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MINING WORKER SAFETY HELMET USING IOT

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ABSTRACT

Among all professions, mining is one of the riskiest. In some nations, there are no social or safety guarantees for underground miners, and they could be left to manage on their own in the event of an injury. Displacement and destroyed livelihoods are just two examples of the detrimental societal effects. All industries included, the mining sector has the greatest rate of occupational fatalities. Rock falls, fires, explosions, methane poisoning, and electrocution are a few common reasons for workplace fatalities. Numerous case studies have been done on underground mines; nevertheless, a recent case study in China and India showed that this industry is the deadliest in the entire globe. Our improved communication technology, which must be used for an intelligent sensing and warning system in order to prevent all of these calamities, has been developed to address this problem. The communication inside the mines is done so using Wireless communication technology. Any type of industry must prioritize safety. Safety and security are key components of everything in the mining business.

The mining industry takes a few simple steps to prevent accidents of all kinds.

Keywords—Temperature Sensors, Gas Sensors, Wireless Communication, GPS, Blynk.

I. INTRODUCTION

Are worried these dangers are associated with coal Industries. Therefore, worker safety should always be a top priority in all underground mining activities. Underground mining operations can be dangerous for both the health and safety of workers. These dangers result from the various methods used to extract the various minerals. The risk increases with the depth of the mine. These safety concerns are quite important, particularly for the coal industry. Therefore, whether mining for coal or any other minerals, worker safety should always be a top priority. Due to ventilation issues and the possibility of a collapse; underground coal mining entails a higher risk than open pit mining. However, all types of mining have safety risks due to the use of heavy equipment and excavation techniques.

As a result of the numerous safety measures, worker education and training programs, and health and safety regulations that are frequently implemented in modern mines, both open-pit and underground mining have seen significant changes and advancements in safety. The principal source of energy in India has always been coal, and this has greatly accelerated the country's industrial development.

It is essential to the generation of about 70% of the power. Consequently, coal's significance in the energy sector is crucial. However, the process also creates additional byproducts, which pose a possible risk to the environment and the nearby population. Instead, the current study is a sincere effort to evaluate the seriousness and create a real-time monitoring system of detection using Wireless Technology (Wi-Fi) and RF transmitter and receiver.

II. LITERATURE REVIEW

Safety of the mining workers is the most important aspect in the mining industry as the mining workers will face lot of risk in the deep mines like Miners collide with heavy objects which risk their life. And miners can inhale hazardous gases that put their life in danger. When there are situations like these occur the miners will be not able to communicate with outside mining people or staff. No sensors have been used in the mining industries back then and there was no information available about environmental conditions around mining areas. And there was no tracking system available to track miners location when the miners are in danger and miners helmet were not deployed with panic button or emergency button when the mining worker is at risk so it was very difficult for miners to communicate to the control room earlier days.

Now with the proposed safety helmet miners can interact with the outside control unit and take the necessary steps when there life is in stake. And there are sensors which can check the environmental conditions in the mining area and can give clue about the upcoming hazardous situations which can be faced by the mining worker during mining job through wireless network or through RF technology and there is a GPS system to track miners location and a panic button is available in the miners helmet he/she can press the panic button when there life is in danger.

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III. COMPONENTS USED

Ardunio UNO Mircocontroller

A microcontroller board based on the Atmega328P.It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. Connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

Node MCU

NodeMCU is an open source firmware developed on the ESP8266 that enables Wi-Fi connectivity and data transmission. The firmware uses the Lua scripting language. It has micro-controller Tensilica 32-bit RISC CPU Xtensa LX106 and has 16 digital I/O pins and 1analog input pin and has a Input Voltage of 7-12V.

Temperature Sensor

A tool used to measure temperature is called a temperature sensor. This might refer to the temperature of the air, a liquid, or a solid. There are various kinds of temperature sensors available, and they all monitor temperature using various technologies and philosophies.

Gas Sensor

A gas detector is a tool that checks for the presence of gases in a space, frequently as a safety measure. Operators in the vicinity of the leak may hear an alarm from a gas detector, giving them the chance to flee.

GPS Module

Small processors and antennas found in GPS modules are used to directly receive data from satellites using specific RF frequencies. From there, it will get data from various sources, including timestamps from all visible satellites.

Push Button

A push-button, often known as a pushbutton or just a button, is a basic switch mechanism used to regulate various functions of a machine or process. Usually constructed of metal or plastic, buttons are made of strong materials.

RF transmitter

A tiny PCB sub-assembly called an RF transmitter module may send a radio signals and modulate that signal to carry data. Typically, microcontrollers are used in conjunction with transmitter modules to supply the module with data that may be communicated.

RF Receiver

The RF Receiver has four pins namely: Vcc, Dout, Linear Out, and Ground. The Vcc pin should be supplied by a controlled 5V supply. Less than 5.5mA is the working current for this module. The pins Dout and Linear out are coupled by a short circuit in order to collect the 433 MHz signal from of the air. This signal is then transferred via the data port following demodulation to obtain data.

Software Used

A). Arduino IDE

A program for Arduino may be written in any programming language for a compiler that produces the binary machine code for the target processor. Atmel provides a development environment for their microcontrollers, AVR studio and the newer Atmel Studio. The Arduino project provides the Arduino integrated development environment, which is cross platform application written in the programming language Java. It originated from the IDE for the languages Processing and Wiring.

B). Blynk Cloud

For online control of devices like Arduino, Raspberry Pi, and others, there is a platform called Blynk that has apps for iOS and Android. You can create a graphic interface for your project by simply dragging and dropping widgets on a digital dashboard.

IV. PROPOSED SYSTEM

Ensuring the protection of miners in the event of mining mishaps brought on by a rise in temperature, pressure. To facilitate outside communication between the underground coal mine workers and the people outside the mines.

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Must keep an eye on the conditions in the mines and notify the miners of any emergencies.

The location of miners can be followed via GPS.The suggested system uses the Internet of Things (IOT) so that it can early on detect and track the location of miners as well as dangerous gases at the mining area.

A). Working Principle

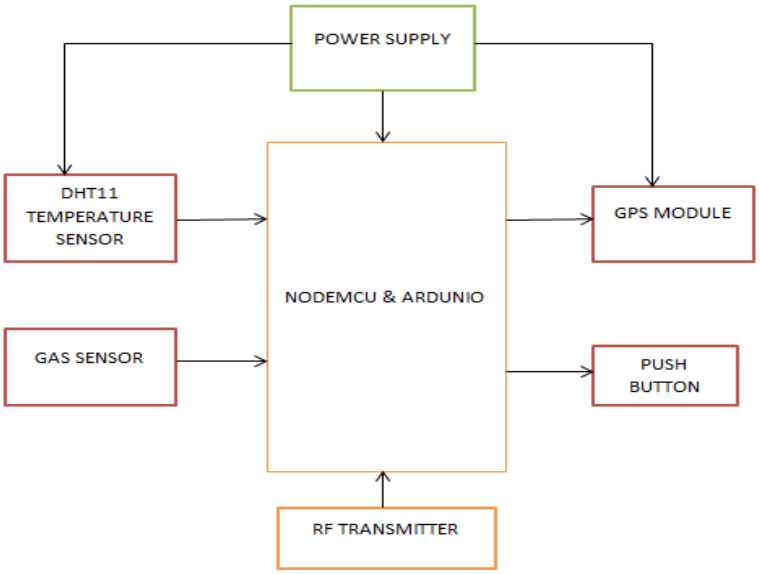

Fig 1: Helmet Unit

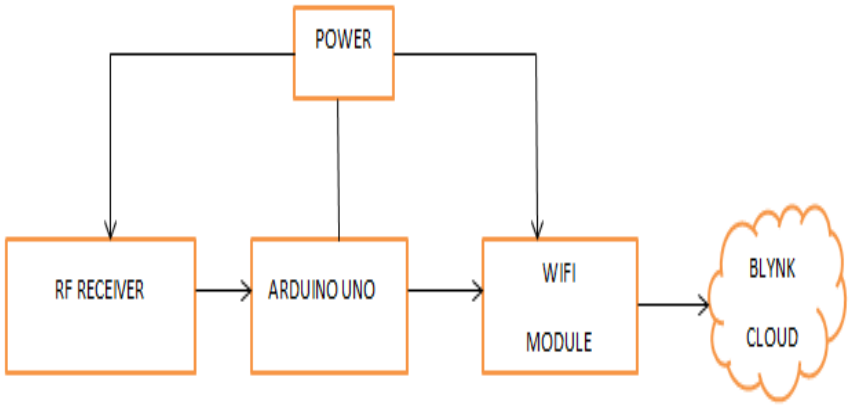

Fig 2: Control Unit

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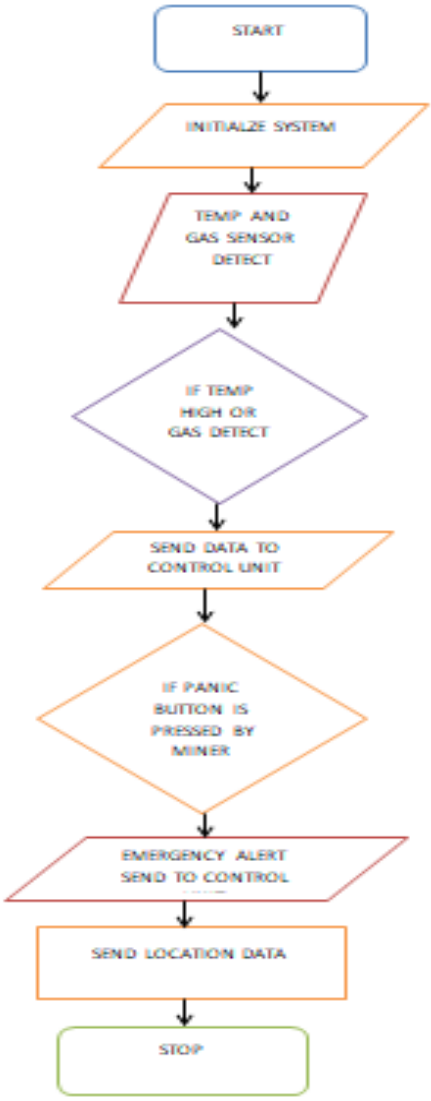

Fig 3: Flowchart Helmet Unit

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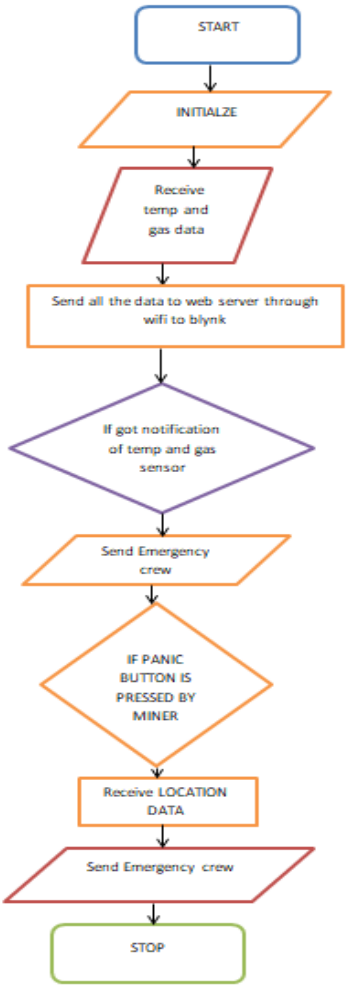

Fig 4: Flowchart Control Unit

Two modules are included in the design: a helmet module and a control room module.

Numerous sensors, a microprocessor, antennae, encoders, decoders, etc. are included in the helmet module. In the wireless sensor network, the helmet unit side functions as an clever, transmitter. The GPS module and push button for location tracking and notifications are part of the control room module. The sensors are used to assess fluctuations in temperature, humidity and gas in order to preserve the security of the mine workers, and judgments regarding the necessary actions are made based on historic data. The geolocation of the mining area miners for their protection on a hazardous operation base is likewise guaranteed by Wi-Fi technology and RF transmitter and receiver. As a result, the suggested method guarantees security and trustworthy wireless communication inside the mines.

For monitoring the temperature, humidity, and gas sensor data in this project, we're using the Blynk cloud. The Blynk software will be updated with new sensor data. The Blynk software will notify the control room if the temperature exceeds the set value. Similarly, the control room will be notified by the Blynk software if the gas sensor detects any gas. Additionally, the helmet module has a push button that, when activated in the event of an accident, notifies the control room. Additionally, the helmet has a GPS module that allows the control room to follow the miner's location in the event of an accident, saving the miner from harm.

V. EXPERIMENTAL RESULTS

Thus, the suggested system was effectively built as illustrated in fig.3, and it aids in warning the centralized terminal in the event of emergency situations. When there are anomalies in the sensor data, GPS can be used to track the miners' location.

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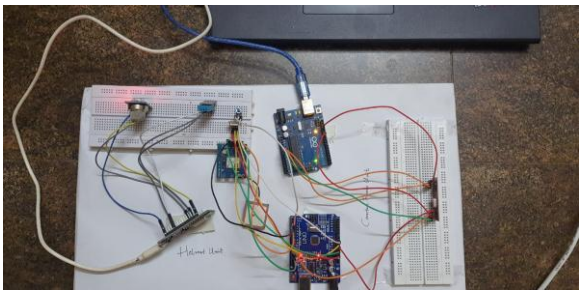

Fig 5: Prototype of the project

In underground coal mining locations, the sensors are connected to an Atmega microcontroller or Ardunio Uno that reads the value and transmits it over Wi-Fi to the blynk application installed for the helmet. One can view the real-time sensor readings using the Blynk application. The Blynk application will notify the control room if the sensor reading exceeds. Additionally, there is an RF transmitter and receiver to transmit data in the event that Wi-Fi is unavailable.

Additionally, the helmet device has an alarm button that, when pressed in an emergency, notifies the control room.

Additionally, a GPS tracker is built into the helmet module to allow emergency personnel to locate the miner.

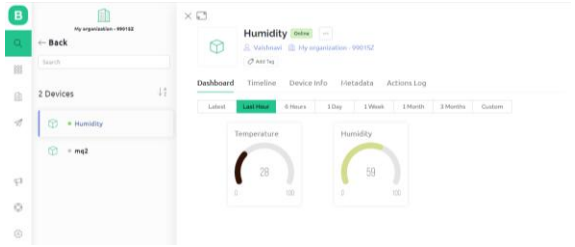

Fig 6: Temperature and Humidity Readings in Blynk

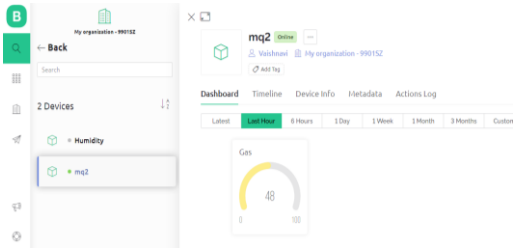

Fig 7: Gas Readings in Blynk

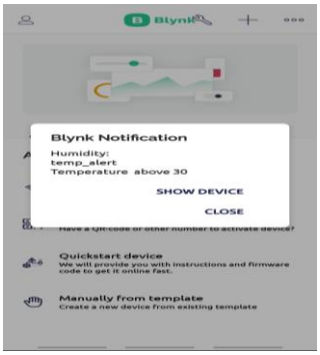

Fig 8: Blynk Notification for Temperature exceeds

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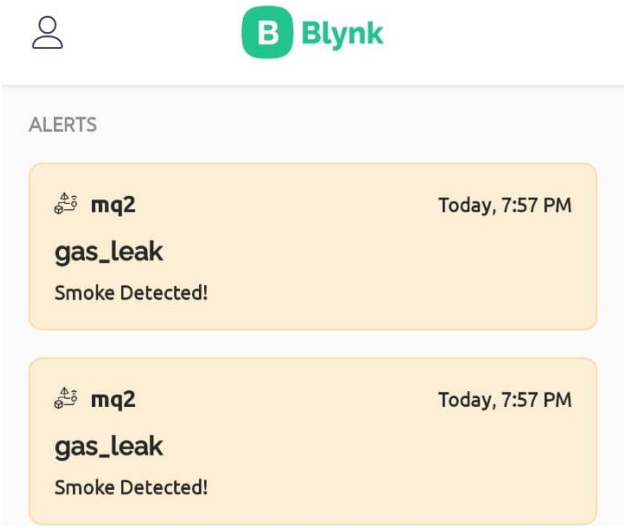

Fig 9: Blynk Notification for Gas Detected.

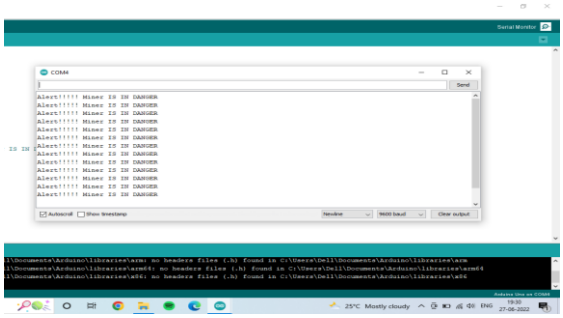

Fig 10: Alert Message when the push button is pressed by the miner

When Wi-Fi is unavailable, we can still transfer data using RF technology because the helmet unit has an embedded RF transmitter and the control room unit has an attached RF receiver.

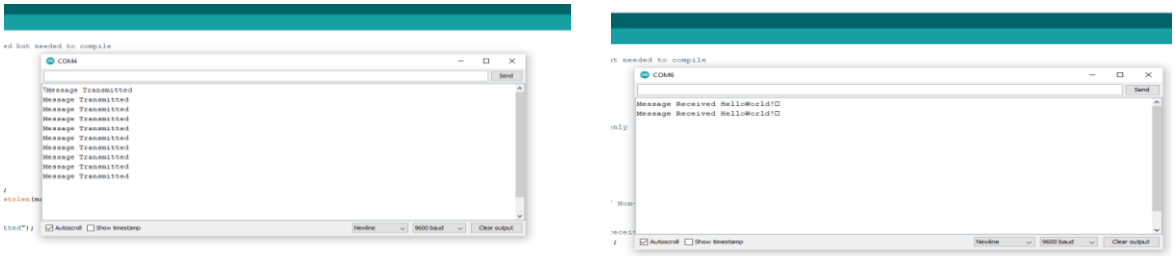

Fig 11: RF transmitter and receiver

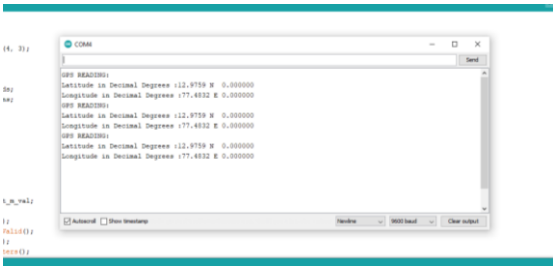

Fig 12: GPS Values

VI. CONCLUSION AND FUTURE SCOPE

In the mining industry, safety has always been a concern, particularly in depth level mining. Even while mining is much safer now than it was in earlier decades, accidents sometimes happen. According to official statistics, 5,000 Chinese miners perish in accidents every year. Worldwide, there are still many mining mishaps that

result in dozens of fatalities at once, such as the 2009 Heilongjiang mine explosion in China, the 2010 Upper Big Branch Mine disaster in the United States, and the 2007 Ulyanovskaya Mine tragedy in Russia. There are numerous safety devices.

Are offered on the market. But the Smart Helmet distinguishes out from the rest because to its advantageous design and potential. Because, in contrast to other safety equipment, it facilitates ongoing worker monitoring in mines. Alteration in the environment can be tracked with the use of a smart helmet, and the required safety measures can be implemented. Additionally, it provides a method for tracking the location of the mining worker, allowing the evacuation crew to offer timely assistance in dangerous situations. The future developments and process operations for the control room unit can be made for the mentioned purposes.

Future smart helmets may have additional sensors to increase the level of safety they offer. Using a more advanced power source that can give electricity for a very long time can also improve the functioning of the smart helmet. A power source that provides continuous protection over a long length of time will reduce the likelihood of danger. Thus, the Smart Helmet technology can stop accidents in deep mines all around the world. When compared to other communication methods, radio frequency technology and Wi-Fi is less expensive. Thus, radio frequency technology-based and Wi-Fi technology smart helmets are the nations underground miners' lifesaver.

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