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SMART HELMET FOR COAL MINERS

Review - 3

By

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Submitted to

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in partial fulfilment of the course of

Technical Answers for Real World Problems

ECE3999-TA2

DECLARATION BY THE CANDIDATES

We hereby declare that the project report entitled "**SMART HELMET FOR COAL MINERS**" submitted to VIT University, Vellore is a record of J-Component project work carried out by us under the guidance of **Mrs. Prayline Rajabai C**. We further declare that the report has been written in our own words and have provided proper references whenever we referred to other articles or the internet.

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I express gratitude to my guide **Prayline Rajabai C**, for guidance and suggestions that helped me to complete the project on time. Words are inadequate to express my gratitude to the faculty and staff members who encouraged and supported me during the project. Finally, I would like to thank my ever-loving parents for their blessings and my friends for their timely help and support.

Signature of Student

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ABSTRACT:

Underground mining hazards include suffocation, gas poisoning, roof collapse and gas explosions. Keeping all these aspects in mind we designed a system, i.e. smart helmet using 8051 microcontroller technology for monitoring the hazardous gases, abnormal temperature conditions and the humidity levels in the air. In our system, the helmet is having the circuit with three sensors i.e. temperature, humidity and gas to monitor the conditions in coal mine.

If there is any hazardous situation in the mine the helmet gives the information to the coal miner by sending message to the respected person so that a miner can have a chance to rescue his life from the hazards occurred in coal mines.

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1. Introduction

India is the fourth largest producer of coal in the world, producing 536.5 million metric tons of coal per year. There are around 3,33,097 miners working in India. The safe production level of coal mine is still low, especially in recent years, disasters of coal mine occur frequently, which lead to great loss of possession and life, the safety problems of coal mine has gradually become to the focus that the nation and society concern on. Mining accidents can have a variety of causes, including leakage of poisonous gas, Roof fall and insufficient oxygen level. Sometimes during mine disasters miners who are alive get trapped by roof fall occurrence lost their lives due to lack of or delay in rescuing operation

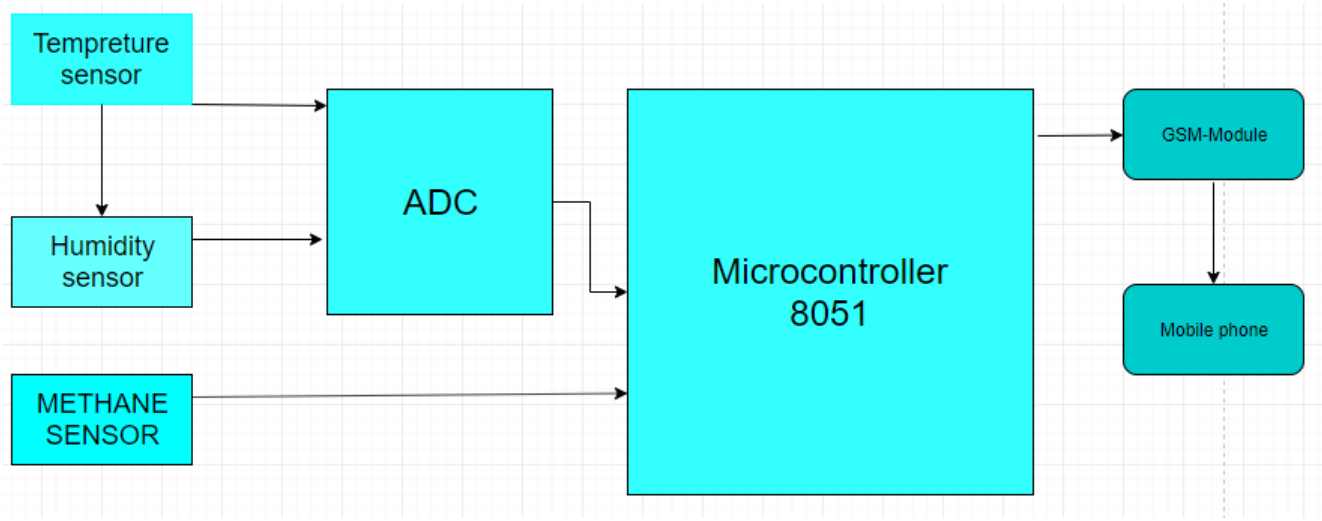
The most important part of any type of industry is safety. In the mining industry safety and security is a first aspect of all. To avoid any types of unwanted conditions, every mining industry follows some basic precaution.

Communication is the most vital key factor today, to monitor different parameters such as collision, gas, and helmet remover continuously using sensors such as collision sensor, gas sensor MQ5 and Helmet sensor to take necessary actions accordingly to avoid any types of hazardous conditions and gives an alert. To achieve safety in underground mines, a suitable communication system must be created between workers, moving in the mine, and a fixed base station. The wired communication network technology system will be not so effective. Under the mines due to uncomfortable situation the installation cost as well as maintenance cost is high for wired communication networks.

The person who are working in coal mines has to face various environmental parameters in their mining. They have danger from methane, carbon monoxide and temperature. So, we need to provide a strong security for the people who are working in the coal mine the

purpose of this project is to provide a solution to mining a wireless communication and safety monitoring.

2.BLOCK DIAGRAM:



3.Literature review:

3.1. Zigbee Based Intelligent Helmet for Coal Miners Safety Purpose

This paper focuses on a mine supervising system which is based on the cost effective IOT (ZigBee) system. This project aims at developing a sensor networks, realized real-time surveillance with early-warning intelligence on harmful gases, temperature, humidity in mining area and used ZigBee communication to reduce potential safety problems in coal production using a ZigBee technology. All these three parameters are detected continuously by temperature sensor, gas sensor, humidity sensor and if they cross the pre-defined limit, then the user gets information about all three sensors and it displays on thing speaks site as the graphs and it will automatically update the values to this site. With a Zigbee positioning devices the system might be easily extended. The values of different sensors are continuously transmitted

by ZigBee transmitter to the remote monitoring unit which are received by Thingspeak site through IP address.[1]

3.2. Microcontroller Based Smart Helmet for Coal Miners Safety

This paper main focus on the miners supervising system, which is based on the cost-effective wireless network. Real time monitoring with initial warning intelligence on harmful gases, helmet removal, collision detection in mining area and RF module used for information transfer to reduce safety problems in coal mining area for this purpose they develop smart helmet. All these parameters are detected continuously by gas sensor, collision sensor, and helmet remover sensor and if they cross the pre-defined limit, then the remote device gets alert as the buzzer will automatically turn on with LCD display shows the status. As the system consisting of microcontroller transmitter and receiver the system can be easily extended. The values of different sensors are continuously transmitted by RF transmitter to the remote monitoring unit which is received by RF receiver module.[2]

3.3. Microcontroller Based Smart Helmet for Coal Miners Safety

This paper tends to the supervision system of miners in order to detect hazardous events that occur in the mining environment. The problem addressed in this paper include gas poisoning, helmet removal and object fall which can sustained a life-threatening injury. In mining industry harmful gases like SO2, CO and NO2 occurs which can cause suffocation. Death of minors mainly causes due to object fall if proper treatment is not provided. Helmet removal is also a dangerous. This paper tends to develop a wireless sensor network to monitor real time situation of underground mines from base station. It gives surveillance with early warning intelligence of harmful gases. So, to detect all these,

they are using air quality sensor, accelerometer, Infra-red (IR) sensor. These are connected to the RF module. This module does all processing and also controls wireless communication between separate helmet using Contiki operating system. Microcontroller AVR-ATMEG 16 is used as analog to digital converter. All sensors have some threshold value if they cross that value then buzzer will automatically on and status will display on LCD. [3]

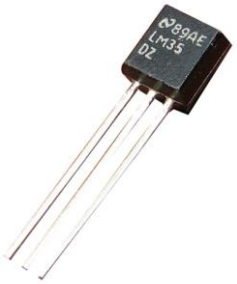
4.COMPONENTS:

1. 8051 microcontrollers	-Rs.300
2. Temperature and Humidity sensor	-Rs.150
3. Methane sensor	-Rs.190
4. GSM module	-Rs.800
5. Bread board	-Rs.50
6. LEDs	-Rs.10
	Total= Rs.1500

4.1. TEMPERATURE SENSOR:

Contact sensors include thermocouples and thermistors that touch the object they are to measure, and noncontact sensors measure the thermal radiation a heat source releases to determine its temperature. The latter group measures temperature from a distance and often are used in hazardous environments. Temperature sensors are used in diverse applications such as food processing, HVAC environmental control, medical devices, chemical handling and automotive under the hood monitoring (e.g., coolant, air intake, cylinder head temperatures, etc.). Temperature sensors tend to measure heat to ensure that a process

is either; staying within a certain range, providing safe use of that application, or meeting a mandatory condition when dealing with extreme heat, hazards, or inaccessible measuring points.



4.2.GAS SENSOR (MQ2):

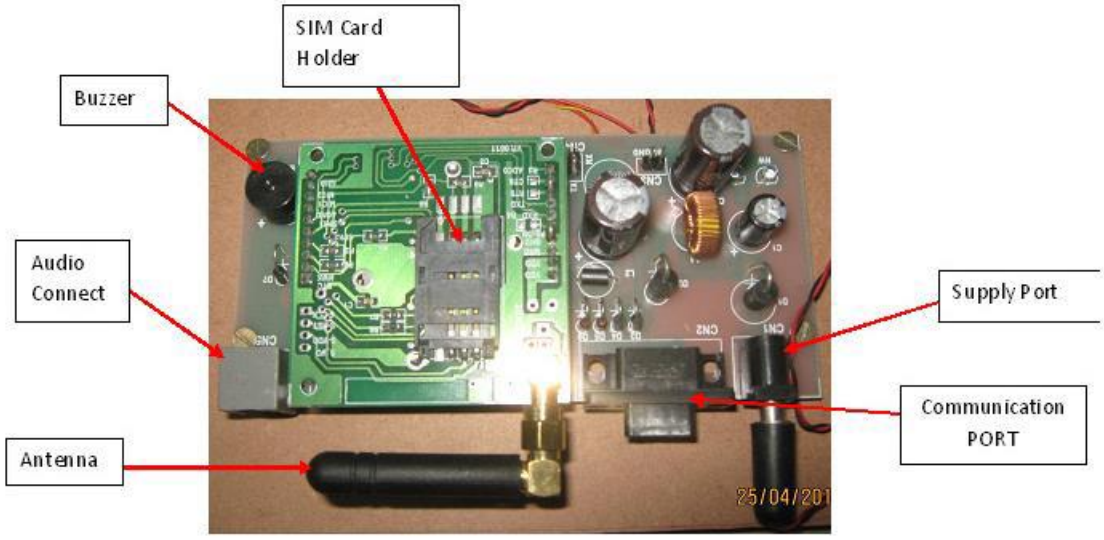
The Grove - Gas Sensor (MQ2) module is useful for gas leakage detection (home and industry). It is suitable for detecting H2, LPG, CH4, CO, Alcohol, Smoke or Propane. Due to its high sensitivity and fast response time, measurement can be taken as soon as possible. The sensitivity of the sensor can be adjusted by potentiometer.

Features:

- Operating Voltage is +5V
- Can be used to Measure or detect LPG, Alcohol, Propane, Hydrogen, CO and even methane
- Analog output voltage: 0V to 5V
- Digital Output Voltage: 0V or 5V (TTL Logic)
- Preheat duration 20 seconds
- Can be used as a Digital or analog sensor

4.3.GSM:

GSM (Global System for Mobile Communications, originally Groupe Special Mobile), is a standard developed by the European Telecommunications Standards Institute (ETSI). It was created to describe the protocols for second-generation (2G) digital cellular networks used by mobile phones and is now the default global standard for mobile communications – with over 90% market share, operating in over 219 countries and territories.



CONNECTION BETWEEN MICROCONTROLLER AND GSM MODULE:

For connection, Receiver Pin (Rx) of Microcontroller is connected to the Transmitter Pin (Tx) of GSM Module and Transmitter Pin (Tx) of Microcontroller is connected to the Receiver Pin (Rx) of GSM Module. Also Ground Pin (GND) of both are connected.

5.Theory:

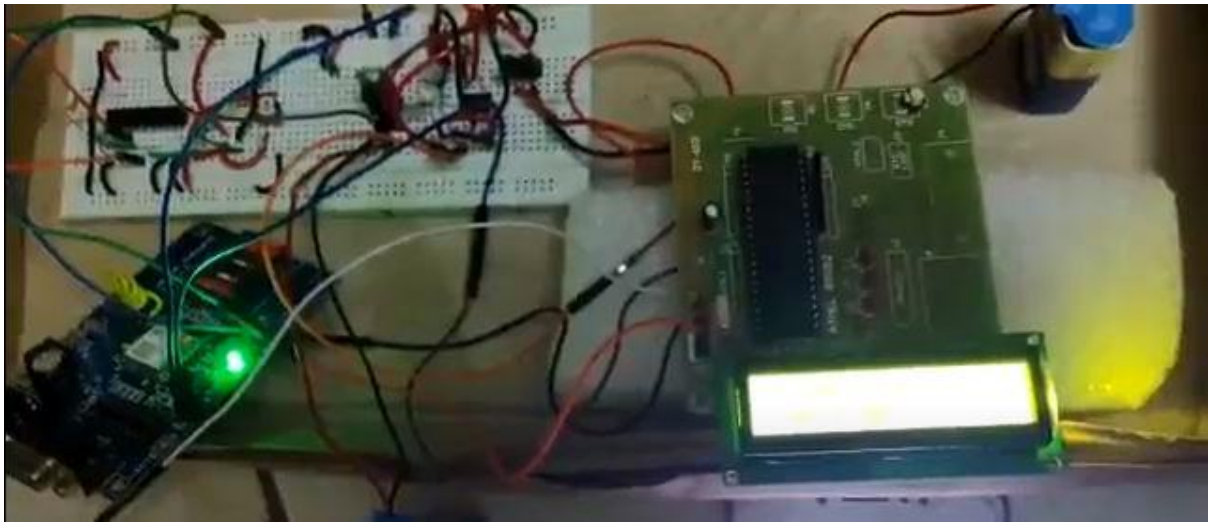
The intelligent security system consists of a helmet, which is mounted with the sensor circuits. The transmitter section has a microcontroller which receives input from various sections like gas sensor.

The gas sensor detects the presence of any hazardous gas in the region and then it sends the data to the GSM module. The GSM - module is configured to connect to the Mobile network through sim in the region. After the detecting the gas and temperature above the threshold level a message will be send to mobile phone with registered mobile number, he/she will be receiving a warning call by the GSM – Module placed in the device.

In this project, a continuous monitoring system, which monitors the environmental parameters such as oxygen level, the presence of poisonous gases (methane, carbon dioxide and carbon monoxide). The different sensors such as methane sensor, carbon monoxide sensor, carbon dioxide sensor, oxygen sensor is placed in the helmet of the miners. It will sense and gives the values to the microcontroller. The controller compares the input values with the threshold values. If any abnormal condition occurs, it gives us an alert through the GSM module. During mine accidents, most of the miners die due to lack of or delay in rescuing operation.

This system uses wireless transmission. It is received by the receiver and displayed in the PC. During coal mining consider if the emission of methane is high, the methane sensor fixed in the helmet sense the gas and gives it to the microcontroller. It compares the input value to the threshold value, due to the high value of methane level over the threshold level it alerts the miner.

6. Complete Circuit In hardware

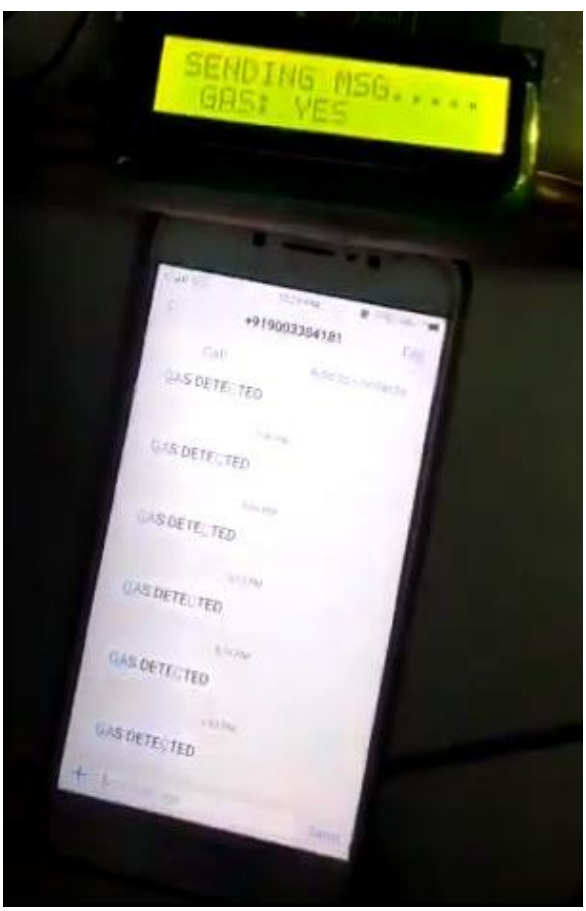


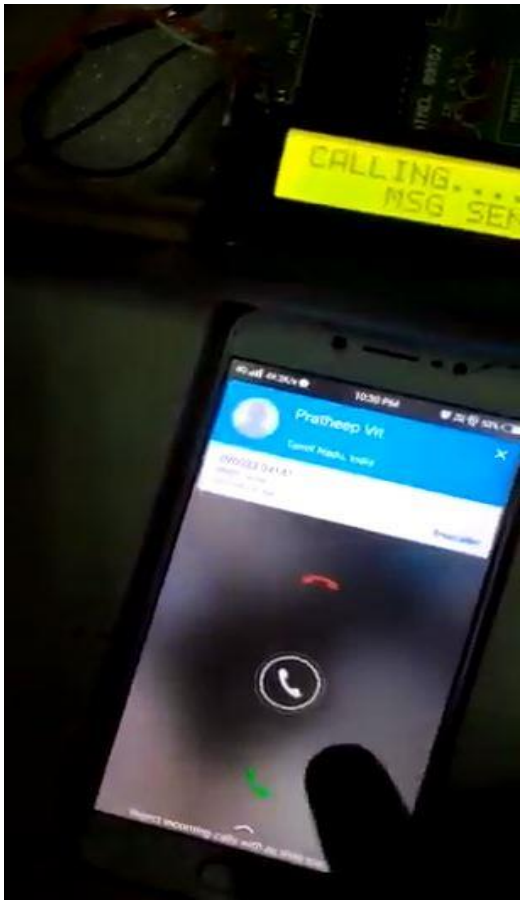
7.Results:

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. Significance of each block has been resonated out and placed carefully, thus contributing to the best working of the unit. Hence the system is reliable with simple and easily available components, making it light weight and portable.

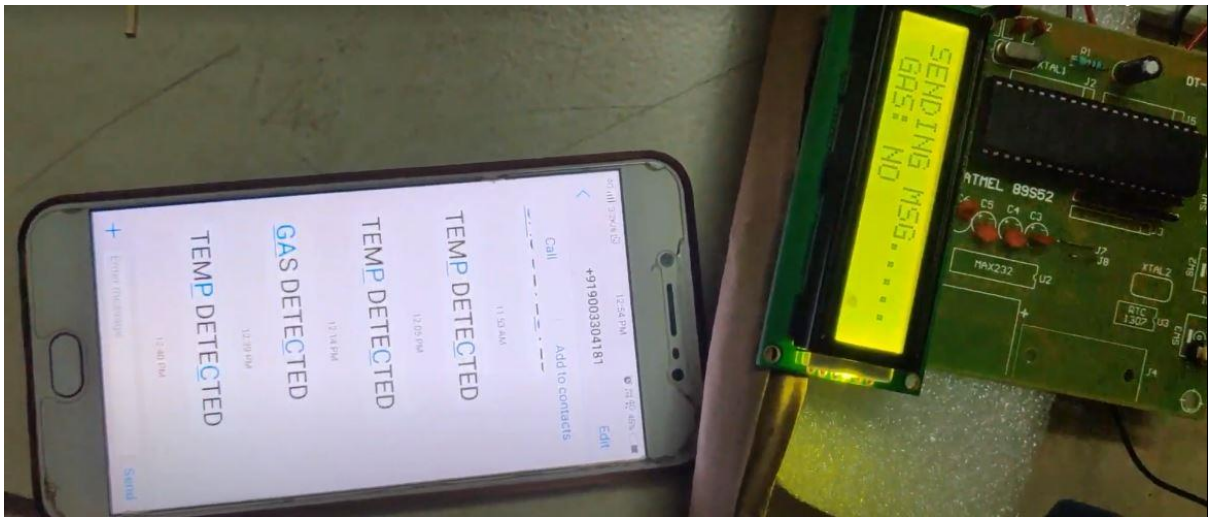
7.1. Firstly, when we ON this helmet it shows us in the following way:

7.2. When the gas is detected, we get a message and a call to the registered numbers at the gsm module.





7.3. When the temperature is detected, we get a message and a call to the registered numbers at the gsm module.



8.ADVANTAGES:

- “Intelligent Helmet for Coal Miners” provides an automatic safety system for coal miners and other workers or engineers entering into coal mine.
- Safety monitoring for helmet
- Alert the emergency services through wireless network
- Prevent higher temperature, humidity and harmful gases.
- Cost avoidance

9. DISADVANTAGES:

- This technology can be used only when we have network signal for GSM-module
- Battery inside the helmet must be regularly charged.
- It takes approximately 30 seconds to get information, if there are any harmful gases are high temperature.

10.APPLICATIONS:

- Can be applied to the persons who are working in the underground.
- Can be applied at any weather conditions
- Can be used in construction works also.
- It’s is very small that it can be carried any place.
- Can be used in hostels.
- Can be used industries.
- Can be used in theatre’s, etc.

11.CONCLUSION:

We used GSM-Module in this project, if the temperature reaches the threshold limit and any gas detected by the gas sensor ,the GSM-module sends an SMS that 'Gas detected ' and 'High temperature' and also gives an warning call to the registered mobile number in this way we can detect that person in danger ,and he can be revived. Hence 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. Significance of each block has been resonated out and placed carefully, thus contributing to the best working of the unit. Hence the system is reliable with simple and easily available components, making it light weight and portable.

12.REFERENCES:

1. K. HARSHITHA, K. SREEJA, "Zigbee Based Intelligent Helmet for Coal Miners Safety Purpose", IJITECH ISSN 2321-8665 Volume.06, Issue.01, Jan-June, 2018, Pages:0403-0406
2. Sunil E. Waghmare, "Microcontroller Based Smart Helmet for Coal Miners Safety", IJSETR Volume 6, Issue 8, August 2017, ISSN: 2278 -7798
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4. E. K. Stanek, "Mine Electrotechnology Research: The Past 17 Years", IEEE transactions on industry applications, vol. 24(5), pp 818-19, 1988.