DEPARTMENT OF MINING ENGINEERING,
IIEST SHIBPUR

PRESENTS

INITIUM 2019

5th ANNUAL MINING TECHNOLOGICAL FEST

MANAS

MIND
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SPIRIT

THE OFFICIAL TECHNOLOGICAL MAGAZINE

INITIUM

SOSMINE

SME Society for Mining, Metallurgy & Exploration
IIEST SHIBPUR

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FROM THE DESK OF HOD

The mining engineering department of IIEST, Shibpur has the proud privilege of being the oldest mining engineering department of the country. The first torch bearers of mining engineering education in the country were produced by this institute. The department is committed to excel in mining engineering education and our students are highly motivated to serve the industry and work under toughest mine working conditions .Many of our alumni are eminent mining engineers of the country. As a part of our ongoing effort to expose our students to some of the renowned mining engineers, who are making significant contributions to the present mining industry, our students are organizing Tech Fest. Also as a part of the Tech Fest an inter-collegiate technical meet of Mining Engineering students from across the country is being organized. Going by our past experience we know that this Tech Fest plays an important role in grooming our students as per the requirements of the industry. By inviting students from other institute the Fest also plays significant role in fostering brotherhood amongst the budding mining engineers.

Let me hope, like previous years, this year too, INITIUM would provide a platform for exchange of engineering ideas and strengthening the bondage with mining industry as well as other mining engineering institute of the country.

I wish the tech fest all success**.**

PROF. SUDIPTA MUKHOPADHYAY

Head of The Department , Department of Mining Engineering.

FROM THE DESK OF CONVENER

The tireless effort put in by the students of the Department of Mining Engineering, Indian Institute of Engineering Science and Technology, Shibpur to provide a platform to exchange innovative ideas and to become a techno-expert. They have left no stone unturned while going from pillar to post, to reach as many industry players and potential experts. We know this tech–fest plays an important role in bringing the industry closer to the institute and the future miners. I take this opportunity to thank everyone who is directly or indirectly associated with this fest. I hope, like previous years, this year too, Initium will be a grand success and shall fill the students and faculty members with a spirit of zeal and enthusiasm.

PROF. GOPAL CHANDRA ROY

Convenor, INITIUM 2019.

FROM THE DESK OF CONVENER

It is my immense pleasure to convene the event like student technical festival "INITIUM 2019". Really, I am thrilled to accept the offer and request by my students to take the responsibility of convening the event. The vibrant enthusiasm and creativity shown by our students motivate me to spread it out to national levels. To organize this type of event would open up the platform for budding mining engineers of the department to show their potential in terms of innovation of ideas, sharing of knowledge and thoughts, event organizing and managerial capability development, the competitive mindset in front of the participants from different institutions and industries from coal and mineral sectors.

Top level intellectuals from major coal and mineral industries, will deliver special talks in the seminar to enlighten our students and other participants regarding the status of the industries in terms of technical problems, solutions, and expectations from young mining professionals. Our students and other participants would have the opportunity of interaction with high-level intellectuals from industries and practicing mining engineers in our country.

I welcome all the participants from my inner part of the heart and I do believe that we can achieve the goal if all of us could synchronize our consorted efforts, thoughts and ideas towards the goal.

I pay my immense gratitude to all the people who have contributed to its success. I would like to thank profusely to all guest judges of students' events, sponsors, cosponsors, companies, and institutions who have sent delegates and contributed towards advertisements. My special thanks to Head and my colleagues in the department, students organizing the event of our department and all others who have worked day and night to make this "INITIUM 2019" a grand success.

PROF. MD. MIRAJUL ISLAM

Convener, INITIUM 2019.

FROM THE DESK OF FACULTY ADVISOR

It gives me immense pleasure to be part of INITIUM 2019, the technological festival and seminar organized by the students of Mining Engineering at IIEST, Shibpur. This is an annual event being successfully organized over the last few years. Although, it is an ongoing process, INITIUM aims at formalizing a conclave for industry-academia interaction, where a large number of eminent professionals from Mineral and allied industries deliberate on the current developments and the future directions, which the Mining Engineers of tomorrow should be aware of to measure up to the challenges. It has been a wonderful experience working with our extremely talented students, who have slogged hard to make the event successful and hope the momentum to continue in the coming years.

PROFESSOR PRATIK DUTTA

Faculty Advisor, INITIUM 2019.

FROM THE DESK OF CHAIRMAN

Initium 2019 happens to be the fifth edition of the intercollegiate technical festival of students pursuing mining and related engineering studies in India. Held under the aegis of the Society of Student Mining Engineers,- in short SOSMINE, of the Institute, the success of the past few editions of the seminal meet has been something to rejoice.

To transform India through generating and propagating new ideas of global significance based on research and creation of risk-taking leader-managers who change managerial and administrative practices to enhance the performance of organizations has remained an ever-important cherished goal of the Department of Mining Engineering, IIEST Shibpur. Meets as these contribute significantly towards realizing these goals and ideals.

Unless young minds are oriented early towards creating knowledge through applied and conceptual research,- relevant to mining and its underlying disciplines, and to disseminate such knowledge, the dream for a resource-secured India may remain a distant proposition. As such, the idea of an intercollegiate platform for exchanging young minds has been conceived and put to practice at IIEST Shibpur. It is hoped that like previous years, this year too, the event will see a congregation of willing, energetic and innovative minds.

Let the feet-fall vibrations transform into resonating innovations.

My best wishes

PROF. INDRANATH SINHA

Chairman, INITIUM 2019.

STUDENT'S SPEAK

General Secretary SOSMINE

The department of Mining Engineering at IIEST Shibpur is one of the oldest in the country and since its establishment in 1906, it has strived hard to train undergraduate and post graduate students enthusiastically so that they can work efficiently and excel in one of the most important branches of engineering.

I, myself, have been a part of this establishment for almost four years now and have been privileged enough to see the department grow with respect to innovation and technical excellence.

This year sees the wood anniversary of the annual technical fest organised by the members of SOSMINE- Initium 2019. Started in 2012, the event has grown with leaps and bounds and since the time of its commence, it has helped in the development of a strong and useful bond between the students and the core industry. The event aims primarily at the development of skills requisite for excelling at the soft floor as well as a healthy exchange of ideas and information about latest developments.

The event, still being quite a new affair, has to face various challenges during the course of its planning and execution. The main problems faced by the organisers of the same include convincing the core companies to participate and promoting the idea of the event amongst fellow students- both inside and outside our college. But, thanks to our hardwork and zeal shown by the organising committee the event has transformed from a technical fest to an industrial conclave.

This year, we have also undertaken the initiative to develop a departmental magazine which will aid in propagating the developments in the department well as about the projects being undertaken by the students.

I hope people will appreciate the efforts of the students as well as the professors and the future generation of organisers will be inspired to work hard to take Initium to the great heights it deserves.

ROHIT ANAND

General Secretary SOSMINE, INITIUM 2019.

Student Convener

Been a part of this technical extravaganza from the past 2 editions, I have seen it grow bigger and better. This year we started early and showed positive changes, which I proudly say is an achievement for us, as an active student society and the department as a whole. Although the number of students is the least, together the potential and strength we possess are unmatched. The main challenge was to include a maximum number of companies and managing delegates from all over India, mainly to boost the deeming visibility of the department and finally to make the bond between the industry and the department a stronger one. With the formation of the Student Council, I was bestowed upon with the baton of leadership, aimed at budget growth, structured and organized core committee with a process of continuous evaluation, 10+ mining industries, reducing less effective events and concentrating more on technical ones like Industrial Case Studies and Paper Presentation, inclusion of more sponsors and partners which were never a part of the previous editions. To encourage the core committee members to maintain a decent work efficiency, we introduced The Rising Star Award for the 2nd and 1st Years and Young Leader's Award for the 3rd Year Undergraduate Students as a gesture to recognize talents and take on the baton of leadership in the successive years. We here at INITIUM 2019 believe in making changes and preparing future leaders whose contributions to the society on behalf of the department shall make us proud. As a leader, I am glad to inform that this year we have taken an initiative to execute a Mining Exhibition at INITIUM 2019, wherein the various companies will be hosting their own stalls and demonstration will be done of various working models made by our Department of Mining Engineering. I believe that we are the strongest Department as we learn from the past mistakes, work on it in the present and better the future. I appreciate the efforts my Professors, batch mates, juniors and seniors who backed me up in every situation. Thus, I welcome you all to the largest edition of INITIUM till date, THE INITIUM 2019.

SOUGATA MAZUMDER

Student Convener, INITIUM 2019.

ABOUT THE DEPARTMENT OF MINING ENGINEERING

Mining Engineering as a discipline was first started in India at Bengal Engineering and Science University (formerly, Bengal Engineering College), Shibpur in the year 1906 to meet the requirements of the statutory provision in Indian mines. After the establishment of the Indian School of Mines at Dhanbad in 1926, the entire infrastructure of this department was shifted there. However, after independence, Dr. B. C. Roy, the then Chief Minister of West Bengal, took a personal interest in revamping the department to satisfy the growing demand of qualified mining professionals, and the Department of Mining & Geology was re-born in 1956. In 2005 the Geology section was separated and the department was renamed as the Department of Mining Engineering**.**

Mining Engineering as an engineering discipline involves the practice, the theory, the science, the technology, and application of extracting and processing minerals from a naturally occurring environment. Mining Engineers provide fundamental inputs to the development of society in the form of raw materials required for energy production, steelmaking, manufacturing of cement and other vital ingredients like copper, aluminum etc. The job a Mining Engineer is very diverse and challenging in nature. Mining Engineering graduates from IIEST, Shibpur are trained to be amongst the best in the world and are in great demand in the industry.

VISION:

To be recognized nationally and internationally as one of the leading institutes in research and providers of quality engineers in the field of Mining Engineering

MISSION:

To impart quality education and training to undergraduate, postgraduate and dual degree B.Tech-M.Tech students in Mining Engineering so as to prepare them for the industry and higher studies. The department actively encourages excellence in teaching, multidisciplinary research, collaborative activities and positive contributions to society.

The Department of Mining Engineering at IIEST, Shibpur was the pioneer in imparting Mining Engineering education in the country. Today, it stands as one of the most diverse and vibrant departments encompassing all disciplines within Mining Engineering and associates areas. Our students are trained in sound fundamental theories in engineering backed by state-of-the-art laboratory and computational facilities. The department has regular intense interactions with the industries, which help the students to get abreast with the latest developments.

We have one of the most diverse blends of faculty members available anywhere in the country. In addition to their excellent skills in teaching, they have excelled in diverse multi-disciplinary research areas. These include Geomechanics, Coal bed methane, and shale gas extraction, Carbon sequestration, Safety & Ergonomics, Remote Sensing and Geographical Information System, Mineral Beneficiation, slime Waste Management. The Faculty members have secured research grants worth a few crores over the last few years from agencies like Department of Science and Technology, Ministry of Coal, Department of Space, Ministry of Environment and Forests, University Grants Commission, and British Petroleum etc.

In addition, a number of industrial consultancy projects have also been taken up. The Department is also actively involved in arranging seminars and short-term courses for the dissemination of knowledge in various fields.

Lastly, the students are our strength. The high quality of our students is amply manifested by their excellent performance in the Industries. They are in high demand for employment in various top mining companies in India. They also maintain a very dynamic environment in the department and regularly undertake many challenging activities. They have earned numerous laurels while participating in different technical festivals across the country.

ABOUT INITIUM

INITIUM- The Annual National Technological Festival of The Department of Mining Engineering, IIEST, Shibpur was started in 2012 and this year we will be celebrating its 5th edition in 2019. It has been a milestone as we the students work truly hard to ensure good participation as well increase interactions as much as possible. The events took place has always been oriented towards the development of skills necessary for both in and out of the curriculum. This festival has been a bond between the Industry and the Institute and thus forms the main stepping stone for participating in the "BEST STUDENT CHAPTER" competition on the global stage.

We had eminent Guest of Honours and Lecturers from the industry during our inauguration ceremony at INITUM 2018. Their presence surely added to the glory and success of our INITIUM 2018. The patiently waiting participants in the hall brimmed with zeal, slowly turned into a round of applause as the delegates marked their presence at The inauguration ceremony of INITUM 2018.

NUMBER OF EVENTS WERE HELD IN INITIUM 2018. FOLLOWING IS THE LIST-

- **CASE STUDY**
  The event focused on highlighting the technical excellence of the students and their ability toapply them in solving a practical problem related to the field of mining engineering. This eventwas highly dominated by the students of IIEST, Shibpur and was really a matter of pride toannounce the winners:

- **PAPER PRESENTATION**
  This event aimed at focusing on the research ability and the presentation of those results in thegrand platform. With competitors filled with passion we were proud to provide a platform tothe budding mining engineers to showcase their talents.

- **GEOBOTICS**
  This event aims to bring out the practical application of the theoretical knowledge of Physics,Math in the mode of Robotics. Our main aim was to find out the best bot which can completethe assigned task, related to mining engineering. Technical efficiency, time required tocomplete the task, design, innovations and understanding the problem statement were the main criteria of judgement of this event.

- **INDUSTRIAL DESIGN PROBEM**
  This event was highly successful with two rounds to ensure best participation. The first roundtested aptitude whereas the qualifiers in the next round had to prove their mettle in the field of application of mining knowledge to solve an industry oriented problem to make production easier.

- **SURVEY**
  The skills of surveying in Mining Engineering certainly contributes to the quality of theu pcoming mining engineers. This event gave participants the chance to showcase their mettle n surveying according to the giving conditions and find out results as accurate as possible**.**

LIST OF THE WINNERS OF THE FLAGSHIP EVENTS

SL. No.	EVENTS	WINNERS
1	Case Study	1. Sourav Chal, IIESTS 2. Pratyusha Chowdhury, St. Xaviers, Kolkata 3. Sougata Mazumder, IIESTS
2	Paper Presentation	1. Priyanshu Keshri, IIESTS 2. Arpit Srivastava, IIESTS 3. Nabyendu Neogi, IIESTS
3	Geobotics	1. Soham Shailesh Dhande, IIESTS Subhechchha Paul, IIESTS Tathagata Saha, IIESTS Ipsita Das, IIESTS Anjishnu Mukherjee, IIESTS 2. Aniket Haste, IIESTS Nand Kumar Nitesh, IIESTS Angshuman Ray, IIESTS Kumar Suryamauli Shah ,IIESTS Manab Mandal, IIESTS 3. Souvik Ghosh, IIESTS Anirban Majumdar, IIESTS Subid Majumdar, IIESTS Sagnik Acharya, IIESTS
4	IndustrialDesign Problem	1. Gaurav Mukherjee, IIESTS Aranya Ray, IIESTS Anirban Paul, IIESTS Arka Mandal, IIESTS 2. Arpit Srivastava, IIESTS Priyanshu Keshri, IIESTS 3. Arunava Mondal, IIESTS Saurabh Kumar, IIESTS Soumik Dhar, IIESTS
5	Survey	1. Sanjeev Kumar, IIESTS Abhishek Singh, IIESTS Rohit Kumar, IIESTS Mohit Durgekar, IIESTS 2. Adnan Qumar, IIESTS Priyanshu Keshri, IIESTS Anil Singh, IIESTS

GLIMPES FROM THE INITIUM 2018.


IIEST, SHIBPUR
INITIUM

LIST OF GUEST FROM ACADEMIC AND INDUSTRY

SME IIEST STUDENT CHAPTER

- **Guest of Honours**

  - **Shri. SUBIR DAS**
    [Director Technical (Mines), NLC India Ltd.]
  - **Shri. ANUPAM BAGCHI**
    [Senior Vice President, HINDALCO]
  - **Dr. SUJOY MAJUMDER**
    [Deputy Coal Controller, SCCL]
  - **Shri. KALYAN HAZRA**
    [Vice President, JMS Pvt. Ltd.]
  - **Shri. DEEPANKAR BANERJEE**
    [Chief Operating Officer, TIPL]
  - **Dr. PRABHAT .KUMAR MANDAL**
    [Senior Principal Scientist, CSIR-CIMFR]
  - **Shri. ARKA JYOTI DAS**
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2.	Gobardhan Nayak
3.	Janardan Kar
4.	Prasanta Gope
5.	Saibal Ghosh
6.	Sanjoy Ghosh
7.	Sandipan Patra

INITIUM CORE COMMITTEE MEMBERS

Following are the members of the committee without which this would not have been possible.

COMMTTEES	HEADS (3rd Year)	ASSOCIATES (2nd Year)
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PAPER 1- IoT APPLICATION IN THE MINING INDUSTRY

Swapnaneel Bhuiya[1], Aranya Ray[2]

Department of Mining Engineering

Indian Institute of Engineering Science and Technology, Shibpur, Howrah (W.B), India

ABSTRACT

Human beings cannot be happy with any kind of tiredness based work, so they focused on machines to work on behalf of humans. The Internet-based latest technology provides the platforms for human beings to relax and unburden feeling. The Internet of Things (IoT) field efficiently helps human beings with smart decisions through Machine-to-Machine (M2M) communication all over the world.

According to condition that safety situation of national coal mine production remains serious, and serious accidents have not been effectively curbed, current status of safety supervision information is analysed. Through introducing concept of Internet of Things (IOT), view of using IOT to help safety supervising authorities of coal mine strengthen supervision on enterprises implementing principal responsibility for safety along with specific application of IOT in safety supervision of coal or metal mine can be undertaken.

Program of networked remote inspecting technology on basis of IOT provides a new way for innovating supervising way, thereby working effectiveness of supervision against coal mine can be enhanced, and serious situation of safe production in coal mines can be improved, finally safe and stable development of both the coal industry as well as the metal industry can be further promoted.

Keywords: IoT, Machine to Machine Communication, coal industry, metal industry, safety, supervision, stable development.

1. INTRODUCTION

The term “Internet of Things (IoT)” acts as an umbrella keyword that covers the various features such as the extension of the internet, the web as physical realm, deployment of extensive embedded distributed devices, sending and the actuation abilities. The term IoT is also called future internet.

The IoT four key technological enablers are: -

- For tagging the things RFID technology is used
- For sensing the things sensor technology is used

- For thinking the things smart technology is used
- For shrinking the things Nanotechnology is used

The IoT devices have border vision which covers several services, consisting of earthquake monitoring systems, building health system, landslides detection, energy management (smart parking and lighting), automation of public building and air quality of noise monitoring system. The IoT is a fusion of heterogeneous networks including chip technology that scopes gradually more and more, expanding due to the rapid growth of internet applications such as logistics, agriculture, smart community, intelligent transposition, control and tracking systems.

2. BACKGROUND

The mining industry has been facing significant headwinds lately. Low commodity prices, increased environmental requirements, and greater haulage distances are all pressuring profitability. Replacement rates of large and long-life deposits are declining and the lead times to develop greenfield sites are, at the same time, increasing. Add skilled labour shortages into the mix and it's no wonder the industry is feeling squeezed.Several technologies are available, or under development, to help mining companies face these challenges. Some have been around for years but they are only just becoming economical enough to rollout. Increased mechanisation, optimised equipment and material flow, and real-time performance monitoring are only a few of the initiatives.

3. LITERATURE REVIEW

IoT can be applied to the mining industry in several ways due to its wide application and benefits. It can be applied in data integration from an increasing number of sources enables mining companies to plan mines and future operations with unparalleled accuracy. It can be applied for unmanned vehicles. Driverless mine vehicles operate autonomously. Some don't include a cab, meaning it's not even possible to ride on board. These GPS-powered vehicles can fully interact with each other to minimise delays and fuel costs. Today, one mining giant has these trucks hauling iron ore 24/7 at mines in Australia. It can be used for predictive maintenance as predictive maintenance technologies help determine precisely when equipment will need maintenance.By combining analytics with inventory management, companies could ensure inventory is stocked on a just-in-time basis, in just the right quantities thereby improving inventory management. Finally, technologies such as cloud-based logistics and load-sharing platforms can enable mining companies to optimise their supply chains. Companies can use digital tools to execute and manage sales contracts, determine price in real-time, and manage inventories and product flows in ways that control for risks and optimise costs.

4. THEORY

The system layout of a basic IoT network in a mine mainly consists of three layers namely the perception layer, the network layer and the application layer. In the perception layer the waste materials from the waste dumps and other sources are transported either to the treatment plant or to the disposal facilities. Dumpers are responsible for the transportation processes. In order to implement IoT in a mine all the devices and machines are connected together with the help of RF trans-receivers. The

trans-receivers send and receive signals at regular interval form the central computer as well as from other set-ups present on different devices.

In the network layer, the data received from the perception layer is now stored in the Internet belonging to the Network layer. From here the data can either be transferred to the cloud storage from where it can be accessed by different gadgets or to the semantic web network. From the Network layer the data is transferred into the Application layer where it is processed as per the user need. The data from the network layer either enters for the Data Product and Handling or it is sent for the Data Mining. The Data Mining comprises of an array of applications and processes which are discussed in the later part. From Data Mining the information is sent for Data and Knowledge Utilisation. It comprises mainly of three parts, i.e. System Engineering and Analysis, Decision-making Analysis and Artificial Intelligence.

IoT can be implemented in the mining industry in the following mentioned ways:

- Use Sensors to Move Toward Proactive Maintenance.
- Carry IoT capabilities into other areas by enabling remote control of certain heavy equipment by combining the operational technology that physically controls machines with IoT systems. Secondarily, the IoT can help companies identify the root cause of a performance issue, even if it originates in another asset or department. If a conveyor belt slows down, technicians are likely to only make adjustments at the belt.
- Enable Real-Time Analysis: By switching to real-time analytics, organizations can achieve operational awareness as the data is being collected.
- Consider Increased Autonomy and Smart Machines: Remote control of machinery or vehicles has delivered safety and production boosts in mining. Another use of IoT-related technology and real-time data analysis is autonomous smart machines.
- Plan for a Machine-Only Future: Finally, nearly every industry foresees more people-less operations. Mining companies still require many employees on-site for now, but they're heading toward a machine-only future.

Further applications include:

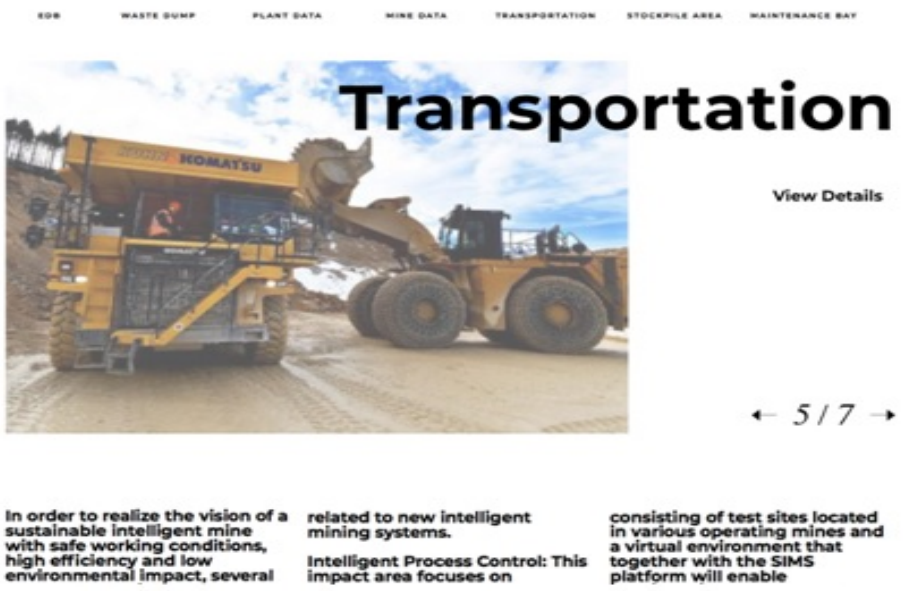
- Tracking supervision of underground personnel
- Monitoring and warning of environment
- Monitoring and warning of device
- Supervision of management

5. CONCLUSION

We conclude from our project that the implementation of IoT in mining activities can be of greater advantage as all the systems will be connected with one another and this will help us to monitor the various activities from a single central computer location. **We have also proposed** the design of a website which will be having the template that will connect different aspects that are necessary for the

running of the mines in a more economically profitable way. The website will be including Employee Data Base, Waste Dump site, Plan Data, Mine Data, Transportation units, Stockpile Area and Maintenance Bay. The website will accumulate all the data from different activities and sources which

will then be processed by the central computer and then can be displayed on the operator's screen from where it can be monitored. Use of IoT in mining industry will drastically reduce the number of accidents as well as the cases of machine failures thus protecting both human lives and economic resources. The Fleet Management System can easily reduce the ideal time thus increasing the annual ROI of the mines. Adopting IOT technology for remote dynamic supervision, coal mine supervising pattern can be innovated, tracking inspection on illegal action can be achieved, capabilities of emergency response and accident investigation can be increased, situation of safe production can be further improved, and safe and stable development of coal industry can be promoted.



As we can see from the above picture the final view of our webpage would appear as above. We can see the various parts of the webpage that we can access to view our information for different sites, the whole mine and for local operations. The different sections have their following purposes:

1. **EDB**: The Employee Data Base can be accessed to view information regarding the employees, their names, area allocated to work, duties, salaries, attendance, work efficiency and so on by connecting the on site data reader like fingerprint scanner and ID reader through the internet to this central computer where the information will be connected and displayed once clicked on the menu.
2. **Waste Dump:** Here all the information regarding waste dump site like waste deposited per hour, over load or under load condition, disposal rate and much more can be obtained by interconnecting the devices present there for local collection of information through the internet to the central computer.

3. **Plant Data:** Plant data bar will help us access the necessary details regarding various plants like the crushing plant, Ore processing plant, waste treatment plant and more, and will also help us determine the working conditions of the various equipment being used in the mines and notify against any failure.
4. **Mine Data:** Here we can access the details related to amount of excavation being carried out per day, blasting information, any geological disturbance creating work hindrance, mine progress as a whole, ore deposits and much more.
5. **Transportation:** This will help us implement dynamic allocation and real time data analysis of the various machines being used and help us achieve optimal match number to eliminate mismatch using GPS and LPS system in the machines and mines. This will also incorporate the GOIC system in trucks.
6. **Stockpile Area:** This will help us access information related to the stockpile area, like the ore deposited, transported, quality, condition of bunker equipment like stacker, and so on.
7. **Maintenance Bay:** This will help us access information regarding the maintenance of vehicles, their availability, condition, requirements to be fulfilled for full repair and so on in the maintenance workshop.

6. REFERENCES

1. Zhang Y., Fu Gua., Zhao Zhg., Huang Zhi., Li Hong.,Yang Ji., 2012. “Discussion on Application of IOT Technology in Coal Mine Safety Supervision,” International Symposium on Safety Science and Engineering in China, 2012 (ISSSE-2012), pp.233-237

2. Bandyopadhyay D., SenJ., 2011. "Internet of things: Applications and challenges in technology and standardization," Wireless Personal Communications, vol. 58, pp. 49- 69.
3. Sun, JP., 2011. “Research on Characteristics and Key Technology in Coal Mine Internet of Things,” Journal of China Coal Society 36, pp.167-171.
4. Singh D., Tripathi G., and Jara A. J., 2014."A survey of Internet-of-Things: Future vision, architecture, challenges and services," Internet of things (WF-IoT), 2014 IEEE world forum on, pp. 287-292.
5. Srivastava L. and Kelly T., 2005. "The internet of things," International Telecommunication Union, Tech. Rep, vol. 7.

PAPER 2- Mining Subsidence and Displacement Prediction using Influence Function Methods

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ABSTRACT:

Surface subsidence is recognised as a problem in most countries. Subsidence is usually associated with underground mining operations even though in several cases subsequent surface subsidence may not be of any significance. There are also many areas possessing a history of past mining, and the stability of the surface in respect of existing and future structures and particular land uses is frequently questioned.

This report addresses the problems relating to subsidence whether caused naturally, or arising from mining or other forms of underground extractive activity and he prediction of subsidence, particularly its occurrence and general characteristics by using influence function and computer programming simulation.

INTRODUCTION:

There are many methods of subsidence prediction available, each having particular advantages and disadvantages. The best method for coping with non-rectangular workings involves the categories of influence functions and zone area methods. Main objectives of this work was to expand subsidence prediction to include Displacement prediction.

LITERATURE REVIEW:-

The principal method of underground coal extraction is room and pillar mining, although longwall and some special methods of thick seam extraction have also been practised to some extent. Room and pillar mining often gives rise to extraction panels of irregular shapes making subsidence predictions difficult because all earlier empirical approaches have been two-dimensional.

The classical method, however, requires some modifications to suit the observed subsidence behaviour. Given in the following pages, are the salient findings from subsidence observations in India, followed by a modified influence function method. These subsidence studies were carried out largely over room and pillar panels, although some longwall panels were also covered.

THEORY:

There are many kinds of influence functions:

(1) Stochastic influence function:

$$K_z = \frac{1}{R^2} e^{-\frac{\pi r^2}{R^2}} \quad (1)$$

R = the radius of influence circle, and
r = the radial distance from point P.

(2) Bals' influence function:

$$K_z = \cos^2 \zeta \quad (2)$$

ζ = zone angle (Fig. 1), which is in the range of $0 \leqslant \zeta \leqslant \theta$ (angle of draw)

(3) Scanns' influence function:

$$K_z = 2.256 \frac{1}{r} e^{-4r^2} \quad (3)$$

(4) Ehrhardt and Sauer influence function:

$$K_z = 0.1392 e^{-0.5r^2} \quad (4)$$

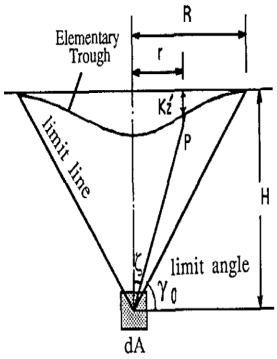

Fig. 1. Influence function definition: extraction based.

Subsidence in terms of maximum subsidence can be stated by the equation:

$$S(i) = S/S_0 = \int_A \int K_z dA$$

The stochastic function for example, gives:

$$S(i) = \int_A \int \frac{1}{R^2} e^{-\frac{\pi r^2}{R^2}} dA$$

As demonstrated in Fig. 3, if 'A' represents the area of the annular r_1 to r_2, (integration was changed into polar system) it gives:

$$S(i) = \int_A \int \frac{1}{R^2} e^{-\frac{\pi}{R^2} r^2} r d\theta dr$$

$$= \int_0^{2\pi} d\theta \int_{r_{i-1}}^{r_i} r \frac{1}{R^2} e^{-\frac{\pi r^2}{R^2}} \, dr$$

$$= e^{-\pi\left(\frac{r_{i-1}}{R}\right)^2} - e^{-\pi\left(\frac{r_i}{R}\right)^2} \quad (6)$$

CONCLUSION:

The influence function/zone area method can be applied and adjusted to produce results in Indian conditions for both subsidence and displacement. . Of all the different tools available for subsidence modelling, the influence function method with suitable modifications appears to be a powerful method for complete subsidence prediction for all shapes of extraction panels. This method, in its classical form, consists of laying a surface grid of square elements overlapping the panel up to the draw limits. An influence circle, subdivided into a sufficient number of rings and sectors, gives the subsidence at the grid point which is the sum of the weighting factors of all the sectors falling within the extracted area. The weighting factors are derived from an axisymmetric influence function of bell shape covering the influence circle. The classical method, however, requires some modifications to suit the observed

subsidence behaviour. The line demarcating the limit of discontinuous Subsidence has been given for single seam as well as multi-seam cases, but it is felt that the thickness of unfractured rock in relation to the total depth in multi-seam cases will probably make some difference to this limit.

REFERENCES:

[1.] National Coal Board, Subsidence Engineers' Handbook, NCB Publ., Hobart House, London, 1966, rev.1975.

[2.] China Institute of Mining Technology, Mining Rock Behaviour and Ground Movement, China Coal Industry Publ., Peking, 1981.

[3.] B.N. Whittaker, D.J. Reddish and D. Fitzpatrick, Calculation by computer program of mining subsidence ground strain patterns due to multiple longwall extractions, Mining Science and Technology, 3 (1985):21-33.

[4.] H. Kratzsch, Mining Subsidence Engineering, Springer-Verlag, New York, 1983. [5] Ren G, Reddish DJ, Whittaker BN. Mining subsidence and displacement prediction using influence function methods. Min Sci Tech 1987;5:89–104.

PAPER 3: 3D Capacitive tracking interface for Indian Underground mines

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Abstract:

Mining, since age-long has been the backbone of the economy of majority of the principalities and has thereby supported it vehemently. With passing time, technology has grown at an extremely rapid pace. This requires a subsequent advancement in the technologies used in our mines too. One of the major challenges of working in the Indian underground mines is the geological condition of the mines, most importantly the gassiness, which makes a substantial number of mines prone to dangerous hazards. All these need to be tracked down in order to ensure the safety of those risking their lives and working inside. Hence, it has become quite essential to know the exact conditions prevailing underground and dealing with the associated problems by acting according to the plans which must be initiated at the surface itself. With this comes the importance of knowing the whereabouts of the workmen underground and the progress of the work that has been carried out. RFID has achieved success in counties abroad, but in India conditions are different. Using waves which emit signals at a frequency greater than 20000Hz can cause a mine to catch fire, so to resolve this, an electrically controlled system needs to be developed which can do the job for us. For this purpose, this paper would deal with that electrical analogy which with the help of capacitive fields would be able to track the location of the workers and would also help in assessing the running health of the mines, all of this, from the surface.

Keywords: Geological condition, hazards, gassiness, RFID, underground, surface.

1.INTRODUCTION:

A touchless 3D tracking interface that can track position of an object and show it on a computer using a graphical user interface. We make use of Arduino, an open-source prototyping platform-based board to make a simple capacitive sensor.

1.1 Understanding the problems:

- Surveillance has not yet been made available for underground Indian Mines. Why? Is it because of lack of technology?
- There are systems available for tracking each and every mining personnel working inside the mine but all of these depend upon the geophysical conditions.
- No safety provisions can guarantee results unless and until people assure themselves abiding by the rules.

1.2 **Project Objective:**

- Protecting resources and workers against possible accidents and maximizing their utilization through real time location monitoring and controlling. This can improve the safety of those working underground and productivity, to a great extent.
- Developing a prototype, similar to the existing ones at a much lesser capital investment

1.3 The Prototype:

Nearly all sensing of this kind depends upon how long it takes a capacitor to charge (known as the **time constant**). Placing an object within the electric field of a capacitor will affect the capacitance value and the corresponding time constant.

Using each face of the open cube we compute the time it takes to charge the capacitor. The charge time follows a power law relative to the distance of the object. After we have computed the distance of the object from each of the three points, we can use Cartesian Coordinate System to locate the object in space.

This system, currently in use in medical science, can be made to work in order to track the location of an object entering into the field generated by the capacitive plates, if, coupled with an appropriately strong magnetic sensor, which canbe attached to any essential equipment that the worker carries underground.

2. CONSTRUCTION:

2.1 The Interface:

A 3D open cube interface can track the position of a moving object **without using a camera**. As the object moves in the sensor cube, the coloured sphere follows along on the screen.

Each dimensional plate acts like a capacitor that can store charge when a voltage is applied to it. Each plate is attached to a different pin on Arduino microcontroller which provides the voltage and current to charge the plates.

As the object approaches the plate, it gets electrically coupled with the plate and changes its capacitance. The higher the capacitance, the longer it will take for the plates to be fully charged.

The software of the Arduino measures the time it will take for the capacitor to get charged.

The change in charge time corresponds to the distance of the object from the plate. By adding a plate for each dimension and measuring them in turns, we can establish the object's position in 3 dimensions.

2.2 CAPACITIVE SENSING

Capacitive sensors can directly sense a variety of things—motion, chemical composition, electric field—and, indirectly, sense many other variables which can be converted into motion or dielectric constant, such as pressure, acceleration, fluid level, and fluid composition. They are built with conductive sensing electrodes in a dielectric, with excitation voltages on the order of five volts and

detection circuits which turn a capacitance variation into a voltage, frequency, or pulse width variation. The range of application of capacitive sensors is extraordinary.

The capacitance size (Fig:2), C is determined by the size of their plates, A and the distance, d between each other. The formulation of this concept is shown in Equation

$C = (\varepsilon_0 A)/d = (k\varepsilon_0 A)/ d$

where: $\varepsilon_0 = 8.854 \times 10{-}12Fm{-}1$;

permittivity of space k = relative permittivity of the dielectric material between the plates and k = 1 for free space, whereas k > 1 for all media

The hypothesis is that the capacitance is directly proportional to the sensor area and the dielectric property of material. For increasing the sensitivity, flatter plates can be constructed.

Nearly all sensing of this kind depends upon how long it takes a capacitor to charge (known as the time constant). Placing an object within the electric field of a capacitor will affect the capacitance value and the corresponding time constant.

Using each face of the open cube we compute the time it takes to charge the capacitor. The charge time follows a power law relative to the distance of the object. After we have computed the distance of the object from each of the three points, we can use Cartesian Coordinate System to locate the object in space.

This system, currently in use in medical science, can be made to work in order to track the location of an object entering into the field generated by the capacitive plates, if, coupled with an appropriately strong magnetic sensor, which can be attached to any essential equipment that the worker carries underground.

3. HYPOTHESIS

3.1 Installation:

- ✓ **At haul roads:**

A rather more rigid material, constituted of Aluminium foils will be installed at timber props erected for support along the roadways (Fig1).

This type of two timber props will behave like two capacitive interfaces for our system and at each pillar there will be three such types of plate interfaces and this combination will be continued throughout the haulage roadways. Now these capacitor plates will be connected in parallel combination through the underground sheathed cable laying providing a potential difference of 5V across all plates to each such set. Now, all these sets connected in parallel, will behave like a series of 3-D interfaces surface, with a set of 2 such interfaces facing each other. Each capacitive interface will give the specific location of an object (worker with a mildly strong magnet attached to his helmet or heavy machinery) passing through this 3-D interface and the real time data will be sent to central computer which could monitor the entries and exits in haul road or, can track the position of worker working in a specific panel. Electric supply to this system is provided through the step-down transformer underground.

Only 1 Arduino can be used to couple all these capacitor plate which would record the real time data of each plate and the same will be stored in the central computer in the form of binary data, wherein the locations will be tagged in the same manner as is used for the nomenclature of the pillars in a panel. This system will even help us in monitoring the maintenance work at haul roads, where we can ensure that no haulage towards inbye or outbye side takes place while maintenance work is going on.

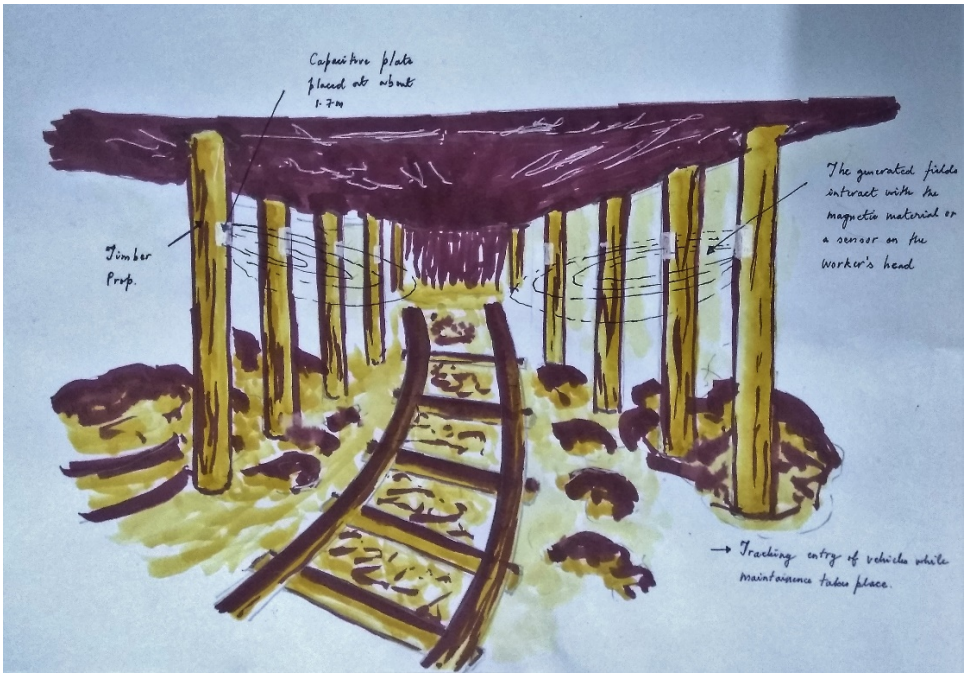

Fig 1: Installation on props

- ✓ Near depillaring faces:

This system can be installed at de-pillaring faces where the timber props are removed one by one. This can be used to measure the goaf line velocity wherein, the difference in distances between the props nearest to the goaf will be taken. With this, we could also track any unwanted entry in goaf area, prior to installation of skin to skin support. We can install this system for the purpose of warning against any entry in goaf area as installation of skin to skin support will take time and any entry in such area may cause accident due to unwanted roof fall. This will track the movement of worker in the goaf area and automatically sound the alarm connected to the system so that no one could enter into the area and in this way, it can be installed as a safety device to curb any accident due to roof fall.

3.2 Making the device work:

It works on principle of charging time of a parallel plate capacitor (basically a series R-L-C Circuit).

Each set of two-timber props where aluminium foil is incorporated, works as set of two 3-D capacitive interfaces.

When any object passes through it, it makes a separate plate with that object and based on the distance from each capacitive plate, it takes different time to get charged. The time constant can be calculated

for a 63% charged capacitor and by knowing the charging time we can calculate the distance of that object from each interface, and hence locate the position of the object.

As the object moves, it makes a capacitor pate with different set of interfaces and relatively, takes different time to get charged and this movement can be traced on central computer which is connected through Arduino, having a pre-installed processing software which can generate blocks which constitute the 3-D interfaces. Since we are providing only 5V dc supply and since the size of aluminium sheet is not very large, there will not be any problem of charge leakage. The series of such capacitive plates makes a complete 3-D interface throughout the mines dividing it into a specified no. of blocks.

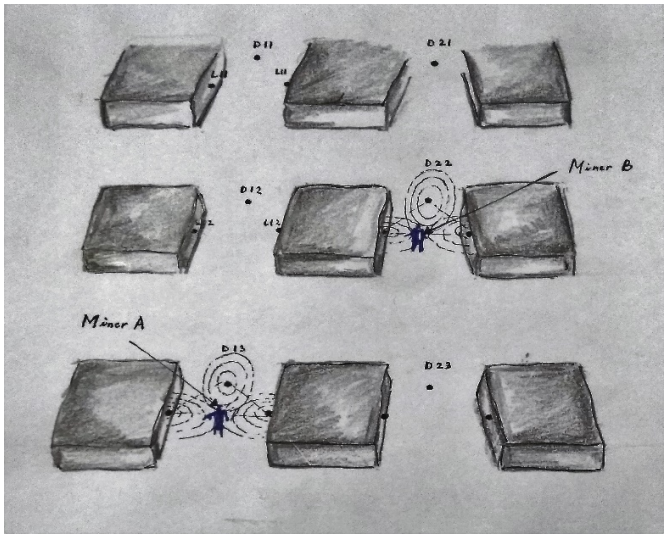

Fig 2: Interaction of the Fields with the sensors

3.2.1 'Principle' of Working:

Using a small magnetic sensor placed on the roof of the haul road with the 3-D interface, we will magnetically couple the system with the helmet of the worker and as the person will move through haul road this considerably magnetic metallic material (or another small magnetic sensor) will get coupled with the magnetic field generated by the sensor that uses an in-built inductor (Fig 2).

The Electromagnetic Field, generated due to the series R-L-C circuit, gets distorted when a material, considerably active magnetically, comes into the range of the field created by the RLC circuit. The amount of distortion is maximum when the person is directly below the magnetic sensor placed above. Its working can be associated with the working of a Magnetic Locator.

The use of this system as a series R-L-C circuit, not only will enhance the sensitivity and accuracy of our system but also will give short time backup for capacitive sensor as, even in case of a power failure,

the current will continue to flow, for a short duration, due to back emf induced in the inductor of RLC circuit.

4. APPLICABILITY IN UNDERGROUND MINES:

- Time & Attendance: The reporting of personnel times and exact locations within a production area can facilitate big improvements in the effective and efficient deployment of miners underground. By integrating a person's competency requirements, the system can ensure that personnel only enter into areas or undertake tasks for which they have sufficient and up to date induction, training and accreditation. Exception reports and reminder renewal notices can be automatically generated and transmitted.

- In Haul Roads: It can be used to track the location of workers which are in haul road maintenance purposes, thereby saving them from any accidents due to haulages or locomotives or any other moving machinery.

- In Travelling Roadways: It creates a capacitive field which can track the position of workers and displays their respective positions on the system which is installed at mine office.

- Restricting unauthorised entry in mines It can be successfully used to restrict any unauthorised entry in the goaf areas where there is a huge risk of fatality due to poisonous, toxic and inflammable gases. There are certain places in mine where entry is not permitted such as any fire prone area, old abandoned area, explosive area (magazine).

- Measuring Goaf Line Velocity: From the distance measurement between two successive goaf line during depillaring operation in a certain period goal line velocity can be easily found out.

- In small mines: As it is cheaper and requires least maintenance cost which make it price effective to be installed in any small mine where RFID installation is not cost friendly.

- Emergency Mustering: In an emergency the ability to quickly locate personnel in the underground coal mine ensures safe and thorough evacuations, and supports fast and targeted search and rescue operations.

5. FUTURE PROSPECTS IN VIEW OF 'AUTOMATION OF MINES'

From the perspective of providing wearable devices for mine workers to improve safety, this study proposes a wearable safety management system for miners. The system includes the combined utilization of several wearables and is intended to improve safety, provide hands-free operation, and help monitor occupational health. The system consists of the following: a sensor-equipped safety vest, smart eyewear, a smart helmet, and a commercially available Android system smartwatch (Fig 3). The proposed system can be expanded by additional sensors or electronic equipment, or reduced in complexity according to the specific needs of the worker and mine operations.

PAPER 4: CBM ESTIMATION AND IMPROVING METHODS OF MEASURING LOST GAS

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ABSTRACT:

Coal Bed Methane produce during the coalification CBM is clean natural gas as its combustion produce no toxin less co2 and ash.CBM is mainly produce due to microbial or catalytic degradation of organic matter present in the coal seam and contain mainly methane, co2 and other hydrocarbon.CBM reserve estimation is done by determining the lost gas, desorbed gas, residual gas.The main problem with the accuracy of reserve estimation is that the in proper determination of the quantity of the lost gas volume which can me methodologically change to get better result

LITERATURE REVIEW :

- WHAT IS CBM: Coal Bed Methane produce during the coalification and per cubic feet concentration of methane in coal is greater than that of sandstone reservoir. And generally higher grade of coal and deeper seam has more methane than others. The gases generally occur in pockets and release in atmosphere during mining activity or processing, in some case the gas is extracted or ventilated from the virgin coal seam by drilling well into it. CBM is clean natural gas as its combustion produce no toxin less CO2 and ash. CBM is mainly produce due to microbial or catalytic degradation of organic matter present in the coal seam and contain mainly methane, co2 and other hydrocarbon. There are mainly three types of CBM is there; biogenic, thermogenic and mixed origin. Biogenic CBM is mainly produce by degradation of organic matter by microorganism at low temperature (Scott et al.1994). Thermogenic CBM mainly occur due to chemical degradation and thermal breaking at high temperature (Haunt,1979). thermogenic CBM is found mainly in deeper and thermally stable coal seams therefore higher rank of coal has more gas content than the lower one. The origin of CBM plays an important role for determining the type of extraction strategy to be used. As in case of biogenic gas it can found in the shallow seam at lower temperature with greater fractures for faster extraction where thermogenic gas occur in deeper seam and with more constrained network of open fractures
- CBM RESERVE ESTIMATION :Gas is put away in coalbeds in a way unique in relation to traditional reservoir.The volume of gas sorbed inside the micropores of coalbed gas supplies. The most commonly used gas content determination methods subdivide the total gas content of a coal sample into three parts: lost, desorbed and residual gas.

G=VR+VD+VL

Where

G = gas content of the coal in the formation, scf/ton

VR = residual gas of core, scf/ton

VD = gas released (desorbed) by the core in the canister, scf/ton

VL = gas lost from the core in the coring process, scf/ton

Each of these parts is generally measured or estimated by a different procedure, and then combined to 'yield the total gas content of the sample.

- Lost gas

The lost gas is that bit of the aggregate gas that escapes from the sample amid its accumulation and recovery preceding being fixed into a sealed shut desorption canister. Lost gas are coalbed gas reservoirs that are not water-saturated, which contain bigger volumes of free gas. Some segment of this free gas will avoid amid test recovery and won't be represented by lost gas estimation approaches dependent on diffusion of desorbed gas.

- Desorbed gas

Once a coal sample is sealed in the desorption canister, the desorbing gas accumulates and can be measured directly,.

- Residual gas

The volume of gas desorbing from a coal sample gradually declines with time. Desorption measurements for the extended desorption techniques are terminated at some point when an arbitrary low desorption rate is reached. This rate may be reached in a matter of days for very friable samples or can take months for some blocky coals. Generally, when the desorption rate reaches an established termination point, some volume of gas remains in the sample.

PROBLEM STATEMENT : The Canister Method is a very crude method to follow keeping in mind the advancing technology and the increased need to extract Coal Bed Methane in a sustainable manner. The total gas content in the working seam is calculated as the summation of lost gas, desorbed gas and residual gas. There is a pressing need to see the parity between the values of estimated lost gas through extrapolation and laboratory methods.

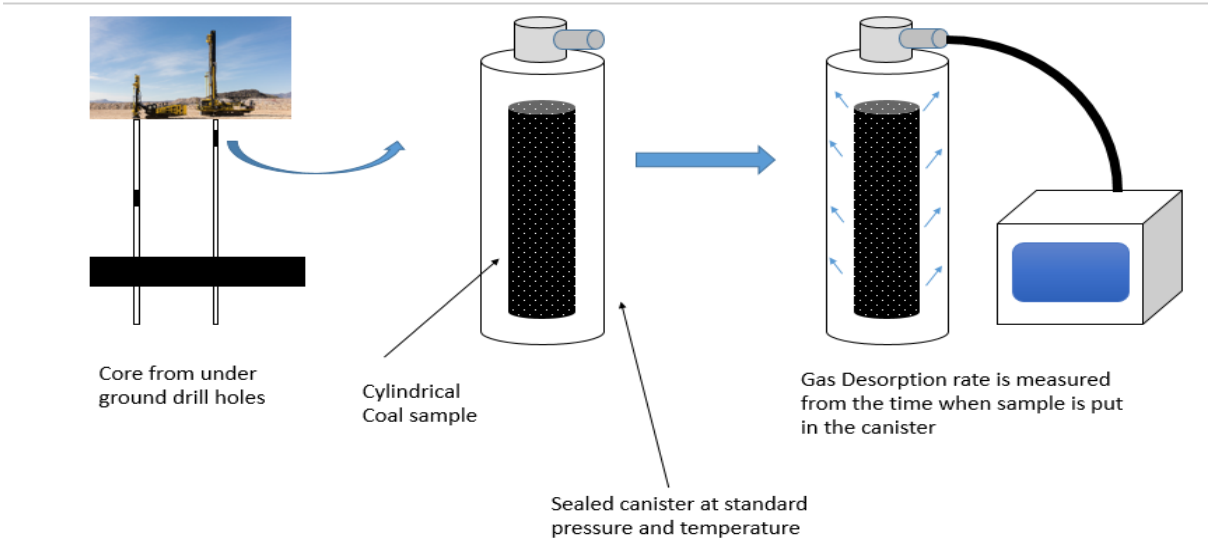
Lost gas value is estimated by analyzing the data obtained during the Canister Desorption Test. This analysis method is based on the solution which suggests that the cumulative desorbed gas is proportional to the square root of the elapsed time since the inception of gas desorption. The inception of gas desorption is referred to as “time zero” which usually occurs during the core recovery process. Proper estimation of time zero is required to estimate accurate lost gas volume. The lost gas amount is determined by extrapolating the diffusion model to the zero time till it is put into the canister. The nature and rate of desorption is analyzed by the fitting model and the lost gas estimation is found. During this course of time, there is a high possibility that the nature of the curve used for this estimation

for lost gas changes due to change in parametric observations. To solve this problem, the same physical conditions shall be emulated in the laboratory and reduce the lost time ranging

from nearly zero to negligible. This shall ensure that the extrapolation of the diffusion model gives an accurate nature of the lost gas diffusion. This step would intern help us have an accurate estimation of the lost gas. Now the two aforementioned methods to calculate lost gas, i.e, one by extrapolation of desorption rate graphs and other by making the lost time zero and then plotting the nature in the laboratory shall be followed. It is of the apprehension that there will be changes in the magnitude obtained of lost gas through both these methods. It shall be correlated with the diffusion model and the mathematical equation obtained in order to identify the correct lost gas amount for any period of lost time, more accurately.

Moreover, the desorption takes place in a condition of distressed core and thus the stressed core is emulated in the laboratory to apply the same in-situ stress, as in the field. Pressure coring can eliminate the lost gas but because of the difficulties involved in operating the specialized equipment and the added expenses, its use has been limited to research studies.

SOLUTION : A canister will be taken and the core from the field will be put inside. The canister now will be applied to a similar in-situ stress varying with the depth. The same pressure will be applied till the entire trapped gas inside the core is released. The core is exposed to the stress till it is saturated, as it is in the actual coal seam. The pressure is now released and gas desorption is made to occur within a negligible span of time (ranging from 1s to 2s). The time for releasing the gas is taken to be zero. So, the canister method can be used to now evaluating the lost gas amount accurately starting from time zero and the need to extrapolate the diffusion model is thus eliminated. The correlation analysis and the graphical interpretation shall conclude with a difference between the two methods and solutions to improve the procedure of measuring lost gas amount.



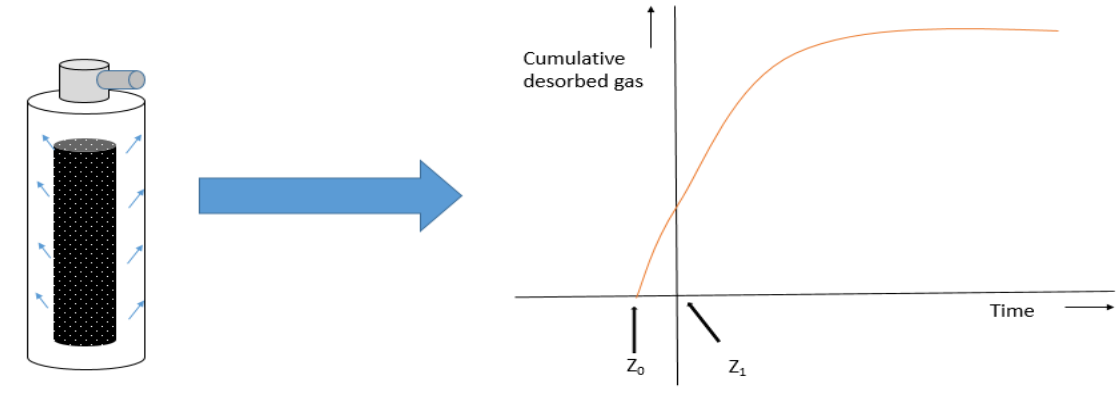
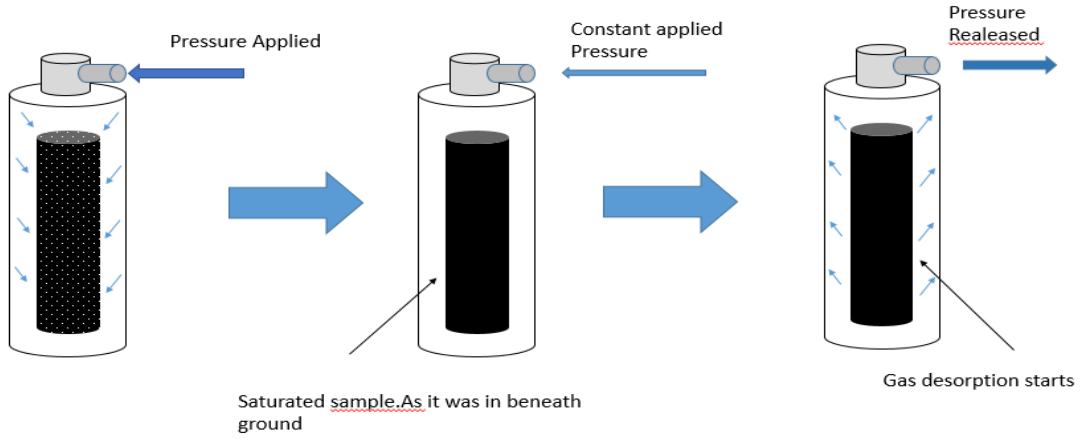
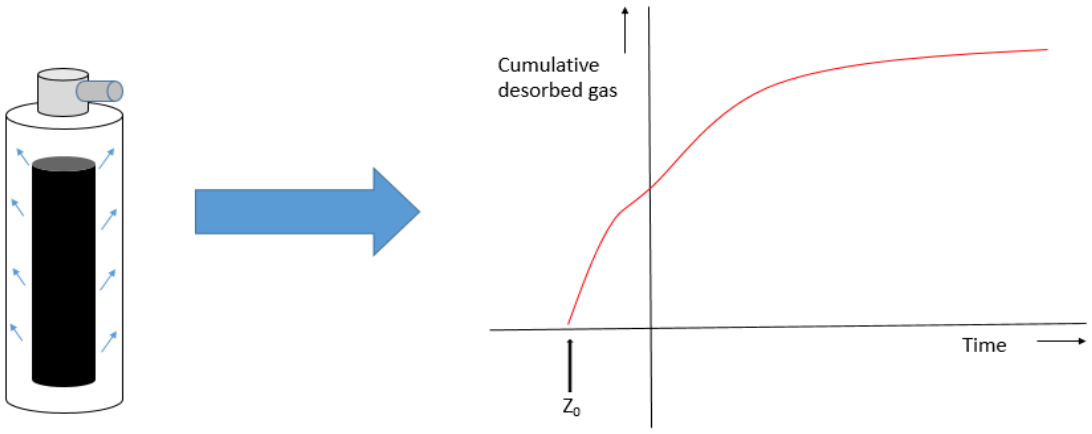
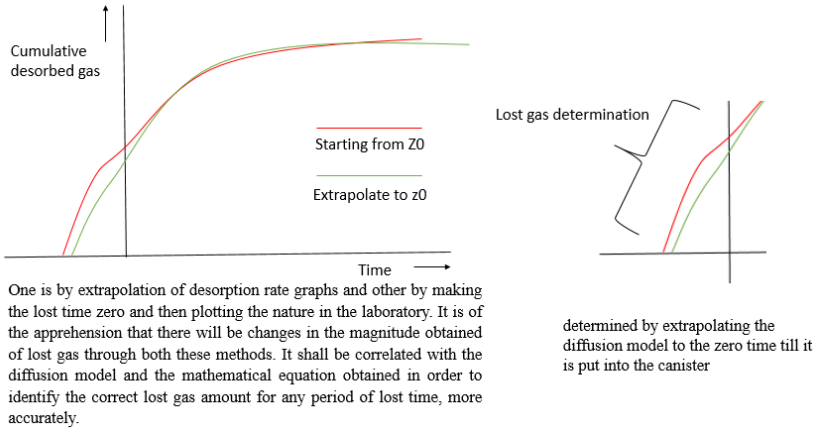


FIG 1 : Normal approach to determine the lost gas







One is by extrapolation of desorption rate graphs and other by making the lost time zero and then plotting the nature in the laboratory. It is of the apprehension that there will be changes in the magnitude obtained of lost gas through both these methods. It shall be correlated with the diffusion model and the mathematical equation obtained in order to identify the correct lost gas amount for any period of lost time, more accurately.

determined by extrapolating the diffusion model to the zero time till it is put into the canister

FIG 2 :Our solution in change in way of approach to determine the lost gas volume

REFERENCES

[1] https://www.e-education.psu.edu/png520/m18_p7.html [last accessed on 12/12/2018]

[2] https://www.stovesonline.co.uk/coal-types.html [last accessed on 12/12/2018]

[3] EIA. Countries Brief– India. Energy Information Administration 2013. (http://www.eia.gov/countries/analysisbriefs/India/india.pdf last visited on 07 Dec 2013)

[4] BP. Statistical Review of World Energy. 2013.

[5] PNGRB. Vision 2030– Natural gas infrastructure in India. Petroleum & Natural Gas Regulatory Board 2013.

[6] Moor TA. Coalbed Methane: A Review. International Journal of Coal Geology. 2012; 101: 36–81p.

[7] Rao VK. Coal Bed Methane A Frontier Potential and Projections. Directorate General of Hydrocarbons New Delhi 2008.

[8] Directorate General of Hydrocarbons. Annual Report 2010–2011.

[9] http://shodhganga.inflibnet.ac.in[last accessed on 12/12/2018]

PAPER 5: Vaccine Storage Unit

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ABSTRACT

The success of efforts against vaccine-preventable diseases is attributable in part to proper storage and handling of vaccines. Vaccines exposed to temperatures outside the recommended ranges can have reduced potency and protection. Storage and handling errors can cost thousands of dollars in wasted vaccine and revaccination. Our Vaccine storage cabinet seeks to address all these issues. Salient features are: [1] It obtains its operational energy from dynamos, and solar panels in addition to direct current supply,[2]Use of aspen aerogel,[3]Temperature Monitoring Equipment.

1.INTRODUCTION

Proper vaccine storage and handling practices play a very important role in protecting individuals and communities from vaccine-preventable diseases. This vaccine storage uses renewable energy for its operation, providing an alternative means to traditional approaches of energy, the Aspen Aerogel is used to regulate the ambient temperature inside the storage system, and temperature monitoring equipment.

2. THEORY

Conversion of energy principle, insulation by aspen aerogel, 3 modes of power supply, faradays law of electromagnetic induction in the dynamo

Here we have 3 modes of power supply as given below:

- Direct connection
- Solar energy
- Dynamo

Solar panels are installed on top of the unit. Photovoltaic solar panels absorb sunlight as a source of energy to generate electricity. A photovoltaic (PV) module is a packaged, connected assembly of typically 6x10 photovoltaic solar cells.The majority of modules use wafer-based crystalline silicon cells or thin-film cells. To work, photovoltaic cells need to establish an electric field. Much like a magnetic field, which occurs due to opposite poles, an electric field occurs when opposite charges are separated. To get this field, manufacturers "dope" silicon with other materials, giving each slice of the sandwich a positive or negative electrical charge.

Dynamo installed with the wheels of the vaccine storage unit is used to convert rotational mechanical energy to electrical energy.Dynamo is an electrical generator that creates direct current using

a commutator. The rotating conductors cutting the magnetic flux lines, induce an emf, thus generating a current. This rotation is provided by connecting the armature of the dynamo with the wheels of the unit.

Aerogel is a lightweight solid derived from gel in which the liquid component of the gel has been replaced with gas. When the liquid is removed, what remains is “puffed-up sand," with up to 99% porosity. The result is an extremely low density solid with several remarkable properties, most notably its effectiveness as a thermal insulator. Aerogels also have value in emerging applications such as energy storage, filtration and carbon capture.

The solids in silica aerogels are poor conductors, consist of very small, three-dimensional, intertwined clusters that comprise only 3% of the volume. Conduction through the solid is therefore very low. The remaining 97% of the volume of aerogels is composed of air in extremely small nanopores. The air has little room to move, inhibiting both convection and gas-phase conduction.

These characteristics make aerogels the world’s lowest density solid and most effective thermal insulator.Aspen Aerogels offers high performance aerogel insulation blankets for both hot and cold service applications. It has an efficiency of 90%, if we take a slab of 6mm and apply 100 degree Celsius on one side, then the temperature on the other side of the slab will experience a temperature of 10 degrees. It has a compressive resistance >=3 psi. Estimation of maximum use temperature is 650 degree Celsius. The temperature monitoring equipment records the inside temperature and shows it in a digital screen as an external output.The electronic monitoring system can provide assurance that storage temperatures remains within vaccine manufacturers’ recommended ranges and that corrective action can be taken quickly if they go out of range.Providers should determine how they are to be notified in the event of an emergency (e.g. a power outage) during hours when the facility is not open.

Thermometer placement within the unit is just as important as thermometer selection. Prior to storing vaccines in a unit, the temperature should be allowed to stabilize and then be measured in various locations within the unit to document that a consistent temperature can be maintained. This can detect if there are any particular cold or hot spots where vaccine should not be placed, as well as determining where the most reliable, consistent thermometer reading can be obtained. New units may need 2 or more days of operation to establish a stable operating temperature. Auto mechanised hands are used to implement the shake test on vaccines. Shake tests are used to check the authenticity and potential of the vaccines. Here laser light is passed through the vaccine tube. If the light directly passes through it, then it is a true solution, otherwise if the light scatters it is a colloidal solution. The whole process reduces the potential and efficiency of the vaccines. The auto mechanical hand is used to do this test in our unit, which reduces the chances of reducing the potential of the vaccines by reducing temperature variations.

The outer shell of the storage unit is made up of carbon steel which is lightweight, scratch resistant, durable and temperature resistant.

Advantages:

- High efficiency
- Less human errors

- High portability
- Automatic testing
- Eco- friendly

Disadvantages:

- Financial aspect

3. CONCLUSION

States with poor infrastructure and large rural areas, where there is still a dearth of direct supply, as well as problems of transportation and management, i.e. lack of medical workers, this vaccine storage unit can be an excellent candidate to make the availability of vaccines to one and all.

4. REFERENCES

[1]Chapter5-Vaccine-Storage-and-Handling

Available at https://www.cdc.gov/vaccines/pubs/pinkbook/vac-storage.html

[2]storage-handling-toolkit – Copy

Available at https://www.cdc.gov/vaccines/pubs/pinkbook/vac-storage.html

[3]https://www.cdc.gov/vaccines/hcp/admin/storage/index.html

[4]IP2015_Module2.pdf

Available at https://www.who.int/immunization/documents/IIP2015_Module2.pdf

PAPER 6: Carbon Dioxide Emissions in India

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ABSTRACT:

With India being the world's fourth largest emitter of CO_2, it is important to understand what the country's emissions are currently and where they might be headed. Given India's early stage of economic development, low per-capita emissions and its large population, there is significant scope for its emissions to increase.

INTRODUCTION:

Carbon dioxide is a colourless gas with a density about 60% higher than that of dry air. Carbon dioxide consists of a carbon atom covalently double bonded with two oxygen atoms. Carbon dioxide is essential to the survival of plants and animals. Too much, however, can cause all life on Earth to die. Not only do plants and animals need to ingest carbon dioxide, but they also rely on the gas to keep them warm, as it is an essential component of Earth's atmosphere.
In concentration up to 1% it will make some people fell drowsy and give the lungs a stuffy feelings. Concentration of 7-10% make a suffocation even in the presence of sufficient oxygen, which appears as dizziness, headache, visual and hearing dysfunction and even unconsciousness.

LITERATURE REVIEW:

Combustion of fossil fuels and deforestation have caused the atmospheric concentration of CO_2 to increase by 43% since the beginning of the industrial age. The annual global carbon dioxide emission in 2006 was 34.332 gigatons which increased to 36.682 gigatons in 2016. From 1870 to 2014, cumulative CO_2 emissions were around 2000 gigatons.

THEORY:

The value for CO_2 emissions in India was 2.2 million tons as of 2016. India ranked 4^{th} in the world when it comes to carbon dioxide emissions, only behind China, United States and the United Kingdom.Uttar Pradesh leads the Indian states as far as mean CO_2 emissions between1980 and 2015 are concerned. It is closely followed by Madhya Pradesh, Maharashtra and Bihar. It can be seen that the general trend in India is that all these states have a high proportion of emissions from coal.

Various sectors of human life and society are responsible for the emissions of carbon dioxide into the atmosphere.The emissions from various industries are from the major industrial processes which emit considerable amount of carbon dioxide gases and are located on the periphery of the city. Fuel

consumption in major industries is also a factor. Iron and steel industry, cement industry, fertilizer plants and chemical manufacturing industry are the few major industries which releases huge amount of the gas into the atmosphere during the process.Transportation contributes 23% of the entire GHG Emissions of India. As per IPCC; the total contribution of Transport sector is 7.0 Gt CO_2 equivalent direct GHG emission (Including non-CO_2 gases). As per data published by Planning Commission / NITI Aayog, CO_2 emission from Indian Railway is 6.84 million tons while road transport contributes 123.55 million tons (18 times).

Domestic sector is a major sector which contributes to the considerable amount of emissions when city level studies are carried out. The major sources include electricity consumption for lighting and other household appliances and consumption of fuel for cooking. The major fuels used are LPG, Piped Natural Gas (PNG) and kerosene. The chart given below shows the total greenhouse gas emissions converted in terms of CO_2 equivalent from the domestic sector in major cities.

Emissions from paddy cultivation are calculated for two major cities based on the area of paddy fields. Carbon dioxide equivalents were found to be 17.05 Gg in Delhi and 5.10 Gg in Greater Bangalore respectively. Emissions resulting from burning of crop residues at the end of growing year are estimated based on Delhi's emission of 2.68 Gg of CO_2 equivalents. There are no agricultural activities in most of the cities which indicates decline in agricultural practices as a result of increasing urbanization.

CONCLUSION:

This paper estimates the magnitude of CO_2 emissions of the Indian states from 1980 to 2018. The estimates show that of the several sources from which CO_2 is emitted, coal is by far the most important for India. Liquid fuels come second. Though we did not have data for distinguishing the consumption of coal for domestic usage and that for industrial purposes, the scatterd plot between coal and income appears to suggest that a large majority of people have not yet been able to shift from coal to petrol/LPG for personal usage.
Income, especially through its effect on the consumption of coal appears to be important in dictating the estimates. However by no means can we discount other determinants like population. Also the relationship between income and CO_2 emission for Indian states (eliminating the states having major steel plants) exhibits an inverted- U curve when using panel data estimates.

REFERENCES:

- "Six Degrees" by Mark Lynas
- "Climate Wars" by Gwynne Dyer
- "This changes Everything" by Naomi Klein
- *Parliamentary Papers*, 1840, Vol 256 xxvii.

PAPER 7: Waste Water Management

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INTRODUCTION:

With rapid urbanizations, our country's facing massive waste water management challenges. Waste water management systems in our country are based on sustainable development of water treatment plant. The key to efficient waste water management is proper waste segregation at the source.

The scope of this study includes utilization of existing modern technologies of waste water management in a more eco-friendly and more efficient way.

BACKGROUND:

To counter any problem we at first need to know the source of the problem. So at the very beginning we will put a glance on the sources of river pollution.

- **Industrial pollutants:** Chemical waste products from industrial processes are sometimes accidentally discharged into rivers. Examples of such pollutants include cyanide, zinc, lead, copper, cadmium and mercury. These substances may enter the water in such high concentrations that fish and other animals are killed immediately. Sometimes the pollutants enter a food chain and accumulate until they reach toxic levels, eventually killing birds, fish and mammals.
- **Pollutants from agriculture fields**: Farmers put fertilizers and pesticides on their crops so that they grow better. But these fertilizers and pesticides can be washed through the soil by rain, to end up in rivers. If large amounts of fertilizers or farm waste drain into a river the concentration of nitrate and phosphate in the water increases considerably. Algae use these substances to grow and multiply rapidly turning the water green. This massive growth of algae, called eutrophication, leads to pollution. When the algae die they are broken down by the action of the bacteria which quickly multiply, using up all the oxygen in the water which leads to the death of many animals.
- **Domestic Waste Water:** This includes all wastewater generated by home dwellings, public restrooms, hotels, restaurants, motels, resorts, schools, places of worship, sports stadiums, hospitals and other health centers, apartments and the like. They all produce high volumes of wastewater.

LITERATURE REVIEW:

Increase in pollution load definitely is a worry but decrease in the water flow is a bigger concern. The dilution factor of the river is getting minimized due to reduced water flow," said Prof BD Tripathi,

expert member, UP State Ganga Conservation Society and chairman of the cell constituted for research on Ganga at BHU.

- Biochemical processes lead to the degradation and decomposition of organic wastes by organisms (including microbes and plants) in the water.
- Hydro chemical processes like oxidation, mineralization etc. may purify the water.
- Physical processes like adsorption, dilution etc. also aid in the same.
- The geochemical profile of the substratum, ion exchange properties that determine mobilization or retention of metal pollutants for instance.

THEORY:

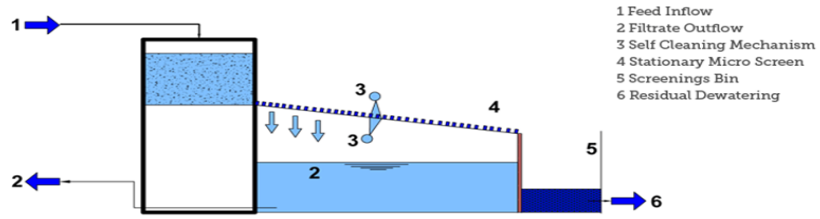
Industrial Pollutants-

For sedimentation of metal pollutants like cyanide, zinc, lead, copper, cadmium and mercury **WETLANDS and SILT FENCE** is the first choice. Also the **BALEEN FILTER** is able to absolutely separate suspended solids from any liquid based stream to 25 micron, and can be used for selective separation of those suspended matters in the drainage waters from industrials complexes.

Pollutants from Agriculture Fields:

Concentration of nitrate and phosphate in the water increases considerably due to fertilizers and pesticides. Algae use these substances to grow and multiply rapidly turning the water green. This massive growth of algae, called **Eutrophication**, leads to pollution.

- **BIOREMEDATION:** This is "a treatment that uses naturally occurring organisms to break down hazardous substances into less toxic or non-toxic substances", undertaken to clean drains and rivers. This process can be a useful medicine against the **Eutrophication.**
- **BALEEN FILTER:**



The word ‘Baleen’ is an anatomical description for the whalebone that belongs to a group of filter-feeding whales. The baleen is essentially the filter mechanism that enables the whale to collect plankton, small fish and other marine organisms from the water during feeding. The combination of a sweeping action of the tongue and the reversing of the water flows as the whales dive and re-surface during feeding, enable them to capture and strain food, then clean their baleen prior to the next dive.The Baleen Filter technology is an adaptation of this natural technique used by whales to keep their baleen clean and free from long-term deposits.

- **SILT FENCE:**

Silt Fence is used on construction sites to help protect streams, rivers, lakes and other aquatic resources as well as terrestrial resources from contamination by silt, sediment and construction debris. Manufacturers manufactures silt fence from durable, UV-stabilized woven geotextile attached to premium wood stakes. Quality wood stakes ensure fast, efficient and economical installation by on-site crews.

- **WETLANDS**:A wetland is a land area that is saturated with water, either permanently or seasonally, such that it takes on the characteristics of a distinct ecosystem. The primary factor that distinguishes wetlands from other land forms or water bodies is the characteristic vegetation of aquatic plants, adapted to the unique hydric soil. Wetlands play a number of roles in the environment, principally water purification, flood control, carbon sink and shoreline stability.

THE NATURAL KIDNEY:

Like the human bodies we can have natural kidneys for rivers.Now the question arrives what a natural kidney actually is?Obviously, it will be a system consisting of natural things (assisted with some technologies adapted from nature) taking polluted water as input and extracting fresh water as output exactly as kidney does with our blood.

How will The Natural Kidney Model Work?

- We can divert the polluted water stream flowing towards the river by a small canal and make the flow come at first in a wetland area.
- At the entrance of the pond there will be **SILT FENCE** and **BALEEN FILTER** installed. **SILT FENCE** will purify the water from contamination by silt, sediment and construction debris. Whereas **BALEEN FILTER** offers reliable trouble-free filtration up to 25 microns without chemical assistance.
- Then the water would be diverted towards **WETLANDS.**

  At the **WETLANDS-**

  - ✓ At that pond the biochemical processes lead to the degradation and decomposition of organic wastes by organisms (including microbes and plants).
  - ✓ Hydro chemical processes like oxidation, mineralization etc. will also be taking place.

PAPER 8 : UNDERGROUND COLLISION DETECTION AND PROXIMITY WARNING SYSTEM

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ABSTRACT

The relatively high number of collisions between mining vehicles is the primary reason why collision detection and proximity warning systems are being increasingly introduced in this domain. This work presents a safety measure taken to help workers on the mine floor and to visually aid operators using RFID tags to detect underground moving vehicles and other obstructions. The following document contents the work done in this domain for reducing the problems faced by the mine workers.

1. INTRODUCTION

The numerous accidents taking place each year in underground coal and non-coal mines in India and across the world caused by errors in movement of mine cars, tubs in haulage systems and dumpers were the motivation for this project of ours.

1.1. SCOPE:

The scope of the project includes an overview of existing technology in order to prevent collision in underground mine, This literature review on said technology along with a new alternative system have been present here including the algorithm of the project .

1.3. GOALS:

The said new system attempts to signal clearly and give due notice to any personnel in the area about the movement of any mine car or tub or any other moving heavy loaded machinery, using a sequence of lights and buzzers. This adds to the safety and efficiency of the working and also improves efficiency of Shuttle car operation. It also serves as additional auditory and visual aid to mobile mining equipment operators working along with the RFID sensors mounted on the said equipment.

2. BACKGROUND

Mining accidents and injuries can be serious, even fatal and occur frequently enough to be of constant concern to the industry, the workforce and the regulatory authorities. In India alone there had been 2761 fatal or serious accidents in mines in 2010-2014. Of the 438 accidents that took place in 2014 alone, 24 accidents were caused by movement of loaded transportation machines.

3. LITERATURE REVIEW

Mining equipments are huge, dauntingly at times. And while their bulky exteriors protect the operator from the rugged terrain and falling objects, they also cause blind spots and limited maneuverability

which are the major contributing factors related to mine vehicle collisions and accidents. Repeated job functions tends to fatigue for operators and ultimately leading them to take poor decision. Proximity detection system helps to increase the alertness of the operators resulting in drastic reduce of transportation related accidents. Approximately 95% of the continuous mining machines are remotely controlled, and most remote controlled continuous mining machines (RCCMs) do not have an operator's compartment, according to MSHA. The RCCM operator controls the machine using a remote control unit that directs movement and other functions of the machine. The remote control unit communicates with the RCCM using radio waves or a trailing cable. Even though the RCCMs being supervised by their operators, there runs a risk of accident affecting the personal working at the mine face. The introduction of proximity warning detection systems and collision avoidance system in underground metal mine application are new . Between 2002 and 2006, MSHA had conducted a series of tests in collaboration with proximity detection manufacturers and mine operators at mine sites. A significant number of mining accidents are attributed for powered haulage equipment collisions, loss of control and pinning-related accidents. More than 40% of the most serious injuries (fatalities and permanent disabilities) in the underground metal mining industry involve accidents classified as struck-by or caught-in machinery and powered haulage equipment. The most common activities associated with these incidents were maintenance and operating the machine. According to Mine Safety and Health Administration (MSHA) accident data, from 2002-2008 the mining industry averaged 1,206 accidents per year involving mobile face equipment. Of these, 252 per year occurred while operating continuous mining machines

4. THEORY

Various methods including shrinkage stopping, lode mining, block caving and many more are currently being used in underground metal mines. Some of these methods employ the use of haulage systems while others use mine cars or tubs. Load Haul Dump machines, Shuttle Cars and Continuous Miners are also used . All these systems use heavy and loaded moving machinery controlled by operators or automated in nature either track mounted, rubber mounted or rail mounted. Some of these use RFID systems to locate themselves as well as obstructions in their path. Our system uses light mounted on the gallery wall and proximity sensor that are coupled to the light and the buzzer. This creates an auditory and visual system which can be used to locate and warn a moving vehicle much before expected impact in order to protect the machinery and personnel working at the mine face. The use of multiple lights to indicate the vehicle distance from the proximity sensor, a buzzer to warn for an expected crash and a separate light representing the crashing of the car into the wall have been used in this project . This is done so that shuttle cars can avoid damage to the gallery , personnel and equipment . The system is used in tandem and supplement to the RFID system to maintain safety in such underground location.

5. CONCLUSION

This system can be utilized to add on to the safety and betterment of existing conditions in an underground metal mine where moving mine vehicles are employed. In absence of an RFID system it can serve as the basic indicator for upcoming moving underground mine vehicles and give sufficient auditory and visual warning to personnel on the mine floor or machine operators using series of lights and buzzer to indicate the positions and ultimately crashes if such. If RFID system is pre-installed, then the proposed system can serve as an additional safety feature and prevent accident.

6. REFERENCES

[1] E.J.Haas, K.A.Rost (2015), Integrating Technology: Learning from mine worker perceptions of Proximity Detection Systems

[2] Tim Horberry, Tristan Cooke, Collision Detection and Proximity Warning Systems for Mobile Mining Equipment: A Human Factors Exploration

[3] Statistics of Mines in India Volume - I (Coal) (2014), DGMS, ML&E, GoI

[4] Colin G. Drury, William L. Porter, Patrick G. Dempsey, Patterns in Mining Haul Truck Accidents

[5] Mine Safety and Health Administration (MSHA)

[6] Manpreet Kaur Jai Pal (2015), Distance Measurement of Object by Ultrasonic Sensor HC - SR04

PAPER 9: FLY ASH UTILISATION

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ABSTRACT

Fly ash generated during the combustion of coal for energy production is an industrial by product which is recognised as an environmental pollutant. Fly ash has been used in very eco-friendly way over last years. This paper attempts to describe a scientific way of ash utilisation . such as in automobile ,aerospace and agriculture sector.

INTRODUCTION

Coal based thermal plants have been a major source of power generation in india where about 57%of the total power obtained is from coal based thermal plants. Fly ASH(FA) is the by product. Which is being generated by combustion of pulverised coal the year 2017-2018. India produced 180 million tons of fly ash storage of huge amount of fly ash is a major problem for india. There are so many significant negative impact of fly-ash on environment. If it is not being used by timely.

This article attempts to deal with utilisation of fly ash in very convenient way. Our major attempt to lay out the some fundamental and revolutionary area, where ash could be used.

THEORY

Fly Ash: Emerging Solution For Automobile Industry

Automobile and aerospace sector mainly rely on alumina and steel. According to manufacturing report more than half of the total volume in the production of a modern car consist of cast iron and steel parts (55%) ,about 11% plastic the third place-aluminium alloys ,which is about(9%).

Coal fly ash contains fine microscopic structures called cenospheres , basically strong but hollow bubbles that are part of the work by-product of burning coal.

These cenosphere can be separated from the rest of material using water, because they float while the rest sinks.

If we coat these spheres, with nickel, copper or any other composite metal or ceramic material that manufactures might prefer creaks an ultra-strong but light weight material that can be mixed in with a variety of metals.

By this experiments, it is proved that weight of steel or aluminium could be cut dramatically without compromising the strength of the metal. It is not only tool to cut the cost as well as, increase the ash utilisation in most efficient way.

Fly Ash: Agricultural Revolution

Indian agriculture has been using chemical fertilizers. Pesticides to increase the production, but it's impact on environment is so horrible that fertility of soil is been reduced ministry of agriculture claim that 42% of India's districts use 85% of its chemical fertilisers.

Study shows that the current growth rate will be unable to feed the countries population by 2025.The countries need to produce 300 million metric tonnes of grains against its current output of 253 mmt.

This result is really worrying for us. But, fly ash is having not only solution to boost production by 1.5 times it is also eco friendly. Study reveals that about 1.5 times production increased after using of fly ash as a fertiliser.

But utilisation of fly ash in agriculture is only 2% of total ash production. Indian farmer has to be more aware towards using fly ash fertiliser. fly ash is having phosphorous and potassium (NPK) is 4:2:1), which is desirable condition.

CONCLUSION

This paper gives the idea of fly ash utilisation from conventional method to unconventional method. Paper deals with some micro properties of fly ash which can be used to bring revolution in automobile sector, Agriculture and Transport sector.

REFERENCE

Indian j med res 146 december 2017 .pp 714-721

DOL:10.4103/ijmr-651-15.

Disrupting the Mining Industry – Blockchain

-Mousom Singha, Sr. Engineer, Vedanta Resources

In recent few years, the word 'blockchain' has become synonymous with being the latest disruptive technology the world has embraced. Though it has diverse applications, the most prominent industry it has graced is that of the world of finance. Finance, being an industry which calls for the highest levels of security in data transmission has found an excellent spouse in this technology as the staggering rise of crypto-currencies can bear witness.

SO WHAT IS BLOCKCHAIN?

Blockchain is simply a growing list of records or blocks which are linked by cryptography. It is an open ledger which records transactions in a peer-to-peer network collectively. Each of the computers connected to this network is called a node. Blockchain adheres to certain protocols for inter-node communications and validating new blocks.

A more simple explanation goes like this: Think of a MS-Word file being edited and then shared to a second person for modification. Till the Word file is with the second person, the first author neither can view the modified version nor edit it. The file has to be obtained from the second person in order to do so. Now, let's think of a Word file available over a network accessible at all times by everyone and can be edited by anyone who wishes to and has the authority, something just like Google Docs. It does not call for much rumination on how such a metamorphosis can be favourable for businesses worldwide involving numerous legal contracts and their execution.

Blockchain technology has several advantageous features like its built-in robustness and incorruptible nature. The information stored through blockchain is not controlled by a single authority and hence has no single point of failure. Data is embedded within the specified network as a whole and by definition is public in a broad sense. It is incorruptible as alterations cannot be made by changing data at any one node; it has to be altered on all nodes present on the network, which would require a huge computing power, though theoretically possible, but practically not so. It, thus, eliminates the risks arising from a centralized data repository.

WHY BLOCKCHAIN?

Since 2010, there have been as many as 17 instances of cyber-attack on twenty two separate entities in the mining sector[1]. These attacks accounted for a range of intentions such as thwarts in mergers and acquisitions, intellectual property stealth and stealth of personal information. A 2016 report from Symantec states that the mining industry is the number one target from spam emails and correspondingly a third of these emails contain malignant content[2]. Blockchain technology can help mitigate these risks by decentralizing the storage of data and thus making it much difficult to get hold of a central storage and alter data. However, the application of this technology extends much beyond than simply storing proprietary data. A primer of the emerging uses is outlined in this article.

GOVERNANCE:

Blockchain can be used for effective governance by making data transparent to all the stakeholders as it can be accessed by anyone connected to the node network and in extended cases, by anyone connected to the internet.

SUPPLY CHAIN AUDIT

A blockchain ledger can be maintained wherein the end product would carry a signature of the origin. This is more prominent in the diamond mining industry where there are chances of desegregation of legally mined diamonds and unethically procured ones. An UK based firm, Everledger has created digital records of over 2 million diamond stones with dozens of attributes inscribed by laser on the crown or the girdle of the stone. Such initiatives can and are replacing paper-based tracking. Thus, instead of obtaining certificates on quality and ethics, a potential buyer, in a few years time and with the development of further advances, may hope to gather all the information of a stone just by scanning it with a smartphone.

INTERNET OF THINGS (IOT)

The emergence and the subsequent usage of Autonomous Decentralized Peer-to-Peer Telemetry (ADEPT) is revolutionising how the whole process of maintenance of assets and consumption of resources is carried out in the mining industry. This sector has a number of consumables such as diesel, tires, electricity etc. Predictive maintenance is quite a challenge too due to a huge intake and maintenance of an inventory of spares. A combination of sensors, software and network can trigger automated contracts sent out to vendors when these essentials run below a preset value. The payment is similarly automated when the order is received. This can not only reduce time, and consequently costs, but also provide an excellent base for data analytics.

IMMUTABLE RECORD OF MAJOR DATA

The integrity and authenticity of important data such as wellbore sample information and lab analysis reports are challenging to maintain as these are handled by a number of internal and external parties. Presently, these are shared through spreadsheets and databases and hence are prone to alteration either due to human-error or malign intentions. Blockchain can safeguard against such possibilities by provided a base for records that is incorruptible in nature. BHP Billiton Ltd., a market leader, is already using this technology for the movement of wellbore rock and fluid samples and to secure real-time data generated during the delivery of mined ore. Previously, tracked by using spreadsheets, the new method is driving internal efficiencies upwards.

Blockchain is bound to have even more profound usages in the coming times. Though disruptive in nature, in a capital intensive industry like mining, a movement towards it has to be lead by even more elaborate research and implementation at a much smaller scale before being applied to the whole industry.

REFERENCES:

[1] https://news.softpedia.com/news/mining-sector-faced-17-major-cyber-incidents-in-the-past-six-years-505783.shtml

[2] Internet Security Threat Report, Symantec, Vol 21, April 2016; https://www.symantec.com/content/dam/symantec/docs/reports/istr-21-2016 en.pdf?aid=elq_&om_sem_kw=elq_16244209&om_ext_cid=biz_email_elq_&elqTrackId=283a3acd b3ff42f4a70ab5a9f236eb71&elqaid=2902&elqat=2

OFFICE BEARERS 2018

Souvik Saha
President

Somnath Kundu
Vice President

Priyanshu Keshri
Treasurer

Sougata Mazumder
Founder & Secretary

Swapnaneel Bhuiya
Operations Committee (Program and Field trips)

Soumik Sinha
Human Resources(Membership Development)

Piyush Ranjan
Marketing Committee(Publicity)

Abhishek Kumar
Head Associate

Gaurav Mukherjee
Event Head

Anirban Paul
Event Head

Ayan Saha
Event Head

Ritam Kumar Karmakar

FUTURE GOALS:

Looking ahead in the successive years

Our prime focus has been the welfare and benefits of the students and the community of Mining world and especially our Department of Mining Engineering, IIEST, Shibpur. With the inclusion of The IIEST, Shibpur SME International Chapter, we look forward in recruiting more sophomore and fresher students who can be a huge potential in carrying the flag of this prestigious chapter even forward.

In recent years we promise to conduct more of industry oriented events and furthermore increase chances of prospective students in the industry. Our team will be prepared for participating in the Student Design Competition, SME and more indulgence in the SME activities.

For the first time, we here at IIEST, Shibpur have participated in this global stage of Best Student Chapter, SME and surely look forward for a good result and feedback.

Taking ahead, our new office bearers in the next session are filled with passion to serve this IIEST, Shibpur SME International Chapter and carry the legacy forward. We all have much faith from them.SME IIEST STUDENT CHAPTER

PICTURES FROM EXCURSION AND TRIPS TO INDUSTRIES

- Following is a picture from the trip to Jhanjra MIC undertaken by 2nd year students of 2018-2019 batch.

  Third-semester student members of SME IIEST Student Chapter 4th semester (2nd year), had a visit to Jhanjra as a part of Mining excursion. The trip was supervised by Professor Gopal Chandra Ray and Professor Md. Mirajul Islam, and Mining Engineering Department. The aim of this trip was to gain knowledge about Longwall method of working and to visualize mining work culture.

  The excursion was conducted on 16-17th November 2018,in Jhanjra under Eastern Coalfields Limited. Jhanjra is a village in Faridpur Durgapur CD Block in Durgapur subdivision of Paschim Bardhaman district in the state of West Bengal, India. Jhanjra is
  located at 22 23°38′59.3″N 87°17′22.6″E. Following is a picture from the trip to Jhanjra MIC undertaken by 2nd year students of 2018-2019 batch.

- Following is a picture from the trip to Ghatsila undertaken by 3rd year students of 2018-2019 batch. Fourth semester student of SME IIEST Shibpur(currently in 3rd year,6th semester) student chapter have visited Ghatsila on 23rd March, 2018 as a part of Geology excursion. The trip was supervised by **Prof.Tapas Kumar Gangopadhyay, H.O.D. of Earth Sciences Department.** The aim of this trip was to gain knowledge about rocks, minerals. Ghatshila is located at **22.60°N 86.48°E.** It has an average elevation of **103 m (338 ft.).** Ghatshila (also spelt as Ghatsila) is a census town in Purbi Singhbhum district in the state of Jharkhand, India. The city is located on the bank of the Subarnarekha River, and it is situated in a forested area. It contains a railway station on the main line of the South Eastern Railway.

- Fourth-semester student members of SME IIEST Student Chapter had visited to Jhanjra as a part of Mining excursion. The trip was supervised by Professor Netai Chandra Dey, Professor, and Mining Engineering Department. The aim of this trip was to gain knowledge about Bord and pillar method of working and to visualize mining work culture.The excursion was conducted on 7th February 2018, Wednesday, in Jhanjra under Eastern Coalfields Limited. Jhanjra is a village in Faridpur Durgapur CD Block in Durgapur subdivision of Paschim Bardhaman district in the state of West Bengal, India. Jhanjra is located at 22 23°38′59.3″N 87°17′22.6″E.

- Fifth-semester student (currently 6th semester) members of SME IIEST Student Chapter had visited to Noamundi Iron Ore Mine as a part of Mining excursion. The trip was supervised by Professor Indranath Sinha and Professor Suranjan Sinha. The aim of this trip was to gain knowledge about opencast metalliferous mines and to visualize mining work culture.The excursion was conducted between 12th to 14th November.

- Meghahatuburu is a census town in West Singhbhum district of the Indian state of Jharkhand. The town was largely built by the Steel Authority of India Limited as it is the Raw MaterialDivision of SAIL. Coordinates of Meghahatuburu is 22.07°N 85.26°E.

STUDENT LIST

1) B. Tech List:

- **Student List of Final Year (2019 Batch)**

Sl. No.	NAME
1.	Himangshu Dutta
2	Somnath Kundu
3	Sanjeev Kumar
4	Satyabrata Nayak
5	Neeraj Kumar
6	Jyotirmay Pal
7	Rishabh Gaurav
8	Pritam Kumar Roy
9	Tuhin Kundu
10	Souvik Saha
11	Iswar Dey
12	Shashwato Das Sharma
13	Sujit Kumar
14	Amit Dey
15	Prashant Kumar
16	Adnan Quamar
17	Harsha Gupta
18	Arpit Srivastava
19	Rohit Anand
20	Ashutosh Kumar Saha
21	Anil Singh
22	Rohit Kumar
23	Abhishek Singh
24	Rahul Deo
25	Mohit Durgekar
26	Priyanshu
27	Saumya Jyoti Dey

- **Student List of Pre-Final Year (2020 Batch)**

Sl. No.	NAME
1.	Soumik Narjinary
2	Ayan Saha
3	Bipin Kumar
4	Sudharshan Saren
5	Sougata Mazumder
6	Soumik Sinha
7	Shreyan Ganguly
8	Ritam Kr Karmakar
9	Anirban Paul
10	Swapnaneel Bhuiya
11	Gaurav Mukherjee
12	Shubham Kumar Pandit
13	Sandeepan Chakraborty
14	Amrutha Prashanth
15	Anirudhha Bhatta
16	Aranya Ray
17	Madhuri Biswas
18	Nabyendu Neogi
19	Abhishek Kumar
20	Piyush Ranjan
21	Hirock Jyoti Kalita
22	Saurav Hembram

2) M. Tech List:

- **Student List of M.Tech (Mining) Final Year (2019) Batch**

SL.NO.	NAME
1.	Parsa Raghu
2.	Uyyla Eliyatar
3.	Kulshresth Singh

- **Student List of M.Tech (Geo-Informatics)Final Year (2019) Batch**

SL.NO.	NAME
1.	Siddarth Roy
2.	Akash Hela

3.	Sudarsan N
4.	Saptarshi Dutta
5.	Yasir Aman
6.	Priyojit Kundu
7.	Kumar Ayush
8.	Nilanjan Sarkar
9.	Naveen Gaddan
10.	Suvro Aon

- **Student List of M.Tech (Mining) Pre-Final Year (2020) Batch**

SL.NO.	NAME
1.	Susanta Biswas
2.	Shubham Srivastava
3.	Shivam Jain
4.	Prashanth Dongri

- **Student List of M.Tech (Geo-Informatics) Pre-Final Year (2020) Batch**

SL.NO.	NAME
1.	Aravind K.Suresh
2.	Tabish Farooq
3.	Abhishek Saha
4.	Venkat Akshay S
5.	Shashank Yadav
6.	Biswajit Balabantaray
7.	Pamir Roy
8.	Eeshan Basu
9.	Debasis Sau
10.	Aarthi Shylu
11.	Perukula Pavan Kumar
12.	Karthik
13.	Shivam Shivhare

3) Student List of PhD Research Scholars:

Rock Mechanics & Carbon Sequestration	• Arpita Roy • Atanu Chatterjee • Ankita Mukherjee • Debojyoti Bannerjee
Environmental Lab	• Saurav Singh
GIS	• Mousumi Chowdhury • Priyanka Roy • Kaushik Ghoshal *
Safety and Ergonomics Lab	• Shibaji Dey • Sumit Bannerjee
Mineral Processing and Beneficiation Lab	• Muthai Manoj Periyasamy

TRAINING IN SUMMER VACATION

To set feet on the grounds of the industries properly, it is quintessential for every undergraduate to go through a series of Vocational Trainings as well as detailed and planned visits of some of the best working mines of the country. Some well-reputed and established institutions have extended their helping hands in providing our students with such training experiences.