

RF CONTROLLED METAL AND DELETERIOUS GAS DETECTING ROVER

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ABSTRACT

As technology is growing there is a considerable demand on machine interface to the controlling system. Robotics is an era where mechanical structures are powered by interfacing personal computers with the improved software tools. Hyperlink is a standalone program to interact with the devices remotely interfaced with the personal

computers. Wireless communication is also a supporting mechanism to regulate the direction and movement of the robotic machines. This paper aims to direct the conductive gas finding robot in all directions. An IR sensor assembly is used to position the Rover to move with defined angle. A Zigbee wireless module is used to communicate with the user device and control it through user command window with 2.4 GHz which is used for transmitting the information to the remote control section of the rover. The mechanical load calculations are estimated to design the rover. The developed model is best suited on uneven surfaces and mars area.

1. INTRODUCTION

The rapid growth of technology is enabling the researchers to meet the challenges of the society. Considering the speed and Flexibility to the demands, especially the new innovation in the electronic era is totally dominating the requirements in association with the mechanical structures, the combination of mechanical structures and electronics is labelled as mechatronics. The mechanical components will be driven by the electronic circuits to fulfil the needs of the developer labelled as a robot which will be guided by an operator or

independently i.e. Knowledge based. Land mines buried under the ground causes threat to the lives and affect the economy of the nation. Detection and removing of these mines manually is a dangerous task, which may sometimes causes accidents. In such situations robots aid in detection of the land mines. Not only can land mines, these robots be used to detect any other metals presented in the ground.

In past years of underground mining, 55 people have died in a decade. The reason being that the concentration of methane in air is exorbitance; it can kill people by causing suffocation. In the underground, when the environmental temperature reaches certain condition, the coal will be spontaneous combustion, as the Oxygen supply of those places is insufficient, it will cause combustion inadequate and forms a large amount of CO, have a strong attractive to haemoglobin. When CO entered in respiratory system, it will cause anoxemia, and it leads to histanoxia, and the inhibition of tissue respiration can kill people due to suffocation. According to their features of the mash gas and CO they are both possess explosive, and dangerous for human body. When the robot reaches the explosive coal mine site, it detect and sends the environmental conditions such as temperature, presence of poisonous and dangerous gases.^[2] A robot equipped with different sensors for detecting various poisonous gases and if value of hazardous gases crosses set limit then system provide safety to workers who are working in coal mine. An electronic nose (e-nose) is a device that identifies the specific components of an odour and analyzes its chemical makeup to identify it. An electronic nose consists of a mechanism for chemical detection, such as an array of electronic sensors.

An odour is composed of molecules, each of which has a specific size and shape. Each of these molecules has a correspondingly sized and shaped receptor in the human nose. When a specific receptor receives a molecule, it sends a signal to the brain and the brain identifies the smell associated with that particular molecule. Electronic noses based on the biological model work in a similar manner, albeit substituting sensors for the receptors, and transmitting the signal to a control circuit, rather than to the brain. Electronic noses are one example of a growing research area called biometrics, or biomimicry, which involves human-made applications patterned on natural phenomena.

This paper focuses on designing and developing a robotic vehicle that can sense the metals in front of it in coal mines. A metal detector circuit is interfaced to the control unit that alarms the user about a suspect ted metal ahead. The metal detector circuit is mounted on a robotic

vehicle and its operation is to detect metals underneath automatically. Also, it is used to detect the harmful gases by the variation of temperature as different gases have different temperatures. The temperature of the possible harmful gases is programmed in the robot and when sent underneath to detect the metals, it also senses the temperature of gases sends the signal to the remote place whether the gas is harmful or not. The distinguishing feature of our method from the traditional one is that it aims at reducing the cost of production and hence can be implemented at low budget which is the main criteria in developing areas.

2. BACKGROUND

The Robot is one of the growing and challenging fields in the emerging artificial technology. Robot with sensor detects toxic gases and rescue people in the tunnel. It provide safety against fire explosion, poisoned gases like CO, CO₂ , CH₄ and increased temperature level it alert people in tunnel. Gas concentration is meant for the fuel gases like methane and carbon-monoxide, carbon dioxide. A microcontroller is used with the sensors to receive the sensor outputs and to take the necessary decision. Once temperature is more than the safety level buzzer activate. Again, once the measured carbon dioxide gas value is more than the safety level, it activate buzzer. 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. One such design is to send a robot inside a coal mine. A robot equipped with sensors for detecting various poisonous gases along with a wireless transmitter and receiver can be used to monitor such an environment. The Zigbee had much better range than Blue Tooth and hence it could transmit commands and receive data from long distance from the tunnel. LM35 has been used as a temperature sensor in the system.

3. LIMITATION OF THE CURRENT WORK

This project mainly deals with two sections:

- Under Coal Mine Section
- Coal Mine Section.

The designed systems are placed in different parts of the mine and connected by means of Zigbee. In under Coal Mine Section the sensors will sense the environment conditions such as temperature and harmful and poisonous gases and this information is sent to the microcontroller and the number of workers inside the coalmine is also obtained by means of IR sensor. Microcontroller displays this information in the monitor display and sends through

Zigbee transmitter. In Coal Mine Section Zigbee receiver take that information and send to the controller and controller sends the information to Zigbee and as well as displays on the GUI display. Here GUI sends the message and Store data of various parameters in data log. The main limitation of the current work is that the transmitter can operate only in the range of RF.

4. MOTIVATION AND OBJECTIVES

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. Robot is an ideal tool in coal mine disaster. The robot used in coal mine tunnel must have many special characters which are different from other robots on ground. Coal mine tunnel is a special environment. The first problem is explosion gas is everywhere in tunnel. Any fire can cause an explosion. Robot must be designed as a flame-proof device to avoid malfunction of components. The second problem is the mine have narrow tunnel and rugged. The middle of the tunnel is railway. One side of the railway is belt transmission. The other side is a narrow road on coal. The mine passageway is filled with many obstacles and rugged coal road, so it is difficult to move on the mine tunnel. But various obstacles must be crossed. 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. The proposed system consists of transmitter and receiver circuit. The transmitter circuit transmits the commands required to

operate the robot. The receiver circuit receives these commands through zigbee and moves the robot according to the received commands. A metal detector is interfaced to the controller in the receiver side. Thus whenever any metal is detected the robot stops there and buzzer starts ringing. The most developed and organized species on the Earth are the humans. Hence, it becomes to save the people who work underneath the mines where there is high temperature and limited supply of oxygen. The mines are subjected to harmful and poisonous gases which are explosive in nature and create the suffocation around the environment. Two of the major harmful and poisonous gases are methane (CH₄) and carbon monoxide (CO). This metal detecting robot overcomes this problem and saves many lives of people and also reducing the human effort.

5. METHODOLOGY

As shown in figure 2, hardware at local site is composed of ARM processor, Zigbee module transceiver, sensors such as LM35 for temperature detection, CO₂ gas sensor, MQ135 for carbon dioxide gas detection, driver IC, RS 232 connector PC Monitor display, buzzer, metal detector. Various sensors like carbon dioxide MQ135, temperature sensor LM-35, IR sensor are taking analog measurement from local site of various parameter such as carbon monoxide, increasing temperature, different water level and through ADC give digital output to the microcontroller Zigbee transmits this digital sensor data to the remote monitoring site located at maximum distance from local site (30m).

Zigbee can be used inside mines at router as shown in figure 3. Remote monitoring site continuously monitoring sensor data in the designed format of GUI as shown in figure 2. Whenever the sensor data exceeds the specified threshold (preset) value of temperature, carbon monoxide and water level, the Zigbee module at remote monitoring site is transmit alert signal to local site by blowing buzzer continuously.

In this project there are two sections. The first section is under Coal Mine Section and another section is Coal Mine Section. The overall block diagram of the system is as shown in Figure1. The designed systems are placed in different parts of the mine and connected by means of Zigbee. In under Coal Mine Section the sensors will sense the environment conditions such as temperature, Methane gas, gas etc..., and this information is send to ADC of the micro controller, the number of members inside the coalmine is also obtained by means of IR sensor. Microcontroller displays this information in the monitor display and sends through Zigbee transmitter.

In Coal Mine Section Zigbee receiver take that information and send to the controller and controller sends the information to Zigbee and as well as displaying on the GUI display. Here GUI sends the message and Store data of various parameters in data log.

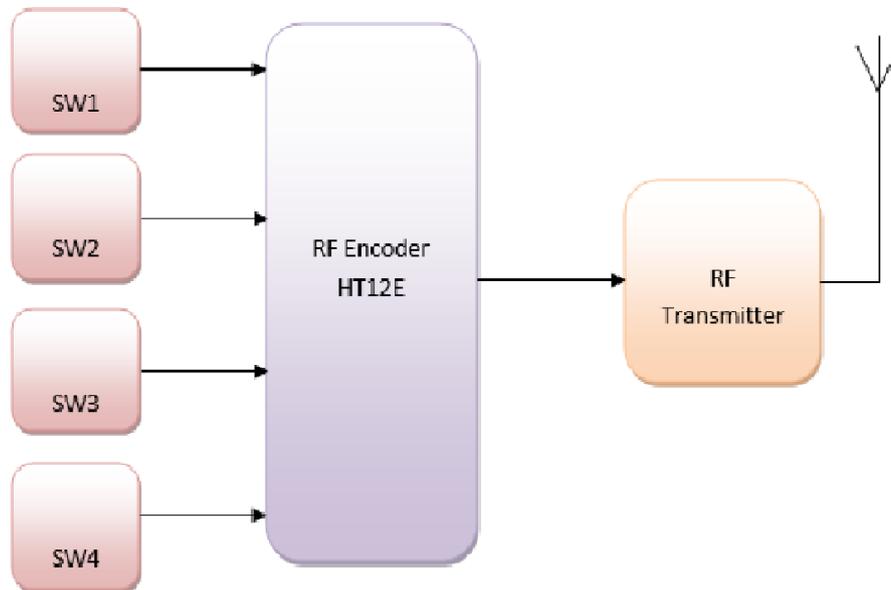


Figure 1: Transmitter Block.

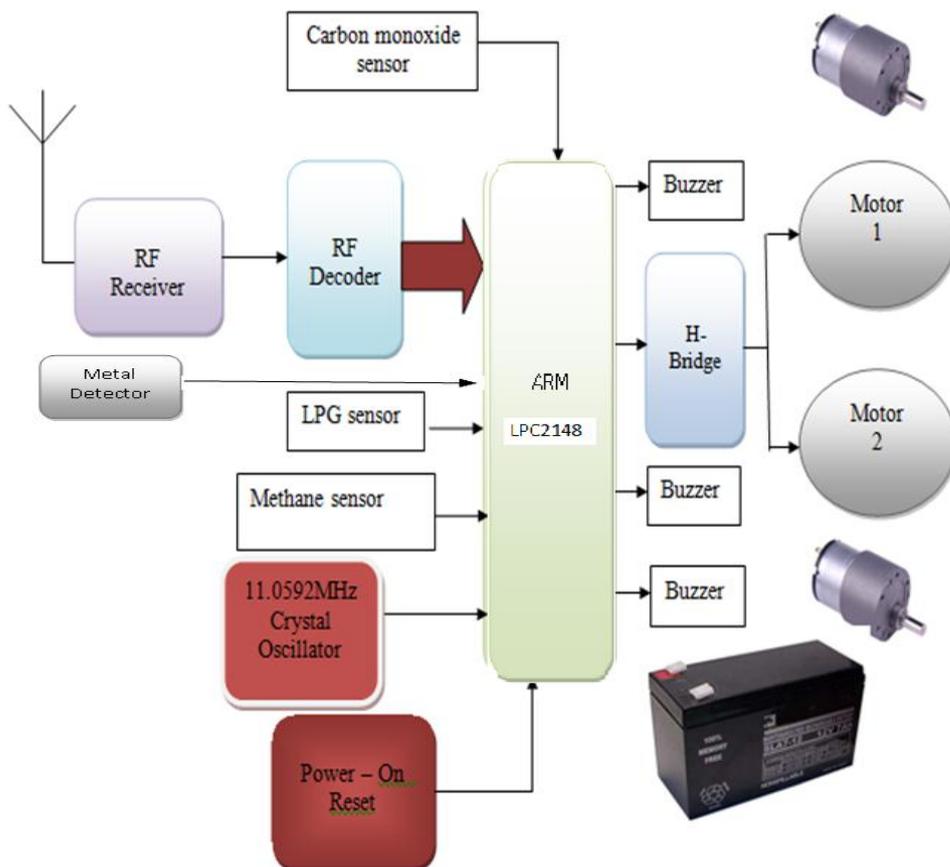


Figure 2: Receiver block.

6. CONCLUSION

The proposed gas detection rover can be used in mining and mars area as the transmitter and receiver are handled wireless, hence the distance range increases and able to control the rover from long distance and get the information about gas and metal. The proposed work will be carried out with effective cost and disserve to work accordingly.

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