Raspberry Pi Based Coal Mine Safety System

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Abstract

Coal mine accidents have been found and reduced by the government. The system is having Raspberry Pi microcontroller for detecting coal mine hazardous gases by using temperature and gas sensors. The information is transferred by using wi-fi. The disaster is happening due to the environment. The different environmental effects that are affecting is methane, carbon monoxide, temperature and oxygen the information transferred by the cable. The gases in the mine that causes the accident like fire due to this information transferred got affected because it is done using cable. So that we cant predict the alarm properly. Wi-fi is wireless communication technology by using it we can transfer the data properly without any distraction. In underground mining the power transfer taking many safety actions to avoid the unwanted accident in the coal mine. So, the data transfer is done by the wireless technology. Because of this system the manual checking will get reduced and human life will get saved.
Key Words: Raspberry Pi; Wi-Fi module; Sensors; Gear
Motor; Fan

1 INTRODUCTION

In underground mining some accidents will happen so some safety procedure should concern. The risks are depending on type mining action [1]. The safety issues are mainly concern in coal industry. The safety of workers should always be a major consideration not only in coal mine it considered in all the industries [2-3]. Underground coal mine having higher risk than open pit mining due to the problem in ventilation. The utilization of heavy machinery and the methods performed safety risks in all types of mining [2-5]. Coal is always being the primary resource of energy in India, which has significantly contributed to the rapid industrial development of the country. In India 70

Wireless communication technology, with a short distance. It is very safe and reliable. It can use wi-fi technology to collect the various transferred parameters to the sensor on the tunnel gateway. Then use a wired data transmission to the gateway on the ground central control real-time forest fire detection system based on wireless sensor network [7-8]. The collected system data is processed in the WSN for detecting the forest fire [9-11]. The monitoring and detecting sensor networks designed and it using neural network [12]. The degree of monitoring safety can be improved using this scheme and reduce misfortune in the coal mine it is done by using Zigbee based GSM technology. The wireless communication, and safety monitoring is done by using this scheme [13]. For collecting and storing data and accordingly generating a control signal to stop or start the induction machine wireless through a computer interface developed with Zigbee it is done by a micro-controller. This system utilizes a wireless Zigbee transceiver by using remote controller to control the all the parts connected to the system [14].

2 EXISTING SYSTEM

The maximum coal extraction is done by the combination of ventilation and methane drainage efficiency. Ventilation is used to remove
the gases in the coal mine to prevent from accident. Mine ventilation equipment is need more safety procedure to remove the gases. A mine ventilation system is designed to achieve three objectives:
1) Deliver breathable fresh air to the workers,
2) Control mine air temperature and humidity,
3) Effectively dilute or remove hazardous gases and airborne respirable dust.

The existing systems are mostly using cable network for data transfer in underground mining system. When accident occur in mine like fire the cable get affected and it cant able to transfer the data from mine to the data receiver. Nowadays every system is changed to automation so all the process is done by automatically by using wireless network.

3 PROPOSED SYSTEM

In this system we are designed to monitor and control the process occurred in coal mine. The main aim of our system is used to get the accurate value of the sensors output by using Raspberry Pi. The hazardous gas is sensed by using the sensor and the variation in temperature level also found by using the temperature sensor. If the hazardous gas value increase above the threshold value then the controller enables the buzzer to give alert to the workers. Simultaneously the motor switch turned on automatically to remove the excess gas present in the mine. The automatic control of the switch is done by relay. Relay are used to control the motor, fan, temperature sensor and gas sensor. All the data are transferred by wi-fi to html and the direction of the robot also controlled html page.

4 SYSTEM DESIGN

The components used in this system is given below, • Raspberry Pi
• Wi-Fi module
• USB camera
• Temperature sensor
• Gas sensor
• Relay switch

The above components are explained below. The temperature sensor is used to identify the variation in the environment temperature level. The gas sensor is used to identify the harmful gas present in the coal mine. Wi-Fi module is used to share the information and also the share the camera output to the html controller. By using the camera data, we can drive the robot in proper way.

Ethernet is the one of the family of computer network technology. It is used to receive the data from the camera, temperature, gas sensor and controlling unit.

Raspberry Pi is like credit card sized board. It is like a small computer. It can do process like a computer so that only it is called small computer. In Raspberry Pi is having different model with different specification for our use we can choose which board we needed. The coal mine section shown in fig.1.

![Coal Mine Section](image)

The system having the USB port and power input port. It basically having the video input port(USB). In this robot it is act as a controller like a heart of this robot. This is also having the micro SD port for storing the information it having the RAM 1 GB.
The system has Secure Digital (SD) (models A and B) or Micro SD (models A+ and B+) sockets for boot media and persistent storage. As of 18 February 2015, over five million Raspberry Pi have been sold. While already the fastest selling British personal computer, it has also shipped the second largest number of units behind the Amstrad PCW, the Personal Computer Word-processor, which sold eight million. The Raspberry Pi connection is shown in the above fig.1. The receiver section of the system is shown below figure 2. Here ethernet is used to communicate with the personal computer or mobile of the html section by using wi-fi connection.

![Fig.2. Receiver Section](image)

![Fig.3. Raspberry Pi](image)

The technical specification is shown in table.1. Operating Voltage 5V Input Voltage(recommended) 7-12V Input Voltage(limit) 6-20V Architecture ARMv6 (32-bit)

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5
LM35 Temperature Sensors
The LM35 sensor is the temperature sensor. The circuit of the temperature sensor already made inside the tube. The temperature sensor output is in Celsius so we need convert it in to degree. It consumes only 60 mA. Its self-heating temperature is 0.1°C. Its suitable for remote application and it cost also very low. Gas Sensor is a sensor that used to find the gases present near to it. It detecting range is very low. It used to find the hazardous gas present in that area and share that information to the controller. When it detects the gas present in the mine the controller unit switch on the buzzer and ventilation fan is try to operate at maximum speed to remove harmful gas in that area to prevent the human life.

Wi-Fi Module

![Wi-Fi Module Image]

Wi-Fi module is used for the communication purpose to transfer or sharing the controller information. Normally all the wi-fi module having a different range level based on its range level set by the manufacturer. Wi-Fi module used more number of place for giving internet connection. The speed of the data sharing is based on the router and the connected device. The camera output also shared by the wi-fi module to the computer or mobile.

5 RESULT & DISCUSSION
The temperature and gas sensor are interfaced with Raspberry Pi. The USB camera also interfaced with that to give details in video.
mode. The motors are controlled by using HTML and it turns on and off is done with the help of the relay switch. If the temperature level increases above the threshold value then controller unit turns on fan to cool down the place. If the gas level present in the area is more the controller turns on buzzer to give an alert for all. The output module is shown in fig.5.

Fig.4. Full Module

6 CONCLUSION

The study on real-time monitoring is done by this method. This system is also used to reduce human work and it also reduces the human life. Because before this system mostly this checking is done by manually during checking when fire occurs it affects the human life. This system helps to watch how mine is affected and also temperature and gas level will show in real-time monitor. After this checking only, workers will enter into the mine. Here real-time monitoring is done by HTML. Mostly accidents are happening in underground mining only not in open pit mining.

References


[4] Borkar, C., Development of wireless sensor network system for indoor air quality monitoring


