

Wireless Communication System for Coal Mining Worker using Arduino

EL. Sowparanika*, R. Nandini, R. Subamangala, R. Gayathri

Department of Electrical and Electronics Engineering, KCG college of Technology,
Karappakam, Chennai-600097

*Corresponding author: E-Mail: Sowbar.elavarasu@gmail.com

ABSTRACT

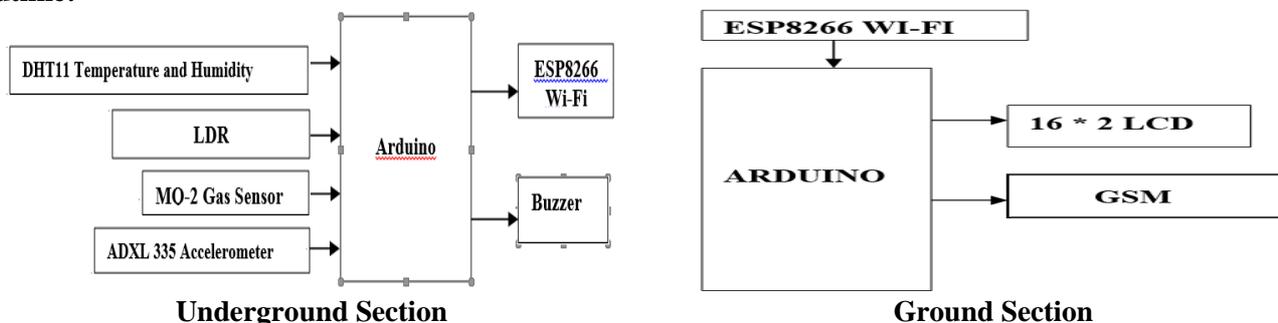
Mines are the most dangerous place in the world to work because a thousand of people are dying in the mine accident. And a statistic report states that an average of about 12000 people has died in such mine accidents. In remote location, during the emergency condition, this project will be useful to them. This paper gives an overview of wireless communication using Wi-Fi and Arduino. Apart from this it also consists of LDR, MQ-2 Gas sensor, DHT11 Humidity and Temperature sensor, the ADXL335 Accelerometer which is used to monitor the underground hazards. This paper has two sections the details are collected in the underground section are passed to the Arduino and the collected information is further passed to the ground section using Wi-Fi. And the ground section will compare the received data with the safety limits and if any hazards detected the ground section will send the necessary alert using GSM.

KEY WORDS: W-Fi ESP8266, Arduino, Sensor, GSM.

1. INTRODUCTION

The worst mining disaster took place killing 1549 miners on April 26, 1942, and thousands of workers are dying in the mine each and every year. So the main aim of this system is to provide safety in coal mining. Lots of accidents are occurring in the mines, and they are mainly due to leakage of poisonous gas, dust explosion, collapsing of mine, mechanical error etc. This system will provide safety to the mine works that operate on the strength of Wi-Fi. The Wi-Fi ESP 8266 is connected to Arduino. This system is consists of DHT11 Temperature and Humidity sensor, Light Dependent Resistor, MQ-2 Gas sensor and ADXL 335 Accelerometer. If any sort of accident happened in mine such as fire accident, poisonous gas explosion, landslide etc. or any injuries occurred to workers then the details will be sensed by the sensors are transferred to Arduino, and the Arduino will transmit the information to the control room through Wi-Fi, and the people in the control room will take the necessary action. And this system also consisted of two section underground section and ground section.

Outline:



Outline Descriptions: The above-mentioned system has various sensor networks such as temperature and humidity sensor, Accelerometer sensor, Light Dependent Resistor, and MQ-2 Gas sensor. The live conditions in the mine will update for every 5 seconds. The sensor network has measured the temperature, humidity, intensity of light, and the presence of poisonous gas. Even the smallest change in the above-mentioned parameter would get updated. The system is consists of two sections, and each section is having an Arduino. A threshold limit that has programmed in the Arduino. If the above-mentioned parameters crossed the threshold limit then the alarm will be turned ON. The sensor will send the information to Arduino that will transmit the measured quality to the ground section via Wi-Fi. The parameter will get displayed in the LCD display. If the condition is worse, then the control room will alert the emergency service such as fire engine, the ambulance with the help of GSM module. And the Accelerometer will get activated only when the person remains in the X-axis for a stipulated period.

Hardware Descriptions:

Sensors:

DHT11 Humidity and Temperature Sensor: This temperature and humidity sensor is calibrated with digital signaling output. It has a complex sensor configuration. The characteristic of this sensor is long-term stability and high reliability. The power supply is 3 to 5.5V DC. In order to avoid the instability, the sensor will not send any sort of instruction for few second after the supply was given.

ADXL 335 Accelerometer: The Accelerometer is a thin, tiny and low-cost device it is used to detect the accident. It has three axes X, Y, and Z which is a single structure, it is used for sensing. The three axes are perpendicular to

each other. The X and Y axes have a Bandwidth in the range of 0.5 Hz to 1600 Hz, and the Z axis is a range of 0.5 Hz to 550. The supply will range for -0.3 to 3.6 v.

MQ-2 Gas Sensor: The poisonous gas that leaked in industries, factories and in the home can be detected using this sensor. Gasses like LPG, I-butane, propane, methane, and alcohol, Hydrogen, smoke can also detect by this sensor. The Sensor is composed of a micro Al_2O_3 ceramic tube, Tin Dioxide (SnO_2). A sensitive layer measuring electrode and a heater are kept at the crust made of stainless steel and plastic. This sensor has high sensitivity, low cost and it is a simple driver circuit.

Light Dependent Resistor (LDR): The LDR works on the principle of photoconductivity. It is simple in construction and it is low-cost devices. The LDR will take few milliseconds to respond to the light intensity. The resistance of the photo resistance decreases, as there is an increase in the light intensity. That is resistor content in the LDR is indirectly proportional to the light intensity. This resistance is called as dark resistance. It can be as high as $10^{12}\Omega$.

ESP 8266 Wi-Fi Module: ESP8266EX is very cheap and an effective form of communication through the internet. And it can be connected easily with Wi-Fi. It can be controlled through the local Wi-Fi network or the Internet. This module can be programmed using an Arduino to TLL converter through serial pin transmitter and receiver. The input power supply is 3.3 V.

Arduino: The Arduino is used to design verity of microcontrollers and microprocessors. It can be easily programmed with Arduino IDE software and it can be easily interfaced with another circuit. The Arduino is a small breadboard based on the ATmega 328. The supply for the board is taken from a dc power jacket and it can be worked with a USB cable.

GSM: SIM300 can fit almost all the space requirement in your application, such as Smartphone, PDA phone, and other mobile devices. The physical interface to the mobile application is made through 60 pins. It is a wireless module, which is used to transmit and decode the data over a cellular network. It is an M₂M technology that supports wired or wireless

Liquid Crystal Display (LCD): LCD has the combination property of both liquid and crystal. It has a temperature range where the molecules are in the liquid state but can be grouped together to form a crystal state. LCD (Liquid Crystal Display) is the used to display the values or characters in the calculators, TV and other smaller mobile phones. When compared with cathode ray technology LCD and LED displays are much thinner. The field effect display and dynamic scattering display are two types of LCD. Develop a uniquely decoded 'E' strobe pulse, active high, to accompany each module transaction. The RS and R/W inputs are assigned to drive by the address or the control lines.

Software Description:

Arduino IDE: The Arduino IDE software is an open electronic platform. The hardware and software of this platform are easy to use. It is used to install the code on the Arduino board. It is simple and easy to program all types of the Arduino board. This Arduino software is available for all types of windows, mac, Linux etc.

2. CONCLUSION

During the emergency condition, this system will be very much helpful to the coal-mining workers. A safety system is developed for the mineworkers using wireless sensor networks. A larger area and more depth and potential accident can be controlled effectively.

REFERENCES

Ahalya G, Suresh Babu P, Prabhakar Rao P, sDevelopment of Coal Mine safety System using Wireless Sensor Network, International Journal of Engineering Science & Advanced Technology, 3 (3), 2013, 74-78.

Ashutoshpatri, Abhijitnayak, and Jayanthu S, Wireless communication for underground mine- A critical Appraisal, International Journal of Engineering Trends and Technology, 5 (7), 2013, 758-761.

Divya G, Sarath Manohar Babu B.A, Rescue System for Coal Mine Workers using Different Sensors Based on GSM and RF-PRO, International Journal of Advanced Research in Computer Engineering & Technology, 3 (7), 2014, 2540-2544.

Himanshu K. Patel, Deep H. Desai, Tanvi G. Badheka, GSM Based Flexible Calling System For Coal Mining Workers, International Journal of Engineering Trends and Technology, 4 (4), 2013, 758-761.

Thorat R.R, Ragha L.K, Patane R.D, Safety of Underground Mine Coal Worker, International Journal of Application of Innovation in Engineering & Management, 3 (9), 2014, 36-40.

Vandana S, Sundheep V.B, Development of Coalmine Safety System Using Wireless Sensor Network, International Journal on Computer Science and Engineering, 3 (5), 2011, 2076-2085.