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IOT Mining Tracking & Worker Safety Helmet

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Abstract: ***Working in the earth presents many different security and health dangers. Frequently the underground environment is unpleasant. The mines that are deeper, the more dangerous it could be to be running jobs. This paper proposes a Mining Tracking as well as Safety system for the mining industry using microcontroller-based circuit on the worker helmet. We use RF based circuitry to detect workers moving through the entire mining site. The helmet is integrated with a RF based tracking system which in coordination with the tracker RF systems help provide data over IOT. The system makes use of Atmega microcontroller based RF tracker circuitry to receive the data transmitted by worker helmet nodes. This helps map the current location of workers through the entire mining site. Moreover, each worker helmet circuit is integrated with a panic/emergency button. This button when pressed shows an emergency sign over the IOT web interface about the worker emergency***
Keywords: Mining, Worker Safety Helmet, IOT Mining Tracking

I. INTRODUCTION

In mining industries, there are risks for workers in emergency situations. Thus, workers safety is a main consideration in mining areas. These risks may be due to different gases, minerals, heavy machinery and methods performed in extraction in the mines whether it is for minerals or coal. In coal mines there are higher risks because it is not as open area as mineral mines, it is a closed mine. It can cause the ventilation problem for workers. Mining is necessary to the creation of goods, infrastructure and services which enhance the quality of their lives. There's oxygen leak that is restricted, and there are challenges related to leaving a mine if a crisis happens. As a society we're blessed to enjoy the many advantages that industry manufactured products provide us by processing these raw materials.

But in modern mining industries we often use safety precautions and training for workers both in coal and mineral mines. Coal has been major emergency source in India. Over 70% of energy source depends on it. But the production brings with it the other by products, which proves to be a potential threat to the environment and the people associated with it. Here we need reliable communication between workers and authorities. So here we propose a Mining Tracking as well as Safety system for the mining industry using Microcontroller-based circuit on the worker helmet. Using Microcontroller-based circuit on the worker helmet has a RF based circuitry to detect workers moving through the entire mining site.

Here the helmet is integrated with a RF based tracking system, where RF transmitter is integrated to the helmet with emergency button and RF receiver at microcontroller, which in coordination with the tracker RF systems helps provide data over IOT. In this way it will be helpful to all miners present inside the mine to save their life.

II. RELATED WORKS

Prof. K.S.Ingle, Nisha Dube et al. [1] have suggested In underground mining, ventilation systems are crucial to supply sufficient oxygen, maintaining non explosive and non-toxic atmospheres and operating an efficient mine. 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 changes based on the extensive data and the monitoring system.

Warsha M.Choudhari Professor, Datta Meghe et al. [2] They said Unexpected changes in the ventilation system are noticed by the monitoring arrangement, allowing prompt action to be considered. In underground mine, ventilation systems are critical to supply adequate oxygen, keeping up non-dangerous and non-lethal environments and an effective working mine. To monitor an underground mine, can help killing high hazard environments. Primitive procedures of monitoring a mine's air can be followed back to the utilization of canaries and different creatures to ready diggers when the climate gets to be lethal. Incorporating ventilation monitoring systems empowers a mine to insightfully roll out ventilation improvements in view of the far reaching information given by the monitoring systems. New and creating correspondence and following systems can be used to monitor mines more proficiently and transfer the information to the surface.

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Johannes Schmid, Tobias Gadeke, Wilhelm Stork, Klaus D. Muller-Glaser et al. [3] have designed the progression of technology has allowed mine monitoring techniques to become more sophisticated, yet explosions in underground coal mines still occur. The safety issues of coal mines have gradually turned into a major concern for the society and nation. The occurrence of disasters in coal mines is mainly due to the harsh environment and variability of working conditions. So, it makes the implementation of mine monitoring systems essential for the safety purpose.

Wireless sensor networks have earned a significant worldwide attention in current scenario.

Vandana et al. [4] have designed the small sized sensors are quite inexpensive compared to traditional sensors and also require limited computing and processing resources. These sensor nodes can detect, measure and collect information from the environment and based on some local statistical decision process, they can convey the collected data to the control room.

Andreas fink, Helmut Beikirch, Matthiassvob, Christian Schroder et al. [5] have given possible solutions about Wired network systems used to be a trend for traditional coal mines, which have really played a significant role in safely production in coal mines. With the continuous enlargement of exploiting areas and depth expansion, lane ways have become blind zones, where numerous unseen dangers are hidden out. Moreover, it is not possible there to lay expensive cables, which is also time consuming. So, it is essential to have a wireless sensor network mine monitoring system, which can be disposed in such mines in order to have a safe production within. The number of nodes can be increased to eliminate blind areas. Also, it offers a general communication and allocation of the goal. The dense nodes ensure the data acquisition with high accuracy and optimum data transmission, and further realization of real-time monitoring system for mine environment.

From above survey, the techniques used are ventilation monitoring system, wireless sensor methods, zigbee, LR- LAN these are primitive techniques to monitor the mining atmosphere and miners safety from the above techniques we designed a system where we can track miners status and to alert the authorities in case of emergency situations using a panic button.

III. METHODOLOGY

To Overcome the problems that were faced by miners in mining industries, we are developing a Transmitter Helmet for mining industry workers that contains a buzzer. A Transmitter Helmet provided to each of two mine workers. Eg: Miner 1 and Miner 2. The receiver is connected to two checkpoints location 1 and location 2. Each worker must report to assigned check one, then the status of mine workers is then displayed over IOT. In case of emergency, the mine workers can press the button on helmet to alert the authority. If we, power it on, then the system will get connected to website using wi-fi. The system is now online. If miner presses the button on helmet, then the status will update over IOT. The Authorities can respond the alert and help the miners.

Block Diagram

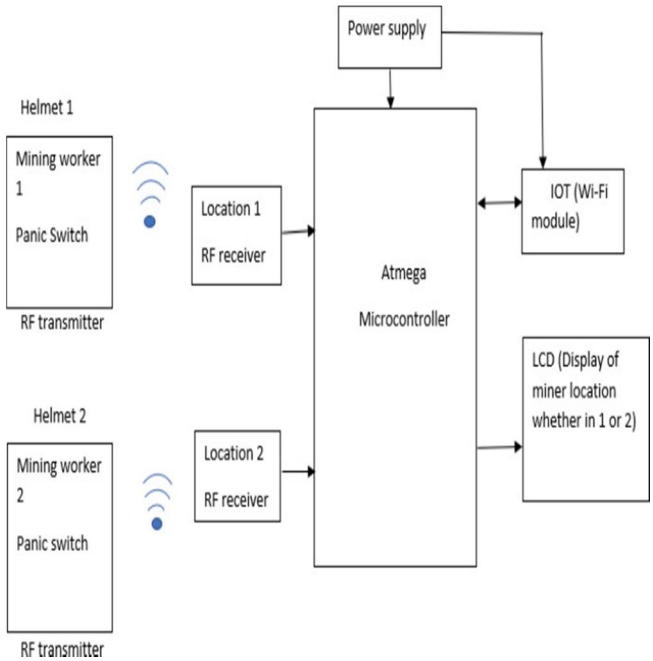

Fig 1: IOT Mining Tracking & Worker Safety Helmet The IOT module is a small electronic device embedded in objects, machines, and things connected to wireless networks and sends and receives data.

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A transmitter Helmet provided to each of two mine workers. Eg: Miner 1 and Miner 2. The receiver is connected to two checkpoints location 1 and location 2. Each worker must report to assigned check one, then the status of mine workers is then displayed over IOT. In case of emergency, the mine workers can press the button on helmet to alert the authority. RF based circuity is used to detect workers moving through the entire mining site.

The helmet is integrated with RF transmitter that upconverts the quadrature baseband signals to 2.4 GHz, and drives the antenna with a high powered CMOS power amplifier which can sense the signal of frequency range from 20KHZ-300GHZ. This signal is received by RF receiver which downconverts the RF signal to quadrature baseband signals and converts them to the digital domain with two high resolution high speed ADCs which is connected to Atmega Microcontroller to the pin PD5-PD7. Here we are using ATmega328P Microcontroller.

Now the microcontroller does the required protocols and displays the location and alerts of the miners, over the IOT web interference using the Wi-fi module that is ESP8266 as it hosts the application and used to drive both the Tx and Rx mixers. Here, LCD which is 16x2 displays the emergency situation of the worker to us. By this authorities can take the actions before the damage happens.

IV. FLOW CHART

Worker helmet circuit is integrated with a panic/emergency button. This button when pressed shows an emergency sign over the IOT web interface about the worker emergency. If miner presses the button on helmet, then the status will update over IOT. Now the Authorities can respond the alert and do the needful. This is the Expected result of our project.

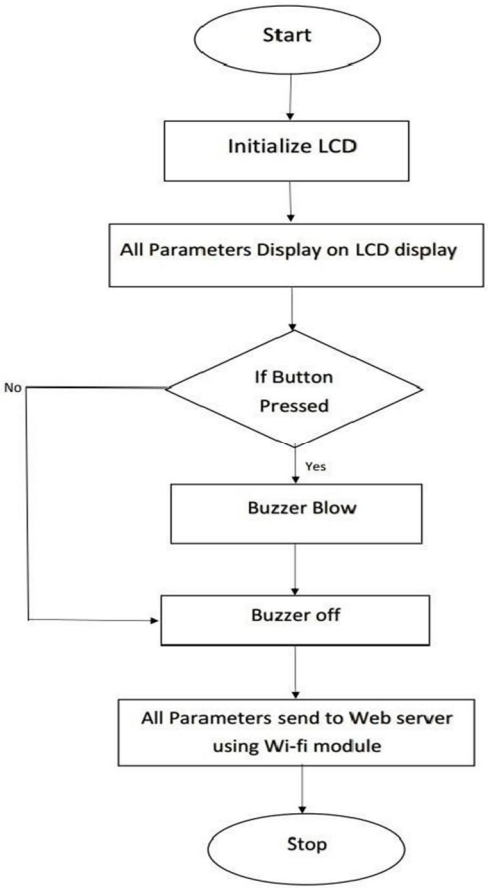

Fig 2: Flow Chart

We need to initialize the 16*2 LCD display, in which we can see the locations of miner1 and miner2 in which area they are working like location 1 and location 2. In case of emergency if worker presses the panic switch then the buzzer will blow. If the worker didn't press the panic switch then the buzzer will not blow. In case the button is pressed an alert signal is shown on the web server using Wi-Fi module. Here we use ESP8266 Wi-Fi module.

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V. EXPECTED RESULT

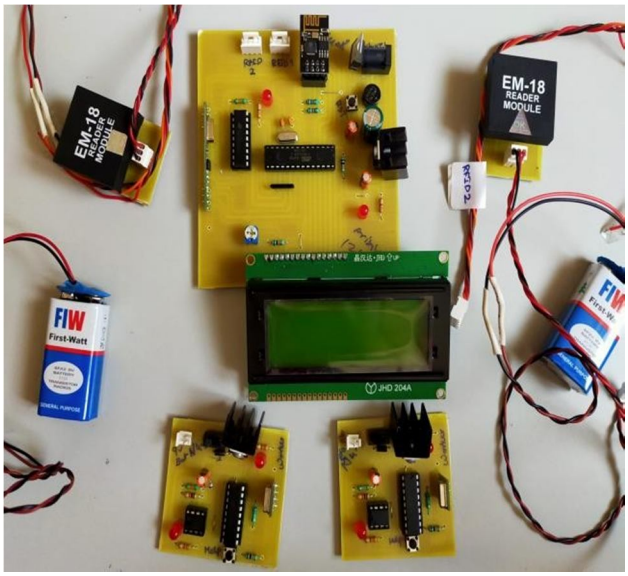

Fig 3: Expected Result

VI. CONCLUSION

For this project we have gone through the required components and specifications and we have connected the circuit according to the block diagram and circuits diagram. We are very much confident that we will get the expected outcome by the end of the project. It is developed to provide more point to point perspective of the mining system. This project is developed by RF Technology and IOT web server. It also provides reliable communication using microcontroller that is Atmega328P which is 32 bit, radio frequency is 2.4 GHz and ESP8266 Wi-Fi module. At transmitter side we have a panic switch and RF transmitter which is used to find miner locations. In case the panic switch is pressed, then at receiver side, the RF receiver which is connected to microcontroller receives the miner location. So that, it will be helpful to all miners to save them before any casualty occurs. As of now the partial connections of hardware components is done according to block diagram According to this we will plan further to implement the software part that is C programming for microcontroller and IOT web interference and testing will be done in next phase. Hence this project going to help all the miners who are working in mining industries by sending us signals before the casualties.

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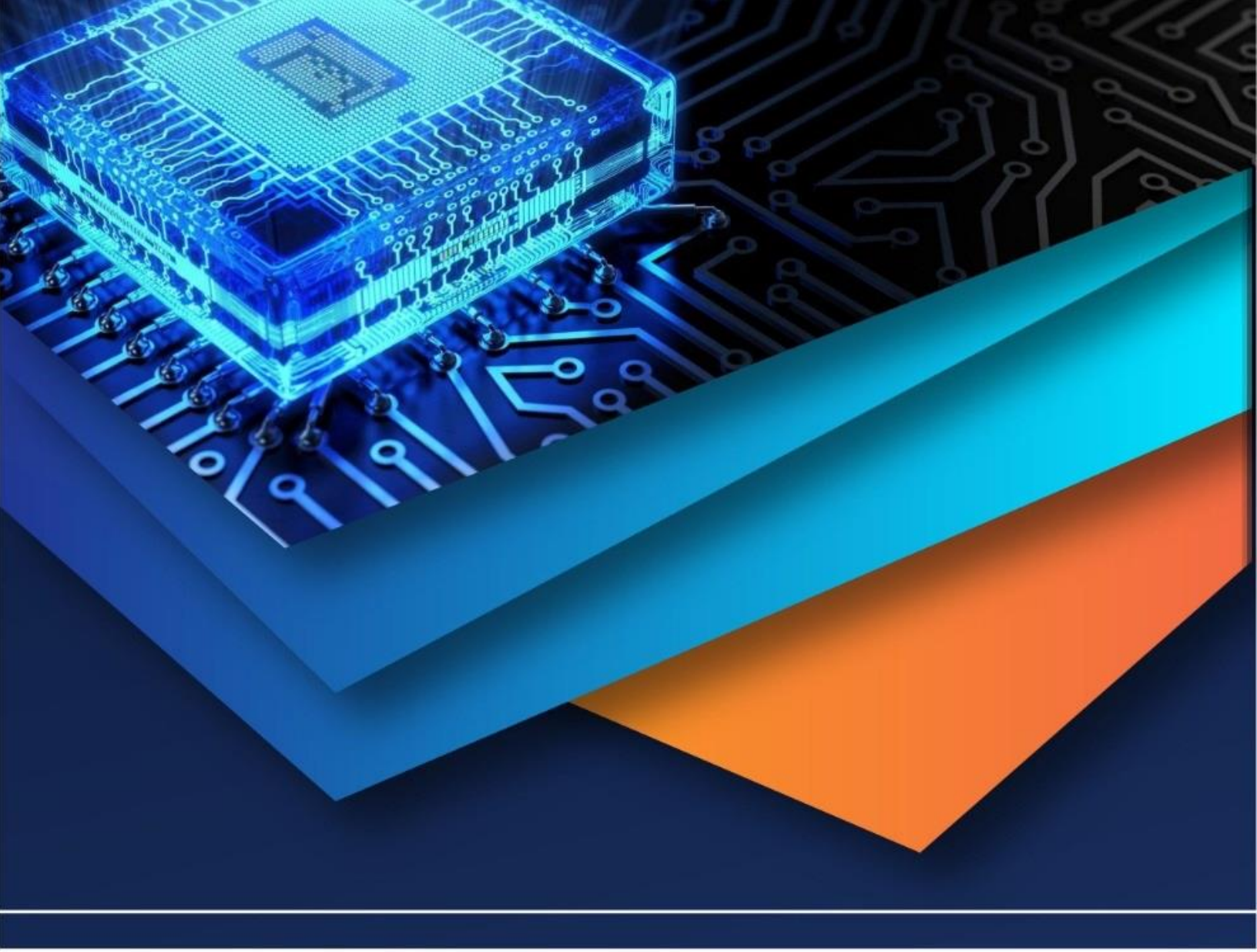

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