ABSTRACT

A coal mine safety system is implemented for this project by using an IP address as a data transmission medium. The device is used to monitor a variety of parameters inside coal mines, including light detection, gas leakage, temperature and humidity levels, and fire detection. This sensor network is known as one large device and is installed in coal mines. All sensor rankings are automatically fed into the thinking processors, generating the ideas for them to investigate.

Gas monitoring equipment is still running here to detect any potential problems, and a buzzer is used to alert the staff. In this framework, Fire sensors are used to detect the presence of flame. When you turn on the lights, they illuminate automatically, and you can control them with the LED button. A notice is sent to the designated individual's mail to ensure proper response to any potential fire hazard. There is also a collection of constantly measured and recorded temperature values, which are displayed on the serial monitor and the website platform. A vibration sensor is also used to detect any movement in the mine.

Keywords: IOT, LCD, SENSORS, TELNET.

I. INTRODUCTION

Entire as far as the safety and health of workers are concerned. These risks are due to different techniques used for extracting different minerals. The deeper the mine, the greater is the risk. These safety issues are of grave concern especially in case of coal industries.

Thus, safety of workers should always be of major consideration in any form of mining, whether it is coal or any other minerals. Underground coal mining involves a higher risk than open pit mining due to the problems of ventilation and potential for collapse. However, the utilization of heavy machinery and the methods performed during excavations result into safety risks in all types of mining. Modern mines often implement several safety procedures, education and training for workers, health and safety standards, which lead to substantial improvements in safety, level both in opencast and underground mining.

A worker in a mine should be able to work under conditions which are safe and healthy for his body. At the same time the environmental conditions should be such as will not impair his working efficiency. This is possible if mine air is nearly the same as on the surface without toxic and inflammable gases [1].

The gases are the present in the underground mines are flammable gas (CH4), Noxious gases (NO2, NO3, N2O5), Carbon Monoxide (CO), Carbon Dioxide (CO2). Hydrogen Sulphide (H2S), Sulphur Dioxide (SO2). The permissible limit set for these gases are as follows: • Underground air should not have more than 0.5% CO2 or other noxious gases. • Inflammable gas should be below 0.75% in the general body of return air and below 1.25% at any place in the mine. • The general air on road must not normally contain more than 0.005% of CO[1]. Different gases that are present in the mine have different effects on the human body and can also cause explosion if reaches above a certain limit. The effects of some of the harmful gases are as follows: - • Carbon Dioxide – on 3% (breathing gets doubled), 6% (headache, exhaustion), 15 % (consciousness loss), 25% (death after hours) [3]. Methane – This is the gas which is responsible for most of the underground mine explosions. It forms a layer just below the roof of the mine. The gas is not poisonous but can suffocate a person due to lack of oxygen [2].

II. RELATED WORKS

A. Coal mine safety monitoring and alerting system with smart helmet.

Mangesh Rudrawar, Shivam Sharma [1], this paper introduces an Coal mine safety monitoring and alerting system with smart helmet. The Wireless monitoring system is capable of detecting and alerts to the workers.
B. Safety monitoring system in coal mine using IOT.

Sathish kumar N1, Manoj A M2 [2], this paper presents on safety monitoring system in coal mine using IOT. A safety monitoring system in a coal mine using IoT typically involves various sensors and devices interconnected through a wireless network.

C. Intelligent safety system for coal miners.

Beena M Varghese, Binisha Balan, Neethu Varghese [3], this paper present on Intelligent safety system for coal miners. An intelligent safety system for coal miners integrates advanced technologies such as artificial intelligence, machine learning.

D. Smart helmet for coal mines safety monitoring and alerting.

S.R Deokar1, V.M.Kulkarni2, J.S.Wakode3 [4], this paper present on smart helmet for coal mines safety monitoring and alerting. Smart helmet for coal mines safety monitoring and alerting is a wearable device designed to enhance the safety of miners.

III. IMPLEMENTATIONS

An IoT-Based coal mine safety monitoring and alerting system typically involves integration of sensors, microcontrollers, communication modules and data analysis to detect the system.

Fig 1 explains the block diagram of the work.

1. Microcontroller: At the heart of the Arduino Uno is a microcontroller chip. The Uno typically uses the Atmega328P microcontroller from Atmel (now Microchip). This microcontroller is responsible for executing the program instructions and controlling input/output operations.

2. LCD Display: This LCD is used to display the numbers and characters.

3. Temperature sensor: A temperature sensor is a device that detects and measure hotness and coolness and converts into a electrical signal.

4. Gas Sensor: A gas sensor is a device that detects the presence of specific gases in the surrounding environment.

5. Fire Sensor: A flame detector is a type of sensor that can detect and respond to the presence of a flame. These detectors have the ability to identify smokeless liquid and smoke that can create open fire.

6. Buzzer: A buzzer is a device that creates an audible tone under the influence of an applied external voltage.

7. WIFI Module: A Wi-Fi module is integrates all the necessary components for wireless communication using Wi-Fi technology.

Flow Chart and its steps:

SENSORS: sensors are devices that detect and measure physical properties or changes in the environment and convert them into signals can be interpreted or used by other devices or systems. In the context of an IoT-based
coal mine safety monitoring and alerting system, various types of sensors are deployed to monitor different aspects of the mine environment and ensure the safety of workers and operations.

Gas Sensors: These sensors are used to detect the presence of harmful gases such as methane (CH4), carbon monoxide (CO), and hydrogen sulfide (H2S), which are common hazards in coal mines due to natural gas emissions and underground fires.

Temperature and Humidity Sensors: Temperature and humidity sensors monitor environmental conditions within the mine to prevent overheating, excessive humidity, or condensation, which can affect both worker comfort and safety, as well as equipment performance.

LCD Display: This LCD is used to display the numbers and characters.

IOT: The Internet of Things (IoT) refers to the network of interconnected devices, sensors, actuators, and other objects embedded with electronics, software, and connectivity capabilities that enable them to collect, exchange, and act upon data.

THRESHOLD: In the context of IoT-based systems or data analysis, a threshold refers to a predefined value or condition that serves as a boundary or limit for determining whether an event or condition is considered normal or abnormal, safe or unsafe, or requires action.

BUZZER: A buzzer is a device that creates an audible tone under the influence of an applied external voltage. A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short).

III. METHODS/SOFTWARE

In an IoT-based coal mine safety monitoring and alerting system, the Arduino board serves as the central processing unit orchestrating the operation of various components. Initially, the system initializes the necessary peripherals such as IR and voltage sensors, A/D converters, LCD displays, WIFI modules, and relays with buzzers. Through continuous monitoring, the Arduino reads signals from the IR sensor to detect physical obstructions indicative of tampering and analyses voltage levels using the A/D converter to identify abnormal consumption patterns suggesting theft.

Upon detecting anomalies, the Arduino triggers actions such as activating the buzzer for immediate local alerting, controlling the relay to cut off power supply, and sending data to the WIFI module for remote transmission to a central monitoring station or user’s device.
IV. RESULTS

FIRE SENSOR

Fig 4.1 Fire sensor on LCD display

Fig 4.2: Fire sensor on mobile Telnet

Temperature sensor

Fig4.3: Temperature sensor on LCD display

Fig3.4: Temperature sensor on Mobile telnet Gas sensor

Fig4.5: Gas sensor on Mobile telnet
Used to detect the gas in the mobile telnet.

Fig 4.6: Gas sensor on LCD Display

V. CONCLUSION

The conclusion of an IoT-based coal mine safety monitoring and alerting system would likely highlight several key points: Enhanced Safety, Early Warning System, Data-driven Decision Making, Remote Monitoring, Integration with Existing Systems, Continuous Improvement, Compliance and Regulatory Requirements.

In conclusion, an IoT-based coal mine safety monitoring and alerting system represents a critical advancement in safeguarding the well-being of miners and ensuring the sustainable operation of coal mines. By leveraging technology to detect and respond to potential hazards in real-time, the system contributes to a safer and more efficient working environment while supporting regulatory compliance and industry best practices.

VI. FUTURE SCOPE

We are finding the shortest path based on the distance of nearby hospitals but there may be chance that the traffic will be more in that path. So we need to come up with some algorithm which gets the nearby hospitals with minimal distance and traffic.

We may add some modules which will also let the system know about the traffic details and then find out which node will take less time to reach from the accident spot. Another thing which we may add is „first aid kit“ for emergency medical treatment at the scene itself. We can also add some modules which will measure the injuries level or some additional information like blood group, heart beats, current glucose level which may be send to the hospitals in advance before the victims reaches the hospitals hence improvise the performance of the proposed system.

ACKNOWLEDGEMENT

We thank “Sri Divya”, Assistant Professor, Department of Electronics & Communication Engineering, for the guidance and support in completing the project and also to “Dr. G. Srikanth”, Professor and Head of the Department of Electronics & Communication Engineering, and “Dr. A. Raji Reddy” Director of CMR Technical Campus for providing all the facility required.

VII. REFERENCE


International Journal of Science, Engineering and Technology Research (IJSETR) Volume 6, Issue 8, August 2017, ISSN: 2278 -7798 —Microcontroller Based Smart Helmet for Coal Miners Safety‖ First author- Sunil E. Waghmare, Second author-Prof. Ashish Manusmare, Third author – Prof.Vijay Roy


Sudhir Rao Rupanagudi ; Sumukha Bharadwaj ; Varsha G. Bhat ; S. Eshwari ; S.Shreyas; B. S. Aparna ; Anirudh Venkatesan, Amrit Shandilya, Vikram Subrahmanya, Fathima Jabeen A novel video processing based smart helmet for rear vehicle intimation.