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Iot Based Coal Mine Safety Monitoring and Alerting System

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ABSTRACT

Today, safety of miners is a major challenge. Miner's health and life is vulnerable to several critical issues, which includes not only the working environment, but also the after effect of it. To increase the productivity and reduce the cost of mining along with consideration of the safety of workers, an innovative approach is required. Coal mine safety monitoring system based on wireless sensor network can timely and accurately reflect dynamic situation of staff in the underground regions to ground computer system and mobile unit. The air pollution from coal mines is mainly due to emissions of particulate matter and gases include sulphur dioxide (SO2), nitrogen dioxide (NO2), carbon monoxide (CO) etc. To monitor the concentration level of harmful gases, semiconductor gas sensors are used. Due to any reason miner's falls down and lose consciousness also proper treatment is not provided them at that time, so number of miners are died. To overcome this problem the system provide emergency alert to the supervisor if person fall down by any reason. Some workers are not aware for safety and they are not wear helmet. A Limit switch was then used to successfully determine whether a miner has removed his helmet or not. This system also provides an early warning, which will be helpful to all miners present inside the mine to save their life before any casualty occurs. There is alert switch at receiver and transmitter side for emergency purpose.

Keywords- temperature sensor, pressure sensor, gas sensor , IOT module, Cloud , data logging, data acquisition and data processing.

INTRODUCTION

Mines are the world's most dangerous place to work because in the mines, explosion often happens and thousand people are dying. And a recent report states that in such mine accidents an average of around 12,000 people have died. Coal is a no sustainable origin that cannot be widely replaced by humans, there are several mishaps of coalmines occurring in the mines, and the diggers are putting their lives at risk, by working in the coal mines, even once in a while they end up losing their lives in the coal mines that are an unfortunate part. Mainly such mishaps happen as a direct result of the old equipment and wired devices, resulting in the end, mishandling, spillage of the noxious gases in the coal mines, pose tremendous hazards to the excavators inside the coal mines. So we've designed the coalmine protection system to stay away from this problem. We tackled the issues in our research by testing each of the information collected by the sensors, we use and finishing the analysis using the Thinger system. Controlling can be done automatically or manually.

PROPOSED SYSTEM

The proposed system consists of the sensor modules that senses all the data around the coal mine environment and logs the data onto the cloud controlled server page using IOT module. The sever page is maintained using the Java Server Page. The logged data is processed into the average values for each entry on an interval basis. These values are automatically processed using a predefined values maintained by the server page. Ehen there is any arbitrary change in the values of the sensed data an alert is send to the IOT MODULE and the concerned authorities. The IOT module detects the alert signal and glows the inbuilt alarm system and alert message to the authorities may take precaution steps. The main advantage of this project is that Iot detects the uncertainty in the environment in beforehand using data analysis reports the situation to the concerned authority and the miners. The system also considers the emergency

situations in hand to alert the miners quickly as possible. This project serves the aspect of "Prevention is better than Cure".

Components

Fire Sensor:

This fire sensor circuit mishandles the temperature distinguishing property of an ordinary sign diode IN 34 to recognize heat from fire. At the present time it recognizes heat, an uproarious alarm reproducing that of Fire separation will be made. The circuit is unnecessarily unstable and can distinguish a climb in temperature of 10 degree or more in its locale. Ordinary sign diodes like IN 34 and OA 71 show this property and the inside restriction of these contraptions will lessen when temperature rises. The fire sensor circuit is exorbitantly sensitive and can recognize a rising in temperature of 10 degree or more in its locale. Standard sign diodes like IN 34 and OA 71 showcase this property and within restriction of these devices will lessen when temperature rises. In the pivot uneven mode, this effect will be progressively basic. Ordinarily the diode can make around 600 mV at 5 degree centigrade. For each degree rise in temperature; the diode makes 2 mV yield voltage. That is at 5 degree it is 10 mV and when the temperature rises to 50 degree, the diode will give 100 mV. This voltage is used to trigger the remainder of the circuit. Transistor T1 is a temperature controlled switch and its base voltage depends upon the voltage from the diode and from VR and R1. Commonly T1 conducts (as a result of the voltage set by VR) and LED sparkles. This shows the run of the mill temperature.

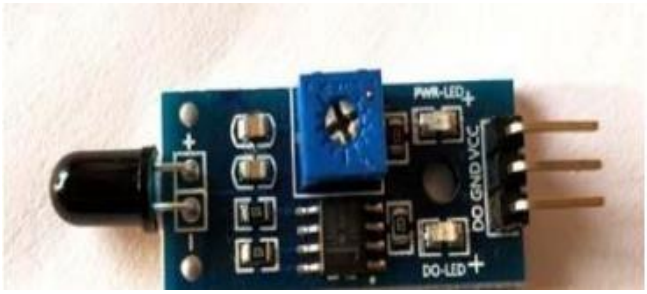


Fig 1: Fire Sensor

Gas Sensor (Mq2):

Fragile material of MQ-2 gas sensor is SnO2, which has lower conductivity in clean air. Right when the goal burnable gas exists, the sensor's conductivity is progressively higher close by the gas center rising. You should use a clear electro circuit, Convert change conductivity to look at caution signs of gas obsession. MQ2 gas sensor has high affectability to LPG, Propane and Hydrogen, also could be used to Methane and other burnable steam, it is with negligible exertion and suitable for different applications. Sensor is delicate to flammable gas and smoke. Smoke sensor is given 5 volt to control it. Smoke sensors show smoke by the voltage that it yields. More smoke more yield. A potentiometer is given to change the affectability. In any case, when smoke exists the sensor gives a basic resistive yield reliant on union of smoke. The circuit has a hotter. Power is given to the hotter by VCC and GND from the power supply. The circuit has a variable resistor. The check over the pin depends upon the smoke in air in the sensor. The deterrent will be cut down if the substance is more. Besides, voltage is extendedbetween the sensor and weight resistor.

Fig 2: MQ-2 Gas Sensor

16*2 LCd Display:

LCD (Liquid Crystal Display)) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters , animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

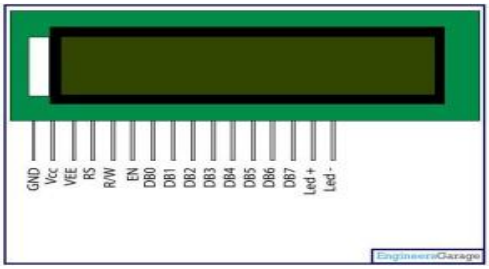


Fig 3: 16*2 LCD Display

Lm35 Temperature Sensor

Outputs 10mV per Degree that can also be read directly on multimeter or read in to microcontroller. For example at 30 degree celcius it will output 300mV at linear scale. The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain 25 convenient Centigrade scaling.

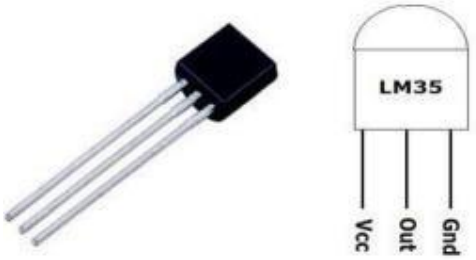


Fig 4:Temperature Sensor

Fall Detection Accelerometer:

The ADXL335 is a low power, thin, small, complete 3-axis accelerometer with signal conditioned voltage outputs. Product processes acceleration with a minimum full-scale range of ±3 g. They can measure the static acceleration of gravity in tilt-sensing device, as well as dynamic acceleration resulting from vibration, shock, or motion.

IOT module:

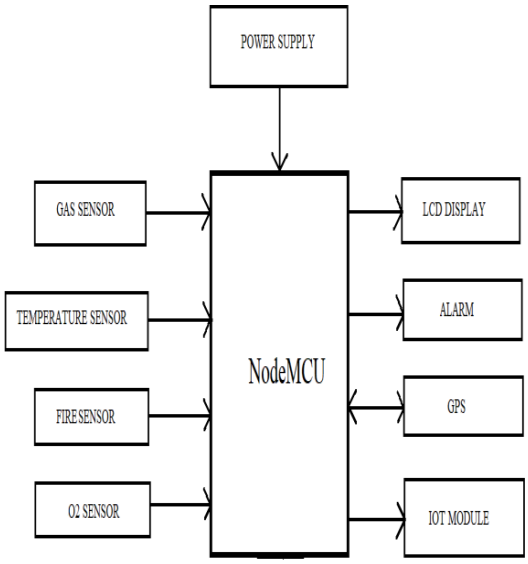
The Internet of Things (IoT) is the network of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors, actuators, and connectivity which enables these things to connect and exchange data, creating opportunities for more direct integration of the physical world into computer-based systems, resulting in efficiency improvements, economic benefits, and reduced human exertionsIoT involves extending internet connectivity beyond standard devices, such as desktops, laptops, smartphones and tablets, to any range of traditionally dumb or noninternet-enabled physical devices and everyday objects. Embedded with technology, these devices can communicate and interact over the internet, andthey can be remotely monitored and controlled.

ESP8266:

The ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by Shanghai-based Chinese manufacturer Espressif Systems. The chip first came to the attention of western makers in August 2014 with the ESP-01 module, made by a third- party manufacturer Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at the time there was almost no English-language documentation on the chip and the commands it accepted.

The very low price and the fact that there were very few external components on the module, which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, chip, and the software on it, as well as to translate the Chinese documentation. The ESP8285 is an ESP8266 with 1 MiB of built-in flash, allowing for single-chip devices capable of connecting to Wi-Fi.

BLOCK DIAGRAM



CONCLUSION

The above paper proposes the basic idea for the life saving measures for the miners and the concerned authorities and also the cost their total resource cost. The sensors used for demonstration of concept are general. The MQ-7 gas sensor is more sensitive to carbon monoxide but can sense methane, butane, LPG, hydrogen, smoke, etc. We found more heating of sensor if operated for long time. It is noise free and has low power platform. More advanced version of controller like Cortex- M3 can be used for more speed of execution and extreme low power consumption. With use of sophisticated sensors, the system can work with more accuracy in real time. It can be modified in industrial monitoring as well. A real time monitoring system is developed to provide clearer and more point to point perspective of the underground mine. This system is displaying the parameters on the monitoring unit; it will be helpful to all miners present inside the mine to save their life before any casualty occurs. Alarm triggers when sensor values crosses the threshold level. This system also stores all the data in the computer for future inspection.

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