RF SYSTEM TO DETECT THE LOCATION OF MINERS IN COAL MINES

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Abstract-- **The main aim of the paper is to develop a smart helmet for mining industry workers. The problem addressed in this paper is the improvement of a mining helmet in order to ensure more safety awareness between miners. When working with noisy equipment, being aware of one's surroundings can sometimes be challenging. In the mining trade miners tend to get rid of their safety gear because the gear is too significant, heat or uncomfortable to work with. So, this system is developed to intimate the authorities in critical conditions. To overcome the above problem, we are developing a smart helmet for mining industry workers. Firstly to identify the worker, each worker will be having different tag. Once the tag is identified, person's data will be sent to the PC, in order to check whether the worker has been using the helmet or not. The surrounding hazardous gases will be detected by the gas sensor present in the helmet. Temperature and humidity sensor check the data and sent to the base station, LDR sensor is used to control LED turn on and off.All the data related to sensors will be sentto the PC using wifi.**

Keywords--Industry workers,gas sensor, temperature and humidity sensor, IoT based system.

I. INTRODUCTION

India is a country, whichisrenowned for its extensive and distinct mineral reserves and big mining businesses. As of 2014 April, India has over three hundred Billion Tonnes coal holds. Generation of coal in the year 2012 and 2014 remained at five hundred and forty Million Tonnes and five hundred and fifty sevenMillion Tonnesrespectively.Coal mining is a relatively dangerous Industry. Employees in coal mining may be killed or may face major injuries and compared to the workers in private industry, coal miner injuries will be severe. Supervisors will be held accountable for all the wounds that take place below their management, and thus they need to consider the probable unsafe circumstances.Theissuethatweareaddressinginthis workistodevelopaprototypeofasafetyhelmetsoas to assure extra safety alertness amongmineworkers. At the point while they are on job with machinery which produces loud noise, being alert to ones surroundings will typically bedifficult.The present mining helmets are so simple that can protect miner only from physical damages to head. It doesn't have special features to let workers know when he or his associate worker has experienced a dangerous event. Thus, the motivation of the project is to add extra safety measures ina current protective helmet for mine workers to make it more safer and technologically advanced by including a sensors, micro controllers and wireless communicating capabilities.In this project, we give an overview of the Mine worker Location Detection System with Gas, Temperature Sensing and Alert System. The main aim of our project is to rescue the mine workers who gets stuck in the tunnel while working due to some accidents. It can be used in any coalfields like, Western Coalfields. The worker are having the helmet and all the sensors are attached on the helmet. The RF signal use to identify the tunnel of the worker. The signal send to the outer control room via Wi-Fi. For this the repeaters are connected in the tunnel to increase the range of Wi-Fi.

II.   PROPOSED SYSTEM

The system consists of two parts first is miner module RF transmitter and receiver, second is ground station unit. In which the wearable hardware device (miner module) is attached to the body of the mine workers. The other hardware part is the RF receiver unit which will be present in the mine to detect the location of workers. The ground station unit will get all the data from the mine.

- **MINER MODULE**

Miner module consists of all the hardware parts to get the data from the mine. This miner module is mounted on the helmet of the miner. In this module the Node MCU ESP8266 Wi-Fimodule is the main microcontroller unit. All the sensors like gas sensor, temperature and humidity sensor, LDR sensor, 3.7V rechargeable battery, solar panel, RF receiver module are connected to the microcontroller unit to get all the data. This miner module is also consists of the RF transmitter module which is placed in the mine or tunnel to identify the workers presence in the particular mine, which will notify the ground station unit.

- **GROUND STATION UNIT**

The ground station unit is the monitoring device which can be android or IOS device or computer. The data willbe sent through the internet to the server and using the specific IP address the ground station unit will get the data on the monitor screen.

Figure 1gives the block diagram of the miner module which consists of node MCU, Wi-Fi, RF Rx, gas and temperature sensors, the power supply is provided by the 3.7V rechargeable battery and solar panel. The tunnel consists of RF Transmitter (Tx) module. When worker moves through the tunnel, the sensors on the helmet will detect the inflammable gas (LPG) and send the signal to the out station via Wi-Fi. To the outer control room is connected to the tunnel via Wi-Fi. For our demo project we use the NodeMCU which is use to connect the system via Wi-Fi. The whole system will be on the helmet. For the demo we are using the system which is bulky but if we go for mass production, the system will be compact and easy to wearable. The location of the worker is detected by the tunnel map. Every tunnel is Wi-Fi enabled by the repeater so as to increase the network range. The Gas and the temperature sensor send the signal to the control room, so that the control room will get notification and condition of each tunnel. In case, if any inflammable gas (for demo we use LPG) occurs then the signal sends to the control room and the alert alarm will ring in the complete tunnel to evacuate the area. Also, if the temperature grows then the same action will takesplace. Each helmet have the emergency button so that the worker when pressed the button then the control room will take immediate help for the worker.

B.   CIRCUIT DIAGRAM OF THE SYSTEM
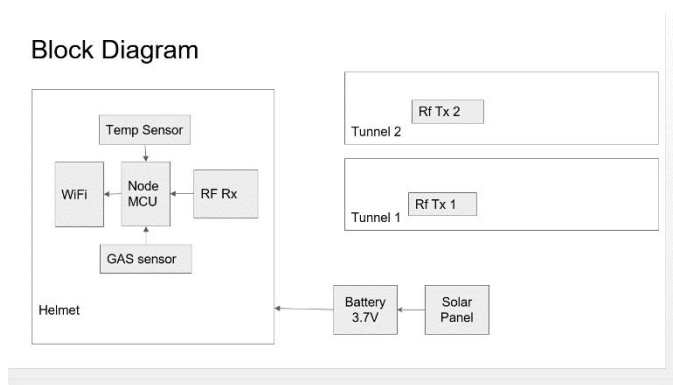
A.   BLOCK DIAGRAM AND ITS WORKING PRINCIPLE
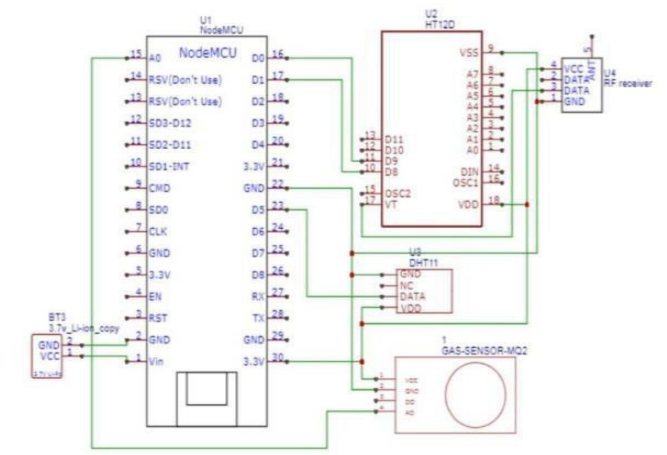

Figure 1: Block diagram of the miner module system

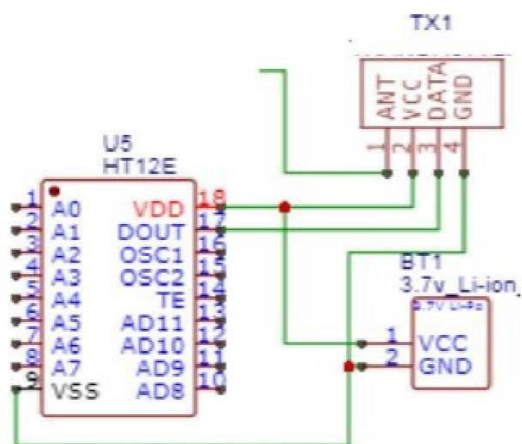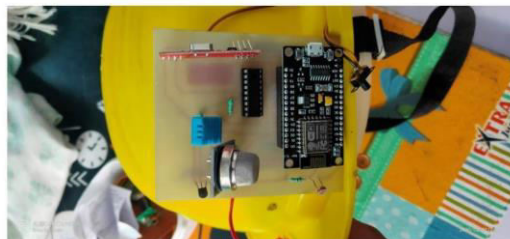Figure 2: Circuit diagram of hardware on helmet

Figure 3: Circuit diagram of hardware in tunnel

Figure 5: Flow chart of the program

C.   PROTOTYPE OF PROPOSED SYSTEM

III.   APPLICATIONS

This project has the following applications:

- Coalmine
- Chemical industries
- Refineries

IV.   RESULT

We have developed a smart helmet to help workers to get rid of hazardous events in mining such as humidity and temperature condition and existence of combustible gases. Significance of each block has been resonated out and placed carefully, thus contributing to the best working of the unit. Heart of the system is Node MCU which controls and monitors these events using IOT.

V.   CONCLUSION:

A prototype of smart helmet is developed to detect various types of dangerous event such as air quality, miner removing the safety helmet and collision on miner head and send this dangerous event information towards the monitoring section which provides rescue operation for the miner. The present Mine security system can be effectively replaced by using this rescue safety system. This system covered the most Important and Primary necessity aspect of any mine workers safety. The monitoring of depth and dangerous mines is made easy with this paper. In this paper we used Low power RF transmission and receiver. All the sensors can be easily place on helmet that helps in continuous monitoring.
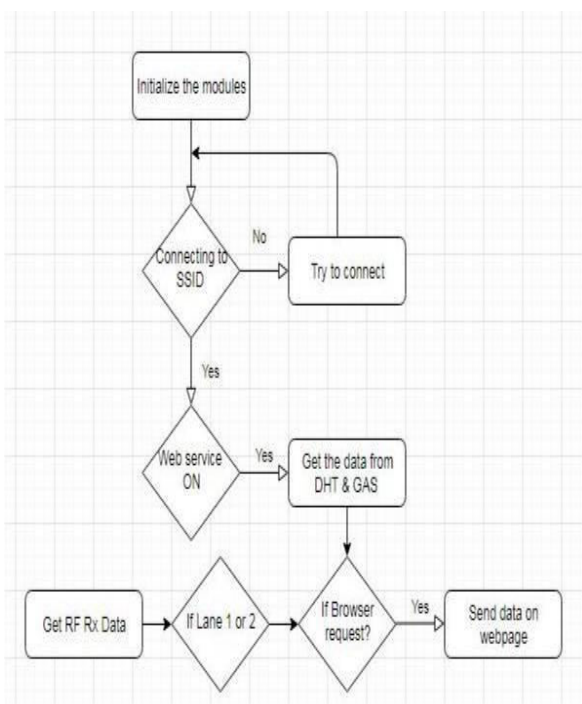
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