

ADVANCED RESCUE AND MONITORING ROBOT FOR COAL MINE

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Abstract - Rescue operation in coal mine is extremely dangerous due to several factors. It is particularly very harmful for the rescuers to get into the coal mine tunnel in disaster without the prior knowledge of environment because the subsequent explosions may likely to occur at any time it is therefore essential to detect the explosive environment details such as toxic gases, high temperatures and also to perform a visual inspection of miners, trapped in collapsed tunnel through a wireless camera. These details will help the rescuers to make a preparatory plan and to equip themselves for carrying the rescue operation defensively. This paper designs a rescue robot for coal mines. With the help of this mobile robot, we reduce the loss due to coal mine disaster and efficient rescue operation can be carried out.

Key Words: Robot, Coal mine, Rescue, Sensors.

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. A coal mine is an underground tunnel system. There only a few pitheads on ground. If there are some accidents, people are easily trapped in tunnel and often cannot escape from it. It has dangerous accidents as collapse, gas explosion, CO, CO₂ poison gas, low O₂ content, high temperature, smoke, coal dust, fire, water, etc. All these accidents can kill people easily. CH₄ gas is intergrowth with coal. When coal is mined, CH₄ gas is released. Gas is pushed off by forced ventilating system. But if the ventilating system is faulty or gas is leaked from coal layer, gas diffuses throughout the tunnel.

A flame current can cause a heavy gas explosion. Mine tunnel passageway is narrow, so the explosion wave can destroy any thing in the tunnel. All devices and people may be affected and the gas of CH₄, CO, CO₂ and coal dust are filled in the tunnel, and the environment of the tunnel comprises of low O₂ content and high temperature. Besides, the forced ventilate system has been damaged, the gases cannot be push out and gets accumulated in tunnel. A fire may cause a second explosion. People in tunnel could be poisoned by CO, stifled by CO₂ and low O₂ content, high temperature and coal dust. Rescuers on ground daren't go into explosion mine tunnel. Because situation is not known, any one may be killed by second explosion. So detect of mine tunnel situation is the first mission to the rescuers.

Communication is another difficult problem in mine tunnel because electromagnetic wave is absorbed and echoed in a coal tube. Because of many corners in the tunnel, Wave cannot cross these corners easily.

2. LITERATURE SURVEY

The previous collected data reveals that large number of accidents occurs in a coal mine during and after a disaster. The main reasons being, gas accidents, explosives, flood, caving, etc. It requires the development of a system that can help minimize the human and material loss that happens during rescue operations in coal mines. Thus sensors for detect the gas are mandatory in the robot to be deployed.

The idea of a Mobile Robot is able to aid the rescue team entering into a coal mine got picked up with the tremendous uplift in the technology. The Robot is used to get in to the disaster zone and rescue research operations. The robot can go in to mine and detect butane levels, temperature, gas contents, etc. The data can be sent to controller in safe field.

3. PROPOSED SYSTEM

The aim of the project is to build a robot that can be controlled by an android phone. We are creating Wi-Fi network between the android phone and Raspberry Pi. Commands are given to the robot from the phone and robot works according to that commands. The DC motors are also interfaced with the raspberry pi for their control and movement commanded from the android.

DC motors are being used for the movement of robotic wheels i.e. to move right-left or to move in forward or backward direction. Some of the reasons for the proliferation of ARM-based processors include low cost, low-to-very-low power consumption, decent processing power, and open development environment. Also some sensors are deployed with robot such as temperature, gas, light and fire sensors. The following figure shows the block diagram of proposed system.

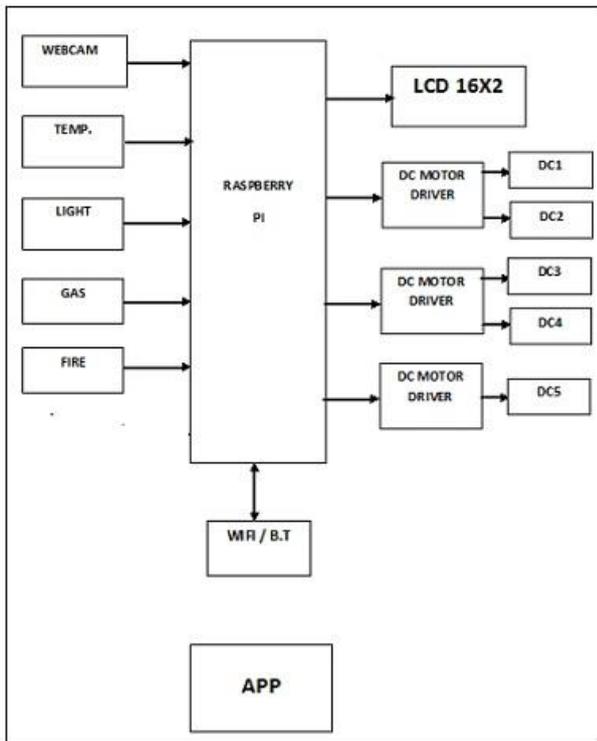


Fig-1: Block Diagram of System



Fig-2: Hardware Setup

4. HARDWARE SYSTEM DESIGN

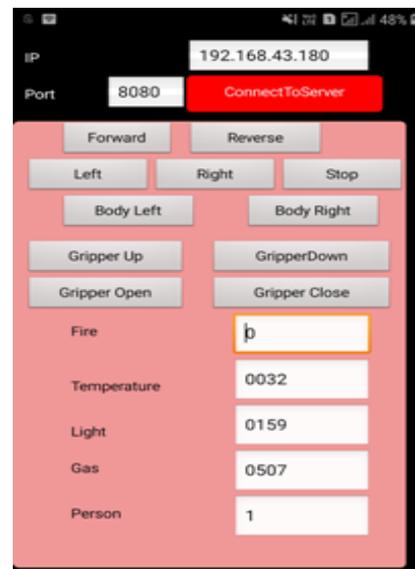
The following figure shows the setup of the system. The raspberry pi is a main part of an system along with sensors. This paper represents a method for controlling a robot using Raspberry Pi and an application built in the android Platform. We present a review of Robots controlled by mobile phone via moving the Robot upward, backward, left and right side by the android application and Raspberry Pi. The android phone and raspberry pi board is connected through wifi. A signal is generated from the android app and which will be received by the raspberry pi board and the robot works according to predefined program.

The android app is command center of robot. The program is written in the python language in the raspberry pi board. The robot also sends the output of different sensors wirelessly to the android app. The robot performs the same activity as the human hand works.

The raspberry pi works on 5V power supply, which is given by an adaptor and DC motor works on 12V power supply for which we specially designed a power supply section.

5. RESULT

The following snapshot shows output of the system on mobile phone.



The android app shows the controls of robot and also shows the output of the different sensors connected to the robot. The output of sensors are wirelessly transmitted by the robot to the android app.

6. CONCLUSION

The project is aimed at providing human safety for the rescue team in hazardous environments such as coal mines .This is a prototype which can be implemented in real time by using components with better range and efficiency. This robot enters into hazardous environments and provides data like the content of gases after the explosion has occurred and also the temperature based on which the rescue team will be sent with necessary precautionary measures in order to make sure that the rescue team does not come to any harm.

In future by the use of higher transmission range transceivers so that it can travel for a greater distance and can be used in different environments based on the transmission range. Development can also be made in the number of sensors incorporated in the robot. Various other sensors like O₂ sensor, humidity sensor can be added and thus helping to get a much improved image of the environment inside. Implantation of an arm on the robot can help the robot pick up samples or remove small debris from path.

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