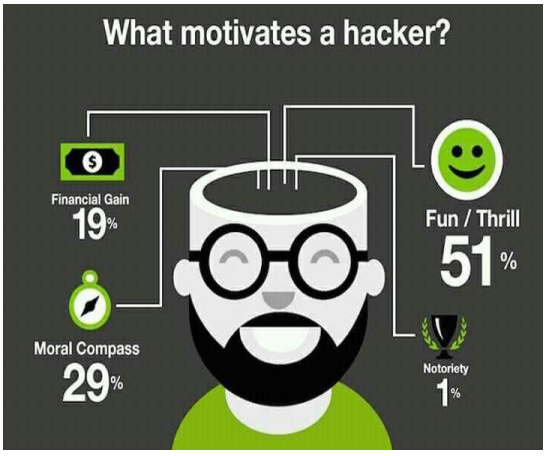
In computing, a **hacker** is any skilled computer expert that uses their technical knowledge to overcome a problem. While "hacker" can refer to any computer programmer, the term has become associated in popular culture with a "security hacker", someone who, with their technical knowledge, uses bugs or exploits to break into computer systems. (Hacker) Today, mainstream usage of "hacker" mostly refers to computer criminals, due to the mass media usage of the word since the 1980s. This includes what hacker slang calls "script kiddies," people breaking into computers using programs written by others, with very little knowledge about the way they work. This usage has become so predominant that the general public is unaware that different meanings exist. (Ben, 2015). While the self-designation of hobbyists as hackers is acknowledged by all three kinds of hackers, and the computer security hackers accept all uses of the word, people from the programmer subculture consider the computer intrusion related usage incorrect, and emphasize the difference between the two by calling security breakers "crackers" (analogous to a safecracker).Currently, "hacker" is used in two main conflicting ways:

(a) as someone who is able to subvert computer security; if doing so for malicious purposes, the person can also be called a cracker (Danish and Muhammad, 2011).

(b) an adherent of the technology and programming subculture.

The controversy is usually based on the assumption that the term originally meant someone messing about with something in a positive sense that is, using playful cleverness to achieve a goal. But then, it is supposed, the meaning of the term shifted over the decades since it first came into use in a computer context and came to refer to computer criminals (Ajinkya, et. al., 2010).

Below mention figure describe how to hacker are attract towards hacking.



II. TYPES OF HACKER

Let me explain about different kind of hackers exist in the cyber security world.

(a) **Script Kiddies-** Script Kiddies are the persons who use tools , scripts, methods and programs created by real hackers. In a simple word, the one who doesn't know how a system works but still able to exploit it with previously available tools.

(b) **White Hat Hacker-**White Hat hackers are good guys who does the hacking for defensing. The main aim of a Whitehat hacker is to improve the security of a system by finding security flaws and fixing it. They work for an organization or individually to make the cyber space more secure.Break The Security only concentrates on white-hat hacking and help you to learn the Ethical Hacking world.

(c) **Black Hat Hacker-** BlackHat hackers are really bad guys , cyber criminals , who have malicious intent. The hackers who steal money, infect systems with malware, etc are referred as BlackHat hackers. They use their hacking skills for illegal purposes.

(d) **GreyHat Hacker-**The hackers who may work offensively or defensively, depending on the situation. Hackers who don't have malicious intentions but still like to break into third-party system for fun or just for showing the existence of vulnerability.

(e) **Hacktivists-**The hackers who use their hacking skills for protesting against injustice and attack a target system and websites to bring the justice. One of the popular hacktivists is Anonymous and RedHack.

III. TECHNEQUE USED BY HACKERS

(a) Bait and Switch

It's been a favorite gag of carnival and street hustlers for centuries: Offer your mark something that they're sure to want, then swap it out for something different when they're not looking. In the digital realm, this trick has several variations.

One of the most common is a scam perpetrated by cyber-criminals on websites (preferably big, high-profile ones) that sell advertising space to third parties. Attackers can acquire sidebars or pop-up panels by registering with a verifiable email address and links to a legitimate-looking site – which is the one that the site administrator gets redirected to. But when the ad goes live, site visitors clicking on the link may be sent to a page that's been booby-trapped with malware. Another variant is the direct appeal to users, with an irresistible download of some fantastic widget or app – which runs malicious code on your website or device once it's installed. If you want great products, software, or desktop/web page gadgets, your best bet is to obtain them from reputable sources (approved app stores, recognized brands and vendors, etc.). And if you're selling advertising space, due diligence should be your watchword.

(b) Cookie Theft

The cookies (little text files) stored in your system or browser cache when you visit various websites can hold a wealth of information about you – including personal and financial data, user credentials, and passwords.Cookies may be stored as plain text, or with varying degrees of encryption (depending on the website). And the use of browser add-ons has made the decades-old practice of cookie theft a richer and easier prospect for hackers.Once stolen, cookies may be read or decrypted to reveal your information, or used to impersonate you online (e.g. if they contain your passwords). Cookie theft may also operate in conjunction with a fake WAP attack (see below), or a hijacked session. Avoiding public or unprotected private networks is your safest bet. Using a VPN (Virtual Private Network) to encrypt and tunnel the connection on your phone or mobile device is also advised. And periodically clearing your browser and system caches will reduce the number of cookies you have available to steal.

(c) Denial of Service/Distributed Denial of Service (DoS/DDoS):

A classic technique used to bring down systems or networks, by overloading them with login attempts, data requests, repetitive tasks, etc.

Attacks range from the fairly basic (configuring a system to continually bombard a site or server with requests), to the orchestrated (infecting a multitude of systems with malware to form a "botnet" that proceeds to flood a target network with unmanageable traffic), to the specific and sophisticated (buffer overflow attack swhich allow hackers to gain access to personal information by filling online form fields with excess data, so they freeze up).

Systems infected by malware are a common vector for DoS and DDoS attacks, so exercising caution when downloading files or opening email attachments is a basic first step. Having an up to date anti-malware package installed is the next.

If your website hosts an online form, a cloud-hosted security service which uses unified threat management (UTM) technology can be a hedge against overflow attacks.

(d) Eavesdropping:

A passive technique used by hackers to listen in on a network connection and observe and record as much high-value information as possible. Packet sniffing, interception of data transmissions, and other monitoring techniques may be used – but the success of this kind of attack depends on the hackers themselves not being detected or observed.

Unsecured networks are again the greatest gift to eavesdroppers. Users of public WiFi should connect via a VPN. Corporate networks may deploy Intrusion Detection Systems (IDS) and/or Intrusion Prevent Systems (IPS) to guard against eavesdropping.

(e) Keylogging:

One of the simplest and oldest hacking techniques, keylogging allows attackers with basic software to record to a log file the strokes you make on a keyboard (or in more sophisticated cases, the clicks and movements of a mouse). These log files may hold sensitive data like passwords and user names.

Virtual (on-screen) keyboards – which scramble or encrypt your text input as you click on each key – are a guard against this kind of attack. That's why so many banking and online commerce websites use them. They're also available as apps for personal use, and well worth having.

(f) Malware:

One of the greatest weapons in the hacker's arsenal is malicious software of all kinds. Viruses, Trojans (innocent-looking files and programs that deliver a malicious payload later on), worms (for continuous network infiltration), and ransomware can all deliver a handsome pay-day – if you allow them onto your system.

Numerous methods exist to induce unsuspecting users to do just that (some of which are described below).

To avoid becoming infected, exercise caution and due diligence when dealing with email messages and attachments. Disable pop-up windows in your browser, to eliminate the temptation to click on them. Restrict your downloads of software to approved app stores and reputable manufacturers. And keep your anti-malware and security software regularly updated.

(g) Phishing and Related Phenomena:

Using specially crafted email messages to induce a recipient into divulging personal or financial information is the basis of a phishing attack – and hackers have improved on the technique by using social engineering to add an element of increased urgency into their lures.

A not-to-be-missed financial deal or software download. A court summons from the power company, over that unpaid bill. An alert from the police, regarding your recent browsing activity. Any or all of these can be the bait that lures you to a spoofed website where an online form harvests your credentials, or malware is pushed onto your system in a "drive-by download."

Beyond the caution and due diligence already discussed, a dose of common sense is also advised. If you're unsure about a message, call or visit the office or person who supposedly sent it, to verify.

Security awareness training is a good idea for corporate users – as well as the posting of security intelligence, to keep workers advised of the latest threats and scams observed in the wild.

(h) Watering Hole and WAP Attacks:

Setting up a fake wireless access point or WAP (like a spoofed WiFi hotspot) is a great way for hackers to gain a captive audience whose data streams can be monitored, intercepted, or hijacked for various purposes.

Likewise, setting up a bogus but attractive website (like a spoofed social media platform) in a "watering hole" attack is a great way to assemble a herd of unwitting victims in one place – where you can harvest data, or spread a malware infection to the maximum number of recipients.

A Virtual Private Network (VPN) remains your safest option when using wireless access. Caution and a fully updated security and anti-malware suite are your safeguards against watering hole attacks.

(i) "Man in the Middle" (or "MITM") Attack:

Unsecured network connections expose users to this particular tactic, which involves intercepting the data stream between sender and recipient (of an ongoing communication or file transfer). An attacker effectively establishes two connections: One between themselves and a server/sender, and another between themselves and the client/recipient. They can then read or modify the data being passed through their proxy connection.

The objective may be to observe and record a confidential transmission such as an exchange of login credentials or the transfer of intellectual property. Or the attacker may insert malicious code into the data stream, compromising or infecting either or both systems involved in the exchange. If undetected, such attacks may persist for an extended

time period. Secure connections are key to avoiding MitM attacks, and using a reliable VPN is a way of ensuring the required encryption strength and point to point security.

IV. CONCLUSION

The entire world is moving towards the enhancement of technology, and more and more digitization of the real world processes, with this the risk of security increases day by day. In the security empire, we see more and more activity: spyware, viruses, spam. But as the number of malicious black hats increases, we can expect a corresponding increase of security jobs and white hats. We think more and more high-profile attacks on public targets, and snugger controls via legislature. This paper described about the working of hackers and what types of technique they used to hack someone. In conclusion, it must be said that Ethical Hacking is a tool to control the hacker's attack. I think that there is a need of more white hat hackers and need to develop an advanced security system in technology.

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An Overview of Global Position System (GPS) and Its Technology of Navigation

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I. INTRODUCTION

GPS is one of the most fantastic utilities ever discovered by man. The Global Positioning System GPS is a satellite based Navigation System made up of at least 24 satellites that are eleven thousand nautical miles in space and in six different orbital parts. The satellites are constantly moving to complete orbits around the earth in just under24 hours. GPS works in any weather conditions anywhere in the world, 24 hours a day, with no subscription fees or setup charges. The US Department of Defense (USDOD) originally put the satellite into orbit for military use, but they were made available for civilian use in the 1980s. [www.ja-gps.com.au/what-isgps] by Johny.

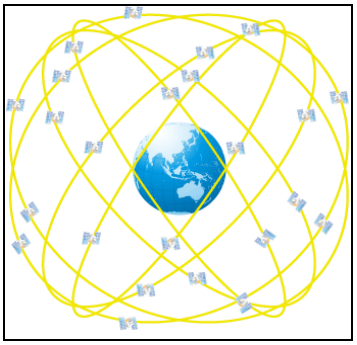

Fig. 1 Orbit of GPS Satellite

Fig. 2 GPS Satellite

The GPS satellites are referred to as NAVISTAR satellite. Each satellite weighs approximately 1 tonne and is about 5 meters across with the solar panels extended. Transmitter power is only 50 watts or less. Each satellite transmits on three frequencies. Civilian GPS uses the L1 frequencies of 1575.42 MHz. Is satellite is expected approximately 10 years. Replacements are constantly being built and launched into orbit. The satellite orbits are roughly 25,000 k.m. from the earth's center or 20,000 kms. Above the earth's surface. The orbital parts of the satellite take them between roughly 60 degree North and 60 degree South latitudes. Satellite signals can be received anywhere in the world at any time. One of the major benefits over previous land based navigation system is that all GPS works in all weather conditions. The GPS signal contains a "pseudo-random code" ephemeris and almanac data. The pseudo random code indentifies which satellite is transmitting an I.D. Code. Ephemeris data is constantly transmitted by each satellite and contains important information's such as status of the satellite, current date and time. Without this part of message the GPS receiver would have no idea what the current time and dates are. This part of the signal is essential to determine a position, of an object.

The almanac data tells that GPS receiver should be at any time throughout the day. Each Satellite transmits almanac data showing the orbital information for that satellite and for every other satellite in the system, each satellite transmits a message - "I'm satellite #x, my position is currently Y, and this message was sent at time Z. The GPS receiver reads the message and saves the ephemeris and almanac data for continual use. The information can also be used to set the clock within the GPS receiver.

To determine our position the GPS receiver compares the time a signal was transmitted by a satellite with the time it was received by the GPS

receiver. The time difference tells the GPS receiver how far away that particular satellite is. On adding distance measurement from a few more satellites our position can be triangulated with a minimum of three satellites GPS receiver can determine a 2D-latitude/longitude position. With four or more satellites, a GPS receiver can determine 3D position which includes latitude, longitude and altitude. By continuously updating, a GPS receiver can also accurately provide speed and direction of travel. By capturing the signals from three or more satellites (among a constellation of 31 satellites available), GPS receiver are able to triangulate data and pin point our location. With the addition of computing power and data stored in a memory such as road maps point of interest, topographic information and much more, GPS receivers are available to convert location speed and time information into a useful display format. GPS receivers are generally accurate within 15 meters and newer models that use Wide Area Augmentation System (WAAS) signal are accurate within three meters.

II. STRUCTURE OF GPS

The GPS technology mainly comprises of three parts:

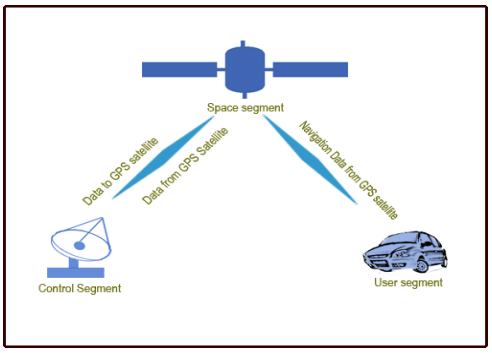

Fig. 3 Structure of GPS

(a) **Space Segment**: The satellites are the heart of GPS which helps to locate the position by broadcasting the signal used by the receiver. The signals are blocked when they travel through buildings, mountains and woods, to calculate the position the signals of four satellites should be locked. You need to keep moving around to get clear reception.

(b) **User Segment:** This segment includes military and civilian users. It comprises of a sensitive receiver which can detect signals (Power of the signal to be less than a quadrillionth power of a light bulb) and a computer to convert to data into useful information. GPS receiver helps to locate your own position but disallows you being tracked by someone else.

(c) **Control Segment:** This helps the entire system to work efficiently. It is essential that the transmission signals have to be updated and the satellites should be kept in there appropriate orbits.

III. METHODOLOGY

The GPS is network of about 30 satellites orbiting the earth at an altitude of 20,000 kms. Whenever you are on the planet at least four GPS satellite are visible at any time. Each one transmits information about its position and the current time at regular intervals. These signals traveling at the speed of light are intercepted by your GPS receiver which calculates how far away each satellite is based on how long it took for the message to arrive. Once it gets information on how far away we are at least three satellites on our GPS receiver can pinpoint our location using the process called “trilateration”.

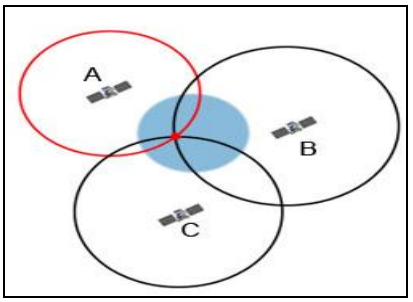

Fig. 4 Identification of Location

(a) **Structure of GPS Signal: The** GPS signal is an electromagnetic wave generated by an oscillating electric force transmitted from GPS satellites. As the distance traveled between the satellites and GPS receiver increases the strength of the signal decreases. All GPS satellites transmit two carrier frequencies. One at 1575.42 MHz (10.23MHz x 154) called L1 and second at 1227.60 MHz (10.23 MHz x 120) is called L2. Two different codes are modulated on GPS signal. The precise code (P-code) is modulated on both L1 and L2 signals P-code is intended for military uses as it is encrypted with additional W-code. This Anti-spoofing (AS) encryption denies civilian users access the P–code.

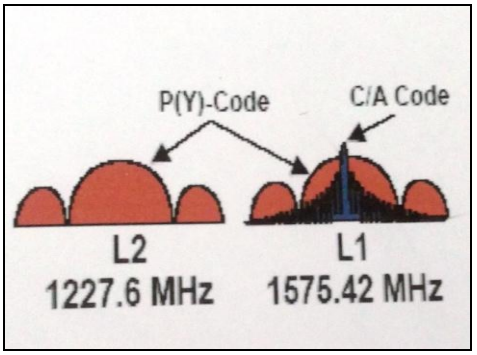

Fig. 5 Signal spectrum for current GPS signal

The second code is the course acquisition code (C/A code) which is transmitted on the L1 frequency as a 1.023 MHz signal using a bi-phase shift keying (BPSK) modulation technique. It is intended primarily for civilian users.

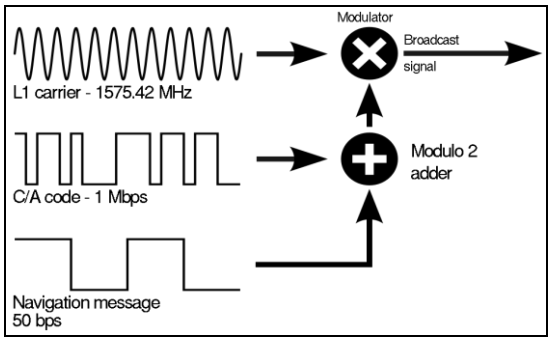

Fig. 6 GPS signal spectrum

(a) **Applications:** Imagine we are standing somewhere on earth with three satellite in the sky above us. If we know how far away we are from satellite A then we know you must be located somewhere on the A circle. If you do the same for satellite B and C we can work out our location by seeing where the three circles intersect. This is just what our GPS receiver dose although it uses overlapping spheres rather than circles. The more satellites there are above the horizon the more accurately our GPS unit can determine where we are.

IV. GPS AND IONOSPHERIC MEASUREMENTS

The GPS constellation of satellite is revolutionizing the science and technology of the Earth's ionosphere nowadays it is widely used to calculate total electron content [TEC] of the ionosphere. It is a unique and unprecedented resource for ionospheric measurements because it provides –

- Instantaneous global coverage
- Continues operation
- High temporal resolution and
- Near real –time data acquisition.

(a) **Satellite Elevation and Ionospheric Effect:** The severity of the ionospheric effect on a GPS signal depends on the amount of time that signal spends traveling through it. A signal originating from a satellite near the observers horizon must pass through a larger amount of the ionospheres to reach the receiver than does a signal from a satellite near the observes zenith. The longer the signal is in the ionosphere, the greater the ionosphere's effect on it. The error introduced by the ionosphere can be very small but it may be large when the satellite is near the observer's horizon, the vernal equinox is near and/or sunspot activity is severe. For example, the TEC is maximized during the peak of 11 years solar cycle. It also varies with magnetic activity, location, time of day, and even the direction of observation. Even given all this variation, it's fair to say that one thin one can depend as is the longer that the GPS signal remains in the atmosphere, the longer its trip through that atmosphere, the greater he effect of attenuation will be and the greater the slowing will be. So one of the things that a GPS receiver ought to do is ignore the signals coming from satellites that are near the observers' horizon. Obviously, as the GPS satellite is low in the sky, the signal is going through a greater atmosphere than it would be when it is directly overhead at zenith. This is one of the reasons why it's a good idea to have a mask angle on the GPS receiver 15-20 degrees, such that we would ignore the signals that are low, coming in across a great deal of atmosphere. So no matter what time of year or the time of day, we won't avoid going through the atmosphere and get signals from satellite that are a little but higher in the sky. The ionosphere in the absence of selective availability can be the greatest source of range and range-rate errors for GPS users. The dual frequency automatic correction for these effects is the best solution, and the single frequency user can correct for approximately 50-60 percent of the rms range. [et.al(ionospheric effect/GEOG862:GPS&GNSS for Geospatial professionals)

(b) **Accuracy of GPS:** Today's GPS receivers are extremely accurate; thanks to their parallel maintain a tracking lock in dense tree cover or in urban setting with tall buildings. Certain atmospheric factors and other error sources can affect the accuracy of GPS receivers. Garmin GPS receivers are typically accurate to within 10 meters. Accuracy is even better on the water. Some GARMIN GPS receiver's accuracy is improved with WAAS (Wide Area Augmentation System). This capability can improve accuracy to better than 3 meters by providing correction to the atmosphere, no additional equipment or fees are required to take advantage of WAAS satellite. Users can also get better accuracy with differential GPS, which corrects GPS distances to within an average of 1 to 3 meters. The U.S. coast guard operates the most common DGPS correction service, consisting of a network of towers that

receive GPS signals and transmit a corrected signal by beacon transmitters. In order to get the corrected signal, users must have a differential beacon receiver and beacon antenna in addition to their GPS. (www.engineersgarage.com/articles)

(c) **GPS signals errors sources:** Factor that can affect GPS signals and accuracy includes the following: Ionosphere and troposphere delays: satellite signal slow as they pass through the atmosphere the GPS system uses a built in model to partially correct for this type of error. Signal multipath: The GPS signal may reflect off objects such as tall buildings or large rock surface, they don't penetrate indoor spaces well before it reaches the receiver which will increase the travel time of the signal and cause errors. Receiver clock errors: A receivers built in clock may have slight timing errors because it is less accurate than the atomic clocks on GPS satellite. Orbital errors: The satellite reported location may not be accurate. Number of satellites visible: The more satellites a GPS receiver can "see" the better the accuracy, when a signal is blocked you may get position errors or possibly no position reading at all. GPS units typically will not work under water or underground but high sensitivity receivers are able to track some signals when inside building or under tree cover. Satellite geometry/shading: Satellite signal are more effective when satellites are located at wide angles relative to each other rather than in a line or tight groping. Selective availability: The U.S. Department of Defense once applied Selective Availability (S.A.) to satellites, making signals less accurate in order to keep "enemies" from using highly accurate GPS Signals. The government turned of SA in MAY 2000, which improved the accuracy of civilian GPS receivers. (Garmin/what is GPS)

V. COMPARISON BETWEEN GPS AND OTHER MEASUREMENT TECHNIQUES

There is still considerable interest in comparing GPS-derived ionospheric observables with independent techniques both to validate GPS and to augment the remote sensing capabilities of other methods. Lanyi and Roth (1988) compared GPS measurements to TEC derived from beacon satellite transmissions (Farady-effect) this is followed more recently by comparisons at Boulder, Colorado (Conkright et.al, 1997) both techniques showed good agreement in traking TEC changes. Collocated GPS receivers and ionosondes traking a traveling atmospheric disturbance during a major geomagnetic disturbance over Europe are reported by Ho et al (1996) comparison between GPS and incoherent scatter radar measurement of electron density are discussed by Jakowski et al (1996). Measurement of vertical total electron content available since 1992 from the TOPEX dual-frequency satellite altimeter are discussed in more detail below with reference to assessing the accuracy of global ionosphere TEC maps derived from GPS.

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Make in India: Defence Manufacturing

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Abstract – India has the third largest military in the world and is the sixth biggest defence spender. India is also one of the largest importers of conventional defence equipment and spends around 30% of its total defense budget on capital acquisitions. 60% of defence related requirements are currently met through imports. The 'Make in India' initiative by the Government is focusing its efforts on increasing indigenous defence manufacturing and becoming self-reliant. The opening up of the defence sector for private sector participation is helping foreign original equipment manufacturers (OEMs) enter into strategic partnerships with Indian companies and leverage opportunities in the domestic market as well as global markets. In this study we found that defense manufacturing played a very important role in the field of defense sector and also helps to build India a strong nation. This paper is based on secondary data it was taken from various sources.

Keywords: - Make in India, Defence Manufacturing And Indian Military.

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I. INTRODUCTION

The Defence industry of India is a strategically important sector in India with strength of over 1.3 million active personnel. India is probably the only large country in the world which is overwhelmingly dependent on external sources for its defence requirements. According to Stockholm International Peace Research Institute (SIPRI), India is the world's largest arms importer, accounting for 14 per cent of global arms import during 2009-13. Replying to a question in the Rajya Sabha, the Union Defence Minister stated that India spent a whopping Rs. 83,458.31 crore on arms imports in a matter of three years ending 2013-14. This dependency on arms import is a stark reminder of how far India is from the objective of substantive self-reliance in defence production that it has aspired to since the early days of independence. However all is not lost. The 'Make in India' (MII) initiative launched by the National Democratic Alliance (NDA) government of Prime Minister Narendra Modi offers a ray of hope. Under the initiative, 25 sectors including defence manufacturing have been identified to revive India's industrial growth and more importantly propel the nation as a global manufacturing hub.

II. OBJECTIVES & METHODOLOGY

(a) Objectives

(i) To explain about the concept of Defence Manufacturing & Make in India.

(ii) To analyze Government imitative in the field of Defence manufacturing.

(b) Research Methodology

The study is based on secondary data. The required data has been collected from various sources i.e. research papers, various Bulletins of Govt of India , Publications from Ministry Of Commerce, which are available on internet.

III. DEFENCE MANUFACTURING

(a) Make in India in Defence Sector

The 'Make in India' policy for the defence sector aims to reverse the current imbalance between the import of defence equipment and indigenous manufacture of defence equipments without adversely affecting the requirements, capability and preparedness of the user. Therefore, achieving self reliance and reducing dependence on foreign countries in defence is a necessity today rather than a choice, both for strategic and economic reasons. The requirement for domestic production of defence equipment is more than for any other sector because it will not only save precious foreign exchange but will address the national security concerns. 'Make in India' policy aims at facilitating investments and fostering innovations for the manufacturing sector in India. Government being the only consumer, 'Make in India' in defence sector will be governed by the defence procurement policy of India. As the Indian Companies may not have adequate capabilities in terms of technology, they are encouraged to partner with foreign

companies for joint ventures, technology transfer arrangements and tie-ups.

(b) Defence Manufacturing Expenditure

It is in strategic interest of a nation aspiring to be the regional power to develop indigenous and internationally competitive defence industry base. Presently, India is one of the largest importers of conventional defence equipment. According to government statistics, roughly 60% of India's defence requirements are met through imports. The data's at table 1 shows status of various nations.

Table 1

Defence Expenditure Status of Important Nations

Country Wise Military Spending 2014

Region	Spending ($ billion)	Change(%)
USA	610.0	3.5
Russia	84.5	4.5
China	216.0	2.06
India	50.0	2.4
World Total	1776	-

Source: Facilitating 'Make in India' in Defence Sector Through Defence Procurement Procedure July 2015

Top 10 Arms Importers 2010-2014

Importer	Share of international arms imports (%)		Main Suppliers (share of Importer's total Imports) 2010-14		
	2010-14	2005-09	1st	2nd	3rd
India	15	7	Russia (70%)	USA (12%)	Israel (7%)
Saudi Arabia	5	1	UK (36%)	USA (35%)	France (6%)
China	5	9	Russia (61%)	France (16%)	Ukraine (13%)
UAE	4	5	USA (58%)	France (9%)	Russia (9%)
Pakistan	4	3	China (51%)	USA (30%)	Sweden (5%)

Source: Facilitating 'Make in India' in Defence Sector Through Defence Procurement Procedure July 2015

IV. REASONS FOR MAKE IN INDIA IN DEFENCE

(a) India's current requirements on Defence are catered largely by imports. The opening of the Defence sector for private sector participation will help foreign original equipment manufacturers to enter into strategic partnerships with Indian companies and leverage the domestic markets as well as aim at global markets. Besides helping in building domestic capabilities, this will also bolster exports in the long term.

(b) Contractual offset obligations worth approximately USD 4.53 billion in next 5-6 years

(c) The offset policy (which stipulates the mandatory offset requirement of a minimum 30% for procurement of defense equipment in excess of USD 306.69 million) introduced in the capital purchase agreements with foreign defense players. It would also ensure that an eco-system of suppliers is built domestically.

(d) Favorable government policy which promotes self-reliance, indigenization, technology up gradation and achieving economies of scale including development of capabilities for exports in the defense sector.

(e) The country's extensive modernization plans with an increased focus on homeland security and India's growing attractiveness as a defense sourcing hub.

V. GOVERNMENT INITIATIVE IN THE FIELD OF DEFENCE MANUFACTURING

(a) Financial Support for Defence Manufacturing

Following are the highlights of the key provision of the 2016-17 union budget:-

(i) Provision of USD 34.53 billion for defense services in the FY 2016-17 Union Budget.

(ii) Capital outlay for Defense in 2016-17 is kept at USD 12.09 billion.

(iii) Out of this, USD 10.75 billion has been allocated for Capital Acquisition of the Defence Services.

(iv) USD 1.33 billion has been provided under "Other than Capital Acquisition" segment for capital expenditure to Army, Navy, Joint staff and Air Force.

(v) Either of the following two deductions can be availed:

(vi) Investment allowance (additional depreciation) at the rate of 15% to manufacturing companies that invest more than USD 15.38 million in plants and machinery acquired and installed between 01.04.2013 to 31.03.2015 provided the aggregate amount of investment in the new plants and machinery during the said period exceeds USD 15.38 million.

(vii) In order to provide a further fillip to companies engaged in the manufacture of an article or thing, the said benefit of additional deduction of 15% of the cost of new plants and machinery, exceeding USD 3.84 million, acquired and installed during any previous year until 31.3.2017

(b) Policy Initiatives & Investments

(i) FDI Policy

100% FDI is allowed in defence sector, out of which up to 49% is under automatic route. FDI above 49% is permitted through Government route on case to

case basis where it is likely to result in access to modern technology.

(ii) Exports

During FY 2015-16, INR 2,059.18 crore worth of defence platforms, equipment and spares manufactured in India were exported to more than 28 countries. Some of the major defence equipment exported by Defence Public Sector Undertakings (DPSUs) and Ordnance Factory Board (OFB) are Patrol Vessels, Helicopters & their spares, Sonars & Radars, Avionics, Radar Warning Receivers (RWR), Small Arms, Small Caliber Ammunition, Grenades and Telecommunication equipment.

(iii) Fiscal Incentives

- In budget 2017-18, defence budget has received a boost of 6.2% as compared to budget 2016-17. INR 86,488 crore has been allocated for Defence Capital out INR 2,74,114 crore allocated for defence expenditure (excluding pension) in the budget.
- The preferential treatment given to Defence Public Sector Undertakings (DPSUs) in excise duty/custom duty has been discontinued to create a level playing field. As per the revised policy, all Indian industries (public and private) are subjected to the same kind of excise and custom duty levies (April 2015).
- Exchange Rate Variation protection has been made applicable for Indian private sector at par with Public Sector Undertakings for all categories of capital acquisitions (August 2015).
- The custom duty exemption on import of defence equipment has been removed to encourage imports and incentivize domestic manufacturing. Defence Procurement Procedure The Defence Procurement Procedure (DPP) of 2013 was amended w.e.f from April 2, 2016 to provide for the following:
- Indian companies are allowed for tie-ups with a foreign Original Equipment Manufacturer (OEM) for Transfer of Technology (ToT) under 'Buy & Make (Indian)' category.
- Under 'Buy & Make' Category of Capital Acquisition, the foreign vendor is required to transfer the Technology to Indian Production agency for indigenous production of the items.
- Defense products list for industrial licensing announced in June 2014; large number of parts/components, castings/ forgings etc. have been excluded from the purview of industrial licensing.

VI. SUPPORTING FACTORS

(a) Research & Development

Research and Development Centres of Excellence for Defence Research and Development Organisation (DRDO) have been setup for conducting research in the defence sector. The following three Centres of Excellence were established during 2016:

(i) Centre of Propulsion Technology (CoPT), IITMumbai was established in June 2016

(ii) Jagdish Chandra Bose Centre for Advanced Technology (JCBCAT), Jadavpur University, Kolkata was established in June 2016

(iii) Joint Advanced Technology Centre (JATC), IITDelhi was established in Oct 2016 Ease of Doing Business

(b) Ease of Doing Business

(i) Foreign vendors can finalize Indian Offset Partners (IOPs) and offset product details one year prior to the intended offset discharge or undertake the offset activity and submit claims thereafter. Foreign players no longer need to provide all details of their Indian partners at the time of bidding (December, 2015) − 100% offset claims filed during the past 2 years as compared to 64% during 2008-2013.

(ii) Acceptance of Necessity (AoN) validity has been reduced to 6 months from previous one year fast tracking procurements.

(iii) The list of military stores for the purpose of issuing NOC for export has been notified by the Government to remove ambiguity and to make the process transparent (March, 2015).

(iv) The requirement of single largest Indian ownership of 51% of equity has been removed.

(v) A lock-in period of three years on equity transfer has been done-away with in FDI for Defence.

(vi) Standard Operating Procedures (SOPs) for issue of NOC for export of military stores has been simplified and specific timelines prescribed. Requirement of Government signed End User Certificate for export of

parts and components and other non-sensitive military stores has been removed (July 2015).

(vii) Application for NOC for export of military stores can be made online (November 2015). The maximum processing time has been reduced to 25 days and 70% of the NOCs are issued in 15 days. 241 NOCs were issued in FY 2015-16 as compared to 39 in FY 2013-14.

(viii) Industrial Licensing has been simplified and can be applied online:

(ix) A large number of components, parts, subsystems, testing equipment, production equipment excluded from preview of industrial licensing on the Defense Products List.

(x) Validity of Industrial Licence granted under the IDR Act has been increased to 15 years from 7 years with a provision to further extend it by 3 years on a case-to-case basis. - 119 industrial licences have been issued to private defence equipment manufacturers during April 2014 to March 2016. - Renewable of registration can be carried out on self certification basis. Department of Industrial Policy and Promotion The capacity verification of non-registered firms have been made valid for three years with renewable facility in line with registered firms.

(xi) A 'Make in India' portal for Defence Production (www.makeinindiadefence.com) has been launched. It provides policy and procedural issues relevant for defence manufacturing industry.

(xii) e-tendering for procurement has been implemented for various items.

VII. CONCLUSION

Achieving self-reliance and reducing dependence on foreign countries in defence is a necessity today rather than a choice, both for strategic and economic reasons. Our Prime Minister has taken a very important initiative in form of 'Make in India' to promote and encourage domestic manufacturing of various items. The requirement for domestic production of Defence equipment is more than for any other sector because it will not only save precious foreign exchange but will also address the national security concerns. Government being the only consumer, 'Make in India' in defence sector will be driven by our procurement policy. The Government policy of promoting domestic defence industry is adequately reflected in the Defence Procurement Policy, wherein preferential treatment is given to 'Buy (Indian)' and 'Buy and Make (Indian)' categories of acquisition over 'Buy (Global)'. India has the potential to emerge as a global platform for defence research, manufacturing, supply chain sourcing, software development, and offsets, which will strengthen our defence capabilities and spur industrial development as well as exports in this sector.

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Traffic Grooming in Optical WDM Network

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Abstract – Traffic Grooming has become a very important issue on optical Network, as optical networks provide a very high speed data transmission for huge amount of data. A Sparse grooming Network with only a fractional of noes having grooming functionalities may achieve the same performance as the one in which all the nodes are grooming, but with much lower cost. In literature different algorithms, models and techniques have been proposed to design the sparse grooming networks. With Proper assignment of routing and wavelengths in the network reduces the blocking probability ultimately increases the bandwidth of the network. In this paper, we studied and analyzed the different sparse traffic grooming and RWA assignment strategies with its performance metrics for optical mesh networks.

Keywords :OXC - Optical Cross Connect, OC-Optical carrier, RWA- Routing & wavelength assignment, WDM – wavelength division multiplexing, G-Fabric - Grooming Fabric, G-Node Grooming Node, G-OXC – Grooming Optical Cross Connect, W-Fabric - wavelength-switching fabric.

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I. INTRODUCTION

The rapid expansion of the internet in the last decade has been made possible largely by optical networks with high bandwidth and reliability. WDM significantly increases the capacity of a fiber by allowing simultaneous transmission of multiple wavelength channels. A single fiber strand has now over a tera-bit per second bandwidth and a wavelength channel has over ten giga-bit per second transmission speed (e.g. OC-48 has capacity of approx. 2.5 Gbps1). In WDM optical networks, the bandwidth request of a traffic stream can be much lower than the full wavelength capacity.

Traffic Grooming in WDM networks can be defined as the techniques used to combine low-speed traffic streams onto high-capacity wavelengths in order to minimize the network cost in terms of terminating equipment and/or electric switches (Barr, et. al., 2005).It is useful in order to improve bandwidth utilization and optimize network throughput by a procedure of efficiently multiplexing/ demultiplexing different wavelength channels (Barr, et. al., 2005).Grooming is a term used to describe the optimization of capacity utilization in Internet transport systems by means of cross-connections between different transport systems or layers within the same system (Zhu and Mukherjee, 2003).

In the past few decades, computer and telecommunication networks have experienced dramatic growth. With the growth of the Internet technology, there is a huge demand for network bandwidth. This demand is aggravated by the advent of new bandwidth hungry applications, such as multimedia communications e.g. voice mails, video on demand and high data traffic on Internet. The unprecedented growth of internet traffic and rapid advancements in the optical transport technologies have fueled the Internet transport infrastructure to evolve towards a model of high speed IP routers interconnected by intelligent optical networks.

(a) **Optical Transport Network-**Optical transport networks are high-capacity telecommunications networks based on optical technologies and components that provide routing, grooming, and restoration at the wavelength level as well as wavelength-based services. Optical networks, based on the emergence of the optical layer in transport networks, provide higher capacity (in Tbps) and reduced costs for new applications such as the Internet, video and multimedia interaction, and advanced digital services. Optical networks are also being used widely nowadays in backbone networks that spans long distances, e.g., each link could be a few hundreds to a few thousands of kilometers in length., due to their high

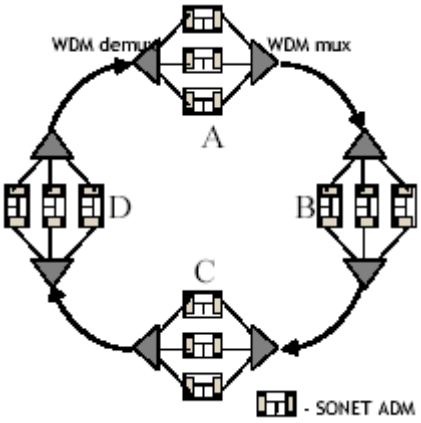
relatively low cost. The backbone network can be set up to provide nationwide or global coverage. Most telecom backbone networks are deployed today as an interconnection of "stacked" SONET/SDH rings, in which the fibers support multiple wavelengths using WDM transmission equipment. Ring networks, however, are inefficient in using the expensive bandwidth resources of the network. Thus, mesh networks, which consist of an arbitrary interconnection pattern, are being deployed as the backbone of choice for our future telecom networks.

(b) Optical WDM Network- With the advancement of Dense Wavelength Division Multiplexing (DWDM) technology, the bandwidth of a fiber has significantly increased. Recent studies indicate that up to 360 DWDM wavelength channels can be sent through a single fiber. Similarly each wavelength channel can also carry up to 100 Gbps, with the advancements in switching equipments, tunable lasers and photo detectors. Even though fibers can offer very high bandwidth, user requests that come to optical fiber networks are of lower bandwidth. The capacity requirement of these low-rate traffic connections can vary in range from STS-1(51.84 Mbps or lower) up to full wavelength capacity.

This requires efficient grouping of individual connections onto the same wavelength as dedicating a unique wavelength for each demand will lead to huge wastage of bandwidth. Intelligent grouping is also required because each wavelength has to be dropped at the source and destination of each of the connections assigned to it. Dropping a wavelength at any node involves conversion from optical to electronic domain, and the equipment for performing this is the main contributor towards the cost of the network. This grouping of connections and assigning wavelengths to these groups, so as to optimize on some objective such as throughput or network cost, is reduced.

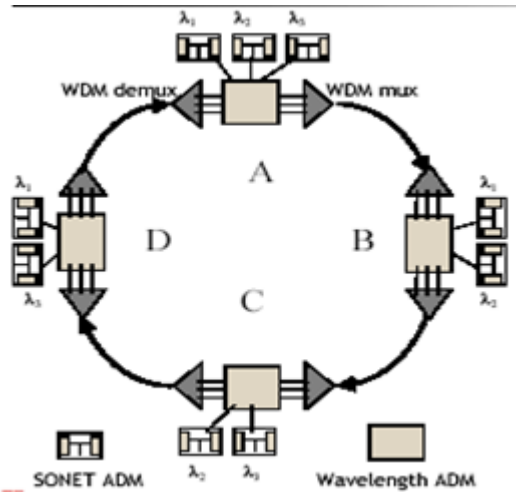
II. MINIMIZING THE NETWORK RESOURCES

The network resources must be used efficiently to achieve high performance. By carefully grooming the low speed connections and using wavelength-division multiplexer (OADM) to perform the optical bypass at intermediate nodes, electronic ADMs can be saved and network cost will be reduced. To reduce the amount of traffic that must be electronically processed at intermediate nodes, future WDM systems will employ WDM add/drop multiplexers (WADMs), which allow each wavelength to either be dropped or electronically processed at the node or optically bypass the node electronics (Modiano and Lin, 2001).The SONET/WDM architecture shown in Fig. 2a is potentially wasteful of SONET ADMs because every wavelength (ring) requires a SONET ADM at every node. A WADM at a given node is capable of dropping and adding any number of wavelengths at that node. Consequently, it is no longer necessary to have a SONET ADM for every wavelength at every node, but rather only for those wavelengths used at that node.



SONET/WDM ring (Ungroomed): Fig 2(a)

The above figure 2(a) shows an ungroomed unidirectional ring network with four nodes A, B, C and D, and 3 wavelengths λ1, λ2 and λ3. Wavelength λ1 carries the traffic between nodes A and D and that between nodes C and B, etc. Therefore, each node would require an ADM on every wavelength for a total of 12 ADMs – which is potentially wasteful of ADMs because every wavelength requires an ADM at every node.



SONET/WDM ring (Groomed) : Fig 2(b)

Assignment2 on Wavelengths

λ1 : A ↔ B, A ↔ C (3 ADMs)

λ2 : B ↔ C, B ↔ D (3 ADMs)

λ3 : A ↔ D, C ↔ D (3 ADMs)

- Requires total 9 ADMs