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## Contents

<b>S. No</b>	<b>Title of Paper</b>	<b>Authors</b>	<b>Page Number</b>
1	Biometric Limitations and Solutions	Dr. Sunil Kumar Singla	1
2	Research Article On “Price & Consumer Behavior of Global Depository Receipts”	Goel Shuchi	5
3	Neural and fuzzy approach: A Novel	Ajay Kakkar	14
4	Automatic Tools for Audio Genre Classification	Manish, Davinder Pal Singh, Shubhangi	18
5	Overview on Android – The New Mobile Operating System	Monika Bazard, Sonia Bhardwaj	25
6	Optimized Elevator by using PLC and HMI	Piyush Jain, Dr. Sunil K. Singla, Ajay Kakkar	35
7	Automobile Industry in India – Pattern Of Growth	Dr. P.D. Rathi, Dr. Sandeep Jain	42
8	Study of DSDV, DSR and AODV in Mobile Ad hoc Networks	Pardeep Kumar, Sandeep Lamba, Dayal Sati	52
9	Examination for Shell Wall Thickness of Magnesium Alloy Using Three Dimensional Printing	Amandeep Singh, I.P.S. Ahuja, and Rajesh Kumar, B.Lonia	61
10	“Work Culture in Public and Private Sector Organizations of Rewa Division	Dr. Suprina, Dr Roshan Lal	69
11	Performance and Evaluation of a Diesel Engine Fuelled with Filtered Pongamia Oil and its Standardization Characteristics	V.Sitaram Prasad, Dr. S. K. Mohapatra Dr.J.K.Sharma P.L.Bali	79
12	Analysis, Evaluation, and Comparison of Algorithms For Scheduling Task Graphs on Parallel Processors	Neha Sharma, Navneet Randhawa	90
13	Electron Impact Ionization Cross- Section of Tropospheric Atoms	Dr. Praveen Bhatt, Parmjeet Kaur, Priyanka & Sham Singh Saini	100
14	Role of Emotional Intelligence on Personality	Mandeep Kaur	109
15	BER and SNR Evaluation of Mobile Wi-Max using Different Coding Schemes	Pooja Sharma & Vijay Kumar	115
16	Control of Heating Systems in Process Industry	Mohan Kashyap, Jaswinder Singh & Bhanu Partap Singh	123

## **Biometric Limitations and Solutions**

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### **Abstract:**

Biometrics provides better security solutions than conventional authentication (knowledge/possession) systems because it uses certain physiological or behavioral traits associated with the person. Although a single biometric system has been used in many applications such as ATM, airport security checks etc., but the single biometric system has certain drawback which must be kept in mind before its deployment for a particular application. The focus of this paper will be to discuss the limitations of single biometric system and suggest the measures to overcome the limitations in order to enhance the system performance.

*Key Words: Biometric, FAR, FRR, Security.*

### **Introduction:**

“Biometric” is a general term used alternatively to describe a characteristic or a process, where as a characteristic, it is a measurable biological (anatomical and physiological) & behavioral characteristic [1] that can be used for automated recognition and as a process it is an automated methods of recognizing an individual based on measurable biological (anatomical and physiological) and behavioral characteristics [2]. This technology is becoming popular on pretext that each person has specific unique physical characteristics that can't be lost, borrowed or stolen. In the present day of automated world, machines are replacing the human in every aspect of life. Due to this, the security concern regarding the authenticity of the user goes on increasing. Hence, it becomes necessary to include some constrains in order to reject imposters (unauthorized persons) and allow only the authorized user to access automated services. Some of the biometric traits are

- Fingerprints
- Eye features such as iris or retina
- Facial features
- Hand geometry
- Palmprint
- Handwritten signatures
- keystrokes or typing
- voice print

Although a single biometric system has been used in many applications such as ATM, airport security checks, access control etc., but the single biometric system has certain drawback which have been discussed in the next section. The solutions to the limitations of biometric have been discussed in section 3. The section 4 concludes the discussion of this paper.

**Limitations of Single Biometric System:**

The single biometric system suffers from the following drawbacks:

**Non-universality:**

Universality is the basic requirement of a biometric authentication system in which every user is expected to possess the biometric trait used for verification/ identification. However, in practice the biometric trait used may not be universal i.e. every user in the population may not have the required biometric trait. For example, T. Mansfield et al. [3] reported that in fingerprint biometric system 1 in 1000 fingers are missing or have no fingerprints. P. M. Cobby et al. [4] reported a 15% failure to enrollment problem in an iris based biometrics system. The persons who are suffering from eye abnormalities or diseases cannot provide good quality of samples for iris biometric system [5]. Similarly some people do not have hand so they cannot provide the required information for hand or palm print recognition system. In general it can be said that a single biometric trait cannot cover the entire population for a given biometric based security system.

**Non-uniqueness:**

The characteristics of the chosen biometric system must be unique in the sense that no two individual should have the same characteristics but in practice, it may not be the case. For example, in a face recognition system due to genetic factors identical twins or father-son may have the same facial appearance [6]. The lack of uniqueness will increase the false accept rate (FAR) of the system.

**Noise:**

The presence of noise in the acquired biometric information may affect the accuracy of the authentication system. The noise may come into picture mainly due defective sensor or unfavorable environmental (ambient) conditions. The accumulation of dirt on the fingerprint sensor or scar on the fingerprint may add the noise component in the fingerprint based system while voice altered due to cold and blurring of the images due to non-focusing of camera are examples of noise in speaker based and face based authentication system. If the biometric system depends upon a single biometric trait than the false reject rate (FRR) will increase due to the presence of noise [7].

**Intra-class variation:**

Biometric data obtained from the same subject may vary at different instants of time, for example, data obtained during verification/ identification may vary from the data that was obtained during enrollment. The inter class variation results due to

- (i) Improper interaction of user and the sensor
- (ii) Change in biometric traits over a period of time
- (iii) Use of different sensors during enrollment and authentication

The inter class variation may increase the false reject rate (FRR) of the system.

**Circumvention:**

An imposter can circumvent the system by stealing biometric traits of the authenticate user or by spoofed traits. The possibility to circumvent the system is more when behavioral traits such as

voice [8] or signature [9] are used than the physical traits. However, physical traits such as fingerprint can be artificially constructed to circumvent the system.

**Solutions to the Problems Caused by Single Biometric:**

The non universality problem of single biometric system (which results in failure to enroll and/or failure to capture errors) can be taken care by using a multi-biometric system which contains more than one biometric trait. The resulting system is likely to be used by a large population and will be perceived as user friendly since the user can choose the biometric (s) of his/her own choice. The non uniqueness problem of single biometric can be addressed by combining biometric with the conventional authentication (knowledge/possession) systems. For example, instead of asking only the biometric trait of the person, the biometric trait and the password may be requested, which will give more security than the single biometric system or the conventional system alone. The multi biometric system can also address the problem of non-uniqueness of a single biometric trait. The introduction of more than one biometric trait can significantly improve the recognition accuracy of authentication system. The problem of noise and intra class variation can also be addressed in a similar manner. For example, two or more than two different biometric can be fused in such a way that if one biometric trait results in a lower value of match due to noise or intra class variation and the other gives the higher value of match then the claim of the user can be accepted (some other fusion rules can also be formulated). In the biometric plus conventional system the threshold value, to accept or reject the claim of the user of biometric part may be reduced to compensate for noise and intra class variation because another security layer is also provided by the conventional system. It becomes difficult to circumvent the combined system or multi-biometric system as it is comparatively difficult for the imposter to steal all the biometric traits of the authorized person simultaneously. The multi-biometric system are computationally and economically more expensive than single biometric system. However, the computational time can be reduced by using a relatively simple but less accurate modality to prune the database before using the more complex and accurate modality on the remaining data to perform the final authentication.

**Conclusion:**

In conclusion it can be said that the problems introduced by the single biometric system can be rectified by

- (a) Combining a biometric modality with conventional techniques
- (b) Combining more than one biometric modality i.e. multibiometric system

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**Research Article**  
**On**  
**“Price & Consumer Behavior of Global Depository Receipts”**

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**Abstract:**

One of the outstanding features of globalization in the financial services industry is the increased access provided to non-local investors in several major stock markets of the world. Increasingly, stock markets from emerging markets permit institutional investors to trade in their domestic markets. Portfolio flows often referred to as ‘hot- money’ are notoriously volatile capital flows. They have also responsible for spreading financial crisis causing contagion in international market. The explosive portfolio flow by FII brings with them great advantages as they are engine of growth, lowering cost of capital in many emerging market. This opening up of capital markets in emerging market countries has been perceived as beneficial by some researchers while others are concerned about possible adverse consequences. Global Depository Receipts (GDRs) have come into prominence recently as being the favored instrument by which companies from emerging markets such as Russia, India and China raise capital on western stock exchanges. The purpose of the study is to examine the behavior of sample stock prices in weak, semi-strong and strong form of market efficiency in the GDR markets as well as in domestic markets. This study is essentially empirical and exploratory in nature.

*Key Words: Depository Receipts, GDR Prices.*

**Introduction:**

Globally strong consensus has emerged that the achievement of more dynamic economic growth requires a greater role of the foreign capital. Generally, it is not possible for a developing country like India to grow without sufficient import of capital because of the gaps exist in domestic savings and capital requirements. During the initial stages of development, domestic savings are normally not adequate to finance the development projects required to achieve faster economic growth. Foreign capital flows to developing countries have been growing sharply since 1991 because of the liberalized policies adopted by most of them in this regard. There are many forms of the foreign capital inflows including Official Aid, Commercial Borrowings, Foreign Direct Investment (FDI) and Foreign Portfolio Investment (FPI). According to Global Development Finance report (2002) published by World Bank, 64% FDI had concentrated in just 10 developing countries during 1990s. These countries were China, Brazil, Mexico, Argentina, Poland, Chile, Malaysia, Korea, Thailand, and Venezuela. Among these, China has emerged as the major recipient of FDI because of its low production cost and large domestic market. During

1990s, India (the fourth largest developing country) stood at 14th position in the list of FDI recipient's developing countries. Growth of FDI has been paralleled by major variations in the composition of FDI to developing countries. Services sector emerged as the most important sector attracting maximum FDI during 1990s.

Equity placements in the international capital market have registered a huge increase over the last decade. Developing markets' share represents close to 40% of those issues, if we exclude the retreat observed after the Mexican crisis of December 1994. Most international equity placements have been offered by Latin American and Asian firms with special emphasis for Mexico, Argentina, China and recently India. In the recent years, international cross-listing started taking place in special shares of the foreign firm, depository receipts (DRs). Depository receipts are claims issued by a depository institution to an underlying foreign security. When issuers raise money in two or more markets, they issue Global Depository Receipts (GDRs). Global depository receipts (GDRs) as tradable instruments are becoming increasingly popular in the hands of institutional investors worldwide and an accepted option for companies to access global equity markets. India is no exception, and a number of Indian companies have spread their presence to foreign bourses through GDRs and gained access to investment capital overseas.

Global Depository Receipt (GDR) - certificate issued by international bank, which can be subject of worldwide circulation on capital markets. GDR's are emitted by banks, which purchase shares of foreign companies and deposit it on the accounts. Global Depository Receipt facilitates trade of shares, especially those from emerging markets. Prices of GDR's are often close to values of related shares.

GDRs are securities available in one or more markets outside the company's home country. The basic advantage of the GDRs, compared to the ADRs, is that they allow the issuer to raise capital on two or more markets simultaneously, which increases his shareholder base. They gained popularity also due to the flexibility of their structure.

### **Objectives of the Study:**

The main objectives of the study under consideration are as follows:

1. To study the price behavior of GDR stocks with a view to examine the semi-strong form of stock market efficiency.
2. To understand the price movement of GDR stocks to vis-à-vis the strong form of market efficiency.

### **Conceptualization:**

Global Depository Receipt (GDR) - certificate issued by international bank, which can be subject of worldwide circulation on capital markets. GDR's are emitted by banks, which purchase shares of foreign companies and deposit it on the accounts. Global Depository Receipt facilitates trade of shares, especially those from emerging markets. Prices of GDR's are often close to values of related shares. It refers to a receipt denoting ownership of foreign-based corporation stock shares which are traded in numerous capital markets around the world.

### **Research Methodology:**

The study under consideration Price and Consumer Behavior of Global Depository Receipts is essentially empirical and exploratory in nature. The main objective of the study is to examine the price behavior in three forms i.e. weak form, semi strong form and strong form.

**Review of Existing Literature:**

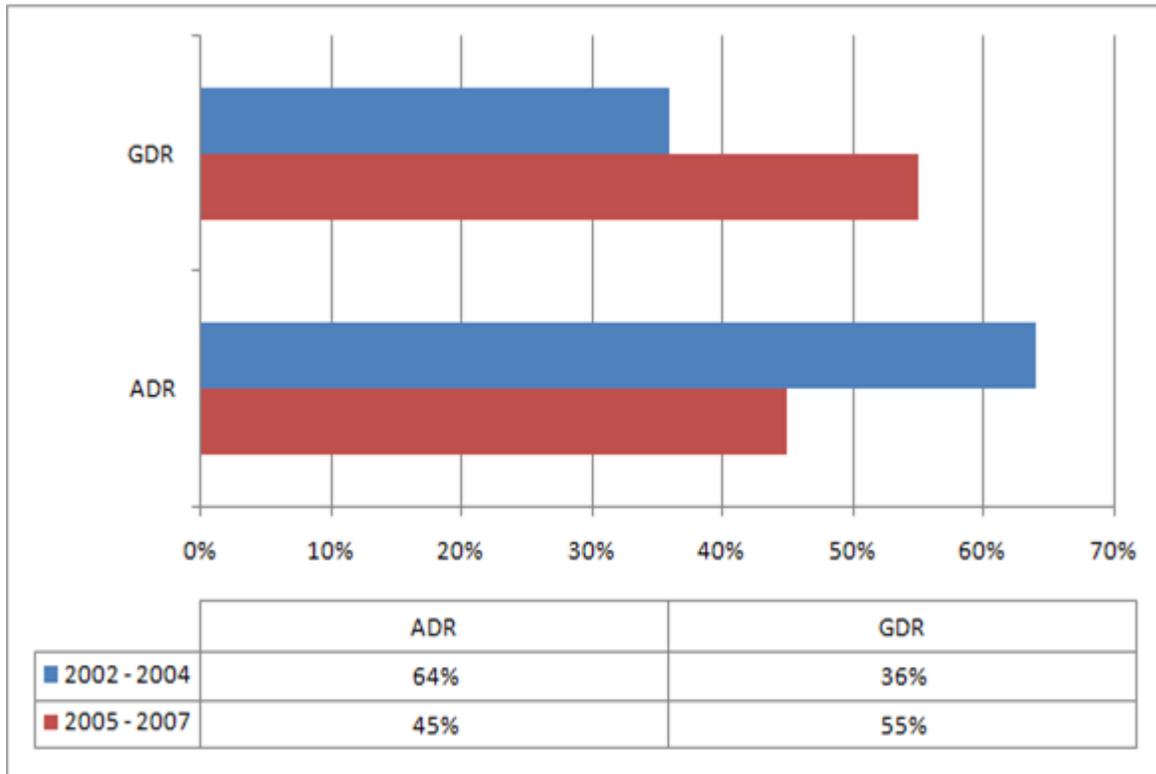
Merton (1987) refers to changes in investor recognition as a source of value. Investors only invest in the assets they are aware of. Investors require higher returns to compensate not only for market risk but also for the shadow cost of incomplete information. Listing on a major exchange, by expanding the firm's investor base could result in a decrease of its expected return. The diversification gains are proportional to the firm's specific risk and to the weight of its capitalization in the world market capitalization.

Recent literature refers to the fact that managers time their application for listing, could explain the decline in expected returns observed after listing. As there is evidence that this decline is more pronounced for small firms, for which listing requirements may be binding, it may be the case that managers choose to list when firms have recently performed well. This line of argument does not address why firms are motivated to dual-list. Numerous studies have been conducted to test the stock market efficiency world over particularly in the second half of twentieth century. Efficient market efficiency (EMH) claims that one cannot out perform the market for the simple reason that there are numerous knowledgeable analysts and investors who would not allow the market prices to deviate from the intrinsic value due to their active buying and selling. Research studies have noted that this movement in market prices in random being independent from preceding or succeeding price. This does not mean that abnormal rate of returns is impossible in such markets but for a given risk level is extremely difficult. Second aspect of efficient market is that the organized and systematic efforts of thousands of analysts and investors to evaluate intrinsic values crystallizes in such a manner as to leave any scope for consistent superior performance over a longer period of time. If the efforts were abandoned, the efficiency of the market would diminish rapidly.

**Global Depository Receipts:**

A negotiable certificate held in the bank of one country representing a specific number of shares of a stock traded on an exchange of another country. To raise money in more than one market, some corporations use global depository receipts (GDRs) to sell their stock on markets in countries other than the one where they have their headquarters. Global Depository Receipts (GDRs) have come into prominence recently as being the favored instrument by which companies from emerging markets such as Russia, India and China raise capital on western stock exchanges. Yet GDRs are rarely fully understood by the people that use them, either because they appear 'complicated' (they are not) or because they are thought to be something to do with the 'back office' (this is only true of the settlement of GDRs). This article is intended to explain more about these instruments and to provide some commentary about their role in the wider marketplace. The GDRs are issued in the currency of the country where the stock is trading. For example, an Indian company might offer GDRs priced in pounds in London and in yen in Tokyo. Individual investors in the countries where the GDRs are issued buy them to diversify into international markets. GDRs let you do this without having to deal with currency conversion and

other complications of overseas investing. The objective of a GDR is to enable investors in developed markets, who would not necessarily feel happy buying emerging market securities directly in the securities' home market, to gain economic exposure to the intended company and, indeed, the overall emerging economy using the procedures with which they are familiar. GDRs are traded outside the U.S. or among U.S. qualified institutional buyers (QIBs). Although ADRs were the most prevalent form of depositary receipts, the number of GDRs has recently surpassed ADRs because of the lower expense and time savings in issuing GDRs, especially on the London and Luxembourg stock exchanges.



Source: JP Morgan

**The Global Depositary Receipt as a Financial Instrument:**

A GDR is issued and administered by a depositary bank for the corporate issuer. The depositary bank is usually located, or has branches, in the countries in which the GDR will be traded. The largest depositary banks in the United States are JP Morgan, the Bank of New York Mellon, and Citibank. A GDR is based on a Deposit Agreement between the depositary bank and the corporate issuer, and specifies the duties and rights of each party, both to the other party and to the investors. Provisions include setting record dates, voting the issuer's underlying shares, depositing the issuer's shares in the custodian bank, the sharing of fees, and the execution and delivery or the transfer and the surrender of the GDR shares. A separate custodian bank holds the company shares that underlie the GDR. The depositary bank buys the company shares and deposits the shares in the custodian bank, and then issues the GDRs representing an ownership

interest in the shares. The DR shares actually bought or sold are called depository shares. The custodian bank is located in the home country of the issuer and holds the underlying corporate shares of the GDR for safekeeping. The custodian bank is generally selected by the depository bank rather than the issuer, and collects and remits dividends and forwards notices received from the issuer to the depository bank, which then sends them to the GDR holders. The custodian bank also increases or decreases the number of company shares held per instructions from the depository bank. The voting provisions in most deposit agreements stipulate that the depository bank will vote the shares of a GDR holder according to his instructions; otherwise, without instructions, the depository bank will not vote the shares.

**Global Depository Receipt (GDR) Stock Prices:**

GDR is a list of all the Indian Companies listed on more than one country's stock exchange under the Global Depository Receipts (GDR) category and can be traded globally. This list gives you a Current Market Price (US \$), P/E, Change (US \$) and % Change.

Company	CMP(US\$)	PE	Chg(US\$)	Chg(%)
Dr. Reddy's (A)	35.74	41.25	0.27	0.0
GAIL (G)	61.17	25.44	1.32	0.0
Grasim Industries (G)	49.67	11.10	[0.65]	[0.0]
ICICI Bank (A)	43.34	28.71	0.02	0.0
Infosys Tech (A)	67.71	30.30	0.09	0.0
<u>Instanex Skindia</u> DR Index	2,901.01	25.23	3.49	0.0
ITC (G)	3.55	17.50	[0.13]	[0.0]
L & T (G)	35.54	25.17	0.02	0.0
Mahindra & Mah. (G)	15.50	14.16	0.30	0.0
Ranbaxy Labs (G)	11.90	-36.61	0.09	0.0
Reliance (G)	39.75	20.51	[0.02]	[0.0]
Satyam Computers (A)	2.75	3.63	[0.07]	[0.0]
State Bank of India (G)	117.50	17.38	0.50	0.0
<u>Sterlite</u> Industries (A)	14.45	96.18	0.21	0.0
Tata Communications (A)	10.17	15.93	0.05	0.0
Tata Motors (A)	24.26	34.66	[0.45]	[0.0]

Source: IndiaInfoline.com

**Issue of Global Depository Receipt (GDRs):**

Companies in India which have the eligibility to issue shares to person resident outside India, under the Foreign Direct Investment scheme, are generally allowed to raise equity capital in the international market by issuing rupee denominated shares to a non-resident depository for the purpose of issuing of GDR. This is possible with the approval of the Ministry of Finance and with reference to the scheme for issue of Foreign Currency Convertible Bonds and Ordinary Shares (Through Deposit Receipt Mechanism) Scheme and in accordance with the guidelines

issued by the Central Government in this regard. A listed Indian company, which does not possess the eligibility to raise funds in the Indian market including a company held by the SEBI, becomes ineligible to issue GDR. Unlisted companies, which have not tried the GDR route for raising its capital, would mandatorily be required to possess prior or simultaneous listing in the domestic market. Unlisted companies which have already tried GDR need to list in the domestic market on making profit or within 3 years of such issue of GDR, whichever is earlier? As per the guidelines, the GDR are valued and in consultation with the Lead Manager, are issued on basis of the ratio worked out by the Indian company. The proceeds from the issue are required to be kept abroad till the time it is utilized. Till such time, the proceeds may be invested as per guidelines prescribed. Indian companies do not have any restriction on the number or monetary limit of GDR / FCCB that can be floated in a financial year. Before seeking the final approval from the Ministry of Finance, a company which is engaged in the manufacture of items covered under the Automatic route would need to obtain prior government clearance through the Foreign Investment Promotion Board, if the FDI after a proposed issue of GDR / FCCB is likely to exceed the sectoral caps. Except for the express ban on investment in real estate and the stock markets, there are no end-use restrictions on the proceeds of GDR issue.

**How does Global Depository Receipts trade:**

Similar to the shares of US companies, depository receipts are traded on major stock exchanges or on the over-the-counter market. It is just as easy for an investor to trade depository receipts of Vodafone or Toyota as it is to trade shares of AT&T or General Motors. In addition, depository receipts can be created or cancelled to satisfy investor demand in either the US or the local trading market. A depository receipt is created when an investor contacts a broker to make an investment in a non-US company. The broker can purchase depository receipts in the secondary market or can create depository receipts by purchasing the company's shares in the local stock market and then delivering them to the depository's local custody bank. The broker who initiated the transaction converts the US dollars received from the investor into the corresponding foreign currency and pays the local broker for the shares purchased. The custodian bank instructs the depository bank to issue the depository receipts and deliver them to the initiating broker, who then delivers the depository receipts to the investor. Conversely, when depository receipts are sold, the underlying shares held outside the United States can be released into the home trading market through a cross-border transaction. In this case, the depository receipt is cancelled and the shares held with the local custodian bank are delivered to the broker within the home trading market.

**GDR Indexes:**

**BNY Mellon GDR Index:**

For global depository receipt (GDR) investors, BNY Mellon GDR Index is an ideal benchmarking tool as it is the only index that tracks all GDRs traded on The London Stock Exchange. BNY Mellon GDR Index is calculated on a continuous basis throughout the trading day - beginning with the open of the U.K. market through its close. In addition to the Bank's Composite GDR Index, there are six regional indices (Eastern Europe, MENA, Eastern Europe x- Russia, Asia, Middle East and Africa), one market index (Emerging) and 23 country indices.

### Skindia GDR Index:

Indian GDRs traded on international bourses are governed by parameters specific to the market in which they are traded, making their prices unique. To capture their movement and performance, it is necessary to develop reliable market indicators which can be used as a tool by investors for measuring their portfolio returns vis-à-vis market returns. In response to this need, Skindia Finance pioneered a GDR index which became popularly known as the 'Skindia GDR Index'. The base of the Skindia GDR Index is April 15, 1994 with the index set consisting of 22 actively traded GDRs. The Index, a market value weighted index (total number of GDRs issued multiplied by GDR price), is one of the most popular GDR Indices worldwide.

INSTANEX SKINDIA DR INDEX AND CONSTITUENTS							
Company	Weight	Price (\$)	Change	% Change	Prem/Disc	EPS	P/E
		21-Feb-2011			to Local	(\$)	
<u>Skindia</u> GDR Index	100.00%	3,013.51	27.69	0.93%	0.68%	118.54	25.42
Dr. Reddy's (A)	4.39%	33.85	0.00	0.00%	0.05%	0.89	37.89
GAIL (G)	1.66%	60.75	1.45	2.45%	2.39%	2.48	24.51
Grasim Industries (G)	2.48%	51.58	0.75	1.48%	0.89%	4.61	11.18
ICICI Bank (A)	23.08%	45.57	0.00	0.00%	-0.38%	1.56	29.27
Infosys Tech (A)	26.28%	69.37	0.00	0.00%	-0.42%	2.30	30.11
ITC (G)	0.90%	3.52	0.07	2.15%	0.90%	0.21	16.82
L & T (G)	2.28%	36.46	0.20	0.55%	0.11%	1.46	25.05
Mahindra & Mah. (G)	1.24%	14.26	0.10	0.71%	-0.63%	1.13	12.64
Ranbaxy Labs (G)	0.57%	11.35	0.02	0.18%	1.04%	(0.34)	(33.86)
Reliance (G)	11.24%	44.33	2.69	6.46%	4.85%	2.00	22.18
Satyam Computers (A)	0.86%	2.85	0.00	0.00%	5.75%	0.78	3.65
State Bank of India (G)	11.25%	124.60	1.33	1.08%	1.28%	6.97	17.88
<u>Sterlite</u> Industries (A)	7.52%	14.36	0.00	0.00%	-1.62%	0.15	92.70
Tata Communications (A)	0.42%	9.41	0.00	0.00%	1.41%	0.66	14.29
Tata Motors (A)	5.84%	26.40	0.00	0.00%	3.11%	0.72	36.58

Source: finance.indiamart.com

### The Benefits of Global Depository Receipts:

The GDR functions as a means to increase global trade, which in turn can help increase not only volumes on local and foreign markets but also the exchange of information, technology, regulatory procedures as well as market transparency. Thus, instead of being faced with impediments to foreign investment, as is often the case in many emerging markets, the GDR investor and company can both benefit from investment abroad. Let's take a closer look at the benefits:

#### a) For the Company:

A company may opt to issue a GDR to obtain greater exposure and raise capital in the world market. Issuing GDRs has the added benefit of increasing the share's liquidity while boosting the company's prestige on its local market ("the company is traded internationally"). Global Depository receipts encourage an international shareholder base, and provide expatriates living

abroad with an easier opportunity to invest in their home countries. Moreover, in many countries, especially those with emerging markets, obstacles often prevent foreign investors from entering the local market. By issuing a GDR, a company can still encourage investment from abroad without having to worry about barriers to entry that a foreign investor might face.

**b) For the Investor:**

Buying into a GDR immediately turns an investors' portfolio into a global one. Investors gain the benefits of diversification while trading in their own market under familiar settlement and clearance conditions. More importantly, GDR investors will be able to reap the benefits of these usually higher risk, higher return equities, without having to endure the added risks of going directly into foreign markets, which may pose lack of transparency or instability resulting from changing regulatory procedures. It is important to remember that an investor will still bear some foreign-exchange risk, stemming from uncertainties in emerging economies and societies. On the other hand, the investor can also benefit from competitive rates the U.S. dollar and euro have to most foreign currencies.

**Conclusion:**

Giving you the opportunity to add the benefits of foreign investment while bypassing the unnecessary risks of investing outside your own borders, you may want to consider adding these securities to your portfolio. As with any security, however, investing in GDRs requires an understanding of why they are used, and how they are issued and traded. Depositary receipts present a win-win proposition for the global financial markets, offering measurable benefits to issuers and investors alike. Depositary receipts offer ready access to capital, broad exposure and a vehicle for establishing commitment to the US and global markets. At the same time, US and global investors use depositary receipts to access a wider range of companies and industries than they can domestically, without the typical hassles associated with international investing. As a result, the depositary receipt market appears well positioned for continued expansion in the future.

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## Neural and fuzzy approach: A Novel

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### Abstract:

Soft computation is an essential approach to solve many linear and non linear problems. They are achieved by using various tools such as MATLAB, VHDL, C++, Lab view. The main problem arises if single problem has been solved by using different tools and the output of all the units is required to club at a same time. The papers show the various techniques used for software computing such as neural network and fuzzy logic.

*Key words: Fuzzy logic, neural network, rough set.*

### Introduction:

Neural Network includes a network of simple processing elements (neurons), which can exhibit complex global behavior. An ANN is defined as a data processing system consists of a large number of simple highly interconnected processing elements. If the connections are trained using Hebbian learning then the Hopfield network can perform as robust approach. The weights of output neurons are the only part of the network that can change and be learned. In a probabilistic view of neural networks for random variations one can be viewed as a form of statistical sampling [1,4]. The Cascade-Correlation architecture has several advantages over existing algorithms. This is particularly useful in applications where the complexity of the data or task makes the design of such a function by hand impractical. Depending on the Fuzzy Inference System, there are several layers that simulate the processes involved in a fuzzy inference. With supervised learning, the artificial neural network must be trained before it becomes useful. Training consists of presenting input and output data to the network.

Fuzzy Logic was initiated in 1965 by Lotfi A. Zadeh, professor for computer science at the University of California in Berkeley. FL provides a simple way to arrive at a definite conclusion based upon vague, ambiguous, imprecise, noisy, or missing input information. Values strictly between 0 and 1 characterize the fuzzy members. Fuzzy inference is the process of formulating the mapping from a given input to an output using fuzzy logic. The process of fuzzy inference involves all of the pieces that are described in the previous sections: membership functions, fuzzy logic operators, and if-then rules. The various inputs and outputs are selected by the user and then the membership function with their rules will be designed. Mamdani fuzzy inference system was first used to control a steam engine and boiler combination by a set of linguistic rules obtained from human operators. Takagi-Sugeno fuzzy inference system was first introduced by Takagi and Sugeno [6-7]. The difference of Takagi-Sugeno model is that each rule has a crisp output

**Literature Survey:**

**Neural approach:**

In 1967, Will Gersch presents the stochastic model for real and simulated problems based upon the mathematical properties. In 1999, R.Cheng provides QoS-provisioning neural fuzzy connection admission controller for multimedia high-speed networks. In 2000, Jun Wang presents network for nonlinear optimization having a continuously differentiable objective function and bound constraints for recurrent neural network. In 2002, Mauro Forti explained some extensions of a new method to analyze complete stability of NN. In 2003, Hong Qiao provides the NN's reference model approach to stability analysis and develops a series of new, generic stability theories for various neural network models. In the same year, Youshen Xia gave the general projection NNs for solving optimization and related problems. In 2005, Yutaka Maeda provides a recursive learning scheme for recurrent NNs using the simultaneous perturbation method and its FPGA implementation [2,3,7,8-10]. In 2008, X.Liu presents an impulsive stabilization of high-order hopfield-type NNs with time-varying delays. In the same year, T.Hayakawa developed NN adaptive control for nonlinear uncertain dynamical systems with asymptotic stability guarantees.

**Fuzzy Logic:**

It was initiated in 1965 [3] by Lotfi A. Zadeh, professor for computer science at the University of California in Berkeley. In soft computing, tolerance and impression are explored in decision making. Fuzzy logic and probabilistic logic are mathematically similar. Both of them have truth values ranging between 0 and 1 but their basic concept is different due to different interpretations. Both degrees of truth and probabilities range between 0 and 1. FL techniques have been used in image-understanding applications such as detection of edges, feature extraction, classification, and clustering [5,7,11]. It is a concept of which the content, value, or boundaries of application can vary according to context and/or conditions, instead of being fixed once and for all. Fuzzy logic can model nonlinear functions of arbitrary complexity. The Sendai railway in Japan is controlled by fuzzy logic controllers. Applications have been developed in tracking problems, tuning and interpolation. Different functions are used in fuzzy approach and are given as:

**Union:**

The membership of elements in a set is assessed in binary terms according to a bivalent condition. An element either belongs or does not belong to the set.

**Intersection:**

The membership function of the intersection of two fuzzy sets A and B with membership functions  $\mu_A$  and  $\mu_B$  respectively is defined as the minimum of the two individual membership functions.

**Complement:**

The membership grades can be computed by means of an increasing function of the similarity between an object and the prototype elements of a fuzzy set. In terms of Boolean algebra these are given as:

AND			OR			NOT	
A	B	$A \cap B$	A	B	$A \cup B$	A	$\bar{A}$
0	0	0	0	0	0	0	1
0	1	0	0	1	1	1	0
1	0	0	1	0	1		
1	1	1	1	1	1		

Table 1: Truth tables for AND, OR, and NOT operators

**Membership Functions:**

A fuzzy set is an extension of a crisp set. Crisp sets allow only full membership or no membership at all, whereas fuzzy sets allow partial membership.

In order to create the custom membership (custmf) functions following steps are used:

- Create an M-file for a function, custmf.m,
- It takes values between 0 and 1; note that it can take maximum 16 parameters.
- Then select the Add Custom MF item from the Edit menu on the membership function.
- Enter custom membership function M-file name, custmf, in the M-file function name text box [9,12].

<b>MATLAB Commands for various membership functions</b>	<b>Description</b>
dsigmf	Built-in membership function composed of difference between two sigmoidal membership functions
gauss2mf	Gaussian combination membership function
gaussmf	Gaussian curve built-in membership function
gbellmf	Generalized bell-shaped built-in membership function
trapmf	Trapezoidal-shaped built-in membership function

Table 2.2: Various types of membership functions

The syntax for trapezoidal is written as:

Syntax is given as:

```
>> x=0:1:100;
>> y=trapmf(x,[1 47 75 90]);
>> plot(x,y)
```

**Conclusion and Future Scope:**

By using neural and fuzzy approaches one can be able to solve the various linear and non linear problems in a real time environment. The basic concept of using the above approaches is to create the custom membership functions. Other membership functions can also be created but they are not optimized. The work can be extended if hybrid approaches can be used.

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## **Automatic Tools for Audio Genre Classification**

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### **Abstract:**

Audio information plays an important role in understanding the semantic content of multimedia. The audio signals can provide rich semantic cues that are very useful for analyzing multimedia content, so audio information has been recently used for content-based multimedia indexing and retrieval. Due the huge amount of audio data and the high expense of manual classification, an automatic audio classifier is required and thus audio classification has become an active research area. Audio classification can be used in many different application domains. For example, news information providers would like to label the huge amount of news audio data they collect everyday in a reliable and easy way, and video classification systems can use the audio information along with the video stream to achieve higher accuracy. The problem of distinguishing audio signals into these different audio types is thus becoming increasingly significant. A human listener can easily distinguish between different audio types by just listening to a short segment of an audio signal. However, solving this problem using computers has proven to be very difficult. Nevertheless, many systems with modest accuracy could still be implemented. In this paper we put forward an audio classification technique. The main goal of this paper was, initially to design a system that would be able to classify audio signals into music or speech. The classification task was further to be extended to include audio signals other than speech and music. And finally the system was to be modified so that the audio signal is partitioned first into homogeneous segments and then classified.

*Keywords: Audio Content Analysis, Segmentation, Classification, Semantic.*

### **Introduction:**

Audio signals which include speech, music and environmental sounds are important types of media. The problem of distinguishing audio signals into these different audio types is thus becoming increasingly significant. A human listener can easily distinguish between different audio types by just listening to a short segment of an audio signal. However, solving this problem using computers has proven to be very difficult. Systems with modest accuracy could still be implemented. Audio segmentation and classification have applications in wide areas. For instance, content based audio classification and retrieval is broadly used in the entertainment industry, audio archive management, commercial music usage, surveillance, etc. There are many digital audio databases on the World Wide Web nowadays; here audio segmentation and classification would be needed for audio searching and indexing. Recently, there has been a great deal of interest in monitoring broadcast news programs, in this case classification of speech data in terms of speaker could help in efficient navigation through broadcast news archives. Like many other pattern classification tasks, audio classification is made up of two main sections: a

signal processing section and a classification section. The signal processing part deals with the extraction of features from the audio signal. The various methods of time-frequency analysis developed for processing audio signals, in many cases originally developed for speech processing, are used. The classification part deals with classifying data based on the statistical information extracted from the signals. Many automatic audio classification schemes have been proposed in recent years. Audio classification has been an active research area. For example, Wold et al [1] presented an audio retrieval system named Muscle Fish based on audio classification. This work is a milestone about audio retrieval because of the content based analysis which distinguishes it from previous works. In this system, pitch, harmonicity, loudness, brightness and bandwidth were used as the audio features. The nearest neighbor (NN) rule was adopted to classify the query audio into one of the defined audio classes. Traditionally, the most common approach is speech/music classifications in which the highest accuracy has been achieved, especially when the segmentation information is known beforehand (i.e., manual segmentation). Saunders [2] developed a real-time speech/music classifier for audio in radio FM receivers based on features such as zero crossing rate (ZCR) and short-time energy (STE). Zhang and Kuo [3] developed a content-based audio retrieval system, which performs audio classification into basic types such as speech, music and noise. In [4], Li concatenated the perceptual and cepstral feature sets for audio classification. A new classifier name nearest feature line (NFL) for audio classification was also presented and produced better results than the NN-based and other conventional methods. This study was improved by the author's later work [5]. By using SVM with the same feature set as instead of the NFL method, Guo and Li managed to significantly improve the previous work on classification performance. Recently, Kiranyaz et al. [6] propose a generic frame work to classify audio into speech, music, fuzzy or silent. However, the fuzzy type cannot tell whether the audio data are speech with music background or speech mixed with environmental sound. There are simple audio types such as speech, music, silence and environmental sound, in addition, there are complex audio types such as speech with music, speech with environmental sound. The audio features that are used for differentiating simple audio types—such as zero crossing rate (ZCR)—do not work for complex audio types. From figure 1, we can see that it is difficult to distinguish three ZCR curves of speech, speech with music and speech with environmental sound. The challenge is how to classify complex audio type with the existing audio features.

### **Methodology:**

When dealing with audio data large amount and of different genre it is desired to have a system which is quite efficient and fast to classify the audio content. We apply simple operations to classify the content of audio signal into music, speech and silence. Our method of classification consists of first obtaining a zero crossing rate (ZCR) followed by Short term energy calculation (STE). MFCC is then performed on each audio signal the output of all these operation is the summoned up to finally classify the audio signal. Figure below shows a block diagram of the processing scheme.

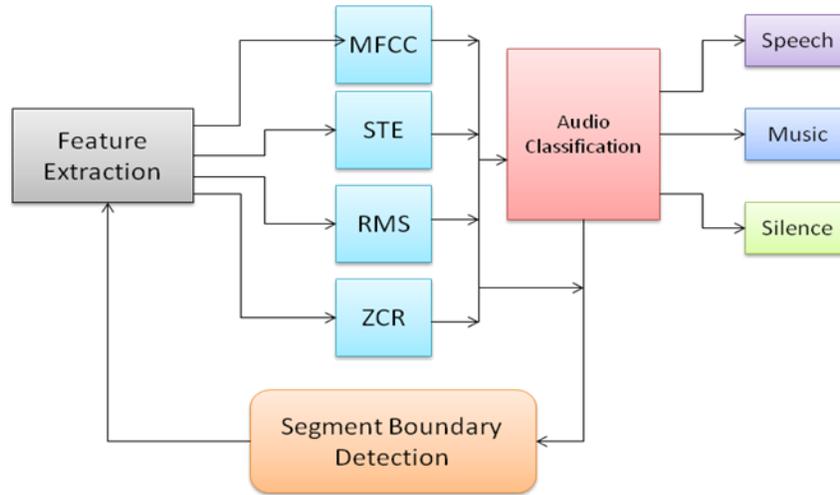


Fig.1 System block for processing

**Zero Crossing Rates:**

ZCR is defined as the number of zero crossing within an audio frame. It has been widely used to differentiate speech from music. We compute the variance of ZCR for each audio segment. In the case of discrete time signals, a zero crossing is said to occur if there is a sign difference between successive samples. The rate at which zero crossings happen is a simple measure of the frequency content of a signal. For narrow band signals, the average zero crossing rate gives a reasonable way to estimate the frequency content of the signal. But for a broad band signal such as speech, it is much less accurate. However, by using a representation based on the short time average zero crossing rate, rough estimates of spectral properties can be obtained. The expression for the short time average zero crossing rate is shown below (Eq.1). In this expression, each pair of samples is checked to determine where zero crossings occur and then the average is computed over N consecutive samples.

$$\text{Zero Cross} = \frac{1}{2} \sum_{n=1}^N |\text{sign}(x(n)) - \text{sign}(x(n - 1))| \quad \text{Eqn. 1}$$

Zero crossing rate has been proven to be useful in characterizing different audio signals and has been popularly used in speech/music classification problems. Variations of the zero crossing rate have also been used in some audio classification systems. From literature it is studied that a variation of the ZCR- the high zero-crossing rate ratio (HZCRR), to be more discriminative than the exact value of ZCR.

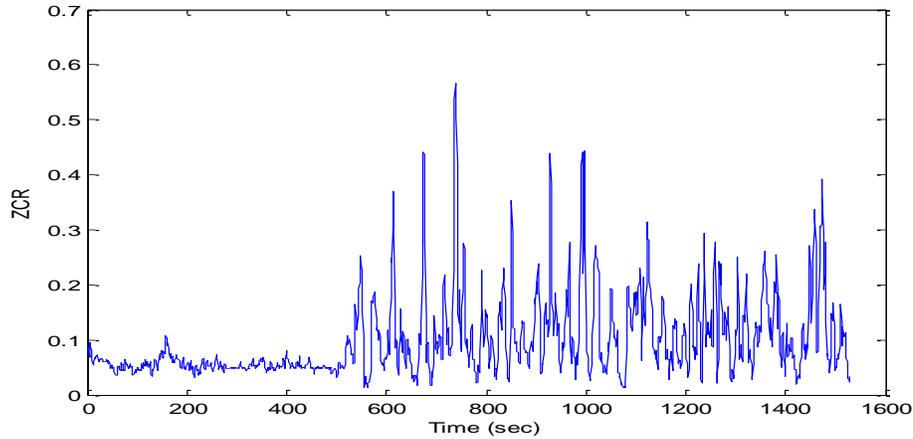


Fig.2 Zero Crossing rate of a sample wave file

**Short Time Energy:**

Short time energy (STE) is also a simple feature that is widely used in various classification schemes. It is defined to be the sum of a squared time domain sequence of data (eqn. 2), as shown in the equation

$$STE = \sum_{m=0}^{M-1} x^2(m) \quad \text{Eqn. 2}$$

Where M is the total number of samples in a processing window and x(m) is the value of the m<sup>th</sup> sample.

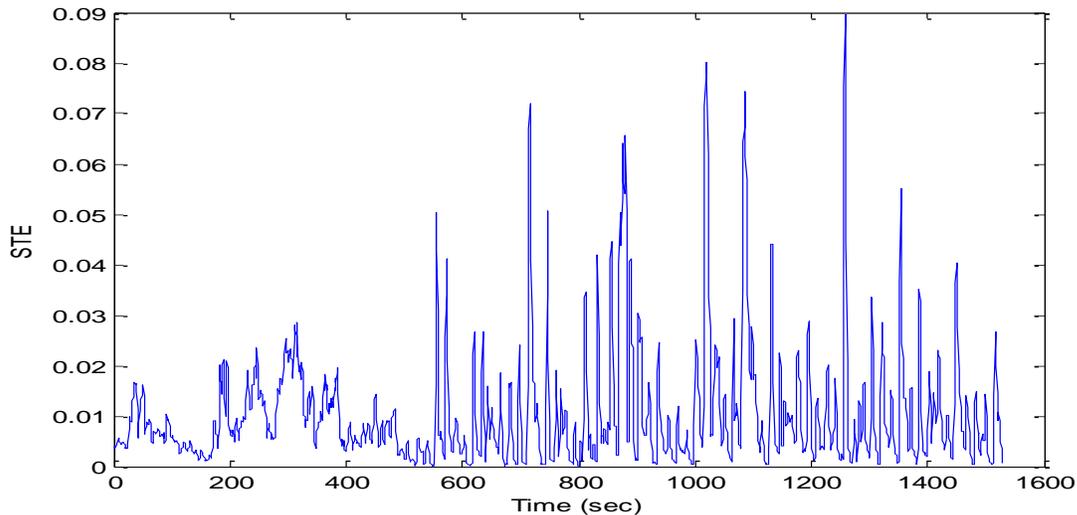


Fig.3 Short Time energy plot of same signal

As STE is a measure of the energy in the signal, it is suitable for discrimination between speech and music fig. 3. Speech consists of words and mixed with silence. In general this makes the variation of the STE value for speech higher than music.

**Mel Frequency Cepstral Coefficients (MFCC):**

MFCC's are short term spectral based features. MFCC features are frequently used by many researchers for speech recognition. MFCC works well in music/ speech classification problems. A block diagram showing the steps taken for the computing MFCCs can be seen in figure 4. Each step in this process of creating Mel Frequency Cepstral Coefficients is motivated by computational or perceptual considerations. The first step in this process is to block a continuous audio signal into frames. The purpose here is to model small sections of the audio signal that are statistically stationary.

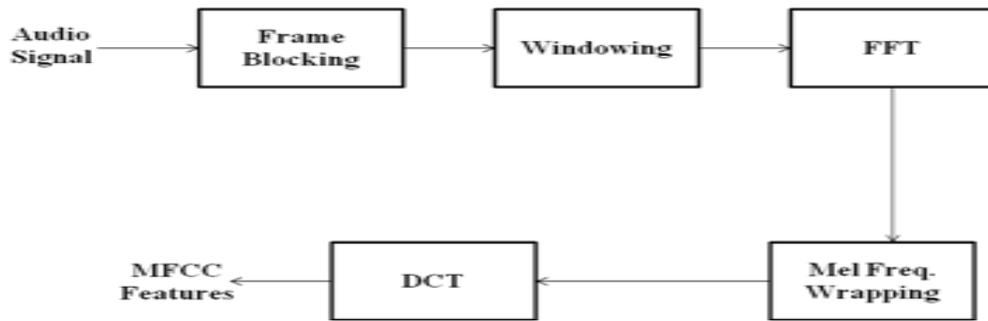


Fig.4 Block diagram showing the steps for computing MFCCs

Each frame consists of n samples with adjacent frames separated by m samples. The following frame starts m samples after the first sample and overlaps it by (n - m) samples. In a similar way the third frame starts m samples after the second frame and overlaps it by (n - m) samples. Typical values for n and m are 256 and 100 respectively.

The cepstrum is defined as the inverse Fourier transform of the log spectrum log(S) as shown (equ. 3)

$$c_n = \frac{1}{2\pi} \int_{w=-\pi}^{w=\pi} \log S(w) \exp jwndw \tag{Eqn.3}$$

If the log-spectrum is given in the perceptually defined mel-scale, then the cepstra are called MFCC. The mel scale is an approach to model the perceived pitch; 1000 mel are defined as the pitch perceived from pure sine tone with 40 dB above the hearing threshold level. Other mel frequencies are found empirically (e.g. sine tone with 2000 mel is perceived twice as high as a 1000 mel sine tone and so on). The mel-scale and Hz-scale are correlated as follows and expressed in equation (eqn.4):

$$\text{mel}(f) = 2595 \cdot \log_{10} \left( 1 + \frac{f}{700} \right) \tag{Eqn. 4}$$

In order to eliminate covariance between dimensions to produce MFCC-s, the discrete cosine transform is used instead of the inverse Fourier transform. When using the discrete cosine transform, the computation for mel frequency cepstral coefficients is done as described in the following steps. First, the audio signal is converted into short (usually overlapping by one half) frames of length usually about 23 milliseconds. Then the discrete Fourier transform is calculated for each frame and the magnitude of the FFT is computed. Next, the log base 10 is calculated from the amplitudes of the spectrum. Then the mel-scaled filterbank15 is

applied to FFT data. Finally, the discrete cosine transform is calculated and typically 12 first (most important) coefficients are used.

### **Results and Discussion:**

The experimental result shows that the accuracy of classification of silence is highest, because the STE and the ZCR of silence are very small comparing to other types of audio. Occurring undetected because the ZCR and the STE of silence fragments are higher than the preset ZCR threshold value and STE threshold value, this problem can be solved using adjusting the threshold. The efficiency of the system is given by

$$\text{Detection Efficiency} = \frac{\text{Num}(\text{correct Detections})}{\text{Num}(\text{total Detections})}$$

Another observation made from the experimental results is that the preset threshold of ZCR and STE affects the efficiency of the system. The non-pure speech has the lowest classification accuracy. On the one hand, the non-pure speech is missed, because the speech has silence frames; speech with music background is misclassified into music. On the other hand, music background is weaker than speech and it is easily misclassified into speech. In content-based audio genre classification feature extraction and analysis are the foundation of system. This paper has analyzed the discriminating features for audio classes and implemented a hierarchical classifier to classify audio signals into four classes, which are music, pure speech, silence, and non-pure speech. The methods employed Zero Crossing Rate (ZCR), Short Term Energy (STE) and MFCC are very efficient in audio classification. Experiment results show that the features we selected are rational and effective. In the future, our audio classification scheme will be upgraded to discriminate more audio classes, which also contain important semantic and are helpful for us to understand audio content of news video. Some new audio features will be introduced to characterize those subclasses in order to reduce the error rate in the classification of audio that have environment sound.

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## **Overview on Android – The New Mobile Operating System**

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### **Abstract:**

Cellular telephony has had a significant worldwide rate of acceptance, by year 2010 it is estimated that 3.5B of the 6.8B people in the planet will have access to a cell phone. Smartphone devices such as iPhone, Blackberry, and those that support the Android operating system are progressively making an impact on society. In addition to their support for voice and text exchange, smartphones are capable of executing sophisticated embedded software applications, as well as provide a simple link to the Internet and its resources.

*Keywords: Android, Dalvik virtual machine, linux, open- source system,nJIT compiler.*

### **Introduction:**

Android is a software stack for mobile devices that includes an operating system, middleware and key applications. Android's mobile operating system is based on a modified version of the Linux kernel. The increasing interest from the industry arises from two core aspects: its open-source nature and its architectural model. Being an open-source project, allows Android to be fully analysed and understood, which enables feature comprehension, bug fixing, further improvements regarding new functionalities and, finally, porting to new hardware. On the other hand, its Linux kernel-based architecture model also adds the use of Linux to the mobile industry, allowing taking advantage of the knowledge and features offered by Linux. Both of these aspects make Android an appealing target to be used in other type of environments. Another aspect that is important to consider when using Android is its own Virtual Machine (VM) environment. Android applications are Java-based and this factor entails the use of a VM environment, with both its advantages and known problems. In computing, a solution stack is a set of software subsystems or components needed to deliver a fully functional solution, e.g. a product or service. Middleware is computer software that connects software components or some people and their applications. Software that provides a link between separate software applications. Middleware is sometimes called plumbing because it connects two applications and passes data between them. Middleware allows data contained in one database to be accessed through another. The Android open-source software stack consists of Java applications running on a Java-based, object-

oriented application framework on top of Java core libraries running on a Dalvik virtual machine featuring JIT compilation. Libraries written in C include the surface manager, Open Core media framework, SQLite relational database management system, OpenGL ES 2.0 3D graphics API, WebKit layout engine, SGL graphics engine, SSL, and Bionic libc. The Android operating system, including the Linux kernel, consists of roughly 12 million lines of code including 3 million lines of XML, 2.8 million lines of C, 2.1 million lines of Java, and 1.75 million lines of C++. Android uses WAVE & CALFIT. WAVE is an API for Android OS which allows easy management of by sensor networks (BSNs) on mobile platforms. It present a simple framework for health-oriented applications by providing functionality for data collection from sensors and data processing. Is an interactive application built using WAVE that leverages the power of social influence to promote physical activity?

### **History:**

#### **Android Inc. founded in 2003**

Android, Inc. was founded in Palo Alto, California, United States in October, 2003 by Andy Rubin (co-founder of Danger), Rich Miner (co-founder of Wildfire Communications, Inc.), Nick Sears (once VP at T-Mobile), and Chris White (headed design and interface development at WebTV) to develop, in Rubin's words "...smarter mobile devices that are more aware of its owner's location and preferences."

#### **Android Inc. acquired by Google:**

Google acquired Android Inc. in August, 2005, making Android Inc. a wholly owned subsidiary of Google Inc. Key employees of Android Inc., including Andy Rubin, Rich Miner and Chris White, stayed at the company after the acquisition.

Version history Android has seen a number of updates since its original release. These updates to the base operating system typically focus on fixing bugs as well as adding new features. Generally each new version of the Android operating system is developed under a code name based on a dessert item.

The most recent released versions of Android are:

- Android 1.5 (Cupcake)
- Android 1.6 (Donut):- (features) Most of the changes in 1.6 are behind the scenes, but users will be able to notice a few updates:

Analysis of Android 1.6: The new Android 1.6 Market could be a game changer for users and developers alike. In 1.5, paid applications were hidden from users behind an obscure menu option. But in 1.6 they will be brought to the forefront. By exposing users to high-quality paid applications, the Market should see a surge in revenue which will encourage developers to produce even more and better content. For months the Android Market has lagged the iPhone app store, but 1.6 could put it on a path to change that.

- 2.0/2.1 (Eclair), which revamped the user interface and introduced HTML5 and Exchange ActiveSync 2.5 support.
- 2.2 (Froyo), which introduced speed improvements with JIT optimization and the Chrome V8 JavaScript Engine, and added Wi-Fi hotspot tethering and Adobe Flash support.

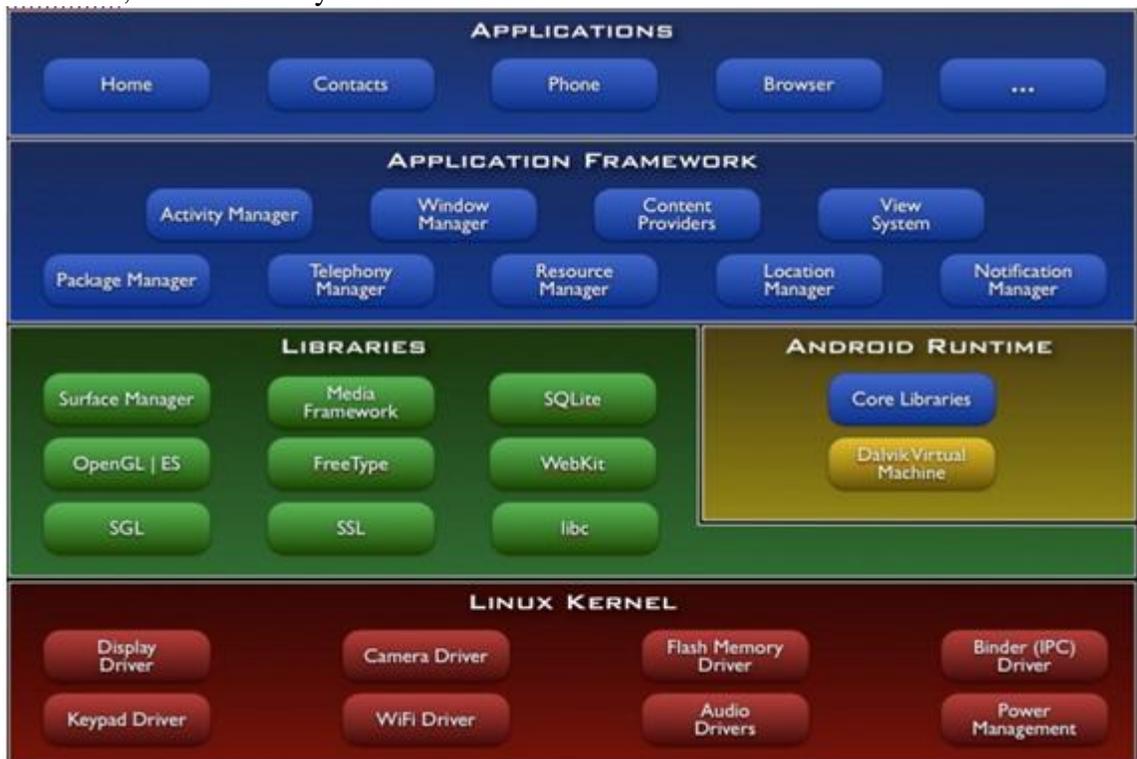
- 2.3 (Gingerbread), which refined the user interface, improved the soft keyboard and copy/paste features, and added support for Near field Communication.
- 3.0 (Honeycomb), a tablet-oriented release which supports larger screen devices and introduces many new user interface features, and supports multicore processors and hardware acceleration for graphic. The Honeycomb SDK has been released and the first device featuring this version, the Motorola Xoom tablet, went on sale in February 2011.

This is the first closed source version of Android. The upcoming version of Android is:

- Ice Cream Sandwich, a combination of Gingerbread and Honeycomb into a "cohesive whole".

#### ANDROID ARCHITECTURE:

The following diagram shows the major components of the Android operating system. Each section is described in more detail below. It consist of four layers: Application, Application framework, the layer below is divided in two parts: libraries and Android RunTime, and the last layer is Linux Kernel.



(Source-<http://developer.android.com/guide/basics/what-is-android.html>)

#### Applications:

Android will ship with a set of core applications including an email client, SMS program, calendar, maps, browser, contacts, and others. All applications are written using the Java programming language.

#### Application Framework:

By providing an open development platform, Android offers developers the ability to build extremely rich and innovative applications. Developers are free to take advantage of the device hardware, access location information, run background services, set alarms, add notifications to the status bar, and much, much more. Developers have full access to the same framework APIs used by the core applications. The application architecture is designed to simplify the reuse of components; any application can publish its capabilities and any other application may then make use of those capabilities (subject to security constraints enforced by the framework). This same mechanism allows components to be replaced by the user.

**Underlying all applications is a set of services and systems, including:**

A rich and extensible set of Views that can be used to build an application, including lists, grids, text boxes, buttons, and even an embeddable web browser  
Content Providers that enable applications to access data from other applications (such as Contacts), or to share their own data.  
A Resource Manager, providing access to non-code resources such as localized strings, graphics, and layout files  
A Notification Manager that enables all applications to display custom alerts in the status bar  
An Activity Manager that manages the lifecycle of applications and provides a common navigation backstack. For more details and a walkthrough of an application, see the Notepad Tutorial.

**Libraries:**

Android includes a set of C/C++ libraries used by various components of the Android system. These capabilities are exposed to developers through the Android application framework. Some of the core libraries are listed below:

System C library: A BSD-derived implementation of the standard C system library (libc), tuned for embedded Linux-based devices

Media Libraries - based on Packet Video's Open CORE; the libraries support playback and recording of many popular audio and video formats, as well as static image files, including MPEG4, H.264, MP3, AAC, AMR, JPG, and PNG

Surface Manager - manages access to the display subsystem and seamlessly composites 2D and 3D graphic layers from multiple applications

LibWebCore - a modern web browser engine which powers both the Android browser and an embeddable web view

SGL - the underlying 2D graphics engine

3D libraries - an implementation based on OpenGL ES 1.0 APIs; the libraries use either hardware 3D acceleration (where available) or the included, highly optimized 3D software rasterizer. FreeType - bitmap and vector font rendering

SQLite - a powerful and lightweight relational database engine available to all applications

Android Runtime

Android includes a set of core libraries that provides most of the functionality available in the core libraries of the Java programming language.

Every Android application runs in its own process, with its own instance of the Dalvik virtual machine. Dalvik has been written so that a device can run multiple VMs efficiently. The Dalvik VM executes files in the Dalvik Executable (.dex) format which is optimized for minimal

memory footprint. The VM is register-based, and runs classes compiled by a Java language compiler that have been transformed into the .dex format by the included "dx" tool.

The Dalvik VM relies on the Linux kernel for underlying functionality such as threading and low-level memory management.

**Linux Kernel:**

Android relies on Linux version 2.6 for core system services such as security, memory management, process management, network stack, and driver model. The kernel also acts as an abstraction layer between the hardware and the rest of the software stack.

**Features:**

**Current features and specifications:**

Handset layouts The platform is adaptable to larger, VGA, 2D Graphics library, 3D graphics library based on OpenGL ES 2.0 specifications, and traditional smartphone layouts.

Storage SQLite, a lightweight relational database, is used for data storage purposes

Connectivity Android supports connectivity technologies including GSM/EDGE, IDEN, CDMA, EV-DO, UMTS, Bluetooth, Wi-Fi, LTE, and WiMax.

Messaging SMS and MMS are available forms of messaging, including threaded text messaging and now Android Cloud to Device Messaging Framework(C2DM) is also a part of Android Push Messaging service.

Web browser The web browser available in Android is based on the open-source Webkit layout engine, coupled with Chrome's V8 JavaScript engine. The browser scores a 93/100 on the Acid3 Test.

Java support While most Android applications are written in Java, there is no java Virtual Machine in the platform and Java byte code is not executed. Java classes are compiled into Dalvik executables and run on the Dalvik virtual machine. Dalvik is a specialized virtual machine designed specifically for Android and optimized for battery-powered mobile devices with limited memory and CPU. J2ME support can be provided via third-party-applications.

Media support Android supports the following audio/video/still media formats: WebM, H.263, H.264 (in 3GP or MP4 container), MPEG-4 SP, AMR, AMR-WB (in 3GP container),AAC, HE-AAC (in MP4 or 3GP container), MP3, MIDI, Ogg Vorbis, WAV, JPEG, PNG, GIF, BMP.

Streaming media support RTP/RTSP streaming(3GPP PSS, ISMA), HTML progressive download (HTML5 <video> tag). Adobe Flash Streaming (RTMP) and HTTP Dynamic Streaming are supported by the Flash 10.1 plugin. Apple HTTP Live Streaming is supported by RealPlayer for Mobile-and planned to be supported by the operating system in Android 3.0 (Honeycomb). Microsoft Smooth Streaming is planned to be supported through the awaited port of Silverlight plugin to Android.

Additional hardware support	Android can use video/still cameras, touchscreens, GPS, accelerometers, gyroscopes, magnetometers, proximity and pressure sensors, thermometers, accelerated 2D bit blits (with hardware orientation, scaling, pixel format conversion) and accelerated 3D graphics.
Development environment	Includes a device emulator, tools for debugging, memory and performance profiling. The integrated development environment(IDE) is Eclipse (currently 3.4 or greater) using the Android Development Tools (ADT) Plugin. The programming languages are Java and C/C++.
Multi-touch	Android has native support for multi-touch which was initially made available in handsets such as the HTC Hero. The feature was originally disabled at the kernel level (possibly to avoid infringing Apple's patents on touch-screen technology at the time) Google has since released an update for the Nexus One and the Motorola Droid which enables multi-touch natively.
Bluetooth	Supports A2DP, AVRCP, sending file (OPP), accessing the phone book, voice dialing and sending contacts between phones. Keyboard, mouse and joystick support is available through manufacturer customizations and third-party applications. Full HID support is planned for Android 3.0 (Honeycomb).
Video calling	The mainstream Android version does not support video calling, but some handsets have a customized version of the operating system which supports it, either via UMTS network (like the Samsung Galaxy S) or over IP. Video calling through Google Talk is planned for Android 3.0 (Honeycomb).
Multitasking	Multitasking of applications is available
Voicebased features	Google search through Voice has been available since initial release. Voice actions for calling, texting, navigation etc. are supported on Android 2.2 onwards.

#### Security:

In March 2011, Google pulled 58 malicious apps from the Android Market, but not before the 58 apps were downloaded to around 260,000 devices. These apps were malicious applications in the Android Market which contained trojans hidden in pirated versions of legitimate apps. The malware (called DroidDream) exploited a bug which was present in versions of Android older than 2.2.2. Android device manufacturers and carriers work in tandem to distribute Android based updates and had not uniformly issued patches to their customers for the DroidDream exploit, leaving users vulnerable. Google said the exploit allowed the apps to gather device specific information, as well as personal information. The exploit also allowed the apps to download additional code that could be run on the device. Within days, Google remotely wiped the apps from infected users and rolled out an update that would negate the exploits that allowed the apps to view information. They also announced that they would be resolving the issue to

ensure that events like this did not occur again. Security firms such as AVG and Symantec have released antivirus software for Android devices.

In August 2010, an SMS Trojan called Trojan-SMS.AndroidOS.FakePlayer.a infected a number of mobile devices, according to security firm Kaspersky Lab. Disguised as a harmless media player application, the trojan, once installed sends out SMS text messages without the users knowledge or consent. According to Denis Maslennikov, Senior Malware Researcher at Kaspersky Lab, there's not an exact number of infected devices available at present, but the outbreak is currently regional. For now, only Russian Android users can actually lose money after installing the Trojan, but anyone can be infected.

### **Suitability of ANDROID for Open Real-Time Systems:**

Android was evaluated considering the following topics: its VM environment, the underlying Linux kernel, and its resource management capabilities. Dalvik VM is capable of running multiple independent processes, each one with a separate address space and memory. Therefore, each Android application is mapped to a Linux process and able to use an inter-process communication mechanism, based on Open-Binder, to communicate with other processes in the system. The ability of separating each process is provided by Android's architectural model. During the device's boot time, there is a process responsible for starting up the Android's runtime, which implies the start up of the VM itself. Inherent to this step, there is a VM process, the Zygote, responsible for the pre-initialisation and pre-loading of the common Android's classes that will be used by most of the applications. Afterwards, the Zygote opens a socket that accepts commands from the application framework whenever a new Android application is started. This will cause the Zygote to be forked and create a child process which will then become the target application. Zygote has its own heap and a set of libraries that are shared among all processes, whereas each process has its own set of libraries and classes that are independent from the other processes.

Android applications provide the common synchronization mechanisms known to the Java community. Technically speaking, each VM instance has at least one main thread and may have several other threads running concurrently. The threads belonging to the same VM instance may interact and synchronise with each other by the means of shared objects and monitors. The API also allows the use of synchronized methods and the creation of thread groups in order to ease the manipulation of several thread operations. It is also possible to assign priorities to each thread. When a programmer modifies the priority of a thread, with only 10 priority levels being allowed, the VM maps each of the values to Linux nice values, where lower values indicate a higher priority. Dalvik follows the pthread model where all the threads are treated as native pthreads. Internal VM threads belong to one thread group and all other application threads belong to another group. Android uses the mark-sweep algorithm to perform garbage collection. The main advantage provided by the platform is that there will be a GC running per process, which wipes all the objects from the application heap of a specific process. This way, GCs belonging to other processes will not impact the GC running for a specific process. The main disadvantage arises from the algorithm used. As this algorithm implies the suspension of all the threads belonging to an application, this means that no predictability can be achieved as that specific process will be frozen while being garbage collected. Interrupt/event handling plays another important role when concerning real-time systems, as it may lead to inconsistent states if

not handled properly. Currently, Android relies on the Linux kernel to dispatch the interrupt/event via device drivers. After an interrupt, the Java code responsible for the event handling will be notified in order to perform the respective operation. The communication path respects the architecture layers and inter-process communication may be used to notify the upper event handlers.

The task scheduling plays one of the most important roles concerning the real-time features presented by a particular system. Currently, Linux's real-time implementation is limited to two scheduling real-time classes, both based on priority scheduling. Another important aspect to be considered in the evaluation is that most of the tasks are scheduled by Completely Fair Scheduler (CFS). Although CFS tries to optimise the time a task is waiting for CPU time, this effort is not enough as it is not capable of providing guaranteed response times. One important aspect that should be remarked is that although the Linux kernel supports the real-time classes aforementioned, these classes are only available for native Android applications. Normal Android applications can only take advantage of the synchronisation mechanisms.

Resource management implies its accounting, reclamation, allocation, and negotiation [12]. Concerning resource management conducted at the VM level, CPU time is controlled by the scheduling algorithms, whereas memory can be controlled either by the VM, if we consider the heaps and its memory management, or by the operating system kernel.

#### **Possible Direction Making Android Real Time-System:**

The first approach considers the replacement of the Linux operating system by one that provides real-time features and, at the same time, it considers the inclusion of a real-time VM.

The second approach respects the Android standard architecture by proposing the extension of Dalvik as well as the substitution of the standard operating system by a real-time Linux-based operating system.

The third approach simply replaces the Linux operating system for a Linux real-time version and real-time applications use the kernel directly.

Finally, the fourth approach proposes the addition of a real-time hypervisor that supports the parallel execution of the Android platform in one partition while the other partition is dedicated to the real-time applications.

#### **Some new emerging areas:**

Medical application: physical sensor technology to provide a new type of application for human/computer interaction, one that can improve quality of life for people suffering from a variety of medical conditions. Android applications developed to improve the quality of life for patients suffering from chronic disease. Emerging smart phone devices with built-in accelerometers, GPS, camera, microphone, and other sensors provide a fundamentally new opportunity for early detection of AD. These devices, which are becoming commonly used, can be readily programmed to acquire necessary data with little additional cost; this makes much larger scale data acquisition feasible. More importantly, data acquisition can be conducted on a daily basis, providing data at a granularity to detect even subtle changes required for pre-clinical detection of AD.

Fall detection: Injuries due to falls are among the leading causes of hospitalization in elderly persons, often resulting in a rapid decline in functionality and potentially, death. iFall is an alert system for fall detection using common commercially available electronic devices to both detect the fall and alert authorities. iFall operates in the background of Android phones, using the accelerometer to evaluate position and force data to detect a fall. A fall is suspected when the accelerometer readings indicate a free fall constituting a period of force reading well below one gravity. If a fall is suspected a notification is raised requiring the user's response. If the user does not respond, the system automatically alerts individuals indicated as willing to help in the event of an emergency.

Sight for the blind : Voice [ref] is a mobile application that can offer a form of vision to individuals that are completely blind. Voice utilizes a digital camera to capture a series of images which are converted into a sound field, proving an auditory representation of the image. This is achieved by translating each pixel of the image into a sound frequency. To do this, the visual field is scanned from left to right over an interval of about one second. (source-www.csi-india.org )

#### **Advantages and Disadvantages of Google's Android Smart Phones:**

Google Android is open source software. In theory this means that the Google Android software platform will have a competitive advantage over other operating systems like Symbian, Microsoft mobile or Blackberry. There are a host of advantages that Google's Android will derive from being open source software. Some of the advantages include:

1. The ability for anyone to customize the Google Android platform will open up the applications playing field to small and new players who lack the financial muscle to negotiate with wireless carriers like AT&T and Orange. The consumer will benefit from having a wide range of mobile applications to choose from since the monopoly will be broken by Google Android.
2. Although this will depend on the carrier, one will be able to customize a mobile phones using Google Android platform like never before, right down to the screen. Features like weather details, opening screen, live RSS feeds and even the icons on the opening screen will be able to be customized.
3. In addition, as a result of many mobile phones carrying Google Android, companies will come up with such innovative products like the location- aware services that will provide users with any information they might be in need of. This information could include knowing the location of a nearby convenience store or filling station. In addition the entertainment functionalities will be taken a notch higher by Google Android being able to offer online real time multiplayer games.

However, Google Android is likely to experience some problems as well. These problems might include rejection of Google Android by carriers who charge a fee for some of the web based applications which Google Android will enable mobile phone holders to access free of charge.

Also, since Google Android is an open source platform driving all Android phones, it could significantly increase the risk of hacking these devices. If this happens, then locking mobiles as a security measure will be a mockery.

**Conclusion:**

Now cell phone is the major part of everyone's life. Android making them more and more users interactive by providing lots of applications and services. Its large touch pad and sensor mode provide easy access to user. As all the mobile applications are build in java but android does not have any java virtual machine, there is a special virtual machine which is built for Android that is Dalvik virtual machine which compiles the code in .dev form. Android support for real time application, providing four different directions making it a real time system.

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## **Optimized Elevator by using PLC and HMI**

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### **Abstract:**

Automation is the delegation of human control functions to technical equipment aimed towards achieving higher productivity. To design a parallel lift system as a PLC system is a challenging task in itself, in addition to this, designing an interactive Human Machine Interface for this system is what makes this project so interesting. Existing hardwired systems are being revamped with PLC based systems to make the system more productive and efficient. Integrated Parallel Lift System is an intelligent lift system in which lift which is near to a particular floor is activated and only that lift functions. The paper deals with the optimization of elevator by using PLC in order to produce efficient and reliable results

*Key words: Optimization, elevator, PLC, reliability, computation.*

### **Introduction:**

The development of state-of-the-art control and automation systems had led to eventual replacement of mechanical automation systems. Screen development and tag linking are the two most important aspects of HMI-PLC communication. WinCC is a powerful HMI system. HMI stands for "Human Machine Interface; that is the interface between the person (the operator) and the machine (the process). The automation process retains actual control over the process. Using PLC programming and then linking it with HMI one can make made Integrated Parallel Lift System. Programming can be done either "On-line or "Off-line"Off-line programming means writing the instructions. One of the most important features of STEP5/STEP7 programming language is its flexibility. We can write the user program in any one of the following forms:

- a) Statement List (STL)
- b) Control System Flowchart (CSF) or Function Block Diagram (FBD)
- c) Ladder Diagram (LAD)

### **Components of PLC:**

The PLC is basically a programmed interface between the field input elements like limit switches, sensors, transducers, push buttons, etc and the final control elements like actuators, solenoid valves, dampers, drives, etc. figure 1 shows the block diagram of a PLC.

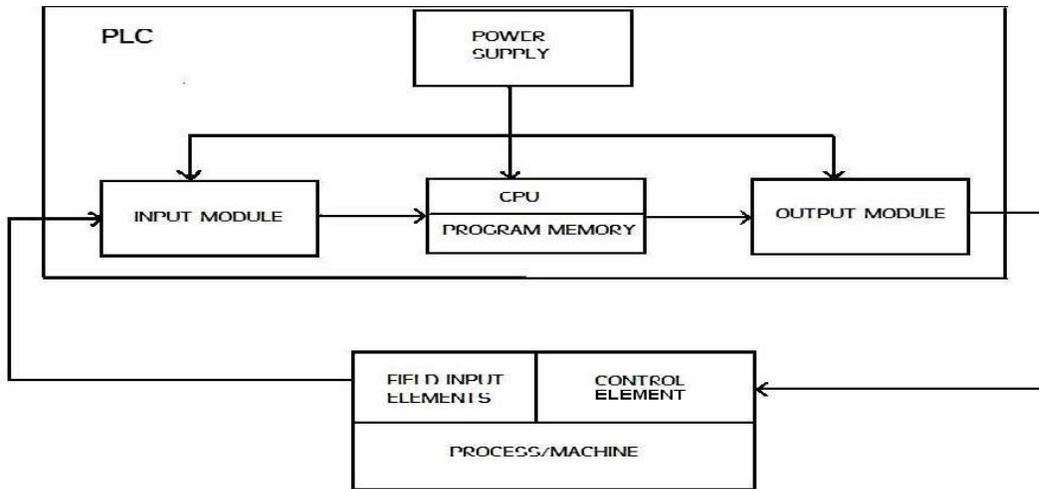


Fig 1: Block Diagram of a PLC

**Input Module:**

The voltage or current signals generated by sensors, limit switches, pushbuttons, etc are applied to the terminals of the input module.

**The input module helps in the following ways:**

It converts the field signal into a standard control signal for processing by the PLC. Depending upon the nature of input signal coming from the field, the input module can be analog or digital input module. The input module acts as an interface between the field control inputs and the CPU.

**Central Processing Unit:**

The heart of CPU is its microprocessor/microcontroller chip. The working of CPU is fully controlled by the instructions/program stored in “user program memory”. This program is prepared by the user based on the control logic required for the control and automation task. CPU consists of following blocks:

**Arithmetic Logic Unit (ALU):**

ALU is the organizer of the PLC. It organizes the input of external signals and data. It performs logical operations with the data and performs calculations. It takes account of the value of internal timers and counters. Program and Process Image Memory  
Internal timers and counters and flags.  
Flags.

**Output Module:**

The output module acts as a link between the CPU and the output devices located in the field. The field devices could be relays, contactors, lamps, motorized potentiometers, actuators, solenoid valves, dampers, etc. These devices actually control the process.

**Bus System:**

There are three buses in a PLC:

Address bus that makes the selection of a memory location or a module. Data bus, which carries the data from modules to processor and vice versa. Control bus that transfers control and timing signals for the synchronization of the CPU's activities within the programmable controller.

**Power supply:**

The power supply module generates the voltages required for electronic modules of the PLC from the main supply.

**Project starting:**

**Step 1: Connecting PLC**

First, you have to insert a proper driver

Right clicking on the Tag Management -> Add new driver -> Select "SIMATIC S7 Protocol Suite"

SIMATIC S7 Protocol Suite contains all possible ways, how to connect to Simatic PLC. Check the tree under the inserted driver.

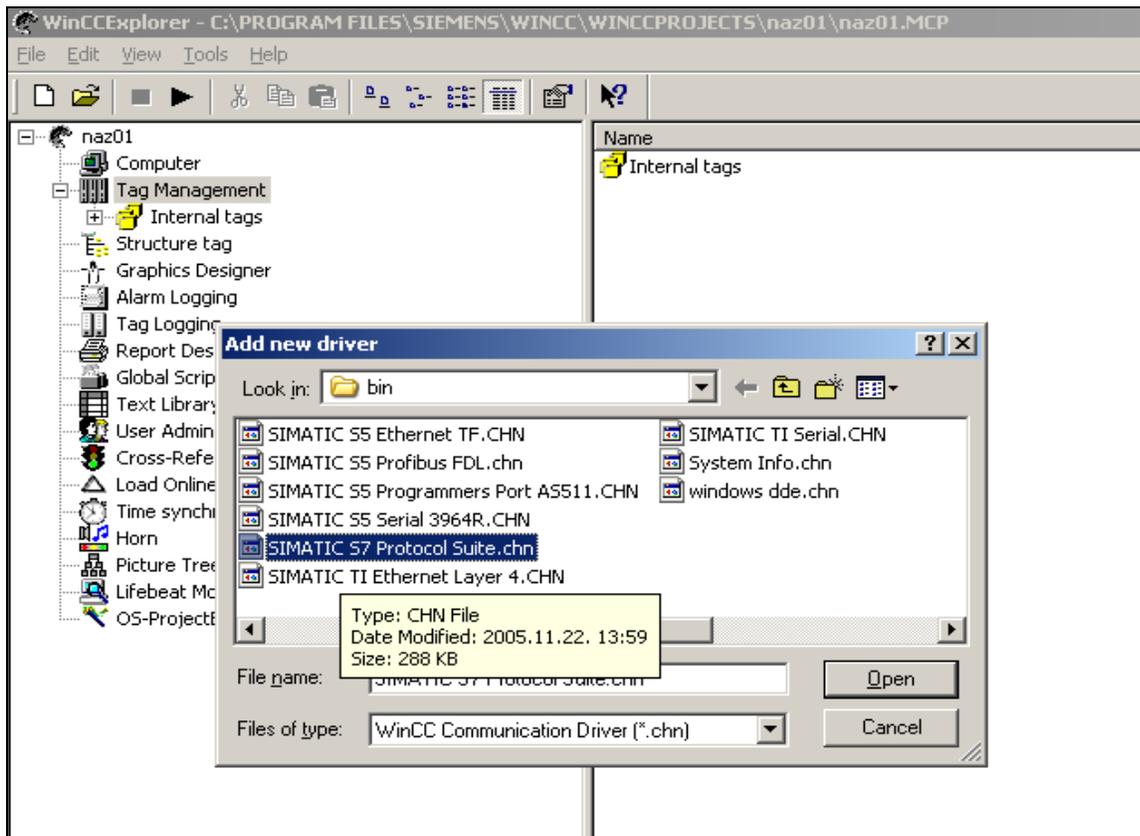


Figure 1: starting of project

**Step 2: Creating connection via the selected network protocol**

In our case, we select TCP/IP (even other protocols are possible – e.g. Industrial Ethernet)  
Important options that have to be filled in are the IP address, rack, in which the PLC is inserted, and the slot of the CPU.

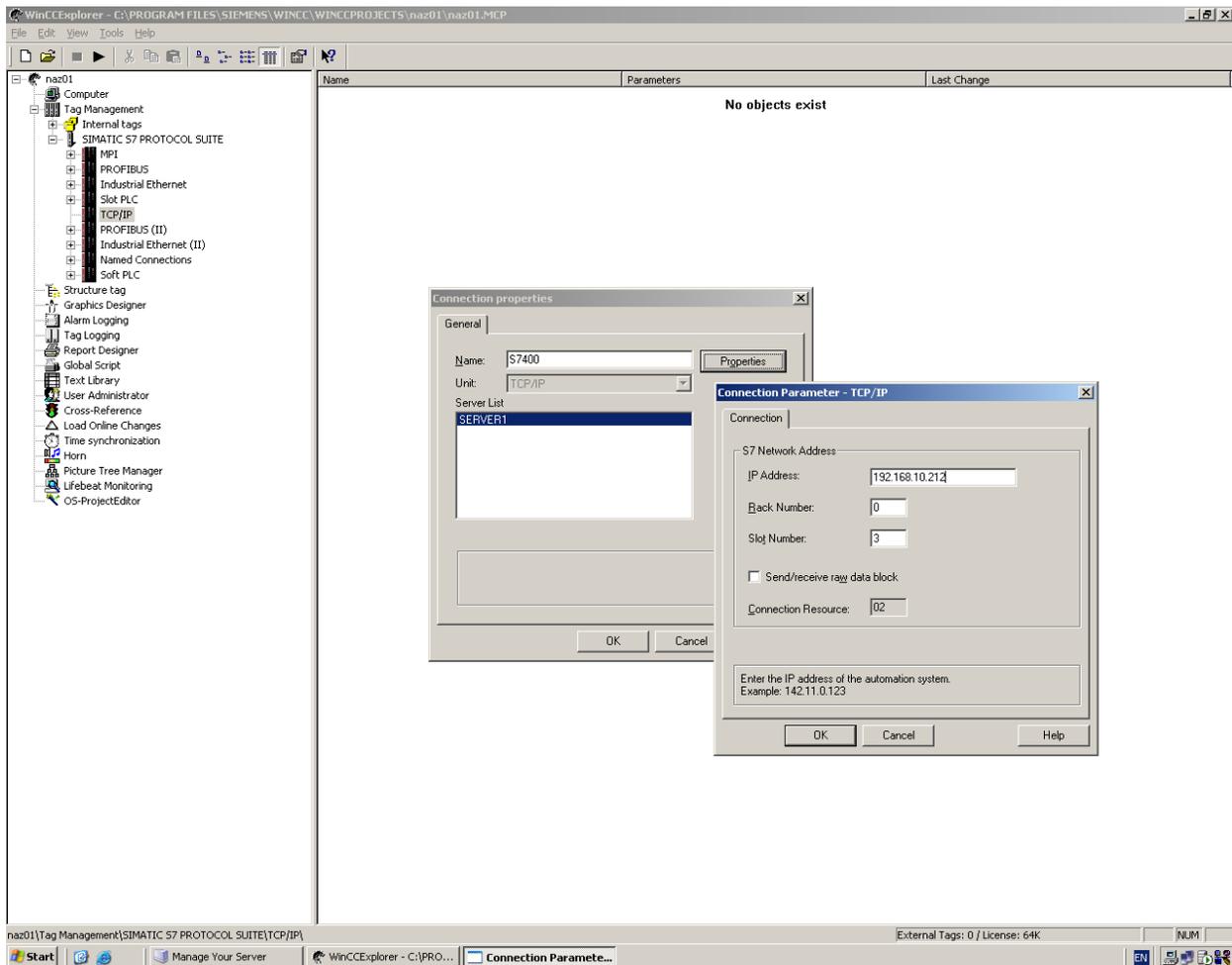


Figure 2: Creating netlist

**Step 3: Check the connection status**

Start the project with the “PLAY” button (cancel the error message for this time – no start screen is set). The connection to the PLC can be checked under Tools -> Status of Driver Connections. The status must be OK by all created connections. The status must be OK by all created connections.

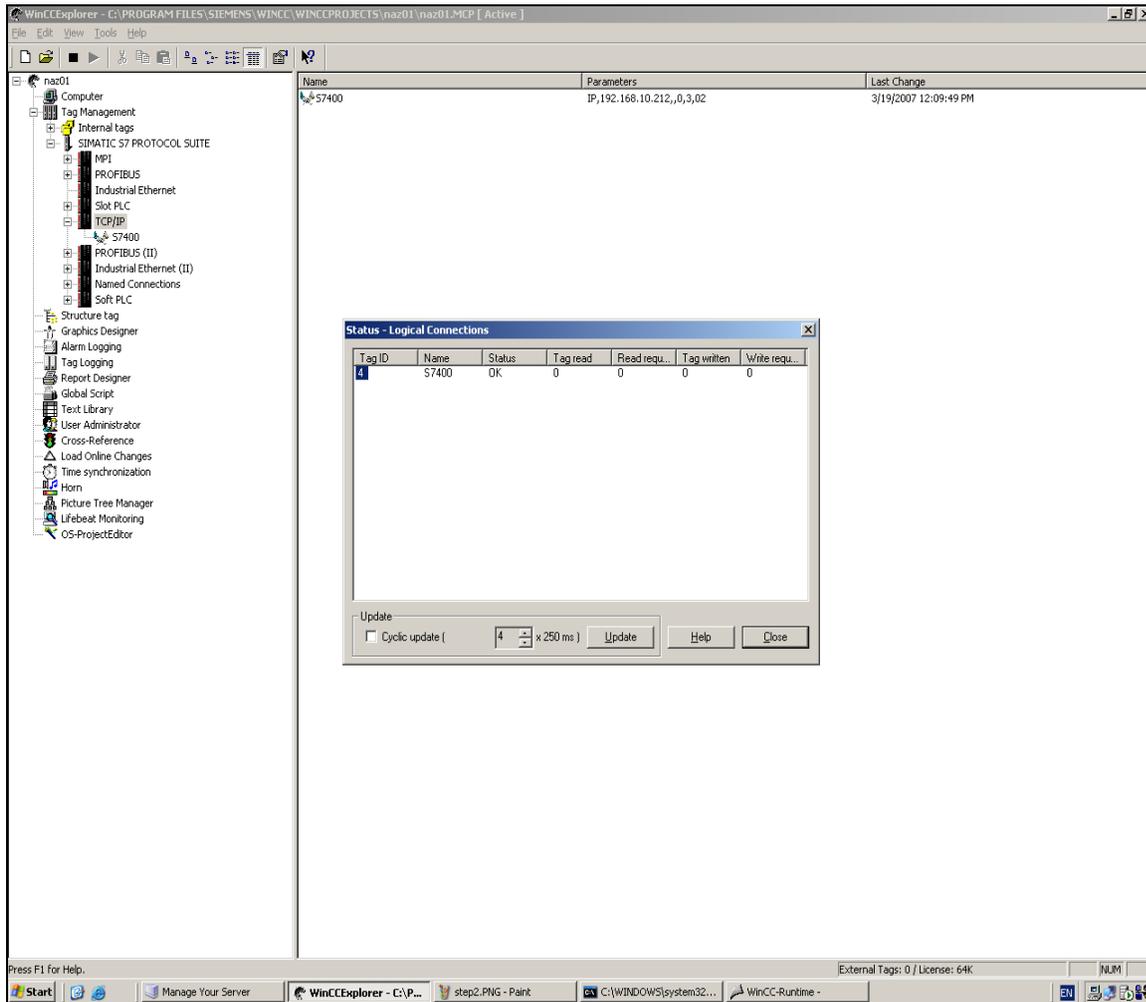


Fig 3: Connection of Drivers

**Step 4-5: Creating Tag group and inserting Tags**

Create 2 Tag groups under the created connection in step 2 – Analog Inputs and Motors. Insert the tags from the table.

Name	Type	Address	Note
AI001	Floting-Point 32-Bit	DB100.DBD 0	sine
AI002	Signed Integer 32- Bit	DB100.DBD 4	saw

Table 1

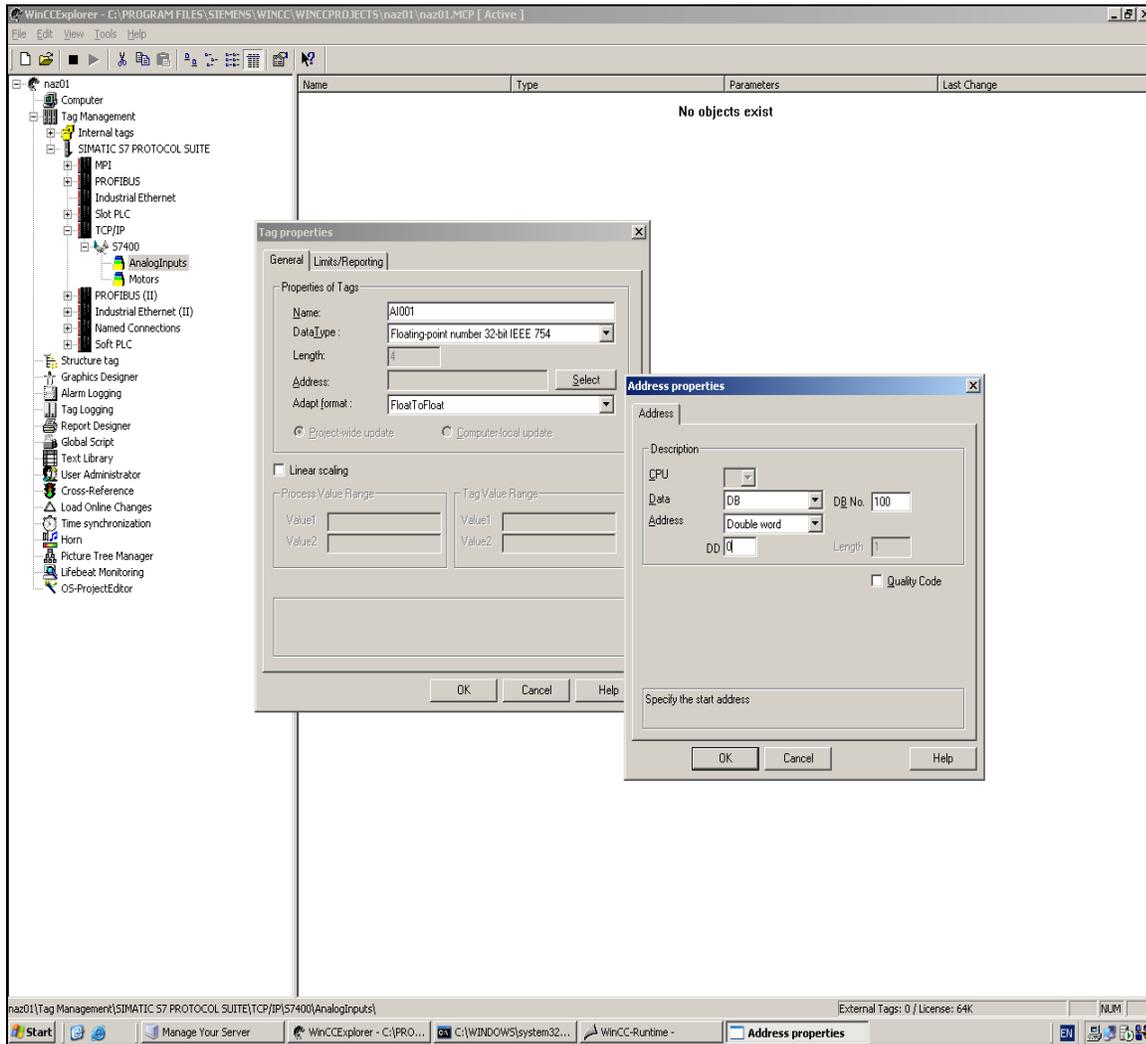


Fig 4: Generation of Tags

**Step 6: Creating structural tag**

Create the structural tag Motor. The motor is controlled according to the status and control bits in the status and control BYTE – see the following table:

Name	Type	Rel. Address	Note
Control	BYTE	0	Control BYTE
Status	BYTE	1	Status BYTE

Table 2

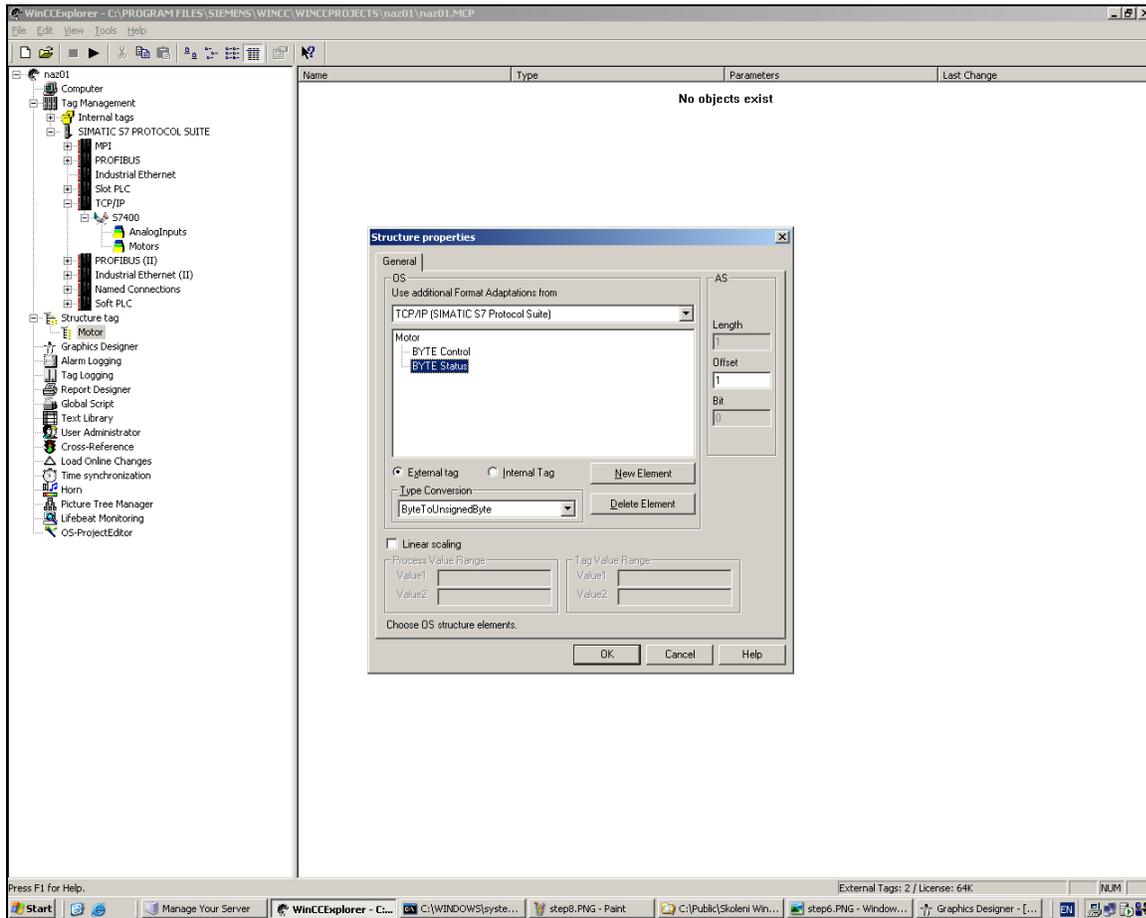


Fig 7: Status of a bit

### Conclusion and Future Scope:

PLC based automated system, is more efficient, reliable, and economical and has a shorter project time. It has tremendous flexibility, high processing speed and enhanced communication abilities. To implement changes in control logic, no rewiring is required hence saving time and resources. HMI makes it easier for the operator to control and monitor the whole system without being present at the field.

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## **Automobile Industry in India – Pattern Of Growth**

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### **Abstract:**

While motorization rate is lower than many developing countries-both in absolute term and relative to size of population, but over the last decade, Indian automobile industry is experiencing one of the fastest growth rates in the world. Automotive industry consists of commercial vehicles, passenger vehicles, two wheeler and three wheelers. The history of Indian automobile is very long but in recent years it gets a momentum not only in production but domestic as well as external sale. This paper examine the growth pattern of automobile industry with some lighting on its historically development, it also consider some of the basic problems of Indian automobile industry.

*Keywords: Automobile, Industry, Growth Pattern, production, sale and export.*

### **Introduction:**

Automobile Industry occupies a significant place in the industrial economy of our country. It not only serves as a source of conveyance to the ordinary citizens but also plays a crucial role in the sphere of transportation and communication. The Automotive industry in India is one of the largest in the world and one of the fastest growing globally. India manufactures over 17.5 million vehicles (including 2 wheeled and 4 wheeled) and exports about 2.33 million every year. India's passenger car and commercial vehicle manufacturing industry is the seventh largest in the world, with an annual production of more than 3.7 million units in 2010. According to recent reports, India is set to overtake Brazil to become the sixth largest passenger vehicle producer in the world, growing 16-18 per cent to sell around three million units in the course of 2011-12. In 2009, India emerged as Asia's fourth largest exporter of passenger cars, behind Japan, South Korea, and Thailand. As of 2010, India is home to 40 million passenger vehicles and more than 3.7 million automotive vehicles were produced in India in 2010 (an increase of 33.9%), making the country the second fastest growing automobile market in the world. According to the Society of Indian Automobile Manufacturers, annual car sales are projected to increase up to 5 million vehicles by 2015 and more than 9 million by 2020. By 2050, the country is expected to top the world in car volumes with approximately 611 million vehicles on the nation's roads.

### **History of Automobile Industry in India:**

The origin of the Indian automobile industry can be traced to the year 1942 when the Hindustan Motors was established in Baroda. In fact, long before this, the General motors had an assembling plant in India and vehicles were assembled at this plant with completely imported assembly parts. It was in 1949 that the first partially manufactured car rolled out of the assembly line of Hindustan Motors Limited. The establishment of Hindustan Motors Ltd. (HML) was followed by Premier Automobiles Ltd. (PAL) with its car units in Bombay and the standard motor product in India in Madras. As usual the initial years of the industry were the years of strains, stresses and all sorts of difficulties. During this period the automobile industry of the country consisted of only importers, assemblers, etc. who were just in the assembly line. The manufacture of motor vehicles was not taken until 1953 when the Government approved the recommendations of Tariff Commission on the automobile industry. Most of the manufacturing units started production in 1953-54. They were compelled to work at a loss as a small market was over flooded with the imported cars of various designs. Besides, the three main passenger car manufacturers, Ashok Leyland, took up the production of commercial vehicles in 1957 and Tata Engineering and locomotive Company (TELCO) in 1962, Mahindra and Mahindra was promoted in 1965 in the Jeep line. In two wheelers group three main units Enfield India, Bajaj Auto, Escorts and Jawa were the prominent units. After 1970, the automotive industry started to grow, but the growth was mainly driven by tractors, commercial vehicles and scooters. Cars were still a major luxury. Japanese manufacturers entered the Indian market ultimately leading to the establishment of Maruti Udyog. A number of foreign firms initiated joint ventures with Indian companies. In the 1980s, a number of Japanese manufacturers launched joint-ventures for building motorcycles and light commercial-vehicles. It was at this time that the Indian government chose Suzuki for its joint-venture to manufacture small cars. Following the economic liberalization in 1991 and the gradual weakening of the license raj, a number of Indian and multi-national car companies launched operations. Since then, automotive component and automobile manufacturing growth has accelerated to meet domestic and export demands.

Following economic liberalization in India in 1991, the Indian automotive industry has demonstrated sustained growth as a result of increased competitiveness and relaxed restrictions. Several Indian automobile manufacturers such as Tata Motors, Maruti Suzuki and Mahindra and Mahindra, expanded their domestic and international operations. India's robust economic growth led to the further expansion of its domestic automobile market which has attracted significant India-specific investment by multinational automobile manufacturers.

An overview

The major groups of automobile playing Indian roads can be categorized as:

- (i) Commercial Vehicles
- (ii) Two Wheelers
- (iii) Three Wheelers
- (iv) Passenger Vehicles

**Commercial Vehicles:** Commercial vehicles are categorized into heavy, medium and light  
Till eighties the progress of the automobile industry was uneventful. The Industry was accorded only a marginal status in the scheme of industrial development of the country. It was, of course, recognized even in the fifties that the consumption of motor vehicles in India was much below the potential demand for a country. In the wake of this, Government allowed the setting up of

two units for the manufacture of commercial vehicles with foreign collaboration in the mid-fifties.

In 1953 the Tariff Commission in its first report recommended that firms which a manufacturing Programme should be allowed to assemble vehicles in the country. In its second report (1956) the Tariff Commission recommended that high priority should be accorded to the production of commercial vehicles rather than passenger cars. The Fourth Plan gave a crucial role to the industry in the overall economic growth considering its high employment potential. A rise in the car out-put and impressive increases in the production of trucks, scooters are all parts of the fourth plan. The causes for the industry's tardy development are its high cost structure and the poor quality of the vehicles. There was a point in the argument that much of the high cost of Indian vehicles was accounted for by the incidence of taxation to the tune of about 4.6 per cent. The dependence on too many and too small ancillary units has also contributed to the increase in vehicle prices. The price control policy badly affected the industry. So during Fourth Plan period Government decided to assist the industry by removing the price control. But major changes have taken place after 1980 as the Government decided to change its policies. In January 1985 the Government announced the liberalization of licensing of the automobile industry by freely permitting the manufacture of passenger car and commercial vehicles by all the existing manufacturers of four wheels. But, despite the liberalization of licensing the automobile units will have to get Government approval for any new foreign collaboration. The Government would like the commercial vehicles and new cars to be rapidly indigenized. The heavy commercial units took advantage of the new opportunities and implemented expansion schemes.

They also changed their pattern of production. The heavy commercial units Ashok Leyland and the TELCO implemented expansion schemes. The TELCO doubled its capacity to 54480 units and established a new unit in Pune. Ashok Leyland started new units in Hosur in Tamilnadu, Bhandra in Maharashtra and Alwar in Rajasthan. Mahindra & Mahindra also expanded its capacity. The Hindustan Motor and the Premier Automobile too entered the commercial vehicles sector though their entry did not make much headway. Similar developments took place in light commercial vehicles sector. There was euphoria when four entirely new enterprises named DCM-Toyota, Allwyn Nissan, EICHER Motors and Swaraj – Mazda were promoted with Japanese financial and technical participation. Each of these units had an annual capacity of 10000 units. The volume of investment on modernization expansion and new schemes was at over Rs.1000 crores. Such heavy investment in concentrated manner in less than 5 years did not take place at any time in the earlier history of the industry. But later, situation was improved. Since then, there was a continuous rise in the output of LCVs which shows that LCVs will be in greater demand for movement of goods in urban and rural areas and for passenger traffic also. But a marginal decline was evident in same years. This was due to hike in oil prices and absence of enough market as there was a mushroom growth of new automobile units.

The demand for commercial vehicles may also get accelerated with new provision of the amended Motor Vehicle Act. The average vehicles have to be replaced at a faster rate for ensuring efficiency and economy in fuel consumption. The pattern of growth in sales of HCVs and LCVs in the Eight & Nine Plans may be different as the off take of HCVs will be more pronounced because of the economies in operation and the increase in volume of long distance freight traffic.

The Table given below shows the trends in production of commercial vehicles for the period from 2004-05 to 2010-11. Growth of commercial vehicle shows sharp rise in production in 2006-07. Thereafter, however a stagnant trend emerged and the output was marginally better in 2009-10. During this period not only production increase but a very good trend in domestic sale which constantly increase. In the export area commercial vehicle done well especially in 2010-11.

Year	Annual Production	Domestic Sale	Annual Export
2004-05	353,703	318,430	29,940
2005-06	391,083	351,041	40,600
2006-07	519,982	467,765	49,537
2007-08	549,006	490,494	58,994
2008-09	416,870	384,194	42,625
2009-10	567,556	532,721	45,009
2010-11	752,735	676,408	76,297

TABLE 1: Latest trends in growth of Commercial Vehicles (Unit: No. of Vehicles)

Source:

1. Kothari's Year book on Business and Industry of various years.
2. [www.siamindia.com](http://www.siamindia.com) (Society of Indian Manufacturer of Automobile).

Two Wheelers: It is opined by the experts that the most suitable vehicle in India is the two-wheeler. But the progress of the two wheeler industry over a long period was not impressive with any spectacular growth of output as it was not accorded priority status by the Government. The Government attitude changed radically after 1980. Not only did it recognize the advantages of economies of scale but also the fact that the models being made in the country were hopeless and outdated. There was a long waiting period for delivery of vehicles in some cases.

The Government recognized the need to satisfy the growing demand and the consumer was not getting the benefit of modern automotive technology in internal combustion engine technology outside India. The Government liberalized its technology import policy and eased the restrictions on foreign collaboration and import of critical components and reduced duties and taxes on fuel efficient vehicles.

So with the new open door policy on technology imports, especially the easing of restrictions on manufacturing equipment and kit imports, there is enthusiasm among almost every well known manufacturer abroad to offer technical and financial collaboration to the Indian companies. The prominent ones are Ind-Suzuki (Motor Cycles) with Suzuki of Japan, Escorts (Motor Cycles) with Yamaha of Japan, Bajaj (Motor Cycles) with Kawasaki of Japan, Hero with Honda of Japan. In Scooters Kinetic with Honda (Japan) Lohia Machines and A.P. Scooters with Piaggio of Italy, Kelvinator (Mopeds) with Garelli of Italy, Chamundi Mopeds with Cycles Peugeot of France, Mopeds India with Motobecan of France and Enfield India (Mopeds & Motor Cycles) with Zundapp Werk of West Germany. Nearly 59% of these two wheelers sold were motorcycles and about 12% were scooters. Mopeds occupy a small portion in the two wheeler market however; electric two wheelers are yet to penetrate. At present there are 43 manufacturers in the

country licensed to make two wheeler but only 23 of them are active units with a licensed capacity of 5 million per annum while the installed capacity is 2.3 million. Prominent among them are Bajaj, LML and Kinetic Honda in Scooters, Escorts, Hero Honda, TVS and Bajaj in motor cycles and Kinetic, TVS and Hero in the Moped. Most of the manufacturers produce only one product category.

A noticeable shift in the buying habits of customers is observed. As customer would like to own their two wheeler today and pay for the same in convenient installments. There are chances that this trend in the coming years will accelerate. As new Motor Vehicle Act came into enforcement, it is expected that manufacturers may increase their production and offer better models in the near future which ensure that the co-emission of their vehicles does not exceed 4.5 per cent by volume. Side indicators have already been made compulsory for all two wheelers from February 1, 1990. Now, we can say that over all picture of the two wheeler industry is one of continuous growth. The technology which is inducted in two wheeler sector in India is at par with what is being sold in the developed countries. It is of course difficult to predict whether the industry will have to go in for another massive dose of technology import to catch up with the rest of the world. With the boom in two wheeler production and sales there is no doubt that the industry will continue to flourish.

The data set out in Table 2 reveals that the production of two wheelers has increased to 1598900 vehicles in 2009 against 6,529,829 vehicles in 2004-05. Domestic sale is increasing steadily but gain momentum in last year. Our two wheeler export sharply increase from 2008-09 and reach at level of 1,539,590 units in 2010-11.

Year	Annual Production	Domestic Sale	Annual Export
2004-05	6,529,829	6,209,765	366,407
2005-06	7,608,697	7,052,391	513,169
2006-07	8,466,666	7,872,334	619,644
2007-08	8,026,681	7,249,278	819,713
2008-09	8,419,792	7,437,619	1,004,174
2009-10	10,512,903	9,370,951	1,140,058
2010-11	13,376,451	11,790,305	1,539,590

TABLE 2: Latest trends in growth of two wheelers Unit: No. of Vehicle

Source:

1. Kothari's Year book on Business and Industry.
2. [www.siamindia.com](http://www.siamindia.com) (Society of Indian Manufacturer of Automobile).

### Three wheelers

Three wheelers are categorized into passenger carriers and goods carriers. Three wheelers account for about 4% of the market in India. Bajaj Auto in itself is occupying about 58% of the three wheeler market.

The growth pattern of three wheeler is not so impressive in India due to technical and legal restrictions but recent years it shown a rising trend.

Table 3 shows the production, sale and export growth of three vehicles.

The production of three wheelers as almost a double in 5 year as 799553 in 2010-11 from 374445 in 2004-05. There is sharp increase in export in same years. Export took jump in 2006-07 and continuously increasing, as it reaches to 269967 units in 2010-11.

Year	Annual Production	Domestic Sale	Annual Export
2004-05	374,445	307,862	66,795
2005-06	434,423	359,920	76,881
2006-07	556,126	403,910	143,896
2007-08	500,660	364,781	141,225
2008-09	497,020	349,727	148,066
2009-10	619,194	440,392	173,214
2010-11	799,553	526,022	269,967

Table 3 Latest trends in growth of three wheelers Unit: No. of Vehicle

Source:

1. [www.siamindia.com](http://www.siamindia.com) (Society of Indian Manufacturer of Automobile).

**Passenger vehicles:**

Passenger vehicles include cars, jeep and taxis, but cars have major share in this category. Some major developments have also been taking place in the passenger car sector. It was in 1898 that first imported motor car rode down India’s roads. From then till the First World War, about 40,000 cars were directly imported to India from foreign manufacturers. It was Premium Automobile who produced the first car in India in 1946. In the 50’s, the Government of India granted approval to only seven cars dealers to operate in India – Hindustan Motors, API, Ashoka Leyland Limited, Standard Motor Products of India Limited, Premier Automobiles Limited, Mahindra & Mahindra and TELCO. The protectionist policies continued to remain in place and in the 60’s and 70’s, things remain same. Since the 80’s, the Indian car industry has seen a major resurgence with the opening up of Indian shores to foreign manufacturers and collaborators. The 90’s have become the melting point for the car industry in India. This liberalized period is also marked by the entry of a large number of firms in the market, monopoly, oligopoly slowly began to disappear. The industry witnessed resurgence due to major policy changes like relaxation (and eventual abolition) of MRTP and FERA, de-licensing of some ancillary products, broad banding of the products and modification in the licensing policy. Also, the concessions it gave to the private sector and the new foreign collaboration policy resulted in higher growth and better performance of the industry. The Government of India tied up with Suzuki Inc. of Japan, a venture that produced India’s most successful family car – the Maruti. Several Indian manufactures such as Tata Motors, Maruti Suzuki, and Mahindra & Mahindra expanded their domestic and international operation. India’s robust economic growth led to further expansion of its domestic automobile market which has attracted significant India specific investment by multinational automobile manufactures. In 2009, Tata Motors Ltd. launched a 1 lakh Rs. car “Nano”. The many others small car manufactures participated in the race. Now the concept of everyone have an own car emerge in Indian society. Car sale jumps very significantly in recent years. From 2003 to 2010 car sales in India progressed at CAGR of 13.7%. At presently, 10

percent of the households in India owing a car. Table 4 shows the growth pattern of passenger vehicle in India. In recent five years not only annual production but domestic sale also got doubled in India. In 2010-11, out of total 2987296 passenger vehicle produced, 2520421 are bought in India itself. Passenger vehicle not only grew in production and sale but become four fold in export in last five years.

Year	Annual Production	Domestic Sale	Annual Export
2004-05	1,209,876	1,061,572	166,402
2005-06	1,309,300	1,143,076	175,572
2006-07	1,545,223	1,379,979	198,452
2007-08	1,777,583	1,549,882	218,401
2008-09	1,838,593	1,552,703	335,729
2009-10	2,357,411	1,951,333	446,145
2010-11	2,987,296	2,520,421	453,479

Table 4: Latest trends in growth of Passenger Vehicle Unit: No. of Vehicle  
Source:

1. [www.siamindia.com](http://www.siamindia.com) (Society of Indian Manufacturer of Automobile).

**Problems:**

The automobile and ancillary industries are passing through a dynamic phase of growth where modernization, expansion and new schemes are taking place on an unprecedented scale. The induction of new technology developed by Japanese, West Germans and French and the promotion of new projects with technical assistance provided by these collaborators is resulting in the creation of new capacity. These new happenings have thrown serious challenges to industry. However, some of the policy issues like levels of indigestion, selling prices of vehicle, quality/durability standards, and economy of operation technology up gradation, excise and taxes etc, which have been raised again and again over the past few years still remain unresolved. Government is very much concerned for the industries problems but clear cut policies have yet to emerge. The following may be termed as the main problems of the industry:

**Lack of Technological up gradation:**

Motor Vehicle is a complex and sophisticated product. There are about 10000 parts and components which make a complete vehicle. Some of these parts are produced by the vehicle manufacturer himself while other parts are supplied by the ancillary industries for raw material and inputs. This is the major problem which manufacturers are facing in maintaining quality. Most of the designs patents are imported ones. The available materials fastener and other items do not conform to the quality specifications called for in the imported designs. The designs are not fully oriented, developed after substituted indigenous materials for adequate environmental tests to prove the pilots endurance. The process of indigenization has affected the price and quality of vehicles. At present due to the lack of research & development activity indigenization lead to an increase in price and deterioration in quality. The engine designers and other agencies meant for ancillaries like fuel injection pump, fuel filters, radiators, oil pumps, fuel pumps shockers etc. have not helped in the direction of variety rationalization. Thus heavy investment in

machinery, research & development and high quality of management skill required in automobile and ancillary industries to produce good vehicles based on fuel economy, safety and pollution standard have become essential.

### **Government Policies**

Regarding the Government policies for automobiles the industry presents a strange story of development. The Governments policies in regard to this industry especially the price controls and regulations, import substitution, taxation and protection have been inconsistent and these policies have played a role of major hurdle in the development of this industry. The industry has remained controlled and protected in the sense that foreign capital investment was not allowed and thus the industry was kept away from foreign competition and latest technology. However, after the economic reform, this sector was opened for global investors but technical conditions kinder the process of growth. No developing country has ever been successful to plan and develop its own vehicle production technology. It appears that protection policy has made the industry backward. Taxation in all countries has been viewed as a means of bringing about changes in the level and distribution of income and wealth. Taxation has been identified as a significant source of industry's sickness. The cost of automobiles shows high degree of incidence of taxation. Tax rate varies between 44 to 60 per cent depending upon the type of vehicles. The taxation policy has not been consistent with the policy of growth of this country.

### **Economic Factors:**

Besides the Government policies there have been many economic factors coming into the way of steady growth of the industry. Some of the significant factors include absence of economies of scale in production, absence of infrastructure, credit facilities, high maintenance cost, poor investment in research and development. Absence of infrastructure facilities like the provision of motor able roads and bridges connecting villages in the interior of the country to towns, non-availability of finance at cheaper rate of interest to buy vehicle, high operational costs mainly due to high petrol prices, duties and taxes, non-availability of certain critical raw materials at times, irregular power supply and frequent break downs. Lower per capital income which places passenger cars beyond the reach of a large majority of the country's population is also a problem to be observed. Poor feed back from user to producer about the performance of vehicles, heavy investment in research and development seems essential for the continuous up gradation of technology. The out dated and inefficient technology has to be replaced by fuel efficient and modern technology. The import of machinery and technology would add to the cost of production but this can be reduced significantly through economies of scale and other policy measures. The role of the auto industry has been emphasized as an engine of growth for the national economy from the point of view of revenue to the government, national defense, employment generation and industrialization. This has been regarded as an essential and vital ingredient of economic development.

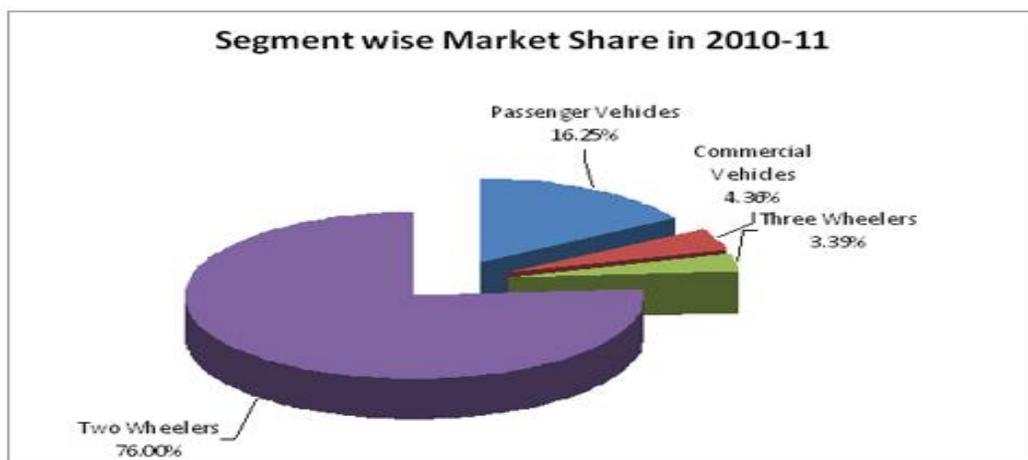
### **Conclusive analysis:**

Motor vehicle fleet in whole country composed of two-wheelers, three wheeler, passenger vehicle and commercial vehicle.

India had 121.63 million vehicles at the end of year 2010. Personalized mode (constituting mainly two wheeler and cars) accounted for more than four-fifth of motor vehicles in the country compared to their share of little three-fifth in 1951. Further breakup of motor vehicle population reflects preponderance of two wheeler with share of more than 75 % in total vehicle population followed by passenger vehicles at a 16% & three wheeler at 3.5 % Share of commercial vehicle is very low, near about 5 % as shown in table 5 and diagram given below:

Type of Vehicle	Market share (%)
Passenger Vehicles	16.25
Commercial Vehicles	4.36
Three Wheelers	3.39
Two Wheelers	76.00

Table-5: Domestic Market Share for 2010-11



Source: [www.siamindia.com](http://www.siamindia.com) (Society of Indian Manufacturer of Automobile).

With a rising income & greater need for mobility the personalized mode of transport is likely to grow in importance in coming year. India like many other countries in Asia has experienced high annual growth rate in excess of 10 %. This is equivalent to doubling vehicle fleet in about seven years.. The two wheeler population in India is 3856 Crores in 2001 which increase up to 91285 crores in 2010-11 almost tripled in 9 years. With the rapid pace of urbanization and economic development, more is a rising trends of personal vehicles. Car is most comfortable vehicle & luxurious option for transportation in India. So share of car is rising in India. Share of cars in total vehicles is near about 9 %. The car owner ship in India is 8 per thousand people. (Jay Desousaza 2010). With country's highway infrastructure improving and business growing, growth of small and heavy commercial vehicles segment outperforming in the growth. The commercial vehicle population doubled of in last ten years. The growth rates of commercial vehicle remain same in all the years and steadily rising. The motorization trends itself is dominated by following preferences in India.

- High specification car, including small utility vehicles.

- Diesel four wheeler.
- Motorcycle in two wheelers.

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## **Study of DSDV, DSR and AODV in Mobile Ad hoc Networks**

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### **Abstract:**

A mobile ad hoc network (MANET) is a network consisting of a set of wireless mobile nodes that communicate with each other without centralized control or established infrastructure. Each mobile node in these networks may act as a host and a router in the meantime that it runs both application programs and routing protocols .In this paper, we have studied the various protocols and the differences between table driven (proactive) and demand driven (Reactive) protocols. We have investigated the performance of protocols in random way point mobility model. The network simulator NS 2 will be used to implement these protocols.

*Keywords: ADHOC network, Routing protocols, DSDV, DSR, AODV, NS2*

### **Introduction:**

An ad hoc network is a collection of wireless mobile nodes dynamically forming a temporary network without the use of existing network infra-structure or centralized administration. Due to the limited transmission range of wireless network interfaces, multiple network hops may be needed for one node to exchange data with another across the network as shown in fig 1. In such a network, each mobile node operate not only as a host but also as a router, forwarding packets for other mobile nodes in the network, that may not be within the direct reach wireless transmission range of each other. Each node participates in an ad hoc routing protocol that allows it to discover multi hop paths through the network to any other node. The idea of an ad hoc network is sometimes also called an infrastructure-less networking, since the mobile nodes in the network dynamically establish routing among themselves to form their own network on the fly [3].Some examples of the possible use of ad hoc networks include students using laptop computers to participate in an interactive lecture, business associates sharing information during a meeting, soldiers relaying information for situational awareness on the battlefield, and emergency disaster relief personnel coordinating efforts after a hurricane or earthquake. The growth of laptops and 802.11/Wi-Fi wireless networking have made MANETs a popular research topic since mid- to late 1990s. Many academic papers evaluate protocols and abilities assuming varying degrees of mobility within a bounded space, usually with all nodes within a few hops of each other and usually with nodes sending data at a constant rate. Different protocols are then evaluated based on the packet drop rate, the overhead introduced by the routing protocol, and other measures.

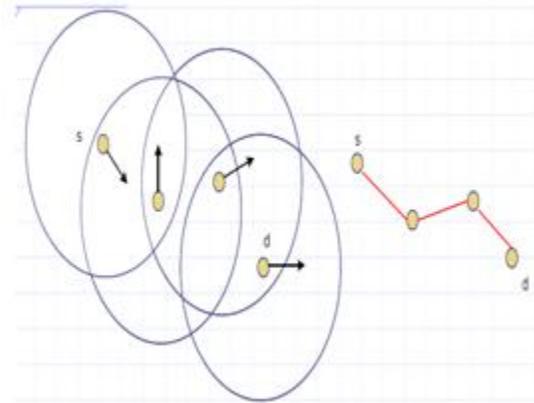


Fig.1: MANET route creation through multihops

**Routing Protocols:**

These routing protocols can be broadly classified into two categories as shown in fig 2:

- Table driven
- Source initiated (demand driven)

**Table driven Routing Protocols:**

Table driven routing protocols attempt to maintain consistent, up to date routing information from each node to every other node in the network. These protocols require each node to maintain one or more tables to store routing information, and they respond to changes in network topology by propagating updates throughout the network in order to maintain a consistent network view. The areas in which they differ are the number of necessary routing related tables and the methods by which changes in network structure are broadcast. Some of such routing protocols are:

- Destination Sequence Distance Vector Routing
- Cluster Head Gateway Switch Routing
- Wireless Routing Protocol

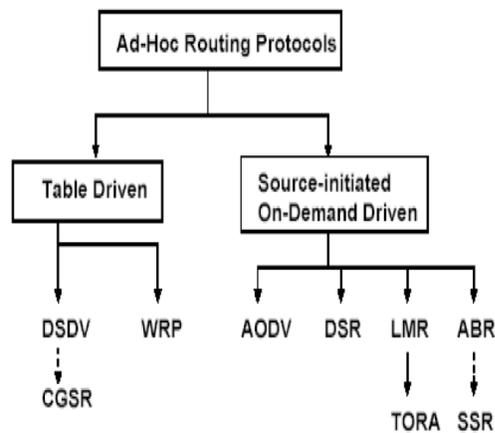


Fig.2: Classification of Protocols

**Destination Sequence Distance Vector Routing (DSDV):**

This protocol is based on classical Bellman-Ford routing algorithm designed for MANETS. Each node maintains a list of all destinations and number of hops to each destination. Each entry is marked with a sequence number as shown in figure 3. It uses full dump or incremental update to reduce network traffic generated by route updates. The broadcast of route updates is delayed by settling time. The only improvement made here is avoidance of routing loops in a mobile network of routers. With this improvement, routing information can always be readily available, regardless of whether the source node requires the information or not [4]. DSDV solve the problem of routing loops and count to infinity by associating each route entry with a sequence number indicating its freshness. In DSDV, a sequence number is linked to a destination node, and usually is originated by that node (the owner). The only case that a non-owner node updates a sequence number of a route is when it detects a link break on that route. An owner node always uses even-numbers as sequence numbers, and a non-owner node always uses odd-numbers. With the addition of sequence numbers, routes for the same destination are selected based on the following rules:

- a route with a newer sequence number is preferred;
- in the case that two routes have a same sequence number, the one with a better cost metric is preferred.

The list which is maintained is called routing table. The routing table contains the following:

- All available destinations' IP address
- Next hop IP address
- Number of hops to reach the destination
- Sequence number assigned by the destination node
- Install time

The sequence number is used to distinguish stale routes from new ones and thus avoid the formation of loops. The stations periodically transmit their routing tables to their immediate neighbors. A station also transmits its routing table if a significant change has occurred in its table from the last update sent. So, the update is both time-driven and event-driven.

As stated above one of "full dump" or an incremental update is used to send routing table updates for reducing network traffic. A full dump sends the full routing table to the neighbors and could span many packets whereas in an incremental update only those entries from the routing table are sent that has a metric change since the last update and it must fit in a packet. If there is space in the incremental update packet then those entries may be included whose sequence number has changed. When the network is relatively stable, incremental updates are sent to avoid extra traffic and full dump are relatively infrequent. In a fast-changing network, incremental packets can grow big so full dumps will be more frequent [4]. Each route update packet, in addition to the routing table information, also contains a unique sequence number assigned by the transmitter. The route labeled with the highest (i.e. most recent) sequence number is used. If two routes have the same sequence number then the route with the best metric (i.e. shortest route) is used. Based on the past history, the stations estimate the settling time of



### **Dynamic Source Routing (DSR):**

The Dynamic Source Routing protocol (DSR) is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. Dynamic Source Routing, DSR, is a reactive routing protocol that uses source routing to send packets as shown in fig 4. It uses source routing which means that the source must know the complete hop sequence to the destination. Each node maintains a route cache, where all routes it knows are stored. The route discovery process is initiated only if the desired route cannot be found in the route cache. To limit the number of route requests propagated, a node processes the route request message only if it has not already received the message and its address is not present in the route record of the message. As mentioned before, DSR uses source routing, i.e. the source determines the complete sequence of hops that each packet should traverse. This requires that the sequence of hops is included in each packet's header. A negative consequence of this is the routing overhead every packet has to carry. However, one big advantage is that intermediate nodes can learn routes from the source routes in the packets they receive. Since finding a route is generally a costly operation in terms of time, bandwidth and energy, this is a strong argument for using source routing. Another advantage of source routing is that it avoids the need for up-to-date routing information in the intermediate nodes through which the packets are forwarded since all necessary routing information is included in the packets. Finally, it avoids routing loops easily because the complete route is determined by a single node instead of making the decision hop-by-hop [6].

The protocol is composed of the two main mechanisms of "Route Discovery" and "Route Maintenance", which work together to allow nodes to discover and maintain routes to arbitrary destinations in the ad hoc network. All aspects of the protocol operate entirely on demand, allowing the routing packet overhead of DSR to scale automatically to only what is needed to react to changes in the routes currently in use. The protocol allows multiple routes to any destination and allows each sender to select and control the routes used in routing its packets, for example, for use in load balancing or for increased robustness.

### **Route Discovery:**

Route Discovery is used whenever a source node desires a route to a destination node. First, the source node looks up its route cache to determine if it already contains a route to the destination. If the source finds a valid route to the destination, it uses this route to send its data packets. If the node does not have a valid route to the destination, it initiates the route discovery process by broadcasting a route request message. The route request message contains the address of the source and the destination, and a unique identification number. An intermediate node that receives a route request message searches its route cache for a route to the destination. If no route is found, it appends its address to the route record of the message and forwards the message to its neighbors. The message propagates through the network until it reaches either the destination or an intermediate node with a route to the destination. Then a route reply message, containing the proper hop sequence for reaching the destination, is generated and unicast back to the source node [6].

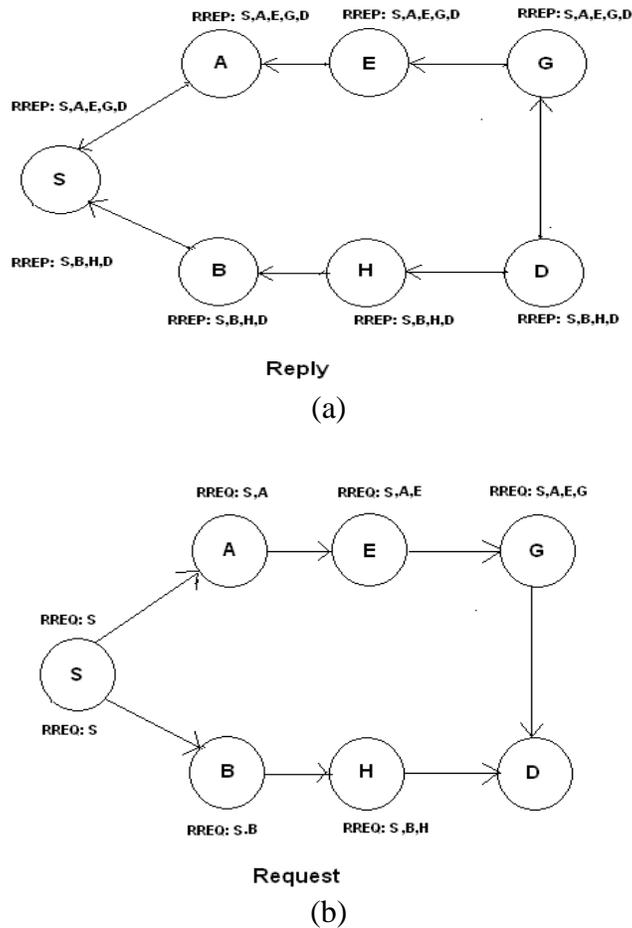


Fig.4: How route request and reply is performed in DSR?

**Route maintenance:**

Route Maintenance is used to handle route breaks. When a node encounters a fatal transmission problem at its data link layer, it removes the route from its route cache and generates a route error message. The route error message is sent to each node that has sent a packet routed over the broken link. When a node receives a route error message, it removes the hop in error from its route cache. Acknowledgment messages are used to verify the correct operation of the route links. In wireless networks acknowledgments are often provided as e.g. an existing standard part of the MAC protocol in use, such as the link-layer acknowledgment frame defined by IEEE 802.11. If a built-in acknowledgment mechanism is not available, the node transmitting the message can explicitly request a DSR-specific software acknowledgment to be returned by the next node along the route [6].

**Ad hoc On-Demand Distance Vector Routing:**

Ad hoc On-Demand Distance Vector (AODV) Routing is a routing protocol for mobile ad hoc networks (MANETs) and other wireless ad-hoc networks. It is jointly developed in Nokia Research Center, University of California, Santa Barbara and University of Cincinnati by C.

Perkins, E. Belding-Royer and S. Das. It is a reactive routing protocol, meaning that it establishes a route to a destination only on demand. In contrast, the most common routing protocols of the Internet are proactive, meaning they find routing paths independently of the usage of the paths. AODV is, as the name indicates, a distance-vector routing protocol. AODV avoids the counting-to-infinity problem of other distance-vector protocols by using sequence numbers on route updates, a technique pioneered by DSDV. AODV is capable of both unicast and multicast routing. In AODV, the network is silent until a connection is needed. At that point the network node that needs a connection broadcasts a request for connection as shown in fig 5. Other AODV nodes forward this message, and record the node that they heard it from, creating an explosion of temporary routes back to the needy node. When a node receives such a message and already has a route to the desired node, it sends a message backwards through a temporary route to the requesting node. The needy node then begins using the route that has the least number of hops through other nodes. Unused entries in the routing tables are recycled after a time. When a link fails, a routing error is passed back to a transmitting node, and the process repeats. Much of the complexity of the protocol is to lower the number of messages to conserve the capacity of the network. For example, each request for a route has a sequence number. Nodes use this sequence number so that they do not repeat route requests that they have already passed on. Another such feature is that the route requests have a "time to live" number that limits how many times they can be retransmitted. Another such feature is that if a route request fails, another route request may not be sent until twice as much time has passed as the timeout of the previous route request. The advantage of AODV is that it creates no extra traffic for communication along existing links. Also, distance vector routing is simple, and doesn't require much memory or calculation. However AODV requires more time to establish a connection, and the initial communication to establish a route is heavier than some other approaches.

#### **Technical description:**

The AODV Routing protocol uses an on-demand approach for finding routes, that is, a route is established only when it is required by a source node for transmitting data packets. It employs destination sequence numbers to identify the most recent path. The major difference between AODV and Dynamic Source Routing (DSR) stems out from the fact that DSR uses source routing in which a data packet carries the complete path to be traversed. However, in AODV, the source node and the intermediate nodes store the next-hop information corresponding to each flow for data packet transmission. In an on-demand routing protocol, the source node floods the Route Request packet in the network when a route is not available for the desired destination as shown in fig 5. It may obtain multiple routes to different destinations from a single Route Request. The major difference between AODV and other on-demand routing protocols is that it uses a destination sequence number (Dest Seq Num) to determine an up-to-date path to the destination. A node updates its path information only if the DestSeqNum of the current packet received is greater than the last DestSeqNum stored at the node.

A Route Request carries the source identifier (SrcID), the destination identifier (DestID), the source sequence number (SrcSeqNum), the destination sequence number (DestSeqNum), the broadcast identifier (BcastID), and the time to live (TTL) field. DestSeqNum indicates the freshness of the route that is accepted by the source. When an intermediate node receives a RouteRequest, it either forwards it or prepares a Route Reply if it has a valid route to the

destination. The validity of a route at the intermediate node is determined by comparing the sequence number at the intermediate node with the destination sequence number in the Route Request packet. If a Route Request is received multiple times, which is indicated by the BcastID- SrcID pair, the duplicate copies are discarded. All intermediate nodes having valid routes to the destination, or the destination node itself, are allowed to send Route Reply packets to the source. Every intermediate node, while forwarding a Route Request, enters the previous node address and its BcastID. A timer is used to delete this entry in case a Route Reply is not received before the timer expires. This helps in storing an active path at the intermediate node as AODV does not employ source routing of data packets. When a node receives a Route Reply packet, information about the previous node from which the packet was received is also stored in order to forward the data packet to this next node as the next hop toward the destination.

**Advantages and Disadvantages:**

The main advantage of this protocol is that routes are established on demand and destination sequence numbers are used to find the latest route to the destination. The connection setup delay is lower. One of the disadvantages of this protocol is that intermediate nodes can lead to inconsistent routes if the source sequence number is very old and the intermediate nodes have a higher but not the latest destination sequence number, thereby having stale entries. Also multiple Route Reply packets in response to a single Route Request packet can lead to heavy control overhead. Another disadvantage of AODV is that the periodic beaconing leads to unnecessary bandwidth consumption.

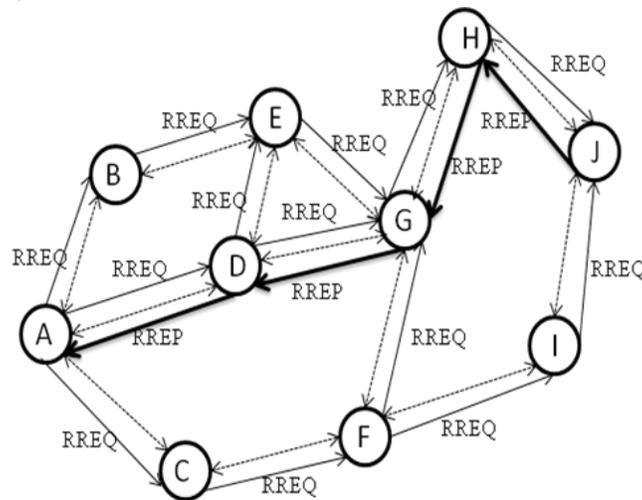


Fig.5: A possible path for a route replies if A wishes to find a route to J.

**Network simulator:**

DSDV and DSR routing protocols can be implemented using Network Simulator 2.31. NS is a discrete event simulator targeted at networking research. It provides substantial support for TCP routing and multicast protocols over wired and wireless networks. Using Xgraph (A plotting program) we can create graphical representation of simulation results. All the work is done under linux platform, preferably ubuntu [1]. NS is an object oriented simulator, written in C++, with an

OTcl interpreter as a frontend. NS uses two languages because simulator has two different kinds of things it needs to do. On one hand, detailed simulations of protocols require a systems programming language which can efficiently manipulate bytes, packet headers, and implement algorithms that run over large data sets. For these tasks run-time speed is important and turn-around time (run simulation, find bug, fix bug, recompile, re-run) is less important [1].

On the other hand, a large part of network research involves slightly varying parameters or configurations, or quickly exploring a number of scenarios. In these cases, iteration time (change the model and re-run) is more important. Since configuration runs once (at the beginning of the simulation), run-time of this part of the task is less important. NS meets both of these needs with two languages, C++ and OTcl. C++ is fast to run but slower to change, making it suitable for detailed protocol implementation. OTcl runs much slower but can be changed very quickly (and interactively), making it ideal for simulation configuration. In NS-2, the frontend of the program is written in TCL (Tool Command Language). The backend of NS-2 simulator is written in C++ and when the tcl program is compiled, a tracefile and namfile are created which define the movement pattern of the nodes and keeps track of the number of packets sent, number of hops between 2 nodes, connection type etc at each instance of time. In addition to these, a scenario file defining the destination of mobile nodes along with their speeds and a connection pattern file (CBR file) defining the connection pattern, topology and packet type are also used to create the trace files and nam files which are then used by the simulator to simulate the network. Also the network parameters can be explicitly mentioned during the creation of the scenario and connection-pattern files using the library functions of the simulator.

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## **Examination for Shell Wall Thickness of Magnesium Alloy Using Three Dimensional Printing**

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### **Abstract:**

Purpose of the current examination is to prove the practicability of shell thickness in rapid shell casting based upon three dimensional printing technologies. The shell used for casting are within the range of (12mm to 2mm).The material used for casting is magnesium alloy, in order to reduce the cost and time of production as well to evaluate the dimensional accuracy of the casting used for assembly purpose. The research shows that the shell thickness having value less than recommended one is more suitable from dimensional accuracy and economic point of view. The result shows that at 5mm shell thickness hardness of casting is improved by 10.1%. Further production cost and production time has been reduced by 53.7% and 55.4% respectively in comparison to 12mm recommended shell thickness, and further consistency with tolerance grade of the casting has been checked as per IT grades. The 3DP technique at different shell thickness provides satisfactory results.

*Keywords: Rapid prototyping; 3D printing; Magnesium alloy; CMM dimensional tolerance*

### **Introduction:**

RP technologies can create a physical part directly from a digital model by accumulating layers of a given material by means of the computer aided design (Wang et al.,2004).RP is an additive manufacturing process combining layers of paper, wax, powder or plastic to create a solid object(Wohlers,1995) (milling , drilling, grinding, etc.) Subtractive process that remove material from the solid block. In rapid prototyping various techniques (stereolithography, selective laser sintering, laminated object manufacturing,3 DP etc,) and machines have been developed. 3DP is an up runner of the ink-jet printing technology, which was originally developed some 30years ago. There are two types of ink jet printing Continuous ink jet printing or Drop-on-demand (Derby,2003). 3DP is a relatively new form of RP. The process of 3DP was patented in 1994 by (Sachs et al 1994). under U.S. patent number 005340656. It was developed at Massachusetts Institute of Technology (MIT) and licensed to Soligen Corporation, Extrude Hone and Z Corporation of Burlington. Parts are built upon a platform situated in a bin full of

powder material (as shown in Fig 1). Powdered material is distributed in form of a layer at a time and selectively hardened and joined together by depositing drops of binder from a mechanism similar to that used for ink-jet printing. After this a piston lowers the part, so that the next layer of powder can be applied. For each layer, powder hopper and roller systems distribute a thin layer of powder over the top of the work tray (Anonymous 2004). Adapted continuous-jet printing nozzles apply binder during a raster scan of the work area, selectively hardening the part's cross-section. The loose powder that wasn't hardened remains and acts as a support for subsequent layers. The process is repeated to complete the part. When finished, the green part is then removed from the unbound powder, and excess unbound powder is blown off. Finished parts can be infiltrated with wax, glue, or other sealants to improve durability and surface finish.(Singh rupinder, 2010).The techniques based on layer-by-layer manufacturing are extending their fields of application, from the building of aesthetic and functional prototypes to the production of tools and moulds for technological prototypes.(Bassoli et al., 2007).The additive construction applied to the production of dies and electrodes, directly from digital data, is defined as rapid tooling (RT). Patterns, cores and cavities for metal castings can be obtained through rapid casting (RC) techniques (Bernard et al., 2003; Rooks, 2002; Song et al., 2001). In both cases, since the tooling phase is highly efficient, great competitive advantages can be achieved. Moreover, RT and RC processes allow the simultaneous development and validation of the product and of the manufacturing process. Technological prototypes can constitute a strategic means, not only for functional and assembly tests or to obtain the customer's acceptance, but mainly to outline eventual critical points in the production process. The relevance of RC techniques consists, above all, in a short time for parts availability (Kumar et al., 2010). Traditionally, in order to produce cast prototypes a model and eventual cores have to be created, involving time and costs that hardly match the rules of the competitive market. For this reason, functional tests are typically performed on prototypes obtained by metal cutting (Rooks, 2002), which are not effective in outlining issues related to the manufacturing process. The possibility to verify the

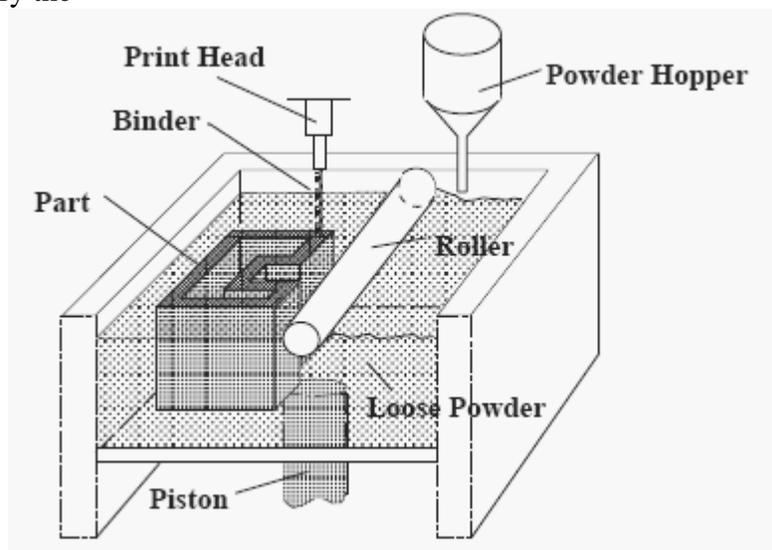


Fig.1 3D Printing Process

effectiveness of a technological solution, in the early stages of the product development, ensures a Concurrent Engineering approach and minimizes the risk of late modifications of the definitive production tools (Ramos et al., 2003). The initial cost increase can thus be repaid through a reduction of costs and time for the following phases of development, engineering and production, as well as through non-monetary advantages (Bernard et al., 2003). In particular, for relatively small and complex parts, the benefits of additive construction can be significant, thanks to its independence of geometry (Bak, 2003; Ramos and 2003). In this field, innovative solutions are now available based on 3D printing process, which can extend RC possibilities thanks to the lower costs with respect to previous technologies such as selective laser sintering of sand casting (Gatto and Iuliano, 2001). One such technological solution consists in shell casting starting from starch patterns produced on 3D-printing conceptual modellers. A second solution is the ZCaste process, in which 3D-printing technology with the use of a ceramic material allows the production of complex cavities and cores, suitable for casting light alloys (Radstok,1999) A key issue regarding the Shell casting process is the production of the pattern in the case of a prototype casting, for which the traditional die casting is uneconomical(Singh 2008).Rapid prototyping techniques can meet this requirement, producing single parts in short times and without tooling cost(Verma,2008)With the help of Rapid prototyping techniques parts can be produced in short times and without tooling costs. The present research aims at using the three dimensional printing technology as rapid shell casting to make the shell moulds. Experimental studies regarding this solution are lacking in literature, in particular the technological feasibility in the case of thin walled parts to be assessed.

Following are the objectives of our study:

- ❖ To find the best settings of the 3DP machine in terms of the layer thickness, part orientation and post curing time to make the RP shell moulds.
- ❖ To verify the feasibility of decreasing the shell thickness from recommended one in order to reduce the production cost and time.
- ❖ To evaluate the dimensional accuracy of the magnesium castings obtained and to check the consistency of the tolerance grades of the castings (IT grades) as per allowed IS standards for casting process.
- ❖ Confirmation of concept, to present the idea in physical form with minimum cost by avoiding the cost of making dies and other fixtures for a new concept.

#### **Experimental plan:**

To accomplish the desired objectives, an magnesium alloy component was chosen as a benchmark, representative of the automobile field, because magnesium alloys gets a huge importance with present demands for light and reliable construction. Magnesium alloys have low density and other benefits such as: a good vibration damping and the best from among all construction materials: high dimension stability, small casting shrinkage, connection of low density and huge strength with reference to small mass, possibility to have application in machines and with ease to put recycling process, which makes possibility to logging derivative alloys a very similar quality to original material (Dobrzanski,L.A 2006).

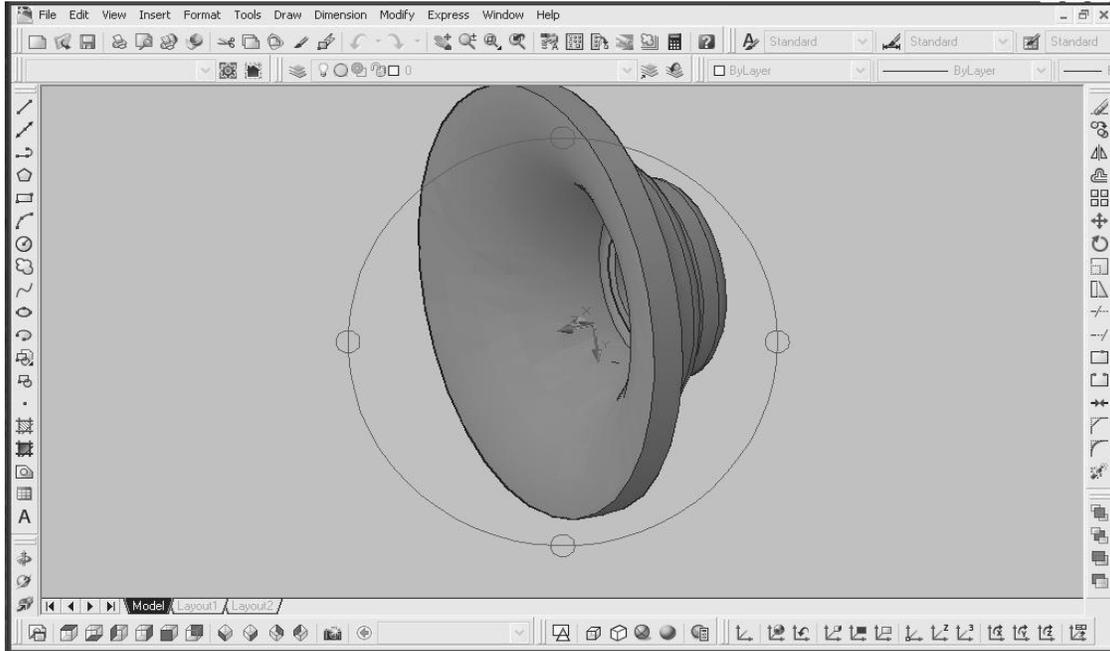


Fig. 2 CAD model of the benchmark

Where the applications of the RT and RC technologies are particularly relevant. The experimental procedure started with the CAD modeling of the benchmark (figure 2) having total volume of  $20483.83\text{mm}^3$  and surface area of  $9225.79\text{mm}^2$ . To obtain best settings of the 3DP machine in terms of layer thickness, part orientation and post curing time, upper and lower shell prototypes were produced by using RC solution based on the 3DP technology. A number of experiments were conducted for the possible outcomes of the 3DP machine with objective function of minimizing the production cost, production time and improvement in dimensional as well as mechanical properties. Post treatment for parts was chosen as standard specifications (6h isothermal at  $200^\circ\text{C}$  heating ramp of  $1.5^\circ\text{C}$ ). Four permutations were established for remaining two machine parameters- layer thickness and part orientation. So for these four permutations, four sets of experiments were conducted with the planning of following phases.

1. The analysis of benchmark leads to definition of the feeding system and riser in a concurrent product process development (Lewis et al., 2001).
2. CAD modeling of Upper and lower shells and these parts were manufactured by 3D printing technique
3. The inner surfaces of the cavity were air-blown and treated by foundry painting to improve the molten metal flow. Parts were assembled for co linearity of axes in both the planes and a commercial cast magnesium alloy was poured to obtain the technological prototype.

**Prototype development for different shell thicknesses and castings production:**

Starting from the CAD model of the component, shells were modelled for different shell wall thicknesses. From the analysis of geometry and volume of benchmark, single feeder and riser

System was designed for pouring the molten metal. RP shell models are used as positive patterns around which the sand is filled in a moulding box. Commercial cast magnesium alloy was used for casting.

**Measurement results:**

The measurement paths for the internal and the external surfaces of the benchmark have been generated through the measurement software of the DEA Iota 0101 CMM (Wolovich 2002). The different dimensions measured with CMM are outer diameter, curve radius and component thickness. Outer diameter was measured as ten (10) circles mean diameter at different points. The curve radius was measured by scanning the inner and outer curve surfaces. The results of the dimensional measurements have been used to evaluate the tolerance unit (n) that derives starting from the standard tolerance factor i, defined in standard UNI EN 20286-1 (1995). The values of standard tolerances corresponding to IT5-IT18 grades, for nominal sizes up to 500mm, are evaluated considering the standard tolerance factor i (in micrometers) indicated by the following formula, where D is the geometric mean of the range of nominal sizes in millimeters. (Singh and Kaplas, 2008)

$$\text{Tolerance factor } i = 0.45 (D)^{1/3} + 0.001D$$

In fact, the standard tolerances are not evaluated separately for each nominal size, but for a range of nominal sizes. For a generic nominal dimension  $D_{JN}$ , the number of the tolerance units 'n' is evaluated as follows:

$$N = 1000(D_{JN} - D_{JM}) / i,$$

Where  $D_{JM}$  is a measured dimension. The tolerance is expressed as a multiple of i: for example, IT14 corresponds to 400i with n= 400. The results of dimensional measurements are used to evaluate the tolerance grades. The obtained tolerance grades are IT13 and IT14. It is important to notice that the tolerance grades calculated for the considered RC techniques are consistent with the values allowed for casting operations, between IT11 and IT18 (chirone et al 2000). Since the technological prototypes lies in the range of IT11 to IT18, thus are completely acceptable at all shell thicknesses.

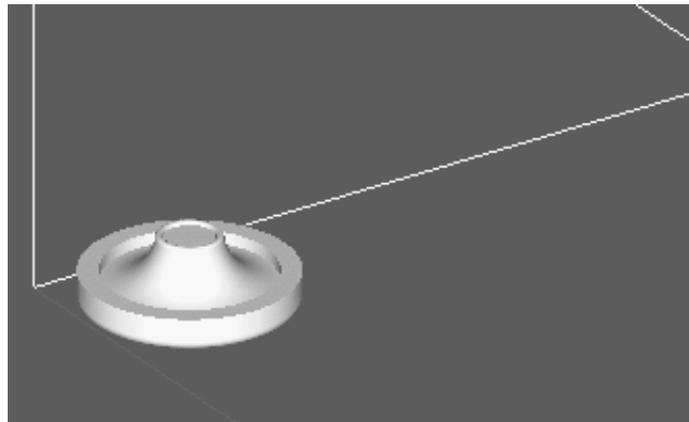


Fig. 3 Model of shell

Exp. No.	Shell Thickness (mm)	Outer Diameter		Standard Tolerance Factor (i)	Tolerance Unit (n)	Hardness value (BHN)	International Tolerance Grades
		D <sub>JN</sub>	D <sub>JM</sub>				
1.	12	50	49.500	1.69	270.5	71	IT13
2.	11	50	49.016	1.69	582.2	71	IT14
3.	10	50	49.239	1.69	450.2	70	IT13
4.	9	50	49.400	1.69	217.6	69	IT13
5.	8	50	49.151	1.69	502.3	69	IT14
6.	7	50	49.364	1.69	378.6	70	IT13
7.	6	50	49.414	1.69	347.0	78	IT13
8.	5	50	49.536	1.69	276.4	79	IT13
9.	4	50	49.167	1.69	497.0	76	IT13
10.	3	50	49.116	1.69	523.0	72	IT14
11.	2	50	49.022	1.69	575.2	74	IT14

Table 1. Observation of final experiment

Surface hardness of the casting obtained was measured on Brinell hardness testing machine. The machine used was Brinell hardness tester model - B 3000 (O).The result of surface hardness International Tolerance grades are shown in table 1and figures-4-5.

Shell thickness vs. outer diameter

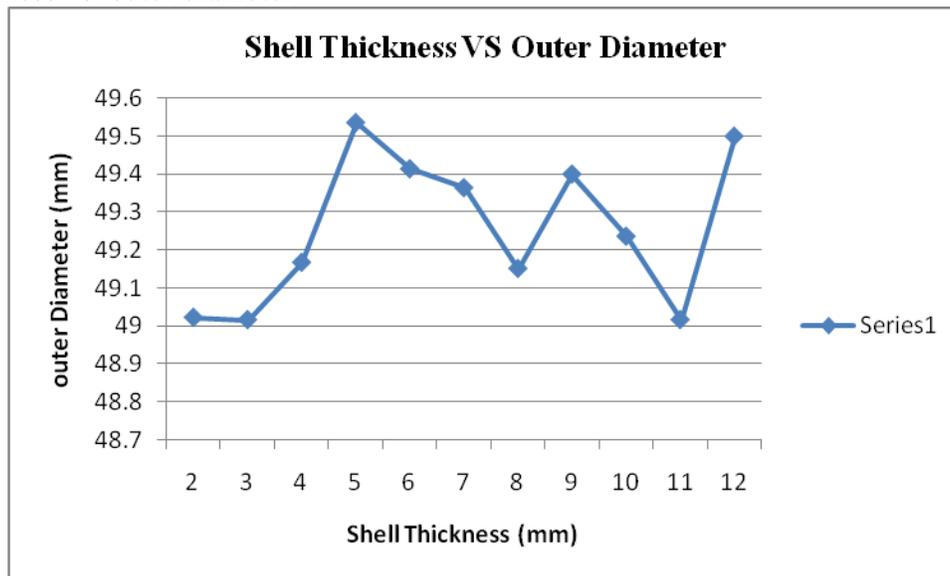


Fig. 4 Effect of shell wall thickness on outer diameter

Shell thickness Vs Hardness

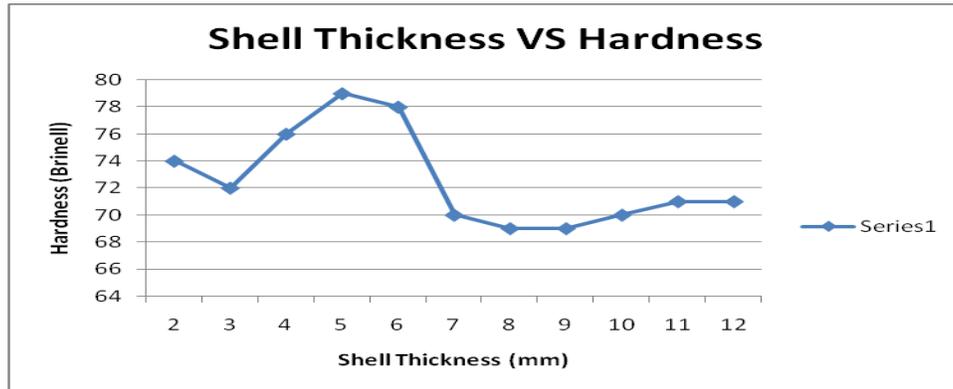


Fig. 5 Effect of shell wall thickness on surface hardness

### Conclusion:

The following conclusions can be drawn from the experimental observations made on the magnesium alloy consisting of different shell wall thickness:

1. It is feasible to reduce the shell thickness from the recommended value of 12mm to 2mm. The tolerance grades of the castings produced from different thicknesses were consistent with the permissible range of tolerance grades (IT grades) as per standard UNI EN 20286-I (1995).
2. The hardness obtained with 5mm thickness was better. However marginal improvement in dimensional accuracy has been observed.
3. It has been observed IT grades comparable to machining (IT13) can be obtained with 3DP, for magnesium alloy. The adopted procedure is better for proof of concept and for the new product, for which the cost of production for dies and other tooling is more.
4. The result indicate that at the 5mm shell thickness, hardness of the casting was improved by 10.1% , The production cost and production time was 53.7% and 55.4% less in comparison to recommended shell thickness.

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## “Work Culture in Public and Private Sector Organizations of Rewa Division”

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### **Abstract:**

Human systems are shifting away from bureaucratic organizational cultures, with their emphasis on a pyramidal structure that places on employee in a hierarchy, and from authoritarian decision-making. Traditional managers who resist such changes find their organisations suffering server institutional crises, or “Organizational Shock”. The challenge of the super industrial age is for existing organisations to go through a process of planned renewal, while innovators create new organizational forms and leadership approaches. The new work culture in the twenty first century is emerging as a result of global shift from business and commerce centered on the production of goods by machines to knowledge-intensive and often highly technical activities that are dominated by information processing and services. Work culture governing the relationship with in the organisation between employer and employee. The purpose is to accomplish a reasonable integration and productive collaboration towards a culture of harmony and goodwill, depends upon the work culture and increase in productivity & efficiency depends upon the organization effectiveness. Strong cultures are sought out by talented people who both want to work and choose to winning the war for talent and being a competitor. Positive culture opens the door to productivity by which organization will effective. This research paper defines the concept of work culture and describes the way of life of a particular group of people. It also highlights, what is distinctive about the way members in society, what with one another and with outsiders and how they achieve what they do. This research paper also highlights the changes in the organizational landscape as well as highlights the importance of work culture in public & private sector of Rewa division.

*Key words: Bureaucratic Organizational Cultures, Traditional Managers, Collaboration, Society and Public and Private Sector.*

### **Introduction:**

Contemporary organisations are in a state of profound transition, as is all of society. Since the early 1950s, there has been a move away from industrial age institutional models and managerial styles. Human systems are shifting away from bureaucratic organizational cultures, with their emphasis on a pyramidal structure that places on employee in a hierarchy, and from authoritarian decision-making. Instead, institutions are moving towards more “ad-hocracy”, with fluid, temporary arrangements and greater participation by personnel in total operations. Traditional managers who resist such changes find their organisations suffering server institutional crises, or “Organizational Shock”. The challenge of the super industrial age is for existing organisations to go through a process of planned renewal, while innovators create new organizational forms and leadership approaches. But this is only one dimension of institutional transformation now

underway. A committee of the National Academy of Science of United States has put it best in 1981 issue of the Futurist:

“The modern era of electronics has ushered in a second industrial revolution its impact on society could even be greater than that of the original industrial revolution.” We are beginning to appreciate the significance of the forecast. The changes brought by communication satellites, computer networks and Internet have literally created the global village and its information highway. Further research and development in outer space, biotechnology and cybernation continually spawn new technologies and industries that will impact our personal and work lives. The high technology businesses that result are usually created around the innovative applications of silicon chips, micro processing and miniaturization. Such breakthroughs have aided and abetted the productions of robots for computerised assembly lines and other displacements of humans from the drudgery of mindless work. Accompanying the rapid advances of microelectronics are swift developments in genetic engineering, leading to the formation of “gen-tech” business. Such new commercial enterprises are met industrial organisation. The new work culture in the twenty first century is emerging as a result of global shift from business and commerce centred on the production of goods by machines to knowledge-intensive and often highly technical activities that are dominated by information processing and services. The outcome not only alters the way we create and define wealth, but also transforms management, organisations and society itself. The human resource professionals should lead in this process because they are the most suitable persons to facilitate the creation of more relevant work environment and organizational work culture. (Harris, 2003). Work culture governing the relationship with in the organization between employer and employee. The purpose is to accomplish a reasonable integration and productive collaboration towards a culture of harmony and goodwill, depends upon the work culture and increase in productivity & efficiency depends upon the organization effectiveness. The work culture of any organization falls broadly into positive and negative culture. Great companies create positive culture strong work culture-places where the work culture is as well known as the product and services. Strong cultures are sought out by talented people who both want to work and choose to winning the war for talent and being a competitor. So, the positive culture will open the doors to productivity by which organisation will become more effective.

The positive and rich work culture is the benchmark of organizational effectiveness. This depends upon the productivity and turnout productivity – achieving quality & quality of results while controlling inputs is the central idea that the employee of the company or organization need to absorb in order to develop the capacity to progress of any organization.

- Financial capital in terms of investments and profits.
- Technological capita in terms of cutting-edge software and hardware.
- Human capital in terms of knowledge, expertise.
- Social-spiritual capital in term of ethics, relationships, meaning and purpose.

The work culture of an organization is a product of its history, tradition value & vision. According to Salaman (1978) organizational work culture is a management tool, and its use is regarded as part of management theory.

This concept of work culture is one that has been used from the discipline of anthropology, where it has long been used to describe the way of life of a particular group of

people. It also highlights, what is distinctive about the way members in society, what with one another and with outsiders and how they achieve what they do.

Organizational work culture “is” a group-up set of factors, which employees can readily identify. Another definition of organizational work culture is “The set of important understandings, such as norms, value, attitudes and beliefs, shared by organizational members.” Over the last 15 to 20 years, the concept of organizational work culture has been expanded to understand what goes on in organization. Work culture has usually been strongly shaped by the history of organization (Schein, 1992).

**Purpose of this research:**

- Changes in the organizational landscape that have highlighted the importance of work culture in public & private sector of Rewa division.
- The visibility of high profile companies that consider positive/negative work culture as there success.
- To exploring the above view of research, the research is conducted in to comparing the public and private of Rewa division.

**The Main Objectives of the Study:**

The main objectives of the present research are as were follows;

1. To study the significance of difference of organizational work culture between private and public sector organizations of Rewa division.
2. To study the significance of difference of mission dimension of organizational work culture between private and public sector organizations of Rewa division.
3. To study the significance of difference of adaptability dimension of organizational work culture between private and public sector organisations of Rewa division.
4. To study the significance of difference of involvement dimension of organizational work culture between private and public sector organizations of Rewa division.
5. To study the significance of difference of consistency dimension of organizational work culture between private and public sector organizations of Rewa division.

**Hypothesis:**

1. It was hypothesised that work culture would be significantly different in public and private sector organisations.
2. It was hypothesized that the mission component of organizational work culture would be significantly different in public sector and private sector organizations of Rewa division.
3. It was hypothesised that the adaptability component of organizational work culture would be significantly different in public sector and private sector organisations of Rewa division.
4. It was hypothesised that the involvement component of organizational work culture would be significantly different in public sector and private sector organisations of Rewa division.

5. It was hypothesised that the consistency component of organizational work culture would be significantly different in public sector and private sector organisations of Rewa division.

### **Review of the Literature:**

The Industrial policy resolution of 1948 made it very clear that the manufacture of arms and ammunition the production and control of atomic energy and the ownership and management of railway transport would be the exclusive monopoly of the central government. It was resolved further that in other six industries the state alone set up new undertaking. These six industries were: Coal, Iron, Steel, Aircraft manufacture, Ship building manufactures of Telephone, Telegraph and Wireless apparatus, excluding radio receiving sets and mineral oils. According to R.C. Dutt, (1950) who has associate with the public sector for long years, the research on social economic scenario was and analysis of public Vs private sector specially from the point of view of a developing economy he gave some suggestions for development of public sector and its alternatives, in developing countries. The Industrial Publicly Resolution of 1956 enlarged the role of the public sector. It stated "The adoption of the socialist pattern of society as national objectives as well s the need for planned and rapid development requires that all industries of a basic and strategic importance, or in the nature of public utility services, should be in the public sector. Thomas Roleins (1956) stated that work culture is not the same thing as national culture, regional culture or any other type of culture. By "Work Culture" we are specifically referring to the values and behaviours of employees in work organisations such as corporations and not for profits. Work culture is certainly influenced by these other type of cultures. Infact, many organizations the world, strive to build and maintain the work culture that hold all over despite the fact' that they must recognised distinctive adapt to different local culture, laws, and practices. Deal and Kennedy (1982) defined organizational culture as the way thing gets done around here. Risk- represents the degree of uncertainty in the organisation's activities. Handy (1985) popularised a method of looking at culture, which some scholars have used to link organizational structure to Organizational Culture. The connection between effectiveness and culture was made by Schein (1985) as relating to issues o external and internal survival and the positive relationship of organizational cultural and these issues. Bhadury, Bikash (1991) Work cultures an exposition in the Indian context, examines the influence of work culture on organizational effectiveness and on motivating individual employees. Agrawal, N.M. (1993) discusses the issues of leadership and role of training and trainers in developing a work culture in Indian organization. Harris and Moran, (1996) Organizational culture is a human creation subject to change and modification, for it touches every aspects of the institution's life-film corporate structure to corporate climate. Knowledge of the six general classifications, all aspects of a corporate culture, may help managers increase their awareness of the workings of the organization and their effectiveness as managers. The context for this will be the emerging mega industrial work culture. Government in July 1997, Unfolded its strategy to grant autonomy to some plus on an experimental basis the objective of the new approach was to select some vanguard PSUs to suppose them in their drive to become global gnats. The government, after a detailed and in depth inter ministerial discussions selected nine PEs for making them truly world-class entities and it euphemistically named these as navaratanas. These are Bharat Heavy Electrical Ltd. (BHEL), Bharat Petroleum Corporation Ltd (BPCL), Hindustan Petroleum

Corporation Ltd (HPCL), Indian Petrochemical Corporation Ltd. (IPCL), National Thermal Power Corporation Ltd. (NTPC), Oil and Natural Gas Corporation Ltd. (ONGC), Steel Authority of India Ltd. (SAI) and VSNL.

**Research Methodology:**

The Sampling Technique: The present study was a scientific survey with the help of structured questionnaire and standardised scale. If sample data are to be used as the basis for generalization to a population. It is essential that the sample should be representative to the population and it must be adequate also (Goode and Hatt 1952). In a sample the present research a sample of the 400 employees was selected through purposive sampling technique from two types of industrial organisation i.e. public sector organizations and private sector organisations of REWA division. Against the targeted sample of 400 questionnaires, 300 questionnaires have been collected and analyzed.

**Research Design:**

The present study was concerned for finding out the role of work culture of public sector organizations and private sector organizations of REWA division.

**The tools of study:**

Questionnaire of Work Culture was developed by the researcher for measuring different dimensions of work culture of the public sector organizations and private sector organizations of REWA division.

**Development of Questionnaire:**

The researcher first of all identified the dimensions of work culture with the help survey of related research literature. Four dimensions namely – mission, adaptability, involvement and consistency were identified. Each of them was consisting of three sub dimensions. Thus, in all twelve sub dimensions of work culture were taken into account. For each sub dimension five questions (in all 60) were framed. All the questions were of binary type having choices between “Yes” or “No”. The preliminary form of questionnaire was given to twenty-two subject experts for their critical comments. They were requested to read the whole questionnaire including the instructions to be provided to the respondents and make the five experts for rating. The dimensions with hundred critical comments on the suitability of each question item vis-à-vis the related dimension of the work culture. They were requested to indicate whether the construction of questions with respect to its contents, language, complexity level etc. was adequate. The questions, which were reported faulty, were reframed or replaced accordingly. Thus the questionnaire consisted of four dimensions and each dimension had three sub-dimensions for each sub-dimension five questions were framed. So questionnaire had in all 60 questions with “Yes” or “No” choice as response. The details of the dimensions and sub dimensions of the work culture taken for making the questionnaire are given below.

S. No.	Dimension	Sub-Dimension	Question No.
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1.	Mission	(i) Strategic direction intent (ii) Goals & objectives. (iii) Vision.	1 to 5 6 to 10 11 to 15
2.	Adaptability	(i) Creating change (ii) Customer Focus. (iii) Organizational Learning	16 to 20 21 to 25 26 to 30
3.	Involvement	(i) Empowerment. (ii) Team orientation (iii) Capability development.	31 to 35 36 to 40 41 to 45
4.	Consistency	(i) Core Values. (ii) Agreement (iii) Coordination & integration	46 to 50 51 to 55 56 to 60

Table 1: Details of the Dimensions and Sub dimensions of Work Culture used in the Questionnaire.

**The Collection of Data:**

The collection of data is a technical process. It needs a clear graph of process and its various facts. The responders need suitable motivation to take up the test in right way and express their real feelings in a frank and straightforward manner. Thus the subjects of the present study were selected from the specific population. The selected employees were administered tests and requested to answer the questions sincerely and truthfully. They were assured that the responses would be kept confidential.

**Administration and scoring of work culture Questionnaire:**

The work culture questionnaire having 60 questions each with a binary “Yes/No” response was administered to the employees selected as sample of the two types of organization. Each subject was administered the questionnaire individually. Before the administration of the questionnaire the respondents were taken into confidence by establishing rapport. They were informed about the nature of research being conducted by the researcher. Efforts were made to explain that the purpose of the research was strictly academic and that in no case their responses are going to be used for any other purposes than the present research work. This questionnaire and its enquiries for furnishing feedback response from different levels of employees both at individual as well as for group employees were used. Type of assessment was depending upon individual ability i.e. literate and illiterate people. In case of illiterate group of respondents it was directed & assisted by the investigator. The time for responding was 25-30 minute approximately. Guidelines concerning process of responding were specified at the cover page. All these data, facts, figure were analysed. However the identity of the respondent was kept confidential. The responses to

the items in the questionnaire were converted into scores as Yes or No. The questionnaire of work culture has been divided into 4 dimensions, which are further segregated into 3-sub dimension & each sub dimension has respective 5 questions. The sample was of 300 employees of 2 types of organisation i.e. public & private (each having 150 samples). The scoring score has been arranged in two parts i.e. positive & negative work culture. The raw score falls between “+” and “-“work culture of the organisation. Each “+” ensure score as 1 for “-“answer it goes as 0. So, Maximum score of this questionnaire for individual employees is 60 and Minimum is 0.

**The Statistical Techniques Used:**

The data was subjected to statistical analysis for the purpose of interpretation. Descriptive statistics such as mean, standard deviation were computed to understand the interdependence between the variables. T- Test and correlation coefficient analysis was used to test the hypotheses.

**Main Results of this Research:**

Organization culture	Private Sector N=150 (Mean)	Public Sector N=150 (Mean)	t	P
Work culture (overall)	41.01	44.37	3.60	<0.01
Mission dimension	10.36	11.15	2.93	<0.01
Adaptability dimension	10.51	11.27	3.56	<0.01
Involvement dimension	9.93	11.36	5.21	<0.01
Consistency dimension	10.21	11.21	3.61	<0.01

Table 2 Relationship between the variables

From the above Table 2, it can be observed that the work culture of public sector “ shows a higher score on the mean indicating that positive work culture. A correlation indicates the strength of the association between the variables. A correlation coefficient is considered significant if the p- value is less than 0.01.

Table 2 reveals the results of t-test analysis. Independent variables work culture explained (t = 3.60, p <0.01). The result indicates that there are four dimensions of work culture namely, mission (t= 2.93, p< 0.01), adaptability (t= 2.93, p< 0.01), involvement (t= 5.21) and consistency (t=3.61, p< 0.01), which are positively associated with work culture. these four dimensions of work culture are directly responsible for presence and sustenance of work culture in organizations. Moreover it can be concluded from the findings that Thus hypothesis 1, 1.1,1.2,1.3 and 1.4 were confirmed. It means the work culture would be different in public sector & private sector organizations of Rewa division,” was confirmed and shows the public sector organization has good work culture with comparison to the private sector organizations in Rewa Division.

**Discussions:**

Work culture would be significantly different in public and private sector organisations of Rewa division". Mr. T.V. Rao suggested OCTAPCE culture for organisations which to be good culture stands for Openness, Conformation, Trust, Autonomy, Proclivity, Authenticity, Collaboration and Experimentation. Angyal (1941) suggested that the "culture is a socially inherited body of directives which define the 'proper' and 'improper' ways of behavior", could help to highlight on one hand the complex environment to which one has to adjust; on the other, being assimilated by the individual, it functions part of the super-ego and conditions his tendency to autonomy." The work culture of any organization starts with the people who make up the organization we have such a diverse at base, respect is required, individuality is obvious and team work is key to achieve mile stone over the years. This team success breeds a Passion & Enthusiasm for what personal goal with organizational goal to achieve result. The work culture is concerned with the how employees perceive the characteristics of an organization. It is a common perception held by the shared meaning a pattern of basic group assumption that has worked well enough to be considered valid and therefore is thought to new members as the correct way to perceive think & feel about the organisation's goals and its effectiveness. Edgar H. Schein (1992) suggests that work culture exists at three levels, namely. Artifacts, espoused values and underlying assumptions refer to the things that one sees, hears and feels when one encounters a new group, with an unfamiliar culture. For example in a certain organization superiors would be addressed by their first name, while in another, they would be addressed as MR/Mrs...these differing artifacts are evidence of two very different organizational work cultures. Artifacts are everywhere and we can learn about a culture by paying attending to them. Espoused values are the reasons given by an organization, for the way things are carried out. In most organizational work culture, espoused values can be traced back to the founders of the culture. Example of values would be safety to products, quality and superior performance of products. Basic underlying assumption, are the beliefs that organizations members take for granted? "Work culture prescribed "the right way to do things" in an organization, often through unspoken assumption." The action of the current top management sets the general climate of what is acceptable behavior and what is not. How employees are to be socialized will depend both on the degree of success achieved in matching new employees' values to those of the organization's. It plays significant role in the selection process and on top management's preferences for socialization methods. It simply means work culture of the organization depend upon employees and employer also but study shows we can see the more positive work culture where the employees satisfied with the organization and do there work very effectively and efficiently. The present research study was conducted on the employees of National Thermal Power Corporation (NTPC) and TONES HYDROELECTRIC PLANT, Sillpara of M.P.E.B. Both of these were represented the public sector of Rewa Division. The other two organizations were from Private Sector. These were Maihar Cement Factory, Maihar and VTL, Rewa. The secondary information/data shows that both the public sector company's studied were having a very good performance records. NTPC has been one. of the "Nav Ratna" of Indian industries perhaps it is the reason that the findings show that public sector's organizational work culture was as good as that of private sector of the region. In fact in most of the dimensions of work culture and organizational effectiveness the public sector was found better as compared to the private sector of the region.

**Limitations:**

- (i) Due to limited time and limited resources at the disposal of the researcher only four organizations/industries were studied. Out of these four two from public sector and other two from private sector. The public sectors were NTPC, Singroli (Disti- Sidhi) and TONES HYDROELECTRIC plant, Silpra (Rewa). The private sectors were MAIHAR CEMENT (Distt. Satna) and VTL (Rewa). It was presumed that above four organizations /Industries represented the public sector and private sector organization of Rewa division.
- (ii) The secondary data given by the companies or organizations were very limited therefore the researcher had depended upon responses given by the responded.
- (iii) The sample size of the present study relatively small, looking to time constraints and nature of work, it was considered appropriate.

**Scope for further research:**

- (i) If a similar research study conducted in the future the researcher must try to verify the finding reported here. It is required because the present findings indicate that the work cultures of the public sector organizations of Rewa division were found better as compare private sector of this region. This is counter to general belief that private organizations have better work culture and more effective organizations than the public sector.
- (ii) The sample size should be larger than the present study.
- (iii) Organizations/Industries from other regions of the country is should also be covered, so the finding can be applicable not only the particular region but to the whole country.

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## **Performance and Evaluation of a Diesel Engine Fuelled with Filtered Pongamia Oil and its Standardization Characteristics**

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### **Abstract:**

Filtered Pongamia oil was tested in 4-stroke single cylinder water cooled diesel engine. Brake thermal efficiency of PO 100 has been found to be 63.11% higher than that of diesel at part load where as it reduces to 11.2% with diesel fuel at full load. After doing the transesterification process the viscosity is reduced from 32.27cs to 5.93 cs. (i.e a reduction of 88.84% ).

*Key words: Filtered Pongamia oil; Transesterification; Acid value; POME; Engine performance and emission*

### **Introduction:**

Biodiesel is fatty acid of ethyl ester or methyl ester made from virgin or used vegetable oils and animal fats. The main common sources for biodiesel in India can be non edible oils obtained from plant species such as *Jatropha curcas* (Ratanjyot), *Pongamia Pinnata* (Karanja), etc. Biodiesel contains no petroleum, but it can be blended at any level with petroleum diesel to create a biodiesel blend or can be used in its pure form. Just like petroleum diesel, Biodiesel works in compression ignition engine, which essentially require very little or no engine modification because biodiesel has properties similar to petroleum diesel fuels. The use of biodiesel in conventional diesel engines results substantial reduction of un-burnt hydrocarbons, carbon monoxide and particulate matters. Both edible oil such as Soybean, Rapeseeds, Canola, Sunflower, Cottonseeds etc. and non-edible oils like *Jatropha*, *Karanja*, *Neem Mahua* etc. has been tried to supplement diesel fuel in various countries. In U.S., biodiesel programme is based on their surplus edible oils like soybean and in Europe from Rapeseeds and Sunflower oils. Under Indian conditions an emphasis is being laid by the government to explore the possibility

of using non edible oils as biodiesel. The problem of high viscosity of vegetable oils has been approached in several ways such as preheating the oils, blending or dilution with other fuels, transesterification and thermal cracking/pyrolysis[1]. High viscosity may lead to poor atomization of the fuel, to incomplete combustion, to choking of the fuel injectors, to ring carbonization, and to accumulation of fuel in the lubricating fuels. A way to avoid these problems is to reduce the viscosity of vegetable oil in order to improve its performance. The objective of this study is to carry out an experimental investigation of the performance of diesel engine fuelled with filtered pongamia oil and its methyl ester compared with diesel fuel.

**Characterization of filtered Pongamia oil:**

In the present study, the filtered pongamia oil, a non-edible type vegetable oil is chosen as potential alternative for producing biodiesel and use as fuel in compression ignition engine. It is an evergreen tree growing in some states of India. It is a multipurpose tree native to Indian subcontinent and south East Asian countries. It grows in drier areas. Pongamia seed kernels contain 40-50% of yellow coloured oil. The significant properties of pongamia oil are found out during present investigation. The characteristics of the vegetable oils fall within a fairly narrow band and quite close to those of the diesel oil. The calorific value of pongamia oil increased 49.48 % than that of diesel. The kinematic viscosity of pongamia oil is however, several times higher than that of diesel oil. The high viscosity of pongamia oil is however, several times higher than that of diesel oil. The high viscosity of pongamia oil about 32.27 cSt. and 3.7 cSt. for diesel oil at 400 C, leads to problem in pumping and atomization in injection system of a diesel engine. The combination of high viscosity and low volatility of pongamia oil causes poor cold engine start up, misfire and ignition delay. Hence, it is necessary to bring their combustion related properties closer to those of diesel oil. The fuel modification is mainly aimed at reducing the viscosity of vegetable oils to get rid of the flow related problems. The free fatty acid content of filtered pongamia oil is about 2.84. It has been established that the ester yield decreases with increase in free fatty acid. Alkaline transesterification takes place only with refined oil having free fatty acid value less than 2 %. It is found that transesterification would not occur if free fatty acid content in the oil were about 3%. Therefore, the alkaline catalyzed transesterification process is not suitable to produce esters from filtered pongamia oil. In order to reduce the acid value, the oil is to be refined first, however the use of refined oils for transesterification will increase the overall production cost of the esters. Hence the present efforts are aimed at the production of esters from filtered high free fatty acid pongamia oil and to analyze its suitability as fuel in diesel engines[4]. The table 2 shows the various equipments were used to determine fuel properties.

Name of fuel property	Method
Relative density	Hydrometer, IS: 1448 [P:32]: 1992.
Kinematic viscosity	Redwood Viscometer, IS :1448 [ P : 25] 1976
Flash point and fire point	Closed cup flash and fire point apparatus, IS: 1448 [ P : 32]: 1992
Cloud point and pour point	Cloud and pour point apparatus, IS: 1448 [P : 10]: 1970
Calorific Value	Bomb calorimeter, IS: 1448 [P:6]: 1984
FFA content	Titration with 0.1 N NaOH

Table 2: The different apparatus used in fuel characterization

**Transesterification of filtered pongamia oil:**

The transesterification process consists of the following stage. The products of first step are transesterified using alkaline catalyst. The important parameter affecting the transesterification process such as alcohol to vegetable oil molar ratio, catalyst concentration, preheating temperature, reaction temperature and reaction time are analyzed. In single stage process the methanol oil ratio 0.178 to 0.356 w/w and alkali catalyst (KOH) 0.01 to 0.03% w/w is pre-mixed in a flask and added rapidly in to oil. The mixture is put into water bath shaker and stirred and heated for about 0.75-1.15 hrs at 600C. The rate of stirring in the start was more vigorous in the range of 650-700 rpm and it reduced to 450-500 rpm after the mixture temperature attained 600C. After the reaction is over within the specified time period, the mixture is poured to in a separating flask and kept overnight for settling. The upper layer is methyl ester (biodiesel) and lower dark layer is glycerol and impurities. The top layer (ester) is separated and purified using silica gel. The lower layer discarded.

**Biodiesel characterization:**

The properties of pongamia oil methyl esters are quite comparable to that of other fuels. Transesterification improves the important fuel properties of oil like density, kinematic viscosity, flash and fire point, cloud and pour point and calorific value. The comparisons show that the methyl ester has to fuel properties relatively closer to diesel as compared to of original filtered pongamia oil. The viscosity was substantially got reduced from a value of 32.27 to 5.93 cSt. The flash and fire point of ester is higher than that of diesel. A small percentage of biodiesel addition with diesel can definitely improve the flash point of resultant mixture, hence this fuel is safe to store and transport compared to that of pure diesel. Viscosity is measured by using Redwood Viscometer, density is measured by hydrometer. Flashpoint and fire point is measured by closed cup apparatus. Calorific value and aniline point, cloud and pour point is measured by oxygen bomb calorimeter, aniline point apparatus, cloud and pour point higher than that of diesel. The experimental results indicated that the relative density of pongamia methyl ester was slightly increased to that of diesel. The kinematic viscosity of diesel, pongamia oil, and pongamia methyl ester were found as 3.7,32.27 and 5.93cSt.at 400C. The results indicated that the pongamia methyl ester had the kinematic viscosity 88.844 percent more than that of diesel. The calorific value of diesel, pongamia oil, and pongamia methyl ester were found as 8770,8511.63,and 9163Kcal/kg respectively. The calorific value of pongamia oil is decreased by 2.94% than that of diesel respectively whereas the calorific value of pongamia methyl ester is increased by 4.48% than that of diesel. The pongamia methyl ester was found to have higher flash and fire point than those of diesel. The flash and fire point of pongamia oil was found to be higher than those of diesel. The result also reveals that the cloud and pour point of pongamia oil and pongamia methyl ester are lower than those of diesel. The table 2 showing the comparative analysis of selected fuels.

Fuel property	Pongamia oil	Pongamia oil methyl ester	Diesel
Density(gm/cc)	0.915	0.87	0.830
Viscosity(cSt)	32.27	5.93	3.7
Flash point(0C)	125	148	60

Fire point(OC)	150	165	65
Cloud point(OC)	5	-1	-12
Pour point(OC)	1	-5	-16
Calorific value(Kcal//Kg)	8511.63	9163.00	8770

Table 2 Fuel properties of Pongamia oil and Pongamia methyl ester and Diesel

**Engine test:**

**Experiment Set up and methodology:**

A four stroke, single cylinder water cooled diesel engine is employed for the present study. The detail specification of the engine used is given in table 3. AVL 437 Smoke meter is employed to measure the smoke opacity of exhaust gas emitted from the diesel engine. AVL DiGas 4000 Five gas analyzer was used to measure the concentration of gaseous emissions such as Oxides of nitrogen, unburned hydrocarbon, smoke opacity, carbon monoxide, carbon dioxide and oxygen level. The performance and emission tests are carried out on the C.I. engine using various blends of biodiesel and diesel as fuels. The tests are conducted at the constant speed of 1500 rpm at various BMEP. The experimental data generated are documented and presented here using the biodiesel-diesel mixture for 1 hr engine test operation. In each experiment, engine parameters related to thermal performance of engine such as brake thermal efficiency, brake specific fuel consumption, brake specific energy consumption, exhaust gas temperature and applied BMEP are measured. In addition to that, the engine emission parameters such as Oxides of nitrogen, unburned hydrocarbon, smoke opacity, carbon monoxide, carbon dioxide and oxygen level were also measured.

Engine	KIRLOSKER TV1
General Details	Four Stroke, CI, Water cooled,
Single Cylinder	
Compression Ratio	17.5 : 1
Capacity	661 cc
Rated Output	5.2 kW at 1500rev/min

Table 3: Engine specification

**Engine performance parameters:**

**Brake thermal efficiency:**

The variation of brake thermal efficiency with respect to brake mean effective pressure for different fuels is presented in fig.2. In all cases, brake thermal efficiency increases for all blends but not more than diesel. The maximum brake thermal efficiency obtained while using POME was 16.53% at part load. Brake thermal efficiency of PO is 63.11% higher than that of diesel at part load where as it reduces 11.2% with diesel fuel at full load. POME show decreasing trend with diesel fuel. Brake thermal efficiency of diesel is 15.37% and 36.89% at part load and full load respectively.

**Specific fuel consumption:**

The variation of specific fuel consumption with brake mean effective pressure for different fuel is presented in fig.3. For all fuel tested, brake specific fuel consumption is found to decrease with increase in brake mean effective pressure. This is due to the higher percentage increase in brake power with brake mean effective pressure as compared to the increase in fuel consumption. At part load, brake specific fuel consumption of POME was observed 27.75% higher than that of diesel at full load. Finally we conclude that it decreases at part load on one hand, it shows increasing trend at full load. It may noted that the calorific value of pongamia methyl ester is decreased by 7.42% than that of diesel. With increase in bio diesel percentage in blends increase as compared to that of diesel . The specific fuel consumption of pongamia oil methyl ester is higher than that of diesel for full load. This is caused due to the combined effect of higher viscosity and lower calorific value of the filtered pongamia oil .

**Brake specific energy consumption:**

The variation of brake specific energy consumption with respect to brake mean effective pressure for different fuels considered for the present analysis is in fig 4. The brake specific energy consumption of NO is increased by 23.96% at full load where as it decreases by 14.07% at part load. The brake specific energy consumption at part load is decreased at all loads when tested with POME and its blend. But it revealed that brake specific energy consumption of POME and its blend show increasing in trend at full load. The brake specific energy consumption of POME was observed 15.06% lower than that of diesel at part load where as 18.27% higher than that of diesel at full load. It is slightly increased due to lower C.V. The differences in brake specific energy consumption may be a reflection of higher density.

**Exhaust gas temperature:**

The variation of brake thermal efficiency with respect to brake mean effective pressure for different fuels as shown in fig 5. The bio diesel also contains some amount of oxygen molecules in the ester form. It is also taking part in combustion. When biodiesel concentration is increased, the exhaust gas temperature increases by small value. Using 100% filtered pongamia oil, higher exhaust gas temperature is attained at full load, which is indicating more energy loss in this case. The exhaust gas temperature increases with increase in brake mean effective pressure at full load only. POME show decreasing in Nature at part load. The exhaust gas temperature of POME was obtained 6.83% lower than that of diesel at part load and it increases at full load by 14.4% than that of diesel. It shows increasing in trend at full load.

**Exhaust emission parameter:**

**Smoke opacity:**

The variation of smoke opacity with respect to brake mean effective pressure for different fuels as shown in fig 11. POME revealed that it increases with high percentage at part load and it decreases at full load condition. It lowers by 18.39% than that of diesel fuel. In case of NO, it again increases by 70.27% than that of diesel fuel at part load and slightly increases at full load condition. It increased due to the higher viscosity and poor volatility of pongamia oil and its ester compared to diesel and it is mainly due to emission of heavier molecules of hydrocarbon and particulates. It is reduced due to reduction in viscosity and subsequent improvement in spray and

fuel-air mixing. Smoke is formed due to incomplete combustion. As smoke is low then better combustion of tested fuel takes place.

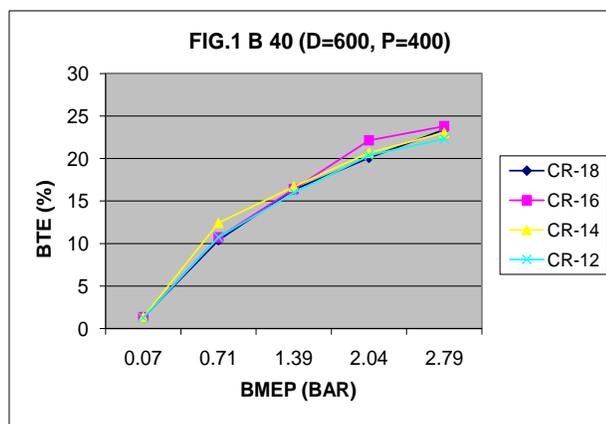
**Conclusion:**

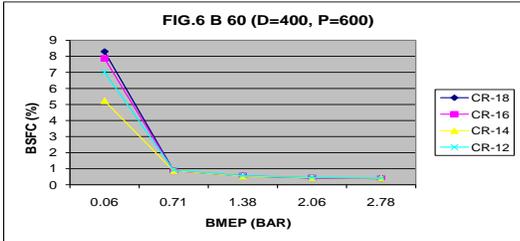
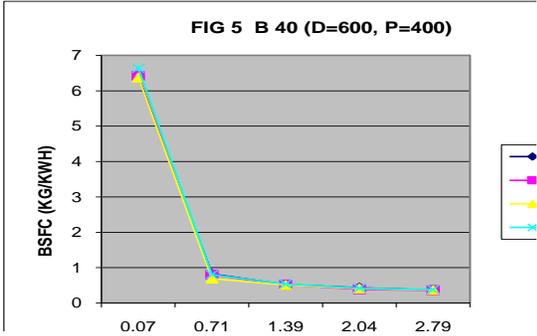
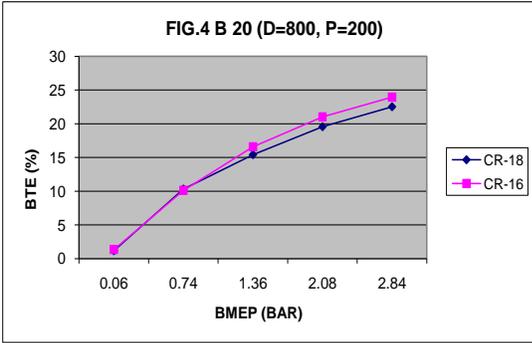
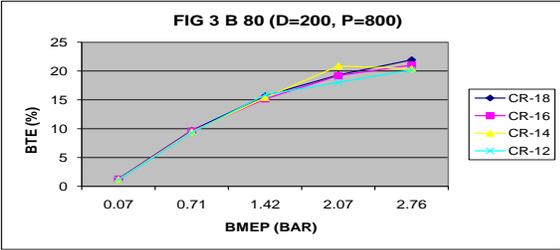
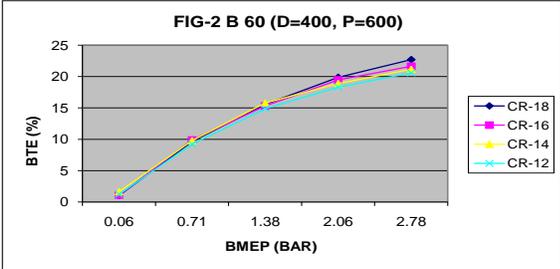
Viscosity and density of methyl esters of filtered pongamia oil are found to be very close to that of diesel. The flash and fire point of biodiesel is higher than that of diesel. The vital properties of biodiesel produced from filtered pongamia oil can be a prospective fuel or performance improving additive in compression ignition engines. The calorific value of pongamia oil is increased by 3.84% than that of diesel respectively, where as the calorific value of pongamia methyl ester is decreased by 7.42% than that of diesel. The use of biodiesel and filtered pongamia oil as a diesel are used as fuel in compression ignition engines and its performance and exhaust emission characteristics are analyzed. As a part load condition is concerned, POME is the best fuel because it reduces oxides of nitrogen and unburned hydrocarbon with improved brake thermal efficiency. As smoke is low then better combustion of tested fuel takes place. High percentage of oxygen content and cetane number leads to low HC, NOX can be controlled by adopting EGR and by employing suitable catalytic converters. Reduced oxygen and flame temperature leads to lower NOX formation. The fuel have more oxygen content inherent in itself may be the cause of higher O<sub>2</sub> level, compared to diesel. The higher O<sub>2</sub> level in fuel blends is always preferred. When biodiesel is concern, the exhaust gas temperature increased gradually. Using 100% filtered pongamia oil, higher exhaust gas temperature is attained at full load, which is indicating more energy loss in this case. The brake specific energy consumption of POME was observed 15.06% lower than that of diesel at part load where as 18.27% higher than that of diesel at full load. The brake specific energy consumption of PO is increased by 23.96% at full load where as it decreases by 14.07% at part load. The specific fuel consumption of pongamia oil methyl ester is higher than that of diesel for full load. This is caused due to the combined effect of higher viscosity and lower calorific value of the filtered pongamia oil. Brake thermal efficiency of NO is 63.11% higher than that of diesel at part load whereas it reduces 11.2% with diesel fuel at full load. In case of full load, POME show decreasing trend with diesel fuel. The present study reveals that methyl ester of filtered pongamia oil could be a good option as alternative fuel which can successfully used in existing diesel engines without any modification and it would be promoting farm economy to be more self reliant and protect environment by reducing dangerous exhaust emissions.

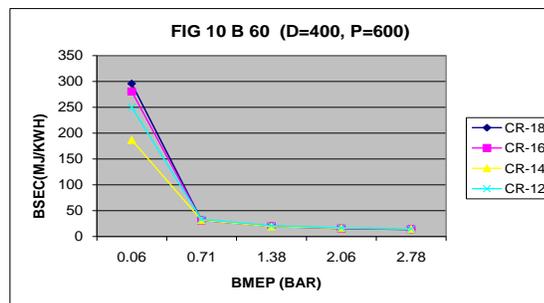
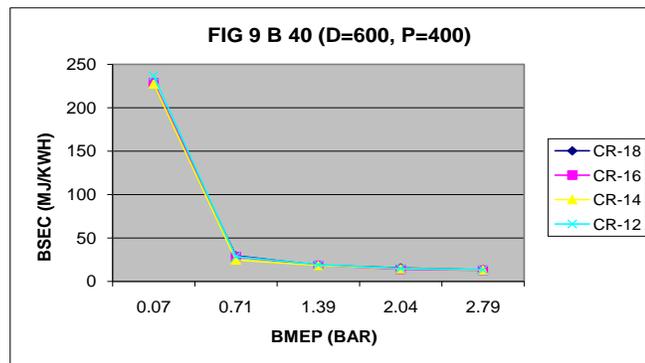
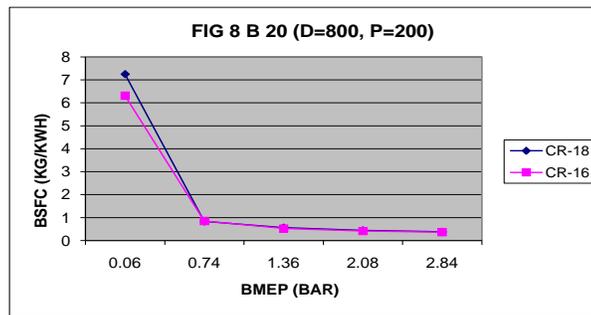
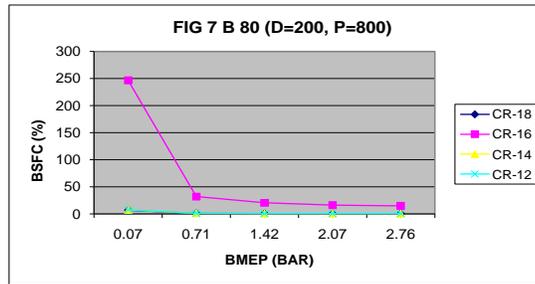
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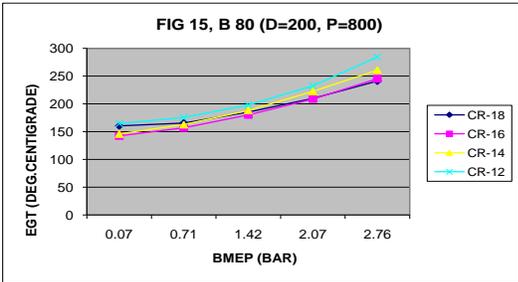
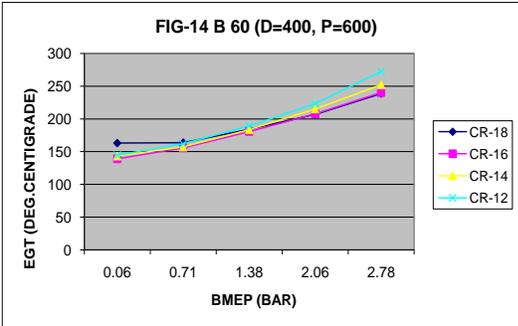
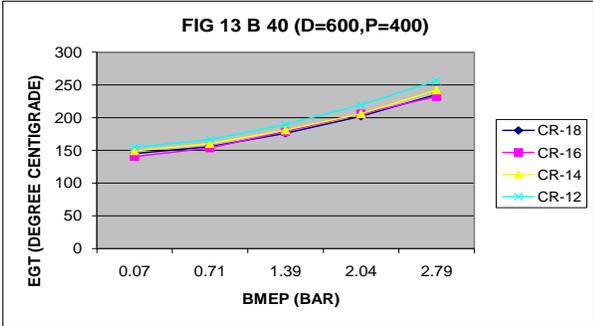
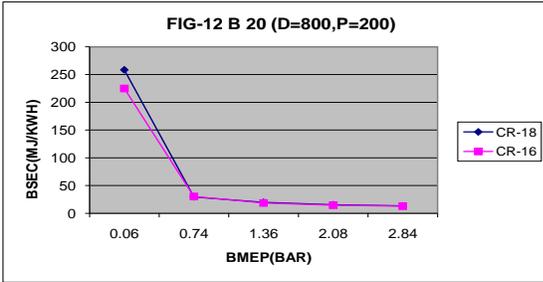
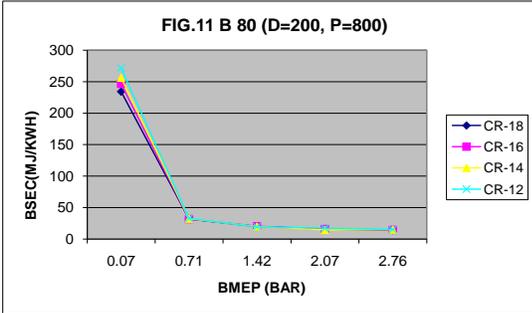
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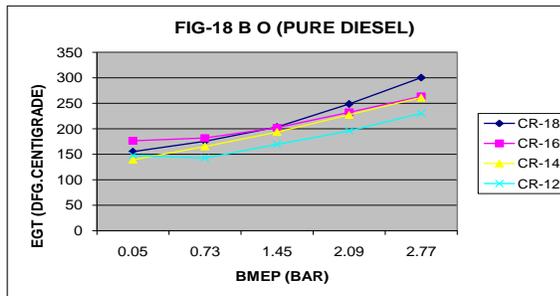
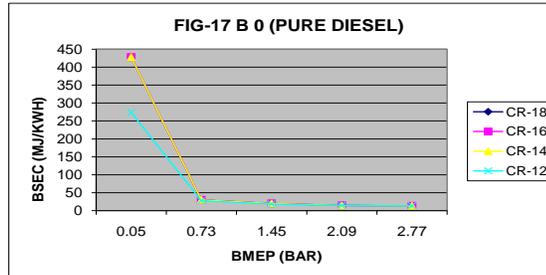
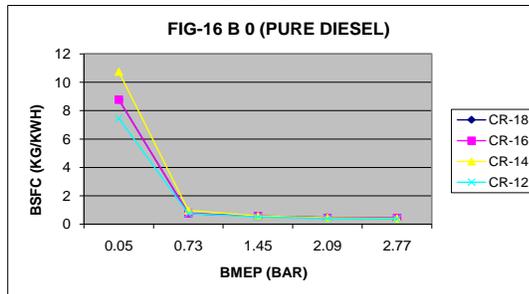
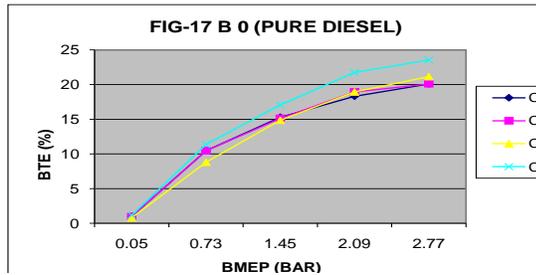
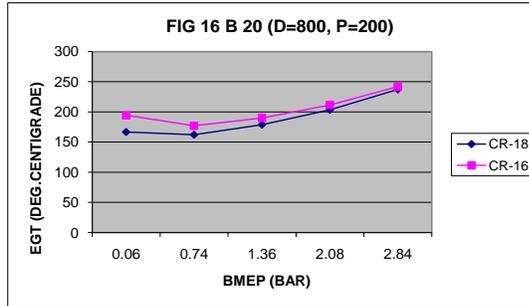
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## **Analysis, Evaluation, and Comparison of Algorithms for Scheduling Task Graphs on Parallel Processors**

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### **Abstract:**

In this paper, I survey algorithms that allocate a parallel program represented by an edge-weighted directed acyclic graph (DAG), also called a task graph or macro dataflow graph, to a set of homogeneous processors, with the objective of minimizing the completion time. I analyze 21 such algorithms and classify them into four groups. The first group includes algorithms that schedule the DAG to a bounded number of processors directly. These algorithms; I called the bounded number of processors scheduling algorithms. The algorithms in the second group schedule the DAG to an unbounded number of clusters and are called the unbounded number of clusters (UNC) scheduling algorithms. The algorithms in the third group schedule the DAG using task duplication and are called the task duplication based (TDB) scheduling algorithms. The algorithms in the fourth group perform allocation and mapping on arbitrary processor network topologies. These algorithms are called the arbitrary processor network (APN) scheduling algorithms. The design philosophies and principles behind these algorithms are discussed, and the performance of all of the algorithms is evaluated and compared against each other on a unified basis by using various scheduling parameters.

*Keywords: Algorithms, Multiprocessors, Parallel Processing, Software, Task Graphs.*

### **Introduction:**

Given an edge-weighted directed acyclic graph (DAG), also called a task graph or macro-dataflow graph, the problem of scheduling it to a set of homogeneous processors to minimize the completion time has intrigued researchers since the advent of parallel computers. Since, the problem has been identified as NP-complete in its general forms [10], and polynomial time solutions are known only in a few restricted cases [7], research effort in this area has resulted in a myriad of heuristic algorithms [5], [21]. While each heuristic individually seems to be efficient, a plethora of research has unused a number of questions: how effective are these algorithms? How sensitive are they to various scheduling parameters? How do they compare against each other on

a unified basis? What are the most effective performance measures? How to classify various algorithms? And what possible improvements can be made for a better performance? In this paper I try to answer some of these questions by examining a number of recently proposed algorithms. This research was supported by the start by classifying these algorithms into the following the target architectures in which the processors are connected via a network of arbitrary topology. I discuss six BNP, five UNC, six TDB, and four APN scheduling algorithms. I analyze their design philosophies and characteristics, and assess their merits and deficiencies. The rest of this paper is organized as follows. In the next section, we describe the generic DAG model and discuss its variations and suitability to different situations. We describe the BNP scheduling algorithms in Section 3, and the UNC algorithms in Section 4. Section 5 describes the TDB algorithms. The APN algorithms are discussed in Section 6. The performance results and comparisons are presented in Section 7, and Section 8 concludes the paper.

**The DAG Model:**

The DAG is a generic model of a parallel program consisting of a set of processes among which there are dependencies. Each process is an indivisible unit of execution, expressed by an atomic node. An atomic node has one or more inputs. When all inputs are available, the node is triggered to execute. After its execution, it generates its outputs. In this model, a set of  $v$  nodes  $\{n_1, n_2, \dots, n_v\}$  are connected by a set of  $e$  directed edges, each of which is denoted by  $(n_i, n_j)$ , where  $n_i$  is called the parent and  $n_j$  is called the child. A node without parent is called an entry node and a node without child is called an exit node. The weight of a node, denoted by  $w(n_i)$ , is equal to the process execution time. Since each edge corresponds to a message transfer from one process to another, the weight of an edge, denoted by  $c(n_i, n_j)$ , is equal to the message transmission time.

**NP Scheduling Algorithms:**

Most BNP scheduling algorithms are based on the *list scheduling* technique [1], [12], [19], [21]. List scheduling is a class of scheduling heuristics in which the nodes are assigned priorities and placed in a list arranged in a descending order of priority. The node with a higher priority will be examined for scheduling before a node with a lower priority. If more than one node has the same priority, ties are broken using some method. The two main attributes for assigning priority are the (top level) and  $b$ -level (bottom level). The  $t$ -level of a node  $n$ , is the length of the longest path from an entry node to  $n$ , (excluding  $n$ ). Here, the length of a path is the sum of all the node and edge weights along the path. The  $t$ -level of  $n$ , highly correlates with  $n$ , start time, denoted by  $T_s(n)$ , which is determined after  $n$ , is scheduled to a processor. The  $b$ -level of a node  $n$ , is the length of the longest path from node  $n$ , to an exit node: The  $b$ -level of a node is bounded by the length of the *critical path*. A critical path (CP) of a DAG is a path from an entry node to an exit node, whose length is

the maximum. It should be noted that some BNP scheduling algorithms do not take into account the edge weights in computing the *b-level*. To distinguish such definition of *b-level* from the one we described above, we call it the *static b-level*. Different algorithms use the *r-level* and *b-level* in different ways. Some algorithms assign a higher priority to a node with a smaller *t-level* while some algorithms assign a higher priority to a node with a larger *b-level*. Still some algorithms assign a higher priority to a node with a larger (*b-level - e-level*). In general, scheduling in a descending order of *b-level* tends to schedule critical path nodes first while scheduling in an ascending order of *t-level* tends to schedule nodes in a topological order. The composite attribute (*b-level - t-level*) is a compromise between the previous two cases. In the following, we discuss very briefly six BNP scheduling algorithms. The detailed steps of the algorithms are omitted due to space limitations.

**CP Algorithm:**

The MCP (Modified Critical Path) algorithm [23] uses an attribute called ALAP time of a node as node priority. The ALAP times of the nodes on the Algorithm: The ETF (Earliest Time First) algorithm [33] computes, at each step, the earliest start times for all ready nodes and then selects the one with the smallest start time, which is computed by examining the start time of the node on all processors exhaustively.

**DLS Algorithm:**

The DLS (Dynamic Level Scheduling) algorithm [22] uses as node priority an attribute called *dynamic level* (DL) which is the difference between the *static b-level* of a node and its earliest start time on a processor.

**LAST Algorithm:**

The LAST algorithm [4] is not a list scheduling algorithm, and its main goal is to minimize the overall communication.

**UNC Scheduling Algorithms:**

The basic technique employed by the UNC scheduling algorithms is called *clustering* [5], [11], [12]. At the beginning of the scheduling process, each node is considered as a cluster. In the subsequent steps, two clusters are merged if the merging reduces the completion time. This merging procedure continues until no cluster can be merged. Usually, no backtracking is allowed in order to avoid formidable time complexity. The clustering strategy is particularly designed for DAGS with non-zero edge weights. If all edge weights are zero, the CP length of the original DAG gives the shortest completion time. The clustering process is so designed that when two clusters are merged and the weights of the edges across the two clusters are zeroed, the new CP length of the resulting DAG becomes

shorter than the one before the merging. Optimal clustering results in a number of clusters such that the CP length of the clustered DAG cannot be further reduced. At this point, the completion time is minimized. In order to facilitate the subsequent cluster mapping step, the secondary goal of the UNC scheduling algorithms is to minimize the number of clusters. In the following, we discuss five UNC scheduling algorithms.

**EZ Algorithm:**

The EZ (Edge-zeroing) algorithm [20] selects clusters for merging based on edge weights. At each step, the algorithm zeros the edge with the largest weight.

**LC Algorithm:**

The LC (Linear Clustering) algorithm [13] iteratively merges nodes to form a single cluster based on the CP. The merged nodes are removed and the merging process repeats.

**MD Algorithm:**

The MD (Mobility Directed) algorithm [23] selects a node  $ni$  for scheduling based on an attribute called the *relative mobility*, which is defined as: If a node is on the current CP of the partially scheduled 208 Cur-CP-Length - (b-level ( $ni$ ) + t-level ( $ni$ ))  $w$  ( $nil$  DAG, the sum of its b-level and t-level is equal to the current CP length. The MD algorithm scans from the earliest idle time slot on each cluster and schedules the node into the first idle time slot that is large enough for the node.

**DCP Algorithm:**

The DCP (Dynamic Critical Path) algorithm [15] is designed based on the value of mobility, defined as: (Cur-CP-Length - (b-level ( $ni$ ) + t-level ( $ni$ ))) . The DCP algorithm uses a look ahead strategy to find a better cluster for a given node. In addition to computing the value of  $T, (ni)$  on a cluster, the DCP algorithm also computes the value of  $T, (n,)$  on the same cluster.

**TDB Scheduling Algorithms**

The TDB (Task Duplication Based) scheduling algorithms described below assume the availability of an unbounded number (of processors. The principal rationale behind the TDB scheduling algorithms is to reduce the communication overhead by redundantly allocating some tasks to multiple processors. In duplication-based scheduling, different strategies can be employed to select ancestor nodes for (duplication. Some of the algorithms duplicate only the direct predecessors whereas some other algorithms try to duplicate all possible ancestors. There is a trade-off between performance and time complexity of the algorithm. In the following, we describe six TDB scheduling algorithms.

**PY Algorithm:**

The PY algorithm (named after Papadimitriou and Yannakakis) [19] uses an attribute to approximate the absolute achievable lower bound of the start time of a node. It is shown [19] that the schedule length generated is within a factor of **2** from the optimal.

**DSH Algorithm:**

The DSH (Duplication Scheduling Heuristic) algorithm [14] considers each node in a descending order of their priorities. The DSH algorithm first determines the start time of the node on the processor without duplication of any ancestor. Then, it considers the duplication in the idle time period from the finish time of the last scheduled node on the processor and the start time of the node currently under consideration.

**BTDH Algorithm:**

The BTDH (Bottom-Up Top-Down Duplication Heuristic) algorithm [6] is essentially an extension of the DSH algorithm described above. The **209** major improvement of the BTDH algorithm over the DSH algorithm is that the algorithm keeps on duplicating ancestors of a node even if the duplication time slot is totally used up in the hope that the start time will eventually be minimized.

**LCTD Algorithm:**

The LCTD algorithm [5] first constructs linear clusters and then identifies the edges among clusters that determines the completion time. It tries to duplicate the parents corresponding to these edges to reduce the *start* times of some nodes in the clusters.

**CPFD Algorithm:**

The CPFD (Critical Path Fast Duplication) algorithm [2] is based on partitioning the DAG into three categories: critical path nodes (CPN), in branch nodes (IBN) and out-branch nodes (OBN). An IBN is a node from which there is a path reaching a CPN. An OBN is a node which is neither a CPN nor an IBN. The main strength of the CPFD algorithm is that it tries to start each CPN as early as possible on a processor by recursively duplicating the IBNs (and also other CPNs) reaching it.

**APN Scheduling Algorithm:**

The algorithms in this class take into account specific architectural features such as the number of processors as well as their interconnection topology. These algorithms can schedule tasks on the processors and messages on the network communication links. Scheduling of messages may be dependent on the routing strategy used by the underlying

network. The mapping, including the temporal dependencies, is therefore implicit - without going through a separate clustering phase. There are not many reported algorithms that belong to this class. In the following, we discuss four such algorithms.

**MH Algorithm:**

The MH (Mapping Heuristic) algorithm [9] first assigns priorities by computing the static b-levels of all nodes. A ready node list is then initialized to contain all entry nodes ordered in decreasing priorities. Each node is scheduled to a processor that gives the smallest start time.

**DLS Algorithm:**

The DLS (Dynamic Level Scheduling) algorithm [22] described earlier can also be used as an APN scheduling algorithm. To use it as an APN scheduling algorithm, it requires the message routing method to be supplied by the user.

**BU Algorithm:**

The BU (Bottom-Up) algorithm [18] first finds out the CP of the DAG and then assigns all the nodes on the CP to the same processor at once. Afterwards, the algorithm assigns the remaining nodes in a reversed topological order to the processors. The node assignment is guided by a load-balancing processor selection heuristic which attempts to balance the load across all given processors.

**Normalized Schedule Length (NSL):**

Schedule length is the prime performance measure of a scheduling algorithm. The NSL of an algorithm is obtained by dividing the schedule length produced by the algorithm to the lower bound (defined as the sum of weights of the nodes on the original critical-path). It should be noted that the lower bound may not always be possible to achieve, and the optimal schedule length may be larger than this bound.

**Pair-Wise and Global Comparisons:**

In the pairwise comparison, we measured the number of times an algorithm produced better, worse or equal schedule length compared to each other algorithm within the same class. In the global comparison, an algorithm was collectively compared with all other algorithms in the same class. These results also indicate that although the PY algorithm *guarantees* a schedule length within a factor of 2 from the optimal, much shorter schedule lengths are possible. Although the BNP algorithms are designed for limited number of processors (they take this number as a parameter), I ran each algorithm with a very large number of processors such that the number of processors became virtually unlimited. From this experiment, we noted the average number of processors used by these algorithms for

each graph size (the numbers of processors used are omitted due to space limitations). In the next experiment, we reduced the number processors to 50% of that average. Here, no significant differences in the NSLs as well as the relative performance of these algorithms were observed. One possible reason for this behavior is that the schedule length is dominated by the scheduling of CP nodes. In the case of a very large number (of processors, the non-CP nodes are Spread across many processors, while in the case of a fewer number of processors, these nodes are packed together without making much impact on the overall schedule length.

#### **Pair-Wise Comparison:**

Each box contains three numbers preceded by '>', '<' and '=' signs which indicate the number of times the algorithm on the left performed better, worse, and the same, respectively, compared to the algorithm shown on the top. For example, the DLS algorithm performed better than the MCP algorithm in 66 cases, worse in 162 cases and the same in 22 cases. For the global comparison, an additional box ("ALL") for each algorithm compares that algorithm with all other algorithms combined. Based on these results, we rank these BNP algorithms in the following order: MCP, ISH, DLS, HLFET, ETF, and LAST. This ranking essentially indicates the quality of scheduling based on how often an algorithm performs better than the others. Note, however, that a ranking of these algorithms based on NSLs is different: MCP, DLS, ETF, ISH, HLFET, and LAST. This ranking indicates the quality of scheduling based on the average performance of the algorithm. An algorithm which outperforms other algorithms more frequently but has a lower rank based on the average NSL indicates that it produces long schedule lengths in some cases. The pair-wise and global comparison of UNC scheduling algorithms is depicted. These results clearly indicate that the DCP algorithm is better than all other algorithms. Both DCP and MD outperformed EZ and LC by a large margin while DSC was marginally better than LC. Based on these results, we rank these UNC algorithms in the following order: DCP, MD, DSC, LC and EZ. Interestingly, this ranking does not change using the NSLs.

#### **Conclusions and Future Work:**

Our study has revealed several important findings. For both the BNP and UNC classes, algorithms emphasizing the accurate scheduling of nodes on the critical-path are in general better than the other algorithms. Dynamic critical path is better than static critical-path, as demonstrated by both the DCP and DSC algorithms. Insertion is better than non-insertion-for example; a simple algorithm such as ISH employing insertion can yield dramatic performance. Dynamic priority is in general better than static priority, although it can cause substantial complexity gain – for example the DLS and ETF algorithms have higher complexities. However, this is not always true – one exception, for example, is that the

MCP algorithm using static priorities performs the best in the BNP class. A BNP algorithm can be used as an UNC algorithm assuming infinite number of processors. However, BNP algorithms are designed for a bounded number of processors. BNP algorithms usually use *b-level*, *t-level*, or combination of both, as the criterion for selecting nodes to schedule. UNC algorithms, on the other hand, usually use mobility as the major criteria. An UNC algorithm can be used for a bounded number of processors if the number of processors is not smaller than the number of clusters generated. Exploitation of other topological properties of the graph such as the concept of critical child used by the DCP algorithm can result in a dramatic improvement in schedule lengths. Low complexity algorithms such as DSC and LC can outperform some of the higher complexity algorithms. The APN algorithms can be fairly complicated because they take into account more parameters. Further research is required in this area. The effects of topology and routing strategy need to be determined. A number of research prototypes have been designed and implemented, showing good performance on a group of carefully selected examples [9], [17]. The current researches concentrate on further elaboration of various techniques, such as reducing the scheduling complexities, improving computation estimations, and incorporating network topology and communication traffic.

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## Electron Impact Ionization Cross- Section of Tropospheric Atoms

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### Abstract:

We present multiple differential cross section for electron impact ionization cross section of He atom the single, double and triple differential cross section for the production of the He<sup>+</sup>, He<sup>++</sup> ions for electron impact ionization of He molecule have been evaluated using Jain –Khare Semi-empirical model. The partial ionization has also been derived with incident electron energies varying from ionization threshold to 1000 eV. ( $\varepsilon + I_i$ ) Where  $I_i$  is the ionization threshold energy.

### Introduction:

A study of the collision phenomenon plays an important role in theoretical and experimental investigations on the structure of matter on a microscopic scale. Hence, a knowledge of reliable atomic in the molecular Collisional cross sections are in ever increasing demand Astrophysics, aeronomy, gas laser, plasma physics, controlled thermonuclear fusion, transport phenomenon, chemical reaction, biophysics gases electronics , aurora, airglow etc. Electron transport in gaseous media is of great theoretical and practical interest. It has provided basic information of the scattering potential and structure of atoms and molecules. Radiation dosimetry, stopping power calculations, plasma and upper atmospheric physics and the wide field of gaseous electronics find unique interest in electron transport studies, especially in low energy region involving sub-ionized and sub excited electrons. These electrons have energies lower than first electronic excitation potential of the medium through which they travel. Such electrons lose through elastic and inelastic collisions by vibrational and rotational excitations. Knowledge of the cross section for the above processes for various molecules as a function of electron energy is of primary interest in radiation physics. For the study of molecular structure in molecular chemistry, a large number of parameters can be evaluated with the help of electron molecules Collisional cross sections. These cross sections are also useful in high energy molecular gas lasers. In a scattering experiment a target is bombarded to a well defined collimated homogenous beam of mono energetic particles from a large distance. After collision the particles of incident beam are scattered in all directions and their distribution is detected over large distances. The number of particles scattered into the detector per unit solid angle per unit incident flux is called the differential cross section for that particular direction. An integration of differential cross sections over all solid angles yields the total cross sections. Thus we note that the total cross

section is the cross sectional area which the target presents to the direction of the beam and differential cross section is the effective area which the target presents to the beam for the deflection of the incident particle into a particular solid angle. During the above scattering process different changes including angular deflection, change in kinetic and internal energies, chemical change, gain or loss of electrons can be detected. Because of these changes three types of scattering may happen. One is the elastic scattering in which the internal structure of the system remains the same. The second is the inelastic scattering (excitation, ionization etc.) in which incident particle transfers its kinetic energy to internal energy of targets to ionize or excite it to some higher energy state. The third is known as super elastic scattering in which the incident particle gains some energy from the target. All these collision processes are analyzed theoretically by quantum collision theory. The probability that a given type of collision will occur under given conditions is usually expressed in terms of collision cross sections.

**Formulation:**

Even on the theoretical side several more methods are available to compute the cross sections over a wide range of atoms and molecules. For example, there is no explanation for Irect dissociate, total, single and double ionization cross section. This formula is also applicable to calculate partial, photo, integral ionization cross sections of atoms and molecules. The formula is useful for finding the rate coefficient of any atoms and molecules.

$$Q_i(E,W,\theta) = \left[ \frac{a_0^2 R^2}{E} \int_{k \rightarrow 0} \frac{E - W}{E - I_i} \frac{1}{W} df_i(W, K, \theta) \times \ln[1 + C_i(E - I_i)] + \frac{E - I_i}{E(\epsilon_0^3 + \epsilon^3)} \times S_i \left( \epsilon - \frac{\epsilon^2}{E - \epsilon} + \frac{\epsilon^2}{(E - \epsilon)^2} \right) \right] \sin \theta,$$

Where  $a_0, R, K, S,$  And  $\theta$  represents the first Bohar radius, Rydbergs constant, momentum transfer, number of ionizable electrons and the scattering angle respectively, Summation of PDDCS over I gives the total PDDCS (DDCS)

$$Q'_i(E,W,\theta) = \sum_i Q_i(\epsilon, W, \theta)$$

Here it is interesting to note that  $Q_i(\epsilon, W, \theta)$  is isotropic and hence the material property of molecule, i.e., the oscillator strength must be isotropic in nature. Here  $df_i(W, K, \theta)$ , the differential generalized oscillator strength (DGOS) in the optical limit  $\epsilon \rightarrow 0$  has been used. From Lassettre's Theorem [22], the DGOS in the Bethe regime is reduced to the cosine distribution form of the linear optical oscillator strengths  $df_i(\epsilon, 0) \delta W$ , i.e.

$$df_i(W, K, \theta) \rightarrow \left( \frac{1}{4\pi} \right) + \beta P_2(\cos \theta) \times df_i(\epsilon, 0) \delta W,$$

Where  $\beta$  is the asymmetric parameter and  $P_2(\cos\theta) = \frac{1}{2}(\cos^2\theta - 1)$  is the second order Legendry polynomial. In the present treatment,  $\beta$  is chosen as the probability of ionizing electrons in the ionization processes, however, it depends on the ejected electron energy. The oscillator strengths are directly proportional to the photo ionization cross sections [23]. Further integration of Eq. (1) with respect to the scattering angle  $\theta$  (from  $0$  to  $2\pi$ ) gives the PSDCS

$$Q_i(E, W) = \int Q_i(E, W, \theta) d\Omega,$$

Where differential solid angle  $d\Omega$  is  $2\pi \sin\theta d\theta$ .

Similarly, SDCS are given as

$$Q_i^T(E, W) = \sum_i Q_i(E, W)$$

Further integration of PSDCS with respect to  $W$  from  $I$  to  $W_{\max}$  ( $E$ ) results in PICS, i.e.

$$Q_i(E) = \int Q_i(E, W) dW.$$

The present formulation requires the major input data of the photo ionization cross-sections in terms of the optical oscillator strengths. From vertical ionization thresholds to 70eV, these values for dissociative processes are taken from the compilation of Gallagher et al. (10-15% uncertainty)[23] and for direct ionization processes from Masuoka. Even on the theoretical side several more methods are available to compute the cross sections over a wide range of atoms, molecules, radicals and even cluster but all of them are partially successful. Among the various as available formulism, only modified Jain Khare. In this research work, we calculate the ionization cross section of various atmospheric molecules and we are using modified Jain- Khare semi-empirical formula. This formula (Jain- Khare semi empirical) is applicable to calculate the direct dissociate, total, single and double ionization cross section. This formula is also applicable to calculate partial, photo, integral ionization cross sections of atoms and molecules. The formula is useful for finding the rate coefficient of any atoms and molecules. It is also applicable to calculate partial, photo, integral ionization cross sections of atoms and molecules. In the calculation of single differential cross-section for the production of  $i$ th type of ion we have replaced it by  $(\varepsilon + I_i)$ . The energy loss suffered by primary electron is from the calculation of partial double differential cross section as a function, second any electron energy cross it and the scattered angle  $\theta$  on the differentials of eqn. with respect to solid angle  $d\delta = \sin\theta d\theta$

Double differential cross sections are angular dependent in all the scattering geometric and hence the angular oscillator strength  $df_i$  (in this contact, we have employed the triple different generalized oscillator strengths in the Bethe region rather than the linear optical

oscillator strengths. Lassette theorem. In the optical limit, where  $K \rightarrow 0$ , TDGOS reduces to the angular linear oscillator strengths.

$$df(\omega, k, \theta) \rightarrow \frac{1}{4\pi} \cdot \frac{df_i(\omega, 0)}{dW} \left[ 1 + BP_2 \cos^2 \theta \right]$$

$$\lim_{K \rightarrow 0}$$

The triple differential cross section is derived by the differential of double cross sections with respect to the energy of the second ejected electron. In (e, 3e) process, however, the outgoing electrons are indistinguishable; the two ejected electrons are designated by their energies  $\varepsilon$  &  $\xi$  respectively. The total energy loss is defined by  $W = I_1 + \varepsilon + \xi$  at fixed incident electron energy and second electron energy treating constant values of  $I_1 + \varepsilon$  one gets  $dW = d\xi$

### Result and Discussion:

Now we present calculate the results of the absolute partial ionization cross section measurements for the He free radical from threshold to 1000 eV modified Jain Khare. Table 1 shows the measured partial cross sections for the formation of the He<sup>+</sup> parent ion and all singly charged fragment ions He<sup>+</sup>, He<sup>++</sup> and He (Total). These partial ionization cross sections along with the total single and double ionization cross section are also summarized in Table 1 in the Appendix. Cross sections the formation of doubly charged ions are not reported here. Similar to what was found in the case of He[6], the maximum values of the cross sections for the formation of doubly charged ions from. To check the accuracy of present result, we have carried out a comparison of total ionization cross section with the available theoretical and experimental data. In the figures, represent the total ionization cross-section for the He<sup>+</sup>, He<sup>++</sup>, ions and the total differential cross-section, respectively, by electron impact alkali Molecules. In Fig.1, 2, 3, represent the production of the He<sup>+</sup> and, He<sup>++</sup>, total ionization cross section ions, respectively, from the electron impact ionization of the atom and molecule. For the He<sup>+</sup>, He<sup>++</sup>, (curve A), the calculated results are in good agreement with the experimental data within experimental uncertainty. However, the experimental data not shown are much lower than the theoretical results and these experimental data points. Furthermore, the experimental data (not shown) are 40% lower than the present theoretical results for the alkalis ions in curve A. In case of total, especially for dissociative process, there is a confusing situation about the experimental data, as we note that the experimental data points are not in satisfactory agreement with the theoretical result as well as many of the experimental data. The reason for the discrepancy has already been discussed. The experimental data (9, 11) show confusion results for the dissociative ionization processes. This may be due to systematic errors in their experiments and the different modes of normalization of their data. In the figures, represent the total ionization cross-section for the He<sup>+</sup>, He<sup>++</sup> ions and the total differential cross-section, respectively, by electron impact Molecules.

Energy (eV)	He <sup>+</sup>	He <sup>++</sup>	Total
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25	0.034		0.034
30	0.0568		0.0568
35	1.09		1.09
40	1.54		1.54
45	1.94		1.94
50	2.3		2.3
55	2.48		2.48
60	2.73		2.73
70	2.97		2.97
80	3.1		3.1
90	3.3	0.044	3.344
100	3.39	0.146	3.536
110	3.42	0.253	3.673
120	3.48	0.403	3.883
130	3.49	0.529	4.019
140	3.46	0.61	4.07
150	3.38	0.736	4.116
160	3.35	0.823	4.173
180	3.27	0.921	4.191
200	3.16	1.11	4.27
225	3.05	1.2	4.25
250	2.93	1.26	4.19
300	2.71	1.35	4.06
350	2.48	1.29	3.77
400	2.34	1.21	3.55

500	2.06	1.07	3.13
600	1.83	0.919	2.749
700	1.65	0.824	2.474
800	1.49	0.735	2.225
900	1.39	0.653	2.043
1000	1.27	0.583	1.853

Table1

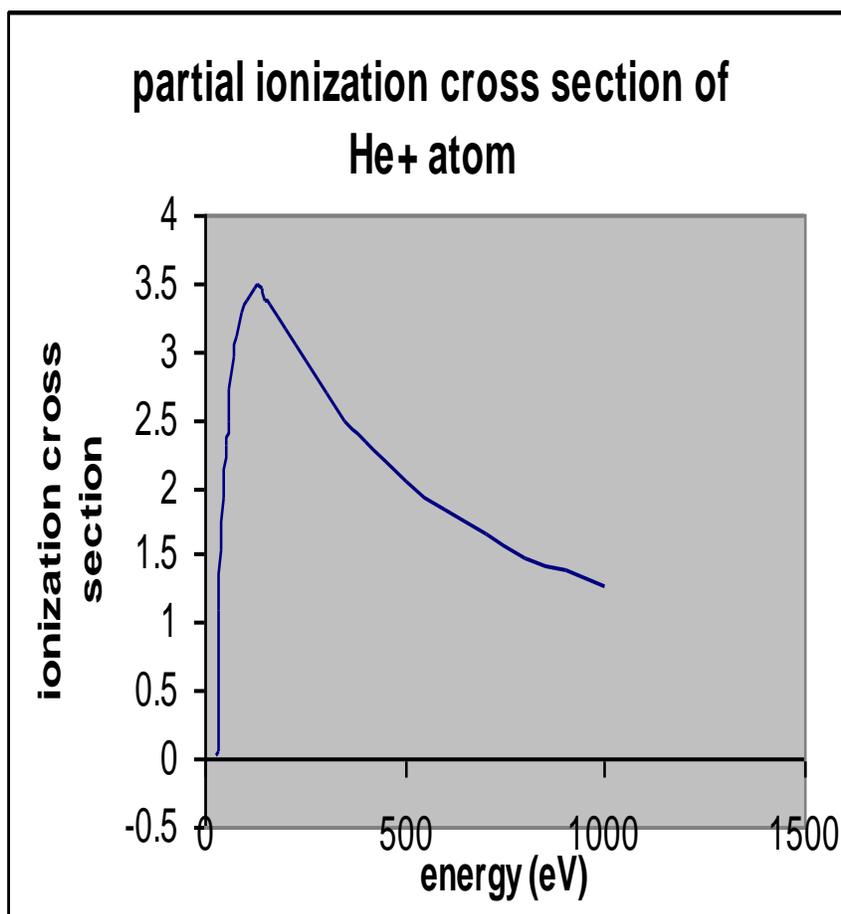


Figure 1 ionization cross section of He +

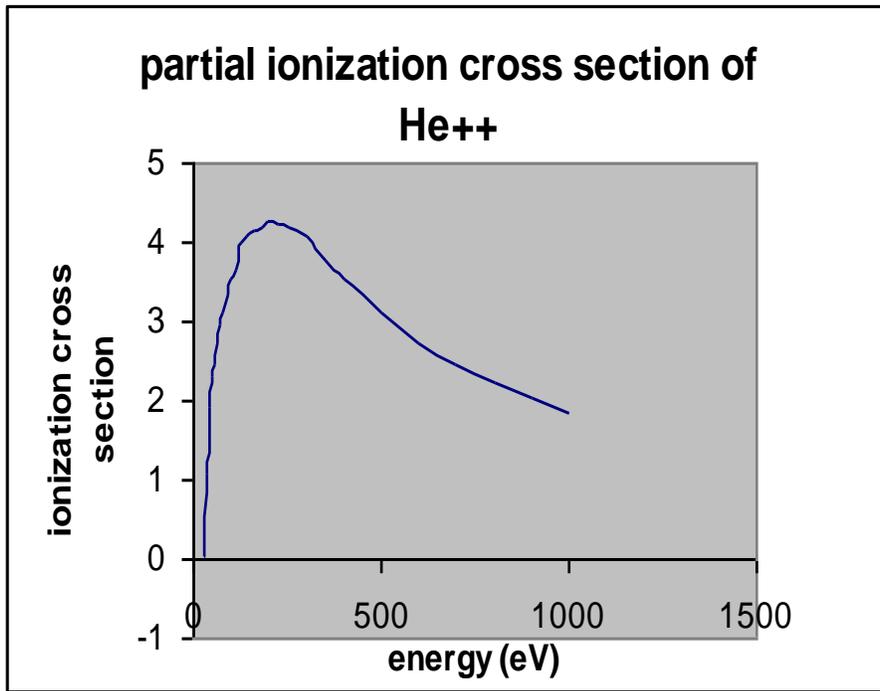


Figure 2 ionization cross section of He ++

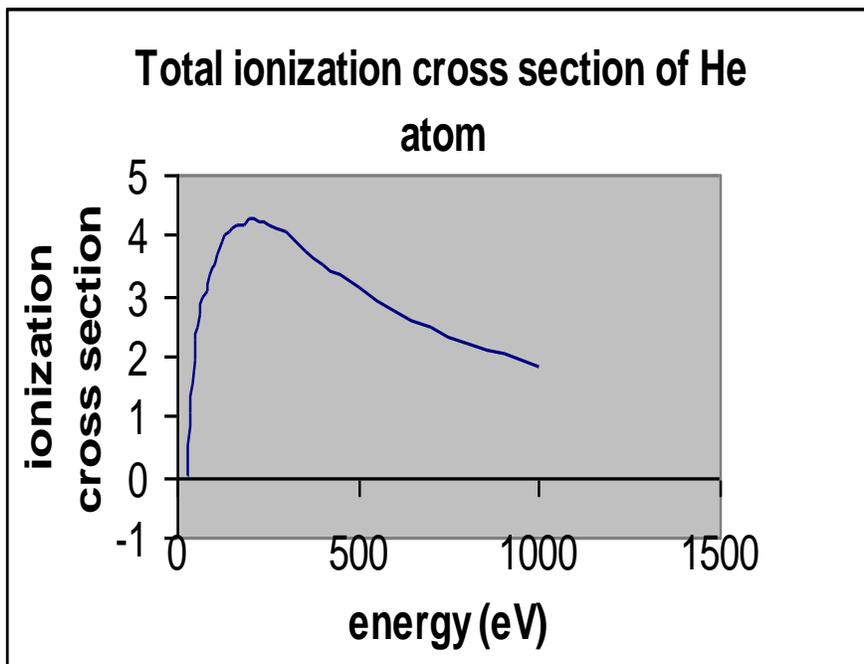


Figure 3 Total ionization cross section of He

Present calculate the partial and total ionization cross-section at a At low energy range, the present result for total ionization cross section are significantly lower than the experimental data of R.Rejoub (1) while at low energy range, good agreement with the experimental data is observed. In Fig. 2, we note that at low energy range eV, the present result for total ionization cross section are 2 times lower than the data, the present result are in satisfactory agreement with data. Further, there is no way to compare the present results above  $W > (E+I)/2$ , the maximum energy employed in the experiments. However, the present results are symmetric with respect to  $W/2$ . It is remarkable that differential cross-sections can be divided qualitatively in two parts, one the dipole allowed part, known as the glancing collision and second the non dipole part known as the knock-on collision, corresponding to the Bethe and the Moller parts of the present semi-empirical formula. Large values of the differential cross-section for slow secondary electron appear from the growing contribution of the dipole allowed interaction while above  $W \geq (E+I)/2$  the cross-section is highly affected by the exchange effects, which are taken into account through the Moller part of the formula. It is also noted that near the threshold ( $\epsilon = 3.0\text{eV}$ ). Figs. 1-3 along with Table 1 show the Total Ionization Cross Section for the production of various ions through the direct, dissociative and multiple electron ionization of alkalis sodium like atoms and molecules. In terms of minor processes also provided a significant contribution in the cross-sections. The present calculated result for the production of alkalis sodium like atoms and molecules ions through the direct ionization shown in Fig.1, 2, 3 are in satisfactory agreement with the experimental uncertainty. In the energy range 0-1000eV, the experimental data of R.Rejoub (1) are in agreement with the calculated results, while, in the low-energy range, i.e., near the threshold and above low energy range. On the other hand, the experimental data are much lower than the present result and other experimental data total ionization cross section, the production of stable He atom ions is a dominant process because of the strong columbic repulsion between the two positive holes. For the production of ion, and multiple ions at low energy, the bond type electronic states of these ions and /or the Rydberg states play an important role through auto-ionization. In case of total, especially for dissociative process, there is a confusing situation about the experimental data, as we note that the experimental data points are not in satisfactory agreement with the theoretical result as well as many of the experimental data. The reason for the discrepancy has already been discussed. The experimental data (9, 11) show confusion results for the dissociative ionization processes. This may be due to systematic errors in their experiments and the different modes of normalization of their data. Furthermore, the experimental analysis of Crowe and J.M .Mahaney (40) did not include the formation of minor ions via meta stable states. Besides, the absolute data show a significant disagreement with our results for dissociative ionization as well as other experimental data, whereas, in the case of the alkalis atoms and molecules an excellent agreement within 5% uncertainty has been noticed. The data of J.M .Mahaney (40) are absolute with a statistical error of 4-10.5% for the dissociative ionization of alkalis like sodium atoms; however, there may be some systematic error in the collection of minor ions produced via dissociative processes in their experiment. The accuracy of the present formula is linked with the accuracy of oscillator strength. Theoretically, the accuracy of the present calculation can be increased if we have the more accurate experimental data for the photo-ionization cross-section for the production of various ions.

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## **Role of Emotional Intelligence on Personality**

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### **Abstract:**

Personality factors are extremely settings. Often the 'wrong' kind of personality proves disastrous & causes undesirable tensions & worries in organizations. Personality is used in terms of influencing others through external appearance & inner awareness. It is stable set of characteristics and tendencies that determine the commonalities & differences among people. In fact according to kwet Lewin, behavior is the function of personality and environment.  $B=f(P,E)$ . This formula suggests that our behavior at any time is complex combination of our unique personality traits and the demands of the environment.

### **Introduction:**

What we are and what we hope or aspire to become is our personality. It pervades every aspect of human life. It influences our behavior. It is said to be the mirror of one's total behavior. It is the total integration of physical intellectual, emotional, social and character make up of the individual which is expressed in terms of behavior, experiences, manners, attitudes, values, beliefs, ambitions, aspirations, interests, habits, sentiments, temperaments and traits.

### **Etymological Definition:**

The word 'personality' is derived from Latin word 'Persona' which means the mask or dress which the actors used to wear in Greek drama. But it is a narrow concept of personality because 'Persona' is something external in nature and it does not include inner traits. Every person has his own physical & mental and inner qualities. The personal quality is known as personality. So, personality is the study of the basic traits of an individual, relationship between these traits, and the way in which a person adjusts to other people & situations. It is the sum total of the ways in which an individual reacts and interacts with others. Heredity plays in an important role in determining one's personality. Personality is also determined by biographical factors, cultural, situational and family factors. Now, we can say that personality is not just the external appearance of a person.

Psycholonalytic view; Freud is the view that there are three major constituents of personality.

- a) ID: Id immoral, illogical and unconscious. It is sum total of natural and general tendencies that cannot be satisfied in the society.
- b) Ego: Ego is social self. It is sum total of consciousness, will power, intelligence and reasoning. It has relationship with id as well as with super ego.
- c) Super ego: It is known as moral self. It is the higher part of the personality. Its function is to warn the ego about its defects & wrong actions. Freud further says that if there is balance between id and super ego these will be balanced personality & if there is not proper balance between id and super ego there will be maladjusted personality.

All port supports our views when he says, "personality is the dynamic organization within the individual of those psychophysical systems that determine his unique adjustment to the environment".

Woodworth also supports our views when he defines personality as the quality of individual's total behavior.

'Emotional Intelligence on personality" In the light of given definitions we can give the following role of emotional intelligence on personality.

- i) **Dynamic:** Personality is dynamic, ever changing and ever evolving. If personality stops growing, take it guaranteed from me that the end of civilization has come.
- ii) **Uniqueness:** There is some specific feature or uniqueness in the personality of every individual.
- iii) **Psychophysical:** Personality is both physical and mental i.e. outer and inner.
- iv) **Adjustment to environment:** Personality adjusting itself to its environment to one's inner life.
- v) **Organized and integrated:** Personality is the organization and integration of various systems.
- vi) **Determination:** Personality determines our thoughts and actions and gives direction to our specific goals.
- vii) **Physical dimensions:** Physical traits include the physical structure, colour, appearance, weight, voice & nervous system.
- viii) **Emotional Dimensions:** Under this particular heading we can include the emotional reactions, temperaments like calm or excitable, cheerful or gloomy, courageous or timid, submissive or dominant, sentiments, desires, attitudes, complexes & various types of abnormalities.
- ix) **Intellectual dimensions:** Intellectual traits of the personality are memory, imagination, observation, attention, perception, judgement, reasoning, thinking ability to make adjustments to various situations.
- x) **Social:** Personality is through and through social. It develops through social interaction. Society plays an important role in shaping the personality of an individual.
- xi) **Self-conscious:** Personality is self conscious. We do not attribute personality to a crow and even a child cannot be described as a personality because it has only a vague sense of personal identity. In children it is still shaping itself

**Determinants of personality:**

- i) **Biological factors.**
- a) **Heredity:** It means the transmission of the qualities from ancestor to descendant through a mechanism lying primarily in the chromosomes of the germ cells. Physical stature, facial attractiveness, temperament, reflexes etc are inherited from one's parents.
- b) **Brain:** There is a general feeling that brain plays an important role in the development of one's personality. However, no conclusive proof is available so fare about the nature of relationship between the brain and personality.

**Other factors:**

- 1) Interest: The individual normally has many interests in various areas. The top executive in any organization do not have interests in common. The organization should provide opportunities like job rotations & special training programmes to satisfy the interests of executives.
- 2) Schema: It is an individuals belief, frame of reference, perception & attitude which the individual possess towards the mngt. The job, working conditions, fringe benefits, incentive system and development towards religion, govt. & the satisfaction derived from the environment and cultural influences of his community.
- 3) Personality: Character primarily means honesty. It is resistance to stealing & cheating others. Character is a very important requirement for responsible jobs. It is likely that an individual may not steal under normal circumstances.
- 4) Motives: Motives are the inner drives of the individual. They represent goal directed behavior of individual. Individuals differ in variable, which determine the inner drives. The behavior of an individual to accomplish the goal varies because of his inner drives.
- 5) Intelligence: There is definitely some relationship between intelligence and personality. Intelligence is mainly hereditary. Persons who are very intelligent can make better adjustment in home, school and society than those persons who are less intelligent.

**Measurement of personality:**

It would be better to speak of evaluating or appraising personality rather than measuring it for, here we are concerned with ascertaining progress in the development of personality of the individual which is a very complex phenomenon. Personality cannot be quantitatively measured as we measure height or weight. We evaluate personality because it helps us to know about the physical, mental emotional & social behavior of the individual. It also helps us in knowing the unconscious mind. Moreover, unless we have succeeded in measuring the personality of the students it will not be possible for us to furnish proper guidance to the students. Some of the methods of measuring personality are given below:

- A) Subjective Method: In this method of measuring the personality, the individual is asked to evaluate himself. Data is also collected with the help of his/her friends relatives & associates. Autobiography, case history method, interview technique and questionnaire are also included in subjective method.
- B) Objective Method: In objective methods, we do not depend upon subject's own statements or responses, but upon his orest behavior as revealed to others who serve as observes, examines or judges. Objective methods are said to be scientific as they depend on the objective data.

**The development of self personality:**

Rogers feels that the fundamental force motivating the human organism is self actualization i.e. "a tendency toward fulfillment, towards the maintenance & enhancement of the organism. The tendency of self actualisation of both the organism & the self is subject to the profound influence of the social environment. In the childhood itself, when the child's behavior is evaluated

continuously by their parents, he will be in a position to discriminate b/w 3 U thoughts U actions that are considered 'worthy' and unworthy experiences from his self-concept. Rogers maintains that the innate tendency toward self actualisation often runs into conflict with two needs the need for their regard & the need for positive reward; it is true that the latter need is universal whereas the former one is the inter ralisation of those actions and values that others approve. The regard may be conditional and unconditional. Ideally, the more completely the individual is given positive regard acceptance that is not conditional to specific behaviour – the more congruence there will be between his self concept & actual experience as well as between his self-concept and ideal self. The formation of self concept is fundamental to the development of individual's personality.

Characteristics of a Good personality inventory are:

1. Significant information: A good personality inventory seeks information which is not obtainable from other sources. It deals with significant topic.
2. Short and attractive: It should be short, comprehensive. Clearly printed & attractive in appearance.
3. Clear directions: It should contain directions which are clear and complete.
4. Clear purpose: The purpose of personality inventory should be made clear.
5. Well worded: Personality inventory should be well worded.
6. Good order: It should present questions in good order, proceeding from general to the more specific responses, from simple to complex.
7. Sufficient interest: It should be of sufficient interest.
8. Easy to tabulate & interpret. It should be easy to tabulate and interpret.
9. No embarrassing questions: It should avoid annoying or embarrassing questions.

### **Personality and organization:**

In organizations, the difference in personalities of individuals are aggregated and lost when they are regarded as having somewhat identical patterns of behavioral tendencies. Some people in organizations respond most favorably to rule conscious, conformity demanding, security laden, and most protective principles. In other words there is a passion for bureaucracy for these people. On the extreme side some other people prefer autonomy, flexibility in operations and jobs dynamism etc. in the organization. Therefore a good match between individual personality and organization is essential. Unfortunately, mismatches b/w personality & organizational requirements may also be bound to happen some times. For instance, bureaucratisation may be associated with the people characterise by geater intellectual flexibility, higher valuation of self, direction, greater openness to new experience & more personally rewarding morale standards etc. Such mismatch b/w personality & organization structure may lead to confusion and chaos, and loss of interest by the members in the organization, low morale an job satisfaction.

### **Personality traits and types:**

A personality trait may be defined as an enduring attribute of a person that appears constantly in a variety of situations.

Sixteen primary traits:

Reserved	Vs	Outgoing
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Less Intelligent	Vs	More intelligent
Submissive	Vs	Emotionally stable
Serious	Vs	Happy-go-lucky
Expedient	Vs	Conscientious
Timid	Vs	Venturesome
Relaxed	Vs	Tense
Tough minded	Vs	Sensitive
Trusting	Vs	Suspicious
Practical	Vs	Imaginative
Forthright	Vs	Shrewd
Self assured	Vs	Apprehensive
Conservative	Vs	Experimenting
Group dependent	Vs	Self sufficient
Uncontrolled	Vs	Controlled

Table 1

**Conclusion:**

Personality is the study of the basic traits of an individual, relationship between traits and the way in which a person adjusts to other people and situations. Personality determines our thoughts, actions and gives directions to our specific goals. Personality inventory should be well-worded. There is definitely some relationship between intelligence and personality.

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## **BER and SNR Evaluation of Mobile Wi-Max using Different Coding Schemes**

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### **Abstract:**

Mobile Wi-Max (Worldwide interoperability for microwave access) is mobile internet based IEEE 802.16e standard for point to multipoint wireless networking to provide individual user to access to very high speed data services where wired solutions may not be viable because of distances and cost involved. IEEE 802.16e uses OFDMA (Orthogonal Frequency Division Multiple Access) to avoid fading caused by wireless channel and to transmit multiple user's information by using orthogonal carriers. In this paper we evaluate the performance of IEEE 802.16e. The signal to noise ratio (SNR) Vs bit error rate (BER) is observed using MATLAB simulation for two types of modulation techniques: Quadrature phase shift keying (QPSK) and 16-Quadrature amplitude modulation (QAM) and two types of forward error correcting codes (FEC): Convolution codes (CC) and Low density parity check codes (LDPC).

*Keywords- FEC, QPSK, QAM, CC, LDPC, Wi-Max 802.16e*

### **Introduction:**

Wi-MAX has two important standards: a fixed usage model IEEE 802.16d-2004 for fixed wireless broadband access (FWBA) and a portable usage model IEEE 802.16e-2005 for mobile wireless broadband access (MWBA). In June 2004, the 802.16 working group won approval for the latest 802.16 standard for fixed wireless access, known as IEEE802.16-2004[1]. In December 2005, an extension that addresses mobility also won approval as IEEE 802.16e-2005[2]. It is a telecommunication technology that provides upto 75 Mb/s symmetric broadband speed without cables. IEEE 802.16e, Mobile Wi-Max standard uses frequency in the range 10 to 66 GHz and signal bandwidth can be set between 1.25 and 20 MHz. IEEE 802.16e is optimized for dynamic mobile radio channels and supports handoff and roaming. At these frequencies the transmission path is essentially line of sight and multipath reflections are reduced. This increases the rate at which data can be sent.

The IEEE 802.16e protocol architecture has four layers:

1. Convergence

2. MAC
3. Transmission and
4. Physical

In our approach to evaluate the performance we implement the PHYSICAL layer using QPSK and 16-QAM using CC and LDPC codes.

### **802.16e PHY Layer System Model Overview:**

The wimax signal bandwidth can be set between 1.25 and 20 MHz and regardless of the bandwidth, the Wi-Max signal contains the same 200 carriers. Thus the carrier spacing varies according to the overall bandwidth (adaptive bandwidth concept). This feature is called scalability. Due to this number of users can be increased from 100 to 1000. As the number of subscriber grows, the spectrum can be reallocated with the process of sectoring. To maintain orthogonality between individual carriers, the symbol period must be the reciprocal of carrier spacing. As a result, narrow bandwidth wimax systems have a longer symbol period. The advantage of a longer symbol period is that this helps to overcome problems like multipath interference. This is a great advantage that a Wi-Max system possesses. The IEEE 802.16 standard supports multiple physical specifications due to its modular nature. The 802.16e OFDMA PHY is based on OFDM modulation.

### **OFDMA:**

OFDMA is a hybrid multiplexing scheme with multicarrier modulation which divides available spectrum into  $m$  carriers, each one being modulated by a low rate data stream. OFDMA uses the spectrum much more efficiently by spacing the channels much more closer to each by making all carriers orthogonal to one another, preventing interference between closely spaced carriers. Fig.1 shows this advantage of OFDMA.

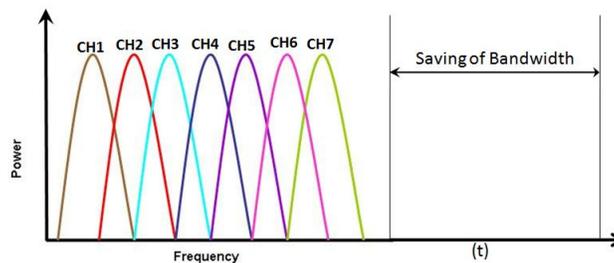


Fig.1 OFDMA bandwidth saving advantage.

### **The OFDMA symbols are constructed from data, pilot and null carriers:**

Data carrier - for data transmission.

Pilot carriers – the magnitude and phase of these carriers are known to the receiver and they are used for channel estimation.

Null carriers – there are no transmitted energy on these carriers to enable the signal to naturally decay and prevent leakage of energy into adjacent channels.

In the time domain, an OFDMA symbol is defined by the useful symbol period  $T_b$  and a guard period  $T_g$ . A copy of the last  $T_g$  of the useful symbol is placed at the front and is referred to as

the cyclic prefix (CP). This is used to help with multi-path effects like fading etc. The symbol structure in time domain is as shown in Fig 2.

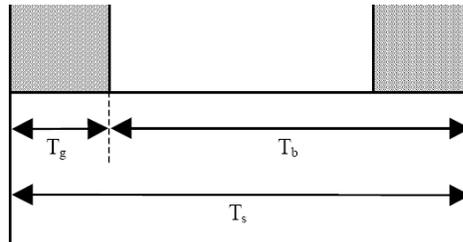


Fig 2. OFDM symbol time structure.

**Simulation Model:**

For this paper simulation is done using Matlab where coding of each block is done individually. The simulation model is as shown in Fig 3.

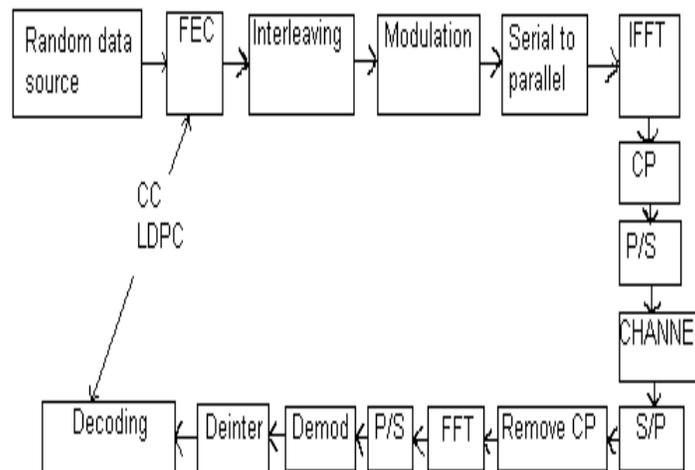


Fig.3. IEEE 802.16e Physical layer

- 1) *Source generator*: The information bits that will be transmitted are generated using MATLAB function "randint".
- 2) *Modulation*: QPSK and 16-QAM modulation is used in our simulation.
- 3) *FEC*: CC and LDPC codes are used.
- 4) *Interleaving*: Serial data after FEC block passed through an interleaver block. There are two types of Interleaving, Time Interleaving and Frequency Interleaving. The data symbols are written in the interleaving block in column order, then once the block is full; the symbols are read in row order and transmitted.
- 5) *S/P*: Converts serial data into parallel data and vice versa.

6) *IFFT*: An inverse Fourier transform converts the frequency domain data set into samples of the corresponding time s-domain representing OFDM Subcarrier. Specifically IFFT is useful for OFDM because it generates samples of a waveform with frequency component satisfying orthogonality condition.

7) *Cyclic Prefix Addition*: In this block no. of bits falling in  $T_g$  time are added in starting of an OFDM symbol.

### **Modulation Techniques:**

Various types of modulation techniques can be used for mobile WiMax. 2 types of modulation techniques used here for the simulation are:-

### **Quadrature Phase Shift Keying (QPSK):**

It is a phase modulation technique which uses phase shifts in increments of 90 deg. from 45 to 135, -45 or -135. The input is a stream of binary digits with a data rate of  $R=1/T_b$ , where  $T_b$  is width of each bit which is converted into 2 separate bit streams of  $R/2$  bps each by taking alternate bits for 2 streams known as I (in-phase) and Q (quadrature phase) streams. For modulation 2 carrier waves are used for I and Q channels to be modulated, both are of the same frequency but orthogonal to each other i.e., one will be sine wave and other will be cosine wave of the same frequency. QPSK is used in applications including CDMA, cellular service, wireless local loop, iridium (a voice/data satellite system) and DVB-S (Digital video broadcasting satellite).

### **16-Quadrature Amplitude Modulations (QAM):**

QAM is the method of combining 2 amplitude modulated signals into one channel. In a 16 state QAM there are 16 possible states for the signal. Since  $16=2^4$ , 4 bits per symbol can be sent. This consists of 2 bits for I and 2 bits for Q. The symbol rate is one fourth of the bit rate. So, this modulation format produces a more spectrally efficient transmission. For 16-QAM each carrier is ASK modulated which are added together and transmitted over the same medium. At the receiver 2 signals are demodulated and results combine to produce original binary input. QAM is used in applications including microwave digital radio, DVB-C (Digital video broadcasting cable) and modems.

### **Forward Error Correction Codes (FEC):**

Types of FEC used for error detection and correction are:-

### **Convolution Code (CC):**

A convolution code is a type of error correcting code in which each m-bit information symbol to be encoded is transformed into n-bit symbol, where  $m/n$  is the code rate ( $n>m$ ) and the transformation is a function of last k information symbols, where k is the constraint length of the code. In the Mobile Wi-Max OFDMA part CC is the only mandatory coding scheme. Its computations depend not only on the current set of input symbols but on some of the previous input symbols. A trellis description is used for convolution encoding which gives relation how each possible input to the encoder influences the output in shift register. It uses the Viterbi algorithm for decoding. CC is used extensively in numerous applications in order to achieve

reliable data transfer, including digital video, radio, mobile communication and satellite communication.

**Low Density Parity Check (LDPC) Codes:**

Low-density parity-check (LDPC) codes are a class of linear block codes. The name comes from the characteristic of their parity-check matrix  $H$  which contains only a few 1's in comparison to the amount of 0's. Their main advantage is that LDPC is the first code to allow data transmission rate performance which is very close to the theoretical capacity maximum, the Shannon Limit and linear time complex algorithms for decoding[5]. It is the sparseness of  $H$  which guarantees both a decoding complexity, which increases only linearly with the code length and a minimum distance, which also increases linearly with the code length. With the optional irregular LDPC codes,  $k$  systematic information bits are encoded to  $n$  code bits by adding  $r = n - k$  parity check bits. An  $(n, j, k)$  LDPC code is specified by a parity check matrix  $H$ , having  $n - k$  rows,  $n$  columns and  $j$  1's per column. In this paper  $j=3$  i.e., all the parity check matrices will have 3 ones per column. We use 1/2 rate encoder and tried to avoid cycle of length-four, where pair of column, both have 1's in particular rows. For decoding a simplified log domain belief propagation decoder using sum-product algorithm is used.

**Simulation Parameter and Results:**

The simulation parameters used for the OFDM transmitter and receiver simulation purpose are given in table-I below

Parameter	Value
Channel Bandwidth	20 MHz
No. of carriers	64
Single frame size	96 bits
Modulation	16 QAM
Cyclic Extension	25%(16)
Ratio of Guard time to useful symbol time, G	1/8

Table-1 Simulation Parameters

In this paper physical layer Simulation of Mobile Wi-Max is done under AWGN condition. CC and LDPC FECs are used for simulation and their evaluation is made.

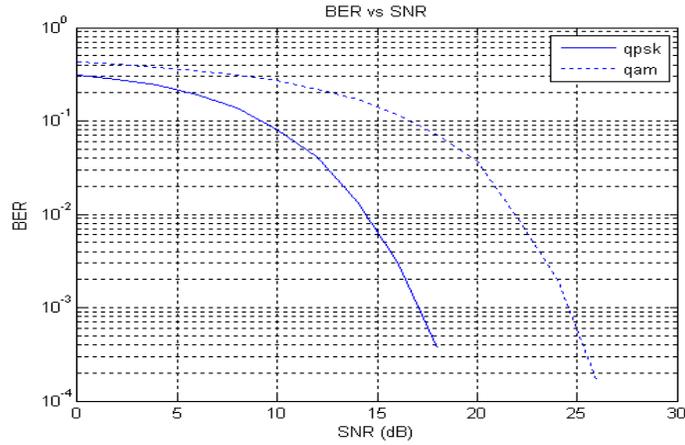


Fig 4. Simulation Result of QPSK, 16-QAM without FEC

Fig.4 presents SNR vs BER performance of Wi-Max without FEC Using QPSK and 16-QAM. It shows that QPSK gives less BER as compared to QAM for a range of SNR.

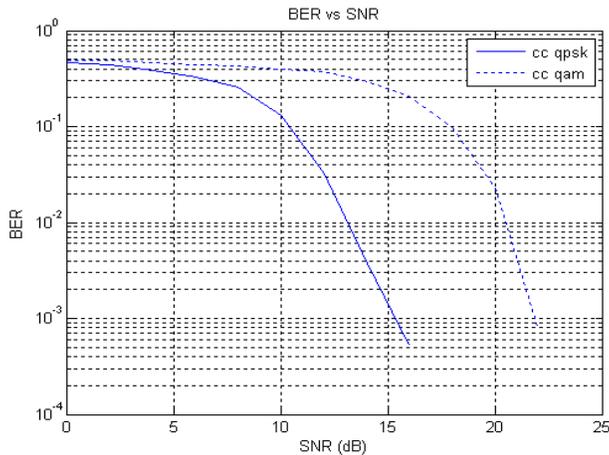


Fig. 5. Simulation Result of QPSK, 16-QAM and 1/2 CC

Fig.5 presents SNR vs BER performance of CC Using QPSK and 16-QAM. It improves performance as Compared to Fig.3

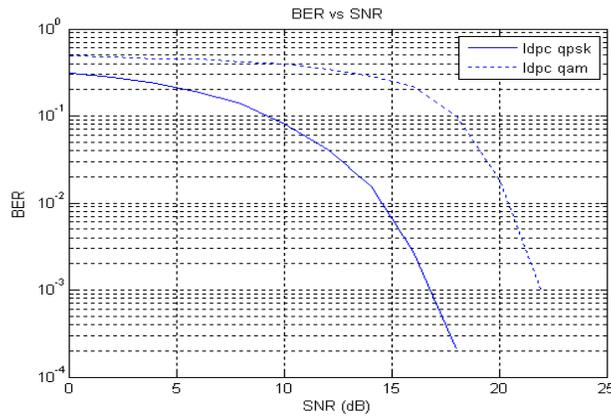


Fig. 6. .Simulation Result of QPSK, 16-QAM and 1/2 LDPC

Fig.6 shows SNR vs BER plot for LDPC

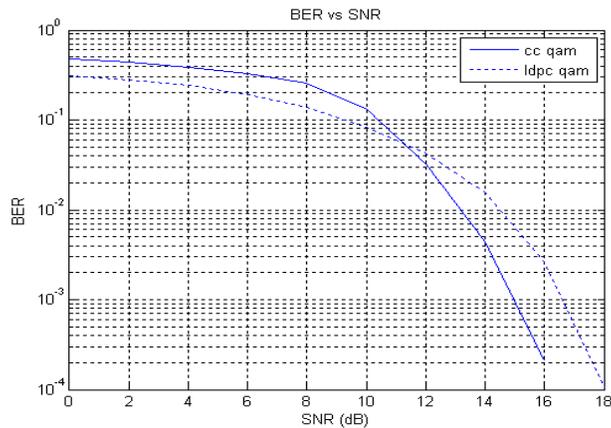


Fig. 6. Simulation Result of 16- QAM , CC and LDPC (FEC)

Fig.6 shows SNR vs BER comparison of LDPC and CC. LDPC perform better than CC. Wi-Max Performance is improved in presence of FEC.

**Conclusion:**

In this paper PHY layer of IEEE 802.16e is simulated. Here CC and LDPC codes are used for Physical layer performance with QPSK and 16-QAM for AWGN channel. It is concluded that LDPC gives noticeable performance improvement as compared to CC over low SNR environment for 16-QAM which gives higher transmission rate as compared to QPSK. . Same simulation can be carried out for fading channel for future work.

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## **Control of Heating Systems in Process Industry**

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### **Abstract:**

Thermal efficiency of process heating equipment such as furnaces, ovens, melters and heaters is the ratio of heat delivered to a material and heat supplied to the heating equipment. For most heating equipment, a large amount of the heat supplied is wasted in the form of exhaust or flue gases. These losses depend on various factors associated with the design and operation of the heating equipment. The set of proposed rules in this paper may help plant operators in reducing waste heat losses associated with the heating equipment by using Fuzzy Logic Control. A closed loop control system incorporating fuzzy logic has been developed for a class of industrial temperature control problems. A unique fuzzy logic controller (FLC) structure with an efficient realization and a small rule base that can be easily implemented in existing industrial controllers is proposed. This paper also demonstrates the potential of FLC in software simulation in an industrial setting including compensation for thermo mass changes in the system, dealing with unknown and variable delays & operating at very different temperature set points. It is achieved by implementing, in FLC, a classical control strategy to compensate for the dynamic changes in the system.

### **Introduction:**

Conventional proportional–integral–derivative (PID) controllers have been well developed and applied for about half a century and are extensively used for industrial automation and process control today. The main reason is due to their simplicity of operation, ease of design, inexpensive maintenance, low cost, and effectiveness for most linear systems. Recently, motivated by the rapidly developed advanced microelectronics and digital processors, conventional PID controllers have gone through a technological evolution, from pneumatic controllers via analog electronics to microprocessors via digital circuits. However, it has been known that conventional PID controllers generally do not work well for nonlinear systems, higher order and time-delayed linear systems, and particularly complex and vague systems that have no precise mathematical

models. To overcome these difficulties, various types of modified conventional PID controllers such as auto tuning and adaptive PID controllers were developed lately. The complexity of these problems & the difficulties in implementing conventional controllers to eliminate variations in PID tuning motivate us to investigate intelligent control techniques such as fuzzy logic as a solution to controlling systems in which time delays, nonlinearities & manual tuning procedures need to be addressed. While modern control theory has made modest in read into practice, fuzzy logic control has been rapidly gaining popularity among practicing engineers. This increased popularity can be attributed to the fact that fuzzy logic provides a powerful vehicle that allows engineers to incorporate human reasoning in the control algorithm. As opposed to the modern control theory, fuzzy logic design is not based on the mathematical model of the process. The controller designed using fuzzy logic implements human reasoning that has been programmed into fuzzy logic language (membership functions, rules & rule implementation). Starting in the early 90s, the Applied Research Control Lab. at Cleveland State University supported by industry partners initiated a research program investigating the role of fuzzy logic in industrial control. The primary question at that time was: What the fuzzy logic control does that the conventional control cannot do. This paper introduces fuzzy logic control (one of the Intelligent Control Technique) as an alternative control strategy to the current proportional-integral-derivative method widely used in a process industry say Sugar Industry. Consider a generic temperature control application shown in Fig.1. The temperature is measured by a suitable sensor such as Thermocouples, Resistive Thermal Devices (RTD's), Thermistors, etc. and converted to a signal acceptable to the controller. The controller compares the temperature signal to the desired set point temperature and actuates the control element. The control element alters the manipulated variable to change the quantity of heat being added to or taken from the process. The objective of the controller is to regulate the temperature as close as possible to the set point as possible [4]. Fig.2 gives the working view of a sugar factory showing the large steam pipes in which steam flows at high pressure [10].

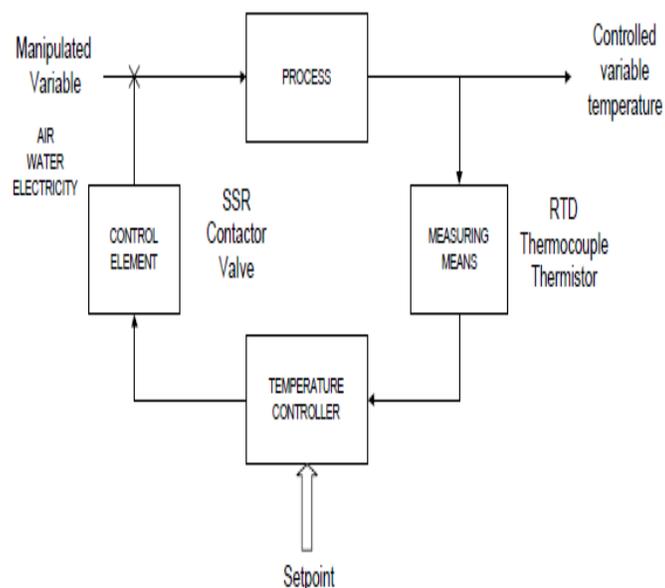


Fig.1. A typical industrial temperature control problem



Fig.2. Working view of a sugar factory

**Motivation:**

Currently, the classical PID (Proportional, Integral and Derivative) control is widely used with its gains manually tuned based on the thermal mass and the temperature set point. Equipment with large thermal capacities requires different PID gains than equipment with small thermal capacities. In addition, equipment operation over wide ranges of temperatures (140° to 500°), for example, requires different gains at the lower and higher end of the temperature range to avoid overshoots and oscillation. This is necessary since even brief temperature overshoots, for example, can initiate nuisance alarms and costly shut downs to the process being controlled. Generally, tuning the Proportional, Integral, and Derivative constants for a large temperature control process is costly and time consuming. The task is further complicated when incorrect PID constants are sometimes entered due to the lack of understanding of the temperature control process. The difficulty in dealing with such problems is compounded with variable time delays existed in many such systems. Variations in manufacturing, new product development and physical constraints place the RTD temperature sensor at different locations, inducing variable time delays (dead time) in the system. It is also well known that PID controllers exhibit poor performance when applied to systems containing unknown nonlinearity such as dead zones saturation and hysteresis. It is further understood that many temperature control processes are nonlinear. Equal increments of heat input, for example, do not necessarily produce equal increments in temperature rise in many processes, a typical phenomenon of nonlinear systems. The complexity of these problems and the difficulties in implementing conventional controllers to eliminate variations in PID tuning motivate us to investigate intelligent control techniques such as fuzzy logic as a solution to controlling systems in which time delays, nonlinearities, and manual tuning procedures need to be addressed.

**The Time Delay Problem and Existing Solutions:**

To study the temperature control problem using classical control techniques, a simplified block diagram, in Fig.3 is used, where  $C(s)$  represents the controller and  $G(s)e^{-s\tau}$  the plant with a pure time delay of  $\tau$ . It is well known that the time delay makes the temperature loops hard to tune. The time delay problem may be characterized by large and small delays. A linear time invariant system with finite delay  $\tau$  can be modeled as  $G(s)e^{-s\tau}$  where  $G(s)$  is a rational transfer function of  $s$ . Note that the delay corresponds to a phase shift of  $-\omega\tau$ , where  $\omega$  denotes the frequency. Small phase shifts at frequencies of interest may be viewed as perturbations and incorporated into a delay free design with sufficient phase margin. A large delay is classified as a delay that significantly affects the stability and phase margins to the point that delay free design methods will not be sufficient.

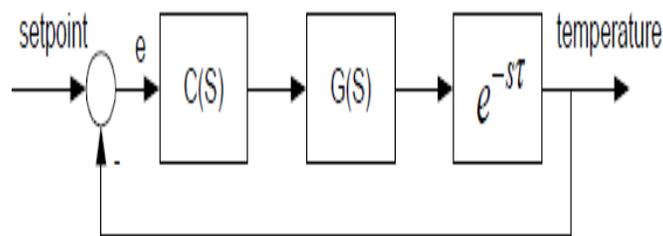


Fig.3. A Closed Loop Temperature Control System

A number of time delay compensation and prediction schemes have been developed and/or improved with modifications. Performance of Smith Predictor Control (SPC) was studied experimentally. It shows that the system performs well if the process model is accurate but that performance degrades rapidly with inaccuracy in the process parameters and time delay. Clearly for an unknown or variable time delay, Smith predictive compensation is no longer a viable technique. Several control design methods for systems with varying time delays have appeared in recent literature including an estimation and self-tuning method proposed by Brone and Harris, a variable structure controller by Shu and Yan and a model reference adaptive approach by Liu and Wang, to name a few. For systems with large time delays, most design approaches use a prediction mechanism as part of the controller to simulate the process for given system parameters and time delay. In the well known Smith predictor, the controller output is fed through models of the process with delay and the process without delay, respectively. The difference of the output signals is added to the actual plant output and then fed back to the controller, thus allowing the controller to act on the prediction of the plant output. Using this well known time delay compensation technique on a simple first order plant in an industry standard PID controller such as Bailey's Infi-90 single loop controller is still not an easy task. The predictor parameters including the plant gain, time constant, and time delay, in addition to the three PID parameters must be determined. These six parameters used in a predictive compensator increase tuning and operational complexity on even the simplest plants. The additional complexity of the Smith predictor is the main reason industry still uses non predictive PI or PID control for time delay using tuning methods such as Ziegler-Nichol's method [4].

### **Fuzzy Logic Control:**

Fuzzy control is an appealing alternative to conventional control methods when systems follow some general operating characteristics and a detailed process understanding is unknown or traditional system models become overly complex. The capability to qualitatively capture the

attributes of a control system based on observable phenomena is a main feature of fuzzy control. These aspects of fuzzy control have been demonstrated in various research literature and commercial products from vendors like Reliance Electric and Omron. The ability of fuzzy logic to capture system dynamics qualitatively and execute this qualitative idea in a real time situation is an attractive feature for temperature control systems. Of course, fuzzy logic control has its own limitations. The analytical study of fuzzy logic is still trailing its implementation and much work is still ahead, particularly in the area of stability and performance analysis. Furthermore, as solutions to practical problems, fuzzy logic control design is problem dependent and the adaptation of an existing fuzzy logic controller to a different control problem is not straightforward. The available design tools such as the Fuzzy Toolbox provided by Math works Inc. generally require further improvements before they become acceptable to control engineers. The validity of fuzzy logic control as an alternative approach in temperature control applications is investigated. Fuzzy Logic Control Theory has been used to simulate the Heat Exchanger Temperature Control System (one of the Industrial Temperature Control System) used in a process industry say Sugar Industry.

### **Fuzzy Logic Control Design:**

#### **Fuzzy Logic:**

In a narrow sense, the term fuzzy logic refers to a system of approximate reasoning but its widest meaning is usually identified with a mathematical theory of classes with unclear or “fuzzy” boundaries. Control systems based on fuzzy logic are used in many consumer electronic devices in order to make fine adjustments to changes in the environment. Fuzzy logic concepts and techniques have also been profitably used in linguistics, the behavioral sciences, the diagnosis of certain diseases and even stock market analysis.

#### **Fuzzy Sets:**

Most concepts used in everyday language such as “high temperature” are not clearly defined. In 1965 Lotfi Zadeh, an engineering professor at the University of California at Berkeley, proposed a mathematical definition of those classes that lack precisely defined criteria of membership. Zadeh called them fuzzy sets. Membership in a fuzzy set may be indicated by any number from 0 to 1, representing a range from “definitely not in the set” through “partially in the set” to “completely in the set.” For example, at age 45 a man is neither very young nor very old. This makes it difficult in traditional logic to say whether or not he belongs to the set of “old persons.” Clearly he is “sort of” old, a qualitative assessment that can be quantified by assigning a value, or degree of membership, between 0 and 1—say 0.30—for his inclusion in a fuzzy set of old persons. Fuzzy sets are a generalization of ordinary sets, and they may be combined by operations similar to set union, intersection and complement. However, some properties of ordinary set operations are no longer valid for fuzzy sets. For instance, the intersection of a fuzzy subset and its complement may be nonempty. In a logic based on fuzzy sets, the principle of the excluded middle is therefore invalid. Fuzziness as defined by Zadeh is no statistical in nature—it represents vagueness due to human intuition, not uncertainty in the probabilistic sense. Membership in a fuzzy set is usually represented graphically. Membership functions are determined by both theoretical and empirical methods that depend on the particular application and they may include the use of learning and optimization techniques.

**Fuzzy Control:**

In technical applications, fuzzy control refers to programs or algorithms using fuzzy logic to allow machines to make decisions based on the practical knowledge of a human operator. The fundamental problem of automatic control is that of determining the appropriate response of the system, or production plant, for any given set of conditions. Conventional control techniques are based on explicit mathematical descriptions of the system, typically a set of differential equations involving a small number of variables. Fuzzy control, on the other hand, does not require an exact theoretical model but only the empirical knowledge of an experienced operator. This knowledge is then expressed as a set of linguistic rules of the form “if [present conditions], then [action to be taken].” For example, “if temperature is low and image density is high, then electric charge should be medium” is one of nine linguistic rules governing the smooth operation of a photocopier. The ambiguous terms—low temperature and high density—are represented as fuzzy sets, and the various linguistic rules are represented as mathematical relations between these sets. The control strategy can then be encoded as an algorithm or computer program. During the operation of the machine, sensors measure the current values of the input variables (temperature and image density, in this case), and a computer or electronic chip then determines the appropriate values of the action variables (e.g., electric charge). E.H. Mamdani, while a lecturer at Queen Mary College, London, working in the design of learning systems, is credited with implementing the first fuzzy logic controller in the early 1970s. Mamdani and his student Seto Assilian wrote down 24 linguistic rules for controlling the operation of a small steam engine and boiler combination. They then used fuzzy sets to translate these linguistic rules into an algorithm that successfully controlled the system, thus demonstrating the power of the new approach.

**Advantages of using Fuzzy Logic:**

Here is a list of general observations about fuzzy logic [9].

- Fuzzy logic is conceptually easy to understand.

The mathematical concepts behind fuzzy reasoning are very simple. What makes fuzzy nice is the “naturalness” of its approach and not its far-reaching complexity.

- Fuzzy logic is flexible.

With any given system, it’s easy to manage it or layer more functionality on top of it without starting again from scratch.

- Fuzzy logic is tolerant of imprecise data.

Everything is imprecise if we look closely enough, but more than that, most things are imprecise even on careful inspection. Fuzzy reasoning builds this understanding into the process rather than tacking it onto the end.

- Fuzzy logic can model nonlinear functions of arbitrary complexity.

We can create a fuzzy system to match any set of input-output data. This process is made particularly easy by adaptive techniques like ANFIS (Adaptive Neuro-Fuzzy Inference Systems) which are available in the Fuzzy Logic Toolbox.

- Fuzzy logic can be built on top of the experience of experts.

In direct contrast to neural networks, which take training data and generate opaque, impenetrable models, fuzzy logic lets us stand on the shoulders of people who already understand our system.

- Fuzzy logic can be blended with conventional control techniques.

Fuzzy systems don't necessarily replace conventional control methods. In many cases fuzzy systems augment them and simplify their implementation.

•Fuzzy logic is based on natural language.

The basis for fuzzy logic is the basis for human communication. This observation underpins many of the other statements about fuzzy logic.

The last statement is perhaps the most important one and deserves more discussion. Natural language, that which is used by ordinary people on a daily basis, has been shaped by thousands of years of human history to be convenient and efficient. Sentences written in ordinary language represent an efficient communication. We are generally unaware of this because ordinary language is, of course, something we use every day. But since fuzzy logic is built with the structures of everyday language, it not only makes it easy for us to use it (since fuzzy logic more closely "speaks our language") but it also takes advantage of the long history of natural language. In other words, language is a fuzzy logic tool the human race has spent a hundred generations developing. Clear language is about getting at the big picture. Fuzzy logic keeps you from bogging down in unnecessary detail. It's all a matter of perspective.

#### **Problems & Limitations of using Fuzzy Logic:**

Problems & limitations of fuzzy systems include [1]:

- a) Stability: There is no theoretical guarantee that a general fuzzy system does not go chaotic & stays stable.
- b) Learning Capability: Fuzzy systems lack capabilities of learning & have no memory.
- c) Determining or tuning good membership functions & fuzzy rules are not always easy. Even after extensive testing, it is difficult to say how many membership functions are really required.
- d) There exists a general misconception of the term fuzzy as meaning imprecise or imperfect.
- e) Verification & validation of a fuzzy expert system generally requires extensive testing with hardware in the loop.

#### **Fuzzy Sets & Crisp Sets:**

The very basic notion of fuzzy systems is a fuzzy (sub) set. In classical mathematics, we are familiar with what we call crisp sets. For example, the possible interferometric coherence  $g$  values are the set  $X$  of all real numbers between 0 and 1. From this set  $X$  a subset  $A$  can be defined (e.g. all values  $0 \leq g \leq 0.2$ ). The characteristic function of  $A$  (i.e. this function assigns a number 1 or 0 to each element in  $X$  depending on whether the element is in the subset  $A$  or not) is shown in Fig.4. The elements which have been assigned the number 1 can be interpreted as the elements that are in the set  $A$  and the elements which have assigned the number 0 as the elements that are not in the set.

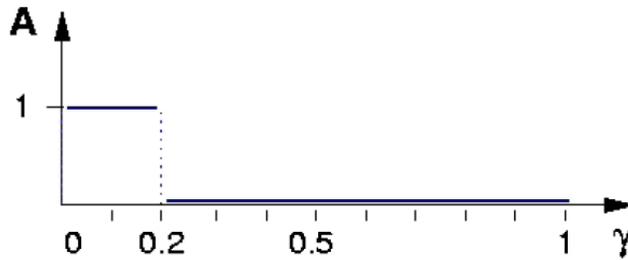


Fig.4. Characteristic Function of a Crisp Set

This concept is sufficient for many areas of applications but it can easily be seen that it lacks in flexibility for some applications like classification of remotely sensed data analysis. For example it is well known that water shows low interferometric coherence  $g$  in SAR images. Since  $g$  starts at 0, the lower range of this set ought to be clear. The upper range, on the other hand, is rather hard to define. As a first attempt, we set the upper range to 0.2. Therefore we get  $B$  as a crisp interval  $B = [0, 0.2]$ . But this means that a  $g$  value of 0.20 is low but a  $g$  value of 0.21 not. Obviously, this is a structural problem, for if we moved the upper boundary of the range from  $g = 0.20$  to an arbitrary point we can pose the same question. A more natural way to construct the set  $B$  would be to relax the strict separation between low and not low. This can be done by allowing not only the (crisp) decision Yes/No, but more flexible rules like "fairly low". A fuzzy set allows us to define such a notion. The aim is to use fuzzy sets in order to make computers more 'intelligent', therefore, the idea above has to be coded more formally. In the example, all the elements were coded with 0 or 1. A straight way to generalize this concept is to allow more values between 0 and 1. In fact, infinitely many alternatives can be allowed between the boundaries 0 and 1, namely the unit interval  $I = [0, 1]$ . The interpretation of the numbers, now assigned to all elements is much more difficult. Of course, again the number 1 assigned to an element means that the element is in the set  $B$  and 0 means that the element is definitely not in the set  $B$ . All other values mean a gradual membership to the set  $B$ . This is shown in Fig. 5. See [8].

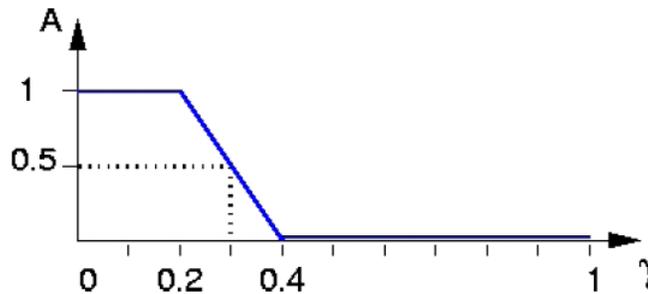


Fig.5. Characteristic Function of a Fuzzy Set

The membership function is a graphical representation of the magnitude of participation of each input. It associates a weighting with each of the inputs that are processed, define functional overlap between inputs, and ultimately determines an output response. The rules use the input membership values as weighting factors to determine their influence on the fuzzy output sets of the final output conclusion. The membership function, operating in this case on the fuzzy set of interferometric coherence  $g$ , returns a value between 0.0 and 1.0. For example, an interferometric

coherence  $g$  of 0.3 has a membership of 0.5 to the set low coherence (see Fig. 5). It is important to point out the distinction between fuzzy logic and probability. Both operate over the same numeric range and have similar values: 0.0 representing False (or non-membership), and 1.0 representing True (or full-membership). However, there is a distinction to be made between the two statements: The probabilistic approach yields the natural-language statement, "There is a 50% chance that  $g$  is low," while the fuzzy terminology corresponds to " $g$ 's degree of membership within the set of low interferometric coherence is 0.50." The semantic difference is significant: the first view supposes that  $g$  is or is not low; it is just that we only have a 50% chance of knowing which set it is in. By contrast, fuzzy terminology supposes that  $g$  is "more or less" low, or in some other term corresponding to the value of 0.50.

**Two input Single output Controller:**

The two Fuzzy Logic Control Design consists of setting up of membership functions adequately representing the input & output Universe of Discourses & development of rules to achieve desired performance. The FLC developed here is a two-input single-output controller. The two inputs are error,  $e(k)$  and error rate,  $\Delta e(k)$ . The FLC is implemented in a discrete-time form using a zero-order-hold as shown in Fig.6a. The operational structure of the Fuzzy controller is shown in Fig.6b. See [4].

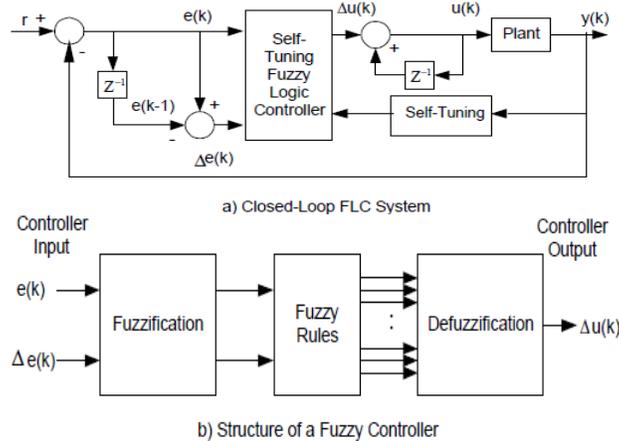


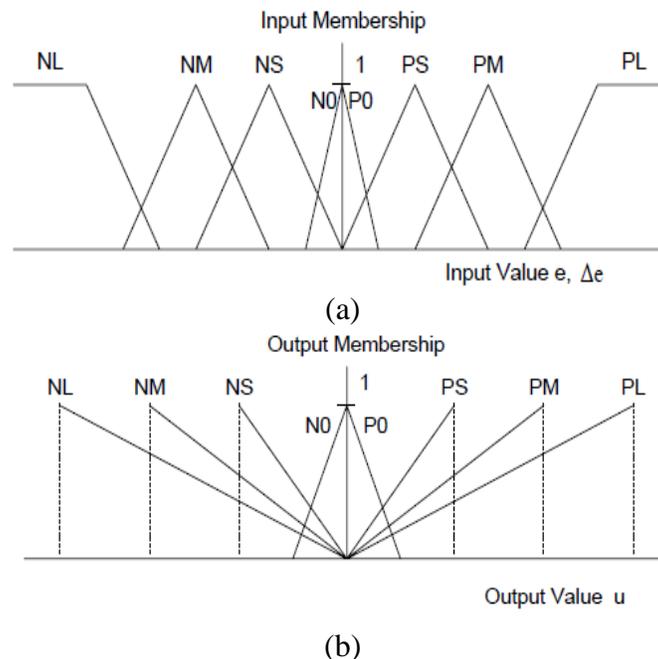
Fig.6. Fuzzy Logic Control System

**Fuzzification/Defuzzification:**

Fuzzification and defuzzification involve mapping the fuzzy variables of interest to "crisp" numbers used by the control system. Fuzzification translates a numeric value for the error,  $e(k)$  or error rate,  $\Delta e(k)$  into a linguistic value such as positive large with a membership grade. Defuzzification takes the fuzzy output of the rules and generates a "crisp" numeric value used as the control input to the plant. The FLC membership functions are defined over the range of input and output variable values and linguistically describes the variable's universe of discourse as shown in Fig.6. The triangular input membership functions for the linguistic labels zero, small, medium and large, had their membership tuning center values at 0, 0.2, 0.35, and 0.6, respectively. The universe of discourse for both  $e$  and  $\Delta e$  may be normalized from -1 to 1, if necessary. The left and right half of the triangle membership functions for each linguistic label was chosen to provide membership overlap with adjacent membership functions. The straight

line output membership functions for the labels zero, small, medium, and large are defined as shown in Figure 6 with end points corresponding to 10, 30, 70 and 100% of the maximum output, respectively. Both the input and output variables membership functions are symmetric with respect to the origin. Selection of the number of membership functions and their initial values is based on process knowledge and intuition. The main idea is to define partitions over the plant operating regions that will adequately represent the process variables [4]. The FLC's rules are developed based on the understanding of how a conventional controller works for a system with a fixed time delay. The rules are separated into two layers: the first layer of FLC rules mimics what a simple PID controller would do when the time delay is fixed and known; the second rule layer deals with the problem when the time delay is unknown and varying. In developing the first layer rules, consider the first order plant,  $G(s) = e^{-s\tau} / (s+a)$ , where  $G(s) = a/(s+a)$ . In the PID design, the following assumptions are made:

- The time delay  $\tau$  is known.
- The rise time,  $\tau_r$  is known.
- $\tau_r$  is significantly smaller than  $\tau$ .
- The sampling interval is  $T_s$ .



(b)  
 Fig.7. Fuzzy Membership Functions

The conventional PI-type controller in incremental form is given by:

$$u(k) = u(k - 1) + \Delta u(k) \quad \dots\dots\dots(1)$$

Where  $\Delta u(k) = f(e, \Delta e)$  is computed by a discrete-time PI algorithm. This control algorithm was applied to a first order plant with delay. Initial tuning of PI parameters was carried out by using the Ziegler-Nichols method. The step response obtained has about a 20% overshoot for a fixed time delay. Next a fuzzy logic control law was set up where  $\Delta u(k) = f(e, \Delta e)$ , the output of the FLC for the  $k$ th sampling interval replaces  $f(e, \Delta e)$  in the incremental controller described in (1).

The rules and membership functions of the FLC have been developed using an intuitive understanding of what a PI controller does for a fixed delay on a first order system. They generalized what a PI controller does for each combination of  $e$  and  $\Delta e$  in 12 rules as shown in table 1 (Shaded Areas Represent Zero Control Action). The output from each rule can be treated as a fuzzy singleton. The FLC control action is the combination of the output of each rule using the weighted average defuzzification method and can be viewed as the center of gravity of the fuzzy set of output singletons.

		$\Delta e$							
		NL	NM	NS	NO	PO	PS	PM	PL
e	NL	NL							
	NM	NM				PS			
	NS				NM	PS			
	NO	NO							
	PO	PO							
	PS				NS	PM			
	PM	NS			PM				
	PL	PL							

Table:1 FLC Control Rules

**Tuning of Membership Functions in Design Stage:**

Since there is little established theoretical guidance, the tuning of rules and membership functions in the design stage is largely an iterative process based on intuition. The membership functions are tuned subject to the stability criteria based on observations of system performance such as rise time, overshoot, and steady state error. The number of membership functions can vary to provide the resolution needed. Note that the number of rules can grow exponentially as the number of input membership functions increases. The input membership functions for  $e$  and  $\Delta e$  generate 64 combinations which can be grouped into twelve regions corresponding to each rule in TABLE 1. The center and slopes of the input membership functions in each region is adjusted so that the corresponding rule provides an appropriate control action. In case when two or more rules are fired at the same time, the dominant rule that is the rule corresponding to the high membership grade, is tuned first. Modifying the output membership function adjusts the rules contribution relative to the output universe of discourse. Once input membership rule tuning is completed, fine-tuning of the output membership functions is performed to achieve the desired performance. Although this FLC is constructed based on the assumption that the time delay is fixed and known, the only element of the controller that is a function of the delay is the universe of discourse for the output. It is shown below that with some adjustment and extra rules, the FLC can be made to adapt to an unknown nature or change in delay.

**Self Tuning:**

The FLC structure presented above can be directly modified to compensate for changes in the plant dynamics and variable time delays by adding a second layer of self tuning rules to the FLC.

The discussion is limited to adding the self tuning function to the FLC in the presence of variable time delay. In the case of varying time delay, the FLC gain must be adjusted to offset the effects of the changes in delay. It is shown that the maximum gain or control action is inversely proportional to the time delay. Therefore, if the delay increases, we should decrease the FLC gain to reduce the control action, and vice versa. Based on this relationship, the system performance can be monitored by a second layer of rules that adapts the output membership functions of the first layer of rules to improve the performance of the fuzzy controller. Consider an output membership function tuned for a nominal delay. When the true system time delay is larger than the nominal delay, the control action determined by the nominal delay causes the control output to be too large for the true system. This condition effectively increases the controller gain and as the difference between the true and nominal delay becomes large, system stability problems could arise. Conversely, when the true delay is smaller than the nominal delay, the controller gain will be too small and the system becomes sluggish. The output membership functions (see Fig.7) of the FLC are defined in terms of the maximum control action. A viable mechanism to compensate for a varying time delay is to adjust the size of the control action under the assumption that the number of control rules remains fixed and the linguistic control strategy is valid for different values of time delay. These conditions are reasonable given the plant parameters are known and that the control strategy developed is based on a plant with delay. To adjust the FLC on-line for systems with varying time delay, a second layer of six rules was added as an adaptation mechanism to modify the output membership function used by the first layer rules with a scaling factor. This effectively changes the FLC control output universe of discourse (i.e., the maximum control action) based on system performance. These rules adjust the FLC output based on rise time and overshoot. The overshoot is monitored and classified as large (L), medium (M) and small (S). It is observed that changes in overshoot are indicative of a change in time delay. A longer delay results in a larger overshoot. Such effects can be alleviated by reducing the output scaling factor appropriately. Rise time performance is classified as Very Slow (VS), Medium Slow (MS) and Slightly Slow (SS) and an increase in the output scaling factor can help to speed up the response. The design strategy for the second layer of rules is based on two different aspects of tracking performance i.e. rise time and overshoot calculated from  $(e, \Delta e)$ . The second layer rules are listed in table 2. They monitor the plant response and reduce or increase the FLC controller output universe of discourse. The fuzzy membership functions are defined using a membership configuration similar to the control strategy in Fig.7. The adjustment rules perform two actions; they reduce the FLC gain when the plant is significantly overshooting the desired response and increase the gain when rise time performance is slow.

**Remark:**

A unique fuzzy control system is presented in this section. Although a PI controller is used as a guideline for setting up the FLC, it by no means limits its ability to perform more complicated tasks. Similar approaches can be used to set up a FLC that mimics more complex controllers. The emphasis here, however, is to deal with unknown dynamics and variable time delay problems which we have difficulty with using analytical approaches.

Rise Time Rules <i>If Tracking is <math>L_1</math> then Adjust is <math>L_2</math></i>		Overshoot Rules <i>If Overshoot is <math>L_3</math> then Adjust is <math>L_4</math></i>	
$L_1$	$L_2$	$L_3$	$L_4$
SS	PS	L	NL
MS	PM	M	NM
VS	PL	S	NS

Table: FLC output adjustment

**Application Areas:**

Fuzzy systems have been used in a wide variety of applications in engineering, science, business, medicine, psychology and other fields. For instance, in engineering, some potential application areas include the following [2]:

- Aircraft/spacecraft: Flight control, engine control, failure diagnosis, navigation and satellite attitude control.
- Automated highway systems: Automatic steering, braking and throttle control for vehicles.
- Automobiles: Brakes, transmission, suspension and engine control.
- Autonomous vehicles: Ground and underwater.
- Manufacturing systems: Scheduling and deposition process control.
- Power industry: Motor control, power control distribution and load estimation.
- Process control: Temperature, pressure and level control, failure diagnosis, distillation column control and desalination processes.
- Robotics: Position control and path planning.

**Software Simulation:**

The Fuzzy Logic Controller developed above is simulated for the heat exchanger control system shown below in fig. 8(a) and heat exchanger control loop is shown in fig. 8(b). The outlet temperature of the process fluid (cane juice),  $\theta(t)0C$  is to be controlled by adjusting the steam flow at its desired value or set point,  $\theta_r0C$  in the presence of disturbances in the process fluid flow,  $q_m(t)$  kg/sec flowing inside the tubes of the heat exchanger and inlet temperature,  $\theta_i(t)0C$ . The steam flow,  $q_{ms}(t)$  kg/sec, condensing on the outside of the tubes, is the variable that can be adjusted to control the outlet temperature, as it determines the amount of energy supplied to the process fluid. In addition to counteracting the effects of disturbances, the control system will be called upon to follow the commands for change in the outlet temperature of the process fluid. The temperature/pressure of the fluids will also affect the delay.

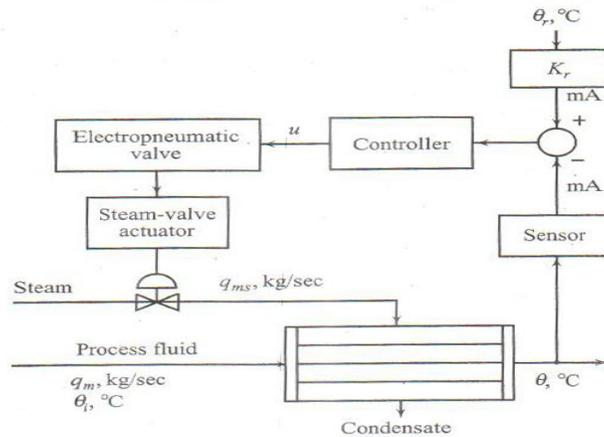


Fig.8 (a) Heat Exchanger Temperature Control System

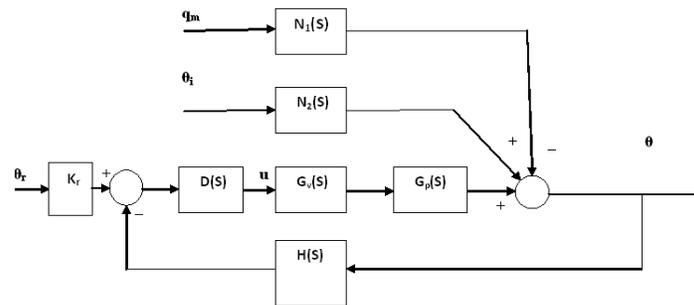


Fig.8 (b) Proposed Heat Exchanger Control Loop

The first step in the design is the selection of the temperature sensor and steam-valve actuator. For temperature measurement, we select an intelligent sensor which has, in addition to the basic device such as a thermocouple, a signal processing circuit which takes the output from the thermocouple and converts it to a current signal that is proportional to the temperature. The signal processing circuit includes an amplifier and a filter. For steam valve adjustments, we select a pneumatic actuator which can provide large output power. Since the valve actuator must be operated by air pressure and the sensor generates electric current signals, a current to pressure transducer is also required in the feedback loop. The feedback control scheme works as follows: the measured controlled variable as compared with the set-point;  $K_r$  in Fig. represents the conversion of set-point scale. The controller generates a control signal,  $u(t)$ , on the basis of the difference between the measurement and set point. The control signal is then connected to the pneumatic actuator of the steam valve through an electro pneumatic device—a current to pressure transducer. The function of the valve actuator is to position the valve in proportion to the control signal. The steam flow is then a function of the valve position. If the design is to be carried out analytically, a transfer function description of the feedback system must be found. Let us now find the transfer function model of each block starting with the heat exchanger. The heat exchanger consists of three blocks, one for each of its three inputs.  $G_p(s)$  is the process transfer function relating the outlet temperature to the steam flow,  $N_1(s)$  is the process transfer function relating the outlet temperature to disturbance in process fluid flow &  $N_2(s)$  is the process transfer function to disturbance in inlet temperature. The following parameters obtained from the survey

of a sugar industry are used in developing a model of feedback system [12]. The exchanger response to the steam flow has a gain of 600C/ (kg/sec) and a time constant of 20 sec. The exchanger response to the process fluid flow has a gain of 60C/ (kg/sec) and to inlet temperature; the gain is 20C/0C. Therefore,

$$G_p(s) = 60 / (20S+1);$$

$$N_1(s) = 6 / (20S+1);$$

$$N_2(s) = 2 / (20S+1)$$

The time constant of process depends on the residence time (tube volume/volumetric flow rate) of the fluid in the tubes. As a consequence, the time constant may vary because of flow rate fluctuations & fouling. Therefore this should be ascertained how sensitive the performance of the final system design will be to changes in the time constant of the process. The control valve has a maximum capacity of 1.8 kg/sec of steam, linear characteristics and a time constant of 4 sec. The nominal pressure range of the valve is 4 to 16 psig.

$$\text{Valve gain} = 1.8(\text{kg/sec}) / (16-4) \text{ psi} = 1.8/12(\text{kg/sec})/\text{psi}$$

The electro pneumatic valve has a constant gain

$$\Delta P / \Delta I = (16-4) \text{ psi} / (20-6) \text{ mA} = 12/14 \text{ psi/mA}$$

Including the constant gain of current to pressure transducer in the control valve transfer function,  $G_v(s)$ , we obtain

$$G_v(s) = 0.15 / (4S+1)$$

The sensor has a calibrated range of 20 to 120<sup>0</sup>C and a time constant of 10 sec.

$$\text{Sensor gain} = 14 \text{ mA} / (120-20)^{0}\text{C} = 0.14 \text{ mA}^{0}\text{C}$$

The transfer function of the sensor is given by

$$H(s) = 0.14 / (10S+1)$$

The set point scale factor

$$K_r = 0.14 \text{ mA}^{0}\text{C}.$$

The block diagram of temperature control loop as proposed is shown below in fig.9.  $\theta_r$  is the change in set point value from initial setting,  $\theta_i$  is the deviation in process fluid temperature from nominal value,  $q_m$  is the deviation in process fluid flow from nominal value,  $\theta$  is the deviation in outlet temperature from nominal value and  $q_{ms}$  is the deviation in steam flow rate from nominal value.

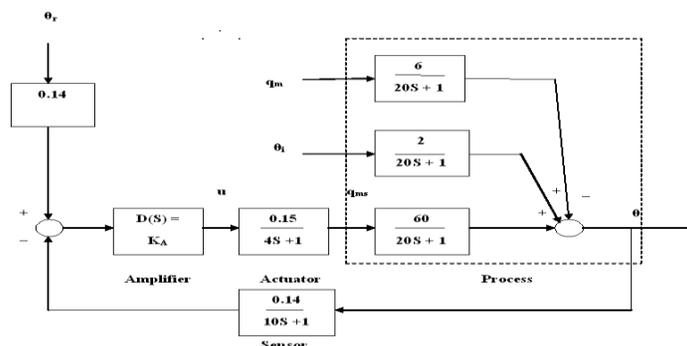


Fig.9 Model of Heat Exchanger Control Loop

**Simulation Results:**

The Fuzzy Logic Controller is applied to the plant described above in fig.8 (a) with a transfer function model given in fig.8 (b). It is simulated for the above Heat Exchanger Control System. Simulation with FLC is done with rules, FIS editor, rule editor, rule viewer, surface viewer and membership function editor as shown in fig.10.

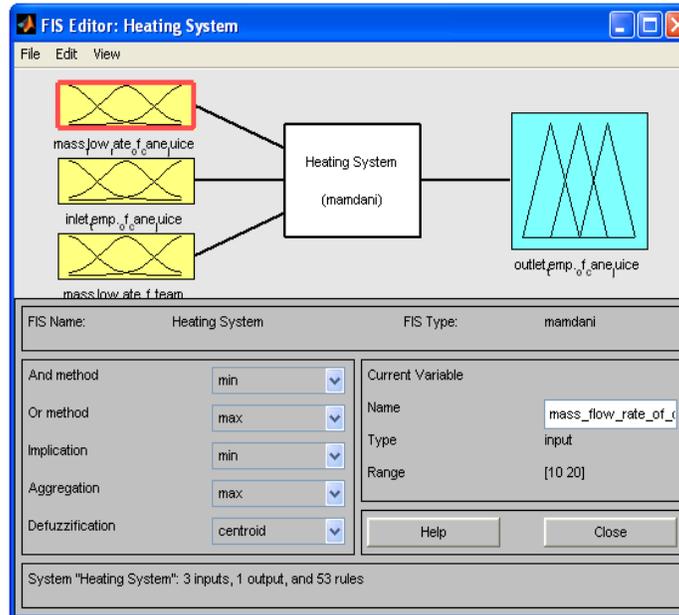


Fig. 10(a) FIS Editor

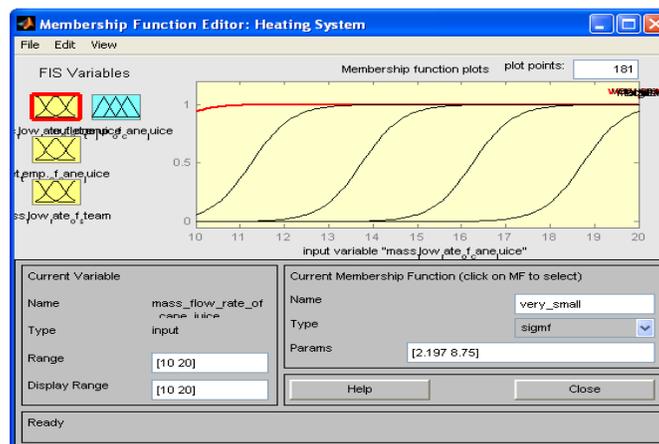


Fig. 10(b) Membership Function Editor for input 1

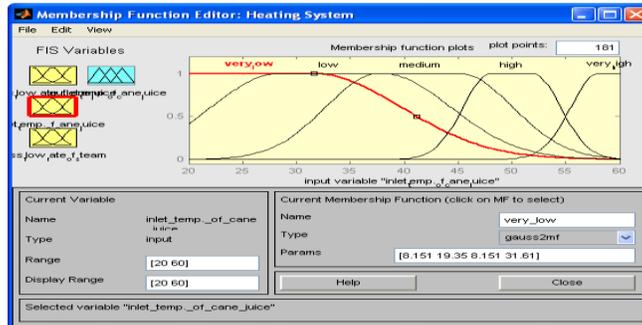


Fig. 10(c) Membership Function Editor for input 2

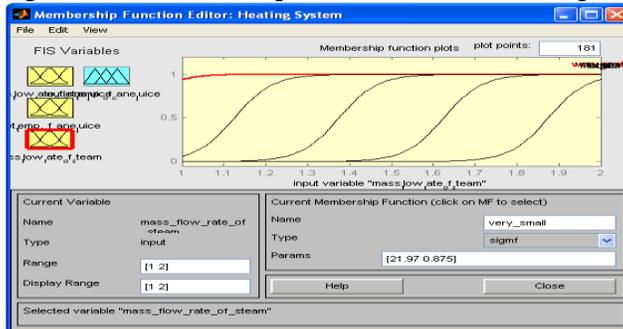


Fig. 10(d) Membership Function Editor for input 3

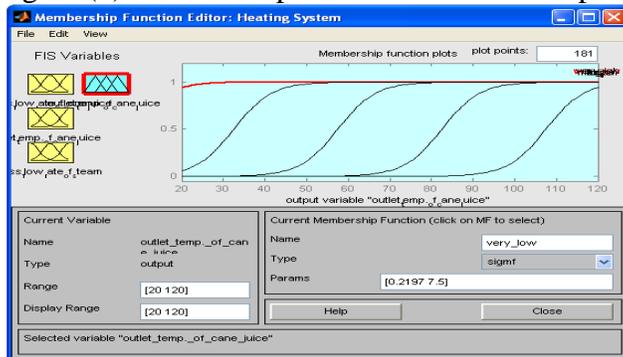


Fig. 10(e) Membership Function Editor for Control Output 1

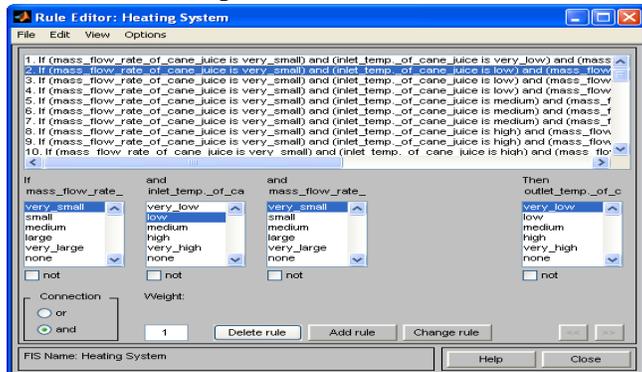


Fig. 10(f) Rule Editor

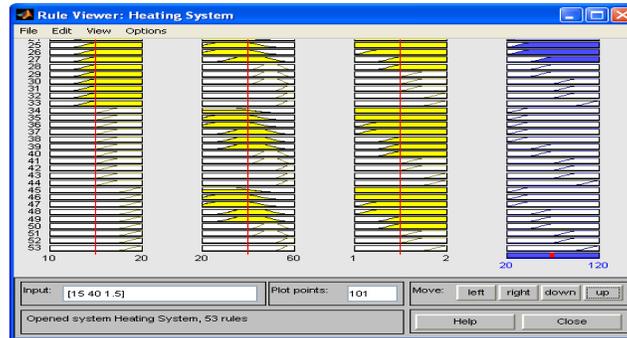


Fig. 10(g) Rule Viewer

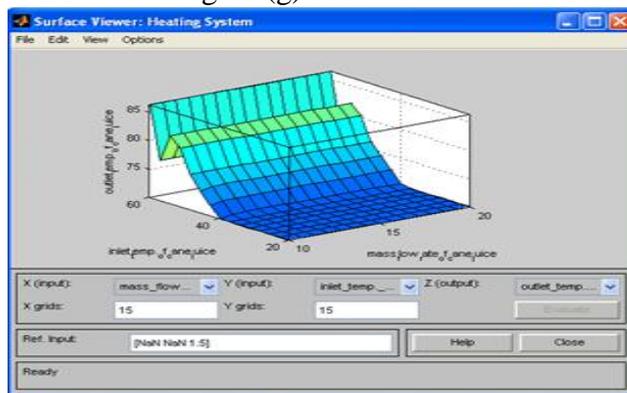


Fig. 10(h) Surface view

Fig. 10 Fuzzy Logic Controller Parameters  
(FIS editor, Rule editor, Rule & Surface viewer and Membership function editor)

### Conclusion:

Unlike some fuzzy controllers with hundreds or even thousands of rules running on dedicated computer systems, a unique FLC using a small number of rules & straightforward implementation is proposed to solve a class of temperature control problems with unknown dynamics or variable time delays commonly found in industry. Additionally, the FLC can be easily programmed into many currently available industrial process controllers. The FLC simulated here is based upon a heat exchanger temperature control problem & promising results obtained can be applied to an entirely different industrial temperature apparatus. The FLC exhibits robust performance for plants with significant variation in dynamics.

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