IoT based Safety Helmet for Mining Workers

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Abstract: Accidents are frequent in mines due to lack of competent workers; hence miner's safety cannot be guaranteed. Men who are presently employed in coal mining must confront environmental constraints. Temperature rise, emissions such as carbon dioxide, carbon monoxide, nitrous oxide, and methane poses causes threats to humans. As a result, security for the miners working in coal mining is indispensable. The goal of this work is to provide safety precautions to miners through communication and security monitoring. Coal mining has a unique function in the modern world; it has the potential to save the lives of coal miners by creating particular gadgets that can be extremely beneficial to the industry's workers. People working in underground coal mines must ensure several safety precautions such as helmets with collision detectors and gas detectors. In this proposed work, the hardware circuit within the Smart Helmet provides security to the workers who are employed in coal mining. Coal mining remains a hazardous activity that can have a variety of negative environmental impacts, such as the discharge of hazardous gases during mining operations.

Keywords: IoT (Internet of Things), Safety helmet, Steel rolling mills, Heartbeat sensor, Temperature sensor.

I. INTRODUCTION

Mining is very important for the economy of any country as it generates various opportunities for many sectors. As a society, we are blessed to appreciate the benefits that this sector manufactures by processing these materials and products that supply us. Working on the ground presents many different safety and health risks. The environment is disagreeable or shaky. The deeper the mines are, the more harmful it might be to conduct tasks. There are challenges there. So here we suggest a security system in addition to a mining monitoring system for the mining sector using microcontroller-based circuits. Utilize circuitry to discover employees moving through the mining website. The helmet includes monitoring system that communicates with all of the trackers via Wi-Fi techniques to help provide information.

The system uses "mega microcontroller-based Wi-Fi tracker circuitry" to get the data. This helps to map the location of employees. Each employee's helmet circuit has been incorporated using a button. This button shows a crisis indication and it may be used for almost any sort of issues, like poisonous gas inhalation, cave-ins, bodily harm, etc. Hence, mining employee safety is ensured by the IoT. Pakistan has vast coal deposits, primarily in Sindh, with estimated reserves of 184.623 billion tons. Our country's market has been expanding rapidly, resulting in an increasing supply of raw materials. New foreign firms are assisting in the discovery of coal reserves. It is aware that, tragic accidents in mines are on the rise due to a lack of competent personnel, and miner's safety cannot be guaranteed, nor can coal manipulation be carried out.

Men working in coal mining must contend with environmental factors. Fever, carbon dioxide, and methane pose a harm to them. As a result, we must provide security for the men and women who are now employed in coal mining.The goal of this study is to provide a solution to mining through communication and security monitoring. The helmet must be worn by the individual when performing underground work. Here, we must organize our circuit inside the kit in order to provide security to the man who is currently working in coal mining. In late times coal mining continues to be a dangerous activity that can lead to many negative consequences on the environment such as during mining operations dangerous gases are released

II. EXISTING SYSTEM

The safety of people or labor who work in coal mines and are regularly exposed to risks. This prototype is made in a way that senses many things, such as the occurrence of dangerous gases, the heartbeat of a worker in coal, underground environmental conditions, and pinpoints the location of the miner through GPS. These parameters will

probably be transmitted via a Wi-Fi protected channel to a dynamic internet protocol. These researchers developed a device that is very useful for risk mitigation in areas where there is mineral exploration activity, such as coal, gold, etc. This system is best for finding the exact location of the coal worker. With this device, tracking is easy, and any help in an emergency can be delivered very quickly

The primary drawback of the system is that Bluetooth is a short space wireless technology, and the usage of cabling is tough They have suggested a system that has a remedy for various issues with the help of GPS. This application will search for a pinpoint location, and any missing coal worker can be traced easily with the help of GPS. In this system, the client-server architecture approach is utilized. The server allows the mobile phone of the client to register and login, and it saves its password and credentials in the database of the server. It is designed for coal workers, this helmet is very suitable for underground coal exploration where there is a risk of dangerous gases such as methane and carbon, etc

III. PROPOSED SYSTEM

Modern mines often implement several safety procedures, education and training for workers, health and safety standards, which lead to substantial changes and improvements and safety level both in opencast and underground mining. Mine ventilation system can help in eliminating high risk atmosphere. Primitive techniques to monitor the mining atmosphere can be traced back to the use of canaries and other animals to alert miners, when the atmosphere becomes toxic. Integrating ventilation monitoring system enables mine to intelligently make ventilation changesbased on the extensive data, the monitoring system provides. The most basic gadget that the workers carry inside the mine is a "safety helmet". This helmet is thus taken up as the target on which the improvisation is done without altering the characteristics of the helmet. The problems mentioned can be solved only by proper sensing of the environment. For this purpose, various sensors are used which are interfaced with a microcontroller.

According to the structure of industrial helmets consists of a vacuum between the outer and the inner layer which can become the most appropriate place for placing the electronic components. Also there is the problem of communication of data from the helmet to the control room. There can be no routers placed inside the mine as because the dimension of a mine is not constant. This might be achieved by a wireless network to which all the helmets are connected in which the data from the end nodes can be transferred to the coordinator through a mesh. The last object to be dealt with is the monitoring of the internal conditions of the mine. The setting up of a separate control room would involve a large capital which might be reduced by using the concept of IoT. Mining is indispensable to the creation of goods, infrastructure and services which enhance the quality of their lives. As a society we were blessed to enjoy the many advantages that industry manufactured products provide us by processing these raw materials.
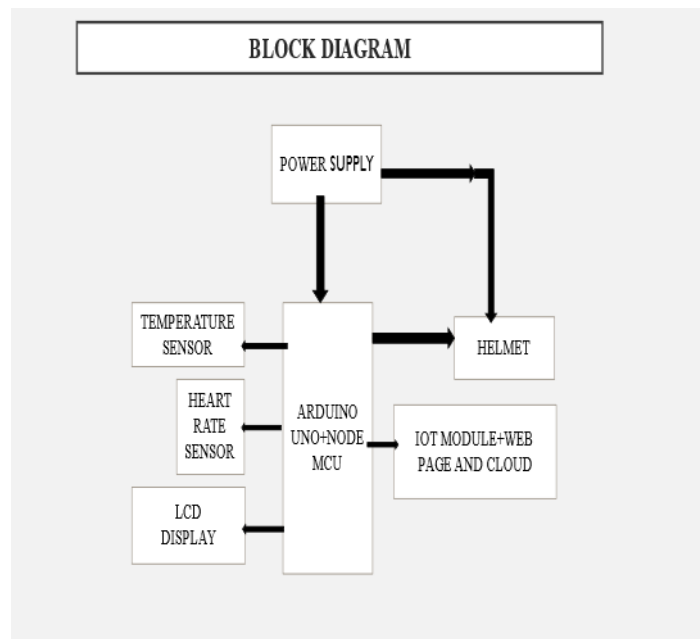
Fig.1.Block Diagram

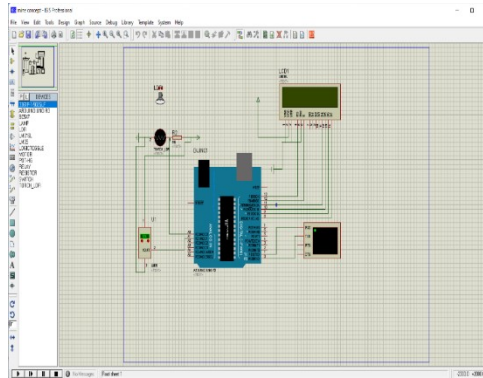## IV. SIMUALTION RESULTS

Fig.2.Output and Proposed System

Fig.3. Hardware Implementation

IoT-based safety helmets for mining workers are designed to enhance the safety of miners by using various sensors and technologies. The helmet is equipped with GPS, heart rate, and temperature sensors to monitor the health and safety of miners in real-time.The GPS sensor is used to track the location of miners and send alerts in case of any danger or emergency. It can also help to optimize the mining process by monitoring the movement of miners and equipment. The heart rate sensor measures the heart rate of miners to detect any abnormal activity and alert the safety team in case of any health issues. This is especially important in a physically demanding and risky environment like mining. The temperature sensor is used to monitor the temperature of the miner's body and the surrounding environment. It can detect if a miner is suffering from heat exhaustion or if the surrounding environment is becoming hazardous due to high temperatures. Overall, an IoT-based safety helmet for mining workers can significantly improve the safety and well-being of miners by providing real-time monitoring and alerts for potential hazards or health issues.

V.CONCLUSIONS

The proposed prototype's objective is to examine the nearby individual environment and examine individual health in real-time and take necessary actions when the working environment is non-preferable for the miner. The proposed prototype is a three-tier architecture. The first tier measures the health and environment parameters through Arduino Uno. The second tier is the fuzzy classifier, which determines the environment types based on the

first-tier Parameters. The third tier gauged the data in a cloud database for future reference (generating the miner's health report) and is also responsible for alerting the monitoring and rescue team in case of the worst situation. The proposed prototype is analyzed in three different environments. It has been concluded from the analysis that the accuracy of the proposed prototype is 99 percent for the indoor environment, 97 percent for the outdoor industry environment, and 96 percent for the coal mining environment. Therefore, the proposed prototype can determine the preferred ability of the working environment for miners based on the real-time individual health and individual nearby environmental conditions. In case the nearby environment and individual health are non-preferable.

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