IoT based Earthquake and Hazardous Gases Detection in Coal Mines using Raspberry Pi

Gudla Ravitheja¹, K. Jeevana Jyothi ²

¹PG Scholar, Department of ECE, Siddartha Institute of Technology and Sciences, Hyderabad, Telangana, India
²Assistant Professor, Department of ECE, Siddartha Institute of Technology and Sciences, Hyderabad, Telangana, India

Abstract. Eventually a day's a consequence of a general temperature alteration and atmosphere changes there are attempting conditions in field of coal mine. To decrease the cost and improve the productivity close by thing quality the atomization in the field of coal mine is irrefutably essential, which will in addition reduce the mine laborers endeavors. This paper proposes a structure of a WSN with the assistance of Raspberry pi processor which can screen the temperature, diligence, gas and status of smoke in an underground mine. This structure in addition controls the ventilation requesting to mine laborers relying upon present atmosphere conditions inside the mine field. This structure uses low force, practical Raspberry pi, and a temperature sensor LM35, clamminess sensor, and smoke sensor, gas sensor for recognizing the mine atmosphere parameters and Wi-Fi for remote logging of information at focal locale to control the air state with the assistance of engine and valve control hardware. Standard coal mine watching structures will all things considered be wired structure frameworks, which anticipate an enormous action in coal mine guaranteed creation.

Keyword: Temperature sensor, Humidity sensor, Raspberry Pi, Smoke Sensor, Coal Mine, IOT- module.

1. Introduction

Web of Things (IoT) is only the contraptions (things) chatting with one another by utilizing the web [1, 2, 3]. IoT applications move for a mammoth degree. European Research Group on the Internet of Things orders major IoT applications as incredible structures, sharp transportation, Smart hulk, mind blowing industry, sharp accomplishment and the gifted city as basic locales. IoT is a model setting advancement wherein all the information from sensors is overseen in the cloud where it may be productively got to from the cloud. Sensors and actuators for get-together the information and sending over the web are what are undeniably related with this progress. We use cloud not exclusively to store information yet likewise for information assessment, gathering, depiction. Such a rising development can be utilized in different IoT applications like agribusiness, prospering, tricky home, and so forth, to make the previously existing frameworks consistently gainful. The key qualities of the cloud recall for request connection philosophy, in all cases get to, asset pooling and, versatility. Existing arrangement of Dangerous Gases Location in Coal Mineshafts doesn't meet the necessary green climate boundary and cautioning framework. This coal mineshaft security framework there isn't anything for information change for refreshing the public individuals just as administration of climate quality and earth tremor alarms encompassing of mines. Because of this no information communicating, no precise boundary observing, we go to the new creative framework or coal mineshaft wellbeing estimation. This proposed framework used to screen the coal mineshaft boundary and alarm the treat alert for making sure about people
2. Literature Survey

Kumar et al [1] proposed structure which relies upon MSP430, in the coal mine different parameters like Temperature, soaked quality, gas and smoke are seen. A Zigbee handset is set at inside a region and by utilizing the engine condition state is controlled. Lihui et al [2] understood a structure, where temperature, splashed quality, methane estimations of the coal mine are amassed by the sensor place focuses and the data is aggregated by ARM controller for planning, for correspondence reason Zigbee is used. On the off chance that any regards goes high, by then a SMS is sent to keep up the thriving of the laborers. Madhu et al[4] built up a coal mine flourishing watching structure by using Temperature, wetness and the level of carbon-dioxide present are checked. In the event that any harmed condition happen, by then message is sent with the assistance of GSM to the forested zones and close to get-togethers of fire fighters Ashish et al [5] outlined out a structure that depends upon ARM controller and various sensors like temperature sensor, suffering quality sensor and the gas sensor. An IR sensor is set in the mine to check the conditions. Wakode et al [6] proposed a framework that on an exceptionally fundamental level used to screen the relationship of hazardous gases in the coal mine. Existing system of Hazardous Gases Detection in Coal Mines does not meet the required green weather parameter and alerting system. This coal mine safety system there is nothing for data transition for updating the public people as well as government of weather quality and earth quake alerts surrounding of mines. Due to this no data transmitting, no accurate parameter monitoring, we come to the new innovative system or coal mine safety measurement. This proposed system used to monitor the coal mine parameter and alert the treat alert for securing humans.

3. Proposed System

Aim of the proposed system is that monitoring the coal mine parameter and earth quake alerts and updating through internet of things. Proposed paper we implemented Internet of thins based system with Temperature sensor, Humidity sensor, vibration sensor, smoke sensor, all are integrated to the novel micro processor Raspberry pi model and IoT we used ESP8266 module for server creation and alerting to the public government dashboard. All sensors integrated controlling module RPI and post the data into IOT module which can make the data into server for easy of data transfer to the government. This system have the pre state weather monitoring and vibration alert for earth quake measuring ability for safety of coal mine employees and prevent the green weather.

![Fig.1.Block diagram](image)

Microprocessor is the integrated of all input and out modules for process the data every individual sensor find the respective parameter of data gives to the controller like temperature sensor is used to measure the coal mine temperature, smoke sensor is used to measure the carbon component parameters, vibration sensor used to alerting the earth quake alerts all the data gives to the raspberry pi it process data by using programming code and displays in LCD module as well as in IOT server. This system having the buzzer module for alerting the public for any factor changes in coal mine with earth quake alerts using alarm.
This schematic diagram informs that which module of the pins connected to which pins of microcontroller.

A. Regulated Power Supply

In this section of RPS we need 5v dc to work RPI processor. This RPS module is getting the required voltages from higher voltages with the help of filters and voltage regulators. 12v alternating current received by 230 v alternating current step-down by transformer, Bridge rectifier used to converts AC voltage to DC voltage. 1000 micro farad Capacitor for filtering the noise and voltage regulator 7805 used to provide 5v DC for operating the RPI processor.

B. Raspberry Pi

Raspberry pi processor used to integrate the all input and output peripherals, process the input data and control the output modules. This processor having 4 USB ports for integrating output modules. 1GB RAM which is high speed process the data. 3.5mm audio socket for output voice, CSI camera port for interface camera, micro SD card for operating system storage, 1.2GHz speed 64 bit Broadcom processor. This processor having 40 GPIO pins. All input sensors and output modules are interfaced to processor. Python programming used to implement RPI based applications.
C. Temperature Sensor

Temperature sensor LM35 used for measuring of the temperature. This sensor used for Coal mine temperature monitor. Normally used for heat measurement of the weather and auto represents into IOT and LCD.

D. POLLUTION Sensor

Mq-6 is used for pollution recognisation in coal mines. Its having the auto treesholding value when the pollution limits exceeds then automatically alerts the buzzer and monitoring in iot for online monitoring for government dashboard. The role of MQ-6 Actuator is to sense the carbon monoxide gas content and alert give to the micro processor activates the alarm.

E. Vibration Sensor

Vibration sensor used to detect the earth quake alerts in the coal mine. Here we are mercury switch acts as vibrating element it can detect any vibrations and automatically alerts the buzzer and data displays into LCD and iot module at same time.
F. Humidity Sensor

Humidity sensor is used to sense the surrounding humidity of the coal mine and data will be displayed in LCD and IOT module. This humidity also is one the important parameter to detect the alerts the coal mine weather reporting depends on the weather we will take some decision.

G. 16x2 LCD Display

A liquid Crystal Display commonly abbreviated as LCD is essentially a display unit built using liquid technology. LCD module is 32 character displays, which is 16x2 models. Having 16 characters in row. LCD module interfaced to microprocessor with 16 pin configuration. LCD has 16 pins in series. Each pin is programmed to do here: Pins 1 and 16: Power and ground are these. Pin 3: This is used to change the LCD's brightness. Pins 4–6: Used for LCD service. Pins 7–14: Used as line of info. Pins 15–16: Used to control backlight to the LCD.

H. Buzzer

Peizo electric buzzer is used for intimating the changes in this system. Buzzer is the output module used to generate alarm. This module which converts the voltage to sound signal. We directly connected to RPI processor for alerting.
I. IOT- Module

ESP 8266 Module used for Internet of things operations. Internet of things is the latest technology for controlling and monitoring operations through the world fast and secure. Wireless fidelity based operating module which works with 5GHz frequency. It supports 802.11b, 802.11n wireless transmission of data protocols. Normally we use 4 pins in this 3.3v voltage, ground comes under power supply for operating device, TX,RX are transmit and receive the data from micro processor bidirectional.

J. Software Module

In embedded system software module plays important role for any electronic automation. This proposed article we use Python IDE for programming development, debugging and compilation process. Python is effective scripting language for real time applications. Rasberian Operating System is used in Raspberry pi modules.

H. results and discussion

This is the output of iot Coal mine system obtained accurate results and contrusted in a model way. We designed the hardware of internet of things based industrial sensor monitoring system. Temperature, earth quack level, Humidity, pollution sensors re integrated to the raspberry pi processor. The initial state of all the sensors which displays their measured values on the LCD screen as shown in figure 12. The same data generated by the sensors will post into the iot server for wireless data accessing system.
Figure 13 shows that continuous monitoring of temperature in the industrial. It is displayed in LCD and if the temperature exceeds the threshold limit then buzzer automatically alerts the instant. It affects the fields send the data to iot server. IoT server is the open source thing speak server. It can monitor the data continuously and displays like a graph.

Figure 14 shows that when the humidity is HIGH, it is displayed in LCD and buzzer automatically alerts the instant. It affects the fields send the data to iot server. IoT server is the open source thing speak server. It can monitor the data continuously and displays like a graph. Like the same way water leak sensor also monitor the status and alerts LCD, buzzer, iot.
Figure 15 shows that when the earth quack level is HIGH, it is displayed in LCD and buzzer automatically alerts the instant. It affects the fields send the data to iot server. IoT server is the open source thing speak server. It can monitor the data continuously and displays like a graph. Like the same way pollution sensor also monitor the status and alerts LCD, buzzer, iot

4. Conclusion

We implemented and constructed IOT coal mine system with monitoring in internet done successfully in this proposed system we integrated all input modules and output modules to the Raspberry Pi Micro processor. We obtained results accurately. This proposed system proves that this is efficient system than existing one. Used for public water quality maintain.
References

[1] Dange, K.M., Patil, R.T. (2013), Design of Monitoring System for Coal Mine Safety Based on MSP430.
[2] Toby Berger. Spatial direct reuse in remote sensor network[j]. Remote Network, 2008,14(2):133-146.
[3] Dheeraj "IoT in burrowing for distinguishing, Monitoring and desire for underground mines Roof support", assembling on progressing information and progress development 2018
[4] Dong "Coal Mine prosperity Monitoring system subject to Zigbee and GPRS ", Applied Mechanics and Material Volume 422,2013.
[5] Tao Zhiyong, Li Xin. "Remote Temperature System Design Based on nRF905", Journal of Zhongguo Technology I mformation, 2007.22, p.53.
[6] G. Dinardo, L. Fabbiano, and G. Vacca, “A smart and intuitive machine condition monitoring in the Industry 4.0 scenario,” Meas. J. Int. Meas. Confed., 2018, doi: 10.1016/j.measurement.2018.05.041.
[7] A. Pantelopoulos and N. G. Bourbakis, “A survey on wearable sensor-based systems for health monitoring and prognosis,” IEEE Transactions on Systems, Man and Cybernetics Part C: Applications and Reviews. 2010, doi: 10.1109/TSMCC.2009.2032660.
[8] A. Schütze, N. Helwig, and T. Schneider, “Sensors 4.0 - Smart sensors and measurement technology enable Industry 4.0,” J. Sensors Sens. Syst., 2018, doi: 10.5194/jsss-7-359-2018.