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Smart Helmet for Mining Workers

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Abstract: ***A traditional model of the smart helmet has been produced to assist miners operating in the mining industry. Many risky incidents commonly occur in the mining sector, many of which result in life-threatening injuries or death.***
A miner's helmet is one of the most regularly used safety equipment for mine workers hence it must be loaded with some more advanced features with use of different sensor.
A smart helmet has been developed which includes various features such as the two way communication, detection of the hazardous gases, providing notification in the case of helmet removal, collision (miners are struck by an object), panic switch for emergency situations, continuous monitoring of the environmental conditions such as temperature and pressure in the mining industry and GPS is provided to track the location of the miner.
Keyword: GPS, Ardino. Temperature Sensor, Vibration Sensor, GSM.

I.INTRODUCTION

The Internet of Things(IOT) refers to the connection of everyday physical objects to the internet and to each other, allowing them to collect and exchange data.
These objects can include a wide range of devices, such as home appliances, wearable devices, vehicles, sensors, and more. The basic idea behind IoT is to create a network of connected devices that can communicate with each other and with cloud-based applications and services to share information and perform automated tasks.
This can enable various applications, from smart homes and cities to industrial automation and healthcare. IoT devices typically rely on a combination of sensors, wireless communication technologies, and cloud computing infrastructure to enable data collection, processing, and storage.
Some of the key benefits of IoT include improved efficiency, increased automation, enhanced safety and security, and better insights into complex systems.
In this paper we are using IOT for making safety for mining workers Because mining workers were frequently getting into accident. During the time of extraction the accidents take places range from relatively minor incidents ,such as equipment failures or slips and falls, to major disasters that result in serious injuries or fatalities.
Mining companies are required to adhere to strict safety regulations and guidelines to prevent accidents and ensure the safety of their workers.
In the event of a mining accident, emergency response teams are typically called in to provide assistance and rescue trapped miners .So we made a helmet for miners with the help of IOT sensors to make them safe at some point.

II. EXISTING SYSTEM

Government had taken many measures for mining workers like they formed Mine Safety and Health Administration (MSHA), Personal Protective Equipment(PPE),Emergency Response plan, Monitoring System, Safe Work Procedures, Training and Education. In Monitoring systems researchers had used the gas sensor, IR sensor, temperature, pressure, and force.
Environment monitoring is done using temperature and pressure sensors. Force sensors are used each time the miners collide with a heavy item.
When a miner takes off their helmet, an Infrared sensor alerts the central console. To identify the presence of dangerous gases in the atmosphere, gas sensors are utilized.
In the event of any irregularities, GPS is utilized to track the whereabouts of the miners. In cases of extreme emergency, the miner can manually activate the panic switch to request assistance from the central console.
In order to prevent the intake of toxic fumes caused by the solenoid valve opening, an oxygen supplement is provided within the helmet.

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III. PROPOSED DESIGN

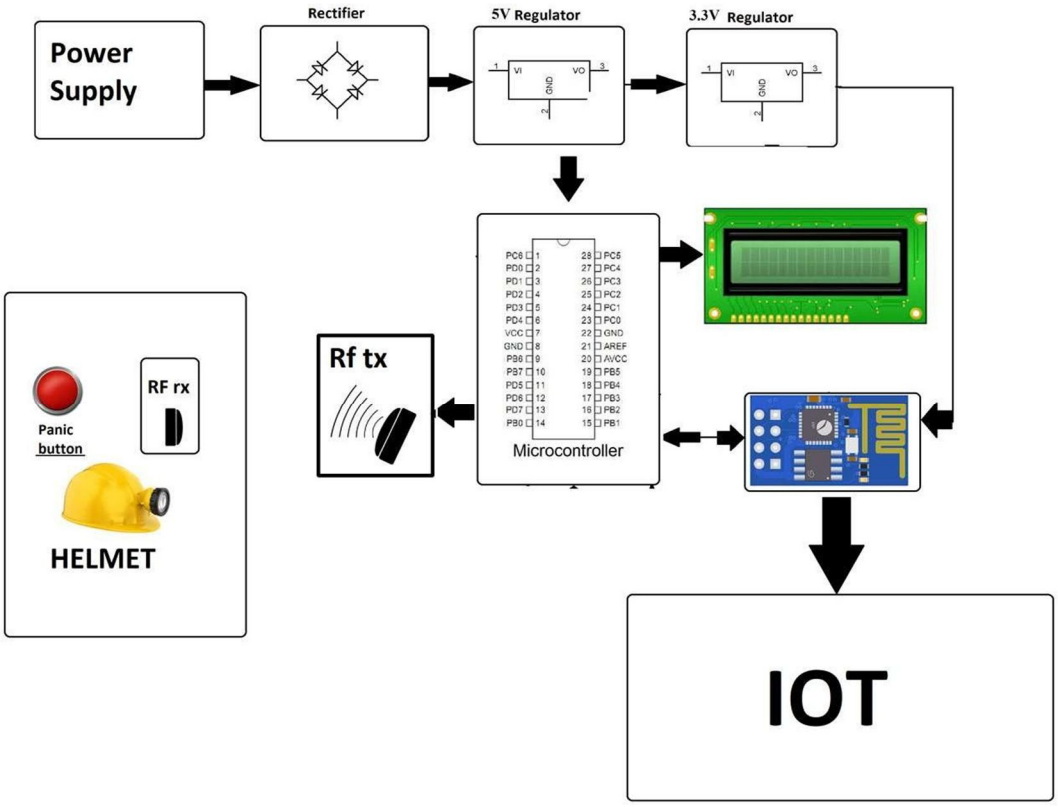


Fig 1 Circuit Diagram

We have put in place a helmet that has the best protection possible and has a tonne of sensors for different kinds of analysis and detection. Initially, gas sensors are used to find the dangerous gases. The solenoid valve opens to provide additional oxygen whenever a dangerous gas is found. A miner taking off their mining helmet was considered the second risky event. It has been successfully designed to use an IR sensor to detect when a miner's helmet is removed from their head. By using a force sensor, which is employed for detection, the third hazardous event is described as a situation in which miners are struck by an object against the head with a force that exceeds a particular level. Wireless transmitters relay the unexpectedly dangerous circumstances, such as temperature and pressure, to the control station.

IV. HARDWARE DETAIL

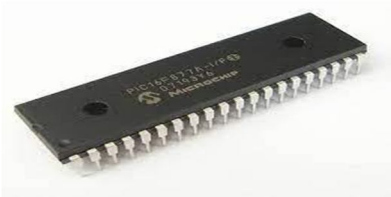


Fig 2 PICI 6F877A Microcontroller

A. PICI 6F877A Microcontroller

The microprocessor PIC l 6F877A employs Harvard architecture. It includes every part a typical modem microcontroller would have. It is the perfect answer for applications like the control device, measurement of various values, etc. because of its low cost, broad application range, high quality, and ease of availability. Its operating speed is DC -20MHz clock input and DC-200 ns instruction cycle, and it has 40 pins. 5 volts is the operating voltage.

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B. Gas sensor(MQ4)



Fig 4 Gas Sensor

A gas sensor is a gadget that looks for gases in a space, frequently as part of a safety system. This kind of apparatus can interface with a control system to trigger an automatic process shutdown when it detects a gas leak or other emissions. Chemical sensors have a category known as gas sensors. The level of gas in the area is measured by a gas sensor. To determine a gas's concentration, a gas sensor interacts with it.

C. Temperature Sensor (DHT11)



Fig 5 Temperature Sensor

This sensor is used in various applications such as measuring humidity and temperature values in heating, ventilation and air conditioning systems. Weather stations also use these sensors to predict weather conditions. The humidity sensor is used as a preventive measure in homes where people are affected by humidity.

D. Vibration Sensor (SW420)

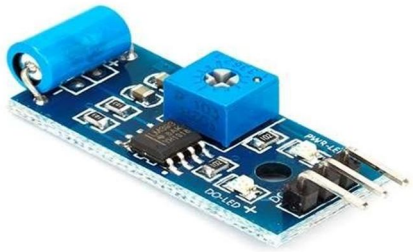


Fig 6 Vibration Sensor(SW420)

The vibration sensor module based on the vibration sensor SW-420 and Comparator LM393 is used to detect vibrations. The threshold can adjust using an on-board potentiometer. During no vibration, the sensor provides Logic Low and when the vibration is detected, the sensor provides Logic High.

E. GPS



Fig 7 GPS

Global Positioning System is known as GPS. It is a navigation system that gives users all around the world access to position and time data through a network of satellites orbiting the Earth. The United States government created GPS, which is now widely used for many purposes such as tracking, mapping, navigation, and surveying.

F. GSM



Fig 8 GSM

To distribute radio frequencies to various users, GSM technology combines time division multiple access (TDMA) and frequency division multiple access (FDMA). In order to avoid interference, this enables numerous users to use the same frequency range simultaneously. A SIM (subscriber identity module) card, a tiny chip containing data about the user's identification and mobile phone number, is also used by GSM. It has the benefit of allowing for worldwide roaming, which enables users to use their mobile devices in other nations with GSM networks. Because GSM uses the same radio bands and standards around the world, this is achievable. Moreover, GSM offers a variety of services, including voice calls .

V. EXPIREMENT RESULTS

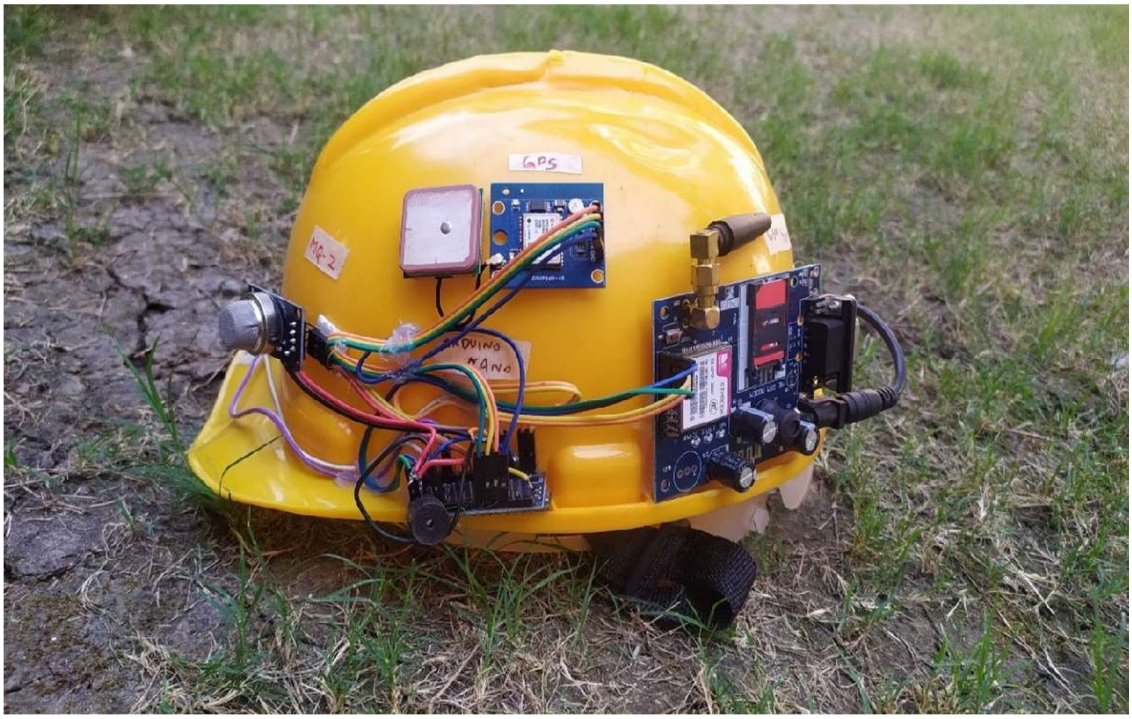


Fig 9 Result

The proposed system is thus developed successfully as shown in the fig:9 and it helps in alerting the central console in case of critical conditions. GPS helps to track the miners location during abnormalities in the sensor information.

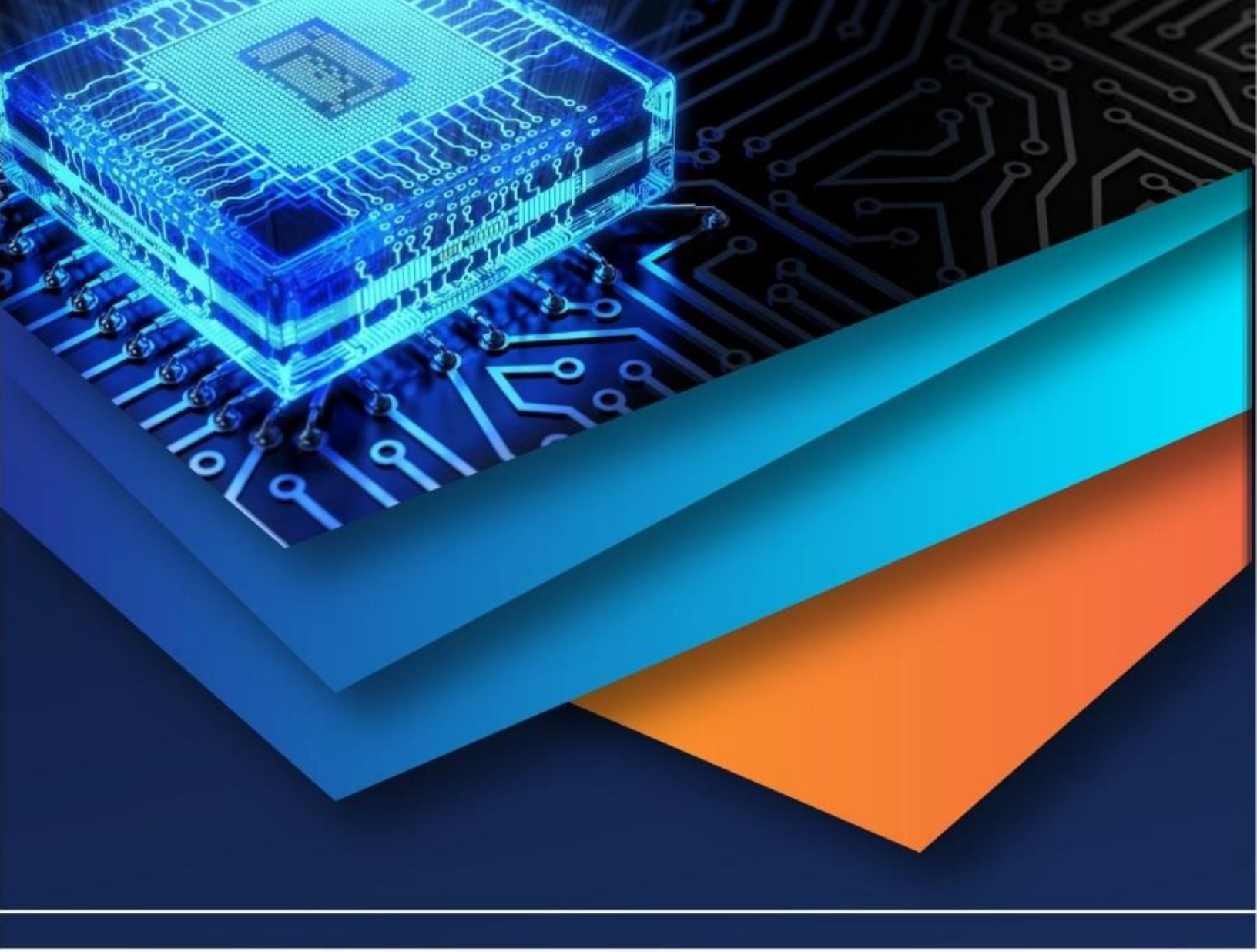
VI. CONCLUSION

This helmet will help miners to get safe even after the accident. Safety has always been of great concern in mines. In modern day mines measures are taken to provide help to the person stuck in any of the life threatening situations. A model is built to sense the data from the real time environment and process. The same data is updated to the cloud, which can be accessed from anywhere around the area. Alert notification is sent to the supervisor if any safety concern is detected. This additional feature of notification alert enhances the features of the wearable device. By using this model of helmet, the identification of each individual is possible, as separate channels are built at the IoT platform for every specific user ID.

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