BRIEF REVIEW PAPER ON IOT-BASED ADVANCED SEMI-AUTONOMOUS SAFETY ROBOTS FOR MINING PERSONALS.

Ankit Yadav[1], Dheeraj Kumar[2], Harshit Yadav[3], Er. Sunil Kumar Singh[3]

[1, 2, 3, 4] *Department of Electronics and Communication Engineering SRMCEM, Lucknow, Uttar Pradesh*

Abstract: This paper describes a robot that uses wireless technology to detect coal mines. Because coal mines are dangerous deposits, people are threatened by many deadly factors. First of all, it is very dangerous to enter a tunnel without knowing the situation in advance because an explosion can happen at any time. Rescue robots eager to work can be sent from here into an explosive environment to determine gas content, temperature, and more. Meanwhile, the environmental data detected by the robot is transmitted to the rescuer via SMS using a telegram app. It transmits data using Bluetooth wireless technology. In this way, rescuers can devise a plan to save the miner's life in the shortest amount of time. Therefore, coal mine detection and rescue robots are very useful robots in coal mine accidents. Human exposure to toxic fumes while working in underground tunnels can be fatal. To avoid such cases, the system must be automated using specific robots. A Robot can provide prior knowledge to the workers about the level of danger so the workers can have preparatory plans which will reduce the loss of human life due to disaster by enhancing the effective operation in mines.

Keywords: Wireless technology robot, Bluetooth,MQ-4, CH4, Wireless Camera.

1. INTRODUCTION

Mining is an industrial activity that takeout rock from the Earth's crust and processes it to take out valuable minerals for us to use. We need mineral resources to make several of the things we use in our daily lives, from toothpaste to buildings, and computers to cars. In mining, a distinction is built in the context of mining technology between extraction as the separation of minerals from the rock, galleries, site preparation using shafts, and drifts, preparation for extraction, ventilation, water management, as delivery and auxiliary technologies. This paper is a complete framework presentation of building a low-cost robot prototyping based on a microcontroller controlled and capable of detecting toxic gases, obstacle detecting, humidity, and explosion. An underground Mining operation proves to be a risky venture as far as the safety and health of workers are concerned.

These risks are related to the different methods used to extract different minerals. The deeper the mine, the greater the risk. These safety issues areof great concern, especially for the coal industry. Therefore, worker safety must always be of paramount importance in all forms of mining, be it coal or other minerals. Underground coal mining is riskier than open-cast mining. To ventilation problems and possible collapses. However, the use of heavy machinery and digging methods present safety risks in all types of mining. Modern mines often implement several safety procedures, worker education and training, and health and safety standards, resulting in significant improvements in both surface and underground mine safety. [1, 2]

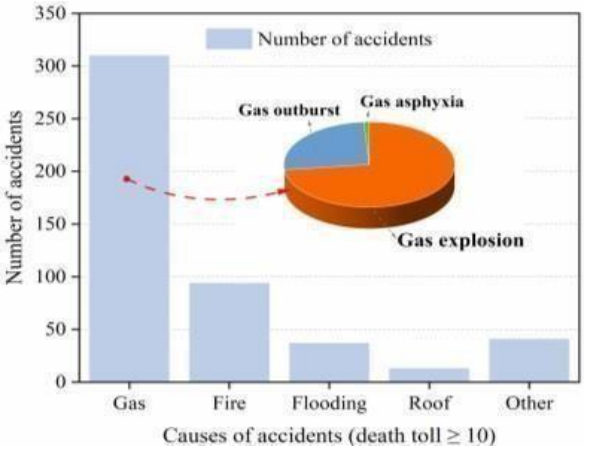

Fig.**1** Statistics on the causes of major or especially Major coal mine accidents in Chinafrom 2001 to 2018. [6]

2. LITERATURE REVIEW

T.S. Kumar ReddyandG. Bala Shiva Krishna

Provides Rescue robots that detect hazardous gases in coal mines. It is harmful to rescuers to enter mines without first examining the environment. Because explosions can happen just in time.

Landslides, gas leaks, high temperatures, and more. The robot is designed to detect explosions such as toxic gases and high temperatures. This robot has a wireless surveillance camera.

G.BhaskarPhani Ram 1 *, Dr.L. Koteswara Rao1, Eliyaz Muhammad 1,

A. Bhanuchander 1,

provides a Coal Mine Disaster Management Robot Using IoT Technology. The main goal of the proposed work is to create a rescue robot thatcan be controlled via a web page. A Wi-Fi connection is created between the control room and the Raspberry Pi. Commands to move the robot are sent via a web page. When a dangerous situation is detected in the mine, the robot sends information about temperature and toxic gas levels. Then a buzzer sounds to initiate the precautionary measures to normalize the atmosphere by providing ventilation with a fan. Formation such as location, temperature, and toxic gas concentration is transmitted to the control room via the Wi-Fi network. The DC motor is connected to the Raspberry Pi for control and motion control in the control room. DC motors are used to drive the robot's wheels. Left, right, forward, or backward.

GUODONG ZHAI, WENTAO ZHANG, WENYUAN HU, AND ZHENDONG JI [11]

Provides a Coal Mine Rescue Robots Based on Binocular Vision: A Review of the State of the Art In the field, the binocular vision module of the robotic sensor system collects image information, performs image analysis and processing, and performs obstacle recognition and 3D reconstruction. The concept of binocular vision originated from the basic theory of vision created by Marr and Poggio. Later, Grimson supplemented and modified the theory.

Prof. A. H. Ansari, Karishma Shaikh, Pooja Kadu, and Nikam [12] This monitoring system contains several components such as boards (PIC board, Xbee module, and Zigbee USB interface board), liquid crystal display (LCD), various sensors, and other small electronic components. This chapter provides a detailed overview of each of these parts and how they work. In the proposed system, the coal mine safety system is fixed with a gas sensor module, temperature sensor, and water level sensor. And relay. Integrates all sensors into the controller. First, you need to create an account on the Thing Speak platform.

The system has a monitoring and control system. The monitoring system monitors all data from various sensors. Gas sensors detect gases in coal mine environments. When the gas level exceeds the normal level, the buzzer goes high to alertthe miner.

3. ALGORITHM USE IN COAL MINE ROBOTS [2]

Step 1. A Specified power supply is given tothe board.

Step 2. GPIO ports are initialized.

Step 3. Buzzer gives an indication wheneverthe threshold is exceeded.

Step 4. If the temperature exceeds a thresholdvalue, The cooling fan will be ON.

Step 5. If the gas value exceeds a thresholdvalue,the oxygen cylinder will be opened.

Step 6. If the fire value exceeds a thresholdvalue, the water sprinkler will be ON.

Step 7. The Camera captures the presentsituation in a coal mine.

Step 8. SMS and e-mail are sent to the controlroom

Step 9. Sensor data is read by Raspberry Pi so that the data is saved in a file and displayed on Webpage

Step 10. The Process is repeated until the user intervenes

4. EXPERIMENTAL SETUP:

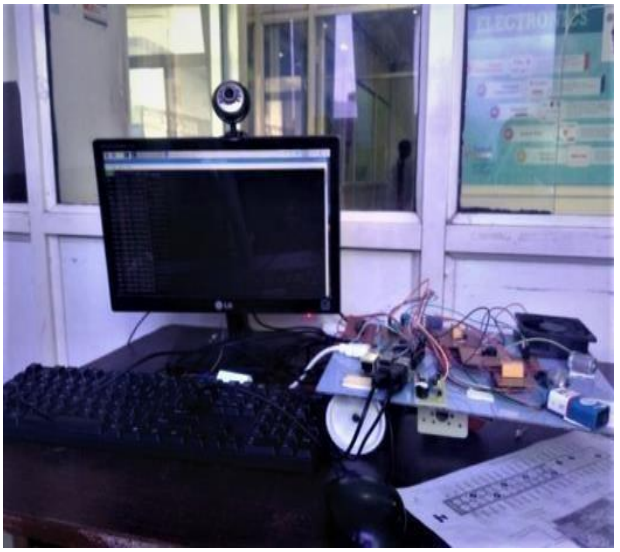

Fig.2 Project Set

BLOCK DIAGRAM

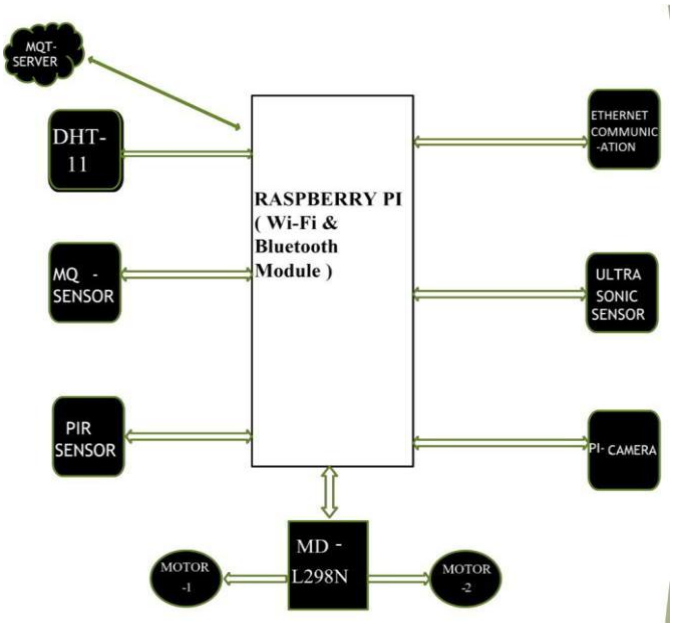

Fig.3 Proposed block diagram

5.1 EXPLANATION OF BLOCK DIAGRAM

The block diagram shows the functional flow of how the robot works. The vital components of the proposed system include sensors, a control unit, Bluetooth, a wireless camera, and a power supply unit. Bluetooth is used to transfer data and messages. All these sensors are directly connected to the raspberry pi which has a default program in it. The working power for the robot is obtained from a battery connected to the raspberry pi.

The main aim of this robot is gas detection and screening the operation in mines. MQ-4 is used for detecting hazardous gas and PIR is used for detecting obstacles. A Wireless camera is used for screening the operation in mines. The visualization of all details is done by using the wireless LCD connected to the robot so that all details of the environment can be traced easily. [1]

6. OVERVIEW OF MICROCONTROLLER

The project's core aspect is the Raspberry Pi. Since we plan to present the results in audio format, we chose to use a headphone. The Raspberry Pi also supports high-bass headphones. The Raspberry pi (3B+) model was used in this project. We choose use a power bank as the Raspberry Pi's power source to give mobility to the user.

One of the most well-liked single-board computers is the Raspberry Pi. Open CV on the Raspberry Pi makes it simple to implement all the major image processing algorithms and operations. The Raspberry Pi is connected to a 32 GB class SD card. The Raspberry Pi or the minicomputer is used because it can interface the camera module with it and provide good results after processing the image. Raspberry Pi.

7. ROBOT STRUCTURE

After considering the problems of coal mines, we developed a robot. The robot consists of a mechanical vehicle, a control system, a drive system, a communication system, and sensors. This robot is made of a light frame and a DC motor is used to drive the robot vehicle. The Engine speed is 60 rpm. The movement of the robot is done by placing 2 motors on each side. The robot can move forward, backward, left, and right. [1]

7.1 MQ6 GAS MODULE

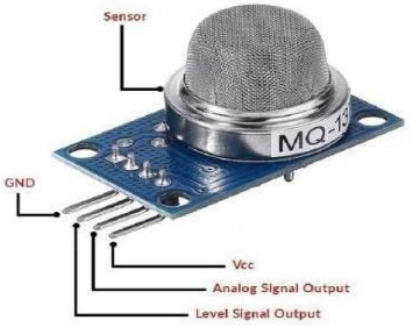

Fig.4 MQ6 Gas Module

It is highly sensitive to LPG, iso-butane, and propane and less sensitive to alcohol, cooking fume, and cigarette smoke. The resistance of the sensitive component changes as the target gas changes. [4]

7.2 HUMIDITY SENSOR (DHT-11)

This sensor is the basic, ultra-low-cost digital temperature and humidity sensor. It uses A Capacitive humidity sensor and a thermistor to measure the surrounding air and spits out a digital signal on the data. These four pins Sensor equipment i.e., VCC, GND, DATA, and NC. [4]

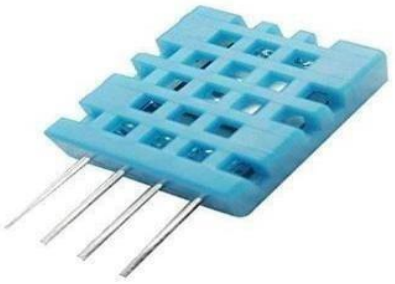

Fig.5 Humidity sensor (DHT-11)

7.3 PASSIVE INFRARED SENSOR (PIR)

It is sometimes called PID Sensor and is commonly known as PIR also. For "passive Infrared Detector. The term passive refers to the fact that PIR devices do not radiate energy for detection purposes. They work entirely by detecting infrared radiation emitted by or reflected from objects.

Fig.6 Passive Infrared Sensor (Pir)

7.4 LM2596 DC TO DC Step-Down Power Supply Module

A DC motor is designed to run on DC electric power. The most common DC motor types are the brushed and brushless types, which use internal and external commutation respectively to create an oscillating AC from the DC source so they are not purely DC machines in a strict sense. [4]

Fig.7 LM2596

7.5 L298 DC MOTOR DRIVER

The L298 is an integrated monolithic circuit in a 15- wire Multi Watt package and PowerSO20.It is a high-voltage, high-current dual full-bridge driver designed to accept standard TTL logic levels anddrive inductive loads such as relays, solenoids, DC, and stepper motors.[4]

7.6 WIRELESS PI CAMERA

The environment in the mines can be monitored using a wireless camera. Image can also be spotted. The camera is connected to the screen wirelessly.[4]

8. CONCLUSION

This paper explains the framework for the design of temperature sensor and gas sensor-based mine detection units. A prototype scanning and search robot using mine detection units is also explained. We will then create a smartphone-compatible Android application capable of controlling the robot remotely. The mining robot for gas detection and disaster monitoring is developed with sensors, cameras, and other components. A 12v/3s battery is used to run the robot. An MQ-4 sensor is used for gas detection and a wireless camera for surveillance. The robot can run in terrain. When the measured value exceeds the set values, the workers will beinformed the "gas level exceeded". The gas level will be displayed on the LCD. This robot is used for trafficand gas leak monitoring to protect people (workers) and provide security to enhance defensive traffic detection. In 2012, 92 workers died due to methane leaks in Turkey and China, to prevent these disasters, our proposed system will be beneficial. [1, 4]

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