DETECTION OF HAZARADOUS GASES IN MINES USING ARM7

M.Sravanthi[1], K.L.Anusha[2] , N.Durga Raj[3] ,M.Chattar Singh[4]

[1] M.Sravanthi, Dept of ECE Geethanjali College of Engineering &Technology, Cheeryala, T.S., India.

[2] K.L.Anusha, Dept of ECE Geethanjali College of Engineering & Technology, Cheeryala, T.S., India.

[3] N.Durga Raj, Dept of ECE Geethanjali College of Engineering & Technology, Cheeryala, T.S., India.

[4]M.Chattar Singh, Asst .Professor, Dept of ECE Geethanjali College of Engineering & Technology, T.S., India

ABSTRACT

A remotely controlled robotic vehicle is designed specifically to lead search or rescue efforts in the mine or in the event of a mining disaster. The robotic vehicle is controlled through Zigbee based remote controlled technology. When mines collapse, the biggest hindrance to a speedy search and rescue operation is the lack of information. Mining accidents generally bring about a buffet of dangerous conditions: structural weaknesses within the shafts themselves, poisonous vapors, explosive gases, flooded tunnels, etc. Rescue crews can't charge into such conditions without proper reconnaissance, lest they risk compounding the situation by creating a second disaster on top of the first.

So here is the project work designed to cope with all of these things so it can get down into a mine quickly, searching and assessing threats so human searchers can get into place as quickly as possible. The system designed here can also be used for many applications like for almost all rescue operations during earth quakes, disasters mostly in mines, etc. The same system can be used as warfare vehicle in war fields as well with some modifications. The system designed as unmanned vehicle and is equipped with sensors for reading different parameter values and transmits the information to the monitoring station through the same zigbee network.

The vehicle can be controlled in all directions through a remote present with the operator. In addition the vehicle is equipped with several sensors for knowing the conditions over there. For identifying if there are any harmful or poisonous gases or vapors, the vehicle is equipped with a gas sensor. For knowing the temperatures of the tunnel or the mine, the vehicle carries a temperature sensor over it that measures the temperature as well. The temperature data will be transmitted continuously by the vehicle and the gas information will be transmitted only if hazardous gases are detected. The remote is designed using AT89C51 controller and the robotic vehicle is designed using ARM7 controller.

INTRODUCTION

The concept presented here requires two ways communication system, the data transmitting unit from where the robot is controlled is also receiving the parameters information from the robot. Similarly the Zigbee module installed over the moving robot in the field also functions as transceiver, it receives the command code signals from the base station, i.e., from where the robot is controlled to travel in the field or mines in all directions, and this place also can be called as monitoring station.

This Zigbee module also transmits the information about the data of hazardous gases and temperature values to the base station and hence both Zigbee modules are performing the function of transceivers, i.e. sending and receiving the data. As a single unit any other communication system cannot perform the function of transceiver, therefore here Zigbee modules are used because in this project work two ways wireless control is one of the most important contributions of the project work.

There are three main levels of challenges. First is the information processing of the robot. Second the Mobility of the robot. Third is the manipulation of the robot. Bringing these robots into real use and being able to use them in all situations is so close to becoming a reality. Some changes will need to be made if they ever expect these robots to function properly. But once they figure out what they need they will hopefully serve a great purpose and be a greater asset to rescuers.

LITERATURE SURVEY

A robot that is designed here is for the purpose of detection of hazardous gases and temperature values. Common situations that employ these types of robots are mining accidents, urban disasters, hostage situations, and explosions, etc. Rescue robots were used in the search for victims and survivors after the September 11 attacks in New York. The benefits of rescue robots to these operations include reduced personnel requirements, reduced fatigue, and access to otherwise unreachable areas.

DESCRIPTION ABOUT CIRCUIT

The control circuit is designed with 89C51 microcontroller; this device belongs to Atmel family is very familiar, generally used for process control applications. A microcontroller is an entire computer manufactured on a single chip. Microcontrollers are usually dedicated devices embedded within an application. For example, microcontrollers are used as engine controllers in automobiles and as exposure and focus controllers in cameras. In order to serve these applications, they have a high concentration of on-chip facilities such as serial ports, parallel input output ports, timers, counters; interrupt control, analog-to-digital converters, random access memory, read only memory, etc. The I/O, memory, and on-chip peripherals of a microcontroller are selected depending on the specifics of the target application. Since microcontrollers are powerful digital processors, the degree of control and programmability they provide significantly enhances the effectiveness of the application.

Zigbee is one of the wireless protocols based on the IEEE 802.15.4 standard for wireless personal area networks (WPAN's). Zigbee is designed to use in embedded applications requiring low data rates and low power consumption. The benefits of using Zigbee technology is to make the design as simple as possible, cost-effective, Robust (Ensuring a reliable solution in noisy environments), low-power wireless connectivity, etc. One main advantage of using this technology is to cover large areas with routers. As each Zigbee module can send and receive data, the received data received from one point can be transported to the third point as a mediator.

ZIGBEE COMMUNICATION

Zigbee is a low power spin off of WiFi. It is a specification for small, low power radios based on IEEE 802.15.4 – 2003 Wireless Personal Area Networks standard. Zigbee is one of the wireless protocols based on the IEEE 802.15.4 standard for wireless personal area networks (WPAN's). Zigbee is designed to use in embedded applications requiring low data rates and low power consumption. The benefits of using Zigbee technology is to make the design as simple as possible, cost-effective, Robust (Ensuring a reliable solution in noisy environments), low-power wireless connectivity, etc. One main advantage of using this technology is to cover large areas with routers. As each Zigbee module can send and receive data, the received data received from one point can be transported to the third point as a smediator.


Fig 4.1.1: Zigbee with circuit   Fig 4.1.2 : Zigbee with antenna
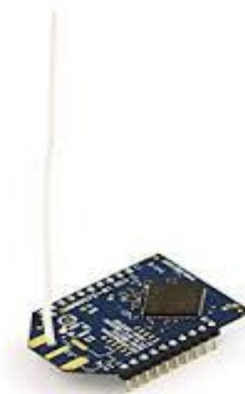
BLOCK DIAGRAM
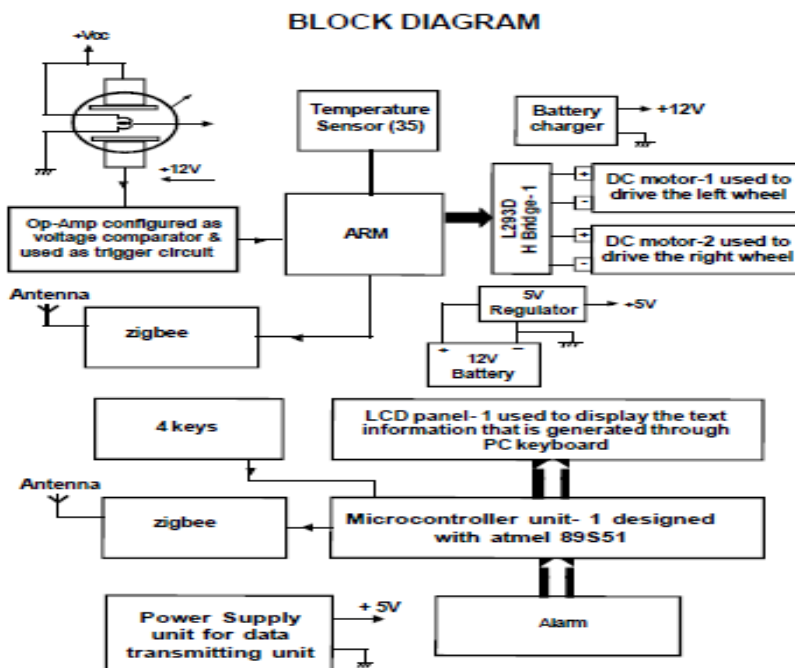
ARM PROCESSOR:

The ARM processor is a 32-bit RISC processor, meaning it is built using the reduced instruction set computer (RISC) instruction set architecture (ISA). ARM processors are microprocessors and are widely used in many of the mobile phones sold each year, as many as 98% of mobile phones. They are also used in personal digital assistants (PDA), digital media and music layers, hand-held gaming systems, calculators, and even computer hard drives.

ARM7 TDMI PROCESSOR

The ARM7TDMI-S is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers. This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core. Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory.

DESCRIPTION ABOUT TEMPERATURE SENSOR (LM 35)

LM35 is an analog sensor that converts the surrounding temperature to a proportional analog voltage. The output from the sensor is connected to one of the ADC input pins of the ARM7 controller to read the equivalent temperature value in digital format. The computed temperature is displayed in a 16×2 character LCD, in °C at the monitoring station.

LM35 is a popular and low cost temperature sensor. It is also easily available. It has three pins as follows.

Fig 9.1 LM35 Temperature Sensor

DESCRIPTION ABOUT GAS SENSOR

The rescue robot is also equipped with the gas sensor to find whether any harmful gases are present in the mine or the tunnel. This circuit senses the release of any toxic gases and gives indication to the controller that transmits the information to the monitoring station through Zigbee. Here is the general description about the gas sensor. The MQ2 (LPG Gas Sensor) is a simple-to-use liquefied petroleum gas (LPG) sensor. It can be used in gas leakage detecting equipment in consumer and industry applications, this sensor is suitable for detecting LPG, iso-butane, propane, LNG. Avoid the noise of alcohol, cooking fumes and cigarette smoke. The sensitivity can be adjusted by the potentiometer.

This sensor has a high sensitivity and fast response time. The sensor's output is an analog resistance. The drive circuit is very simple; all you need to do is power the heater coil with 5V, add a load resistance, and connect the output to an ADC. This sensor comes in a package similar to our MQ-3 alcohol sensor, and can be used with the breakout board below The MQ-2 can detect gas concentrations anywhere from 200 to 10000ppm.

FUTURE SCOPE

A safety system is developed for Cole mine workers using wireless sensor networks. A larger area and more depth inside hazardous underground mines are now can be covered and potential accidents can be controlled effectively. And also in this paper a low complexity parameter. In future our project can be extended using camera to watch the area beneath the mines. A GSM and GPS also can be included and connected to this project to find the exact location of the Robot Vehicle and get the acknowledgement to us through SMS to our mobile to which it is registered. Using more powerful temperature sensor and Gas senor we can also find all types of gases and temperature.

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