

Coal Mining Safety Parameter Monitoring using IOT

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Abstract

A coal mine safety system using helmet is implemented using a IOT platform as a medium to transmit the data. The system is implemented to monitor and control various parameters in the coal mines such as leakage of gas, temperature conditions in the coal mine. These all sensors are together considered as one unit and are placed on the helmet of coal mine workers. All the esteems of the sensors are continuously uploaded to the thinger for analysis. Here the gas is continuously monitored if any uncertainties in the level of gas arise, then buzzer is used to alert the workers. Temperature values are also continuously monitored and displayed on the serial monitor and also in the thinger platform. Also the area is detected where worker is working in mining area in thinger platform and also in serial monitor when switch is pressed. The developed system using helmet is mainly implemented to improve the working condition inside the coal mines and also to ensure workers safety.

Keywords: - Communication, Temperature detection, Gas detection, Area code, Thinger platform

INTRODUCTION

Internet of Things (IOT) is nothing but the devices (things) communicating with each other by using the internet [1,2,3]. IOT applications vary on a large scale. European Research Cluster on the Internet

of Things classifies major IOT applications as smart buildings, smart transportation, Smart energy, smart industry, smart health and the smart city as major areas. IOT is a trend-setting innovation in which all the data from

sensors is stored in the cloud where it can be easily accessed from the cloud. Sensors and actuators for gathering the data and sending across the internet are also included in this advancement. We use cloud not only to store data but also for data analysis, gathering, visualization. Such an emerging technology can be used in various IoT applications like agriculture, health, smart home etc., to make the already existing systems more efficient. The key characteristics of the cloud include on-demand service provision, ubiquitous access, resource pooling and, elasticity.

In India, we have 493 coalmines present. Coal is the most vital asset in the world. These petroleum products are natural assets of the earth which help create power and for some, purposes. Coal is a non-sustainable source which can't be supplanted commonly by humans, there are numerous coalmine mischance's happening in the mines, and the diggers are putting their lives in hazard by working in the coal mines, even once in a while they wind up losing their lives in the coal mines which is an unfortunate part.

Mainly these mishaps are happening as a direct result of the old hardware and the wired systems, resulting in the terminate

mischance's, spillage of the noxious gases in the coal mines are presenting immense dangers to the excavators inside the coalmines.

In the underground coalmines light is an essential thing to convey their work, They can't leave the mine if there is no legitimate lighting which coming about them to harm the mineworker's vision because of working under low lighting area. So to stay away from this issue we have structured the coalmine security framework. In our work, we have tackled the issues by checking every one of the information gathered by the sensors which we have utilized and the observing is finished utilizing the Thinger platform. Controlling is possible by both automatically and manually.

PROBLEM FORMULATION

The major problem identified is that there are numerous accidents occurring in the coal mines due to improper maintenance and inadequate monitoring of the mining activities. These led to numerous life losses and immeasurable recourses loss. There is no proper early detection of the uncertainty in the coal mines. Coal mining has been a very dangerous activity.

The principal hazards are mine wall failures, underground mining hazards include suffocation, gas poisoning, roof collapse and gas explosions. Chronic lung diseases, such as pneumoconiosis (black lung) were once common in miners, leading to reduced life expectancy. In some mining countries black lung is still common. However, in lesser developed countries and some developing countries, many miners continue to die annually, either through direct accidents in coal mines or through adverse health consequences from working under poor conditions.

To prevent these accidents in coal mining we have developed a coal mining safety parameter system to improve monitoring system in coal mines. The main aim of this system is to develop ensure workers safety working in mines.

MOTIVATION

In underground mine, ventilation systems are critical to supply adequate oxygen, keeping up non-dangerous and nonlethal environments and an effective working mine. This helps to implement monitoring an underground mine using wireless sensor network mine monitoring system, which can be disposed in such mines in order to have a safety environment for the workers.

OBJECTIVES

Mining environment often has hidden dangers within such as toxic gases, which may present severe health exposures to the people working within mining. These gases need to be detected at times and informed the dangerous situation in right time for the safety of miners. Wired network monitoring systems have assisted the mine safety significantly, but it is not idea for all types of mining environment. The research investigations to be carried out with the following objectives:

1. Detection of different toxic gases within mining environment
2. Detection of level of temperature in mining area continuously.
3. Communication establishment between sensors and RFID.
4. Establishment of Wireless Sensor Network
5. Design of a real-time monitoring system

SYSTEM OVERVIEW

Architecture is given in Fig. 1.

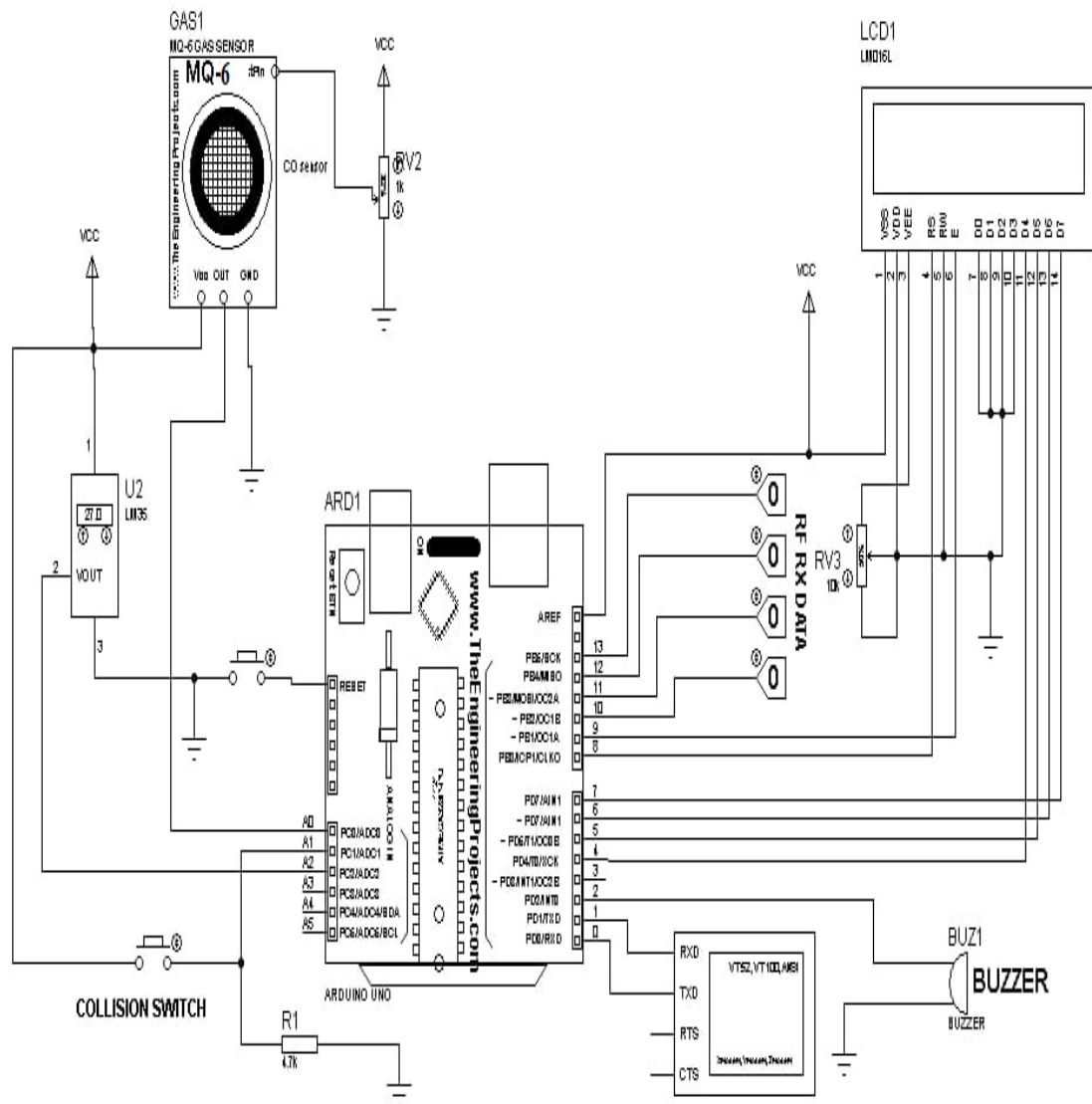


Figure 1: Block Diagram

Power supply

In this system we use different subsystems. For each subsystem different voltages are required, so we use different power supply i.e. 9V, 5V and 3.3V. In power supply we use step down transformer. Generally we

use 230 to 12 v step down ac transformer. This step down voltage is fed to rectifier which converts to dc supply. This regulated 5v dc supply is fed to Aurdino board and to sensors.

Wi-Fi module

Wi-Fi is a high speed internet connection and network connection without use of any cables or wires. The wireless network is operating three essential elements that are radio signals, antenna and router. The radio waves are keys which make the Wi-Fi networking possible. The wifi module receives the data from Aurdino and sends it over thinger platform.

LM35 temperature sensor

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. LM35 is an integrated analog temperature sensor whose electrical output is proportional to Degree Centigrade. LM35 Sensor does not require any external calibration or trimming to provide typical accuracies. LM 35 temperature sensor gives analog value proportional to temperature to microcontroller.

MQ6 gas sensor

Gas Sensor (MQ6) module is useful for gas leakage detection (home and industry). It is suitable for detecting H₂, LPG, CH₄, CO, Alcohol, Smoke. This sensor detects the hazardous gases in coal mining

environment and gives the signal to aurdino.

Arduino

Aurdino collects sensor signals from the sensors like temperature senor and gas sensor, and then gives all these signals to thinger platform.

METHODOLOGY

There are many existing techniques for the communication inside the underground mines. The communication schemes include GSM, GPS, RFID, Zigbee, Radar sensor network, etc. These techniques are used for the communication inside and outside the underground mines. By integration with other techniques, the efficiency of the selected method can be improved. Each technique has its own merits and demerits.

We use IOT technology to transmit data. LM 35 temperature sensor gives analog value proportional to temperature to Aurdino. MQ6 gas sensor detects the hazardous gases in coal mining environment and gives the signal to thinger. Aurdino collects sensor signals from the sensors like temperature senor and gas sensor and then gives all these signals to thinger platform. Also the area is detected where worker is working in mining area in thinger platform and also in

serial monitor when switch is pressed. The area code is transmitted using RFID from transmitter to receiver.

CONCLUSION

Implementation of Coal mine safety system is implemented using MQ6 Gas sensor, LM 35 temperature sensor to increase the safety of the workers in the coal mine and to prevent them from danger, By using this system constant checking of the coalmine and alerting the worker is done by using IOT. The system is cost-effective and efficient.

FUTURE SCOPE

As a future enhancement, the control room module can be designed and implemented for the mentioned purposes. The safety provided by the smart helmet can be improved in future by the Integration of more sensors in this system. We use raspberry pi based image processing along with sensor interfacing. This helps us to get real time monitoring coal mining.

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