Synopsis

On

“Mine Surroundings Analyzer: Mines Environment Analysis & Gas leakage alert using Z-Score Analysis”

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1.INTRODUCTION

- Gas leakage detection systems are an integral part of a safety system, providing the first line of defense against the possible disasters of gas leakage.
- It detects the gas leakage and triggers an alert system to activate safety precautions.
- The basic area that problems arise in terms of worker's health and safety is the production activities phase.
- Production activities consist of activities such as excavation, ground support, and haulage as well as activities such as electricity maintenance, establishing and managing pressurized room networks, communication and signalization systems.
- In particular, accidents in coal mining related to collapses, pit fires, firedamp and coal dust explosions, haulage, and mechanization frequently occur in underground pits.
- Thus, they end up with many complications physically.

Underground mining operations proves to be an adventure as far because the safety and health of workers is concerned. These risks are because different techniques used for extracting different minerals. Underground mining industry comes to the category, were each and every parameter such as methane gas, high temperature, fire accidents and so on has to be monitored regularly.

The disasters happening in coal mine are due to the complexity of mine environment and the variety of work carried out in coal mine, so it is very necessary to monitor the working environment of coal mine. Presence, of various toxic gases such as carbon monoxide (CO) carbon dioxide (CO2) methane (CH4), nitrogen (N20) nitrogen oxides (NOx), and hydrogen sulfide (H2S) can lead to disaster in mine leading to deaths. Mine Analyzer is an IOT based system in which various environmental condition in mines can be detected. In which various parameters of environment such as temperature, humidity, pressure is taken in concern. Implementing this project using Z- Score analysis to get instantaneous results and with high accuracy. Depending upon the certain conditions it will provide an alert to the authorities and miners to take further precaution.

2. Problem Statement & Objectives

Problem Statement

An underground mining operation proves to be a risky venture as far as the safety and health of workers are concerned. Toxic gases in Mines leads to various resulting in financial & human loss. It needs to be detected at an early stage so that we can offer assistance in saving lives.

Objectives

1. To Provide real time monitoring & Alert System in coal mines.
2. To reduce the casualties cause due to accident in coal mines.
3. To provides the Safety towards the workers.

3. Literature Survey

In the hazardous environment, industrialized accident occurs. Due to which consequence maybe very serious and it causes loss of environment, property and life. For moral, legal, & financial reasons hazardous environmental safety & security is more important wireless sensor network in industrial the site, the deployment of distributed point source where the dangerous parameters used, produced and stored is described seven characteristics, fundamental aspects for estimating and mission method was identified. For measurement of temperature using Virtual Instrumentation is by Automatic Process Control in many industries.

Articles: -

India records 377 mine deaths in three years/ The Hindu Methane/CO Poisoning, Water Drowning & Temperature/Pressure Change are the majority of the reasons for accidents in coal mines.

At a time when multiple agencies are involved in the rescue of 15 miners trapped in a rathole mine in Meghalaya, data tabled in the Lok Sabha earlier this week revealed that 377 workers involved in the mining of coal, minerals and oil were killed in accidents between 2015 and 2017. Of the 377 deaths, 129 occurred in 2017 alone. As many as 145 died in 2016, while the figure was 103 in 2015. Coal mines have accounted for the highest number of casualties due to accidents in mines. Of the 377,

more than half, 210, were killed in coal mines. These figures were provided by the Labor and Employment Ministry on December 31, 2018, in response to a question raised by Laxman Giluwa, BJP MP from Jharkhand.

Respiratory Protection Selection Made Easy/ EHS Today An estimated 5 million workers are required to wear respirators in 1.3 million workplaces throughout the United States, according to OSHA[1]. Knowing what the agency requires for respirator use in the workplace, as well as having a thorough understanding of both the application and contaminants present are critical to the respiratory protection selection process. Before an EHS professional starts down the path of purchasing respirators, an understanding of OSHA's hierarchy of hazard control measures is in order. From the agency's perspective, personal protective equipment (PPE) is the last option for an employer seeking to prevent employee exposure to a contaminant. When it comes to respiratory hazards, elimination/substitution means phasing out the contaminant or substituting a non-hazardous material for the contaminant causing the concern. Examples of engineering controls include the isolation or dilution of the contaminant through the use of a fume hood or ventilation. For respirator applications in which the worker could be exposed to unknown contaminants or unknown concentrations of contaminants, APRs are not an option. APRs also are not an option in applications were

the worker could encounter oxygen deficiency. OSHA defines this as oxygen levels of less than 19.5 percent[3]. For these, employers must use either a self-contained breathing apparatus (SCBA) or a pressure-demand SAR with an emergency egress (escape) supply of auxiliary breathing air. When it comes to choosing respiratory protection, there's not a one-size-fits-all solution & custom made are too costly to provide to daily Wage Labors hence safety gets neglected.

R.Craig Schroll "Fire Detection and Alarm Systems: A Brief Guide"/Occupational health & safety|December2007 To be useful, detectors must be coupled with alarms. Alarm systems provide notice to at least the building occupants and usually transmit a signal to a staffed monitoring station either on or off-site. In some cases, alarms may go directly to the fire department, although in most locations this is no longer the typical approach.These systems have numerous advantages as discussed above. The one major limitation is that they do nothing to contain or control the fire. Suppression systems such as automatic sprinklers act to control the fire. They also provide notification that they are operating, so they can fill the role of a heat detection-based system if connected to notification appliances throughout the building. They will not, however, operate as quickly as a smoke detection system. This is why facilities where rapid notice is essential, even when equipped with sprinklers, still need detection and alarm systems. Inspection, testing, and maintenance requirements for these systems are

extensive and ultimately are likely to cost more than the original installation. Early detection also plays a significant role in protecting the safety of emergency response personnel.

Research Papers: -

Deokar Wa et al. (2017) Proposed the key to controlling coal mine accidents the prediction of outburst by implementing sensors and microcontrollers and generating an alarm system before critical atmospheric levels. Continuous monitoring is necessary which again requires some effective and accurate sensing system. Several techniques are adapted to sense the presence of these poisonous gas, among them use of a semiconductor type gas sensor is very much effective. These sensors can be mounted in the coal mine area but sometimes these create some problems in mining too. Accidental damage to the sensor device often took place. Another technique is the use of the robot. These robots are effective but the cost of the robot is very high. However, there is another way of getting an effective and low-cost solution of sensor implantation; it is on the safety helmet of the coal mine workers.

Pravin et al. (2018) The proposed system consists of the sensor modules that sense all the data around the coal mine environment and logs the data onto the cloud-controlled server page using the IoT module. The sever

page is maintained using the Java Server Page. The logged data is processed into the average values for each entry on an interval basis. These values are automatically processed using predefined values maintained by the server page. Then there is any arbitrary change in the values of the sensed data an alert is sent to the IOT MODULE and the concerned authorities. The IOT module detects the alert signal and glows the inbuilt alarm system and alert message to the authorities may take precaution steps. The main advantage of this project is that IOT detects the uncertainty in the environment beforehand using data analysis reports the situation to the concerned authority and the miners. The system also considers the emergency situations in hand to alert the miners quickly as possible. This project serves the aspect of "Prevention is better than Cure"

Cheng Bo et al. (2012) Proposed a restful web services mashup improved coal mine safety monitoring and control automation using WSN network. This system can collect the values of methane, temperature, humidity and personal position information inside the mine. The complex environment of coal mines requires continuous monitoring of the underground environment, equipment and miners to ensure safe coal mining. However, the existing coal mines cannot meet these requirements because of blind spots when using wired networks. We have developed a lightweight web-based remote monitoring and control platform that uses

a REST-style wireless sensor network (WSN) to collect data on temperature, humidity, and methane content in coal mines using sensor nodes. It also collects information about the location of people in the mine. They implemented a RESTful application programming interface (API) that allows access to underground sensors and instruments via the Internet, making it easy to connect physical equipment in underground coal mines to remote monitoring and control applications. Various solutions for easy remote Web monitoring and security control, as well as measurement and analysis of system performance.

4. Proposed Work

- **Module 1-** Study of Z-Score Analysis for sensor values and implementing it provisionally using Arduino.

  The values from sensors are analyzed using Z-score analysis. The assessment of the Z-score is used to detect anomalies. The anomaly here implies that the value of a variable (temperature or gas value) exceeds a certain value variety. The value range is referred to as boundaries (upper and lower bound). We use the upper limit only to detect the fire warning. The input values, frame size, and multiplication factor are used to calculate these boundaries. The frame size is the minimum number of input values needed for the Z-score analysis and the multiplication factor determine the proximity of the bounds to the input values curve.

- **Module 2-** Integrating the "Module 1" with Bolt IOT

  The proposed system consists of the sensor modules that senses all the data around the coal mine environment.

- **Module 3-** Integrating "Module 2" with a User Interface

5. Technology

1) Front End:

JavaScript, HTML

2) Back End:

JavaScript

3) Library/API/Framework:

Bolt IOT App, Bolt Cloud

4) IDE:

Arduino IDE, Visual Studio

5) Hardware used:

MQ-9, MQ-135, BMP180, DHT-11, Bolt IOT Wi-Fi Module & Arduino Mega.

6. Applications

- It is possible to get instantaneous results and with high accuracy with Z-Score analysis.
- Automated detection of flammable/Poisonous gases Change in Atmospheric Pressure & Temperature.
- Supervisors and managers can use the remote platform(s) to monitor key parameters in mines anywhere in the world, thereby improving management and production standards.

7. Expected Project Outcomes

We will develop Mines Environment Analysis & Gas leakage alert using Z-Score Analysis utilizing Temperature and the smoke sensor which would not just sign the presence of hazardous gas in a particular area however will also send related information through IoT. We will observe engineering information to **investigate** this hassle and offer a present-day **engineering solution**. Then we can **layout** the utility into **three modules**. During this project, we will apply professional ethics and understand the importance of **teamwork** and **communication** when introducing a project in various project management competitions and conferences, which encourages us to participate in lifelong learning.

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