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Wireless Networks Based Mine Detection Robot Using Embedded Systems

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Abstract

In the Real time Application the Detection and location of Bomb is highly essential in the field of Defense Applications. Considering the value of human life, the robot is allowed in the field to detect the bomb. In this paper we are using microcontroller for a remote controlled mine detecting robot using sensors. Robot can move in any direction. But when any obstacle comes in front of the robot, IR or Metal sensor senses that obstacle and send appropriate signal to the microcontroller. In PC we will provide appropriate control signals to microcontroller using ZigBee wireless link. After receiving this signal at microcontroller, it direct that signal to the motor.

Keywords: - Keil, Proteus7, Microcontroller, ZigBee.

Introduction

Now a day's Robotics is part of today's communication & communication is part of advancement of technology, so we decided to work on Robotics field, and design something which will make human life today's aspect. There are different types of mobile robots which can be divided into several categories consists of wheeled robot, crawling robot and legged robot**.** This project deals with a wheeled ROBOT. Embedded systems are finding increasing application not only in domestic application but also in areas of industrial automation, automobiles, power electronic, and defense and space equipments. 8051 are the modern building blocks for many embedded systems. The available 8-bit versions manufactured by Intel, Motorola, Philips, Atmel, etc., They are available in the market with various configurations for different applications. The programming language used for developing the software to the microcontroller is Embedded/Assembly. The KEIL cross compiler is used to edit, compile and debug this program. Micro Flash programmer is used for burning the developed code on Keil in to the microcontroller Chip. Here in our application we are using AT89C52 microcontroller which is Flash Programmable IC.

System design

The main block diagram covers the Robot Section and monitoring section. The Robotic section consists of Microcontroller, power supply, sensors, transmitter module and motor driver. The monitoring section includes Receiver module and PC.

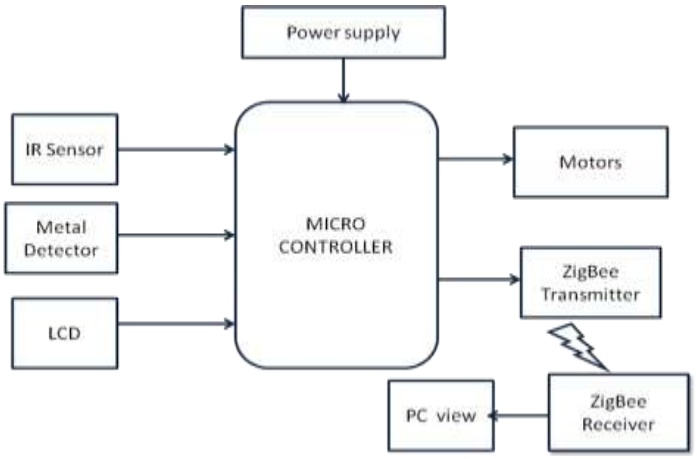

fig: 2.1 Block diagram of Mine detection Robot

Microcontroller

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

The features of the micro controller are as follows:

• Compatible with MCS-51 ™ Products
• 4K Bytes of In-System Reprogrammable Flash Memory

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• 128 x 8-bit Internal RAM
• 32 Programmable I/O Lines
• Two 16-bit Timer/Counters
• Six Interrupt Sources
• Programmable Serial Channel
• Low-power Idle and Power-down Modes

Power Supply

A Power supply is a device that supplies electric power to an electrical load.

Features

- Output Current up to 1A
- Output Voltages of 5, 6, 8, 9, 10, 12, 15, 18, 24
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area Protection

Dc Motor and H-Bridge Concept

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. DC motors are most commonly used in variable speed and torque.

The motor driver used here is L293D. L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The L293D is suitable for use in switching applications at frequencies up to 5 KHz.

DC Motors can rotate in two directions depending on how the battery is connected to the motor. Both the DC motor and the battery are two terminal devices that has positive and negative terminals. In order run the motor in the forward direction, connect the positive motor wire to the positive battery wire and negative to negative. However, to run the motor in reverse just switch the connections; connect the positive battery wire to the negative motor wire, and the negative battery wire to the positive motor wire. An H-Bridge circuit allows a large DC motor to be run in both directions with a low level logic input signal. The H-Bridge electronic structure is explicit in the name of the circuit - H - Bridge.

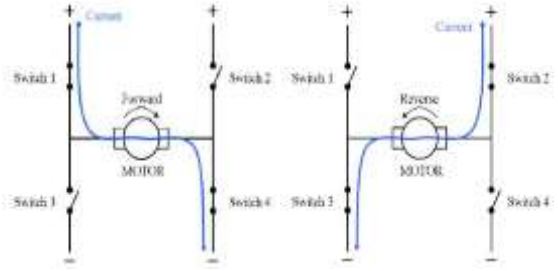

Fig. 2.2 H-Bridge

If it is desired to turn the motor on in the ***forward*** direction, switches 1 and 4 must be closed to power the motor. If it is desired to turn the motor on in the ***reverse*** direction, switches2 and 3 must be closed to power the motor. Fig. 2.2 shows the H-Bridge driving the motor in both forward and reverse direction. L293D is a dual H-bridge motor driver, so with one IC we can interface two DC motors which can be controlled in clockwise and anticlockwise direction.

Sensors

A sensor is a converter that measures a physical quantity and converts it into a signal which can be read by an observer or by an (today mostly electronic) instrument.The sensors used on the robot can be grouped into two, which are, IR sensor, Metal detection sensor and Proximity sensor. These sensors will send signals to the controller to be processed, and appropriate output signals will be sent to the motors. For mines detection, a powerful metal sensor is used. A sensor is essential to sense shaft speed. Typically, devices used for this purpose are shaft (rotary type) encoders, photoelectric (optical type) sensors and magnetic rotational speed (proximity type) sensors. All of these sensors send speed data in the form of electrical pulses. Shaft encoders offer a high resolution of typically 1-5000 pulses per revolution (PPR) and clearly defined, symmetrical pulses. Proximity sensors provide medium (or low) resolution sensing, depending on the number of pulses measured per revolution. Photoelectric sensors usually sense a reflective target on the rotating shaft.

The infrared sensors are basically used to detect the presence of any large object. The IR sensor status and metal detector sensor status are transmitted to the client system from robot through internet. The status of IR sensor helps for path planning and changing the direction of robot. When the bomb is detected by metal detector the robot is stopped and the location of bomb is identified.

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Metal Detector

The basic metal detector used for mine detection as shown in Fig. below.

Fig. 2.3 Metal Detector

It measures the disturbance of an emitted electromagnetic field caused by the presence of metallic objects in the soil. The popular, basic metal detector is easy and cheap to use and has an average success rate. However all metallic objects are identified while the problem is heightened, when using more sensitive detectors for plastic mines. Induction Coil Imaging Sensor – create an image o f the object being detected instead of producing an audio signal. "In its current version it is able to detect and see metal parts of less than 1cm to a depth of 50cm". But the system cannot be used on the newer plastic mines, and the prototype is quite heavy.

LCD

A liquid-crystal display is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. The LCD screen is more energy efficient and can be disposed of more safely than a CRT. Its low electrical power consumption enables it to be used in battery powered electronic equipment. Liquid-crystal displays are used in a wide range of applications including computer monitors, televisions, instrument panels and displays. The LCD screen is more energy efficient and can be disposed of more safely than a CRT. Its low electrical power consumption enables it to be used in battery powered electronic equipment. The LCD used in this paper is 16 pin configuration.

ZigBee Technology

ZigBee technology was developed for a wireless personal area networks (PAN), aimed at control and military applications with low data rate and low power consumption. ZigBee is a low-cost, low-power. First, the low cost allows the technology to be widely deployed in wireless control and monitoring applications. Second, the low power-usage allows longer life with smaller batteries. ZigBee standard is developed by ZigBee Alliance, which has hundreds of member companies, from the semi-conductor industry and software developers to original equipment manufacturers and installers. ZigBee is used to transmit the data from the microcontroller to the PC through wireless communication for controlling the robot directions. At, the PC section the ZigBee receiver is connected to the PC through serial communication. The serial communications are used for transferring data over long distances, because parallel communications requires too many wires. The serial communication here employed is RS232 for data transmission to the ZigBee receiver.

Implementation

In this paper the programming language used for developing the software to the microcontroller is Embedded/Assembly. The KEIL cross compiler is used to edit, compile and debug this program. The C51 Compiler translates C source files into relocatable object modules which contain full symbolic information for debugging with the µVision Debugger or an in-circuit emulator. In addition to the object file, the compiler generates a listing file which may optionally include symbol table and cross reference information. Micro Flash programmer is used for burning the developed code on Keil in to the microcontroller Chip. Here in our application we are using AT89C52 microcontroller which is Flash Programmable IC. At present the Atmel Corporation represents CMOS technology is used for designing the IC. The programming is implemented in keil software and it is feed to the microcontroller. The power supply 12v is given to the microcontroller to perform the operation. The motor driver L293D is connected to the two dc motor to drive the robot. The IR sensor and Metal detector are used to sense the object and are connected to port 1.0 and port 1.1. The 2X16 LCD display is connected to port 3 for display the direction of the robot. The design model of the mine detection robot using Proteus7 software.

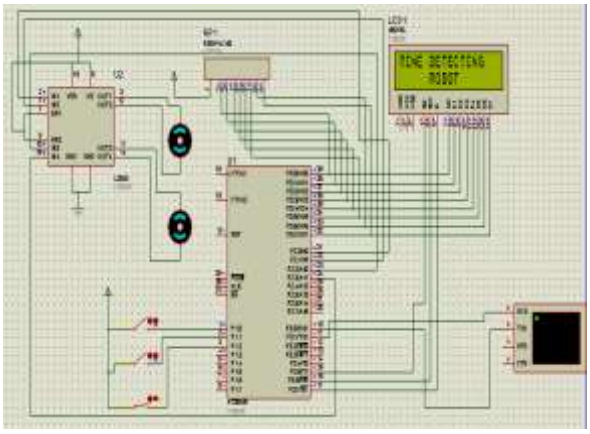

Fig.3.1. Design model of mine detection robot

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The implemented model of the mine detection robot as shown below

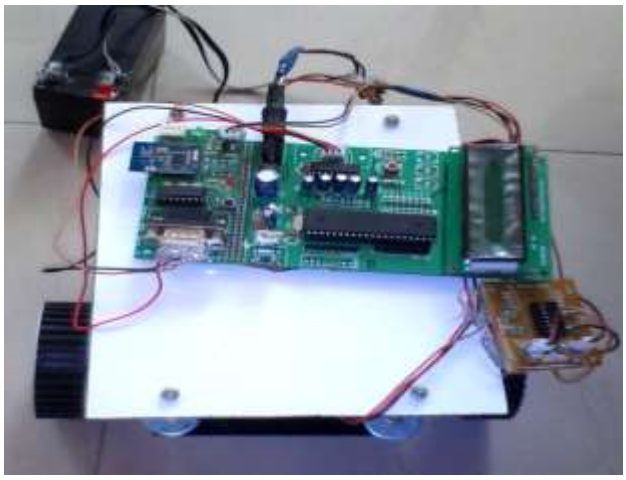

Fig.3.2: Model of mine detection robot control

Results

The output is monitored and the direction can be control using flash magic. The results are shown below.

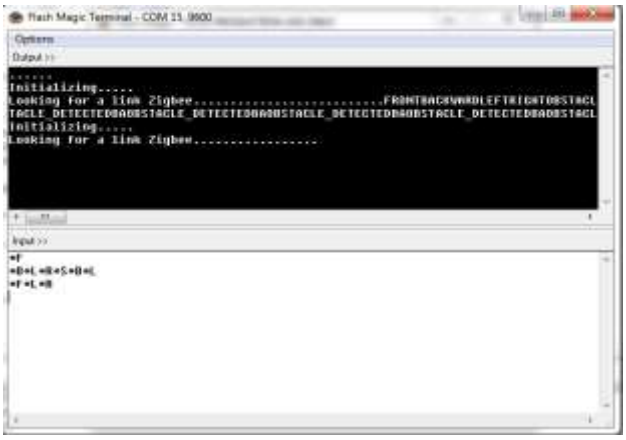

Fig.3.1: Output of mine detection robot control

Conclusion

This paper is very much useful in the places where a human cannot go into the places like ground canals, smoke oriented caves and this project is very much useful in such situations. We developed the robot with a very good intelligence which is easily capable to sense the obstacle. Robot take the left or right or the forward movement in according to the sensing signal with the help of the two dc motor which makes the movement of the robot smooth.

Future Scope

Further scope exits for implement the bomb detection and disconnection of the bomb using arm robot and steering angle for the direction control of the robot.

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