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Editorial

The Global Economic Scenario is grappling with three major crisis those thwart growth and development. These thrilling issues are Food Crisis, Water Crisis and Ground Water Crisis. These elements constitute a major share of five classic elements like Earth, Water, Fire, Air, and Aether, the basic unit upon which the constitution and fundamental powers of anything are based. No doubt the third phase of industrial revolution had already taken place with a lot of emphasis on service sector. But think tanks often argue whether this economic growth is at the cost of environment? Demand for energy in total globe has been enormously increased due to the increasing population and industry as well. The current status of energy supply does not cater to the needs of all the consumption spheres. We have already witnessed the situation during 1970 energy crisis caused by Germany, US, Kannada etc, 1973 oil crisis caused by OPEC, 1979 oil crisis caused by Iranian Revolution, 1990 oil price shock caused by Gulf War and many more. The consequences were nerve-wrecking. In the present times several counties have shown a red sign towards energy supply and conservation. To mention a few 2008 Central Asia Energy Crisis and China Energy Crisis due to diesel and coal shortages are upcoming threats to combat. As petroleum, coal are major source of non-renewable energy sources with a stipulated amount contained in the core of the heart, focus should be shifted to sustainable sources like tide, wind and air.

The industrial expansion has fueled the rate of deforestation as the United Nation Framework Convention on Climate Change has reflected that Subsistence farming is responsible for 48% of deforestation; commercial agriculture is responsible for 32% of deforestation; logging is responsible for 14% of deforestation and fuel wood removals make up 5% of deforestation. With the increasing trend of Population, Urbanization and Globalization and Industrialization the ecology and biodiversity are heinously affected. There is a great challenge to compensate the present level of decay. The situation is alarming and it will still prevail to disrupt the environmental harmony if not addressed.

Water is inevitable aspect of total kingdom of plantae and animalia. In the recent years the ground water crisis is emerging in many parts of this world. The purity of net usable water under the earth continuously gets infected due to multifarious reasons. The industrial influents coupled with ineffective waste management threatens the water resources. Global Warming, Green House Effect although carries a great disaster in a long run it also dampens nitrogen, carbon and water cycle. Soil Fertility and productivity is also reduced due to erratic nitrogen fixation and Oxidation. The excessive usage of water in the emerging sectors like Hospitals, hotels and resorts has led to alarm a future scare of water resources.

Thus we are faced with mighty challenges. Fortunately we have a history of meeting great challenges using imagination and our irrepressible capacity to adopt. To ensure that we journey

in the right direction, we must allow our knowledge, experience and institutions to catch up with the overwhelming progress of science and technology, and learn how to become both good neighbors for each other and good guests of the natural environment.

It's my pleasure to welcome all the participants, delegates and organizer to this international conference. In the process of organizing this conference IRNet family members have shown their commitment and dedication. I sincerely thank all the authors for their invaluable contribution to this conference. I am indebted towards the reviewers and Board of Editors for their generous gifts of time, energy and effort.

The papers that have been included in the proceeding passed through a stringent scrutiny process and thorough review.. I congratulate and wish all success to the authors.

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Identification of Urban Transportation System And Its Effects on Pollutions Control And Human Health From Urban Planning Perspective

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Abstract **-** Road networks, cars, buses, trucks, traffic signs and regulations are normally related to the urban transportation system. There are two types of the urban transportation system. Studies have shown that each type of urban transportation systems with their traits has advantages and disadvantages; nevertheless, they can complement each other. Profiles of each system have different efficiency on kinds of the urban transportation system and some of them are suitable for a certain volume of traffic and makes the city economically. For example, in the modern cities, where there are two types of transportation systems, the old and new system works together. Experience elsewhere has shown that due to lack of attention to the type of equipments or vehicles used to have led to awful results. This study attempts to identify and review two types of transportation system, pollution control and human health within the city from urban planning perspective. Firstly, the traditional transport systems and second, the new systems (or modern system). After identification and evaluation of each transportation system, this study will discuss the traits or characteristics of the two systems standpoints i.e. about the pollution control and human health. The pollution because of vehicles uses, mode of passenger transports whereby and also its effects on human health are important and significant. Finally, discussion about the result of the optimized urban transportation system based on urban perspective will be presented descriptively.

Keywords: *Identification, Urban transportation system, Urbanity, Traditional systems, Modern systems, pollutions control, Human health*

I. INTRODUCTION

Today, a variety of urban transport systems with advantages and disadvantages characteristics can be complement each other. Profile of each system of transportation for the city with a certain volume of traffic makes the city money. Therefore, should not be fallow the certain system that is better to all cities, But the best always comes from the combination of different urban vehicles. In modern cities, old and new types of transport systems work together, and experience has shown that lack of attention to the various devices has produced bad results. The best evidence is the shape of American cities to the full attention to the roads and car system caused to forget other systems such as walking, buses and trains is a city [1]. City's traffic problems are not specific to an urban transportation system for automobiles and others, but most of the problems are resulting from improper use and misuses of the system are not the system itself [2]. The car is likely vehicle in the city because of, privacy vehicle, proprietary device to purchase and circulation. Today rush hour congestion in cities is due to the large number of cars on the roads resulting from the more use of cars for movement from employment and working. So if most people go to work by car because of the weakness and disable of other systems it should be understood and pay attention to some problems with cars, passengers preferring to use it [3]. This is necessary to remember that each transportation system has some characteristics and its possible which some of them be unique characteristics and passengers want to choose any system pay attention their characteristics. The major characteristics or traits of the systems will be influence on the types of vehicles that is interest to traveller's health and the interests of society as a pollution control. Actually the most important disadvantages from some of the urban vehicles are pollution and its effect on human health. “This is a fact that pollution means the loss of nature is beautiful. Pollution can be dangerous for healthy life not only human but also all creatures [4].

Air pollution from vehicles has many different short time and long time effects on human health and has effects on different people. Vulnerability of some peoples against air pollution is more than other. Younger children and elderly people are more suffering from air pollution. There are five important polluters in the cities that include carbon monoxide, nitrogen dioxide, ozone and particulate matters. "According to Iran's health ministry reported around 3600 person's death per annum due to complications of pollution in Tehran-Iran [5]". This study wants to focus and identify and survey two cases emerged transport system within the urban in the world and its effects on pollution control and human health from urban planning perspective.

II. TRADITIONAL URBAN TRANSPORTATION SYSTEM

Traditional system of transport is a groups system that now working in cities in the worldwide. The Mainer traditional transportation systems are described below.

A. Walking

Walking system is the oldest system and this system nowadays is needful to move people into the cities and without the help of this system, any other system is not able to bring passengers from origin to destination. Walking system was forgotten to the short time because of car era, but the consequence of this lack of attention is now turned on all the planning and is important during the planning and design although we can say this still is not too enough. The main limitations of this system are moves slowly, the short length that pedestrian can go and protect against wind, rain and sun (shown in figure 1), [1]. The walking system components are such as, walkway lines, lights for walking, subway and Air Bridge is made for walking. Some researcher have said that the old market of Iran is one of the advance types of walking system and most country in the world today is considered it [6].

Figure 1. Walkway and pedestrians in the city centre of Yasuj-Iran

B. Motor Bikes and Bicycles Systems

All the benefits of walking such as the cheap, energy saving and low effect on the environment is favourable with the bike. In addition, this system is speedy more than walking and to long length can be used. This system is not applicable in all climatic conditions and also in the cities is fast changing the slope so it would not be practical of course motorized bicycle in these cities can replace the bike without the engine (shown in Figure 2).

Figure 2. Bike modern system design by BMW's

Bicycle and motorized bicycle according to safety should not be in ways that made to rapid vehicles. The bicycle way must be separate, and next to vehicle ways and several streets in the city is the necessary to bicycle across travel. Network of bicycle routes has special characteristics same as another rapid transportation that should be attention and considered [7].

C. Car

The main advantage of the car is space dedicated available, adaptability, security, speed and passenger high comfort which this vehicle is popular for people. The car is expensive because of the high volume of invested to streets, terminals, and the environmental effects of inappropriate and excessive use of energy and other raw materials from the social perspective [8]. It could be argued that the United States of America spends about 25 percent of national income to transport people and goods. The other major problem is the allocation of space in cities cannot move all people by the new or old cars (shown in figure 3). Line of a street can be a maximum around 400 cars pass with acceptance speed that, if 1.5 person sit within every car, there is a line that can move up to 600 people, The capacity of the highway for a person to be around 2250 [9].

Figure 3. New and old car models

D. Buses and minibuses

Another city traditional transport system is the buses and minibuses. The Bus is one of the urban public transportation that requires little investment and is expandable quickly. Bus lines can be changed easily and simply. Changes the number of buses is possible and coordinates of the system against changes in demand of traffic works very good. This system in the low density, medium and medium to high works well. The cost of maintaining and operating of the bus and minibus system comparing with other social systems, especially in terms of labour is high. The capacity of this system is less than the capacity of rapid group systems, and its speed in urban traffic is low. Buses are most economical to urban transport, especially for areas with low or medium traffic volume [3]. An important feature of this system is to operate in all weather conditions. Main problem of the bus system is low speed in the city centre, and it's solved with special lines, especially in the crossroad or intersection. If a line of generally street be special for buss at an hour around 200 buses can pass and if be 50 passengers on a bus on a line of the street, about 10,000 passengers can be relocation. The Highway dedicated to bus. The capacity to 60,000 passengers in an hour for a line is possible. Other types of buses are trolley buses which have many advantages in terms of air pollution and noise pollution, are too much better than generally buses. Moreover, in areas where electrical energy is plentiful energy is an advantage. The disadvantages of trolleybus First, the initial investment is required, and it cannot easily change its direction.

E. Light urban rail or tram

This system consists of buses that travel on light rails, and the buses move by the electricity force. The buses and cars have a common area; therefore, trams don't have privacy area. This system becomes before rubber wheel's vehicles and now occurring in more countries, and more cities are in service [10]. The system capacity is higher than normal buses and the energy consume is less than buss, also trams are better to environmental protect. Moreover, the management and labour costs are an economy than buses, because the number of buses moves on a rail with a driver [11].

F. Rapid Public systems

Another traditional transportation system is rapid public systems that should be five features. These features include 1 –has a dedicated space 2 - have not intersections with other vehicle systems 3 - stations shall be fixed and certain 4 - the path is set as specified 5 - schedule regular of movement be vivid and anticipated. So according to these characteristics, rapid public systems that currently are active in different cities in the world are as follows, subway or underground trains, ground up train and a special bus route [12]. In more cities in the world, the subway or metro system is servicing now and train moves on rails, but in the Paris, Mexico City and Montreal, the train move on rubber wheels. One of the most important properties of the subway system is high capacity and did not interfere with the existing urban texture. The average speed of movement varies depending on the capacity of the subway. The average moving speed is higher, and the safety and controlled of trains depending on the average speed [11]. Studies have shown that each line of bus in an hour 1200 buses can pass, and the capacity of each line reaches until 60,000 passengers in an hour. [13].

II. MODERN URBAN TRANSPORTTAION SYSTEM

This section wants to introduce the system is not used wide world. Some of these systems currently are in the design and development stage. Other still in the testing phase as well as a very limited number of cities in the world is used. In the developing process of the new system tried to employ all or some advantages of the traditional system. In addition to these important features such as speed, safety, style, beauty, low energy consumption and environmental effects are considered [14]. Some of these systems include.

A. Highways Automated

Driving by car, the driver must rely on his senses and decisions are very important, to this reason, travel by car is very dangerous. Automatic or semi-automated highway could take all or part of this decision from the driver. Highway automatic has more advantages such as movement is safety and secure, other drivers are not obliged to keep a lot of distance and road capacity will be become up. According to these benefits designing and developing of highway automatic are studying. Auto off the highway will be implemented in two

stages. Firstly, providing lots of information for the driver, the driver of the first does not require to multiple decisions. In this system, central computer through arrows marks the three follow commands to the driver (turn left, right and straight) and through the shortest route to the destination the driver will steer. Secondly, semi-automatic construction of the highway, which is a normal highway, in the middle two lines is automated and can enter the cars to auto parts. So when this vehicle is to be as automatic control and guidance. General Motors Corporation in America for this project is based on the testing experience and estimated to the price of every car that is about 140 dollar needs. The cost of a Km automatic line, about 2.5 million dollars has been made. It is estimated that an automatic line is able to 9000 car pass with 90 km speed per hour [15].

B. Single railway train (ALWEG)

This system first made by EVG (Excel Winner Gren) which a Swedish design. System composed of a train on a rail, move via mount on a rail and is automatically controlled and directed (shown in Figure 4). Currently single-rail train service is being in the Tokyo Disney land (California), Walt Disney world (Florida) and Seattle (Washington State). The system capacity is 45,000 persons per hour, and the minimum distance between stations is 600 meters. "The main advantages of this system are over the existing networks and there is not any intersection with roads in the ground, and the main disadvantage of this system is that it works in snow and freezing weather is not good [16]".

Figure 4. Single-railway train (Kualalumpur)

C. Hanging Train (SAFEGE)

This system is same as a single track but the train does not move on the rails rather the train is hung (shown in Figure 5). So firstly, is not sensitive in the weather conditions, such as single track secondly, beautiful looks, and it's done better at the arches. For two-way traffic about 10 meters, wide space is required and this space provided an aboveground level because of prevention from intersections with other system crossings. maximum speed is 120Km per hour and up to 57,000, people per hour can supplant with its Line [17]

Figure5. Hanging rails train

D. Air train

This system made of light material same as the plane then moved on a thin shell of air is placed between the train and the fulcrum. The fulcrum shape is T-shaped and made of massive concrete. Fulcrum is placed above the ground in a way that existing network not create interference. The cost of fulcrum for two way rail per KM 0/5 million dollars is predicted and also the cost of make an air train with 180-seat capacity is 0/5 million dollars. "The maximum air train speed is about 400 KM per hour. The capacity of each line profile between 4,000 to 11,500 people has been estimate in per hour [18].

E. Gravity vacuum system

According to the most spending of the energy consumed in transportation is to eliminate air resistance a U.S Company designed a vacuum system for saving energy. In this system the vehicles are same as long cylinders shape and slider in the underground tunnel that is a vacuum. Network is designed so that the cylinders are using gravity force to help speed and brake in slope. Vehicle will be fully automated controlled by the group of computer system from outside. Design of the system still is a concept and about $10 million Dollar per Km has been predicated. System capacities about 46,000 people have been estimate that the number of people with very little energy can be relocation.

F. Mini Rail

The Mini Rail developed by both American and Swiss company that combined with small wagons. System moved on rails same as a single railway that sits above the ground. This system differs from the single railway train is small wagons (the wagon has 12 seats), low speed (speed maximum 45 KM per hour) and low number of compartment (9 compartment per train). Mini rail system is light and basic cost is low that it can move up to 600 people in a line at an hour. Another benefit of this system is its beauty. This system can be suitable replace to walking in the place where there is density of activities such as downtown and airport is.

G. Dual- purpose system

This system characteristics include privacy car traits (private space and not depend on particular route) and public vehicle benefits (high capacity, high speed, no problem parking, etc). One of the Dual- purpose system made by American company called Standard Ararat (STA.R.R). This system consists of small cars that can move independently and aid batteries. Car can be stop on the special move lines. Each car can pickup 4 persons and capacity of moving line that car can be stop mode is 28000 people on at hour. Probably this system will be used way the small-cars are rented to people who want to remove them from the main line. They can not go to the city centers by the rented cars but when they want to go to their places in the low density residential can take a small cars and will be return on the main line by its.

H. The proposed of ultra-modern care

The Swiss company for the future of urban transportation and world has an ambitious dream (shown in Figure 6). Making the car whit speed of 2o thousand KM per hour on the road can move. Speed which makes it possible to travel around the world is in two hours. This plan maybe seems a little impossible, but the "Akabion" company he might get the idea until 2100. This company going to used vacuum tunnel to move instead of roads foe these fast cars. Also it is important that this dream was not at the national level and plan is created a global network of vacuum roads that allow passengers to travel around the world in less than two hours.

Figure 6. Car design expected in 2100

IV. EFFECTS of URBAN TRANSPORTATION SYSTEM ON POLLUTION CONTROL AND HUMAN HEALTH

The clean air is human happiness in life that requires is more than needed to feed and water. Nowadays products of gases and particles by modern industry can be contaminating the air. In the past, the coal in the industry produced a lot of sulfur dioxide, but today, due to the low content of sulfur in coal, the fuel does not produce a lot of problems. The motor vehicles are fundamental problems that produced non-biodegradable, nitrogen dioxide and organic particles and converted to ozone by the effect of solar radiation. These are the most important air pollutants [5]. Than human health has a direct relationship with pollution control that this part of study will consider both of A- vehicle and pollution control B- Vehicle and human health.

A. Vehicle and Pollution Control

For first time pollutions especially air pollution erupted in Los Angeles in the years of 1940. In the 1952 was discovered that the problem of "smog" is done because of recreation between nitrogen oxide and hydrocarbons compounds in sunlight exposure and the engines are the main factors. Diesel engines are also a major source of soot and fine particles [4].The fuel of more vehicles especially traditional transportation system is fossil resource and in during of combustion is generated much air pollution. It is better to reduce emissions of pollutants from engines combustion, liquid gas or electric energy (EFI) is replaced fossil fuel. This important work has been done. Some industrialized countries including Japan and United States led the project and the results have been favorable [19]. According to studies about vehicle pollutions shown that the toxic carbon monoxide gas, which is mainly related to the cars, bus, truck and other vehicle that their fuel consumption is petrol and gasoline. These cars have a lot of CO gas in the air through themselves exhaust. Therefore the cars are one of the largest source of CO gas within the cities is (6.65 percent).The concentration of CO gas dependent on the status of population daily activities and traffic condition (shown in figure 7).

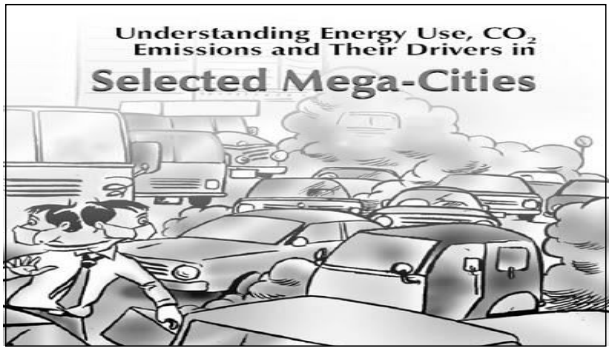

Figure 7. Air pollution by urban vehicles

This poisonous gas is extremely dangerous to human health. In addition another result of air pollution is acid rains that the caused by cars. This rains is disastrous not only for human but for all creature. However pollution and especially air pollution is ill for human. For example in the 1952 London smog disaster around 4000 people died in several days to reason high

concentration of air pollutions [4]. Necessary educations and proper use of gasoline and petrol powered for vehicle can be sufficient to guarantee of existence health and control of air pollution [20]. The study has some solves ideas to pollution control from vehicles that are prevention is the most important action to air pollution, walking and bicycle use to help keep the air clean and health, "modified internal engine combustion in order to reduce of pollution produced during of fuel combustion, developed and developing more fuels with less pollution is the combustion time [21]".

B. Vehicle and human health

The urban vehicle and human have a close relationship and seem that human within cities can not do anything without urban vehicles every day. Also human health depends to kind of vehicles used. Nowadays some of the urban transportation system is threatening foe human health because of air pollution; noise pollution and accidents (shown in Figure 8).

Figure 8. pollution and Human health

Existing data of dead number caused by the some of the urban vehicles are shaker and this is best evidence for harmful effects from some urban vehicles on human health. So the first steps to solve of problems (air, noise pollution and accident) are evaluation. Knowledge and experience has shown that walking, cycling and use of urban electric vehicles have suitable features and are practical against other vehicles about human health and pollution control. Electric vehicle technology has the potential to reduce transport CO2 emissions, depending on the embodied energy of the vehicle and the source of the electricity [22]. Most researchers have written about advantages of walking and cycling for human health. Use of walking and cycling is useful to help keep the air clean and healthy (shown in diagram 1).This diagram shows the amount of emissions such as carbon monoxide, nitrogen dioxide, benzene, toluene and xylene from car and bicycle in Yasuj-Iran [20].

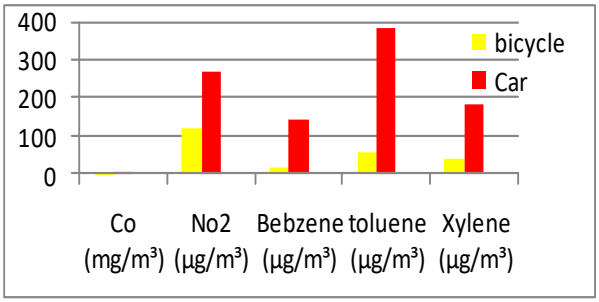

Diagram 1. Compare amounts of emissions by car and bicycle (Yasuj 2010)

In addition to air pollution the other risks of the cars also are threat for human health and these risks are accidents illustrated by (Fig 10). The injury risk is often calculated and used in connection with engineering considerations. Generally, the risk is calculated as the number of undesired incidents (accidents, injuries, injured persons, and deaths) divided by a measure for the amount of transport involved (kilometers, trips, time). [23]. For this reason the number of injured persons shown in relevant Figure 9, 10 and 11) [7].

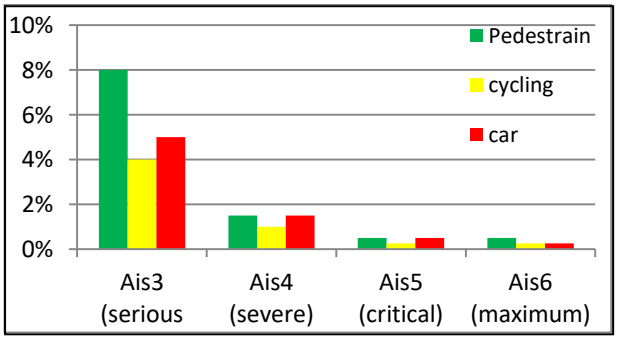

Figure 9. Injury severity in % of all injuries in Yasuj-Iran,2010

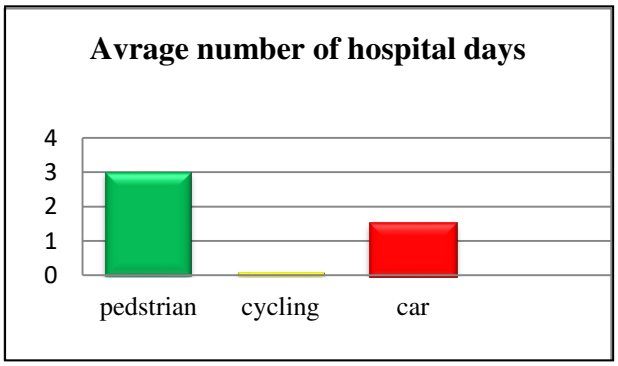

Figure 10. Average number of hospitably days

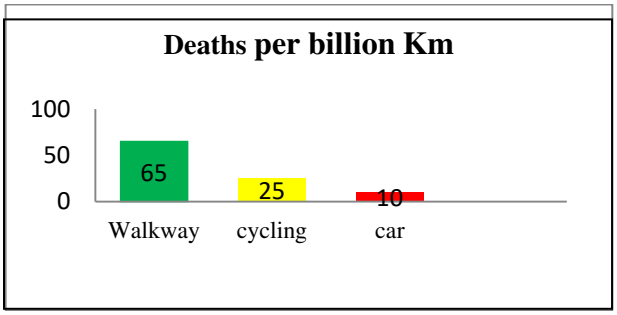

Figure 11. Deaths per billion KM

From the Figures can conclude that only when kilometers are used as a measure, significant risk differences between the three modes appear. Cycling in this case turns out to be 4-5 times as risky as car use, and walking more than 10 times as risky. For risk measured per trip or per time spent in transport the three modes walking, cycling and car driving are not differing significantly [23]. Therefore pay attention to result of study and figures and diagrams selection of urban vehicles is most important for human health and control pollution.

V. METHODOLOGY

A. Field Method

Study include the field observations for obtains photos, collect statistics needed to complete the questionnaire; survey and discussions with some experts have been in place. Also the survey of urban traditional and modern transportation, people behaviors' observed and studied whit this method.

B. Library Method

This case was been study in libraries and other similar locations. Using of scientific different sources and expertise, such as books, scientific journals, magazines and newspapers have been concerned by this method. In this method from the various web sites, video clips and software requirements (photo shop) is used.

VI. CONCLUSION

Surveys have shown that a verity of urban transport system have some advantage that can complement and disadvantage characteristics each other. The Profile of every transportation systems is suitable economy and useful for the kind of city transportation and certain volume of city traffic. Therefore can not find certain system is better for all cities traffic. Best ways always come from the combination of different system. The city's traffic problems are not specific from an urban transportation system such as automobiles and roads, but most of the problems resulting from improper use and misuse of the system, are not because the system is it. Urban air pollution from urban transportation system will be influences on both of the health of citizens and the development of cities. Therefore to solve problems proposed in order to optimize use of transportation systems such as systems management, specialist human resources, targeted planning, proper and fair use, foresight and good investment environment according to the financial resources placed at the head of all things. These should be studied in depth. So only focus on human health or only consider pollution control is problematic and will lead to many problems. Than prevention is the most important action to air pollution and it is useful for human health, walking and bicycle use to help keep the air clean and health, "modified internal engine combustion in order to reduce of pollution produced during of fuel combustion, developed and developing more fuels with less pollution is the combustion time" [21]. There is not one universal remedy for solved environmental problems because there are varieties of individual, group, regional, and physical environmental factors come into play.

REFERENCE

[1] O, Kohzadi, Organizing the walkway in Ysuj city centre, MS degree thesis, Tehran. – Iran, 2004.

[2] H. Behbahani, "advanced system to organize, manages and maintain urban street", j, Traffic, Summer Season.2001

[3] M. Alfonzo, "To walk or not to walk? The hierarchy of Walking needs" j, Environment & Behavior, 37(6), 808-836.2005.

[4] M. Dabiri, "environmental pollution (air –water - soil – noise)", Department of Chemistry, Shahid Beheshti University, Tehran – Iran, 2009. Medical sciences reports of Tehran University, www.dailyir,2011

[5] H, K. Lakher (2 pedestrian and bicycle traffic planning principles, translate by F.Gharib, Tehran University press, 2002.

[6] Omran, K. S (2011). Organizing and Improving the Walkways in city centre of Yasuj, Iran, ITC (International Transportation conference) in Pinang – Malaysia

[7] H.Behbahani and H Piman,"The guide of city street" ", published components.1999.

[8] Federal Highway Administration, "Urban Traffic Control and Bus Priority System", Offices of Preserve and development, Washington, Ministry of Road America Report No. RP-73-9 1980.

[9] S.Matinrad, "Design of internal space for Mashhad K2 train station", Bachelor degree thesis. Dezfoul – Iran, 2011

[10] M, Mirdamadi, " introduction to the construction of roads in Tehran- Iran",Tehran publish (1995).

[11] H, Rezai, "the urban place, (design, implementation and management)" Municipality of Tehran, 1994-1995.

[12] M. H. Hafezi and O, Kohzadi, S, "Study of Bus Lane Layout Efficiency in Tehran, Iran", ITC (International Transportation conference), Pinang in Malaysia, 2011.

[13] J.Spilkova and M. Hochel, "Toward the economy of walkway movement in Czech and Slovak shopping malls", j, Environment & Behavior, 41, (3), 443-445, 2009.

[14] A. Doroor,"The cover of streets",j,Technical & Social 21, Iran, 2002.

[15] K. Zuletzta,"The History of the Alweg Monorail System", www.grassrootsthefilm.com/, 2011.

[16] R. Lamber, "Saran, France – SAFEGE Monorail", "Saran, France - SAFEGE Monorail" Archived version of personal site hosted on now-defunct Yahoo,2010.

[17] Manhattan, "Train-to-Plane Use Sets Record", New York Times, 2007.

[18] M. Sadeghi, "Industrial Environment", Tehran published,1996.

[19] O. Kohzadi, "Identification and characteristics of urban transportation system", Abstract accepted in 4th Asian Civil engineering conference, Yogyakarta in Indonesia, 2011

[20] S. Salehvand, "systems and equipment of vehicles air pollution control", Iran Khodro published, 2007.

[21] Wilson, "The Emperor's New Car Report on Electric Cars", www.caradvice.com, 2010.

[22] K. Thomas, "Cycling, safety and health is available from the European cycling federation, www.copenhagenize.com/2011/04/, 2011.

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Impact of Supply Chain Stratergies On the Reduction of E-WASTE

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Abstract - India is one of the largest consumergoods market in the world. However, with the growing consumption of electronics and IT goods in the country, the environmental threat posed by E-waste has touched an alarming level.'E-waste' is a collective name for discarded electronics devices that enter the waste stream from various sources that include electronic appliances such as discarded computers, televisions, VCRs, cell phones, batteries etc. In concern with the environment and its healthy living, the government has undertaken many reforms and policies to mitigate the impact of e-waste. For instance, Corporate Responsibility for Environmental Protection (CREP) 2003**,** Hazardous Wastes (Management and Handling) Rules, 1989 etc. These reforms have brought out several impacts in the industrial sector and have a huge impact in the making of the products and their selling. Our paper portrays the impacts of the Supply Change Management techniques which led to the design of innovative steps and practices undertaken by the industries like reverse logistics, RFID tools etc to reduce the E-waste in the recent past.

Keywords: *E-waste, Supply chain management, Reverse logistics*

I. INTRODUCTION

The term **e-waste**,expanded form **Electronic Waste**, as a generic term embracing all types of waste, refers to all electronic devices, surplus, broken or obsolete, which have been discarded. Examples: Computers, LCD / CRT screens, cooling appliances, mobile phones, etc., contain precious metals, flame retarded plastics, CFC foams and many other substances. According to estimates by the UN, the world produces up to 50 million tonnes of e-waste per year. The decreasing cost of electronic goods has only compounded this problem. In practice, computers, televisions, mobile phones and electronic gaming devices form the biggest proportion of e-waste.

E-waste is particularly significant because disposal of electronic items can result in toxic rubbish, as they contain dangerous metals like lead, cadmium and mercury, which can contaminate air and water when they are dumped. Concern about the environmental issues surrounding e-waste has led governments across the world to implement laws prohibiting its disposal in landfills and issue directives on recycling. There is also now tighter regulation on the movement of electronic waste, which traditionally found its way into Asian countries such as China and India.

II. CLASSIFICATION OF E-WASTE

- *Large Household Appliances*

  Washing machines, Dryers, Refrigerators, Air-conditioners, etc.

- *Small Household Appliances*

  Vacuum cleaners, Coffee Machines, Irons, Toasters, etc

- *Office, Information & Communication Equipment*

  PCs, Laptops, Mobiles, Telephones, Fax Machines, Copiers, Printers etc.

- *Entertainment & Consumer Electronics*

  Televisions, VCR/DVD/CD players, Hi-Fi sets, Radios, etc.

- *Lighting Equipment*
- Fluorescent tubes, sodium lamps etc. (Except: Bulbs, Halogen Bulbs)
- *Electric and Electronic Tools*

  Drills, Electric saws, Sewing Machines, Lawn Mowers etc. (Except: large stationary tools/machines

- *Toys, Leisure, Sports and Recreational Equipment*
  Electric train sets, coin slot machines, treadmills etc.
- *Medical Instruments and Equipment*
- *Surveillance and Control Equipment*
- *Automatic Issuing Machines*

TABLE 1: *Composition of e-waste in India*

Equipment Category	Weight in Composition
Computer equipment	75
Telecommunication equipment	13
Entertainment equipment	3
Electrical equipment	4
Medical equipment	4

III. MARKET SHARES ON DIFFERNT ELECTRONIC GOODS

Companies	Revenue 09-10 (millions)	Revenue 10-11 (millions)	Growth	Market Shares
Nokia	12,900	12,929	0.2	39
Samsung	4,700	5,270	21.7	17.2
Micromax	1,602	2,289	42.9	6.9
BlackBerry	1,210	1,950	61.2	5.9
LG	1,600	1,834	14.6	5.5
G'Five	755	1,326	75.6	4
Karbonn	800	1,004	25.5	3
Spice	1,040	920	11.5	2.8
Maxx	514	745	44.9	2.2
Sony Ericsson	590	690	16.90	2.1

This table represents the total revenue of the mobile phone companies in the calendar years 2009-2010&2010-2011.From the table it is seen that the brand Nokia surpasses other companies in its shares although their growth rate is minimum.

TABLE 3: *Laptop market Shares 2010-2011*

Rank	Vendors	2011 Shipments	Market Share	2010 Shipments	Market Share
1	HP	4,692	26.3	4,721	25.3
2	Dell	3,959	22.2	4,408	23.7
3	Apple	1,917	10.7	1,671	9
4	Toshiba	1,617	9.10	1,560	8.40
5	Acer	1,513	8.50	2,028	10.9

This table represents the market shares and year over year growth of the laptop in 2010 &2011.From the table it is clear that HP leads in its market share.

TABLE 4: *Television Market Shares*

Rank	Brand	Share
1	Sony	20.40%
2	Samsung	19.50%
3	LG	17.40%
4	Videocon	17.20%
5	Onida	7.50%

This table shows the list of TV companies showing its shares in quantity and growth wise and it is clear from the table that Sony has its highest market share.

IV. WHAT IS SUPPLY CHAIN MANAGEMENT?

It is the oversight of materials, information, and finances as they move in a process from supplier to manufacturer to wholesaler to retailer to consumer. It involves coordinating and integrating these flows both within and among companies. It is said that the ultimate goal of any effective supply chain management system is to reduce inventory. The supply chain philosophy ensures that customers receive the right products at the right time at an acceptable price and at the desired location.

V. SCM AND THE ENVIRONMENT

As environmental practices increase in importance supply chain strategies will do the same. Firms finding that release of waste into the biophysical environment is becoming more difficult or even impossible are saddled with a new responsibility, waste control. This may have far-reaching implications for supply chain management. When source reduction is impossible or incomplete, the firm must deal with returned products as well as disassembly, recycling, reuse, repair work or remanufacturing, all of which mean more movement of material. The supply chain is then extended beyond the final consumer to become a "reverse supply chain"

TOOLS APPLIED TO REDUCE E-WASTE BY SCM

- Prequalification of suppliers
- Environmental requirements during the purchasing phase
- Supply base environmental performance management
- Building environmental considerations into product design
- Cooperating with suppliers to deal with end-of-pipe consumer environmental issues
- Reverse logistics
- Influencing legislation to facilitate better SCM policies
- Working with industry peers to standardize requirements.
- Informing suppliers of corporate environmental concerns
- Promoting the exchange of information and ideas

VI. SCM BENEFITS

It plays a large part in reducing costs. Supply chain costs can represent more than 80% of the cost structure in a typical manufacturing company. These numbers indicate that even slight improvement in the process eventually can translate into millions of dollars on the bottom line. Leaner inventories free up a large amount of capital. Depending on the industry, companies leading in supply chain performance achieve savings equal to three to 70% of revenues compared with their median performing peers.

VII. FACTORS INFLUENCING IMPLEMENTATION OF SCM

1. Supplier Management
2. Product Recycling
3. Life cycle management

Supplier management

This section involves in environmental auditions for suppliers, seeking their product testing reports through bills of materials, establishing environmental requirements for purchasing items and implementing green purchasing.

Product recycling

It plays a vital role in reduction of E-waste that includes joining local recycling organisation through collaboration on product recycling to produce disassembly manuals.

Life cycle management

The last stage that includes establishment of an environmental database of products by applying Life Cycling Assessment (LCA) tools to carry out eco-report.

VIII. ILLUSTRATION OF SCM IN COMPANIES TO REDUCE E-WASTE

Toshiba uses Supply Chain Solutions to repairs damaged laptops. Toshiba's customers can take damaged laptops to more than 3,300 stores throughout the country, and it manages the entire repair process. Laptops are shipped to the company's global hub, repaired, and returned to the customers. The one-stop repair model not only increases efficiency by reducing the amount of flights shipping parts back and forth, but also helps to consolidate the collection of e-waste and accelerate its recycling.

Kodak is an example of a company that has a remanufacturing line to the supply chain. It is reported that 31 million single-use cameras have been returned since 1990 .Although the timing of returns of single use cameras is unknown; Kodak has managed to allocate 310 million single use cameras back into their production line. The reason for this success came from its own product design. Kodak's single-use cameras are simple, reusable and easy to recycle, and because of this, Kodak has managed to reuse their products and save costs.

IX. REVERSE LOGISTICS

Reverse Logistics is defined as the process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal. Reverse Logistics (RL) is the opposite of traditional or forward logistics. The reverse logistics as a process where a manufacturer accepts previously.

Shipped products from the point for consumption for possible recycling and Re-manufacturing. Reverse logistics have been widely used in automobile industries such as BMW and General Motors. Other companies such as Hewlett Packard, Storage Tek are also using reverse logistics as a supply chain process. Collection is the first stage in the recovery process. Products are selected, collected and transported to facilities for re-manufacturing. Used products came from different sources and should be brought to product recovery facility to begin the converging process. Sorting and Recycling are also an important mechanism when sorting reusable products. The goal is to sort products that can be reused to reduce costs of making new products.

Panasonic Corporation of North America, Sharp Electronics Corporation and Toshiba America Consumer Products has established a new electronic product recycling management company, Electronic Manufacturers Recycling Management Company to provide a recycling service to electronics manufacturers. MRM has already entered into collection and recycling agreements with Hitachi Electronics, JVC, Mitsubishi, Philips, Pioneer and Sanyo. Some of the e-waste can be refurbished and sent to developing countries for resale. Many electronics companies are designing their products so that they can be disassembled easily. Dell already uses fewer screws in its computers so that they can be snapped apart easily.

X. IMPLEMENTATION CHALLENGERS

- Due to diversion of large chunk of e-wastes from retail consumers to informal recyclers and demand-supply mismatch organised e-recyclers are not getting adequate e-wastes to recycle.
- Collection centres are currently present only in a few cities in India and the collection process for these facilities are restricted due tologistical and geographical problems.
- Lack of legislation has been the core concern for e-waste management. There is no centralized mandatory or strict legislation in this regard. For better management, the legislation must clearly define e-waste and the limitations in terms of quantities of e-waste generated.

XI. CONCLUSION

Formal e-recyclers have to be supported by the central and the state governments to avoid the bottlenecks in building a better reverse supply chain of E-waste. In the long run formal e-recyclers have to be merged and have to make a presence of an influential body in this industry. They can do lobbying with the government to promote some innovative methods of collecting e-waste from retail consumers and promote awareness of the environmental impact of e-waste.

REFERENCE

1. Shobana Ramesh and Kurian Joseph (2006). Electronic waste generation and management in an Indian city, Journal of Indian Association for Environmental Management, Vol. 33, No.2, pp100-105
2. Beamon, B. (1999). Designing the green supply chain. Logistics Information Management, 12(4), 332-342.
3. Christopher, M. G. (1992). Logistics and supply chain management.
4. Lamming, R.; Hampson, J., (1996). The environment as a supply chain management issue. Brit. J. Manage., 7 (Special issue 1), S45-S62.
5. Rao, P.; Holt, D., (2005). Do green supply chains lead to competitiveness and economic performance?
6. Reverse logistics, stake holders' influence, organizational slack and managers' posture, 2006
7. US-AEP, (1999). Supply chain environmental management lessons for leader in the electronic industry. Clean Technology Environmental Management (CTEM) Program.
8. Ammons J and Sarah B. (2003) 'Eliminating E-waste: Recycling through Reverse Production' at www.lionhrtpub.com accessed on 7th September 2005.

Automatic Image Segmentation By Dynamic Region Growth And Multiresolution Merging For Bio-Medical Applications

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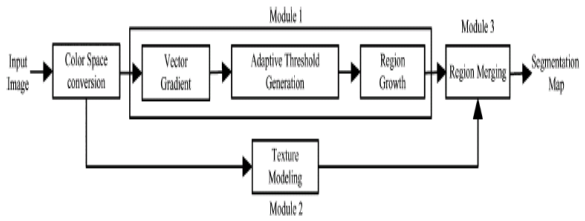
I. INTRODUCTION

A new unsupervised color image segmentation algorithm, which exploits the information obtained from detecting edges in color images in the CIE L*a*b*color space. In color gradient detection technique, pixels without edges are clustered and labelled individually to identify some initial portion of the input image content. Elements that contain higher gradient densities are included by the dynamic generation of clusters as the algorithm progresses. Texture modeling is performed by color quantization and local entropy computation of the quantized image. The obtained texture and color information along with a region growth map consisting of all fully grown regions are used to perform a unique multiresolution merging procedure to blend regions with similar characteristics. Segmentation of human brain from MRI scan slices without human intervention is the objective of this paper.

II. BLOCK DIAGRAM



III. METHODOLOGY

Image segmentation can be defined as the classification of all the picture elements or pixels in an image into different clusters. Various techniques have been proposed, the color, edges, and texture were used as properties for segmentation. Using these properties, images can be analyzed in several applications including video surveillance, image retrieval, medical imaging analysis, and object classification. Color provided significant advantages over gray-level segmentations. A new Gradient-SEGmentation algorithm (GSEG) that automatically: 1) selects clusters for images using gradient information in the CIE L*a*b*color space, 2) characterizes the texture present in each cluster, 3) generates a final segmentation by utilizing an effective merging procedure.

1. VECTOR GRADIENT

The detected areas with no edges inside them are the initial clusters or seeds selected to initiate the segmentation of the image.

2. EDGE-DETECTION ALGORITHM

An edge-detection algorithm is used to produce an edge-map used in the generation of adaptive gradient thresholds, which in turn dynamically select regions of contiguous pixels that display similar gradient and color values.

3. REGION GROWTH AND DYNAMIC SEED ADDITION

The region growth procedure also accounts for regions, which display similar edge values throughout, by detecting unattached regions at various edge density levels.

4. ADAPTIVE THRESHOLD

The GSEG algorithm is initiated with a color space conversion of the input image from RGB to CIE L*a*b*.The Initial Seed Generation employs special size requirements., which are 1) Run-length encoding of the input image. 2) Scan the runs, and assign preliminary labels and recording label equivalences in a local equivalence table. 3) Resolve the equivalence classes. 4) Relabel the runs based on the resolved equivalence classes, requirements to select the initial seeds, in order to prevent multiple seed generation within homogeneous and connected regions.

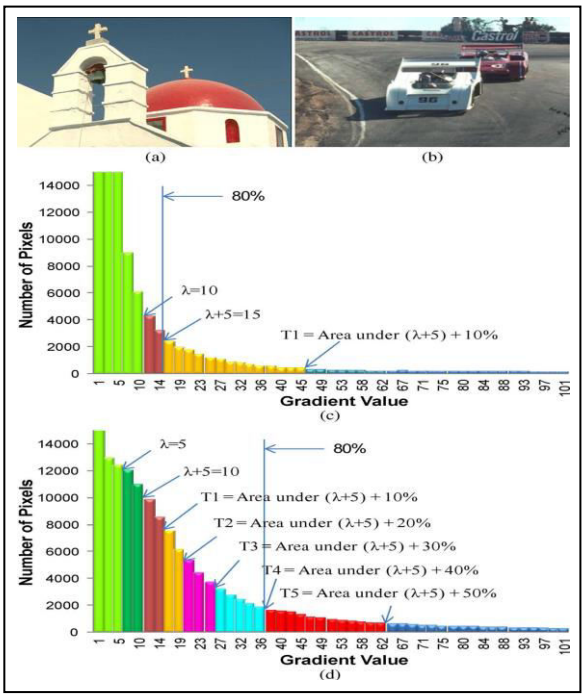


Fig: Adaptive Threshold

5. DYNAMIC SEED GENERATION

It is required for them to meet two qualifications: 1) a group must be large enough to be considered as an independent entity and 2) the color differences between a region and its neighbors must be greater than the maximum color difference allowed.

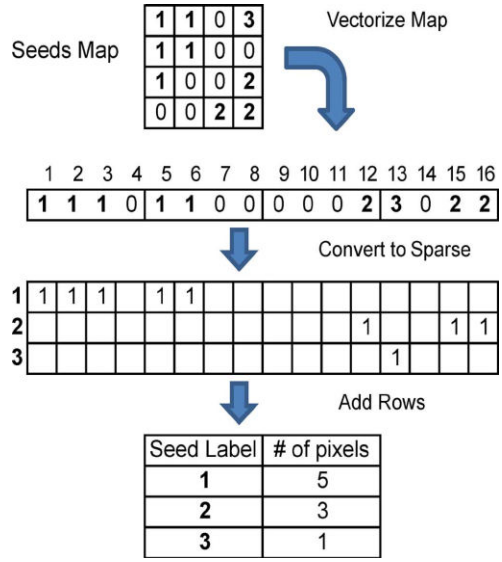


Fig: Method to identify number of pixels per seed.

6. REGION GROWTH

The comparison of regions is performed, using their mean color information. The reason for choosing this color space and distance metric combination is 1) it ensures that comparison of colors is similar to the differentiation of colors by the human eye, 2) the increased complexity of a different distance metric like the Mahalanobis distance does not improve the results, due to the small variance of the regions being compared, owed to their spatial proximity.

7. TEXTURE CHANNEL GENERATION

Entropy provides a measure of uncertainty of a random variable. If the pixel values of a region compose a random variable, entropy will define the randomness associated to the region being evaluated.

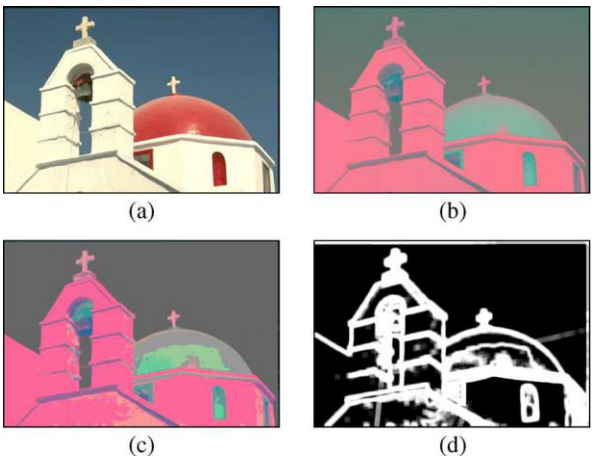


Fig.: (a) Original RGB image. (b) RGB to CIEL*a*b (c) Indexed image. (d) Texture channel.

8. REGION MERGING USING MULTIVARIATE ANALYSIS

The core of a multivariate analysis lies in highlighting the differences between groups that display multiple variables to investigate the possibility that multiple groups are associated with a single factor.

9. MULTIRESOLUTION REGION MERGING

Using a multivariate analysis approach of all independent regions, the resultant Mahalanobis distances between groups is used to merge similar regions.

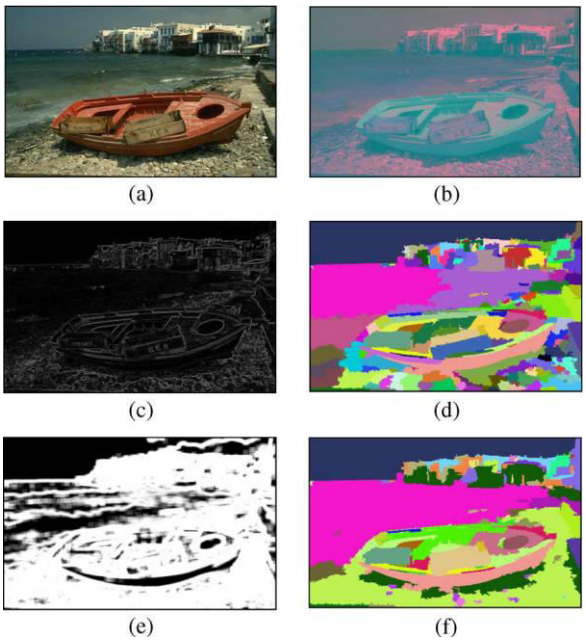


Fig: (a) Original RGB image. (b) Color space conversion. (c) Gradient map. (d) Seed map after region growth. (e) Texture channel. (f) Final segmentation map after region merging.

III. SIMULATED OUTPUT

These days, detection of anatomical brain structures with their exact location and orientation has become an extremely important task in the diagnosis of brain tumor. Detection of anatomical brain structures plays an important role in the planning and analysis of various treatments including radiation therapy and surgery. Because of this, development of efficient and accurate MR Image segmentation technique has become one of the most important areas of research today, worldwide.so our method is extended to brain tumor detection.

Fig 1.Input image

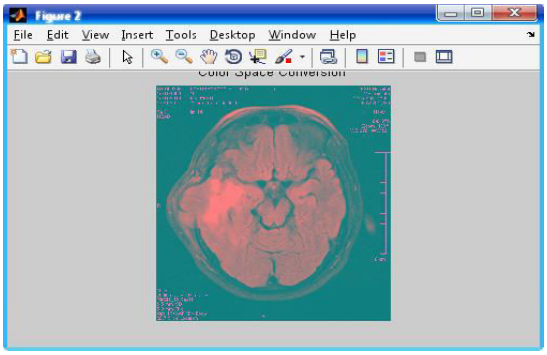


Fig 2.Color space conversion

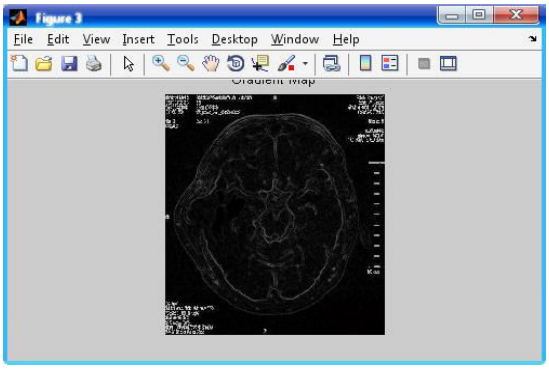


Fig 3.Gradient map

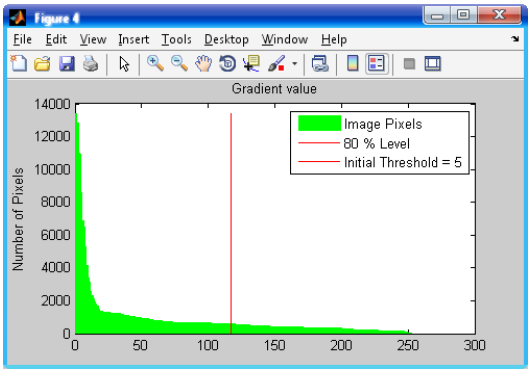


Fig 4.Gradient value

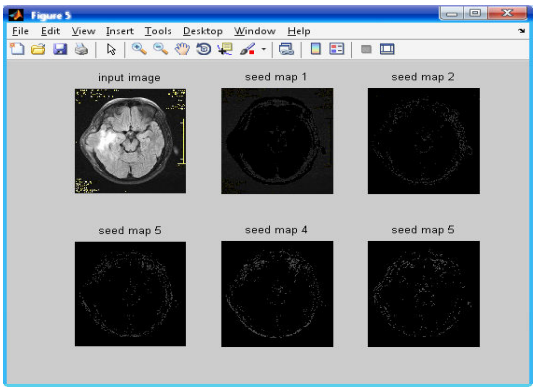


Fig 5.Seed mapping

Thus by using MATLAB SOFTWARE automatic segmentation and detection of brain tumour can be made. This work presents a computationally efficient method designed for automatic segmentation of color images with varied complexities. The GSEG algorithm is primarily based on color-edge detection, dynamic region growth, and culminates in a unique multiresolution region merging procedure.

REFERENCES

1. H. Lee and D. Cok, "Detecting boundaries in a vector field," IEEE Trans. Signal Process, vol. 39, no. 5, pp. 1181–1194, May 1991. P.Green and L. MacDonald, Color Engineering. New York: Wiley, 2002.
2. Y. Chang, D. Lee, and Y. Wang, "Color-texture segmentation of medical images based on local contrast information," in Proc. IEEE Symp Comput. Intel. Bioinf. Comput. Bio, Apr. 2007, pp. 488–493.
3. Otsu.N "A Threshold Selection Method from Gray-Level Histograms," IEEE Transactions on Systems, Man, & Cybernetics,Vol. 9, No. I, 1979, pp.62- 63.
4. G.Paschos, "Perceptually uniform color spaces for color texture analysis: An empirical evaluation," IEEE Trans. Image Process., vol. 10, no. 6, pp. 932–937, Jun. 2001.
5. J.Yoon and I. Kweon, "Color image segmentation considering the human sensitivity for color pattern variations," in Proc. SPIE, Oct. 2001, vol. 4572, pp. 269–278.
6. H.Chen, W.Chien, and S.Wang, "Contrast-based color image segmentation," IEEE Signal Process. Lett, vol. 11, no. 7, pp. 641–644, Jul. 2004.

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Treatment of Textile Wastewater by Electrochemical Method-Aluminum Electrode

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Abstract - The present work focuses on feasibility of electrochemical oxidation technique for the pretreatment of textile wastewater. An attempt has been made to investigate the performance of aluminum electrode for the efficiency removal of color and COD at various current inputs. Electrolysis results indicated that COD and color removal efficiency improved with an increase in applied current. It was observed that increasing the electrolysis time and increased current density bring down the concentration of pollutants. But at the same time increase in current density does not necessarily result in an increase in the oxidation efficiency or oxidation rate. The kinetics reactions are also presented. The present study proves the effectiveness of electrochemical treatment using aluminum as anode for textile wastewater treatment by electrochemical oxidation.

Keywords- *COD; color; aluminum electrode, electrochemical oxidation; wastewater.*

I. INTRODUCTION

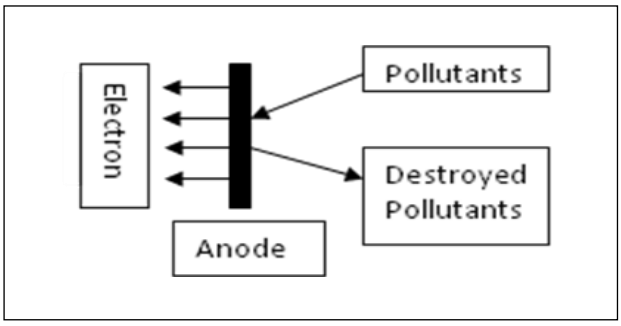
The most significant aspect of textile wastewater is its strong color since it persists for long time. Depending on the type of dyestuff used, the color of the textile wastewater varies from red, brown, blue, purple and black due to their intensifies and dark varieties. Textile wastewater can change color from day to day, or even several times a day because the dyestuff used in the dyeing process changes frequently due to customers requirements. The variation of color also causes frequent fluctuation in the COD content of the textile wastewater. Such a strong color if untreated, would have a marked negative impact on the environment of the receiving water body [3].

For the disposal and management of textile dye wastewater, there is a need for most suitable and effective pretreatment technique. Electrochemical oxidation is known for its high potential to oxidize almost all organics theoretically. It has been known as a clean process since they do not release toxic chemicals into wastewater.

II. ELECTROCHEMICAL THEORY

Pollutants can be destroyed electrochemically by conducting a direct anodic oxidation or an indirect oxidation process. The schematic of these two processes is illustrated in Fig 1. In a direct anodic oxidation process, the pollutants are first adsorbed on the anode surface and then destroyed by the anodic electron transfer reaction [7]. The direct electro-oxidation rate of organic pollutant is dependent on the catalytic activity of the anode, diffusion rate of organic compound in the active points of the anode and the applied current intensity. Indirect electro-oxidation of pollutants, which was observed to be most efficient method on decolorisation and mineralization, can be conducted when chloride, ferric or silver are present. The first being the most important from the point of view of practical application, as chlorides are a common constituent of several industrial textile wastewaters. The indirect electro-oxidation rate is dependent on the diffusion rate of strong oxidants electroformed into solution which are able to completely convert all organics into water and carbon dioxide[8].

A. Direct Anodic Oxidation



B. Indirect Oxidation

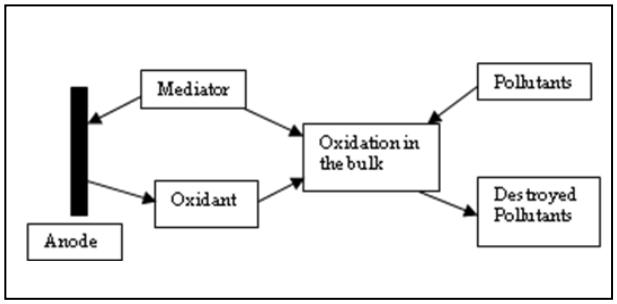


Fig. 1 : The schematic of pollutant removal pathway in electrochemical oxidation process.

The electrochemical process can be a viable alternative. It consists of electrooxidation carried out in an electrochemical reactor, which consists of a cell in which the sacrificial electrodes made of aluminum, where Al ions are generated due to a given applied potential. This stage is known as the anodic stage, in which the metallic aluminum is oxidized. Once formed, these cations immediately undergo further spontaneous reactions to produce the corresponding hydroxides and polyhydroxides. These compounds have a strong affinity for dispersed/dissolved substances, as well as counter-ions to cause coagulation/adsorption phenomena. In case of aluminum, the main reactions are [4]:

Anode:

$$Al \longrightarrow Al^{3+} + 3e^{-} \quad \text{.....(1)}$$

Cathode:

$$3H_2O+3e^{-} \longrightarrow 3/2H_2+3OH^{-} \text{ or} \quad \text{.....(2)}$$

$$2H_2O + O_2 + 4e^{-} = 4OH \quad \text{.... (3)}$$

Al^{3+} and OH^{-} ions generated by electrode reactions 1 and 2 react to form various monomeric species, which finally transform into $Al(OH)_3$ according to complex precipitation kinetics.

$$Al^{3+} + 3H_2O \longrightarrow Al(OH)_3 + 3H^{-} \quad \text{.....(4)}$$

Here the electrochemical behavior of effluent samples was studied and the results obtained provide the optimum conditions for carrying out controlled potential electrolysis. The electrochemical behavior is analyzed in terms of decrease in reduction peak current with time, decrease in absorbance and time taken to remove color and decrease in COD.

III. EXPERIMENTAL PROCEDURE

Effluents for the study were collected from textile processing unit located at Bangalore, Karnataka. The characteristics of the effluents are shown in Table 1.

TABLE I. TEXTILE DYE WASTEWATER CHARACTERISTICS

Sl no.	Table Column Head	
	Parameters	***Range of Values***
1	pH	10.51-11.98
2	Total Solids (mg/L)	6555-11012
3	Total Dissolved Solids(mg/L)	4.96-8.67
4	Total Suspended Solids(mg/L)	160-1148
5	Total Volatile Solids (mg/L)	660-2428
6	Alkalinity (mg/L)	480-1370
7	Chlorides (mg/L)	3249-3514
8	Conductivity (ms)	10-23.5
9	COD (mg/L)	1088-2016

An electrochemical reactor is a device that uses electrical energy to effect a chemical change. Electrolysis was conducted using aluminum as anode material in a glass beaker of 1 lit capacity. An electrochemical cell (EC) in single consists of one anode and one cathode. A schematic diagram of the reactor setup is shown in fig. 2. The anode and cathode were placed at a distance of 4 cm apart by head plate of the electrode grooves at the bottom of the reactor. Sodium chloride present in the wastewater itself was considered as supporting electrolyte and additional electrolyte was not added. During the present investigation, operating parameters like maximum current and maximum voltage consumption for the wastewater were checked without varying the raw effluent characteristics. It was observed, a maximum of 16.17 V and 0.56 A of voltage and applied current were consumed respectively. Based on the preliminary investigations current intensity was varied and samples were drawn at regular intervals for varying current and analyzed for parameters like pH, temperature, COD and color according to the standard methods suggested by APHA [2]. The values were also expressed in terms of current density (current intensity per unit area of electrode); because it controls the reaction time. Absorbance measurements were carried out with mini scan spectrophotometer recording the spectra over 340- 1000 nm range. Percentage of color removal was calculated as given in (5).

$$Color\ \mathrm{Re}moval(\%) = \frac{\lambda \max - \lambda t}{\lambda \max} \times 100 \quad \text{....(5)}$$

λ_{max}= Absorbance of the raw sample maximum wavelength.

λ_t = Absorbance of the samples collected at regular time intervals, t at a fixed wavelength

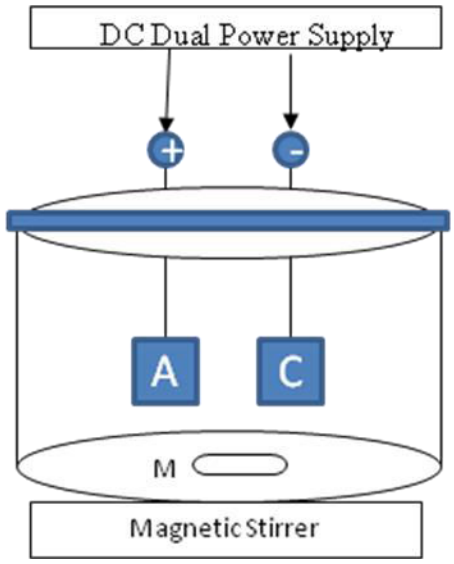


Fig. 2 : Schematic Diagram of an Electrochemical Cell

(M=Magnetic Bit, A=Anode, C=Cathode).

A. Kinetic Constants

The rate of color removal and COD reduction in the effluent depend on the dye concentration [dye] and the oxidizing strength of the anode, i.e., the concentration of active species denoted as [O] by which the color and COD in the effluent are reduced. Thus, the kinetics of the electrochemical effluent treatment at the anode are expressed as

$$\frac{-d}{dt}(color) = k'[dye][o] \qquad (6)$$

$$\frac{-d}{dt}(COD) = k''[dye][o] \qquad (7)$$

Where k' and k'' are the second order rate constants for the color removal and COD reduction reactions at the anode, respectively. During electrolysis, the value of [O] in eq. (8) & (9) will remain constant under a given set of experimental conditions, but it varies as the applied current density is altered. Presumably, under stationary conditions there is no loss in the oxidizing strength of the anode or [O], the rate of active species [O] is equal to the rate of its consumption in both of the electrode processes and at a given current density, and above equations can be modifies as

$$\frac{-d}{dt}(color) = k'obs[dye] \qquad (8)$$

$$\frac{-d}{dt}(COD) = k''obs[dye] \qquad (9)$$

Where k'_{obs} and k''_{obs} are the apparent pseudo-first-order kinetic constants for the electrochemical processes of color removal and COD reduction, respectively, at anode under a given set of experimental conditions [10].

IV. RESULTS AND DISCUSSIONS

A. Chemical Oxygen Demand

The percentage of COD removal with electrolysis time for Al at different current intensities is shown in Fig. 3. The rate of COD reduction increases with increasing current. The rate of COD reduction is very sharp at the beginning and approaches an almost near to constant values with light variations at the end of the process. The maximum increase in COD removal was seen from 60 to 150 min for all the current densities. This may be due to the exhaustion of hypochlorite and free chlorine generation in the electrolyte solution [9].

B. Color

As dyes are designed to be chemically and photolytically stable, they are highly persistent in natural environments. The release of dyes may therefore present an ecotoxic hazard and introduces the potential danger of bioaccumulation that may eventually affect man by transport through the food chain. Hence color removal from these effluents before being discharged constitutes a great challenge for the textile industries. The percentage of color removal with electrolysis time at different applied current is depicted in Fig 3. It can be ascertained that decolorization increases with increasing electrolysis time and current density. Color removal in percentage ranges from 32, 46, 57, 67, 72% for 0.03, 0.06, 0.09, 0.12, 0.24A respectively. It was observed that maximum color removal achieved during electrolysis time varying from 90 to 150 min. The trend of color removal remains same for all the current applied. In the anodic stage metallic aluminum is oxidized and these cations immediately undergo further spontaneous reactions to produce the corresponding hydroxides and/or polyhydroxides. These compounds have a strong affinity for dispersed/dissolved substances, as well as counter-ions to cause coagulation/adsorption phenomena [4].

C. pH and Temperature

The variations of pH are presented in Fig. 5. According Miled, 2010, study on influence of effluent pH on pollutant degradation of textile wastewater concluded that effect of pH value on the degradation of dyes is remarkable under highly basic conditions. The variation of pH with electrolysis time at different current potential found to be same. It was observed that the temperature rose in the range of 2 to 3°C from the initial value. This may be due to the electrolytic dissociation or migration of ions towards the oppositely charged

electrodes which constitutes the flow of electric current in the solution. Increase in temperature increases the decolorization rate and COD removal [6].

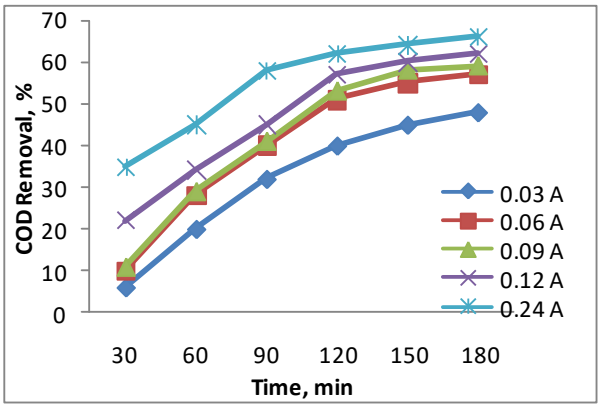


Fig. 3 : Percentage of COD removal with different current potential

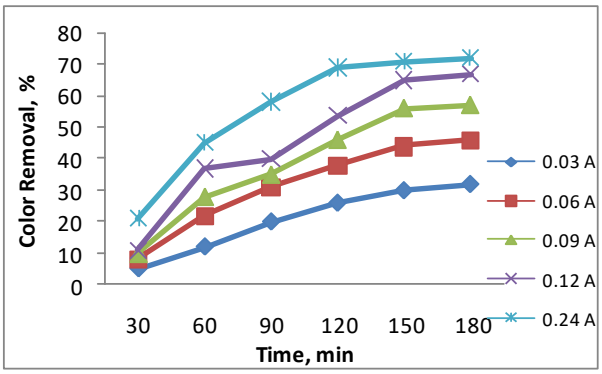


Fig. 4 : Percentage removal of color at different currtent applied

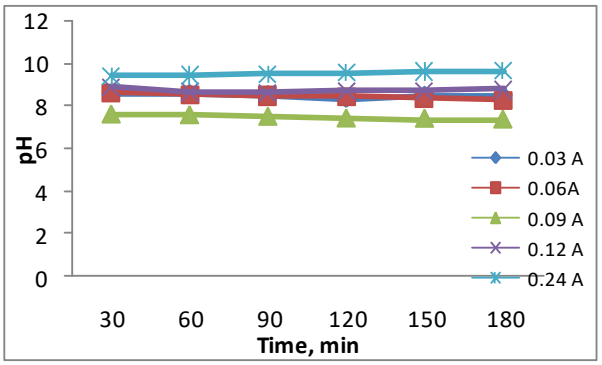


Fig. 5 : Variation of pH at different current potential

D. Kinetic Rate Coefficients

The kinetic study was conducted for aluminum electrode. Fig. 6 shows the pseudo first order reaction kinetics for all the current intensity. It is observed from the fig. 6 that, when current increases the coefficients of correlation was increased but for a current of 0.24A the correlation value decreased. Thus it can be concluded that there is a strong linearity between the rate constant and COD for a current of 0.09 A. Table II shows the correlation values at various current applied.

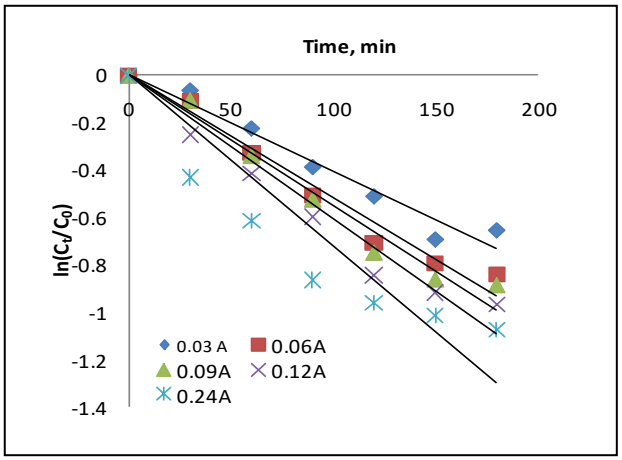


Fig. 6 : Pseudo first order reaction kinetics forCOD

Table –II : Coefficient of Correlation Values for Various Applied Current

Sl No.	Kinetics of Reactions		
	Applied Current, A	*Current Density, A/m²*	R^2
1	0.03	12	0.960
2	0.06	24	0.968
3	0.09	36	0.968
4	0.12	48	0.951
5	0.24	96	0.792

V. CONCLUSIONS

It should be highlighted that an increase in current density does not necessarily result in an increase in the oxidation efficiency or oxidation rate and that for a given anode material, the use of higher current densities usually results in higher operating costs due to the increase in energy consumption [1]. Operating at lower current density always consumes less energy but, at the same time, increases the duration of electrolysis. Therefore, it is necessary to choose a current density that is suitable for real industrial application by way of maximum degradation, shorter reaction time, and less energy consumption. In the present study a current density of 36 A/m^2 was found to be optimum w.r.t. COD and color removal at an ideal time of 90-120 minutes.

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REFERENCES

[1] Angela Anglada, Ane Urtiaga and Inmaculada Ortiz, "Contributions of electrochemical oxidation to waste-water treatment: fundamentals and review of applications", J Chem Technol Biotechnol, 84, pp. 1747-1755, 2009.

[2] APHA, Standard methods for the examination of water and wastewater, 20th edition. Americal Public Health Association, Washington, D.C, 1998.

[3] Bhavya J.G and Usha N Murthy, " performance of electrochemical oxidation treatemnt in treating textile de wastewater using different electrodes", M. E. thesis submitted to Bangalore University, 2011.

[4] Cerqueira A, Russo C, Marques M R C, "Electroflocculation for textile wastewater treatment", J.Chem Eng., 26 (4), 2009.

[5] Chuanping Feng, Norio Sugiura, Satoru Shimada, Takaaki Maekawa, " Development of a high performance electrochemical wastewater treatment system", Journal of Hazardous Materials, B103, pp. 65-78,2003..

[6] Daneshvar N, Sorkhabi H A, Kasiri M B, "Decolorization of dye solution containing acid red 14 by electrocoagulation with a comparative investigation of different electrode connection", J Haz Mat, B112, 2004.

[7] Li-Choung chiangi, juU-en changi and ten-chin wen, "indirect oxidation effect in electrochemical oxidation treatment of landfill leachate", Water Research, Vol 29, No.2, pp 671-678, 1995.

[8] Miled W, A, Haz said and Roudesli. S, "Decolorization of high polluted textile wastewater by indirect electrochemical oxidation process", J. textile and apparel, technology and management, Vol 6, No 3, 2010.

[9] Mohan N, Balasubramanian, and Subramanian V. "Electrochemical Treatment of Simulated Textile Effluent", Chem Eng. Technol, Vol 24, No.7, pp.749-753, 2001.

[10] Sanjay. S, Vahela, Ashok. DJethva, Bhavesh B.Mehta, Sunil P Dave, Subbarayappa Adimurthy and Gadde Ramachandraiah, "Laboratory studies of electrochemical treatment of industrial azo dye effluent", Environmental Science & Technology, Vol 39, No. 8, pp 2848, 2005.

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Multi Region Image Segmentation By Graph Cuts For Brain Tumor Segmentation

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Abstract **-** Multiregion graph cut image partitioning via kernel mapping is used to segment any type of the image data. The image data is transformed implicitly by a kernel function so that the piecewise constant model of the graph cut formulation becomes applicable. The objective function contains an original data term to evaluate the deviation of the transformed data, within each segmentation region, from the piecewise constant model, and a smoothness, boundary preserving regularization term. A variety of noise models are, thus, considered by a single model. The method affords an effective alternative to complex modeling of the original image data while taking advantage of the computational benefits of graph cuts. Using a common kernel function, energy minimization typically consists of iterating image partitioning by graph cut iterations and evaluations of region parameters via fixed point computation. The purpose of study is two-fold: (1) investigate an image segmentation method which combines parametric modeling of the image data and graph cut combinatorial optimization and, (2) use a prior which allows the number of labels/regions to decrease when the number of regions is not known and the algorithm initialized with a larger number. A quantitative and comparative performance assessment is carried out over a large number of experiments using synthetic grey level data as well as natural images from the Berkeley database. Experimental verification shows that the method results in good segmentations and runs faster the graph cut methods. The effectiveness of the method is also demonstrated through a set of experiments with real images of a variety of types such as medical, synthetic aperture radar, and motion maps. Tumor segmentation from MRI data is an important but time consuming task performed manually by medical ex- perts. Automating this process is challenging due to the high diversity in appearance of tumor tissue among different patients and, in many cases, similarity between tumor and normal tissue. We propose a semi-automatic interactive brain tumor segmentation system that incorporates 2D interactive and 3D automatic tools with the ability to adjust operator control. The provided methods are based on an energy that incorporates region statistics computed on available MRI modalities and the usual regularization term. The energy is efficiently minimized on-line using graph cut. Experiments with radiation oncologists testing the semi- automatic tool vs. a manual tool show that the proposed system improves both segmentation time and repeatability.

I. INTRODUCTION

Image segmentation is refers to the process of partitioning a digital image into multiple segments, it is the classification of all pixels. Image segmentation occurs in many important applications. It consists of partitioning an image into regions homogeneous with respect to a given description. Energy minimization formulations have led to flexible, transparent, and effective algorithms. These formulations can be divided into two broad categories: continuous and discrete. Continuous formulations, which seek a partition of the image domain by active curves via a level set representation, have segmented accurately a variety of difficult images. Discrete formulations use objective functions which contain terms similar to those in continuous formulations, generally a data term which measures the conformity of segmentation to the image data, and a regularization term. Image segmentation occurs in many important applications. It consists of partitioning an image into regions homogeneous with respect to a given description. Energy minimization formulations have led to flexible, transparent, and effective algorithms. These formulations can be divided into two broad categories: continuous and discrete. The piecewise constant data term model, and its Gaussian generalization, have been intensively used in the context of unsupervised graph cut methods because user intervention is not required and especially, the data term can be written in the form required by the graph cut algorithm. Minimization by graph cuts of objective functional with a piecewise constant data term produce nearly global optima and, therefore, are less sensitive to initialization. Unsupervised graph cut methods, which do not require user intervention, have used the piecewise model, or its Gaussian generalization, because the data term can be written in the form required by the graph cut algorithm. One way to introduce more general models is to allow user interaction. Several interactive graph cut methods have used models more general than the Gaussian by adding a process to learn the region parameters at any step of the graph cut segmentation

process. Continuous formulations view images as continuous functions over a continuous domain. The most effective minimizes active curve functional via level sets. The minimization relies on gradient descent. The long time of execution is the major impediment in many applications, particularly those which deal with large images and segmentations into a large number of regions.

II. UNSUPERVISED PARAMETRIC GRAPH CUT SEGMENTATION

Discrete formulations view images as discrete functions over a positional array. Combinatorial optimization methods which use graph cut algorithms have been the most efficient. Very fast methods have been implemented for image segmentation motion and stereo segmentation, tracking, and restoration Region is a group of connected pixels with similar properties. The kernel function transforms implicitly the image data is mapped to a higher dimensional feature (kernel) space so as to have a better separability. Graph cut is a cut of graph is a partition of the vertices in the graph. A graph cut formulation states segmentation as a labeling problem. The graph cut algorithm assigns each pixel a grey level label in the set of all possible labels. Graph cut objective functional typically contain a data term to measure the conformity of the image data within the segmentation regions to statistical models and it can minimizes an energy function of data term, estimated in feature space for smooth segmentation boundaries.

Minimization by graph cuts of objective functionals with a piecewise constant data term produce nearly global optima and, therefore, are less sensitive to initialization.

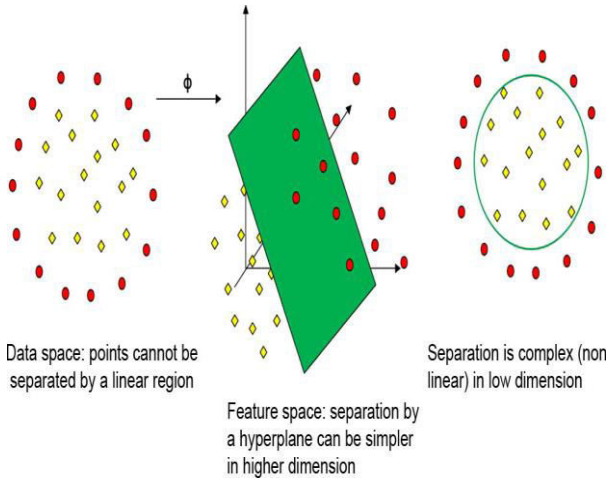


Fig. 1 : Illustration of Nonlinear 3-D Data Separation with Mapping. Data is Nonlinearly Separable in the Data Space. The Data Is Mapped To A Higher Dimensional Feature (Kernel) Space So As To Have A Better Separability, Ideally Linear.

Using a common kernel function, the objective functional minimization is carried out by iterations of two consecutive steps:

1) Minimization with respect to the image segmentation by graph cuts and

2) Minimization with respect to the regions parameters via fixed point computation.

III. SEGMENTATION FUNCTIONAL IN THE KERNEL INDUCED SPACE

The use of kernel functions to transform image data: rather than seeking accurate (complex) image models and addressing a non linear problem, it transform the image data implicitly via a mapping function, typically nonlinear, so that the piecewise constant model becomes applicable in the mapped space. And, therefore, solve a (simpler) linear problem. More importantly, there is no need to explicitly compute the mapping .Using the Mercer's theorem, the dot product in the feature space suffices to write the kernel-induced data term as a function of the image, the regions parameters, and a kernel function. Furthermore, neither prior knowledge nor user interactions are required for the proposed method.

IV. PROPOSED FUNCTIONAL

Kernel induced segmentation functional is

$$\mathcal{F}_{\mathcal{K}}(\{\mu_l\},\lambda)=\sum_{l\in\mathcal{L}}\sum_{p\in R_l} J_K\left(I_p,\mu_l\right)+\alpha\sum_{\{p,q\}\in\mathcal{N}} r(\lambda(p),\lambda(q)).$$

Graph cut methods state image segmentation as a label assignment problem. a data term to measure the conformity of image data within the segmentation regions to a stastical model and a regularization term for kernel functions. Smooth region boundaries statistical model and a regularization term *(the prior)* for smooth regions boundaries.

OPTIMIZATION

Function is minimized with an iterative two-step optimization strategy .Using a common kernel function, the first step consists of the first step, via graph cut iterations. The algorithm iterates these two steps until convergence. The algorithm is guaranteed to converge at least to a local minimum. The steps are:

1) Update of the Region Parameters
2) Update of the Partition With Graph Cut Optimization

Let g =(v,e) be a weighted graph, where v is the set of vertices (nodes) and e the set of edges v contains a node for each pixel in the image and two additional nodes called terminals. Commonly, one is called source and the other is called sink.

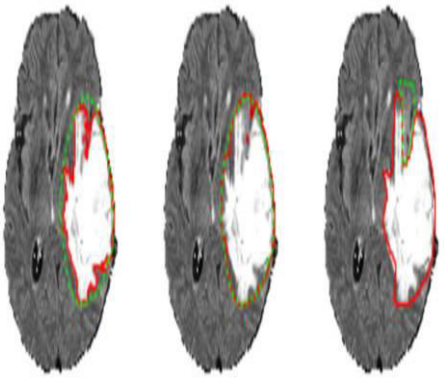
A cut c belongs to e is a set of edges verifying:

- Terminals are separated in the graph g(c)=(v,e\c);
- No subset of c separates terminals in g(c).

The minimum cut problem consists of finding the cut, in a given graph, with the lowest cost. The graph weights need to be set dynamically when ever region parameters and pair of labels change.

V. GRAPH CUT SOLUTION

Several works show that the type of energy presented in with precomputed region statistics (pin, pout) can be efficiently minimized using graph cut. Besides providing a global minimum to the segmentation energy, a graph cut solution is also fast and therefore suitable for the interactive techniques. Each pixel (voxel), p, in is a node in the graph, and there are two special nodes: a source and a sink. Edge weights between a voxel-node and the source/sink represent the data cost for the voxel: wp, src = −h log pin (p) and wp, sink = − (1 − h) log pout (p). Edges between neighboring voxels, p and q, encode the regularization cost. We use 16 neighbors for 2D segmentation and an 18 neighborsn for 3D. Figure illustrates the way the 2D energy is discretized on the graph.Created in this way, a cut in the graph isolates the source from the sink; points connected to the sink are labeled as “tumor” and points connected to the source as “brain”.



Balanacing automatic and manual control, Greeen lines shows user selection and red lines shows updated segmentation.

VI. RESULT

The two types of validation tests are:

1) Quantitative verification, via pixel misclassification frequency, using:

- Synthetic images of various models
- Multimodal images, i.e., images composed of regions each of a different model
- Simulations of real images such as SAR.

2) Real images of three types:

- SAR, which are best modelled by a Gamma distribution
- Medical/polarimetric, which are best modelled by a Wishart distribution
- Natural images of the Berkeley database: these results will be evaluated quantitatively using the provided multi operator manual segmentations.

The KM is a flexible and effective alternative to image modelling.

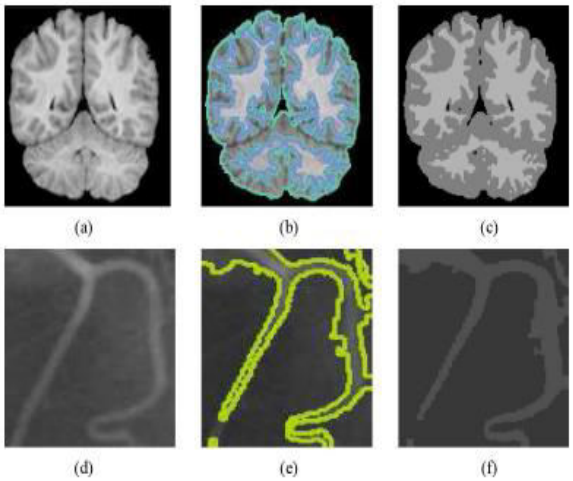


Fig. 3.2 : Brain and Vessel Images. (A),(D) Original Images. (B), (E) Segmentations at Convergence. (C), (F) Final Labels.

Algorithms	PRI [57]	VoI [54]
KM	**0.8253**	**0.8930**
PRIF [56]	0.7748	1.1711
FH [55]	0.6188	1.3817

Table3.1. Average Performances of the KM Method against Two Unsupervised Algorithms In Terms of the PRI and VoI

The KM reached competitive results as it gives relatively good results in terms of two segmentation indices for natural images, and the best results for the synthetic images compared to two state of the art algorithms.

VII. CONCLUSION

The multiregion graph cut image segmentation in a kernel-induced space method consists of minimizing a functional containing an original data term which references the image data transformed via a kernel function. The optimization algorithm iterated two consecutive steps: graph cut optimization and fixed point iterations for updating the regions parameters. The flexibility and effectiveness of the method were tested over various types of real images including synthetic SAR images, medical and natural images, as well as motion maps. A flexible and effective alternative to complex modelling of image data. Performance can be improved for specific applications. In this work we proposed simple and effective algorithms based on graph cuts, which can minimize the energy in the Euler's elastica model. Based on the connection between TV minimization and binary MRFs, our approach simplifies the minimization problems to that of solving a sequence of simpler problems. The sequence of solutions to these problems converges to a minimum point. Experiments show that shrinking and staircasing effects are prevented in the results generated by our methods.

VII. SIMULATED OUTPUT

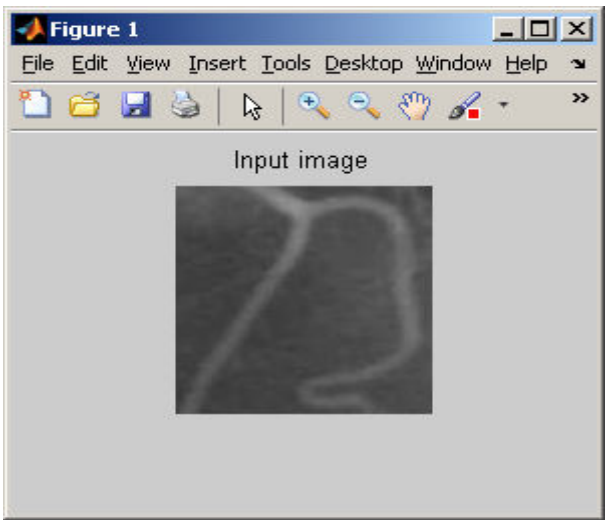


Fig.1: Input Image

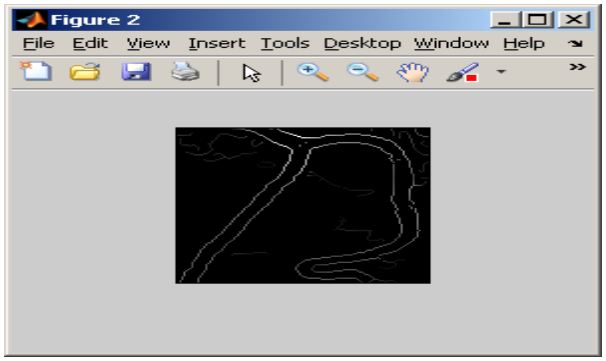


Fig.2 : Labelled Image

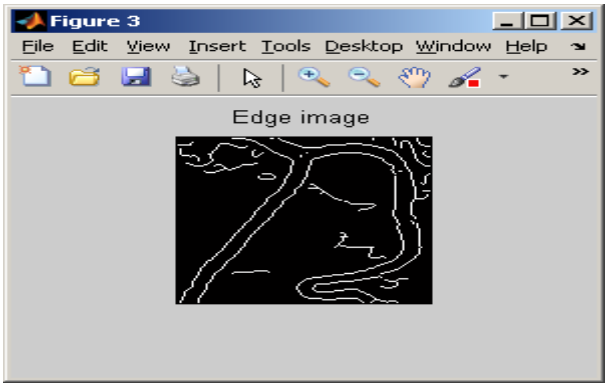


Fig. 3 :Edge Detection

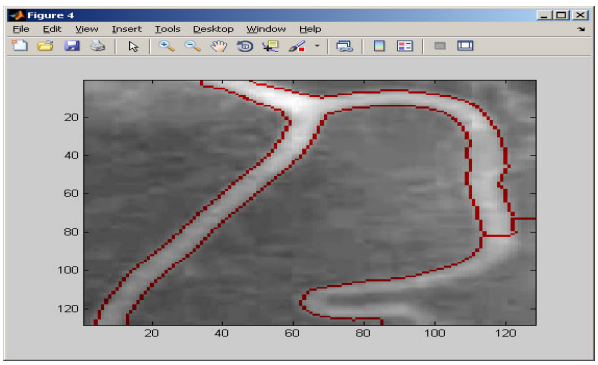


Fig. 4 : Segmentation Boundary at Convergence

REFERENCES

[1] Mohamed Ben Salah, Member, IEEE, Amar Mitiche, Member, IEEE, and Ismail Ben Ayed, Member, "Multiregion Image Segmentation by Parametric Kernel Graph Cuts," IEEE Trans.Image Processing,Vol.20,No.2,Feb.2011.

[2] D. Cremers, M. Rousson, and R. Deriche, "A review of statistical approaches to level set segmentation: Integrating color, texture, motion

and shape," Int. J. Comput. Vis., vol. 72, no. 2, pp. 195–215, 2007.

[3] T. F. Chan and L. A. Vese, "Active contours without edges," IEEE Trans. Image Process., vol. 10, no. 2, pp. 266–277, Feb. 2001.

[4] Y. Boykov, O. Veksler, and R. Zabih, "Fast approximate energy minimization via graph cuts," IEEE Trans. Pattern Anal. Mach. Intell., vol. 23, no. 11, pp. 1222–1239, Nov. 2001.

[5] N. Y. El-Zehiry and A. Elmaghraby, "A graph cut based active contour for multiphase image segmentation," in Proc. IEEE Int. Conf. Image Process., 2008, pp. 3188–3191.

[6] M. Girolami, "Mercer kernel based clustering in feature space," IEEE Trans. Neural Netw.,

[7] D. Freedman and T. Zhang, "Interactive graph cut based segmentation with shape priors," in Proc. IEEE Int. Conf. Comput. Vis. Pattern Recognit., 2005, pp. 755–762.

[8] M. B. Salah, A. Mitiche, and I. B. Ayed, "A continuous labeling for multiphase graph cut image partitioning," in Advances in Visual Computing, Lecture Notes in Computer Science (LNCS), G. B. e. al, Ed. New York: Springer-Verlag, 2008, vol. 5358, pp. 268–277.

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Geopolymer 100% Replacement of Cement using Fly Ash

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Abstract - Every 1 ton of concrete leads to CO_2 emissions which vary between 0.05 to 0.13 tons. About 95% of all CO2 emissions from a cubic yard of concrete are from cement manufacturing. It is important to reduceCO2 emissions through the greater use of substitute to ordinary Portland cement (OPC) such as fly ash, clay and others geo-based material. This paper, report on the study of the processing of geopolymer using fly ash and alkaline activator with geopolymerization process. The factors that influence the early age compressive strength such as molarity of sodium hydroxide (NaOH) have been studied. Sodium hydroxide and sodium silicate solution were used as an alkaline activator. These studies comprises the comparison of the ratios of Na2Si03&NaOH at the values 0.39&2.51The geopolymer paste samples were cured at 60°C for 1 day and keep in room temperature until the testing days. The compressive strength was done at 7 and 28 days. The result showed that the geopolymer paste with NaOH concentration of 12 M produced maximum compressive strength.

Key words *- Geopolymer, Alkali, Fly Ash, Class F, Strength, Acid Resistance.*

I. INTRODUCTION

Ordinary Portland cement (OPC) is conventionally used as the primary binder to produce concrete. The environmental issues associated with the production of OPC are well known. The amount of the carbon dioxide released during the manufacture of OPC due to the calcinations of limestone and combustion of fossil fuel is in the order of one ton for every tone of OPC produced on the other hand, the abundant availability of fly ash world wide creates opportunity to utilize this by-product of burning coal, as a substitute of OPC to manufacture concrete. As far as India is concerned, the first ever study on use of fly ash in concrete was carried out in 1955 by CBRI, Roorkee(1), in the form of a review of American and Australian research work on Fly ash. Later, Fly ash was used in small proportions in mass concreting for dams and other hydraulic.

Ali Allah Verdi &Frantisek Skvara[2000]2, investigated the response of harden paste of a geopolymer cement to acid attack & compared to that of ordinary Portland cement. These cement was produced by activating a mixture of fly ash & blast furnace slag using a proportioned solution of NaOH & Na2SiO3. A.Buchwald, M.Hohmann & Ch.Kaps[2000]3, investigation focuses the influence of the clay composition on the geopolymer performance. Clays with different kind & amount of the clay mineral as well as side mineral were investigating.

The famous report on sustainable cement industry published by Batelle Institute: titled Climate Change, is available on the Internet at the following address: This report confirms the studies carried out by Prof. Joseph Davidovits since [1990]4, on CO2 emissions during Portland cement manufacture (in the LIBRARY the paper on Global Warming). Batelle's report recommends the development of geopolymer cement. John Zachar & Tarun R. Naik[1990]5, use fly ash & foundry sand & slag as a replacement for cement and fine coarse aggregates in concrete. Davidovits [1988]6 proposed that an alkaline liquid could be used to react with the silicon (Si) and the aluminum (Al) in a source material of geological origin or in by-product materials such as fly ash and rice husk ash to produce binders. Because the chemical reaction that takes place in this case is a polymerization process, he coined the term Geopolymer to represent these binders. Geopolymer concrete is concrete which does not utilize any Portland cement in its production. Geopolymer concrete is being studied extensively and shows promise as a substitute to Portland cement concrete. Research is shifting from the chemistry domain to engineering applications and commercial production of geopolymer concrete.

There are two main constituents of geopolymers, namely the source materials and the alkaline liquids. The source materials for geopolymers based on alumina-silicate should be rich in silicon (Si) and aluminum (Al). These could be natural minerals such as kaolinite, clays, etc. Alternatively, by-product materials such as fly ash, silica fume, slag, rice-husk ash, red mud, etc could be used as source materials. The choice of the source materials for making geopolymers depends on factors such as availability, cost, type of application, and specific demand of the end users. The alkaline liquids

are from soluble alkali metals that are usually sodium or potassium based. The most common alkaline liquid used in geopolymerisation is a combination of sodium hydroxide (NaOH) or potassium hydroxide (KOH) and sodium silicate or potassium silicate. This paper is devoted to heat-cured low-calcium fly ash-based geopolymer concrete. Low-calcium (ASTM Class F) fly ash is preferred as a source material than high-calcium (ASTM Class C) fly ash. The presence of calcium in high amounts may interfere with the polymerization process and alter the microstructure [Gourley and Johnson, 2005].

II. METHODOLOGY AND EXPERIMENTAL PROGRAM

a) Objectives of the Investigation

The objective of the present investigation is, to study the performance characteristics of the source materials Workability studies of GPC Mechanical properties of GPC like compressive strength split tensile strength.

To study the micro structural properties like, initial surface absorption test and saturated water absorption test of various GPC specimens. Chemical resistance of geopolymer concrete specimens to acids.

b) Materials Used

Low calcium class F type fly ash

Sodium hydroxide (98% purity in pure form)

Sodium silicate solutions (8M, 10M, 12M and 14M)

Coarse Aggregate (7mm, 14mm & 20mm)

Fine aggregate (fineness modulus 2.6 — 2.8)

Distilled Water.

The following parameters are studied for preparing a low calcium fly ash based geopolymer concrete.

1) By varying the molarities of NaOH solution i.e., 8M, 10M, 12 and 14M

The sodium hydroxide (NaOH) solution was prepared by dissolving the pallets in water. The mass of NaOH solids in a solution varied depending on the concentration of 8M measured as 8x40=320 gram of NaOH solids (in pellets form) per liter of solution, where 40 is the molecular weight of the NaOH. The mass of NaOH solids was measured as 262 grams per kg of NaOH solution of 8M concentration, and the mass of NaOH solids was measured as 404 gram per Kg of NaOH solution of 14M concentration. The mass of NaOH solids was only a fraction of the mass of NaOH solution, and the water is the major component.

2) By varying the ratio of Na2SiO3& NaOH i.e. 0.39. & 2.51

3) Oven dry curing temperature i.e., 60^0 for time in 24 hours is kept constant.

c) The aims of study were:

1. To develop a mixture proportioning process to manufacture low calcium fly ash based geopolymer concrete.
2. To identify and study the effect of salient parameters that affects the Properties of low calcium fly ash based geopolymer concrete.
3. To study the short term engineering properties of fresh and hardened low calcium fly ash based geopolymer concrete.

III. GEOPOLYMER PRODUCTION

a) Mixture Proportions of Geopolymer Concrete

The alkaline activators were mixed at least 1 day prior to the mixing. The fly ash and the aggregates were mixed dry in a pan for 3 minutes. The alkaline solutions and the super plasticizer were mixed together, then added to the solid particles and mixed for another 3 to 5 minutes. The fresh concrete was then casted into 150mm x 150mm x 150 mm steel cube moulds in two layers each. Each layer received 25 strokes and vibrated for 10 seconds on a vibrating table. Immediately after casting, the samples were covered by a film to avoid the loss of water due to evaporation during curing at an elevated temperature. The specimens were cured in an oven at a temperature of 60°C. At the end of the curing period, the cubes were removed from the curing chamber, and were left in the mould for six hours to avoid a drastic change of the environmental conditions. The specimens were then removed from the moulds, and left to air dry at room temperature until subjecting to various testing.

b) Details of Specimens used

- 150 mm x 150 mm x 150 mm cube specimens for Compressive strength, Micro structural study, Chemical resistance
- 100 mm diameters x 200 mm length specimens are used for split tensile, strength test.
- 100mm x 100mm x 450mm prism specimens are used for flexural strength test.

- **Mix Design Methodology**

Absolute volume method of mix design is adopted and the quantity of aggregates required for a ratio 1: 1.5:

3 molarities 8M and Na2Si03/NaOH ratio is 2.51 let C be the quantity of fly ash required.

$$\frac{C}{2.55} + \frac{1.5C}{2.68} + \frac{3C}{2.6} + 0.35C = 1$$

C = 0.42 kg

Accounting for dry concrete quantity = 0.42 x 1.5

= 0.65 kg

Fine aggregate = 0.97 kg

Coarse aggregate = 1.95 kg

Activator liquid to fly ash ratio = 0.35

Activator liquid = 0.35 x 0.65

= 0.288 kg

NaOH + Na2SiO3 = 0.288

Activator liquid 8 Molar of NaOH equals 1 x molecular weight of NaOH (Molecular weight NaOH is 40 g)

$$\frac{Na_2SiO_3}{NaOH} = 2.51$$

Therefore from equation 1

Na_2SiO_3 = 0.162 kg

NaOH = 0.650 kg.

Chemical Composition of Fly Ash

Characteristics	Fly ash (%wt)
Silica	55 - 65
Iron oxide	5-7
Aluminium oxide	22 - 25
Calcium oxide	5-7
Magnesium oxide	<1
Titanium oxide	<1
Phosphorous	<1
Sulphates	0.1
Alkali oxide	<1
Loss of ignition	1-1.5

Physical Properties of low calcium class F Fly Ash

Physical properties	Properties of fly ash used	Properties of fly ash according to IS 1320-1981
Specific gravity	2.51	-
Initial setting time	120 minutes	-
Final setting time	280 minutes	-
Fineness specific surface in m^2/ kg min	320	340
Lime reactivity Avg compressive strength	4.00	6.200

Casting of Specimen

Specimens

Table No. 3.1 A Details of Mixes for $Na_2SiO_3/NaOH = 2.51$

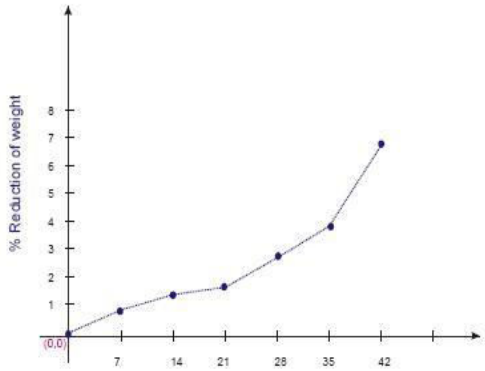
Materials	Mass (Kg/M^3)
Coarse aggregates	
20 MM	277
14 MM	370
7 MM	647
Fine Sand	554
Fly ash (Low Calcium ASTM Class F)	408
Sodium Silicate Solution (SiO_2/Na_2O) = 2	103
Sodium Hydroxide Solution	41 (8 M)

Table No. 3.1 B Details of Mixes for $Na_2SiO_3/NaOH = 0.39$

Materials	Mass (Kg/M^3)
Coarse aggregates	
20 MM	277
14 MM	370
7 MM	647
Fine Sand	554
Fly ash (Low Calcium ASTM Class F)	408
Sodium Silicate Solution (SiO_2/Na_2O) = 2	41
Sodium Hydroxide Solution	103 (8 M)

Table No. 4.35 Test results of acetic acid resistance

Days	Weight in grams	Percentage reduction in weight of specimens
0	3740	0.00
7	3710	0.8
14	3695	1.2
21	3680	1.6
28	3630	2.85
35	3600	3.8
45	3490	6.7



Compressive Strength Test Results at 7 Days for Cube 150mm x 150mm x150mm

Table 4.10 : Compresive Strength Test Results at 7 days

	Specimen	Compressive strength N/mm²	Avg compressive strength N/mm²
8M	Sample 1	13.0	
	Sample 2	18.0	15.83
	Sample 3	16.5	
10M	Sample 1	14.9	
	Sample 2	17.0	17.0
	Sample 3	17.1	
12M	Sample 1	19.11	
	Sample 2	15.19	17.16
	Sample 3	17.2	
14M	Sample 1	19.3	
	Sample 2	15.31	17.3
	Sample 3	17.29	

$\frac{Na_2SiO_3}{NaoH}$ = 0.39 (AT)

AT = Ambient Tempreture

- **Comparison Of The Fly Ash With OPC**

Parameter	O.P.C	Fly ash
Physical properties		
Fineness Passing 45µm	94	84 (288)
Blaine surface area	368 m^2/kg	340 m^2/kg
Setting time		
Initial	140 min	120 min
Final	280 min	280 min
Compressive strength		
07 Day	33 MPa (24.5) A.T	41 MP or 41 N/mm^2 (O.D)
28 Day	39 MPa 27 (A.T)	43 MP or 43 N/mm^2
Chemical analysis		
SiO_2	21.3%	55-65 [58%]
Al_2O_3	4.48%	22-25
Fe_2O_3	1.71%	5-7
CaO	62.9%	5-7 [3%]
MgO	3.23%	<1[1.91%]
SO_3	2.35%	0.1 [1.80%]
Na_2O	0.50%	<1 [2%]
K_2O	0.49%	
Loss on ignition	2.17%	1-1.5 [2%]
Insoluble residue	0.67%	
Split Tensile Strength [cylindrical specimen]	OPC	f. ash
7 day	2.250	1.13 [At] 2.206[OD]
28 day	2.40	1.216 [AT] 2.47 [OD]
Flexural strength Test [Beam Test]	OPC	f. ash
7 day	2.32 N/mm^2 [AT]	3 N/mm^2 [OD]
28 day	2.60 N/mm^2 [AT]	3.10 N/mm^2 [OD]

Compressive Strength Test Results at 28 Days for Cube 150mm x 150mm x150mm

Table 4.11 : Compresive Strength Test Results at 28 days

	Specimen	Compressive strength N/mm²	Avg compressive strength N/mm²
8M	Sample 1	14	
	Sample 2	17.2	16.16
	Sample 3	17.3	
10M	Sample 1	18	
	Sample 2	19.2	19.13
	Sample 3	20.2	
12M	Sample 1	23.3	
	Sample 2	17.39	20.56
	Sample 3	21	
14M	Sample 1	24.3	
	Sample 2	18.5	21.46
	Sample 3	21.6	

$\frac{Na_2SiO_3}{NaoH}$ = 0.39 (AT)

AT = Ambient Tempreture

IV. CONCLUSIONS

Tests on Fresh Geopolymer Concrete:

1) In slump cone test, the slump value of the 8 M. mix is 30 mm and for 14 M. it is 44 mm. Hence the molarities are increased slump value increase.

2) The slump value of the low calcium fly ash based concrete increases with increase of extra water added to the mixture.

Compressive strength test

1) For ratio Na2SiO3/NaOH = 2.51

   As higher concentration in terms of molar of sodium hydroxide solution results in higher compressive strength of fly ash based geopolymer concrete.

2) For ratio Na2SiO3/NaOH = 0.39

   It is observed that when quantity of sodium silicate and sodium hydroxide is reversed by mass, it is observed that compressive strength increases as increase in molarity.

For both cases i.e 1 & 2 compressive strength is more for oven drying as compare to specimen left in ambient temperature

Split Tensile Strength:

For mix of molarity 14 M. and Na2SiO3/NaOH = 2.51 is found to have the maximum tensile strength for both 7 day's as well as 28 day's for oven drying of cylinder specimen. The split tensile strength was found to be 5 % of compressive strength.

For Mix of molarity 8 M. and Na2SiO3/NaOH = 0.39 is found to have the maxi-mum tensile strength for both 7 day's as well as 28 day's for oven drying of cylinder specimen. The split tensile strength was found to be 5 % of compressive strength.

Flexural Strength:

For mix of molarity 14 M. and Na2SiO3/NaOH = 2.51 is found to have the maxi-mum Flexural strength for both 7 day's as well as 28 day's for oven drying of cylinder specimen.

For mix of molarity 8 M. and Na2SiO3/NaOH = 0.39 is found to have the maxi-mum Flexural strength for both 7 day's as well as 28 day's for oven drying of cylinder specimen.

Rebound Hammer Test:

For mix of molarity 14 M. and Na2SiO3/NaOH = 2.51 is found to have the maxi-mum Compressive strength for both 7 day's as well as 28 day's for oven drying of cube specimen. For mix of molarity 8 M. and Na2SiO3/NaOH = 0.39 is found to have the maximum Compressive strength for both 7 day's as well as 28 day's for oven drying of cube specimen.

REFERENCES

[1] Ali Allah Verdi &Frantisek Skvara 2000.as in (2) - "response of harden paste of a geopolymer cement to acid attack.."

[2] A.Buchwald, M.Hohmann&Ch.Kaps 2002 as in (3)- The influence of the clay composition on the geopolymer performance.

[3] Prof. Joseph Davidovits since 1990 as in (4) on CO_2 emissions during Portland cement manufacture (in the LIBRARY the paper on Global Warming).

[4] John Zachar & Tarun R. Naik as in (5)- "use fly ash & foundry sand & slag as a replacement for cement and fine coarse aggregates in concrete

[5] Davis, R,E., R. W. Carlson, J. W. Kelly, and A. G. Davis, as in (6) 'Properties of cements and concretes containing fly ash', Proceedings, American Concrete Institute 33:577-612.

[6] Mehta, P.K., and R.W.Burrows, 2001, as in (7) "Building Durable Structures in the 21st Century." Concrete International 23(3), pp. 57-63."

[7] Mehta, P.K., 1999, 'Concrete Technology for sustainable development', Concrete International 21 (11), pp. 47-52.

[8] Report No. T(S) 006, January, 2005, 'Use of higher volume fly ash in concrete for building sector', CBRI, Roorkee.

[9] Yadava K.P., Tyagi B.S., Pandey K.K. and Singh V. N., January, 1987, 'Fly ash for the treatment of Cd(11) rich effluents', Environmental technology Journal, Volume 8, Issue 1-12, pp.225-234.

[10] Davis, R,E., R. W. Carlson, J. W. Kelly, and A. G. Davis, 'Properties of cements and concretes containing fly ash', Proceedings, American Concrete Institute 33:577-612.

[11] Verma, S.,1997, 'Performance Evaluation of High strength Fly ash concrete paving mixes', M.E. Dissertation, Department of Civil Engineering, University of Roorkee, Roorkee, India.

[12] Prasad, P.V. S. and Jha, K., 'High Performance Concrete', Project work for Course No. 624- Sr.

Professional Course (Bridges and General),IRICEN, Pune.

[13] Aitcin, P.C, Mehta, P.K., 1990, "Principles Underlying the Production of High- Performance Concrete." Cement, Concrete and Aggregates Journal 12(2), pp. 70-78.

[14] Mehta,P.K.,and R.W.Burrows, 2001, "Building Durable Structures in the 21st Century." Concrete International 23(3), pp. 57-63.

[15] Mehta, P.K. and Gjorv O. E., 1982, ' Properties of Portland Cement Concrete containing Fly ash and Condensed Silica Fume', Cement and concrete Research Journal, Vol. 12, No. 5, pp.587-595.

[16] Adams, T. H., 1988, "Marketing of fly ash concrete", MSU seminar: Fly ash applications to concrete (January), 1.10, 5.10, East Lansing: Michigan State University.

[17] Naik, T. R. and Ramme B.W. 1989, 'High Strength Concrete containing large quantity of fly ash', ACI Material Journal, Vol.86, No.2, pp.111-116.

[18] [Raju, N. K., Ipe, T. V. and Srinath, N., 1994,'mix Proportioning and strength characteristics of portland cement and pulverized fly ash concrete', ICI Bulletin No.49, pp.27-32.

[19] American Coal Ash Association, 1995, 'Fly Ash Facts for Highway Engineers', Federal Highway Administration, Report No. FHWA-SA- 94-081, Washington, DC, December

[20] Ho.D.W.S and Lewis R.K. 1983. "Carbonation of concrete incorporating fly ash or a chemical admixture".

[21] Malhotra V.M. and Mehata P.K. 2002. "High – performance, high – volume fly ash concrete".

[22] A.Buchwald, M.Hohmann&Ch.Kaps 2000- The influence of the clay composition on the geopolymer performance.

[23] Michel de Spot and Eng P. "SOS (SCM optimization system)". Proceedings – International congress on fly ash utilisation, December 4 – 7, 2005 New Delhi, India.

[24] Shui Chijuan, Gong Luashu and Wang Haiman. "Concrete made with calcium enriched fly ash". Proceedings – Second international conference Madrid, Spain.

[25] Vimal Kumar. "Fly ash: An opportunity for India". Proceedings – International congress on fly ash utilisation, December 4 – 7, 2005 New Delhi, India.

[26] Ali Allah Verdi &Frantisek Skvara 2000. - "response of harden paste of a geopolymer cement to acid attack."

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Energy Harvesting from Variation in Blood Pressure through Deformation of Arterial Wall using Electro-magneto-hydrodynamics

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Abstract - The present project aims at modelling a generator that harvests energy from the variation in blood pressure by exploiting the motion of the arterial wall between the diastolic and systolic phase of the cardiac cycle. The concept is to use a highly electrically conductive fluid, which is driven by the motion of the arterial wall within a separate compartment outside the artery. A constant magnetic field is applied to a part of this compartment, which allows converting the fluid's motion into electrical energy based on the principle of electro-magneto-hydrodynamics. The simulation encompasses fluid-structure interactions as well as magneto- and electrostatics and takes advantage of the multiphysics capabilities of COMSOL. The setup of the simulation allows parametric studies of the geometry.

Key words - Energy harvesting, electro-magneto- hydrodynamics, fluid-structure interactions, electro-magnetic induction.

I. INTRODUCTION

Human energy harvesting has gained much interest in the last decade, since it opens new perspectives in terms of long-term power supply for medical implants that remain in the body for many years. Several energy sources can be considered in the human body. One of them is the cardiovascular system, with the advantage that the energy is provided continuously.

Electro-magneto-hydrodynamics (EMHD) is a phenomenon that occurs when an electrically conductive fluid (ECF) is flowing through a magnetic field. An electrical field is induced, which is perpendicular to the direction of flow and to the magnetic field.

Electro-magnetic flow measurement was the first application that used the phenomenon of EMHD. Interestingly blood was among the first fluids to be measured with this technique [1].

With regards to power generation, EMHD has been used mainly in relation with plasma generators [2,3,4]. More recently, new fields of application have emerged, like energy generation for unmanned undersea vehicles [5] or human kinematical energy harvesting from a wristwatch [6]. In this project, the use of EMHD in relation with the deformation of arteries is studied.

To model the setup of interest, the following parameters were defined:

- An artery with inner diameter of 10 mm, wall thickness of 1 mm and length of 20 mm is considered. Young's modulus for the arterial wall was taken as 5e5 Pa [7]. Poisson's ratio was set to 0.4 [8].
- The generator consists of a compartment containing the ECF and wrapped around the artery, an array of four tiny tubes connected distal to that compartment, and a flexible membrane distal to the tubes (Figure 1).
- The flexible membrane ensures that a volume of ECF can pass through the tiny tubes during systole. This membrane acts as a spring to push back the ECF during diastole.
- Permanent magnets are arranged between the tubes, such that a high magnetic flux density is achieved perpendicular to the tubes' axes.
- The gradient of blood pressure was considered negligible over the 20 mm length of the artery. Only the time dependence of the pressure pulse was considered. The Navier-Stokes equations were therefore not solved within the arterial lumen. The pressure was applied directly on the arterial wall.

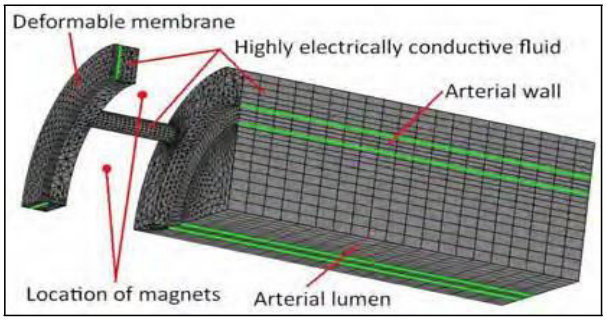

Fig. 1 : Geometry of generator (1/4 is represented, but only 1/8 was simulated to benefit from symmetry).

II. METHODS

The pressure pulse applied to the artery was adapted from [9] and extended in order to model the complete heart cycle [7]. The period for one cycle was set to 0.9 s, leading to approximately 67 bpm. The diastolic and systolic pressures were set to 80 mmHg and 120 mmHg, respectively. The pressure pulse's waveform is given by the following equation (in [Pa]):

$$p(t) = 10666 + 2667 \cdot \begin{cases} 0.5 + 0.5 \cdot \cos(10 \cdot \pi \cdot (t - 0.1)), & 0 < t \le 0.1 \\ 1.5 - 0.5 \cdot \cos(10 \cdot \pi \cdot (t - 0.5)), & 0.1 < t \le 0.3 \\ 0.5 + 0.5 \cdot \cos(5/3 \cdot \pi \cdot (t - 0.3)), & 0.3 < t \le 0.9 \end{cases}$$

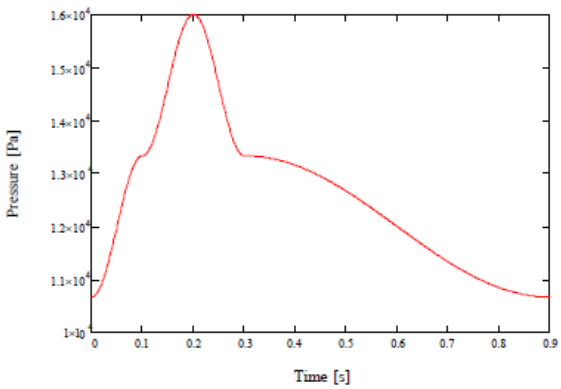

Fig. 2 : Pressure pulse as function of time.

The dimensions at diastolic pressure were taken to model the artery. Initial stress conditions First approximation for initial normal stresses σ_X, σ_Y and σ_Z were obtained by Laplace's law. σ_X and σ_Y were evaluated by Laplace's law for a tube, whereas σ_Z was evaluated by Laplace's law for a sphere [7]. The drawback of this approach is the impossibility to resolve the stress in its different spatial components. Rather, it computes a mean stress over the cross-section of the arterial wall. Furthermore, only normal stresses can be estimated with this method. A stationary simulation of the initial state (artery under diastolic pressure) showed that with the initial stress distribution obtained from Laplace's law, the artery deviated from its initial shape. In a second step, the initial stress conditions (normal and shear stresses) were evaluated by a separate simulation. The artery was placed in a totally relaxed state, i.e. without any pressure applied to it, translating to a smaller inner diameter. The deformation under diastolic pressure was then simulated. Polynomial regressions as function of the radial and angular positions were performed to better resolve the spatial distribution of the stress components:

$$\sigma_x = A \cdot \cos(\varphi - \pi/4) \cdot \sin(\varphi - \pi/4) + B$$

$$\sigma_y = A \cdot \cos(\varphi + \pi/4) \cdot \sin(\varphi + \pi/4) + B$$

$$\sigma_z = A$$

$$\sigma_{xy} = C \cdot x \cdot y$$

$$\sigma_{yz} = \sigma_{xz} = 0$$

$$A = -22.2e6 \cdot r + 181e3$$

$$B = -14.2e12 \cdot r^3 + 235e9 \cdot r^2 - 1.30e9 \cdot r + 2.41e6$$

$$C = -669e12 \cdot r^2 + 8.82e12 \cdot r - 30.2e9$$

$$\varphi = atan2(y, x)$$

$$r = \sqrt{x^2 + y^2}$$

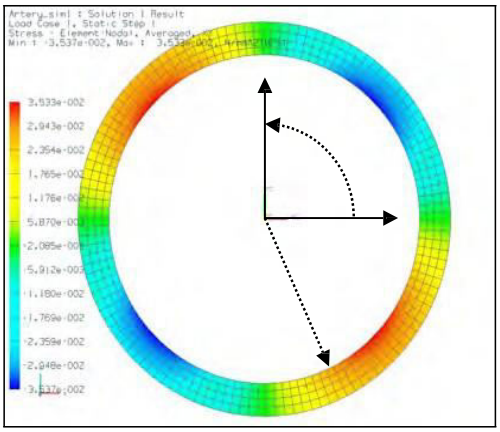

Fig. 3 : Stationary simulation of the artery under diastolic pressure to evaluate initial stress conditions.

With this improved initial stress distribution, the artery under diastolic pressure did not deviate from its initial shape by more than 2 μm.

To model the proposed setup, five application modes were used:

- Incompressible Navier-Stokes (ns)
- Moving Mesh (ale)
- Structural Mechanics, Solid, Stress-Strain (smsld)
- AC/DC, Magnetostatics, No Current (emnc)
- AC/DC, Conductive Media DC (emdc)

In the following sections, the different application modes and their relevant settings are explained.

2.1 Incompressible Navier-Stokes

The incompressible Navier-Stokes equations (conservation of mass and momentum) were solved for the domains containing the ECF:

$$\nabla \cdot \vec{u} = 0$$

$$\rho \cdot \frac{\partial \vec{u}}{\partial t} + \rho(\vec{u} \cdot \nabla)\vec{u} = -\nabla p + \mu \nabla^2 \vec{u} + \vec{F} \qquad (1)$$

Where u is the velocity field of the fluid [m/s], ρ is the fluid's density [kg/m^3] and μ is the fluid's dynamic viscosity [Pa·s]. F is a volume force field that acts on the fluid [N]. No-slip boundary conditions were set for the fixed walls, whereas moving walls were defined at the interface between the ECF and the arterial wall and between the ECF and the membrane. Symmetry conditions were set at the symmetry planes.

2.2 Moving Mesh

To ensure that the domain containing the ECF adapts to the shape of the arterial wall and the membrane, a moving mesh was implemented for all the domains. The normal mesh displacement was constrained at the symmetry planes.

2.3 Solid, Stress-Strain

The arterial wall was modelled using an elastic material. Viscoelastic effects, known to produce a hysteresis loop in the stress-strain diagram, which lead to energetic losses, are therefore not taken into account.

The pressure increase in the ECF, due to deformation of the arterial wall, was applied as surface load on the arterial wall and on the membrane to obtain proper two-way coupling.

2.4 Magnetostatics, No Current

The distribution of the magnetic field was computed once at the beginning of the simulation. Possible perturbations due to the electric current flowing through the generator were neglected.

2.5 Conductive Media DC

Ions moving in a magnetic field experience a force, the Lorentz force, which is expressed as:

$$\vec{F}_L = q \cdot (\vec{u} \times \vec{B})$$

Where q is the charge [C] and B is the magnetic flux density [T]. This force tends to separate the positively from the negatively charged ions, leading to Coulomb forces between the ions, which generate an electrical field:

$$\vec{F}_C = q \cdot \vec{E}$$

Equilibrium is reached when both forces are equal (but in opposite direction), which allows defining the electric field as function of the flow velocity and the magnetic flux density:

$$\vec{F}_C = -\vec{F}_L \quad \Rightarrow \quad \vec{E} = -\vec{u} \times \vec{B} \qquad (2)$$

Ohm's law is expressed as:

$$\vec{J} = \sigma \cdot (\vec{E} + \vec{u} \times \vec{B}) \qquad (3)$$

Where E is bounded due to the load resistor (Figure 4). σ is the ECF's electric conductivity [S/m].

Poisson's equation for the scalar electric potential φ is expressed as:

$$\vec{E} = -\nabla \varphi \qquad (4)$$

Introducing (4) in (3), and using charge conservation. $\nabla \cdot \vec{J} = 0$, the equation can be rewritten as:

$$-\nabla \cdot (\sigma \cdot \nabla \varphi - \sigma \cdot \vec{u} \times \vec{B}) = 0$$

For the source in the open loop, one can state $\vec{E} = -\vec{u} \times \vec{B}$ (cf. (2)) and therefore $\vec{J} = 0$ (cf. (3)).

To ensure optimal power transfer between source and load, the resistor has to match the internal resistance of the generator. In that case,

$$\vec{E} = \frac{-\vec{u} \times \vec{B}}{2}, \text{ and } \vec{J} = \sigma \cdot \frac{\vec{u} \times \vec{B}}{2}$$

The load resistor was modelled using COMSOL's Spice Circuit Editor. The generated power was computed as:

$$P = U \cdot I$$

where U is the voltage measured across the load resistor and I is the current through the resistor.

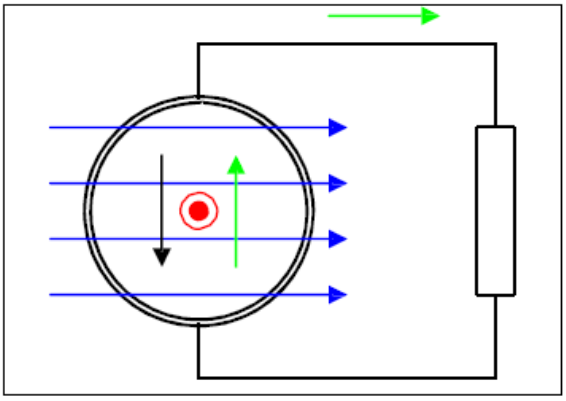

Fig. 4 : Schematic representation of generator (cross-section) and load resistor. Arrows: blue = B; red = u; green = J; black = E

Obviously, if power is consumed in the load (and lost in the source due to its internal resistance), a force must counteract the ECF's motion to ensure energy conservation. This force is produced by the current flow through the magnetic field across the generator:

$$\vec{F} = \vec{J} \times \vec{B} \qquad (5)$$

This force field was implemented in the Navier-Stokes equation – last term on the right of (1) – to model two-way coupling between the two application modes [10].

III. SOLVER SEQUENCE

The following sequence was defined to solve the model for a given geometry:

- First, the internal resistance of the generator is computed by applying a known voltage.
- Second, the magnetic field distribution is simulated and stored for further computations.
- Third, the stationary situation of arterial wall and membrane are computed to find initial conditions to the time dependent problem.
- Finally, the time dependant simulation is run.

The whole model is built in Matlab®, which makes a parametric study very convenient. A loop can be defined for a given geometrical dimension to be evaluated.

IV. RESULTS

The generator presented in this section has an arbitrary geometry. Realistic values were chosen for the free parameters. Instanesous and mean powere (14.6nW) in the load resistor are displayed below. Taking into account that only 1/8 of the geometry was modelled, the mean power of the whole system would reach 117 nW.

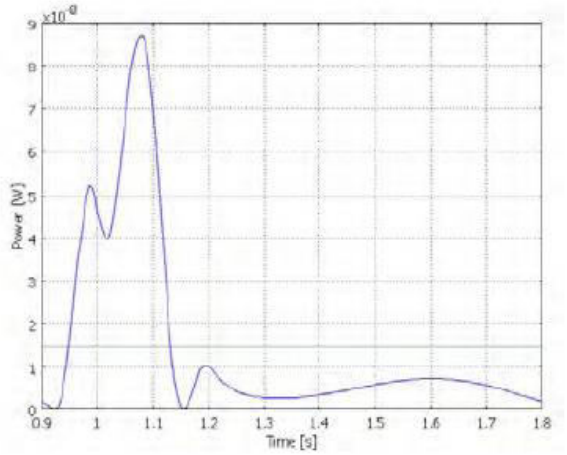

Fig. 5 : Instantaneous (blue) and mean (green) power in the load resistor as function of time.

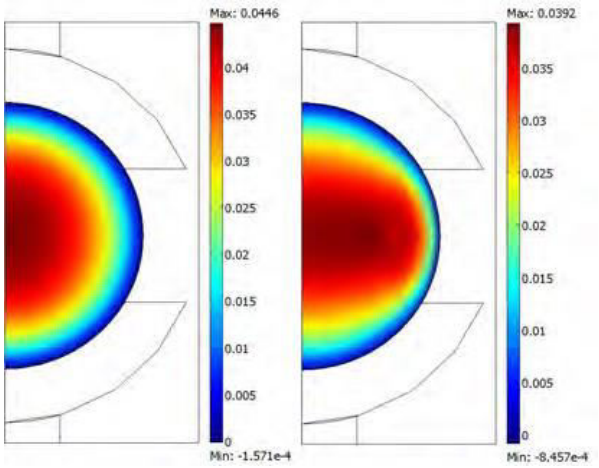

Fig. 6 : Flow velocity through a section of the tube, displayed at half of the tube's length (left: no decelerating force; right: decelerating force).

Comparing the situation with and without decelerating force (cf. (5)), it can be noted that the flow pattern is deformed (Figure 6). Furthermore, the maximum velocity is decreased by 12%.

The maximum radial deformation of the arterial wall reaches 224 µm and 28 µm without and with the generator around the artery. This is a drastic reduction of deformation amplitude. Improved conditions can be expected when a good balance between deformation amplitude and output power is found (no

deformation at all means no flow through the generator, thus no generated power; too large deformation means a lot of elastic energy stored in the arterial wall thus little power is generated).

To validate the simulation, the influence of the load resistor and the decelerating force can be analysed. The table below contains the maximal radial deformation (MRD) of the arterial wall as well as the strain energy (SE) stored in it during systole. Two different load resistors where simulated: a 10 kΩ resistor that mimics an infinitely high load and a resistor matching the internal resistance of the generator

	No decelerating force	Decelerating force	
		Rload = 10k	Rload = Rint
MRD	27.82 μm	27.76 μm	27.71 μm
SE	10.1420 μJ	10.1147 μJ	10.0853 μJ
ΔSE	-	29.4 nJ	

A diminution of the deformation amplitude already occurs when modelling the decelerating force with a 10 kΩ resistor. This is explained by the fact that "short-circuit" currents occur within the ECF due to the inhomogeneity of the induced electrical field [1]. In Figure 6, the flow pattern on the right shows the case for a load resistor matching the internal resistance of the generator. With a 10 kΩ resistor, a similar pattern can already be observed.

When switching from 10 kΩ to a resistor matching the internal resistance, the MRD decreases further. Computing the difference in strain energy between the two resistors leads to 29.4 nJ. The mean power in the load resistor was found before to be 14.6 nW, which corresponds to an energy of 13.2 nJ during 0.9 s. The same amount of energy is also lost in the generator, resulting in a total energy of 26.4 nJ. The error between the generated energy (26.4nJ) and the energy difference in the arterial wall (29.4nJ) is 11%, which is surprisingly small taking into account the strong transients in the pressure pulse and the multi-way couplings between the different physics.

V. DISCUSSION

The different comparisons presented in the previous section show that all the effects that were modelled behave correctly: selecting the load resistor such that the current through the generator is maximised decreases the amplitude of the arterial wall's deformation. Furthermore, energy conservation is ensured within an error of 11%. With this setup, other configurations can be examined.

The work by [11] showed that an elliptical cross-section is preferable over a circular one with regard to sensor's sensitivity for an electro- magnetic flowmeter. The same methodology could also be implemented in the current study to increase output power.

REFERENCES

[1] J.A. Shercliff, The Theory of Electromagnetic Flow-Measurement, p. 3, Cambridge University Press, Cambridge (1962)

[2] H. Branover, Magnetohydrodynamic Flow in Ducts, Israel Universities Press, Jerusalem (1978)

[3] R.J. Rosa, Magnetohydrodynamic Energy Conversion, Hemisphere Publishing, Washington (1987)

[4] H.K. Messerle, Magnetohydrodynamic Electrical Power Generation, Wiley, Chichester (1995)

[5] S.R. Snarski et al., Device for electro-magnetohydrodynamic (EMHD) energy harvesting, Edward M. Proceedings of the SPIE, Vol. 5417, pp. 147-161 (2004)

[6] D. Jia et al., Harvesting human kinematical energy based on liquid metal magnetohydrodynamics, Physics Letters A, Vol. 373, pp. 1305-1309 (2009)

[7] N. Westerhof et al., Snapshots of Hemodynamics, pp. 31,39,106. Springer Science, New York (2005)

[8] C. Lees et al., Poisson's Ratio in Skin, Bio-Medical Materials and Engineering, Vol. 1, pp. 19-23 (1991)

[9] P. Vasava et al., Pulsatile Blood Flow Simulations in Aortic Arch: Effects of Blood Pressure and the Geometry of Arch on Wall Shear Stress, IFMBE Proceedings, Vol. 22, pp. 1926-1929 (2009)

[10] W.B.J. Zimmerman, Multiphysics Modelling with Finite Element Methods, pp. 375-391, World Scientific Publishing Company, Singapore (2006)

[11] J. Krause, G. Stange, Design and Optimisation of a Magnetic-inductive Flow Sensor with Elliptical Cross-Section, Excerpt from the Proceedings of the Comsol Users Conference 2006, Frankfurt (2006)

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A Novel Solution for Effective Bandwidth Utilization in 802.16 Networks

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Abstract - Bandwidth is reserved for each application to ensure the QoS. In this paper, we propose a scheme, named Effective Bandwidth Utilization, to recycle the unused and free bandwidth without changing the existing bandwidth reservation. The idea of the proposed scheme is to allow other SSs to utilize the unused bandwidth when it is free. IEEE 802.16 standard was designed to support the bandwidth demanding applications with quality of service (QoS)[1]. Effective utilization of scarce resources is important to managers in the telecommunications industry, and thus usage-based pricing has become an important tool to address.In this paper we develop a mechanism based on the effective bandwidth concept. This model, effectively characterizes the utilization and business of user in a single metric[3]. For variable bit rate applications, it is difficult for the subscriber station (SS) to predict the amount of incoming data. To ensure the QoS guaranteed services, the SS may reserve more bandwidth than its demand. As a result, the reserved bandwidth may not be fully utilized all the time. We propose a scheme that effectively utilizes the unused bandwidth[4]. The system throughput can be improved while maintaining the same QoS guaranteed services. Mathematical analysis and simulation are used to evaluate the proposed scheme. Simulation and analysis results confirm that the proposed scheme can recycle 43% of unused bandwidth on average[2]. We conduct computational experiments to show the viability of this approach, and also discuss real-world implementation issues.

Key words - *Bandwidth utilization, recycling IEEE 802.16, Bandwidth protector, MAC, QoS, WiMAX.*

I. INTRODUCTION

The Worldwide Interoperability for Microwave Access(WiMAX), based on IEEE 802.16 standard standards [2], is designed to facilitate services with high transmission rates for data and multimedia applications in metropolitan areas. The physical (PHY) and medium access control (MAC) layers of WiMAX have been specified in the IEEE 802.16 standard. Many advanced communication technologies such as Orthogonal Frequency- Division Multiple Access (OFDMA) and multiple-input and multiple-output (MIMO) are embraced in the standards. Supported by these standards. Supported by these modern technologies, WiMAX is able to provide a large service coverage, high data rates and QoS guaranteed services. Because of these features, WiMAX is considered as a promising alternative for last mile broadband wireless access (BWA).

A. Motivation and Problem Overview

In comparison to IEEE 802.11a/b/g based mesh network, the 802.16-based WiMax mesh provides various advantages apart from increased range and higher bandwidth. The TDMA based scheduling of channel access in WiMax-based multi-hop relay system provides fine granularity radio resource control, as compared to RTS/CTS-based 802.11a/b/g systems. This TDMA based scheduling mechanism allows centralized slot allocation, which provides overall efficient resource utilization suitable for fixed wireless backhaul network. (The WiMaxbased mesh backhaul application differs from the 802.11a/b/gbasedmesh, which targets mobile ad hoc networks). However, the interference remains a major issue in multi-hop WiMax mesh networks. To provide high spectral usage, an efficient algorithm for slot allocation is needed, so as to maximize the concurrent transmissions of data in the mesh. The level of interference depends upon how the data is routed in the WiMax network.

In this paper, we consider the following scenario of WiMax-based mesh deployment. A mesh network is managed by a single node, which we refer to as Mesh BS. Mesh BS serves as the interface for WiMax-based mesh to the external network. We provide an algorithm for interference-aware multi-hop route selection for a given capacity-request matrix, which leads to efficient scheduling.

Bandwidth in the *current* frame can be utilized. It is different from the bandwidth adjustment in which the adjusted bandwidth is enforced as early as in the next

coming frame. Moreover, the unused bandwidth is likely to be released temporarily (i.e., only in the current frame) and the existing bandwidth reservation does not change. Therefore, our scheme improves the overall throughput while providing the same QoS guaranteed services.

TABLE I. IEEE 802.16 MESH MODE ACRONYMS

BS	Base Station
SS	Subscriber Station
MSH	Mesh
SN	Sponsoring Node
CN	Candidate Node
MSH-NCFG	Mesh network Configuration Message
MSH-NENT	Mesh Network Entry Message
MSH-CSCH	Mesh Centralized Scheduling Message
MSH-CSCF	Mesh Centralized Scheduling Configuration Message

II. BASIC CONCEPTS AND DEFINITIONS

The IEEE 802.16 network is connection-oriented. It gives the advantage the advantage of having better control over network resource to provide QoS guaranteed services. In order to support wide variety of applications, the IEEE 802.16 standard classifies traffic into five scheduling classes:

- Unsolicited Grant Service (UGS)
- Real Time Polling Service (rtPS)
- Non-real Time Polling Service (nrtPS)
- Best Effort (BE)
- Extended Real Time Polling Service (ertPS).

Each application is classified into one of the scheduling classes and establish a connection with the BS based on its scheduling class. The BS assigns a connection ID (CID) to each connection. The bandwidth reservation is made based on the CID via sending a BR. When receiving a BR, the BS can either grant or reject the BR depending on its available resources and scheduling policies.

2.1 Bandwidth Utilization

Bandwidth utilization improvements have been proposed in the literature. In, a dynamic resource reservation mechanism is proposed. It can dynamically change the amount of reserved resource depending on the actual number of active connections.

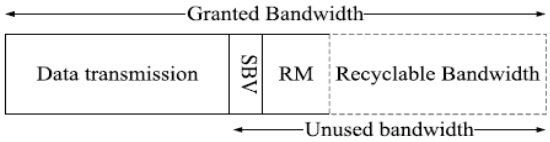

Fig. 1 : Messages to release the unused bandwidth within a UL transmission interval.

The investigation of dynamic bandwidth reservation for hybrid networks is presented in. Evaluated the performance and effectiveness for the hybrid network, and proposed efficient methods to ensure optimum reservation and utilization of bandwidth while minimizing signal blocking probability and signaling cost. In, the enhanced the system throughput by using concurrent transmission in mesh mode.

2.2 Bandwidth Recycling

The complementary station (CS). Waits for the possible opportunities to recycle the unused bandwidth of its corresponding TS in this frame. The

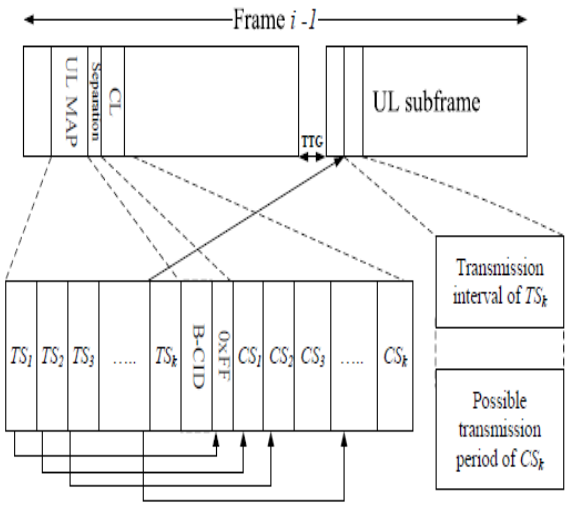

Fig. 2 : The mapping relation between CSs and TSs in a MAC frame

CS information scheduled by the BS is resided in a list, called complementary list (CL). The CL includes the mapping relation between each pair of pre-assigned C and TS.

2.3 QoS Guaranteed Services

It is different from the bandwidth adjustment in which the adjusted bandwidth is enforced as early as in the next coming frame. Moreover, the unused bandwidth is likely to be released temporarily (i.e., only in the current frame) and the existing bandwidth reservation does not change. Therefore, our scheme improves the

overall throughput while providing the same QoS guaranteed services.

2.4 Traffic and Packet Performance

The Packet mean data rate of each application but make the mean packet size randomly selected from 512 to 1024 bytes. Thus, the mean packet arrive rate can be determined based on the corresponding mean packet size. As mentioned earlier, the size of each packet is modeled as Poisson distribution and the packet arrival rate is modeled as exponential distribution.The other factor that may affect the performance of bandwidth recycling is the probability of the RM to be received by the CS successfully.

2.5 Bandwidth Monitor

Bandwidth Monitor monitors bandwidth usages through computer it's installed on. The software displays real-time download and upload speeds in graphical and numerical forms, logs bandwidth usages, and provides daily, weekly and monthly bandwidth usages reports. Bandwidth Monitor monitors all network connections on a computer, such as LAN network connection, Internet network connection, and VPN connection.

2.6 Bandwidth Monitor also offers useful built-in utilities:

speeds stopwatch, transfer rates recorder, and bandwidth usage notification. And, the software supports running as a system service that monitors bandwidth usages and generate traffic reports automatically without log on. Bandwidth Monitor works with the majority network connections including modem, ISDN, DSL, ADSL, cable modem, Ethernet cards, wireless, VPN, and more.

2.7 Bandwidth Meter:

Bandwidth Meter remains in tray and displays the bandwidth consumed for the session, day and month. This will be useful for people with limited bandwidth/month internet connection.

2.8 MAC Address

MAC Address is a tool for finding the MAC addresses of computers on the network. With Find MAC Address, you can find the MAC address of your computer or a remote computer or any computer within a specified range of IP addresses. Unlike similar software, Find MAC Address can find the MAC addresses of computers using four methods (ARP, NetBIOS, NetAPI, WMI).

III. BACKGROUND

Over the past ten years there has been an ongoing debate over the issue of charging Internet traffic. The growing numbers of Internet users coupled with the development of new applications that require large amounts of bandwidth has led to an explosive growth in Internet traffic resulting in frequent congestion that is widely perceived as poor service. More users are growing frustrated by slow connections and increasing packet delays (that result in slow applications like web browsing, ftp, e-mail etc.). Internet Service Providers (ISPs) are trying to solve this problem by over-provisioning (i.e., placing extra bandwidth) in the core of their backbone networks in order to alleviate the congestion experienced. Internet congestion may be reduced by a class of charging mechanisms that assign prices based only on information collected at the ingress of the network, where the user's packets enter. This paradigm is termed "edge pricing" (see Shenker et al., 1995) and it works by monitoring the packets that users send over their connection either constantly or at given intervals. Bandwidth transmitted data may be more than the amount of transmitted data and may not be fully utilized all the time. Before it is different from the bandwidth adjustment in which the adjusted bandwidth is enforced as early as in the next coming frame. Moreover, the unused bandwidth is likely to be released temporarily (i.e., only in the current frame) and the existing bandwidth reservation does not change. The ad hoc networking community assumes that the underlying wireless technology is the IEEE 802.11 standard due to the broad availability of interface cards and simulation models.

There are two transmission modes: Time Division Duplex (TDD) and Frequency Division Duplex (FDD) supported in IEEE 802.16. Both UL and DL transmissions cannot be operated simultaneously in TDD mode but in FDD mode. In this paper, our scheme is focused on the TDD mode. In WiMAX, the BS is responsible for scheduling both UL and DL transmissions. All scheduling behavior is expressed in a MAC frame.

IV. DYNAMIC BANDWIDTH REQUEST-ALLOCATION ALGORITHM AND PRIORITY-BASED SCHEDULING ALGORITHM

A dynamic bandwidth request-allocation algorithm for real-time services is proposed in . The authors predict the amount of bandwidth to be requested based on the information of the backlogged amount of traffic in the queue and the rate mismatch between packet arrival and service rate to improve the bandwidth utilization. The research works listed above improve the performance by predicting the traffic coming in the future. Instead of prediction, our scheme can allow SSs to accurately identify the portion of unused bandwidth and provides a method to recycle the unused bandwidth.

It can improve the utilization of bandwidth while keeping the same QoS guaranteed services and introducing no extra delay.

V. THEORETICAL BACKGROUND FOR EFFECTIVE BANDWIDTH

In order to be able to charge customers for the use of a communications link we need to be able to identify scalars that will measure the resources they use when their packets are forwarded over the Internet. These scalars will then become the independent variables of a pricing function that will associate resource usage with a specific charge. Utilization of a traffic stream is a well defined metric and is easy to measure. However, burstiness is not so well defined. The effective bandwidth concept ties these two notions together, and summarizes

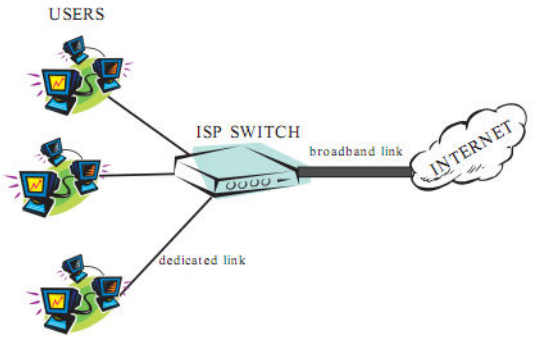

Fig. 3 : Multiplexing of many sources on an outgoing broadband link.

Effective Bandwidth is a scalar that summarizes resource usage on a communications link from a specific source in a packet-switched network. Specifically, at a given switch in the network where many traffic streams from different sources are multiplexed on a single outgoing link (Figure 1), the effective bandwidth of a specific source represents the capacity of the outgoing link used by that source.

VI. IMPLEMENTATION

- The IEEE 802.16 network is connection-oriented. It gives the advantage of having better control over network resource to provide QoS guaranteed services
- To improve the bandwidth utilization while maintaining the same QoS guaranteed services, our research objective is two fold:
  - The existing bandwidth reservation is not changed to maintain the same QoS guaranteed services.
  - Our research work focuses on increasing the bandwidth utilization by utilizing the unused bandwidth.
- We propose a scheme, named Bandwidth Recycling, which recycles the unused bandwidth while keeping the same QoS guaranteed services without introducing extra delay.
- In this system they are using 802.11 MAC layer to evaluate the correct bandwidth. This method combines channel monitoring to estimate each node's medium occupancy.
- Probabilistic combination of the values is to account for synchronization between nodes, estimation of the collision probability between each couple of nodes, and variable overhead's impact estimation.

VII. CONCLUSION

We propose to schedule SSs which have rejected BRs in the last frame because it can ensure that the SS scheduled as CS has data to recycle the unused bandwidth. This scheduling algorithm is called *Rejected Bandwidth Requests First Algorithm* RBRFA). It allows the BS to schedule a complementary station for each transmission stations. Each complementary station monitors the entire UL transmission interval of its corresponding TS and standby for any opportunities to recycle the unused bandwidth. Besides the naive priority-based scheduling algorithm, three additional algorithms have been proposed to improve the recycling effectiveness. Our mathematical and simulation results confirm that our scheme can not only improve the throughput but also reduce the delay with negligible overhead and satisfy the QoS requirements.

REFERENCES

[1] IEEE 802.16 WG,"IEEE Standard for Local and Metropolitan Area Network : Air Interface for Fixed Broadband Wireless Access Systems" .

[2] J. Tao, F. Liu, Z. Zeng, and Z. Lin, Throughput enhancement in WiMax mesh networks using concurrent transmission, In Proc. IEEE Int. Conf. Wireless Commun., Netw. Mobile Computing., 2009, p.871V874.

[3] Bailey, J. P., Nagel, J., and Raghavan, S. (2008). Ex-post internet charging. In McKnight, L. W. and Wroclawski, J., editors, Internet Services.

[4] Besen, S. M., Spigel, J. S., and Srinagesh, P Evaluating the competitive effects of mergers of internet backbone providers.

[5] M. Conti, G. Maselli, G. Turi, and S. Giordano, "Cross-layering in mobile ad hoc network design," IEEE Computer, vol. 37, pp. 48-51, 2007.

[6] S. Shakkottai, T. S. Rappaport, and P. C. Karlsson, "Cross-layer design for wireless networks".

[7] S. Toumpis and A.J. Goldsmith, "Capacity Regions For Wireless Ad hoc Networks," IEEE International Conference on Communications (ICC).

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Automatic Classification of Human Chromosomes Using G-Band Chromosome Images

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Abstract **-** Chromosomes are the cell structures that contain genetic information. The relationship between properties of life and chromosomes, and the fact that the origin of some diseases is abnormalities in chromosomes, are two reasons to pay attentions to analysis of chromosome for detection of properties of life and origins of some diseases. The karyotyping is a set of procedures, in the scope of the cytogenetic that produces a visual representation of the 46 chromosomes (called karyogram), paired and arranged in decreasing order of size. Manual karyotyping is slow, and needs a cytogenetics expert. Also karyotyping is expensive. For these reasons we seek on a system that automatically performs karyotyping using image processing techniques. The goal of automatic karyotyping is creating a system that automatically acquires images of chromosomes and after processing and analysis, present a karyotype image and also help genetic experts in detecting abnormalities. In this paper, a new metric is proposed to compare this type of chromosome images toward the design of an automatic classification and pairing of chromosomes. Besides the features used in the traditional karyotyping procedures, a new feature, based on mutual information, is proposed to increase the discriminate power of the G-banding pattern dissimilarity between chromosomes and improve the performance of the classifier. The proposed algorithm computes similarity of chromosomes instead of classifying them individually. Band patterns are utilized as vital discrimination criterion for human chromosomes classification, and it is able to reduce the error rate of karyotype systems. The density profile is defined as the average intensity of the pixels along the line perpendicular to the approximated medial axis of the chromosome. The ultimate goal of this work is to produce a reliable and accurate pairing method to be used in the scope of the cytogenetic, rather than a chromosome classifier. The optimization task is solved by using an integer programming approach in pairing. The other classifier is BPNN that provides simple but very reliable means of classification. NN's have been applied to perform all major stages of automatic human chromosome analysis, namely feature extraction and classification. Copenhagen, Edinburgh, and Philadelphia datasets can also be used for better results. In addition, the integration of these stages into one coherent system guarantees the accomplishment of the research goals and leads toward a completely automatic human chromosome analysis, a crucial necessity in numerous clinical fields, such as prenatal diagnosis, cancer research and detection of radiation-induced aberrations.

I. INTRODUCTION

The body of each life is organized from cells. In normal form this very large and complex molecule is in the nucleus liquid and cannot be viewed with a common microscope. At cell division this molecule is compressed to a shape that is called chromosome. Cytogenetic technologists study the hereditary material at the cellular level by examining the structure and behaviour of chromosomes. Chromosomes are the condensed form of the genetic material and their images taken during cell division are useful for diagnosing genetic disorders and for studying cancer. The goal of automatic karyotyping is creating a system that automatically acquires images of chromosomes and after processing and analysis, present a karyotype image and also help genetic experts in detecting abnormalities. Banded chromosome analysis is essential to distinguish between normal and abnormal chromosomes. Nowadays, the most commonly used banding technique is the G-banding method, in which the bands are produced by Giemsa staining after pretreating the chromosomes with a protein digesting enzyme (trypsin). Manual banding analysis requires human operators to compare bandings with normal patterns. This is a time consuming and laborious process, and complex chromosome rearrangements are difficult to identify. Automatic image analysis systems have recently been developed to classify chromosomes by using features such as the length, the location of the centromere, and the banding patterns**.** The proposed algorithms use a BPNN classifier based on the traditional dimensional and morphological features extracted from the karyogram and a new one based on the mutual information (MI) and band profile density. The goal is to better characterize the textural information associated with each pair by adding discriminative power to the G-banding profiles information. Band profile is one such prominent feature, which has been used widely. The extracted band profile should be an accurate representation of the spatial distribution of intensity over chromosomal surface to increase the discriminative

power of the classifier. Thus, an algorithm that can accurately extract band profiles from the chromosomes is essential. So, instead of doing the classification process manually by a microscope with the naked eye, our software can do this task using both Image processing approach and Neural Networks (adapting the Matlab utilities).Our software package can be characterized by minimizing the consuming time needed to classify the chromosomes and gain reliable results. The design of automatic algorithms for pairing and classification has been an active field of research in the last two decades and still is an open problem today. The main aspects that must be taken into account in the design of an automatic pairing algorithm are common to the general classification problems:

1) Feature selection; 2) Classifier design; and 3) Training and testing (validation).

II. MATERIALS AND METHODS

Our proposed method consists of a number of steps as it is shown in Fig.1

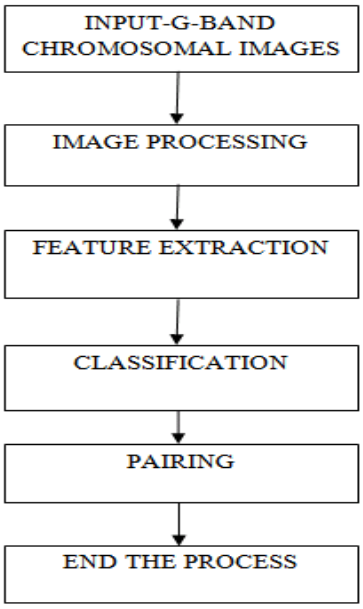


Fig.1 Flow diagram of proposed method

III. IMAGE PROCESSING

The image processing step aims at image contrast enhancement and compensation of geometric distortions observed in each chromosome not related with its intrinsic shape or size.

- Chromosome isolation: Each chromosome is isolated from the unordered karyogram.
- In Geometrical compensation, Chromosome medial axis segmentation, interpolation, border regulation and dimensional scaling are made.
- The steps are performed before the pattern features is extracted to make the entire chromosome with the same size and aspect ratio by interpolating the original images.
- Intensity compensation: The metaphase plaque from which the chromosomes are extracted does not present a uniform brightness and contrast. To compensate for this inhomogeneity, the spatially scaled images are histogram equalized.

IV. EXTRACTION OF FEATURES

Appropriate feature description is considered to be one of the most important part of classification procedures. The processed images are used to extract discriminative features to pair the chromosomes. The extracted features, used to compute the distance between two chromosomes in the pairing process. Three types of features are used to compare two chromosomes, Dimensional, Shape and Textural.

The dimensional features aim to discriminate the dimensions, and correspond to: the axis dimensions of the ellipsis containing the chromosome, the chromosome length proportion, the border perimeter, the length, and the area. The shape is only discriminated by the normalized area of the chromosome image. The textural features are the banding profile and the mutual information. The banding profile is obtained by integrating along the pixels of each chromosomal image line.

Mutual information: This measure is widely used in medical image processing, namely, in medical image registration and is particularly suitable to compare pattern similarities based on the histograms of two images, such as chromosome images. This is a valid assumption since given two chromosomes from the same class, the corresponding G-banding will overlap and maximal dependence between the gray value of the images will be obtained

$$\mathrm{MI}(I_A, I_B) = \sum p_{AB}(a,b) \log \left[\frac{p_{AB}(a,b)}{p_A(a) p_B(b)} \right]$$

Band profile: It is computed as the average intensity values across each line of the shape normalized processed image. The distance between the chromosomes with respect to the band profile is the Euclidean distance between one profile and the other. The overall distance between two chromosomes

involving all features, given a vector of weights, **w**, is defined as a weighted distance computed as follows:

$$D(i,j; w) = \sum_{k-1}^{L} w(k)dk(i,j)$$

where w(k) is the weight associated with the kth feature and d(i,j) is the distance between the ith and jth chromosomes with respect to the kth feature. Each weight vector **w***r* is computed by minimizing the sum of intraclass distances & sum of interclass distances.

IV. CLASSIFIER

Two types of methods are discussed and compared arer as follows:

1) Instead of trying to accurately classify the chromosomes, the proposed algorithm attempts to pair them directly without knowing the class to which they belong. The pairing process is a computationally hard problem because the optimal pairing must minimize the overall distance, i.e., the solution is the global minimum of the cost function. This problem can be stated as a combinatorial optimization problem. Moreover, it can be formulated as an integer programming problem, thus allowing for very efficient optimization methods. To do so, the cost functions, as well as the constraints, have to be expressed by linear functions of the variables.

$$C(\mathcal{P}) = \sum_{(i,j)\in\mathcal{P}} \mathcal{D}(i,j)$$

The goal of the pairing process is to find a total pairing *P* that minimizes *C*(*P*),the cost function and d is the distance matrix. The combinatorial optimization problem can then be restated as an integer programming problem.

$$d(i,j) = \|h_i(n) - h_j(n-\hat{\tau})\|_2.$$

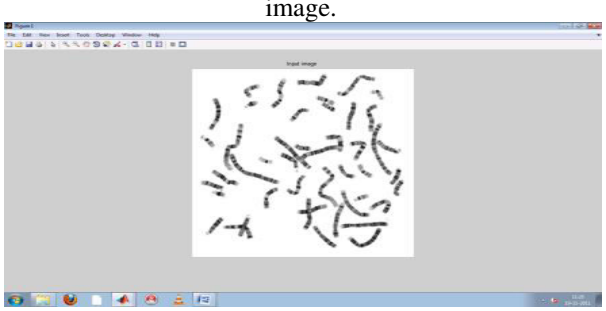
V. BPNN CLASSIFIER:

ANNs are the best chromosome classifiers, especially when the number of classes is small. Feed-forward perceptron neural networks with different number of neurons in the hidden layer were trained by the backpropagation learning rule and used for the classification of the chromosomes. In this technique, the available data is divided into three subsets: training, validation and testing sets. The training subset is used for updating the ANN parameters; the testing subset is used for final assessment, and the classification error on the validation set is monitored during the training process to avoid over-fitting. Neural network will be efficient by choosing the best features. In this method mutual information and band profile details are used. The BPNN provided better classification result as a classifier. In summary, NN's have been applied to perform all major stages of automatic human chromosome analysis, namely feature extraction, image segmentation, and classification. In addition, the integration of these stages into one coherent system guarantees the accomplishment of the research goals and leads toward a completely automatic human chromosome analysis. A crucial necessity in numerous clinical fields, such as prenatal diagnosis, cancer research and detection of radiation-induced aberrations.

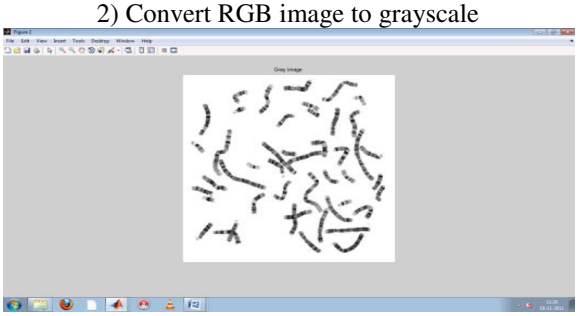
VI. SOFTWARE APPROACH ROPOSED:

MATLAB provides a suitable environment for image processing. It is a faster programming environment for image processing. MATLAB is used to test and tweak new image processing techniques and algorithms. Almost everything in MATLAB is done through programming & manipulation of raw image data and not a user interface. MATLAB handles images as matrices. MATLAB results for the three algorithms mentioned above in the methodology are given below:

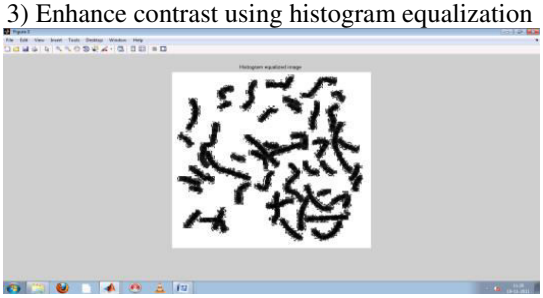
1) G-band human chromosome image is taken as input image.



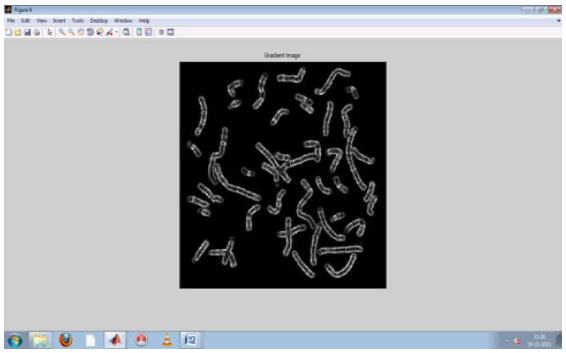
2) Convert RGB image to grayscale



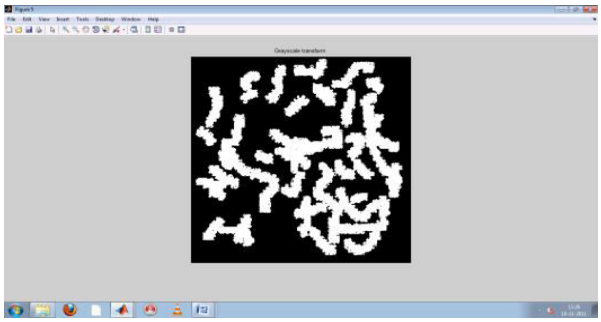
3) Enhance contrast using histogram equalization



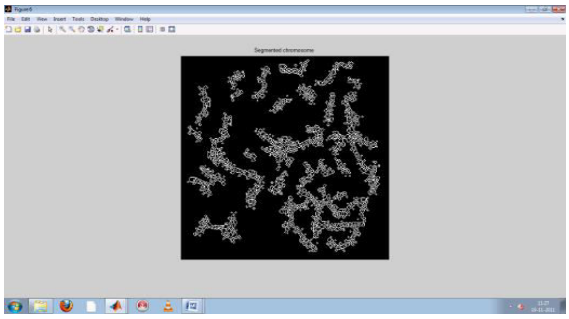
4) Two-dimensional numerical gradient is performed



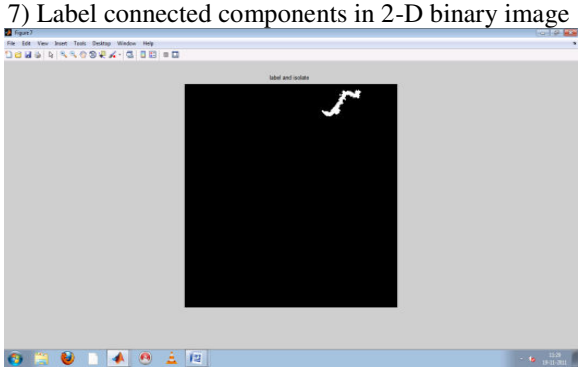
5) Convert image to 8-bit unsigned integers (grayscale transform)



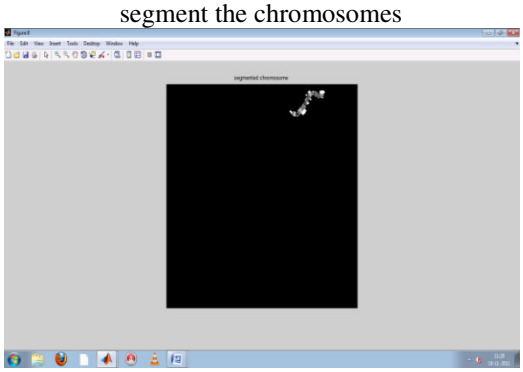
6) Using watershed transform pixels are labeled & complemented



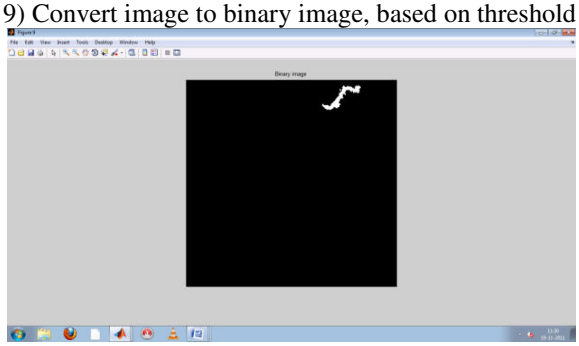
7) Label connected components in 2-D binary image



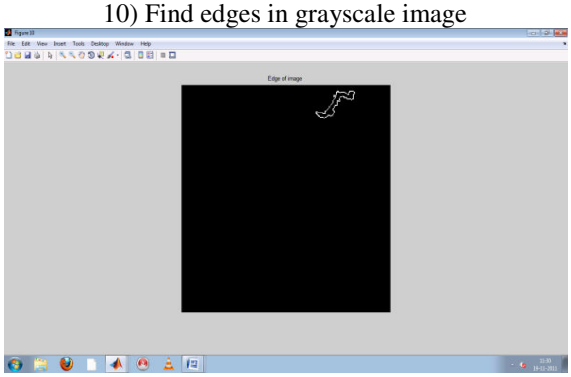
8) Label connected components in 2-D binary image & segment the chromosomes



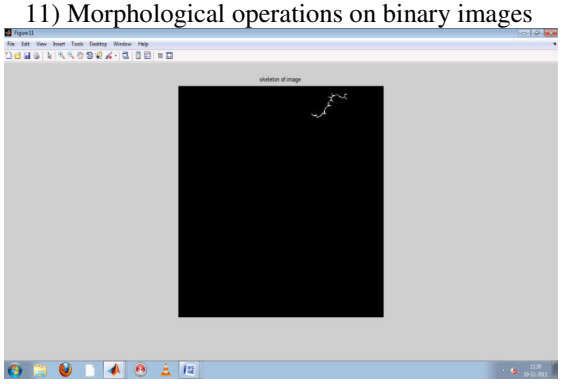
9) Convert image to binary image, based on threshold



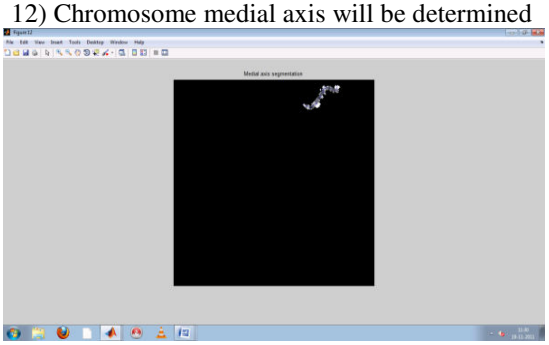
10) Find edges in grayscale image



11) Morphological operations on binary images

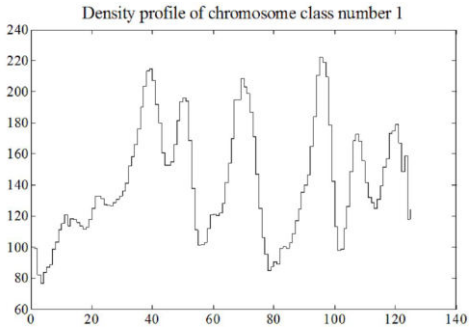


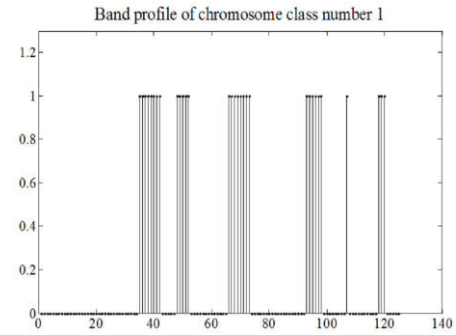
12) Chromosome medial axis will be determined



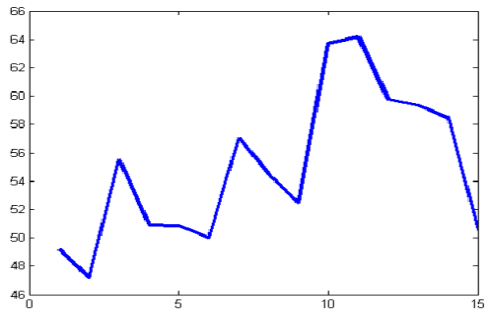
VII. DENSITY AND BAND PROFILE OUTPUTS:

The pairing algorithm is formulated as a combinatorial optimization problem where the distances between homologous chromosomes are minimized and the distances between nonhomologous ones are maximized. The optimization task is solved by using an integer programming approach.

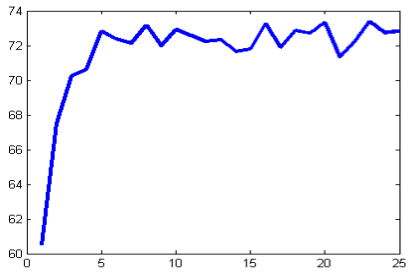




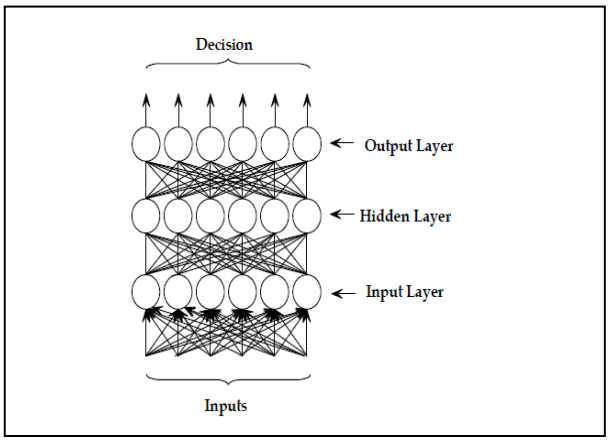
BPNN Classifier



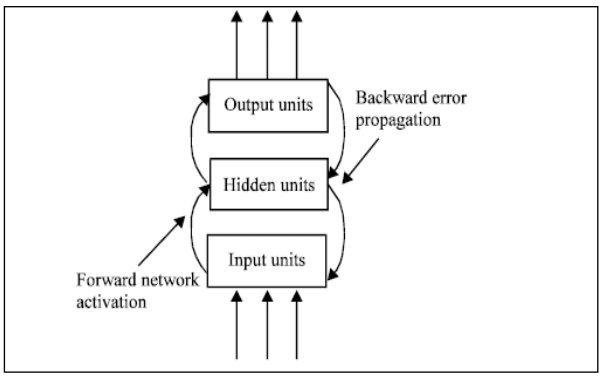
The results of neural network simulation with 6 features at input. Horizontal axis is the number of neurons in hidden layer and vertical axis represents the average percentage of true classification.



The results of neural network simulation with 9 features at input. Horizontal axis is the number of neurons in hidden layer and vertical axis represents the average percentage of true Classification. According to figure the best result is obtained with 11 neurons in hidden layer. So it is recommended that the number of neurons in hidden layer be 11 neurons, will classify the chromosomes, which means that the neural network will be trained to distinguish them and rearrange them into pairs. Each pair must have two identical chromosomes. If there is any extra or lost or defected chromosome, the neural network will show it through its decision.



Neural network architecture



VIII. BACK PROPAGATION ALGORITHM

Back-propagation algorithm is the most popular approach to implement learning in neural networks .This algorithm is a multi-layer network using a weight adjustment based on the sigmoid function. This method of training is an example of a supervised learning, where the target of the function is known.

REFERENCE

1. Artem Khmelinskii, Rodrigo Ventura, and Joao Sanches, "A novel metric for bone marrow cells chromosome pairing," IEEE transactions on Biomedical engineering, vol. 57, no. 6, June 2010.
2. G.Agam and I.Dinstein, "Geometric separation of partially overlapping nonrigid objects applied to automatic chromosome classification," IEEE Trans. Pattern Anal. Machine Intell., vol. 19, pp. 1212–1222, 1997.
3. E.Grisan, E.Poletti, and A.Ruggeri, "Automatic segmentation and disentangling of chromosome in Q-band prometaphase images," IEEE Trans Inf. Technol. Biomed., vol. 13, no. 4, pp. 575–581, 2009.

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Hydrochemistry of Surface And Groundwater Haridwar District, Uttarakhand

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Abstract **-** In recent years, after the formation of Uttarakhand, Haridwar has witnessed phenomenal increase in human activities leading to rapid urbanization and industrialization. A baseline study involving analysis of surface and ground water sample of Haridwar district was carried out in order to assess their suitability for drinking, agricultural, industrial & domestic purpose. Hydrochemistry of surface water pH , EC, TDS, SO_4, Cl, NO_3, PO_4, HCO_3, total hardness, Ca, Na, Mg, K of Haridwar district was studied for impact for land use on water quality.

A total 36 samples were collected from surface and subsurface water Haridwar district and from Risikesh. The parameter like temperature, pH, conductivity, TDS and DO were measured in the field and HCO_3 was measured by acid base titration methods. All cations and anions were measured with the help of Ion Chromatography. For statistical analysis mean, mode and S.D. were calculated.

Study result shows that water is slightly to basic in nature with a pH value of 7.4. The EC were ranged from 148µs/cm to 1330µs/cm with a mean value of 495.5µs/cm during winter season. All cation and anions were compared with WHO and BIS Standard of drinking water quality in order to ascertain its suitability for drinking purpose.

Key Words: *Hydrochemistry, Water quality.*

I. INTRODUCTION

The rapid industrialization and urbanization has led to the over exploitation of the natural resources. Industrial, domestic and agricultural activities sometime uses large quantities of water a part of which returns to the environment via discharges into the atmosphere and the water bodies. And these anthropogenic activities are the main causes for the different kind of pollutions we are facing today.

Ocean contains about 97% of earth's water resource which is unfit for human consumption and other uses because of high salt content. Of the 3% fresh water, about 2% lies in polar region and only about 1% is available for human consumption. Rapid industrialization and urbanization has led to the over exploitation of the natural resources.

After the formation of Uttarakhand state, pace of urbanization, growth of population centres, introduction of industries and employment of auxiliary means of agriculture have increased manifold in Uttarakhand region particularly in Haridwar districts. This is deteriorating the natural quality of surface and `groundwater. Pollutants are increasingly added to the surface and groundwater system through various human activities and through natural degradation processes. Application of fertilizer and pesticides to enhance crop production has become a common practice. Untreated disposal of wastes are adding pollutants to the surface and groundwater system and continuous addition accelerate their movement towards production well.

Variation of water quality in an area is a function of physical and chemical parameters that are greatly influenced by geological formations and anthropogenic activities. Knowledge on hydrochemistry is more important to assess the quality for understanding its suitability for various needs and also to evaluate the aspect of chemical weathering of rocks. A number of studies have been carried out at national and international level.

Globally, weathering of rocks is the major source of ions in the water bodies. Physical chemical and biological processes are involved in rock weathering. The chemical reactions between rock minerals and soil water produce cations, anions and heavy metals in surface and groundwater. The chemical composition of

the world river has been reviewed by [5], [4], [7], [8], [2]. This compilation provided a general idea of chemical composition of rivers flowing through different geological terrains and climatic regimes.

The chemistry of some of the large rivers of the Asian region such as the Ganges, Brahmaputra, Changjiang and Huanghe have been studied extensively by a number of workers, [9], [6], [1], [10], [11], [12], [13], [14] (1984), The water chemistry of the Indus in Pakistan was studied by [5]. In India some of the tributaries of' the Indus were studied by [15]and [17].

It can be observed from the data compiled by Livingstone [4] and [5] that ionic ratios in the water of major river are fairly constant. Among cations Ca were found to be most abundant cation while among anions HCO_3 were found to be most abundant anions in water. This is the case for more than the 90 % of the rivers which have rock dominant type of the water described by [16]. Weathering of both silicate and non silicate rock contribute ~ 70% of river alkalinity while remaining 30% is caused by river based biological processes due to decomposition of organic matter [18. The objective of the present study is to evaluate the major ion chemistry of surface and groundwater in terms of chemical weathering and factors controlling on water chemistry.

II. LOCATION OF THE STUDY AREA

Haridwar district, covering an area of about 2360 km², is in the southwestern part of Uttarakhand state of India. Haridwar is situated at an altitude of about 250 metres above the sea level, between Siwalik Hills in the North and Northeast and Ganga River in the South.

The city is situated between longitude range 39^0 ' to 30^0 '15 N and latitude range 77^o 45' to 78^0 10' E. The district has 6 administrative block namely, Bhagwanpur, Roorkee, Narsan, Bahadarabad, Laksar and Khanpur. The study area is drained by upper Ganga canal, which originate near Har- ki- Pairi in the city of Haridwar and drain over its total channel network length of ~ 300 km. Among the natural stream the region encompasses entire solani river basin which is extended over an area of 655 km^2 and other small rivulets like Ranipur Rao and Pathi Rao originating in the Siwaliks, Pir Khala and Sila khala originating in the plains and river Banganga and Begam Nadi the older channels of the river Ganga.

III. METHODOLOGY

The anions and cations were measured by Ion Chromatograph (D X 500) of Dionax Corp USA with overall accuracy of ± 5%. All the samples were and stored in 500 ml polyethylene "Tarson mark" bottles after filteration with 0.2 M mainframe filter. The measurement of the temperature, dissolve oxygen and conductivity and TDS were made in situ immediately after sample collection in field. The bicarbonate were measure in the laboratory by acid base titration method. A total of 36 samples were collected from surface water (river and stream) and groundwater (Tubewell and Handpump) in winter season, 2008.

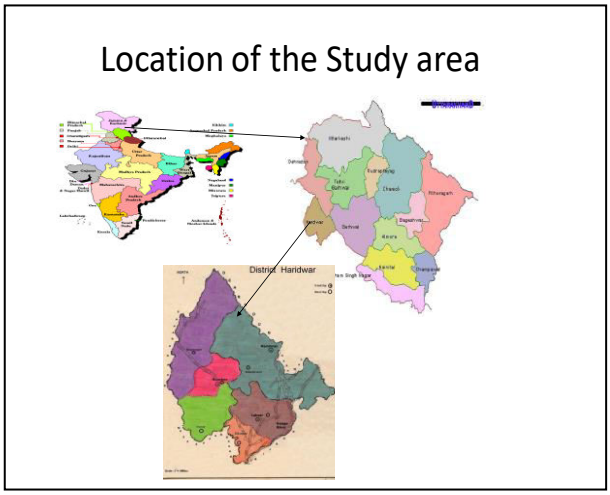


Fig: 1.1 Location Map of the study area

IV. RESULT & DISCUSSION :

Hydrochemistry of Surface Water

In Haridwar district the surface water is mainly represented by the river Ganga. The Ganga river originate from Gangotri Glacier near Gaumukh travel and through the crystalline rocks of Higher Himalayan, meta-sedimentary and crystalline rocks of Lesser Himalaya and sedimentary rocks of Siwalik belt. These rocks are cut by several faults and thrusts.

The pH vale of the surface water of Haridwar range from 8.5 to 6.2 with an average value of 7.4 and the eclectic conductivity range from 148 µs/cm to 1330 µs/cm with an average value of 473 µs/cm. The data are compared with BIS standards (Table 1.1) of water quality. Bicarbonate is the major anion in Ganga waters and account for 73% followed by

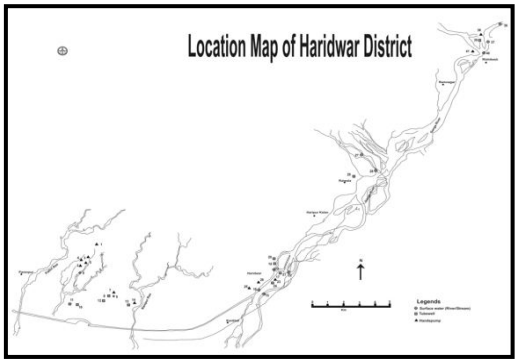


Fig: 1.2 Sampling location map

sulphate and chloride which together constitute about 25% of anions. The plot of (Ca+Mg) versus TZ^+ shows the dominance of Ca and Mg among cations (Fig 1.6). The SO_4 **:** Cl equivalent ratios varies from 2.7 to 13.6 with mean value of 10.8 in winter season. The plot of (Ca+Mg) versus bicarbonate (Fig. 1.8) show that most of the sample during winter, summer and post monsoon season falls slightly below 1**:**1 trend indicating that a significant fraction of bicarbonate has to be balanced by (Na+K). On a ternary cation diagram of Ca, Mg and Na+K (Fig. 1.12) most of the data fall either close to Ca vertex or towards the centre of the field and also on the ternary anions diagram of HCO_3, SO_4 and ($Cl+NO_3$) (Fig. 1.11), most of the data falls close to HCO_3 vertex indicating carbonate weathering as the major source of ions in Ganga river. The earlier studies of [Sarin (1983) and [19] and [10] also substantiate the present observations.

V. MAJOR ION CHEMISTRY OF HARIDWAR GROUNDWATER

The pH vary from 6.8 to 8.5 with an average of 7.3. Calcium and Magnesium are major cations together they account for 90% of total cations. Calcium constitute 72% of total cation followed Mg (17%), Na (86%) and K (1.6%). Among anions, bicarbonate is most dominant and account for 77% of total anions followed by SO_4 (9%), Cl (7%) and NO_3 (6%).

On a ternary anion plot (Fig. 1.6) relating HCO_3, SO_4 and ($Cl+NO_3+PO_4$) most of the data falls close to HCO_3 vertex and on a cation diagram (Fig. 1.12) of Ca, Mg and (Na+K), most of the data falls close to Ca vertex and towards the centre of the field. A plot of (Ca+Mg) vs HCO_3 (Fig. 1.5) shows that in most of the samples the (Ca+Mg) contents are slightly in excess of HCO_3 suggesting that excess of (Ca+Mg) in these water should be balanced by SO_4 and Cl. The plot of (Ca+Mg) versus bicarbonate (Fig. 1.8) shows that almost all the samples falls slightly below 1:1 trend indicating that a significant fraction of bicarbonate has to be balance by (Na+K) in groundwater of Haridwar district.

The average ratio of (Ca+Mg) **:** (Na+K) is ~10 (in micro equivalent) in groundwater of Haridwar district further suggest that carbonate lithologies are the major source of ions in water composition. The average Ca+Mg **:** HCO_3 equivalent ratio of 1, a relatively high contribution of (Ca+Mg) to total cations (Ca+Mg: TZ+ = 0.8) and high (Ca +Mg) **:** (Na+K) equivalent ratio of ~10 indicate that carbonate weathering could be primary source of major ions in groundwater of Haridwar district.

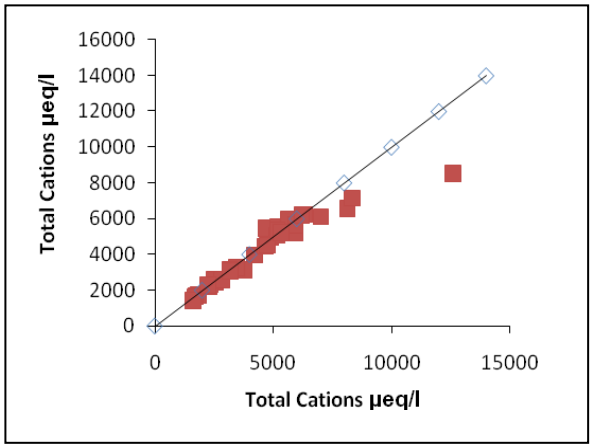


Fig: 1.3. Equivalent ratio of cations & anions.

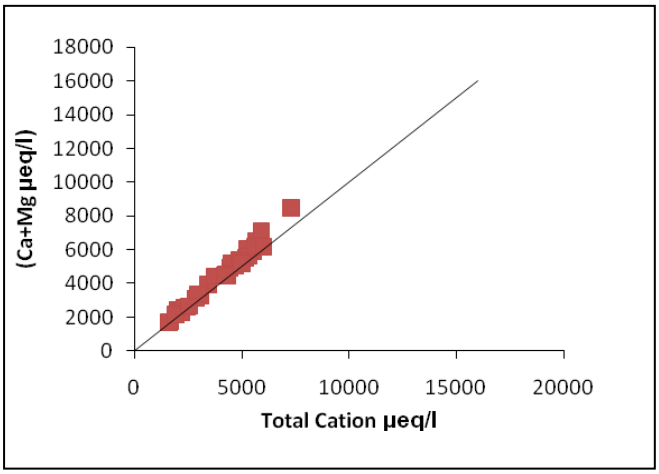


Fig : 1.4. Sactter diagram showing equivalent ratio of (Ca+Mg) and total cations

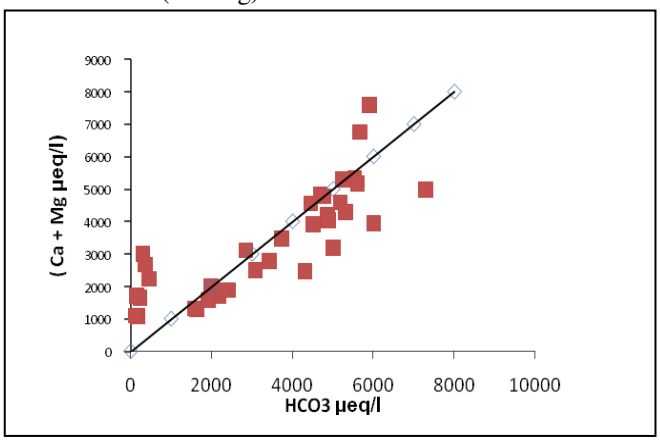
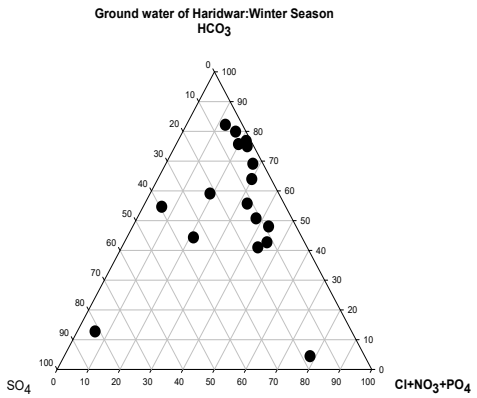


Fig:1.5. Scatter diagram showing equivalent ratio of (Ca+Mg) and (HCO_3)



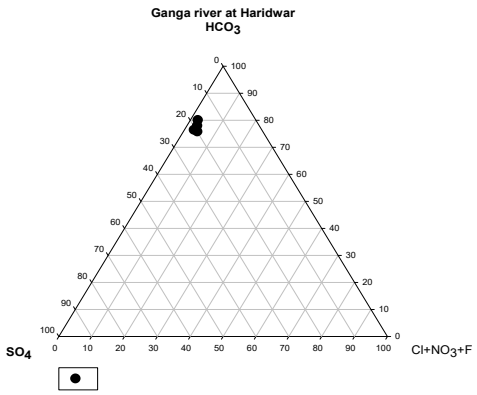


Fig: 1.6. Ternary diagram showing relationship between SO_4, HCO_3, (Cl+ NO_3+PO_4)

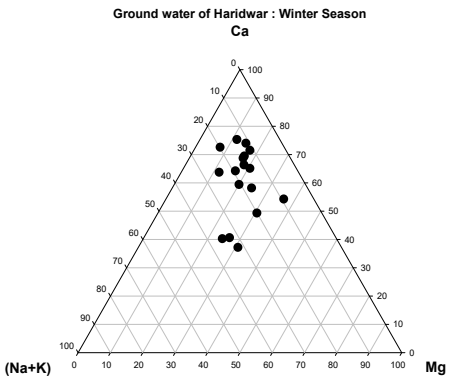


Fig: 1.7 Ternary diagram showing relationship between Ca, Mg and (Na +K)

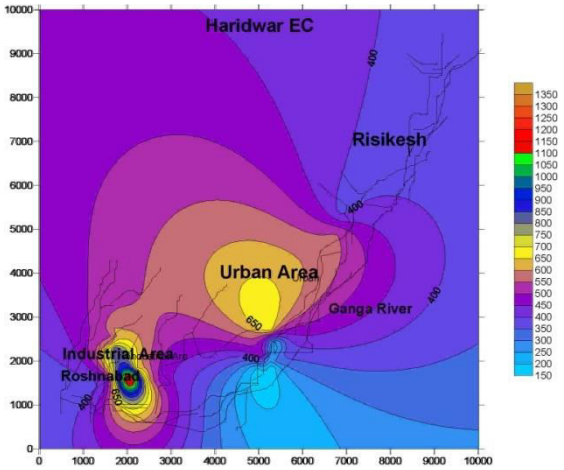


Fig: 1.8. Spatial Variation of EC µs/cm

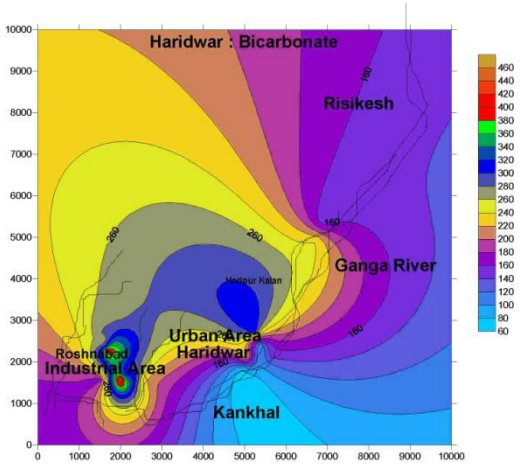


Fig:1.9: Spatial variation of HCO_3 mg/l

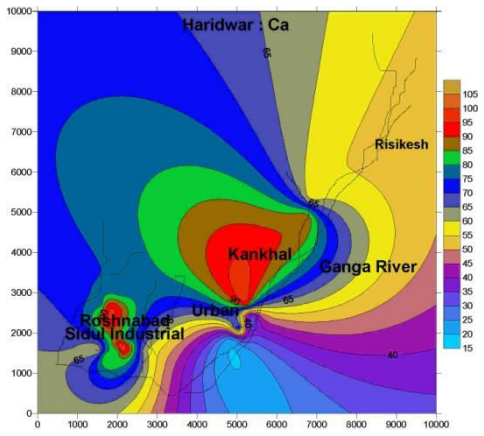


Fig: 1.10. Spatial varation of Ca mg/l

VI. CONCLUSION :

Among cations Ca and Mg are major cations and together they account for 97% and among anions bicarbonate is most dominant anions constitute 73% followed by SO_4 16%. High $(Ca^{2+} + Mg^{2+})/ HCO_3$ ratio (1.2) and high (Ca+Mg) /(Na+K) ratio

(31) and relatively high contribution of (Ca+Mg)) to total cations (TZ+) indicate carbonate weathering as the primary source of major ions to to the surface and groundwater of Haridwar district. It has been observed that the ions i.e. F, NO_3 and K exceeded the maximum permissible limit of WHO and BIS standards for drinking purpose at few sampling locations of Haridwar district.

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REFERENCES:

1. Abbas and Subramanain, (1984), Erosion and sediment in Ganga river basin (India), Jour. Hydrol, v69, 3-182.

2. Durum, W.H. and Haffty, J., (1963). Implementation of the minor element content of some major stream of the world. Geochim. Cosmochim. Acta, 21, 1.

3. Chakrapani G. J., Subramanian ., Gibbs R.J., and Jha P.K., (1995) size characteristic and mineralogy of suspended sediments of the Ganges river India environment geology 25, 192-196.

4. Livingstone, D.A., (1963a). The sodium cycle and the age of ocean. Geochim. Cosmochim. Acta, 27, 1055

5. Meybeck, M., (1976). Total mineral dissolved transported by world major rivers. Hydro. Sci. Bull. 21, 265.

6. Hu M. Stallared R.F. and Edmond J.M. (1982) major ion chemistry of some large Chinese river. Nature 298. 550-553.