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Stabilization of Expansive Soil by The Use of Polypropylene Fibre

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Abstract – Expansive soil are present in various parts of the world. In our country Expansive soils is also called as "Black Soil or black cotton soil". One main property of this soil is to expand or increase in volume as it gets wet and shrink when dry out. Bentonite, expansive, or Black Cotton soil are its common name. This soil is reddish brown to black and this soil is specially known for cultivation of cotton, and it occupies around 30% of the land area in India. Expansive Soil having very good performance at OMC or below OMC (dry side of optimum); But the strength and stiffness of soils reduces as the moisture content increases beyond the optimum (wet side of optimum). Black soil or expansive having poor shear strength and high swelling and shrinkage, need to be treated with ground improvement techniques such as soil stabilization for improvement of its mechanical behaviour for the purpose of enhancing the reliability of this soil in construction. Our purpose is to try to resolve the above problems by adding some amount of soil with stabilizing agents in different combination. The stabilizing agents used by us are polypropylene fibre.

Keywords – polypropylene fiber, Expansive soil, stabilization techniques

I. INTRODUCTION

The definition of expansive soil may be stated as follows "expansive soils are the soils which swells considerably due to absorption of water and shrinks on removal of water". The expansive soil has sufficient strength in dry state, but will reduce strength as water gets absorb. The soil exerts considerable pressure on foundation. The expansive soil, with their expanding lattice structure and resulting capacity for wide range in water content, can be particularly troublesome. Settlement due to shrinkage and cracks due to swelling causes structural instability. This problem is magnified in hydraulic structures. The amount of volume change in expensive soil is related to initial soil density and moisture content, composition of clay fraction and type of clay minerals. The capacity of a soil to swell depends on the type, amount of clay minerals. There are three major mineral groups i.e. Montmorillonite, illite, and kaolinite.

When buildings that are constructed on soft soil have high risk because of the the lower shear strength and high compressibility. Lightweight structures which are built with shallow foundation are more susceptible to expansive soil. Projects, such as highway projects, built on soils, like soft soils, expansive soils, and other soil types, require some form of soil treatment such as stabilization of soil to enhance the subsoil properties. It is important use some stabilization methods otherwise soil will experience many problems because of which they have poor results. The soil stabilization methods can be further divided in to four categories which are: mechanical stabilization, chemical stabilization, thermal stabilization and electrical stabilization. Between these methods the most commonly used method used for soil stabilization is chemical stabilization. This study will be analyse that how polypropylene fibre will be used for the enhancing the physical and mechanical properties of Black cotton soil. Study will be carried out on a soil specimen by adding fibers at 0.30 %, 0.60%, 0.85%, 1.20% and 1.25%.

II. MATERIALS

The soil which is used for investigation is taken from a region of Jaamnagar (Gujrat) which is an industrial area. Collected soil has high amount of moisture content, so firstly soil will air-dried and then converted it into broken into pieces in the lab. Collected soil's engineering properties are listed in Table I. Polypropylene fiber used in this investigation were obtained from the local market. Fig.1 is a photograph of the fiber used and its three properties i.e. Physical, chemical and mechanical used in this investigation are listed II.



Figure.1 Polypropylene Fibre

III. PREPARATION OF SAMPLE

Used sample in the mix is gathered from the industrial fields of Jaamnagar (gujrat). It was combined with soil and fibre in different proportions for further analysis. The soil was broken in to pieces before conducting the tests. The Polypropylene fibres (randomly distributed) of 12mm length used in the present investigation as reinforcement were obtained from local market. Polypropylene fibre is abundantly used synthetic material which is used to reinforce concrete and soil. It is available in very low cost and usually easy mixable with soil. Polypropylene fibre is a chemically inert and hydrophobic in nature, which does not absorb moisture. Soil mixed with five different percentages of fibre i.e., 0.30 %, 0.60%, 0.85%, 1.20% and 1.25%.

IV. EXPERIMENTS

A. Compaction Tests

For determining the relationship between water content and dry density of soil sample for a specified compaction Compaction test is performed.. 'Standard Proctor Test(SPT)' method which is performed on the sample was adopted from Indian Standard Code (IS: 2720 Part VII-1980). Compaction is generally the amount of mechanical energy which is applied to the sample. The apparatus used for conducting the test comprises of oblong or oval metal mould of capacity one thousand cubic centimetre with deployable base plate, metal rammer, removable collar, balances, oven and mixing tools. The soil sample to be compacted was mixed with water in varying amounts in equally three and every layer is given 25 blows by an automatic dynamic compacter consisting of a hammer of 2.5kg dropped from the height of 305mm which gives a compaction of 593.8kj/m³. This test is been applied on soils with different fibre contents of 0.30

		%,
Physical properties of Black co	tton Soil	0.60% and
Property	Values	0.85%,
Specific Gravity	2.79	of dry
Sand (%)	0	mass.
Silt (%)	4	
Clay (%)	96	
LL (%)	276	
PL (%)	33	
P.I (%)	243	
Linear shrinkage (%)	8	
OMC (%)	38	
Maximum dry density (kN/m3)	1.38	
Soil classification (USCS)	СН	

TABLE I

B. Unconfined Compression Tests

To determine the failure stress of prepared soil sample unconfined compression test is to be performed. The procedure for the 'unconfined compression Test' was adopted from Indian Standard Code (IS: 2720 Part X-1991). For determining the initial length and diameter of soil sample , soil sample is prepared at OMC. Then sample is placed on bottom plate of apparatus. The upper plate was so adjusted that it is in contact with the sample. Deformation from dial gauge mass shows the load readings at specified values and it will be noted properly.

Polypropylene fibre's chemical and physical properties	
Physical and chemical properties	Values
Type of fibre	Single fiber
Unit weight	0.95 g/cm3
Diameter	0.038 mm
length	12 mm
Maximum tensile strength	355 MPa
Elastic modulus	3700 MPa
Fusion point	170 °C
Smoke point	600 °C
Resistance to Acidic and Alkali matters	Very good
Dissolvable	Excellent

TABLE II

C. Swelling Tests

This test is performed to know about how much the soil gets swell on addition of water or we can say how much increase in the volume is seen on addition of water and also to know about how much there is a decrease in its volume on drying it. The procedure for the 'Swelling Test' was adopted from Indian Standard Code (IS: 2720 (Part XL) - 1977). For performing this test an oedometer sample is prepared with diameter 50mm and height 20mm which contains the oedometer ring at the required dry unit weight and at optimum water content which was obtained from compression test. Once the compression test is performed the specimen was placed in the oedometer so that swelling test can be carried out. In this test the specimen will measured at full swell and for this specimen is allowed to swell at a surcharge of 5 kpa. After that the specimen is loaded until the void ratio(e) was obtained.

V. RESULTS AND DISCUSSION

A. Effect of addition of fiber on Expensive soil properties according to compaction test

The curve obtained between reinforced and unreinforced soil by adding different percentages of fibre is obtained from compaction test is shown in below fig. (2). the result shows that there is no notable change in the moisture content of the specimen after addition of polypropylene fiber. But the maximum dry density reduces as we increases the fibre content. It can be better explain by reducing the average unit weight of solids in the soil and fiber mixture.



Fig. (2) Shows the effect of fiber on compaction test

B Effect of addition of fiber on Expensive soil properties according to unconfined compression test

The curve obtained between reinforced and unreinforced soil by adding different percentages of fibre is obtained from unconfined compression test is shown in below fig. From the fig. (3a) it is clear that the unconfined compressive strength of the soil upgoes on increasing the fibre content. It is also clear from the graph that the soil reinforced with fibre is shows high ductile behaviour and also loses a small peak strength than the unreinforced soil. Fig. (3b) Shows how the unconfined compression strength of the soil changes on addition of fiber at different percentages.







C. Effect of addition of fiber on Expensive soil properties according to swelling test

The curve obtained between reinforced and unreinforced soil by adding different percentages of fibre is obtained from swelling test at different interval of time is shown in below fig. (4). The fig. Shows that the final swelling is greater in unreinforced soil than the soil which is reinforced with polypropylene fiber. The graph in the fig. is between the free swell which is represented in swell percent and Duration in minutes for various fibre compositions.



Figure. (4) Shows the effect of fiber on swelling test

Figure (3a) Shows Effect of fiber on unconfined compression test

VI. CONCLUSIONS

Following conclusions were obtained from the test which was performed to show the effect of polypropylene fiber on swelling characteristics of Expansive soils. The effect o fiber on compaction, unconfined compression and swelling were obtained from the test.

1. The result obtained from the compaction test shows that there is not significant change in the moisture content of the specimen on addition of polypropylene fiber. But the maximum dry density reduces on increasing the fibre content. This can better explain by reducing the average unit weight of solids in the soil and fiber mixture.

2. Obtained result from unconfined compression test shows that the unconfined compressive strength of the soil increases when the fibre content increases. Tset also gives a clear indication that the soil reinforced with fibre is showing increased ductile behaviour and also a small loss of strength from peak than the unreinforced soi e.g, unconfined compressive strength increases from 197 MPa to 252 MPa for samples reinforced with 1% fiber.

3. The result obtained from the swell test shows that swelling decreases as the fiber percentage increases. There is a considerable decrease in the swelling on addition of 1% of fiber. For example, the swelling decreases from 00000 for unreinforced sol sample to 00000 for reinforced soil sample.

4. The final result obtained from this investigation shows that the stabilization technique of expansive soil by the use polypropylene fiber is of great use for ground improvement. It is considerably easier method for ground stabilization than any other method in the field of geotechnical investigation.

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A Review on Multi-Storey Car Parking Building

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ABSTRACT- As we all can see that the population of our country, as well as our city, is growing rapidly. As the population of the city will increase it will lead to an increase in the usage of vehicles by the peoples. With the increase in the population of the vehicle as every person will need its own vehicle arises a serious problem of parking. In urban areas, where the availability of less space increased the demand for parking areas especially for dense colonies. industrial and business areas. In such cases, a thought comes in the mind that we need parking where a lot of vehicles can be parked at a time. So this problem can be solved by constructing multi-storey parking. Multi-storey parking is a structure or building which is designed and constructed basically for the parking of automobile. It has a number of floors at which the various parking lanes have constructed in which the parking of vehicles takes place.

By the construction of the multi-storey parking system, we can avoid the on-street parking which leads the traffic blockage and accidents. Our city Moradabad (3493 sq.km) is a district of Uttar Pradesh state having a population of 4772066 approx according to cencex2011. In our city, the problem of traffic congestion is normal due to on-street parking and more number of vehicles. At the railway station, more than two open parking is available which can be reduced in single parking by constructing a multi-storey parking and the remaining land can be used for other purposes. So here a need for a detailed study on parking demands, it's characteristics to control the traffic congestion which will help to traffic engineer as well as a town planner.

Keywords: Multi-Storey parking, on street parking facility, parking demand urbanization, traffic congestion

I-INTRODUCTION

In the present scenario of the world, the parking space for the vehicles is very critical. In the urban areas, we all have seen that the vehicles have parked on-street which causes the clearance and road blockage. So the parking system is a very essential element of the transportation system and

Series- A (Civil Engineering) © MIT Publications needs to enhance. Now to avoid the on-Street parking of the vehicle, multi-storey parking is becoming the most favorable option for all advanced countries. Multi-storey parking can be constructed up to the fifth-floor level or more, but an increase in the floor level causes traffic congestion at the time of unparking and it takes more time also. So the multi-storey car parking system can be constructed for a capacity of 350-500 cars, which should be equipped with a lift system, ramp, etc. For proper regulation of the vehicle during peak time the parking system should have multiple access and exit system and it should be lightened.

During the designing of the multi-storey car parking system the various factors should be taken in to consideration such as security and safety of the vehicle, proper clearance, parking space marking, and accessibility of destination for maximum utilization of the parking system. From a rough calculation, it has been found that 365x24 hours in a year, an average only 400 hours a car runs, and the remaining time car remains parked. So the multi-storey car parking system is very essential for urban, industrial, and business areas. By using the multi-storey car parking system we can reduce the on-street parking and regulate the traffic properly.

II- LITERATURE REVIEW

Zhen (Sean) Qian, Feng (Evan) Xiao, H.M. Zhang (2012) they have worked to find a way for reducing the parking charge and continuous supply of the parking to avoid the traffic blockage in an economical way. They first obtain travel patterns under varying parking capacity, parking fees, and destination access; then conduct a sensation study to show the impact of the various factors on network completion and travel contours. Some new thinks that they find in this study are: (i) It is not always desirable to enlarge the central parking lot; (ii) Parking fees and capacity should be determined in such a way that passengers prefer to park in a distant area during early arrival; and (iii) the social cost can be reduced by a easy access time. Ultimately, they obtained most favourable parking charge, capacity, and time that completely produce minimal total social costs. When adjacent parking clusters do not have more than one access advantage, the most favourable travel profile is such that both parking clusters are used. So by using the most favourable parking system may decrease the social cost and line delay.

Paul A. Barter (2013) He has studied and provided an international relative prospect on off-street parking system policy in 14 metropolitan areas in East, South East and South Asia. These are areas where parking disregard is diffuse and fast. It uses a typology that combines parking policy into 'traditional', 'parking management' and 'marketoriented' class. Many different parking policy ethics are studied in the cities identified. Nevertheless, most Asian cities studied have parking policies that are surprisingly linear and promote automobile-dependency. It is a little shocking that many cities, regularly in East Asia; do not have such auto-centric conventional strategies. However, it is surprising that their parking policies still include reduction in parking demands and are not usually the most common option adopted for the traditional methods.

Saleh Abdulaziz Al-Fouzan (2012) In this study they reviewed the ongoing standards for car parking in various countries like USA, UK, and the Kingdom of Saudi Arabia (KSA); to draw the key lessons learned from UK and USA experiences; And to provide appropriate specifications in the measures of car parking at KSA. The paper develops a related procedure in reviewing car parking measure specifications according to various kinds of land usage in the UK, USA and KSA. The article states that UK and USA transportation planners are use parking policies, especially the purpose of car parking types, as well as to support sustainable transport options, to decrease reliance on cars, and to overcome traffic and air pollution Along with other planning and transportation measures. Local officials in the UK and USA have gone from expecting minimum criteria to maximum criteria for car parking. The objective of best parking rules is to overcome the number of trips made by private cars while preserving and improving the viability of economic centres and trying to promote sustainable growth. This study provides that by using proper rules and sustainable material we can improve the car parking in our country.

T. Subramani 2012, In this study various parking studies on main roads in major urban and

Series- A (Civil Engineering) © MIT Publications metropolitan cities were studied. On the basis of his research on various traffic scenarios on the road network, he concluded that it is necessary to eliminate the on-street parking system for the systematic transportation system. Due to imprudent parking and unparking causes an accident which are consider as an accident. In this study also told that for the short term pay and park system may be efficient for the peak hours to regulate and control the traffic and for long term measures off-street parking

Radhika A. Dahane has worked on multi-storey car parking that has many unique characteristics that introduced them distant from other buildings. Almost every growing country is using multi-storev car parking. In United state Multi-storey Park is known as parking structure, basically to make it distinct from garage in the house. According to the utility the building structure architects and civil engineers are generally named as parking structures. In structural design, a structure having minimum three storeys should be design for car parking. She worked on the design load of the multi-storey car parking. The structural member are designed so well that they can transmit the load of occupants to the slab to beam to column and finally to the foundation. The designed structure should be capable to safely transmission of the load coming on it. As the height of the parking will increase, the wind pressure will be more and building will be subjected to the horizontal deflection resulting from the horizontal pressure. This horizontal deflection should be evaluated precisely and it should be in acceptable limit. The deflected shapes of the member should be taken into the consideration for the final analysis and design of the structural member.

K.V.Aabhamol, S. Rekha, and R. Satikumar, May 2009, In this study they generated Parking demand model with the help of Statistical Package for the Social Sciences for Trivadrum city. They have found that -1) formerly the average time duration of two wheelers vehicles was 15 minutes and 8 min for Palyalam and 6 minutes Patom. 2) Four wheeler vehicle parking duration is more the two wheeler.3) The Poisson distribution were followed by leave-taking vehicles. 4. They formed a relation between linear and non-linear parking demand models and concluded that the linear parking demand model has a higher coefficient of resolution than the nonlinear model.

Anuja Sajeev, 2015, in this study she explained about the benefits of the smart parking (Multistorey parking) which is at a very tender phase in

India. People in India rarely know about the smart parking Technology. In our county people exactly don't know about the automatic parking and multistorey parking system. They have a very little knowledge about automatic parking and multistorey parking system and concluded that this system of parking may solve various difficulties of the people such as requirement of space, fuel, wastage of time, and safety of the vehicle. She also concluded that the multi-storey parking system is very essential for our country to avoid the street parking and reduction in the traffic congestion. So multi-storey or smart parking system has given a lot of importance in India as India is going to develop a number of smart city.

III- CONCLUSION

1. By implementing the multi-storey parking we can enhance the problem of traffic blockage.

2. The multi-storey parking system may be suitable for the Moradabad city as it is in smart city project of India.

3. By using this method of parking we save space, time, and fuel and also provide the safety to the vehicle.

4. The Government may produce funds from multistorey parking.

5. Multi-storey car parking also solve the problem arises in on-street parking system such as traffic congestion, and dander for foot passengers.

6. The interdiction of parking at peak hours is to vary depending on the variation in peak gathering in their particular parking lots.

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SMART (System for Managing Access Point to Reduce Time) Shopping

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Abstract- This paper presents an innovative idea to ease shopping in the marts, keeping in mind customer satisfaction and the sense of security money wise. The idea is time sparing as well implemented using a web application. While doing shopping in the marts, customer needed to pick up his products and wait in the long queues whole carrying cash/credit/debit cards to make payment. The web app introduced here would read the QR code(s) if the product(s) and add it to the cart in the application. The customer can add/remove the product and edit the quantity of purchased product. Customer will also be notified about the festival/seasonal offers in the marts. Payment can be done online/offline as per customer comfort.

Keywords- QR codes, customer, shopping

I. INTRODUCTION

From past 2 decades, there is tremendous modification in the mobile technology they are no longer ordinary communication devices they used to be and now a number of activities can be carried with the help of wireless networking in the smartphones. The world is taken up by the wireless networking. Individual and business communication can be made easily and steadily from anywhere and at any time. Establishing internet connection with the smartphone or any in device we can share any information around the world. The intimidating task we face in day to day life can be done in few seconds by few clicks on our smartphones.

Traditional Shopping

In conventional shopping, Product acquisition is a long way procedure time spent in product area, billing lines and checkout lines. Customer commonly encounters some tribulations and difficulty while shopping. These problems include waiting in long queues for payment and worrying about the money, would it be sufficient to purchase all the products they picked up. The customer also faced difficulty about the discounted products as there is inadequate amount of data and they came to know about it at the counter. Shopper needs a lot more equipment and masses to meet customer requirement and provide them ease in shopping.

Although the online shopping has proved to be helpful, there is no long queues, no worries about money and discount offers as they are on the screen but the customer didn't get to feel the product quality and sometimes when the product arrives it does not meet up with the customer expectations. And they also worry about the transactions.

And to overcome this shortcoming, the web application mentioned here would allow customer first to read the QR code(s) of the product(s) using his mobile and can remove/delete/edit the product purchased, add it to cart, essential details of all the products will be retrieved from shop's database and generate the bill. Payment can be made in online/offline mode at the cash on counter.

II. LITERATURE SURVEY

The marketing industry has been supporting "Smart Shopping" for many years using different technologies like RFID Card, Smart Trolley iot based solutions to enhance shopping experience. The aim of SMART Shopping is to ease shopping for customer by providing information about price, discounts etc and seller need not to maintain a large number of masses and equipment.

The advantages of mobile commerce are-

- Better user experience -: Fast, Convenient, Exclusive, Interactive
- Cost Effective
- Time Saving
- New business opportunities
- Easy Store Access
- Attracts new customers

While discovering other technologies such as Window Shopping, where shopping is done through website, the demerits came across are :-

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- Cheating/Fraud
- Limited options
- No in hand product experience
- Shipping charges
- Different prices at different sites of same product.

Difficulty faced in traditional shopping are-

- Waiting in long queues
- Slower billing process
- Carrying heavy items

Survey was conducted at following marts -

- Family Bazar
- Vishal Mega Mart
- Lasa Mart

Issues Encountered-

- Long queues
- Heavy mass required for maintenance
- Payment issue encountered on regular basis

This paper assumes that the web application would be a prototype design that will shape the future and there is still room for improvement, inventions and development. Application is created according to the customer convenience /requirement and it can be easily implemented in to that marts making shopping process easy and user friendly. Customer can easily and conveniently carry out the shopping in the marts with the use of this web page.

III. PROPOSED SYSTEM

In the proposed work, the user will connect to the Wi-Fi facility of the shopping mart and then can access the web application of the mart, after registration procedure, the user/ customer will scan the QR code of the products which he wants to purchase with the help of scanner feature in the web app. After scanning the product a web service will be get called and will create a connection with the shop's database. After the connection is established, the customer will connect with the shop's database and product related details will be provided to him. This procedure will reduce the time of scanning an individual item and thus dipping shopping time. And after scanning all the items user intended to purchase can generate the final bill and make payment via online payment method or via cash on counter and can leave the mart after showing receipt at the exist and getting verification from the guard and can disconnect Wi-Fi by himself or it will get disconnected after 10-15 minutes when not in use. The assumptions for the app are-

- User is connected to the Wi-Fi facility of the mart to access the web application.
- Users have prior knowledge to access the web portal.
- ✤ Web Services

A software named web service is use to connect any device with active internet facility to other another device and setup communication between the devices. It uses Hypertext Transfer Protocol (HTTP) as common communication protocol. Web services is use to setup communication between the shop's database and smartphone to exchange information.



Fig 1: Flow Graph

Representational State transfer protocol also called REST is used as architectural style, as a RESTful web service. REST is a lightweight process. REST contains a set of guidelines for creating web services

with the following properties based on its architecture.

- Client- server
- Stateless
- Manipulation of the resources
- Self-destructive messages
- Resource Identification
- Database

MySQL workbench is used to design shop's database. It is visual database design tool that integrate SQL development, creation, administration into a single integrated development environment. Shop's database consisted of following table:

- User Table The customer details which includes name, address, phone number etc will be stored in this table.
- Employee Table The Employee's details which include name, employee role, address, phone number etc will be stored in this table.
- Product Table The products details which includes product name, price, weight etc will be stored in this table.
- Order Table Order table maintain information about customer purchased products, Cost and other information required to generate bill.
- Inventory Table Information about the product availability, product id, name etc will be stored in this table.

IV. IMPLEMENTATION

- ✤ Technologies Used
 - Database MySQL server
 - Development Tools: JDK, Netbeans
 - Development Language: JSP, HTML, Servlet
- ✤ Application Features

SMART Shopping app has the following features-

- Time Sparing
- This system helps in achieve the fast billing system
- Maintains History if the purchased products
- Support both offline and online payment method.
- ✤ Disadvantages

SMART shopping app has two disadvantages –

- If any customer not has smartphone, then he is not able to use our application.
- Strong Wi-Fi connectivity must be available 24/7.
- Future Enhancement
 - Application suggesting product for customer.
 - GPS can be integrated in the application to tell the customer where the product is exactly located.

✤ Result



Fig 2: Home page

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Fig 3: QR code of product

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Fig 4: Employee Registration

V. CONCLUSION

Mobile phones, have become an important part of day to day life and it is unavoidable and unending, capable of carrying out devastating task in just few clicks so helpful in reducing shopping efforts. With scanner feature in the app using mobile camera customer can scan the QR code and add it to the cart and generate the bill. The advantage of this is that customer is no longer needed to stand in queues to make payment and no individual scanning of the product at the counter, hence saving lots of time and on the other hand people are also safe from the fraud in window shopping system. The product purchased by the customer will be saved in the form of PDF format. The transactions carried out in shop's database will be secured enough. There will not be any modification in the shop's database at the customer end or any other unauthorised user. Payment can be made online by paytm or net banking or by cards at the web portal and offline by cash at the cash on counter making it feasible for every age group.

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Design and Monitor Smart e-Challan automation using Derivative edge detection algorithm, Neural Network and Optical Character Recognition

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Abstract- Since, motorcycles are affordable and are majorly used as a daily mode of transport by many people, it is observed that there has been a significant boost in motorcycle accident as most of the motorcyclists do not wear a helmet and put their life in danger .Though government has made not wearing a helmet a punishable offense to ride a motorcycle still many of them are not following the rules. The surveillance system which are existing are based on video monitoring system is not that effective but it requires much more amount of human assistance. The two major drawbacks for this technique is that with humans efficiency decreases as the time passes and human biasing also plays an important role in it. Therefore, automation of generating e-challan plays a significant role in this process which is highly required. The approach used in this paper for automatic detection, we propose an approach which detects the driver who is without helmet in real-time using surveillance videos. The proposed approach using background subtraction first of all detects the motorcycle from the videos captured by surveillance .Secondly, it differentiate between non-helmet and helmet motorcyclists by making use of neural network and 1st order and 2nd order derivative edge detection algorithm . After detection and classification, if the motorcyclists were found without helmet then it will trace the vehicle number plate of the motorcyclists using (OCR) **Optical Character Recognition and Neural Network** and a copy of challan will be generated and will be send via SMS to the respective traffic rule violator.

Keywords — Helmet Detection, license number plate detection, (OCR) Optical Character Recognition, first and second order Derivative edge detection Algorithm,

I. INTRODUCTION

Two-Wheelers mostly account for the most number of road accidents and contribute the most. Majorly careless and driving in a rush manner is the main cause of such kind of accidents and due to which head injuries form a largest reason for deaths in road accidents. Surveys and Study depicts that more than 1/3 people who died in such kind of road accidents may have survive if they follow rules and have worn a helmet as it is seen that the usage of helmet can save deaths by accidents by 30 to 40% [1]. The rate at which usage of two wheelers as compared to four wheelers in India is growing 50 times according to population is growing. The threat to death is 2.5 times more among riders not wearing a helmet as compared to those wearing helmet. Over speeding is also cause for motorcyclist accidents. Study from many surveys reveals that a fall from motorcycle due to rash driving or even at slower speed can cause head injuries. Imagine a motorcycle travelling at a speed of 65km per hour, which means bike, is covering 49 feet per second. The impact and effect of fall from the motorcycle at such speed is equal to that of a fall from fourth floor of a building [2]. Taking into account importance of wearing a helmet, Government has made it compulsory for all two wheeler drivers to wear a helmet while riding a motorcycle still many of the violators of traffic rule do not obey them. In existing technologies, video surveillance based system is majorly used and became an essential equipment to keep track on such kind of anti law activity or criminal activity in modern world.

The road traffic monitoring with video surveillance is the most crudely part for detecting the traffic rule violators tracking criminals, etc. The existing system is not that effective as it is based only on video surveillance but this system involves large number of manual work done by humans whose performance is not persistent with time. Recent studies and research work shows that human surveillance is not efficient in terms of work as while monitoring the video chances are the errors made by humans may increases. And at some places human biasing also comes into role as some cops are manual clicking the pictures of violators and efficiency of humans also decreases with dense traffic. So, automation of generating challan process is of high demand and requirement for reliable and robust monitoring of these violators. Many countries are adopting surveillance cameras at public places for 24x7 security monitoring to make their cities smart one.

In this paper, we will be using background subtraction and neural network algorithm. Neural network has gain much more attention in complicated tasks such as image classification and has not been explored till date for such classification. The techniques used by automated solution using neural network for detecting the violators of traffic rule

is also cost-effective as it makes use of existing system of video surveillance.

We will extract the image from background subtraction and on that particular image we will apply derivative edge detection and neural network algorithm for detecting the presence or absence of helmet and (OCR) Optical Character Recognition and neural network for tracing the license number plate as compared to traditional methods which uses handcrafted features HOG (Histogram of Oriented Gradient), SVM (Support Vector Machine), SIFT (Scale Invariant Feature Transform), LBP (Local Binary Pattern) for detection.

The paper is organized as follows, Section I contains the introduction of the current scenario of the motorcycle accidents on public roads and the techniques or solution to overcome it. Section II contains the Literature Review on helmet detection and license plate detection methodology. In Section III the proposed working used in paper is described in detail. Section IV contains the Research Methodology of our project. Last section includes conclusion of this project.

II. LITERATURE REVIEW

Wen et al. [3] suggested circle arc detection method. They applied it detect the presence of helmet [4] Geometric features are not sufficient to identify the presence of helmet; many times the head can be mistaken with the helmet. But the drawback is it is used only the geometric features to detect the presence of helmet [14].

Chiverton et al. [5] used (SVM) Support Vector Machine which is trained of (HOG) Histogram of Oriented Gradients and tested as well as described a system for automatic classification of motorcycles with and without helmet. It has used these techniques which are evolved from the head region of the static images and single image frame from videos. By this method, the number of testing images taken were very less but the accuracy rate was high which create confusion.

In Chiu et al. [4] proposes use of computer vision based Helmet detection system. In this paper to detect the helmet edges were computed of the possible helmet region. Dahiya et al. [7] makes use of (HOG) Histogram of Oriented Gradients, (SIFT) Scale invariant feature transform (LBP) Local binary pattern and proposed a system for detection riders without helmet using surveillance videos in real time. By this method the detection accuracy was high but calculation time required was very slow i.e. 11.58 ms per frame.

Silva et al. [6] proposed a system for detection which makes use of (ROI) Region of interest of helmet which first starts with moving object segmentation then detection of helmet tracing using descriptors which is the head region and then classifies between helmet and non- helmet .But problem is that it is computationally expensive. Also it makes use of circle Hough transform to differentiate between helmet and non - helmet which confuses between head and helmet as both has round shape.

Karwal et al. [9] proposed a system in which he addresses the problem of scaling the characters and recognition of characters under different positions for detection of vehicle number plate. Drawback was it has used fixed template matching and we know that using normalized cross correlation for template matching but templates are not same always. Doughmala et al. [8] worked on fixed resolution images. He presented detection by Haar like features like left eye, nose, mouth, ear, right eye. Drawback is it has used still images as input so is not that effective and makes use of circular Hough transform to detect helmet presence.

Lahiri et al. [11] proposed a system which uses edge enhancement to detect the components in an image and is a sub part of image processing. Also he used OCR and unsharp masking for detecting correctly the edges in an image .But the drawback is different size of characters in image are not recognized. Sulaiman et al. [10] worked on static images in Malaysia which is the major drawback in his work. He used combination of image processing and (OCR) Optical Character Recognition to detect vehicle number plate.

Cika et al. [13] proposes a system especially for Saudi Arabian vehicle plate that makes use of Neural Network to recognize characters but drawback was due to its sensitiveness towards brightness of light. Yun-Chung et al [12] proposed a system that makes use of OCR along with Fuzzy system. Drawback with this proposed scheme is that it fails to detect the edges and boundaries of number plate used in such as also fails to differentiate between numbers '8' and '0'.

III. PROPOSED SYSTEM

The major goal of this paper is to design a system that will monitor the traffic in order to detect whether the person is wearing helmet or not and if he is not wearing the helmet then identify and capture vehicle number plate and convert it into text for generation of automatic challan. It differentiates between non-helmet and helmet motorcyclists by making use of neural network and 1st order and 2nd order derivative edge detection algorithm. After detection and classification, if the motorcyclists were found without helmet then it will trace the vehicle number plate of the motorcyclists using (OCR) Optical Character Recognition and Neural Network and a copy of challan will be generated and will be send via SMS to the respective traffic rule violator.

Following are the steps which will be followed during processing

- Pre-processing of the video frame by frame.
- Removal of background from captures images.
- Classification of two-wheelers by segmentation.
- Identification of helmet.
- If helmet detected then stop and If helmet not detected then recognition of number plate.



Figure 1: Proposed System Working.

IV. RESEARCH METHODOLOGY

This part of paper includes an approach for automatic detection of motorcyclists without helmet in videos by surveillance. In such case if the motorcyclists are not wearing helmet then the license number plate will be traced for the vehicle. This overall process is completed in three phases. First phase includes detection of motorcycle in the captured surveillance videos.

Second phase locate the head of the motorcyclists. Here it is detected whether he is wearing a helmet or not. Third phase identifies that if the motorcyclists are found without helmet then trace the license number plate of motorcycle. The steps involved are as follows:

A. Pre-processing of video frame by frame by input road video.

Videos of the road are taken of different duration broken into frames of a fixed interval. After reorganization of frames, on each frame a pre specified processing will be done such as improving the contrast level, image enhancement, removing the noise of the image, and applying Gaussian filter. After applying this filter, video frame is fed in to background subtraction for removal of background.

B. Removal of background from captured images.

As the number plate has to be recognizes and also the remaining part of the video has to be ignored, So in order to raise the detection rate of the number plate we will do background subtraction in order to differentiate the objects which are in motion to that of still objects. Objects which are in motion such as human, bus, cars, motorcycle are to be differentiated from static objects such as hoardings, trees roads houses and buildings are extracted. To separate then Gaussian model is used.

C. Classification of two wheelers by segmentation.

The final output of step B after subtraction of background includes all those objects which are in motion of objects in motion such as such as human, bus, cars, motorcycle etc. After that there must be characterization that which motorcycle in it so segmentation of the motorcycle must be done from the other objects which are in motion using object segmentation. Feature extraction methods must be applied such as (HOG) Histogram of oriented gradients, , (LBP) Local binary pattern and SIFT (Scale Invariant Feature Transform)along with that first and second order derivative edge detection algorithm must be applied.

D. Identification of Motorcyclists without helmet using HOG

After the detection of two wheelers such as cycle, scooter and motorcyclists, we will detect the motorcyclists without helmet [14]. This can be done by feature extraction algorithms (HOG), (SIFT) and (LBP) with Neural Network.

E. Extraction of Licensed number plate, search in database and generation of automatic challan generation and send by SMS

If the motorcyclists are found without helmet, extract the license number plate of the motorcycle using (OCR) [15] as a template matching with Neural Network [16] and if found then search the data related to the owner of the vehicle and send the e-Challan on number by sending SMS.

V. CONCLUSION

The proposed approach is design an automatic e-Challan system to catch violators of the traffic rules who are not wearing the helmet. After taking into account the methods and techniques which are studied in literature review and some surveys to overcome the drawbacks given in the technique used by various researchers we propose a vision-based real-time traffic monitoring system in order to identify and monitor motorcycles after analysing videos on surveillance in a sequence of images feature detection system and edge detection using 1st and 2nd order derivative edge detection algorithm along with neural network in order to identify presence or absence of helmet using OCR with Neural Network for detecting license number plate.

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Review on Battery Charging Strategies Fast Charge and Quick Charge

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Abstract— This paper presents the modernization in charge strategies used on electric vehicles (EVs) and portable devices (such as mobile devices and portable devices) relative to the battery charging infrastructure for both fast charging and quick charging. In particular, we discuss: Charge methodology, definitions: What is a fast charging? What is a quick charging? Charging connectors for EVs, different material type for batter, thermal management of battery. Moreover, the paper presents new loom and possibilities for power supply and systems level research to modernization in fastcharging topologies.

Keywords - Fast charge; Quick charge, Rapid charge, Electric vehicle

I. INTRODUCTION

During in last decades, there is constant revolution in the industry of transportation and automobiles. Industry migrate from petroleum-base engine to hybrid, from hybrid engine and moving towards to electric-base transportation in all direction includes airways, road ways as well as seaways. This change in the trend leads to advancement in electric vehicles (EVs) in terms in drop in price and speed up large scale production [1-3]. It is very clear we have to switch to alternative of petroleum fuel in the field of transportation. Electric vehicles (EVs) are one of the best alternatives in the field of transportation. EVs are able to sustain in long team duration and have benefits overs the present transportation system such running cost economy, very less pollution (in terms of air pollution, sound pollution), according to the survey all electricity produce for domestic uses in U.S., is done by petroleum-based fuels out of which 17% of fuel is imported in year 2017 [4, 5]. Charging time to recharge the battery is one of the major flaws of EVs as we require, charging system must be fast, safe and conventional.

In the fast growing world charging time is one of the concerts for the selection of the device not only for EVs, but also our portable devices (like mobile phones and laptops).

II. LITERATURE **REVIEW**

A. What is slow charging?

It is defined as a method of charging, which usually take 7-9 hours (and 4-6 hours in portable devices) to a get battery charge from 0% (zero) to 100% (hundred). The Limited amount of current is supplied which recharge the battery without distracting the cell while maintain the normal temperature of the charging circuitry as well as the battery. This method of charging is also popular by the name of 'trickle charging' methodology.

B. What are fast charge /quick charge?

Method of charging, which can recharge the battery in 1-2 hours (15-30 minutes for portable devices), or it can be defined any methodology to recharge the battery in short duration of time compared to the slow charging. Table 1 list of similar terms used to fast charge, rapid charge, and quick charge and plug-in –hybrid with SOC (State of charge).

Table 1. Power Methodology with SOC

Methodology	SOC
Fast charge	100%
Rapid charge	60%
Quick charge	70%

C. Charging connectors in EVs

The Society of Automotive Engineers [6] (SAE) created with aim of uniting and develop universally accepted standards for developing technologies in the industry. In 1996, first EV conductive charging coupler has been released by SAE, and revised from time to time till now [7].SAE J1772 is the standard connector developed for DC fast charging in EVs. Other standard connectors developed over the years which are: J2954 (Standard for wireless power transfer tropology), J3068 (Standard for three-phase conductive charging tropology), and other various protocols that explains communications and vehicle performance analyzing parameter's. [8]



Figure 1. DC fast-charging combined charging system (CCS 1) connector standardized by SAE as J1772 [8].

SAE J1772 has three charging output standards:

- Level-1 (for domestic use),
- Level-2 (commercial use),

• Level-3 (DC fast charging).

Level 1 and level 2 in came in the category of slow charging it use AC supply, while level 3 uses DC supply to recharge the battery supply up to 500A, at 600V).

D. Battery Types

Numbers of Li-ion combination are available in today's world of EVs and many are in developing and testing stage. Different combination has different benefits on various parameters. There are some essential parameters on which battery is chosen likewise depending on requirement.

- Specific energy (capacity)
- Specific power
- Safety
- Performance
- Life spam
- Cost

Under the following standards there is comparison table in Figure 2 mainly focus in today's batteries. In Figure 2 parameter with more colored area is ideal for use. on comparing the parameters lithium manganese oxide(LMO), Lithium Iron Phosphate (LFP) and Lithium Nickel Manganese Cobalt Oxide (NMC) are having overall optimum characteristics. Apart from this many research are going to make battery more optimize. [10]



Figure 2. Li-ion batteries comparison table for EVs [9].

E. Charging Strategies

i. Constant Voltage

In this method of charging, constant voltage is supplied to battery, the maximum voltage applied to varied from different-different battery type, as soon as battery gain the state of charging the charging current decreasing gradually and become zero when full battery charge is approached, while using this method this no rise in temperature and this method is ideal for voltage batteries, but it takes long charging time. [11]

ii. Constant Current

As the name suggested, in this method of charging constant current is applies during the charging as soon as it get charge there is rise in battery voltage as well as charging voltage in liner manner. Biggest issue in this charging strategies is at low voltage and high current their there is rise in battery temperature which cause damage to battery, and reduce the battery life spam [11].

iii. Constant Current-Constant Voltage (CC-CV)

Popularly known as "Voltage Controlled Charging" [12], in this method of charging constant current is supplies to the battery, once battery reaches to certain threshold voltage level, voltage constant maintained and current start dropping as in the constant voltage charging method and if become zero when it is fully charge[13]. As shown in Figure 3 and is the old standard method for charging batteries, yet it is bounded in fast-charging applications because battery polarization becomes an issue. As may be expected, the CC-CV method has been further changed to include multiple constant current steps, thereby further improving the rate of charging of the batteries [14].



Figure 3. Constant current-constant voltage battery charging methodology [15].

F. Thermal management

While during charging and discharging of the battery there is a rise in temperature, if the battery temperature is not maintained in the proper set, it will produce hotspot which leads to locally damage of cells, degradation of life spam and internal resistance increase due to which less current flow and degradation in performance. Thermal manage can be provided in two ways.

i. Air Cooling

In air cooling is air is acting as the coolant or cooling medium, this is the simplest, low maintenance and efficient way to maintain temperature of battery similar to the surrounding.in this air flows between the cells and prevents the cell array from getting heat. Limitations of air cooling cells on the front side cool earlier than the cells at the back side which leads to unequal temperature distribution in the battery. Another limitation is it required external blower to maintain the flow of air in the cells [16].

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ii. Liquid Cooling

Another method to maintain the temperature is liquid cooling. In this method liquid coolant is used to flow between the cells of the batter advantage over the air cooling are, equal temperature distribution inside the batter, it work perfectly wide temperature range from extreme cold to extreme hot surrounding conditions . Limitation bulky system, extra components are required, high initialization cost [16].

III. CONCLUSION

This paper presents a review of latest charging moderations methodology used for charging EVs and portable devices, it includes charging standards, advantages, limitations and area of advancements. In the field of transportation, petroleum base system won't survive in the decades ahead, so EVs are the rising star in this field. But this need modernization to become the proper alternative of the petroleum engines. In terms of portable device, it is moving on the peak in doing very well, the main consideration for thermal management in reducing the price of power supply. With continued research on the charging strategies, technology will get better and better with time, new standards will develop which leads to survive as future energy.

IV. FUTURE ASPECT

There are various fields of research and development for fast charging technologies.

1. Power supply circuitry

Simple and convenient power supply to be introduced to recharge battery in short duration of time and use any input source either 120V AC or 240V AC.

2. Battery type

Best suitable battery which performs well in all directions of parameters specially having economic in price and a longer life span.

3. Battery Management System

An advance battery management system is needed to be introduced in an economic cost range for proper charging, discharging, recharging of battery while maintaining battery health and temperature during operation.

4. Global Standards

No proper standard is available in the industry by charging due to which different researcher's used has own standards (such as connectors, charging voltage, charging circuitry).

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A Mathematical Model for E-Waste Management

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Abstract- The electronic Waste is increasing day by day and it is becoming a major problem all over the world. It has become bottleneck and a big hurdle to the economic and technological growth of a society. The consequence of its are pollution, wasted lands, blocked storage yards and technological advances are a new environmental challenge-the growing menace of "Electronics Waste" or "e-waste" that consists of obsolete electronic devices. The current practices of e-waste management in Asian nation suffers many disadvantages like inadequate policies, issue in utilization, health hazards because of informal utilization, poor awareness and reluctance on a part of the company to deal with the vital problems. The impacts are intense once harmful materials enter the waste stream with no special precautions, creates adverse effects on the atmosphere and human health and once economically valuable materials are drop resources are wasted or unhealthy conditions are developed throughout the informal usage. Present paper surveys the current scenario of E waste generation and proposes a solution to the problem through recycling and reuse.

Keywords - e-waste, environmental issues, health impacts and management.

I. INTRODUCTION

Industrial revolution followed by the advances in info technology throughout the last century has radically modified people's fashion. Though this development has helped humanity, management has diode to new issues of contamination and pollution. The technical artistry non inheritable throughout the last century has exhibited a replacement challenge within the management of wastes. As an example, personal computers (PCs) contain bound parts, that square measure extremely toxic, like chlorinate and brominate substances, toxic gases, toxic metals, biologically active materials, acids, plastics and plastic additives. The unsafe content of those materials create associate surroundings and health threat. So correct management is critical whereas, disposing, or use e-waste. Of late PC has become commonest and wide used appliance all told forms of activities starting from faculties, residences, offices to producing industries.

E-toxic parts in computers can be summarized as circuit boards contain significant metals like lead & metal, batteries containing metal, ray tubes with lead compound & Ba, brominated flame retardants used on computer circuit boards, cables and plastic casing, poly vinyl chloride (PVC) coated copper cables and plastic pc casings that unleash extremely ototoxic dioxins & furans once burnt to recover valuable metals, mercury switches, mercury in flat screens, poly chlorinated biphenyl's gift in older capacitors, transformers, etc. It is estimated that the 500 million computers in the world contain 2.87 billion kgs of plastics, 716.7 million kgs

Series- C (Electrical Engineering) MIT Transaction of lead and 286,700 kgs of mercury. The average 14-inch monitor uses a tube that contains an estimated 2.5 to 4 kgs of lead. The lead can seep into the ground water from landfills thereby contaminating it.



Fig. 1 Share of hazardous substances in computer

If the tube is crushed and burned, it emits cytotoxic fumes into the air. E-waste or Electronic waste is also outlined as discarded computers, workplace equipment, recreation device physics, mobile phones, TV sets, and refrigerators. This includes used physics that are destined for employ, resale, salvage, recycling, or disposal. Others are reusable, operating, and serviceable electronics and secondary scrap (copper, steel, plastic, etc.) and reserve the term waste for residue or material that is drop by the client instead of recycling, together with residue from employ and usage operations. Cathode ray tubes (CRTs) are thought-about one in all the toughest sorts to recycle. CRTs have comparatively high concentration of lead and phosphors (not to be confused with phosphorus), each of that are necessary for the show. The high worth of the PC usage set of electronic waste (working and reusable laptops, desktops, and parts like RAM) will facilitate pay the price of transportation for a bigger variety of valueless items than are often achieved with show devices, that have less (or negative) scrap worth.

II. PROPOSED METHODOLOGY

The basic idea behind the paper was to understand the basic hazards involved in handling E-waste. When E-waste like batteries, thermostats, electronics, oil, and other potentially hazardous wastes are improperly disposed of, they can harm public health and the environment. Batteries

and other e-waste—such as computers, printers, and cell phones— contain cyanogenic significant metals like lead, mercury, and Cd. After they are thrown away within the trash, they end up in landfills, and these cyanogenic compounds will leach into soil and water, polluting lakes and streams and creating them unfit for drinking, swimming, fishing, and supporting life.

III. THE MATHEMATICAL MODEL

Figure shows the flow diagram of dynamics of e-waste for the model parameters given in table 1.

Table 1	l:	Model	Parameters
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X 1	The concentration of e-waste in the human
	population
x ₂	The concentration of e-waste in aquatic living
	organisms
X3	The concentration of hazardous substances in
	terrestrial living organisms
X4	The concentration of e-waste in terrestrial
	habitats
X5	The concentration of hazardous substances in
	aquatic habitats
α_1	The rate at which e-waste flow from terrestrial
	habitats to aquatic habitats
α2	The rate at which terrestrial living organisms
	absorb e-waste from the habitat
ζ	The rate at which the human population takes in
	e-waste from various sources
β1	The rate at which the human population
·	consumes terrestrial living organisms
	contaminated with e-waste
β2	The rate at which the human population
	consumes contaminated aquatic living
	organisms and absorb or drink contaminated
	water
β3	The rate at which terrestrial living organisms
	consume contaminated aquatic living organisms
	and absorb or drink contaminated water
γ1	The rate at which the human population drinks
	water contaminated with e-waste
γ2	The rate at which the aquatic living organisms
	drink or absorb water contaminated with e-waste
γ3	The rate at which the terrestrial living organisms
	drink or absorb water contaminated with e-waste
$g_1(t)$	The rate of inflow of e-waste into the terrestrial
	habitats at time t
$g_2(t)$	The rate of inflow of e-waste into the aquatic
	habitats at time t



Fig. 2 Flow diagram of dynamics of e-waste

Based on the flow diagrams and assumptions, the following model equations are derived:

$$\frac{dx_1}{dt} = -\zeta x_1 + \beta_1 x_2 + \beta_2 x_3 + \alpha_3 x_4 + \gamma_1 x_5 \tag{1}$$

$$\frac{dx_2}{dt} = -\beta_1 x_2 - \beta_3 x_2 + \gamma_2 x_5$$
(2)

$$\frac{dx_3}{dt} = -\beta_2 x_3 + \beta_3 x_2 + \alpha_2 x_4 + \gamma_3 x_5 \tag{3}$$

$$\frac{dx_4}{dt} = -(\alpha_2 + \alpha_3 + \alpha_1)x_4 + g_1(t)$$
(4)

$$\frac{dx_5}{dt} = \alpha_1 x_4 - (\gamma_1 + \gamma_2 + \gamma_3) x_5 + g_2(t)$$
(5)

0

The matrix vector equation for the above system is given by:

,

$$y' = A(t)y + b(t)$$

$$\begin{bmatrix} -\zeta & \beta_1 & \beta_2 & \alpha_3 & \gamma_1 \\ 0 & -\beta & -\beta & 0 & \gamma_1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_1 \end{bmatrix}$$

$$\begin{bmatrix} x_3'\\ x_3'\\ x_4'\\ x_5' \end{bmatrix} = \begin{bmatrix} 0 & \beta_3 & -\beta_2 & \alpha_2 & \gamma_3\\ 0 & 0 & 0 & \varphi_1 & 0\\ 0 & 0 & 0 & \alpha_1 & \varphi_2 \end{bmatrix} \begin{bmatrix} x_3\\ x_4\\ x_5 \end{bmatrix} + \begin{bmatrix} 0\\ g_1(t)\\ g_2(t) \end{bmatrix}$$

Where

 $\begin{bmatrix} x_1' \\ x_2' \end{bmatrix}$

$$\varphi_1 = -(\alpha_2 + \alpha_3 + \alpha_1)$$

$$\varphi_2 = -(\gamma_1 + \gamma_2 + \gamma_3)$$

 $\alpha_1, \alpha_2, \zeta, \beta_1, \beta_2, \beta_3, \gamma_1, \gamma_2, \gamma_3 \ge 0$

IV. METHODS OF PROCESSING AND ANALYSING

- 1. Indentifying the products and various materials to be categorized as E-waste.
- 2. Analyzing the techniques that can be used to recycle/reuse E-waste.
- 3. Analyzing awareness among the various person of society about disposal/reuse of E-waste.
- 4. Use appropriate tools and software for analyzing the dates collected.
- 5. Carefully analyzing and recording the outcomes/results.

V. PROPOSED SOLUTION TO THIS PROBLEM IS: RECOVERY AND REUSE

This technique might eliminate waste disposal prices, cut back material prices and supply financial gain from a saleable waste. Waste will be recovered on-the-scene, or at an off-site recovery facility, or through lay to rest trade exchange. Variety of physical and chemical techniques are offered to reclaim a material like reverse diffusion, electrolysis, condensation, electrolytic recovery, filtration, natural process etc. For instance, a printed-circuit board manufacturer will use electrolytic recovery to reclaim metals from copper and tin-lead plating bathtub.

The project will help in analyzing the techniques for reusing/recycling e-waste with the help of, data analysis, feedback, field research and academic writing. The aim is to identify the reuse techniques for E-waste disposal and create awareness about recycling techniques of E-waste in Society. The project includes data collection and feedback from society, practical analysis and a through coverage, analysis report.

VI. RESULTS AND DISCUSSIONS

1. Eliminates Health and Environment Hazards

The major benefits of e-waste recycling are the elimination of the health and environment hazards caused by disposal of untreated e-waste in landfills.

2. Contributes to Energy Efficiency

The benefits of e-waste recycling extend to significant reduction of energy requirements.

3. Contributes to Economic Growth

The financial benefits of recycling or the ability of recycled e-waste to generate income.

4. Conserves natural resources.

Recycling recovers valuable materials from old electronics that can be used to make new products. As a result, we save energy, reduce pollution, reduce greenhouse gas emissions, and save resources by extracting fewer raw materials from the earth.

5. Benefits Community

Donating used electronics benefits community by passing on ready-to-use or refurbished equipment to those who need it.

6. Create Jobs

Re-cycling e-waste creates jobs for professional recyclers and refurbishes and creates new markets for the valuable components that are dismantled.

7. Saves landfill space

E-waste is a growing waste lands by dumping e-waste. By recycling these items, landfill space is conserved.

VII. CONCLUSION

E-waste refers to electronic waste. E-waste could be a growing waste lands by merchandising e-waste. By

Series- C (Electrical Engineering) MIT Transaction employment this stuff, lowland area is preserved. E-waste employment creates jobs for skilled recyclers and refurbishes and creates new markets for the precious elements that are razed. Some of the common E-wastes include: home appliances like televisions, air conditioners, electrical cookers and heaters, air condoners, fans, DVDs, Radios and microwaves among others; data technology instrumentation like computers, mobile phones, laptops, batteries, circuit boards, hard disks, and monitors among different; and other electronic utilities like leisure, lighting, and sporting instrumentation. Recycling of e-waste is a growing trend and donating used electronics benefits community by passing on ready-to-use or refurbished equipment to those who need it. The major benefits of e-waste recycling are the elimination of the health and environment hazards caused by disposal of untreated e-waste in landfills.

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Review On Waste to Energy And Waste Management Technology

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Abstract— Incineration of waste produce energy in the form of electricity or heat this process is known as Waste to Energy. The volume of waste is reduced by 90 percent with the help of combustion. The heat generated has other benefits like generating steam or to produce electricity. Incineration of waste is always be a challenging task as it needs to be near to the place because transportation of garbage to distant location is impractical.

Keywords — Waste Energy Management, Plasma gasification, Water Treatment.

I. INTRODUCTION

The paper described the technologies involved in conversion of waste to energy or energy from waste. Mainly focus on the Indian Technologies which are currently in use at very large scale.

Some of technologies are as follows:

- i. Plasma Gasification
- ii. Waste Water Treatment Plant
- iii. Bio Diesel Plant
- iv. Smart Eco Bins

II. LITERATURE REVIEW

According to [1] Alternatives of mechanical recycling with the help of chemicals is most popular nowadays. To produce a quality product waste treats with these chemicals breakdown polymers into monomers.



Figure 1 chemical recycling for treating plastics in household waste streams

Everyone is looking for an attractive option for waste management and bio waste treatment using Black Soldier Fly mention in [2] not only offers a solution for waste management but also increase the demand of animal feed.

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Figure 2 Schematic diagram of the BSF treatment system considered

According to [3] trash bin equipped with Wi-Fi uses Wi-Fi routers and a dustbin. If anyone pts trash into the dustbin it generates a code which allow internet access to the user for limited period of time. Once the time limit is over it automatically disconnects the user. A single user can use the Wi-Fi twice a day. A Wi-Fi Trash Bin uses multiple technologies.



III. METHODOLOGY

A. Plasma Gasification

Plasma gasification simultaneously reducing the waste and releasing a huge amount of energy and syngas. The main advantage of using this is that it can destroy any king of waste like PCBs (polychlorinated biphenyl), asbestos and hydrocarbons which is hazardous also due to lower environment emission of its byproducts making it more efficient.

B. Why Plasma Gasification?

 It completely decomposes the waste material into simple molecules in an oxygen starved environment exposing it to temperature over

10,000 deg. Celsius to treat any type of waste in safe and reliable manner.

- Output gas is rich in CO, hydrogen and light hydrocarbons.
- The slag is usable as aggregate, rock-wool etc.
- No Harmful emission.
- The energy rich fuel is having high calorific value.
- Replacement of petroleum fuel.
- Plasma gasification is not Incineration.



Figure 4 Process of Plasma Gasification

C. Benefits of Plasma gasification:

- Reduce Municipal waste, Biomass, Agriculture waste, Coal fines, Medical waste, used motor oil and lower level nuclear waste.
- Low emissions.
- Lower energy consumption.
- Easy separation of useful products from slag.
- The slag is used in roads and building construction.



Figure 5 Working of Plasma Gasification

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D. Waste Water Treatment Plant

Waste water treatment plant uses Advanced Oxidation Process to remove organic and inorganic waste present in water by reacting it hydroxyl radicals (OH). Human waste and household activities waste termed as municipal sludge and industrial sludge is that comes from industry.

Sludge is always be the threat to the environment and its management is necessary. But the management of sludge is not always an easy task. Sludge treatments categorized mainly into three i.e., mechanical treatments, biological treatments and final physical-chemical treatments.



Figure 6 Block diagram of water treatment

THE PROCESS OF ADVANCED OXIDATION



Figure 7: Process of advances oxidation

- E. Applications of Advanced Oxidation Process
 - Remove color and to or from water.
 - Chemical Oxygen Demand (COD) removal.
 - Treatment of sludge.
 - Toxic level reduces.

F. Biodiesel Plant

- The chemical reaction of transesterification and esterification produces biodiesel.
- Reaction of vegetable oils pr animal fats with alcohols like ethanol or methanol.

- Ethanol because of its low cost and methanol due to it greater conversion into biodiesel.
- Transesterification catalyzed by either acid.
- Alkaline catalyst is not used due to its sensitivity with water and fatty acids.

• A good substitute of petrol and diesel biodiesel comes into lime light because it is lee toxic and harmful to environment and consider as an replacement in automobiles if diesel fuel.



Figure 8 bio-diesel plant

G. Advantages of biodiesel

- Clean burning, lower in carbon monoxide and carcinogens.
- Lower in sulphur compounds.
- Can be run in any unmodified engine.
- Less flammable than diesel.
- Readily mixed with diesel.
- Carbon dioxide reduction

H. SMART ECO BIN

- Smart ecobins comes into the category of waste management techniques. Mainly operates on solar power these bins equipped with Wi-Fi access and USB mobile device charger. The cost effective waste collection system provide clean, healthy and green environment.
- System consists of renewable energy source, sensors, processors and actuators.
- Smart eco bin mainly operates on solar energy, batteries charged with the help of solar power for proper functioning of processors and controlling unit.
- Wi-Fi enabled these ecobins sallow the user to access internet for a limited period of time. To access the Wi-Fi user first need to add the trash

Series- C (Electrical Engineering) MIT Transaction into bin password is generated which allow him to access the internet.

• Passive infrared sensor for checking waste in the bin or if the user add any trash or not also all the data is send to real time monitoring system. ultrasonic sensor keeps checking if the user is nearby or not if user is near to the bin servo opens the bin so that waste may added to the bin.

• Wi-Fi module to access Wi-Fi password is send using GSM/GPRS module.

• Waste is continuously monitored on real time monitoring system.



Figure 9 Smart Eco Bin Schematic diagram

IV. CONCLUSION

The paper reviews the waste treatment techniques currently used in India under Prajwala Bio Energy. The treatment and process takes place in converting waste to energy is reviewed. The plastic waste which is one of the major causes of pollution how it is degraded. The study includes how fuels being made creating no or less pollution to the environment. Waste Management projects like Solar Wi-Fi ecobins using solar energy for operation and Iot for sending messages to the user improve to perform real-time, reliable and efficient waste management system are also explored in the study.

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Study of Virtual Reality

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Abstract- The forms of reality are Virtual Reality, Augmented Reality and Mixed Reality. This paper presents the study of one of the forms of Reality which is Virtual Reality. Here the comparison of three forms is done. History and evolution of VR is very vast which is described in this paper in a easy form of Timeline. The 3I of VR are Interaction, Immersion and Imagination. Virtual Reality system works on simple process of tracking, simulating and the generating the user-friendly output. This paper discusses the architecture and basic components of the VR System. VR hardware system comprises of computer workstation which works as a bridge or mediator between various input and output VR devices.

Keywords- Virtual Reality, Forms of reality, Components of Virtual Reality, Architecture of VR System, VR Hardware.

I. INTRODUCTION

The term virtual reality (VR) was coined in 1989 by the American computer scientist Jaron Lanier. Virtual Reality is a combination of two words Virtual and Reality. Sherman and Craig [2003] point out in their book Understanding Virtual Reality that Webster's New Universal Unabridged Dictionary [1989] defined Virtual and Reality. Virtual means "being in essence or effect, but not in fact". Reality means "the state or quality of being real. Something that exists independently of ideas concerning it. Something that constitutes a real or actual thing as distinguished from something that is merely apparent.". Thus, virtual reality is an oxymoron i.e. a term that contradicts itself. Fortunately, the Merriam-Webster in 2015 has defined the term virtual reality as "an artificial environment provided by a computer and is experienced through sensory stimuli such as sights and sounds and in which one's actions partially determine what happens in the environment."

VR is an artificial environment that is created by software and presented to user in such a way that user suspends belief and accepts it as a real environment. VR refers to a virtual environment, 3D environment, a visualization of complex data representing an imagined or styled place, computer simulated environment. The term virtual reality (VR) is commonly used by the popular media to describe imaginary worlds that only exist in computers and our minds. Virtual reality is defined to be a digital computer-generated environment that can be interacted and experienced as if that user is in real environment.



Figure 1 Virtual Reality

Due to rapid advancement in technologies and to fulfil expanding need of customers and user's Virtual reality is

Series- C (Electrical Engineering) MIT Transaction nowadays considered as the most efficient and immerging technologies which has made human life easier and simpler. Virtual Reality has also overcome the limitations of augmented reality. Some of the growing needs of virtual reality are given below:

- i. It helps us to simulation of the real world dynamically by use various components such as computer software, hardware, virtual world integration and other technologies.
- ii. It can make us pretend to have physical presence in places in the imaginary worlds as well as in real world.
- We can work in a virtual safe environment without risking our lives or without any real danger.
- iv. The environments where working is not possible can be visualized using the Virtual reality. These places are where people cannot go like mars or low temperature environment so by making same atmospheric conditions and by the use of computer graphics software's, use of headsets, gloves and many more other devices we can make them feel as if they are in that physical presence.

II. HISTORY AND EVOLUTION OF VIRTUAL REALITY

This section of paper presents the history and evolution of Virtual Reality in form of a timeline.



Figure 2 Timeline review for the history of virtual reality

III. FORMS OF REALITY

Reality have many forms which are considered to range on a Virtuality Continuum from real environment to a virtual environment. The form which is between virtual and augmented reality, is defined as "mixed reality", which can be further divided into "augmented reality" and "augmented Virtuality". Augmented reality is digital information overlaid on the actual environment or world of reality and vice versa. Superimposing mixed realities to form possible scenarios that behave as if real but still maintaining virtual environment or element. Virtual reality is a complete digital rendering or representation of the real world i.e. reality. A combination of virtual reality and augmented reality is known as Mixed reality. A virtual portrayal of contingent or non-contingent possibilities is known as Virtuality.



Figure 3 Virtuality Continuum and Forms of Virtual Reality

VR is completely digital environment; AR is Real world with digital information overlaid and MR is real and virtual are combined.

VR is fully enclosed synthetic experience with no sense of real world; In AR real world remains central to experience enhanced by virtual details and MR is interaction with and manipulation of both physical and real environment.

VR creates artificial environment to inhabit and AR simulates artificial objects in real environment or world.

IV. I³ OF VIRTUAL REALITY



Figure 4 I³ of Virtual Reality

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Burden and Coiffed raised 3I of VR. 3I or I3 of Virtual Reality are: Imagination, Immersion and Interaction. VR is both Interactive and Immersive. In Virtual Environment, user experiences immersion which is the feeling of presence in virtual environment and being a part of that World. This synthetic world is not Static but responds to user Input. There are many ways for user to interact with the virtual environment. VR is not just a high-end user interface or medium but it also an application that involve solution to a problem. VR developers design these applications. It depends on Human Imagination up to which extent application will be able to solve a particular problem. This where the third I come into picture. Imagination is the capacity of mind to perceive the non-existing things.

V. WORKING OF VR SYSTEM

Virtual Reality system works in basically three steps as shown in Figure 5. A VR system consists of user input, rendering, application, and output for the user. It works as a cycle of input and output. Input is the information moving from user to the System while Output is response given by the system that goes from system to the user.



Figure 6 VR System

Rendering is the transformation of a computer-friendly format to a user-friendly format that gives the illusion of some form of reality and includes visual rendering, auditory rendering (called auralization), and haptic (the sense of touch) rendering. Output is the physical representation directly perceived by the user.

Input collects data from the user such as where hands are located, where the user's eyes are seeing, button presses and many more. Non-rendering aspects such as updating dynamic geometry, user interaction, physics simulation, are considered in the application part. The transforming of computer-friendly format to the user-friendly format is known as Rendering. User -friendly format gives the illusion of any form of reality including visual rendering, auditory rendering (called auralization), and haptic (the sense of touch) rendering.

VI. ARCHITECTURE AND BASIC COMPONENTS OF VR SYSTEM



Figure 7 Architecture of VR System

Architecture of a VR System is shown in figure 7. It consists of three main processors: Input Processor, Rendering Processor and Simulation Processor.

Input Processor controls the device used to input information. Simulation Processor represents the core of the VR system. Rendering Processor creates the sensations, the output to the user. World Database stores the objects from the virtual world and scripts.

Basic Components of a VR System are:

- 1. VR Engine/ Computer Workstation
- 2. VR Input Devices
- 3. VR Output Devices
- 4. VR Software and Tools
- 5. Database

The components necessary for building and experiencing VR are divided into two main components-the hardware components and the software components.

VII. VR SYSTEM HARDWARE

A VR system comprises of two major subsystems hardware and software. The hardware is further subdivided into VR engine or computer and I/O devices, and the software can be divided into application database and software. Input devices are responsible for interaction, and output devices

Series- C (Electrical Engineering) MIT Transaction gives the feeling of immersion and software for a proper synchronization and control of the environment.



Figure 8 VR System hardware

A. Position and Orientation Tracking devices

There is a device in every tracking system that generates a signal, a sensor for detection of the signal and a control unit to processes the signal and send the information to the CPU. The signals coming from emitter and moving to sensor can be in many forms such as electromagnetic signals, optical signals, acoustic signals, and mechanical signals. Each technology has its own advantages and disadvantages.

This system track position and orientation of a user in the created virtual environment. This system is divided into following types:

- i. Mechanical tracker system
- ii. Electromagnetic tracker system
- iii. Ultrasonic (Acoustic) tracker system
- iv. Infrared tracker system



Figure 9 Basic Components of VR System

B. 3D Input Devices

To make human-computer interaction easier and intuitive, in addition to trackers that capture user body movements positions, many input devices are developed. For full freedom of movements in virtual environment the threedimensional i.e. 3D input devices seem the most natural. Attached to our body or hand-held, they are generally used to select, move, modify etc. virtual objects.

3D Input devices are classified into two:

- i. Navigation Input Devices
- ii. Gesture Input Devices



Figure 10 Classification of Input Device

VIII. ADVANTAGES AND DISADVANTAGES OF VR

There are so many phobias like fear of flying, fear of height, fear of insects, fear of water. VR is used in the treatment of such phobias. It is also helpful in curing combat disorder PTSD (post-traumatic stress disorder). It has been effective in several commercial entities, and academic setting of the patients. Although it was noticed that training for such standardized patient was more realistic, the computer-based simulations provided a number of comforts over the live training. It helps in training of students in medical fields by making them easy to learn their work with the help of virtual environment creation. Their motive was to increase exposure to emergency situations in life to improve performance and decision-making and while a real health emergency it helps to reduce psychological distress. It may help teachers to make a virtual environment for kids for their fast and effective learning. It can also comfort in various places like while learning car, or overcoming the hesitation while teaching or can be beneficial for stage phobia.

Disadvantages are psychologists are bothered about the psychological effect on user that could be due to immersion in virtual environments. According to them Virtua Environments systems that creates a violent situation for a user, notably as the perpetuator of violence, could consequence in the user becoming dull, dumb or desensitized. Hence, there is a fear that virtual environment entertainment systems could result in breed a generation full of sociopaths. User may become addictive of Engaging virtual environments. Another major emerging concern involve criminal acts. In the virtual world, it becomes problematic to define acts such as murder or sex crimes. Studies suggest that users can have really emotional and physical reactions to stimuli in a created virtual environment, and so there is a possibility that victim could feel real emotional attack although that was a virtual attack in virtual environment.

IX. CONCLUSION & FUTURE ASPECTS

In future, there will be rapid advancements in technologies for creating a truly immersive digital platform for best experience. With major players such as HTC, Google, Microsoft, Oculus and many more are making their tremendous efforts to improve the capabilities, we are not more far from achieving a platform that would make us feel like real world i.e. virtual reality. There are countless opportunities in this field of technology for brands to create breath-taking marketing devices. They can win over customers and can also establish themselves as the leader in this field of innovation.

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SMART HEALTH MONITORING SYSTEM

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ABSTRACT- Internet of Things(IoT) is one of the leading technology in the IT world. This paper presents a secure IoT-based health monitoring system that shortens the distance between a patient and relevant medical organizations. IoT monitoring of health helps in preventing the spread of disease as well as getting a proper diagnosis of the state of health, even if the doctor is at a far distance.

For continuously monitoring of the patients, there are doctors and caretakers in hospitals. But when a patient returns home, there is no facility to look after them or check the patients. Hence to overcome this problem, there is a new, precise, and efficient solution i.e. patient monitoring using IoT. Hence patient's data such as heart rate, blood pressure, temperature, ECG, blood oxygen, etc. can be measured and sent to the server. To measure these parameters different sensors are connected to the patient's body. Then this information will be uploaded to the website. Doctors can access this data by typing the login details such as user name and password. Hence continuous monitoring can be accomplished. IoT plays a major role in this system. The system we have proposed will monitor pulse rate, body temperature, and oxygen level. The data will be transmitted using the Wi-Fi module.

Keywords – Internet of Things(IoT), Pulse sensor, Temperature sensor, Health Monitoring.

I. INTRODUCTION

In recent times, the growth of technical devices like smartphones, vehicles, and smart home appliances with one of the latest features possible, that can communicate with each other wirelessly has tremendous graph. In 1999, Kevin Ashton introduced the term Internet of things (IOT) to elaborate this phenomenon. It refers to a network of physical devices and other such electronics embedded with sensors type system and actuators that can fetch and exchange data via certain media such as the Internet or wired communication. The Internet of Things is an associate with Nursing arise the topic of scientific, social, and economic significance. The term IOT refers to things where network property and computing capability extends the things in a unique way, sensors, and

Series- C (Electrical Engineering) MIT Transaction conventional things not usually thought about computers, permitting these devices to come up with the exchange and engross knowledge with borderline human intervention. Preceding methods provides the monitoring of the patient being done only by using different instruments and equipments for different parameters. So, we decided to monitor the required conditions of patients by assembling different apparatus in a particular module. Majorly, all the devices are connected with large variety of smart technologies to create a worldwide ubiquitous network called the Internet of Things (IoT).

We inscribed all the data of each sensor and uploaded the data into the server in a chronicle manner. Availing a smart device, doctors and patients can continuously examine the heart rate and can get important updates accordingly and take proper steps to prevent further health related problems. Nowadays,three most affective factors that are heart rate, body temperature, and oxygen level are becoming the important traits of the human body which are major contributors in determining a patient's health condition. The number of heart beats per minute is signalised the heart rate of the patient. It is also referred as the pulse rate of the body.

The standard pulse rate of a healthy adult ranges 60 - 100 beats per minute. The average human pulse rate has been calculated as 70 beats per minute for males and 75 beats per minute are for females. Females above age group of 12 and older have faster heart rates than males. The rate deflects with illness, due to any injury to body and heart, and doing exercise. Hence, heart rate is essential in determining one's fitness condition. Diabetes and blood pressure is a very common complication throughout the world. According to the World Health Organization (WHO), there are about 422 million people in the world suffering from diabetes and the amount is kept on increment day by day.

To improve the feasibility of utilizing, the latest smart Health Monitoring Device is controlled with the Microcontroller of Arduino Uno and Node MCU ESP8266. In this Paper, the system is designed to gather the data by using a heartbeat pulse and the output of heart pulse is sent to the cloud 'Thing speak' for data to stockpile for the purpose which can act as medical history for the future. The major aim applied in this smart health monitoring device is summarized as;

• To understand and explicitly fetching the data of pulse rate in the real-time environment with the help of IoT.

• Data Processing and Data storage of the patient Pulse rate from the processor to the Cloud space

• To test and verify the reliability of the system to alert it's performance periodically.

II. LITERATURE SURVEY

Several researchers have proposed various models for IoT in Healthcare centres and the prediction of various types of diseases using various research based techniques. This part focuses on the research done in the same area.

Almotiri proposed a system of m-health that uses mobile devices to collect real-time data from patients in and store it on network servers connected to the internet enabling authorised access only to certain specific clients. This data can be used for the medical diagnosis of sufferer and is achieved by using several wearable devices and body sensor networks. Sahoo practiced the healthcare management system and about the large amount of patient data that is generated from diverse reports. They further analyzed the health specifications to forecast the future health conditions of the patient or the said subject in that refrence. They uses cyberspace or cloud-based big data analytic platform for achieving the same using the means of probability.

Punit Gupta has proposed a model which technically shows the implementation of an "IoT based Smart Health Care Kit" for urgent medical cases that provide support to services to operate as quickly as possible. Doctors/Practitioners can help by giving rapid services in an earlier state. Galileo Board acquires data from sensors connected to the patient and the data is transmitted to a webpage through ethernet protocols for temperature calibration. They used the LM35 sensor and data served used for patients' timely records and their history regarding health issues.

Aruna Devi.S, in this paper they has proposed a "Patient Health Monitoring System (PHMS) Using IoT Devices". The sensor connected with the body of the victim is used to gather the health parameter values from patients. The parameters used to recognize the disease may vary from one disease to another. Hence, every parameter can be examined by different sensors that are attached to the patient. The electronic devices attached to the body of the patient are known as BAN in the phase of data **Series- C** (Electrical Engineering) MIT Transaction

collection. In this device, Blood pressure module (for checking blood pressure), Heart rate module (for pulse rate), and temperature sensor (to collect temperature DATA) are the sensors used to examine the whole situation of the patient's body. The device used to broadcast the data is Wi-Fi or Bluetooth module. Mobile application design is used for the doctor to check the health status of the patient. In every 60 seconds the data used to be updated effectively. Only the data collected in the last three victims can be viewed.

III. PROPOSED SYSTEM

In this arrangement, we have propounded an "IoT based patient monitoring system". Nowadays, the patients who stays at home after operational treatment, their health checkups is examined by the medical caretaker. But sometimes if the caretaker is not available at the time of urgency and if an abrupt change occurs in wellbeing parameter, then it may be hazardous for the victim's overall conditions. Moreover, the situation can become worst. So, the new technology "IOT-Internet of Thing" is used. We are advancing the system in which patients can be monitor from anywhere and at any time, their family can be awared regarding their health status without being with them every time as most of the families are nuclear these days. Also, the doctor can observe their status being presented in the hospitals.

A low-cost, thin and light-weighted, low power consuming, Health monitoring system is bringing up here. Data acquisition and sensing are processed by using a variety of every possible sensors that determine physiological parameters such as body temperature, pulse rate, and bodily motion. The measured parameters are then connected to a private cloud space network by the means of internet.



Generally, data transmission components of the system are responsible for transferring the

measured parameters of the patient at any location to the health monitoring centre. The transference of statistics is highly secured because of the use of a private cloud and cyber spacing.

The recorded information is transferred to a server which accounts for assisting the availability of such records from everywhere through the Internet. The cloud possesses similar functionality with a normal server but, it can be accessed from any possible place. The cloud service provider is monitoring this process by Internet protocols. This provides an extensive set of facilities including data storing, data transmission and overall maintenance. Besides, cloud servers are way more officiate than physical servers. It does not possess any hardware issues and data corruption issues.

IV. IMPLEMENTATION METHODOLOGY

This system makes use of temperature and heartbeat sensing both hands in hand to keep traces of patient health.



Fig. 2: Flow Chart of Proposed Methodology

The sensors are connected to a microcontroller to track the status which is in turn interfaced with an LCD display as well as WiFi connection to broadcast alerts. If the system digs out any abrupt changes in patient heartbeat or body temperature, the system automatically notifies the user about the patient's status over IOT and also shows details of heartbeat and temperature of patients live over the internet. Thus, IOT based patient health tracking system effectively utilizes the internet to monitor

Series- C (Electrical Engineering) MIT Transaction patient health status and save more lives in a short span.

The overall implementation divides into the following categories:

• Arduino Uno: The Arduino is generally an ATMEL which consists of the typical features of the 1.8K bytes of Flash, 256 bytes of RAM32 I/O line,16-bit timers or counter and ATMEGA328. Arduino boards are operated to read inputs from the light on a sensor, a finger on a button, or a Twitter message, and these inputs turn into an output like energizes a motor, switching on an LED, broadcast some information on cloud setup. One can operate the board by giving a set of instructions to the microcontroller on the board The Arduino Uno is unveiled in the Fig. 3.



Fig. 3: Arduino Uno



Fig. 4: Temperature Sensor

• LM35 Temperature sensor: Temperature sensor is a device having an analog output voltage proportional to temperature, which is designed

specifically to measure the temperature of a structural human body. LM35 is a high-quality IC temperature sensor containing its output (fair in amount, related to/properly sized, related to) the temperature condition (in \tilde{A} , °C). With LM35, the temperature output is more precise than the Thermistor output.

• **Pulse Oximeter sensor:** The MAX30100 is a maxim integrated pulse oximetry and heart rate monitor sensor method. It comprises of two LEDs, a photodetector, optimized optics, and low-noise analog signal processing to detect pulse oximetry and heart-rate indications. The MAX-30100 breakout operates over a range between 1.8V and 5.5V. The main function of the MAX-30100 is it reads the absorption levels for both light sources and stored them in a buffer that can be read via hyperspace.



Fig. 5: Pulse Oximeter Sensor

• Heart rate sensor: Pulse Sensor is a wellorganized plug-and-play heart-rate sensor for working Arduino perfectly. The sensor clips onto earlobe or on a fingertip and plugs right into Arduino. It also comprises an open-source monitoring app that graphs your pulse in the realtime domain. The front of the sensor is generally covered with the Heart-shaped logo on itself. This is the portion that associates with the skin.



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On the front, you see a small round hollow space, where the LED shines thoroughly from the back, and there is also a little square just under the LED.

• **LCD Display:** A liquid crystal display or LCD objectified its definition from its name itself. It is a mixture of 2 states of matter, the solid and therefore the other one liquid. LCD uses a liquid to provide a noticeable depiction. Liquid crystal displays square measure super-thin technological monitor that's scientifically employed in laptop computer screens, TVs, cell phones, portable video games, and other mobile devices. LCD's technologies permit displays to be a lot of dilutes when putting next to beam tube (CRT) automation.



Fig. 9: LCD Display

• Arduino IDE: Arduino Integrated Development Environment (IDE) is a crossplatform application for Windows, macOS, Linux. This environment supports both C and C++ codes. It includes 2 parts editor and compiler which are used for writing required codes and uploading it into the Arduino module. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output approaches.



Fig. 9: Wi-Fi Module

ESP8266 Wi-Fi module: The module can be operated both as an Access point (can create hotspot) and as a station (can connect to Wi-Fi), hence it can easily fetch data and upload it to the internet making the Internet of Things simplest possible. It can also collect data from the internet using API's hence the project could access any information that is available on the internet, thus making it smarter and quick-witted. Another exciting feature of this module is that it can make computer codes using the Arduino IDE which makes it a lot more user friendly.

- Push-button
- Connecting Wires
- Other different sensors will be added to the project in due course of time according to the requirements.

IV. APPLICATIONS

• IoT Monitoring proves that it is really helpful when we need to monitor & record and keep track of changes in the health parameters of the patient over the period. So, with the IOT health monitoring, we can have the database of these changes in the health specifications. Doctors can take the reference of these changes or the history of the patient while suggesting the treatment or the medication to the patient.

• Hospital staffs are minimized due to Remote Patient Monitoring.

• Hospital visits for normal routine body checkups are minimized.

• The patient's health parameters data is recorded over the cloud. So, it assistance with a better option than maintaining the records on printed papers kept in the files. Or even the digital documentation which is kept in a particular computer or laptop or memory device like a pendrive. Because there are chances that these devices can get corrupt and data might be lost or get misused. Whereas, in the case of IOT, cloud storage is more reliable and utilizes minimal chances of data loss.

V. ADVANTAGES

• Internet of Things based on healthcare provides 24*7 and real-time patient monitoring. It will reduce unnecessary health center visits and transportation including ambulance expenses too. Patients may ask for consultation by a doctor through online video streaming at their home and only on critical situations, patients may reach to hospitals only. IoT based healthcare monitoring can

Series- C (Electrical Engineering) MIT Transaction minimized health insurance premiums as well as patient working leave for a health checkup.

• In IoT based healthcare monitoring physical health information like blood pressure, sugar level, etc., is collected precisely by sensors and corresponding decisions is taken by huge data analytics technique. It helps in minimizing manual errors.

• Any patient can take medical advice from any part of the world because Medicos and patients are connected globally over cyberspace

• Internet of Things based Internet healthcare monitoring support green technology and reduces paperwork and documentation.

• Using Big data analytics and data mining techniques on Physical health issues, the information that is generated by electronic sensors, it is possible to predict chronic disorders in early stages and treatment can be done before it increases further.

• It is vastly quite challenging to make and manage drugs for the health industry. By using RFID (Radio-frequency Identification) technology in drug supply chain management this industry can have accurate drug management for producers, suppliers, and consumers also. It will reduce theft issues, lost and miss management of drugs.

• IoT based vital monitoring devices can alarm healthcare providers or family members in case of medical emergency like a hike in blood pressure or fall off a senior family member.

• 24/7 health monitoring and evidencebased treatment decisions will help to cure diseases on a timing basis. It will enhance treatment outcomes as a result.

VI. LIMITATIONS AND DISADVANTAGES

• Privacy remains a major concern for intimidating users from using IoT technology for medical purposes, as healthcare monitoring alternatives have the potential to be breached or hacked. Sensitive information about the patient's health, location, and meddling with sensor data can be leaked and will have grave consequences, which would counter the welfare of IoT.

• While IoT promises to reduce the cost of healthcare in the long-term, the cost of its implementation in the Medication center and staff training is quite high.

• Failure or bugs in the hardware or even power failure can impact the performance of sensors and connected equipment placing

healthcare operations at a high-risk. Also, skipping a scheduled software update may be even more hazardous than skipping a medico's checkup.

• There's no consensus regarding IoT protocols and standards, so devices produced by different manufacturers may not work well togetherly. The lack of uniformity prevents full-scale summing of IoT, therefore limiting its potential efficacy.

VI. CONCLUSION

In this paper, a real-time health monitoring system using various sensors is dispensed. The proposed system enhances the way of monitoring a patient's health no matter where he/she is. It is easy to understand, simple, and power efficacy. The main objective of developing this system is to reduce health centre visits. The proposed system can be set-up in the hospitals and a massive amount of data can be obtained and to be stored in a cloud database.

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Design and Fabrication of a Model for Filtration and Power Generation from Sewage Water (SHURJA)

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Abstract— This paper aims at how we can design a model in order to limit the amount of water pollution in our country. The model lays stress on filtering the sewage water being discharged directly into the rivers. This sewage water accounts for the major water pollution causing agents in most parts of the country. The model addressed in the paper is created for the aim of water treatment before being discharged into the river bodies. It also lays stress on water generation from the same treated water and then making the treated water safer for use. The setup of these models in different cities in the country will bring a major change as water treatment and rise in pollution will be severely affected. The continuous increase in the pollution of water bodies will fall down to a significant level. Moreover, the steps taken by the government for the cleaning of these water bodies will show much better result than before. This will lead to an increase in significant saving of funds and thus contribute to a healthier and developed nation as a whole. The paper mentions all the apparatus required and also mentions the alternatives for a better and efficient system. Although the changes won't reflect in a day or two but anybody will be able to witness the result easily after a certain time.

Keywords- Sewage, ultrafiltration, turbine, power generation

1. INTRODUCTION

The Idea of the SHURJA Project came up after our PM Modi announced the brilliant scheme of Swacch Bharat Abhiyaan. He promoted the idea that cleanliness in our country can be only brought when we start working from the basic level. India is one of those blessed countries with wide variety of rich natural sources of water. These sources are in the form of rivers, streams and lakes. Some even refer our country as the "Land of Rivers" too. In our country, few rivers are worshipped as gods and goddesses. But the reality speaks otherwise. The past records clearly show that we are not able to respect and maintain the purity and cleanliness of these rivers. In urban areas, almost 80% of water which is used for domestic purpose came back in the form of wastewater. This wastewater either sinks in the ground and pollutes the ground water or is discharged untreated through sewage lines. This direct discharge cause pollution as the harmful elements present in the sewage water gets mixed with the river water. A report shows that about 80% of the Indian sewage flows untreated into the country's rivers.



Figure 1: Drastic effects of sewer lines

Drinking water is the basic right to every human being. In India, this drinking water comes basically from the groundwater or the rivers. But, when polluted water is discharged in these rivers directly, it simply means playing with human life. Treatment of sewage is thus very essential. Improper or partial treatment degrades the aquatic life and disturbs the human life as well. It invites diseases like cholera and diarrhoea. SHURJA is an attempt in order to clean the major rivers like Ganga and other by building up a small setup in each and every city of the country. The setup will help in the treatment of water to a significant amount. Moreover, the treated water will also be used for Power Generation. The name "SHURJA" defines the setup itself.

SHURJA= SHUDDHI + URJA

The setup will start by initially damming the sewage water lines. In the first phase of the project, the water will be passed through the dammed region to separate the heavy particles as much as possible. After this, the treated water will be used for generation of electricity and in the final phase it will be made fit for discharge or usable purpose.

Objectives of the paper

- 1. Separating the harmful waste from the sewage water before its discharge into the River Water.
- 2. Removing waste such as solid wastes, poly bags, oil, grease, harmful chemicals etc. which hampers with the aquatic life as well as the other members of the food chain.

- 3. Filtration of the sewage water to a significant amount.
- 4. Generation of Power from the filtered water.
- 5. Helping in the natural flow of rivers.
- 6. Re-building up the beauty of nature by restricting human interference with rivers.
- 7. Increasing the amount of water treatment in every city of the country.

II. MATERIALS AND METHODOLOGY

2.1 FILTRATION CUM STORAGE TANK

It is one of the major components of the model. The Filtration cum storage tank is a 95 X45 X 50 sized tank which is made of Aluminium Sheet. The tank is divided in three separate chambers to restrict the flow of three different sized elements or waste. In order to stop leakage, the walls of the tank are provided with M-seal bonds. A better look of the tank is shown below:



Figure 2: Top View of Filtration/Storage Tank

Holes of R2 are provided on both the sides of the tank. One is for the water inlet and the other is for the exit of the water. The reason for the placement of holes is to create a pressure head between the two holes. The first chamber carries one mesh laid horizontally to stop macro particles rushing through the waste water. The second chamber carries another mesh of finer holes to restrict the flow of smaller particles. The last chamber carries another vertically fixed mesh on the partition wall of very fine holes to stop the maximum amount of waste right in the tank.

1.2 WIRE MESH (VARIOUS SIZES)

Welded Wire Mesh or welded wire fabric is a prefabricated joined grid of a series of parallel longitudinal wires joined by electric fusion with accurate spacing between them. They are used in a wide variety of operation and you might have commonly seen them for fencing or in homes etc. They are highly inexpensive, durable and highly effective for so many applications. Its versatility and sizes makes it perfect for use in both domestic & commercial purposes too.



Figure 3: Different size Mesh used in the project and Mesh No/Microns Data Table

In the model, they have been used for restricting the particles of various sizes. Three wired mesh of Size 400, 800 and Large Mesh has been used to limit the flow of heavy particles present in water. The Large Mesh is used to stop particles like plastics, rocks, or particles of bigger sizes etc. The 800 wire mesh stops the particles of smaller size that is able to pass through the large mesh. With the help of the 800 wire mesh, such particles gets accumulated in the first chamber of the tank. In the next chamber, 400 size mesh stops the micro sized particles and only allows very fine particles through its mesh. By now, most of the heavy particles present in water will get accumulated in the respective chambers and can now be separated easily.

2.3 TURBINE

Pelton turbine is a modification of various impulse turbine. But turbines existed prior to Pelton's design were less efficient than Pelton's design. Water leaving those wheels had high speed due to which much of the dynamic energy brought to the wheels was carried away. But in Pelton turbine, even when the rim run at half of the speed of water jet, the water left the wheel with very little speed with the help of which all of the water's impulse energy can be extracted allowing a very high efficiency of the turbine.



Figure 4: Front View of Pelton Wheel

2.4 ACTIVATED CARBON

Activated Carbon is usually used in the form of bed in the method of filtration. This method of filtration is referred to as Carbon Filtering. This carbon bed is highly efficient in removing impurities, hazardous chemicals and contaminants etc. These carbon particles adsorb the pollutant molecules over their surface and thus help in water filtration. They are commonly used in water filters, air filters and even industrial gas processing. Activated Charcoal carbon filters are mostly known for their ability to remove chlorine, sediments, organic compounds, taste and odour from water etc. They have the ability to remove particle from size range 0.5 to 50 micrometres. Some chemicals that cannot be adsorbed by carbon include sodium, nitrates etc.



2.5 ULTRAFILTERS/FILTER PAPER

In the apparatus, filter paper has been used as a combination with the fuller's earth and activated charcoal. The filter paper increases the strength of these materials when used together as it restricts some of the particles that gets passed through the fuller's earth bed and activated charcoal bed. On a practical purpose, ultra-filters can be used which works on the basis of a membrane filtration. It restricts the flow of suspended solids and solutes of high molecular weight and thus keeps the water clean.



Figure 6: Working of Ultra Filtration Membrane

The model "SHURJA" works in three different phases which can be understood from the following process chart:



Chart 1: Process Diagram

SHURJA works in two phases. First one is the filtration and the next phase is designed to generate power from the same filtered water. Post generation of power, the water can be treated again to make it fit for use.



Figure 7: Modified Design of the Project

The process will start by providing an obstruction in the path of water distant from a significant distance from the opening of the sewage tunnel. The process will be similar to damming the river. The canal will be opened by opening the gates and the water will rush through the canal entering the storage tank cum filtration tank. In the Storage cum filtration tank, it will pass through meshes of different sizes which will help in restricting the flow of different sized particles in different chambers. These meshes will help in the separation of the solid and the macro sized wastes from the sewage water.

The remaining water will be allowed to rest so that the heavy particle can settle with time. The sedimentation process will help in attaining 60-70% cleaning of the water along the different chambers. After the first filtration process, the water will be discharged with the help of a valve. This discharge at high velocity will now strike the turbine blades. With the rotation of pelton wheel, the shaft of the alternator will be moved and hence electricity will be produced. The water striking the vanes will be collected and now sent on for water filtration again. This final filtration will be carried out with the help of different types of layers as shown below in figure 8.



Figure -8

The first layer will help in the removal of acids, wax, resins, gums etc. The water passed through the first layer will go through another layer of filtration by activated charcoal. It will help in the removal of any kind of odour, colour, impurities and hazardous chemicals etc. By now, the water is fit for use but still it is necessary to go through one more layer of filtration for proper surety and enhanced filtration. This will be achieved by Ultra-Filtration membrane. The water passed through this layer will be fit for purpose and won't harm aquatic or the life nearby rivers in any form. These layers can be made by the side of the rivers in the form of green bridges in order to trap the waste particles. After proper cycle, the waste can be removed in order to initiate a fresh new cycle. From time to time, fuller's earth and charcoal needs to be replaced when they run out of usability. The waste generated from treatment, fuller's earth and activated charcoal must be dumped off to a safe place as they are hazardous in nature and not good for any biological life.

II. RESULTS

DESIGN 1









DESIGN 2: MODIFIED





CALCULATIONS

According to Bernoulli's Theorem,

>
$$P_1 + \frac{v_1^2}{2} + gz_1 = P_2 + \frac{v_2^2}{2} + gz_2$$

> $\frac{v_2^2}{2} = gz_1 - gz_2$

(Since both ends are exposed to atmospheric pressure and V_1)

Velocity at Outlet,
$$v_2 = \sqrt{2 \times 9.81 \times (1.5 - 0.8)}$$

 $v_2 = 3.70540 \text{ m/s}$

> Now, Discharge, $Q = A \times v$

 $=\frac{\pi}{4} \times 0.0254^2 \times 3.70540$

$$Q = 0.00187m^3/s$$
Power generated by the Turbine = $\bigcap_t \times \bigcap_a \times \rho QgH$
= 0.90 × 0.85 × 1000 × 0.00187 × 9.81 × 0.8
1000

$P = 0.01122 \, kW \, or \, 11.22 \, W$

(These results are obtained under minimal head or low head turbine)

S.N	PARTICULARS	COST
0.		(INR)
1.	Filtration/Storage Tank	900.00
2.	Pelton Wheel	430.00
3.	Alternator	370.00
4.	Wire Mesh	350.00
5.	Pipes & Fittings	650.00
6.	Activated Charcoal	50.00
7.	Fuller's Earth	100.00
8.	Filter Paper	75.00
9.	Filter Bed	100.00
10.	Storage Tanks	325.00
11.	Miscellaneous	400.00
	Grand Total	Rs. 3750

IV. COST ANALYSIS

V. CONCLUSION

Proper treatment of sewage water prior to their discharge in river will be done as it includes harmful and hazardous substances which contribute in pollution river water. This treatment will thus lead to safe water disposal of sewage line which won't affect human or animal life. All the harmful organic wastes, suspended solids, bacteria, nitrates and phosphates which are present as pollutants will be separated from the discharged water. To make wastewater acceptable for reuse or for returning to the environment, the concentration of contaminants will be reduced to a safe level. It will also lead to a decrease in the excess concentration of sulphates, nitrates and other chemical substances. With proper treatment a large number of problems will be reduced. For e.g. The Solid Waste and the harmful substances present in sewage water will be removed. Consequently, marine and aquatic life won't be affected. Moreover, water borne diseases will be reduced exponentially. Beneficial for aquatic life as if waste water is released directly into rivers and streams without treatment it would also have major negative impacts on the lives of fishes and other aquatic animals.

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Experimental investigation of effect of squeeze pressure on casting of bronze allov

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Abstract- Bronze castings are extensively used in diversified industrial sectors especially manufacturing of bearing, plumbing pump, valve components and bushes etc. using different conventional casting processes. Squeeze casting is relatively a new casting technique that combines gravity and pressurized casting in which squeeze pressure parameter plays an important role. In present paper, experimental investigation of influence of squeeze pressure on casting of Bronze (PB1) using squeeze casting process is presented. Influence is investigated by varying squeeze pressure (selected range 100, 140, 180 and 220MPa) during solidification of casting and their effect on mechanical properties and surface roughness of obtained bronze castings. Increase in pressure during solidification has resulted in increase in hardness, tensile strength and impact strength of obtained bronze castings. Maximum value of surface finish was obtained with the application of maximum value of squeeze pressure (220MPa) selected in this investigation.

Key words: Squeeze casting, Bronze, Squeeze pressure, Mechanical Properties

I. INTRODUCTION

Squeeze casting is a metal-forming process, which combines permanent mould casting with die forging into a single operation where molten metal is solidified under applied hydrostatic pressure [1]. Thus, squeeze pressure plays major role amongst other important parameters of casting such as pouring temperature, die temperature etc. in achieving sound castings. Literature survey conducted for this research work revels that investigation on analysing the effect of squeeze pressure on various engineering non-ferrous materials (such as aluminium, zinc , Mg and brass alloy) have been performed by various researchers. Maleki et al. [2] examined effects of applied pressure and melt and die temperatures on the microstructure of squeeze cast LM13 alloy. Raji [3] performed investigation to compare cast microstructures and mechanical properties of aluminium silicon alloy components cast produced using sand casting, chill casting and squeeze casting methods.

Lus [4] investigated the influence of casting parameters on the microstructure and mechanical properties of squeeze cast A380 aluminum die cast alloy. Senthil and Amirthagadeswaran[5] carried out research on producing AC2A aluminium alloy castings of a non symmetrical component using squeeze casting process. Souissi et al. [6]

Series- D (Mechanical Engineering) MIT Transaction established relationship between the ultimate tensile strength, hardness and process variables in a squeeze casting of wrought aluminium alloy using Taguchi method. Senthil and Amirthagadeswaran [7] performed experimental study to optimize the squeeze casting process for obtaining high quality AC2A aluminium castings. Aweda and Kolawole [8] investigated the performance of permanent steel mould for temperature monitoring during squeeze casting of aluminium and brass alloy. Goh et al. [9] carried out experimentation to study the effect of squeeze casting parameters on the mechanical properties of AZ91–Ca Mg alloys.

Yang et al., [10] investigated the effects of squeeze casting parameters on the macrostructure of a squeeze-cast Mg-2.5 mass % Nd alloy. Wu et al. [11] investigated the behavior of squeeze casting of Mg-8Gd-2Y-0.4Zr magnesium alloy. Li et al. [12] investigated the influence of specific pressure on microstructure and mechanical properties of squeeze casting ZA27 alloy. Singh et al. [13] reported the optimization of the squeeze casting parameters for obtaining the maximum impact strength of brass alloy.

Lokesh et al. [14] studied of characteristics of Metal matrix composites (MMCs) using squeeze casting method. Ravi et al. [15] optimized the squeeze casting parameters for casting of AC2A Ni coated SiCp composite using Taguchi technique. Arulraj et al. [16] optimize and analyse the effect of squeeze casting parameters on the tensile strength of metal matrix composite (LM24-SiCp-coconut shell ash). Dhandapani [17] investigated the mechanical and microstructure characterization of squeeze casting of metal matrix composite Al-Sic (P) Substance.

Though, phosphor-bronze (PB-1) castings are extensively used in diversified industrial sectors especially manufacturing of parts used in air compressor, aero engines, marine parts, bushes and gears etc. using conventional casting processes. No work has been reported yet on the squeeze casting of PB-1 alloy. The influence of squeeze pressure on casting of phosphorous-bronze using squeeze casting process needs to be addressed. The objective of present research was to investigate the influence of squeeze pressure on casting of phosphor bronze using squeeze casting process. Influence of varying squeeze pressure on casting of phosphorous-bronze has been investigated based on the mechanical properties (hardness, tensile strength and impact strength), surface roughness and microstructure of obtained castings.

II. METHODOLOGY AND EXPERIMENTATION

Based on objectives mentioned in section I, following methodology steps have been planned to perform this research work.



Fig. 1.Steps of methodology planning

A. Selection of squeeze casting process parameters

Based on the technical data available on squeeze casting, following fixed and variable parameters and their levels have been selected (Table I).

TABLE I PARAMETERS USED FOR CASTING OF PHOSPHOR BRONZE

S.	PARAMETERS								
No.	FIXED	VARIABLE							
1	Pouring temperature :	Squeeze pressure:							
	1100 ° C	100 MPa,							
2	Die temperature: 200°C	140MPa,							
3	Squeeze time : 45 Sec.	220MPa							

B. Casting material

Phosphor Bronze (PB1) was used for producing casting in this research work. The composition of PB1 is given in Table II.

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Table II COMPOSITION OF PB1

Element	Copper	Tin	Zinc	Nickel	lead	Р	Al	Iron
%	balance	10- 12	0.05	0.10	0.25	0.5- 1	0.005	0.10

C. Squeeze casting

Procedure of producing casting using squeeze casting process is presented in following Fig.2. Complete procedure of producing squeeze casting is shown from Figs. 3-7.Metal die was preheated at a temperature 200°C (Fig.4) and phosphorous bronze was melted at pouring temperature of 1100°C using resistance furnace (Fig.3). After pouring the melted alloy in die (Fig.5), a power press (Fig.6) was used to apply squeeze pressure as per values given in table I.



Fig.2. Stepwise procedure of squeeze casting

D. Testing of castings

Hardness, tensile properties, surface roughness and impact strength of the casting samples were measured according to their respective standards for the investigation of outcome of increase in pressure on casting of bronze using squeeze casting process. Planning of sample preparation for testing of obtained castings is presented in Fig. 8. The details of testing methods are given in sections E-I.

E. Hardness Testing

Vicker hardness tester (VM 50PC make- FIE, India) was used to measure the hardness of obtained cast components as shown in Fig.10. As per the standards (ASTME92-82; 2003), a load of 5 kgf was applied for duration of 10 seconds (Fig.11.). The hardness measurements were obtained using

Vicksys computer software directly interfaced with the testing machine.



Fig. 3. Resistance Furnace for melting the PB-1



Fig.4. Muffle furnace used for preheating of die



Fig.5. Pouring of PB1 into preheated die



Fig.6.Squeeze casting of melted PB-1



Fig.7. Final casting sample



Fig.8. Planning of sample preparation for testing of obtained casting

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(c)

Fig.9. Specimen for testing (a) Impact strength (b) Hardness and microstructure (c) Tensile properties



Fig. 10.Vicker hardness tester



Fig.11. Position of work piece for hardness testing

F. Tensile testing

Tensometer (PC 2000 make-kudale instrument pvt. Ltd.) was used to measure the tensile properties of obtained cast components as shown in Figs.12-13.



Fig.12.Tensometer used for tensile test



Fig.13. Position of work piece in tensometer

G. Microstructure analysis

The metallographic specimens were prepared as per standard ASTM E3-11 (Figs. 14-15). Etching solution containing ferric chloride 10 gms, distilled water 200 ml and hydrochloric acid (HCL) 50 ml was applied for 10 - 15 seconds on each polished specimens. Final microstructure was captured using Metallurgical MICROSCOPE (Type-Triangular inverted, Model-Dimvictory, Camera-Digieye810, 8MP, 0.5X) installed with material plus software.

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ixed Parameters	Squeeze Pressure (MPa)	Hardness (HV)	Ultimate tensile strength(N/mm²)	Impact strength (J)	Surface roughness (µm)
Die Temperature : (200°C)	100	209	300	28	3.39
Pouring Temperature : 1100°C	140	214	311	33	2.54
Squeeze	180	221	320	37	0.756
(45 sec)	220	237	329	41	0.71

Table II EXPERIMENTAL RESULTS OF SQUEEZECASTING OF PHOSPHOR BRONZE CASTINGS



Fig.14.Polishing of work piece



Fig. 15. Work piece after polishing

H. Surface roughness testing

Surface roughness of the casting samples was measured using a surface roughness tester (SJ–201P) of Mitutoyo Corporation, Japan (Fig.16) as per ISO-4287 norms.

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Fig.16.Surface Roughness Tester

I. Impact testing

Impact strength was obtained using Impact Testing Machine (Make-Enkey Enterprises, Least count-2 joules, striker type-Rectangular V-shape) shown in Fig17. Testing samples were prepared as per the standard ASTM E23.



Fig.17. Impact testing machine

III. RESULTS AND DISCUSSIONS

The details of analyses performed are presented in following sections. Obtained experimental results of effect of varying squeeze pressure on hardness, tensile strength, impact strength and surface roughness of PB-1 castings are presented in Table II.

A. Hardness of castings of phosphor bronze

The relationship between hardness of phosphor bronze squeeze castings produced at variable squeeze pressures is shown in Fig. 18. The results showed an increase in hardness of phosphor bronze castings with increase in pressure. Within the selected range of pressure, maximum value of hardness is obtained at 220MPa. In squeeze casting, nucleation starts initially at the under cooled die wall region. The application of squeeze pressure at that moment increase the contact between liquid metal and die wall which increases the cooling rate and further produced more nucleation which ultimately produced fine grain structure. The increase in applied squeeze pressure also reduces the porosity. Both these effects contribute in increasing the hardness of castings. The increase in hardness is very much evident from the differences in microstructures obtained at different squeeze pressures (See Fig.3.



B. Tensile properties of castings of phosphor bronze

The relationship between UTS of phosphor bronze squeeze castings at variable squeeze pressure is presented in Fig.19. The increase in value of tensile strength with the increase in pressure is observed.



Fig. 19. Variation of UTS with squeeze pressure

The increase in tensile strength with the increase in pressure results due to the increase in solidification rate and refined grain structure due to high pressure applied on solidifying

Series- D (Mechanical Engineering) MIT Transaction casting. The refined structure tends to increase in grain boundaries which further provide obstruction to the movement of dislocations. Consequently the strength of the casting is increased.

C. Surface roughness of castings of phosphor bronze

Fig.20 shows the variation in surface roughness values of squeeze cast component produced at different squeeze pressures. Results show that within the selected range of squeeze pressure, surface finish of obtained castings is increased with the increase in squeeze pressure value and better surface finish is observed at squeeze pressure of 220MPa. Solidification under high specific pressure against a rigid die forces the metal to accommodate closely to the die surface thus paving the way for components to execute improved surface details and finish [18].



Fig. 20. Variation of surface roughness with squeeze pressure

D. Impact Strength o Castings of Phosphor Bronze



Fig. 21. Variation of impact strength with squeeze pressure

The variation of change in value of impact strength with the increase in squeeze pressure in casting of phosphor bronze is

presented in Fig.21. Results show that the value of impact strength of obtained squeeze castings is increased with the



Fig.22. Fractured specimen

E.Effect of squeeze pressure on microstructure of castings of phosphor bronze

Microstructures of squeeze casting obtained at different squeeze pressures are shown Fig. 23 (a, b, c, d). Refined microstructure having fine grains of squeeze cast component produced with maximum value of squeeze pressure was obtained. Fine grains and increase in grain boundaries are obtained at the highest pressure of 220MPa. This effect is attributed in increase in hardness, tensile strength and impact strength of bronze castings. The applied pressure helps to alter the microstructure due to fast cooling rate between liquid metal and mould wall and also reduce in porosity due to high squeeze pressure.

IV CONCLUSIONS

Influence of varying squeeze pressure (100, 140, 180, 220MPa) on squeeze casting of phosphor-bronze was investigated in this research. Following conclusions have been drawn:

- 1. The squeeze pressure had a significant effect on mechanical properties and surface finish of squeeze cast phosphor-bronze.
- 2. Increase in pressure during solidification has resulted in increase of hardness, increase of tensile properties and increase in impact strength of castings.
- 3. Maximum value of surface finish was obtained with the application of maximum value of squeeze pressure.
- 4. Refined microstructure having fine grains of squeeze cast component produced at maximum value of squeeze pressure was obtained which also support the results of mechanical properties.

Series- D (Mechanical Engineering) MIT Transaction 5. The best value of squeeze pressure obtained for casting phosphor-bronze from the selected range was 220MPa.





Fig. 23. Microstructures obtained at 100X magnification of castings produced using different squeeze pressures (a) 100MPa (b) 140MPa (c) 180MPa (d) 220MPa

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Assessment of physico-chemical water parameters of Dhela River in Kashipur (Uttarakhand), India

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Abstract- Dhela river water was collected at four different sites and analyzed for determining the extent of pollution in the river. It was found that the river is highly polluted with reference to water parameters at all four sites. The present study shows that the Dhela river found to be alkaline at every site as the value of Alkalinity is very high as compared to WHO standards. Analysis of data shows that BOD(Biological Oxygen Demand and Chemical Oxygen Demand) values are very high as compared to WHO standards, and dissolved oxygen value is low shows that water is highly contaminated. The variation in the values of Physico-chemical water parameters are only due to various activities like sewage waste mixing, discharge of numerous small scale industries and other humankind activities noticed at these sites.

Key words: Physico-chemical water parameters, Dhela river, WHO standards

I. INTRODUCTION

The rapid growth in industrialization, urbanization and over use of natural resources during the last few decade had been mainly responsible for alarming condition of environmental pollution in developing countries, which now facing serious threat to the ecosystem processes [1-4]. From the last few decades, India has seen rapid population growth and now more than one billion million peoples create a stress on the environment and natural resources, e. Industrial pollution, soil erosion, deforestation, rapid industrialization, urbanization, and land degradation are all worsening problems [7-8].

Series- E (Applied Science & Humanities) MIT Transaction River water plays an important role in the world, as it functions as a solvent for chemical industrry and also facilitates industrial cooling and transportation. Many studies [1-3] have shown that water pollution heavily affecting human life, mainly in the countries like India in which most of the activities are based on river water. Wastewater from various industrial pollutant, urban and rural runoff, coupled with the various chemicals, fertilizers and pesticides used in agriculture and in the decomposition of vegetable and animal matter discharge varying amounts of these and other chemicals into ground and surface water, making it unfit for human and animal consumption [5].

This is attaining hazardous conditions, mainly in big cities where the population is in large amount, the demand for water is very high, and industries are developing at a faster rate. Various organic and inorganic compounds, when present in water are toxic and carcinogenic and cause several ailments in humans. Pollution in general and water pollution in particular has attracted the attention of scientific workers of the world over. As the quality of river water is degrading due to pollution hence there is an urgent need of measuring Physico-chemical parameters of rivers at a regular basis [6-9]. In our study, we are focusing on river Dhela.

The river used for various purposes such as Irrigation purposes, Drinking water source, Washing & Bathing, Fishing, Waste dumping like solid waste, dumping domestic wastewater, industrial wastewater etc. Our areas of study of Dhela river mainly lie in the Kashipur. Dhela river is a tributary of Ram Ganga. It rises to the north of Kashipur tehsil of Uttarakhand

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and flows through the right of Kashipur city. In Tehsil Thakurdwara, it enters Uttar Pradesh and then joins Ram Ganga river near Moradabad City. In this study, an attempt was made to monitor the Physicochemical water parameters of the Dhela river and assess the extent of pollution by comparing the results with WHO standards.

II. MATERIALS AND METHODS Sampling sites and Sampling

Four sampling sites were selected for investigation. These sites were places from where the reach up to the Dhela river was easy. Water samples were collected from the four sites at the centre of the river. The samples were collected by using plastic bottles. The bottles thoroughly washed by the soap solution first and soaked in 20 % HCl solution for one day, and then rinsed with distilled water. Samples were collected at each site with different depth and filled up to the top. All samples were tightly sealed and kept in room temperature in the laboratory.

Chemical analysis

The samples were analyzed for physio-chemical parameters such as Alkalinity, biological oxygen demand (B.O.D.), chemical oxygen demand (C.O.D.), dissolved oxygen (D.O.), total solids (T.S.), pH and total hardness by using standard analytical technique [APHA, AWWA, WPCF. 1995]. The average values of parameters at each site are summarised in Table 1.

III. RESULTS AND DISCUSSION

The average values of water parameters at each site are summarised in Table 1. The value of physicochemical water quality parameters for river Dhela indicates poor water quality and is unsuitable for drinking purposes.

Alkalinity

Alkalinity is defined as the capability of water and wastewater to neutralize H⁺ ions. Observed values of Alkalinity for the Dhela river at different sites is

Series- E (Applied Science & Humanities) 110 MIT Transaction summarised in Table-1. The minimum value of Alkalinity for the Dhela river was 129 mg/L at site-1 and the maximum value of Alkalinity was 160 mg/L at the site-3. The maximum value of Alkalinity at the site-3 may be due to the mixing of untreated industrial effluent in the river water.

Biological Oxygen Demand (B.O.D.)

B.O.D. values ranged from 14.2 mg/lit to 19 mg/lit. Maximum values have been noticed at site-2 and lowest at site-4 as most of the waste is mix in the river between these sites. The river is severely polluted as regular addition of municipal and industrial wastes beyond the assimilating limit of the river.

Chemical Oxygen Demand (C.O.D.)

C.O.D. values ranged from 26.2 mg/lit to 37.4 mg/lit. In general, high values of C.O.D. were recorded which shows that oxidised organic matters were present in the river water which clearly shows that sewage waste and industrial effluent regularly mixing in the river.

Dissolved Oxygen (D.O.)

D.O. range from 2.7 to 3.9, and the maximum value was recorded at site-2. Dissolved Oxygen is essential for the maintenance of healthy rivers as the ability of water to sustain aquatic life is measured by DO. Low D.O. values and high B.O.D. values indicate that the mixing of sewage drain continuously contaminates river water.

Total Solids (T.S.)

A high concentration of T.S. in water reduces the euphotic zone and affect the productivity of the river and create an imbalance for aquatic life. In the present study, the minimum value is obtained at site-2 and the maximum value is obtained at site-4, which may be due to the mixing of a huge quantity of fly ash waste.

pН

The pH of river water is ranged from 7.9 to 8.4. In general, the pH values are almost the same at different sites. The high value of pH is useful for the photosynthesis reaction and the growth of flora and fauna of the water body. Therefore, amount of pH is of great importance because most of the biological processes and biochemical reactions are pH dependent.

Total Hardness (T.H.)

The observed values of T.H. for Dhela river range from 663 mg/lit to 702mg/lit. It was also observed that total hardness at different sites is almost same (Table-1). The observed values indicate that Dhela river water is very hard and exceed the higher limit of hardness by prescribed by WHO.

Site	Alkalinity (mg/lit)	B.O.D. (mg/L)	C.O.D. (mg/L)	D.O. (mg/L)	T.S. (mg/L)	pН	T.H. (mg/L)
S 1	129	14.8	26.2	3.4	620	8.2	663
S 2	151	19	32.6	3.9	407	7.9	702
S 3	160	18.6	33.9	2.7	831	8.1	672
S 4	158	14.2	37.4	3.1	847	8.4	684

Table 1: Average value of physico-chemical parameters of Dhela river

IV- CONCLUSION

The physico-chemical analysis of samples of Dhela river water was done in the present study. In Dhela river, all physico-chemical parameters were found fluctuated at different sites, and raised values of certain parameters indicated pollution in river water. The present investigation showed that the Dhela river water is not fit for the use of domestic, agricultural, and drinking purposes.

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Compositional Dependence Studies on Some Physical Parameters of Ge₁₀Bi_αSe_{75-α}Sn₁₅ Chalcogenide Glasses

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ABSTRACT- In the present article, some basic parameters have been studied for chalcogenide glasses with the variation in Bi content and therefore Se content for Ge₁₀Bi_{α}Se_{75- α}Sn₁₅ (α =2, 4, 6, 8, 10, 12, 14, 16 at. %). Almost all the parameters were found to vary linearly with change in Bismuth content. This makes them suitable for phase change optical recording devices and hence the present combination finds easy applications in rewritable optical recording devices.

Keywords- Average Coordination Number, Glass Transition Temperature, Mean bond Energy, Cohesive Energy.

I. Introduction

It is well known that chalcogenide glasses are covalently bonded materials having at least one or more chalcogens, as a result they are also categorized as covalent network solids. The chalcogenide glasses can be binary (Bi₂Te₃, Bi₂Se₃, etc.), ternary (Ge-As-Se, Ge-Se-Te, Ge-Bi-Te etc) and may be multicomponent mixtures (Ge- Bi-As-Se, Ge-Se -Sb-Te etc.).

In last few years, chalcogenide glasses have imparted a great interest, because of their unique properties. Chalcogenide glasses are also known as semiconductors having band gap ranging from 1eV to 3eV [1]-[3.] These materials are water resistance and also have very good mechanical properties like low internal stress, hardness etc. They also have properties such as high non-linearity high refractive index, low phonon energy etc. as they are having applications in various fields such as thermal imaging devices, in optical fibers in the infrared optical region, RW-DVDs, biochemical sensors, useful applications as components for lenses for infrared cameras, phase change optical switching and memories etc. [4], [5].

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taken Ge-Bi-Se-Sn based Here, we have chalcogenide glasses to study the compositional dependence on some of the physical properties. A combination $Ge_{10}Bi_{\alpha}Se_{75-\alpha}Sn_{15}$ ($\alpha = 2, 4, 6, 8, 10,$ 12,14,16 at. %) has been taken to study the physical properties like, average coordination number, glass transition temperature, cross linking density, mean bond energy, cohesive energy etc., by varying concentration Bismuth in $Ge_{10}Bi_{\alpha}Se_{75-\alpha}Sn_{15}$ composition and subsequently decreasing Se concentration.

II. MATERIAL AND METHODS

2.1 Average Coordination Number

The Phillips approach mentioned about the tendency of glass formation which is to become maximum as number of degrees of freedom equals exactly the number of constraints. Using the standard method [6], the average coordination number (Z) for the composition $Ge_{10}Bi_{\alpha}Se_{75-\alpha}Sn_{15}$ is given by

$$Z = \frac{uC_{Ge} + vC_{Bi} + wC_{Se} + xC_{Sn}}{u + v + w + x}$$

where u, v, w and x are the atomic % of Ge, Bi, Se and Sn respectively and $C_{Ge}(4)$, $C_{Bi}(3)$, $C_{Se}(2)$, $C_{Sn}(2)$ are their respective coordination numbers [9].



Fig. 1: Graph of Average Coordination Number Z with Bismuth concentration.

Fig. 1 shows that the average coordination number increases from 2.52 to 2.66 with increase in concentration of Bismuth from 2 to 16 atomic % for the Ge₁₀Bi_aSe_{75-a}Sn₁₅ system.

The glassy network has been influenced by mechanical constraints (N_c) associated with the atomic bonding and an average coordination number Z as it is also related to N_c. Two types of near-neighbour bonding forces viz. bond-stretching (α -forces) and bond-bending (β -forces) are present in covalent solids [6].

Total number of constraints is given by

$$N_c = N_\alpha + N_\beta$$

where $N_{\alpha} = Z/2$ and $N_{\beta} = 2Z - 3$

Cross-linking density (X) is given by [7]

$$X = N_c - 2$$

According to Thorpe [8], the fraction of floppy modes available in any network is given by



Fig. 2 Graph of Nc with Bismuth concentration

Fig. 2 shows the variation of N_c with Bismuth concentration for $Ge_{10}Bi_\alpha Se_{75-\alpha}Sn_{15}$ system. Here the value of N_c is found to be increasing with increase in Bismuth concentration for the taken composition.

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Fig. 3 Graph of cross-linking density X with Bismuth concentration



Fig. 4 Graph of floppy modes f with Bismuth concentration

This shows that $Ge_{10}Bi_{\alpha}Se_{75-\alpha}Sn_{15}$ is isostastically rigid and no stress is present here. It maintains the fact that here N_c (number of constraints) = N_d (number of degrees of freedom). From fig. 3 indicates that the value of X increases with increase in Bismuth concentration from 2 to 16 atomic %. Fig. 4 indicates that the negative values of f with change in Bismuth concentration from 2 to 16 atomic %. This proves the rigidity of the system, marking towards a strong tendency for making glasses [9].

2.2 Deviation from the Stoichiometry of Composition

The parameter R can be determined for $Ge_{10}Bi_{\alpha}Se_{75-\alpha}Sn_{15}$ system, by using the relation given by [10]

$$R = \frac{wC_{Se}}{uC_{Ge} + vC_{Bi} + xC_{Sn}}$$

where u, v, w, x are atomic fractions of Ge, Bi, Se and Sn respectively. On the basis of the values for R, the chalcogenide systems may be organized into 3 separate categories [11]. R=1 means the minimum selenium concentration for possibility of a chemically ordered network without a metal-metal bond formation. At R>1, the system is chalcogen rich, while at R<1, the system becomes chalcogen poor. It is quite predictable from fig.5, that our system is by far chalcogen rich. Here, the value of R is 1 at 10 atomic % of Bismuth. After that it further decreases which indicates that the system converts to chalcogen poor with the increase in Bismuth concentration. In $Ge_{10}Bi_{\alpha}Se_{75-\alpha}Sn_{15}$ with the increase in Bismuth concentration, the Se concentration decreases. So, we can predict that the system has good glassy characteristics up to Bismuth atomic 10%.



Fig. 5: Variation of parameter R with Bismuth concentration

ROLE OF LONE PAIR ELECTRONS

Pauling [12] illustrated an increase in the number of lone-pair electrons with a decrease in the strain energy in the system and showed that the structures with large number of lone-pair electrons favour glass formation. Using the following relation, the numbers of lone – pair electrons are calculated [13]

$$L = V - Z$$

where number of lone-pair electrons, valence electrons and average coordination number is denoted by L, V and Z respectively. For the present system $Ge_{10}Bi_{\alpha}Se_{75-\alpha}Sn_{15}$, the number of lone-pair

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Fig. 6: Graph of Lone – pair Electrons with Bismuth concentration

Investigators have provided separate definitions for Electronegativity. Pauling defined electronegativity as the power of a molecule or an atom to attract electron to it. Electro negativity of any composition may be defined as geometric mean of all the present constituents while forming a compound. The values of electro negativity were found to decrease with increase in Bismuth concentration from 2 to 16 atomic %.



Fig. 7: Graph of Electro-negativity with Bismuth concentration

2.3 The Mean Bond Energy and The Glass Transition Temperature

Another property of chalcogenide glass is that the glass transition temperature depends on overall mean bond energy $\langle E \rangle$. As explained by the Tichy and Ticha [14], glass transition temperature should not only be co-related with connectedness of a network, which may be to average coordination number, but it should also be well related with quality of connections. The overall mean bond energy for the present Ge₁₀Bi_aSe_{75-a}Sn₁₅system is given by

$$\langle E \rangle = E_c + E_{rm}$$

where arising from strong heteropolar bonds, the overall contribution towards bond energy is denoted by E_c , while contribution arising from weaker bonds, denoted by E_{rm} remains same even after the strong bonds have been maximized. These can be calculated by given relations

$$E_c = 4uE_{Ge-Se} + 3vE_{Bi-Se} + 2xE_{Se-}$$
 and

$$E_{rm} = \left[\frac{2w - 4u - 3v - 2x}{Z}\right]E_{Se-Se}$$

where u, v, w and x are respectively the atomic percentages of Ge, Bi, Se and Sn.

Tichy and Ticha has given an interesting correlation between mean bond energy and glass transition temperature T_g as

$$T_a = 311 [< E > -0.9]$$

here the mean bond energy is given by <E>.

It can be shown using fig. 8 that there is an increase in mean bond energy from 2.547 to 2.770 with increase in concentration of Bismuth from 2 to 16 atomic %.



Fig. 8: Graph mentioning overall mean bond energy <E> with Bi concentration



Fig. 9: Graph of glass transition temperature T_g with Bi concentration

Fig. 9 depicts the variation of the glass transition temperature T_g with Bi concentration which indicates an increase in glass transition temperature from 512.305 to 581.705 with the increase in Bismuth concentration from 2 to 16 atomic %. This increase in the glass transition temperature can easily explained by Tichy and Ticha relation in which glass transition temperature is directly related to mean bond energy.

AVERAGE HEAT OF ATOMIZATION

For ternary and higher order semiconductor materials, the average heat of atomization H_s can be defined for a compound $A_a B_b C_c D_d$ is considered as a

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direct measure of the cohesive energy and so the average bond strength, as [15]

$$H_s = \frac{uH_s^A + vH_s^B + wH_s^C + xH_s^D}{u + v + w + x}$$

where u, v, w and x denote the ratios of A(Ge), B(Bi), C(Se) and D(Sn) respectively. The values of average heat of atomization used here for Ge, Bi, Se and Sn are 376.6 KJ/mol, 207.1KJ/mol, 227KJ/mol and 302 KJ/mol respectively to determine the average heat of atomization in for the $Ge_{10}Bi_{\alpha}Se_{75-\alpha}Sn_{15}$ system.



Fig. 10: Graph of Average Heat of Atomization $T_{\rm g}$ with Bi concentration

The average heat of atomization H_s with the variation in Bismuth concentration for $Ge_{10}Bi_{\alpha}Se_{75-\alpha}Sn_{15}$ composition from 2 to 16 at % is depicted in fig. 10, which were found to be decreasing with increase in Bi concentration.

The average bond strength of the system can be measured by cohesive energy. The bond energies are assumed to be additive as per the chemical bond approach (CBA) method. [16] The cohesive energies for the $Ge_{10}Bi_{\alpha}Se_{75-\alpha}Sn_{15}$ composition with variation in Bismuth concentration from 2 to 16 at % have been measured by summing up all the bond energies over all bonds expected in the system by the relation:

$$CE = \sum C_i D_i$$

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where the number of expected chemical bonds and subsequent energy of each bonds are denoted by Ci and Di respectively. The change in cohesive energy with Bismuth concentration is shown in fig. 11 which shows a decrease in value of cohesive energy with increase in Bi concentration from 2 to 16 atomic %.

III. CONCLUSION

In the present work, we had taken a Ge- Se based quaternary alloy comprising of Ge-Bi-Se-Sn. Here Ge and Sn have been fixed at 10 and 15 atomic % respectively, and then studied the variation in some of the important physical parameters by varying the concentration of Bismuth from 2 - 16 atomic %. It has been established from the above interpretations that physical properties in this system are highly composition dependent. The Ge10BiaSe75-aSn15 glass system is of special interest because of its property to fabricate glasses over a wide domain of compositions. However, addition of Bismuth to this combination decreases the chalcogen concentration in this system. Almost all the parameters were found to vary linearly with the variation in Bismuth concentration, thus making the present combination suitable for phase change optical recording.

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