Mining Workers Tracking and Safety Systemwith Application Interface Using Iot

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Abstract: Here we propose 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 helps provide data over IOT. The system makes use of at mega microcontroller based rf tracker circuitry to receive the data transmitted by worker helmet nodes. This helps to map the current location of the 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. This can be used for any emergencies like- toxic gas inhalation, cave ins, physical injuries etc. Thus, the system ensures mining workers safety using IOT.

*Keywords —**coal mine, Helmet, rf Tracker, Sensors, ThingSpeak, wifi.***

I. INTRODUCTION

This project IoT Based Mining Workers Tracking and Safety System with Application Interface is towards exploration adventure for the project of Smart Helmet for Industrial Workers Safety. In the industrial sector, we were all aware of the need of safety. When workers are concealing from safety engineers and security cameras, theyusually put their helmet away from their heads & this is when their safety is endangered. The goal of this project is to create a smart helmet prototype for industrial safety.Many injuries occur on the factory floor and on construction sites in modern civilization, and these injuries are almost always caused by accidents caused by inadequate visibility, bad illumination, and noise. Workers must be provided with a helmet to prevent injuries and promote safety in industrial settings. A smart helmet is one that has sensors built into it that can measure the physical conditions of safety worker on hazardous environment. These data can be shared on an IoT network. Here ThingSpeak is the IoT Cloud Platform to monitor the parameters of a safety worker. ThingSpeak is an IoT analytics platform service that allows the device data to aggregate, visualize, and analyze live data streams in the cloud. The data can be sent to ThingSpeak from the devices, create instant visualization of live data, and send alerts.

II. LITERATURE SURVEY

In mining industry worker safety is very important issue. Every year, thousands of miners die in accidents and many more get injured, especially in the processes of the

 DOI : 10.35291/2454-9150.2023.0074

coal mining and hard rock mining. The main reason of accidents are gas or dust explosions, gas intoxications, improper use of explosives, electrical burn, fires, collapsing of mine structures, rock falls from roofs, flooding, workers stumbling/falling/slipping, or errors from malfunctioning or improperly used mining equipment . In coal mine use personal protective equipment like helmet, shoes etc. are not proper and proper arrangements were not there to checkif the person is wearing personal protective equipment or not. The proper supervision for worker wear the protective element is very important factor for consideration. Underground mines are very dark so any miners are fall unconscious because of suffocation or falling of structure, supervisor don't know about his health condition and proper treatment is not provided him in time. The main reason for miner death is harmful gases explosions. In coal mines carbon monoxide, methane, LPG gases existing and they are very harmful for human body [1].

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 miningatmosphere 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 ventilation changes based on the extensive data, the monitoring system provides [2].

The proposed study consists of an IoT-based smart helmet, which helps underground workers in many ways. It tells thepredetermined services of coal miners, such as the gas sensor, temperatures, humidity, and many other things that are essential for the safety of the miners. This helmet is made up of a helmet with detectors. The transmitter segment has a microcontroller which receives input from several sections such as a helmet remover sensor, collision sensor, and gas sensor. At a particular instance, when a harmful event happens, the helmet transfer alert towards theapplication is fixed on several different areas of the coal mine. The helmet remover, gas sensors, and collision sensors will feel the corresponding parameters [3].

III. PROPOSED WORK

We have implemented an ultimate protective helmet thatcomes with many sensors for various detection and analysisFirstly, the hazardous gases are detected using gas sensors.Whenever the poisonous gas is detected the solenoid valve gets opened for providing oxygen supplements. The second hazardous event was classified as a miner removing themining helmet off their head. An IR sensor was developedsuccessfully to determine when the helmet is off theminer's head. The third hazardous event is defined as anevent where miners stuck by an object against the with aforce exceeding a certain level by using force sensor whichis used for detection. The unpredicted hazardous conditionssuch as temperature and pressure are sent to the control station via wireless transmitters for continuous monitoring. GPS is also provided for easy tracking of miners position.Panic switch is manually operated by miner to seek helpfrom central console in highly emergency conditions. Thefire sensor present in the helmet detects the fire even in a far distance and helps to provide safety measures at the earliest.

IV. IMPLEMENTATION

The main objective of this project is to create a smart helmet for miners in order to save them from hazardous situations. Such as gas explosion, health issues and temperature changes by using sensors and WIFI for early warning of the danger.

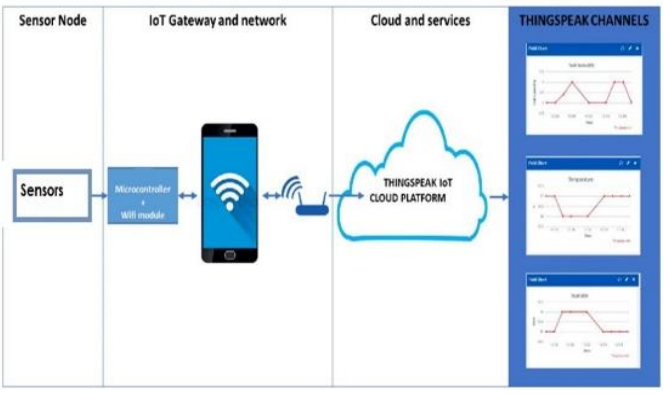

Fig.4.1.System Architecture

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A smart helmet is one that has sensors built into it that can measure the physical conditions of safety worker on hazardous environment. These data can be shared on an IoTnetwork. Here ThingSpeak is the IoT Cloud Platform to monitor the parameters of a safety worker. ThingSpeak is an IoT analytics platform service that allows the device data to aggregate, visualize, and analyze live data streams in the cloud. The data can be sent to ThingSpeak from the devices, create instant visualization of live data, and send alerts. This system is a real-time monitoring system which may assist in monitoring and control over the mining environment. The primary objective of this project is to design an efficient real-time IoT Smart Helmet so that various leaked mine gases, fire, pressure difference underground, temperature variance etc. could be identified at times from remote place and preventive measures could be devised accordingly.

1. Temperature & Humidity: **sensor** Temperature & Humidity sensor used in this smart helmet is DHT11. Whenever the temperature & Humidity operates more than defined limits, limits, buzzer and gives a rescue data will besent to the server & will be displayed on AWS IoT application.

2. Gas Sensor :The gas sensor used here is MQ4 which primarily detects the presence of methane gas with a concentration range of 300 ppm to 10000 ppm. This range is considerably good to detect any presence of gas leaks in the mines or any petroleum industry. If any hazardous gasis detected, the sensor immediately detects with buzzer alert& shares a rescue message to the IoT network.

3. Emergency Switch**:** Emergency switch is present in the helmet if the worker finds any difficulty in breathing or needs any emergency assistance. When the switch is pressed, the system will send a data to the server immediately so that the monitoring station can provide the required assistance immediately

4. Fire Sensor : It is also useful in determining how severe the fire will be after any explosions. The fire sensor presentin the helmet detects the fire even at a far distance & helps to provide safety measures at the earliest.

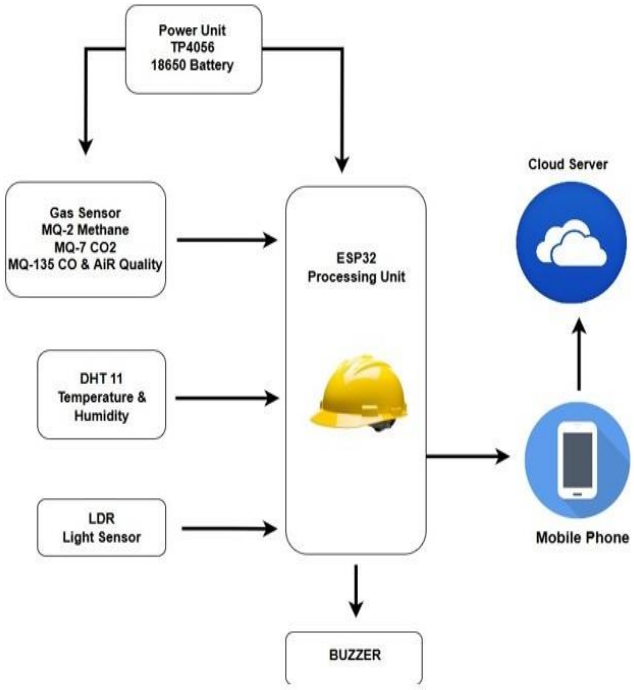

Fig.4.2.Hardware and Software Used

The software design stage is created in accordance with thestudy's operating flow. Sequence programming and interface programming are the two categories in which the software is split. In order to achieve the project's approved goal, both sections must be connected and run at the same time. The steps of testing, adjusting, and troubleshooting are crucial in the design process. These steps occur after the hardwareand software components have been combined. As a result, even a minor design flaw might be time- consuming, requiring retracing back to earlier stages for confirmation.

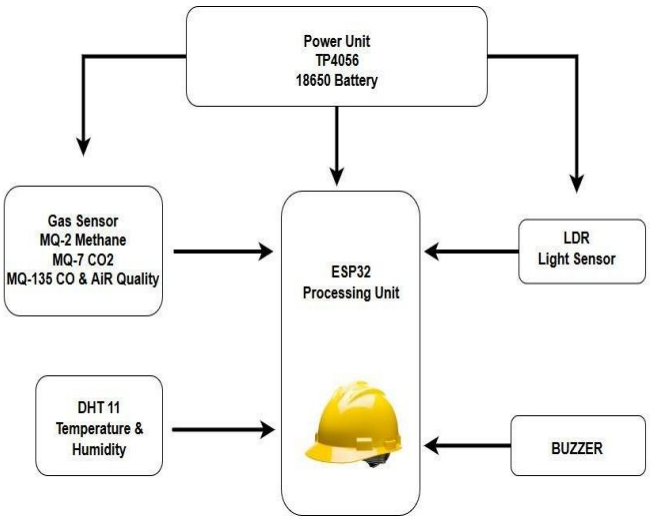

Fig.4.3.Flow of Hardware Section

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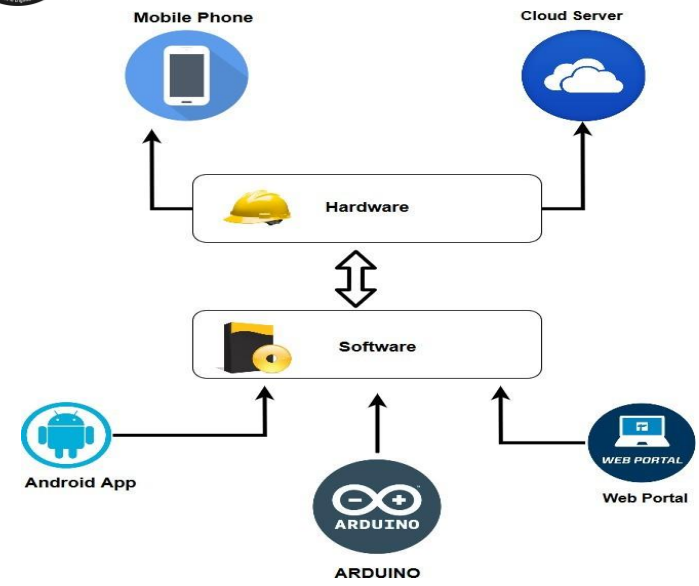

Fig.4.4.Flow of Software SectionSmart Helmet Design

The ESP32 has a faster Wi-Fi, a CPU core, more GPIO pins, and Bluetooth low energy capabilities. The ESP32 also has a temperature sensor, touch-sensitive pins, and a hall effect sensor built in. Both boards are very cost-effective. The ESP32 has more pins than the ESP8266, and you can pick whether the pins are UART, SPI, or I2Call you have to do is specify this in the code. This is feasible because to the multiplexing feature of the ESP32processor, which allows various purposes to be assigned to the single pin.

The MQ2 gas sensor can detect the presence of Hydrogen, LPG, and Propane, as well as Methane and other combustible steam. It is low-cost and suited for a variety of applications. Power is given 5 volts for the smoke sensor. The voltage output by a smoke sensor indicates the presence of smoke. More smoke is produced. To change the sensitivity, a potentiometer is included. Once the air is pure, the SO2 (Sulfur Dioxide) detector is utilized, which has a low conductivity. VCC and GND provide power to the heater from the electricity supply. A variable resistor is included in the circuit. The resistance throughout the pin is determined by the amount of smoke in the sensor's environment. The resistance throughout the pin is determined by the amount of smoke in the sensor's environment. If the content is more, the resistance will be lessened. In addition, the voltage between the sensor and the load resistor is increased. The MQ-7 semiconductor sensor is primarily used for carbon monoxide detection (CO). Tin Dioxide SnO2 (Tin(IV) Oxide) and micro Al2O3 (Aluminum oxide) ceramic tubes make up the MQ-7 gas sensor. A crust has been established between the heater and the electrode. After the sensor has been heated to a higher temperature by 5V, it cleans another gas that has been adsorbed at a lower temperature. The MQ-7 has six pins, four of which are used to bring signals and two of which are usedto supply heating current. Sensor module for air quality MQ135 It is a dangerous gas detection element for the familyand the environment, and it is ideal for ammonia, Sulphur, aromatic compounds, smoke, benzene vapor, and other gases harmful gas detection, as well as the evaluation of gas- sensitive components. Nitrogen oxide, ammonia, benzene, alcohol, carbon dioxide, and smoke are among gases that canbe detected by an air quality sensor. It works well in a manufacturing or office setting with a simple drive and monitoring circuit. Infrared sensor, A helmet removal technique based on an infrared ray sensor is used to determine whether or not a mine employee has removed his protective helmet. When an infrared sensor transmits a continuous signal from one end to the other, the sign is blocked, indicating that the miner is wearing a helmet. This DHT11 Temperature and Humidity Sensor is equipped with a condition and moisture sensor, as well as a survey mac cue harvest. It ensures high trustworthiness and attractive global establishment by accepting the fashionable numerical-alarm- acquisition routine as well as heat and moisture sensing mechanization. This sensor connects to a high-speed 8-bit microcontroller and comprises a resistive-type steaminess measurement segment and an NTC climate assessment piece, resulting in a completed condition rapid response, anti-interference strength, and cost-effectiveness. When the sensor output exceeds the threshold quantity detected by the sensor, the buzzer will sound. It makes use of apiezoelectric sensor. The Piezo buzzer is a handy sound generator that canbe used to provide a sound indicator in digital circuits. It's extensively utilized in digital gadgets as an alarm. A Piezo buzzer is made up of a Piezo disc and an oscillator. A standard Piezo buzzer is powered by 3 to 12 volts DC.

V. CONCLUSION

A clever mining A helmet has been designed that can

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detect types of potentially dangerous events: toxic gas levels, mining helmet removal and collision, and effect, Fire detection, Emergency switch. A miner pulling their mining helmet from their head was classified as a hazardous incident. Another dangerous event is when miners are struck by an object that is opposed to their will and has a force greater than 1000 on the HIC (Head Injury Criteria). It's also possible to measure gas concentrations.

REFERENCES

Lin, B. and Raza, M.Y., 2020. Coal and economic development in Pakistan: A necessity of energy source. Energy, 207, p.118244.

[2]. Jeong, M., Lee, H., Bae, M., Shin, D.B., Lim, S.H.and Lee, K.B., 2018, October. Development and application of the smart helmet for disaster and safety. In 2018 International Conference on Information and Communication Technology Convergence (ICTC) (pp. 1084-1089). IEEE.

[3]. Ghulam E Mustafa Abro, Shoaib Ahmed Shaikh, "PROTOTYPING IOT BASED SMART WEARABLE JACKET DESIGN FOR SECURING THE LIFE OF COAL MINERS"2018 International Conference on Computing, Electronics & Communications Engineering (iCCECE)

[4]. Jiya Tian , Juan Zhu, "POSITIONING SYSTEM FOR MINERS BASED ON RFID" 2011 InternationalConferenceon Multimedia Technology

[5]. D. Kock and J. W. Oberholzer, THE DEVELOPMENT AND APPLICATION OF ELECTRONIC TECHNOLOGY TO INCREASE HEALTH, SAFETY, and productivity in theSouth African coal mining industry," IEEE Trans. on Industry Applications, vol. 33,no 1997.

[6]. Gaidhane, Mahendra Dhame and Prof. Rizwana Qureshi "SMART HELMET FOR COAL MINERS USING ZIGBEE TECHNOLOGY" Imperial Journal of Interdisciplinary Research (IJIR) Vol-2, Issue-6, 2016 ISSN: 2454-1362

[7]. CHENG Qiang, SUN Ji-ping, ZHANG Zhe, ZHANG Fan "ZIGBEE BASED INTELLIGENT HELMET FOR COAL MINERS" World Congress on Computer Science andInformation Engineering 2009

[8]. Yongping Wu , Guo Feng , Zhang Meng,"THE STUDY ON COAL MINE USING THE BLUETOOTH WIRELESS TRANSMISSION" 2014 IEEE Workshop on Electronics, Computer and Applications.

[9] Ghaith Bader Al-Suwaidi, Mohamed Jamal Zemerly, "LOCATING FRIENDS AND FAMILY USING MOBILE PHONES WITH GLOBAL POSITIONING SYSTEM (GPS)," IEEE/ACS International Conference on Computer Systems and Applications, 2009.

[10]. Jesudoss, A., Vybhavi, R. and Anusha, B., 2019, April. Design of smart helmet for accident avoidance. In 2019 International Conference on Communication and Signal Processing (ICCSP) (pp. 0774-0778). IEEE.

[11]. Mohammed, M.N., Syamsudin, H., Al-Zubaidi, S., AKS, R.R. and Yusuf, E., 2020. Novel COVID-19 detectionand diagnosis system using IOT based smart helmet. International Journal of Psychosocial Rehabilitation, 24(7), pp.2296-2303.

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