International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 04
February 2018

Design and implementation of IOT based Industrial monitoring and controlling system

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ABSTRACT:

Now-a-days the accidents in the coal mine industries have increased. Even if any explosion occurs it can't be easily known to the laborers and it may cause accidents. So in order to avoid this, a robot has been designed and this robot is allowed to monitor the ambient situations inside the coal mine industry. Some of the environmental parameters such as gas leakage, temperature, fire are sensed by using the high end sensors and the sensed data are transmitted to the mobile phone or webpage through Wi-Fi. A static ip address is configured in the microprocessor for the Wi-Fi. The robot has a camera that transmits image to webpage for monitoring the status of the coal. If the temperature exceeds a threshold, the cooling fan is automatically set to ON and if any gas leakage is detected the workers are given alert through a buzzer. The robot is designed using a Raspberry Pi 3 board.

Key words: Raspberry pi, sensor, robot module.

1. INTRODUCTION

In the hazardous working environment, human safety is an important concern. Coal mines is a place in which human lives are more dangerous and many workers are injured due to explosions and leakage of toxic gases. Fire accidents can also happen. At the same time if any person is absent in an important place for monitoring, it may also cause serious hazards. At present many systems are implemented in industrial areas but still those accidents are occurring. The new method is to design a robot and that robot is allowed to enter into the coal mine area. The robot will be equipped with some sensors like temperature and gas for detecting the toxic gases and the ambient temperature. The robot used must be a flame-proof so that
even if any disaster occurs it will transmit the information to the receiver without fail. Also, it must be designed to work in the high temperature situations. A camera is also interfaced with the robot which will give a live video of the environment and this video is transmitted to the mobile phone to the user who is controlling the robot by means of Wi-Fi technology. If any serious situation occurs means an alert given to the nearby workers. Wireless communication is also an important issue inside the industry. Usage of wired technologies are not worthy as the cables will get damaged after a certain period of time or due to some environmental factors. So the wireless

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transmission technology is preferred. The industrial monitoring protocol should be designed such that the system must have a reliable end to end data delivery. The data which is collected from the robot should be transmitted without any delay and loss of data. Some of the techniques like zigbee, bluetooth have a small range and the data rate is minimum when compared to Wi-Fi.

PROPOSED WORK

A robot is designed using the raspberry pi board. The raspberry pi board is given a power supply of about 5V. The sensors which are connected are given power through the GPIO pins. An usb camera is fixed in the robot. The camera will capture the industrial environment and it will transmit the live video to the mobile phone and displayed in the created web browser. An ALERT button is placed at the centre for giving alert to the workers in case of any emergency. a web browser should be opened and the static IP address must be given of the raspberry pi are typed. After authenticating, the created web browser will be opened automatically and the robot is operated using the buttons in the browser page. The robot wheels are given 9V from a separate battery. The movement of the robot depends on the python coding inside the Raspbian os. The wheels are connected through a driver. The driver which here used is a 4-channel driver. When the robot is kept stationary, the GPIO pin which is connected to that particular driver is given HIGH. During movement they are set to LOW. When the temperature sensor senses the temperature above threshold, the GPIO pin which is connected with the cooling fan through the relay is set to LOW which will operate the cooling fan. Also, when any gas is sensed, the GPIO pin of the buzzer is kept LOW and thus the buzzer will be ON. If there is more suffocation inside the mining area, the carbon dioxide emission will be more. When this CO2 is sensed, the oxygen supply cylinder will be opened by setting the GPIO pin of that particular relay to LOW. The robot movement operations are given using the python coding and saved in the SD card in the microprocessor.

3. ARCHITECTURE AND WORKING THEORY:

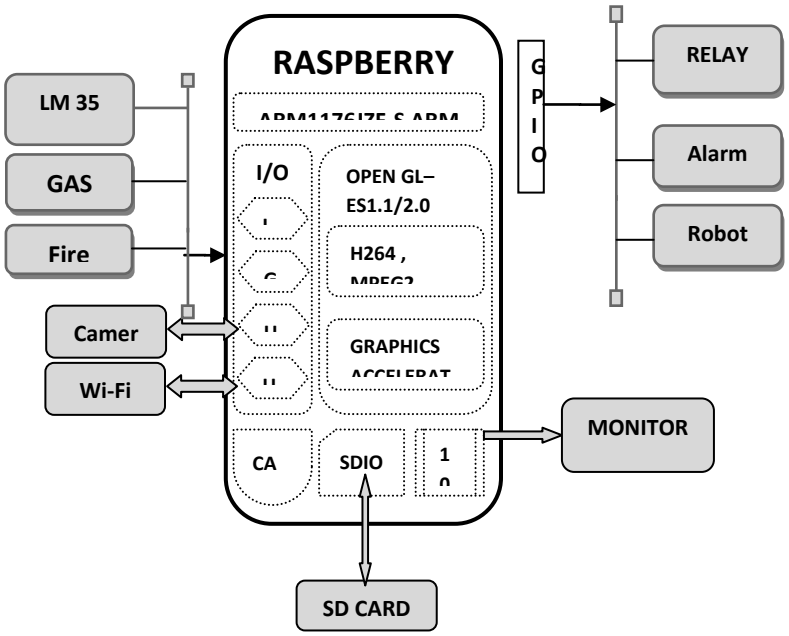

Fig1: Block diagram

The block diagram of the transmitter section for the coal mine monitoring is shown in

the Fig1 The Raspberry Pi 3 board is interfaced with the temperature sensor, fire sensor and gas sensors. A camera is connected to one of the USB port of the board. A buzzer is connected for giving alert to the labors and a cooling fan is interfaced in order to reduce the ambient temperature in case if the temperature exceeds a threshold. Two DC motors are connected for the robot movement through the driver circuit. Another DC motor for supplying oxygen is connected to the board. This whole module is sealed and it is allowed to monitor the working environment. The power supply for the robot wheel is given by using a 9v battery. In this section a mobile phone or a personal computer can be used. The robot is tethered with the mobile phone. The created web browser is opened in it and used.

4. HARDWARE MODULES USED:

Raspberry Pi Core Module

The core module of the system is realized using a Raspberry Pi 3 board; it's a $ 35 bare-bones computer designed and developed by the Raspberry Pi Foundation, the Pi 3 features a BCM 2837 System-on-Chip which includes a Quad-Core 64-Bit ARM Cortex A7 CPU clocked at 1.2GHz paired with 1 GB of RAM. It also has Video Core IV GPU for graphical processing applications, it also includes four USB ports for peripherals and 40 Pin General Purpose Input Output (GPIO) pins for interfacing the Pi with external electronic circuits, these GPIO pins are used to interface the Pi to the module. The Raspberry Pi is designed to run various Linux based operating systems and has Raspbian as its official operating system and Python as its official programming language.

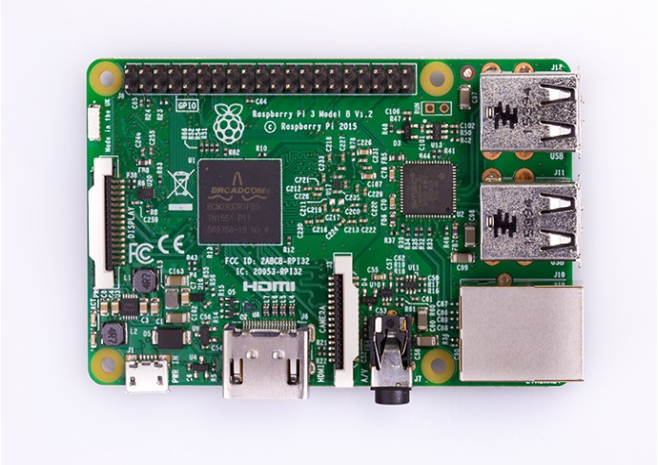

Fig. 4 Raspberry Pi 2 Module

Temperature sensor:

TheLM35 pin diagram is shown in the figure 2 .As a temperature sensor, the circuit will read the temperature of the surrounding environment and relay temperature to us back in degrees celsius. The LM35 is a low voltage IC which uses approximately +5VDC of power. This is ideal because the arduino's power pin gives out 5V of power. The IC has just 3 pins, 2 for the power supply and one for the analog output.The output pin provides an analog voltage output that is linearly proportional to the celsius (centigrade) temperature. Pin 2 gives an output of 1 millivolt per 0.1°C (10mV per degree). So to get the degree value in celsius, all that must be done is to take the voltage output and divide it by 10- this give out the value degrees in celsius.

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Fig2.Temperatur e sensor LM35

Fire sensor:

In the fire sensor , an efficient ,inexpensive, easily-obtainable temperature sensing material is used. When the external heat is applied to the thermister , it will generate voltage in the circuit. The output voltage from the thermister is given to the comparator for voltage amplification. This in turn helps in detecting a very small voltage changes which in turn detects all range heat variation.

Smoke sensor:

Ideal sensor for use to detect the presence of a dangerous LPG leak in your car or in a service station, storage tank environment. This unit can be easily incorporated into an alarm unit, to sound an alarm or give a visual indication of the LPG concentration. The sensor has excellent sensitivity combined with a quick response time. The sensor can also sense iso-butane, propane, LNG and cigarette smoke.

Fig3: Smoke sensor

Imaging Module

The imaging module in the proposed system is realized using a USB web Camera, the main reason behind choosing USB Camera over the Pi camera is the cost effectiveness. The camera features a high-quality CMOS sensor, with an image resolution of 25 MP (Interpolated), an adjustable lens for focus adjustment, a frame rate of 30 fps and f2.0 lens. The USB camera also is equipped with night vision for low light photography. The camera interfaces with the Raspberry Pi via the USB 2.0 port and is responsible for capturing images when requested, the pictures are captured by using the command fswebcam.

Fig. 3 USB Camera

DC motor:

DC motors are configured in many types and sizes, including brush less, servo, and gear motor types. A motor consists of a rotor and a permanent magnetic field stator. The magnetic field is maintained using either permanent

magnets or electromagnetic windings..Motors are the devices that provide the actual speed and torque in a drive system. This family includes AC motor types (single and multiphase motors, universal, servo motors, induction, synchronous, and gear motor) and DC motors (brush less, servo motor, and gear motor) as well as linear, stepper and air motors, and motor contactors and starters.

CONCLUSION AND FUTURE WORK

The designed robot is reliable to use and may be employed in any operating surroundings. The sensors that are used are thus sensitive. The gas detector will notice alternative outflow like H, smoke etc. This model can also be used for other purpose also. The work surroundings are often seen from the controller space itself. Since Wi-Fi is employed, the info are often transmitted from anyplace. The suffocation of the labors operating within the mine is avoided. The accidents ar prevented that ar caused by close conditions. This application are often used for all industrial space wherever human intervention for security are often avoided. In hospitals, searching malls conjointly this application are often used. This project are often increased by inserting a water sprayer within the robot. just in case of any fireplace accidents water must be sprayed at the proper place. Also, another detectors like dirt sensor, wetness detector are often interfaced for more convenience of the employees.

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