Metal Detector Robot Using PIC Microcontroller

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Abstract—Robotics applications are being widely used in industries now-a-days. Wireless robotic applications are built to reduce much of the human efforts. Metal detector robot works on the same wireless communication platform for detection of metals in sensitive areas such as mines and war fields. The system works on PIC16F series microcontroller and RF modules for wireless communication. It can sense metallic objects with the help of metal circuit mounted on the robot. At the transmitting end, user can operate the robot movement using push buttons interfaced with PIC assembly. The commands from transmitting end are being wirelessly received by receiving end PIC assembly which is mounted on the robot body. RF transmitters and receiver modules have sufficient range for metal detecting purpose at mine locations. It has around 100 meters in uninterrupted communications path, and 60 meters with interrupted path. A metal detector circuit working is based on special purposed IC for metal detection circuits. Robot movements are being carried out by Dc motor drivers. In future scope, a wireless camera can be mounted on robot for better efficiency and modified user interface.

Keyword—Metal Detector, RF Module, Robot, Motor Driver IC, LCD, PIC Microcontroller..

I. INTRODUCTION

Early metal detector was developed at the end of the 19th century. Alexander graham Bell is credited with the invention of the first metal detector in 1881.Nowdays, Metal detectors have become an essential component in today's society and widely used not only for hobbyists but also for safety purpose. [1] For Safety purpose, Metal detector that used in airport to ensure that there is no dangerous weapon such as knives, guns or any metal objects that could be used as weapons has been brought along by terrorist into the airplane. Metal detector is mainly used for finding metallic item. There are several different types of metal detectors. The kind of metal detector sometimes could be finicky and demanding especially when the scope search area is wide.

The metal detector circuit is mainly used for security systems in malls, hotels using hand metal detectors. This project consists of similar types of metal detection technique. a metal detector circuit is mounted on robot body, which is design specially for mine application. In many mine areas and war fields area metal detector is required. We are designing wireless robot with metal detection capability.

II. METHODOLOGY

Metal detector robot consist of PIC16F877A microcontroller and RF wireless communication modules. The interfacing connections are as shown in the diagram below. PIC16F877A microcontroller is programmed in MPLAB programming software and XC8 compiler. We are using a metal detector circuit based on TDA0161 IC, which is a special purpose IC for metal detection circuits. A copper coil of around 120 turns is being used in metal detector circuit which gives metal detection sensitivity up to 3 cm. The signal from metal detector circuit is received by PIC assembly present on robot body, which then provides alarm to the user.
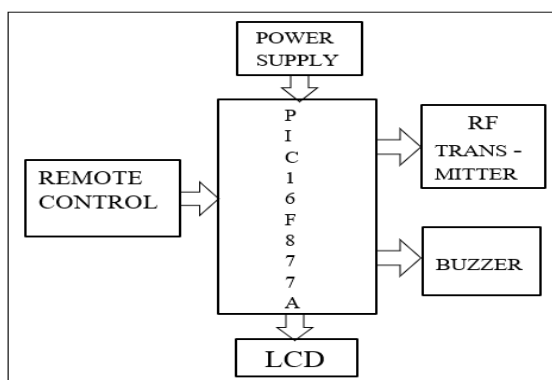
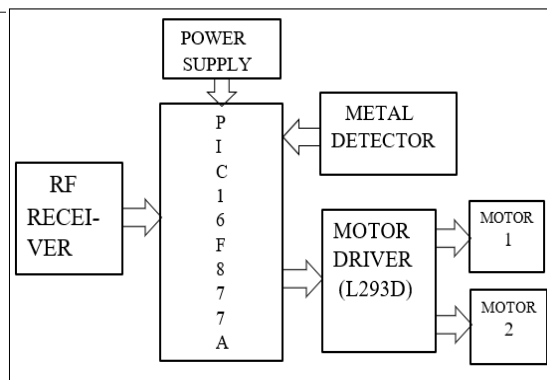Figure 1. Block Diagram of Transmitter   Figure 2. Block Diagram of Receiver

Robot navigation is totally done wirelessly by using Radio frequency controlled remote. At remote end, i.e. transmitter end, push buttons are interfaced with microcontroller, which then gives commands to RF transmitter. 12V DC motors are used for movement of robot with the help of motor driver IC L293D interfaced with microcontroller assembly. For supply system, two regulator ICs, 7805 and 7809 are used for positive DC supply to microcontroller board. When push button is pressed at the transmitting end, robot movements are done with associated Motor operation. The buzzer system is used for acknowledgement to the user on metal detection.

1. METAL DETECTOR SENSOR (TDA0161):

In metal detector circuit there used TDA0161 IC which is proximity detector IC. The IC has 8 pins. In metal detector circuit there used one transistor(2N2222A). This IC has operating between 4 to 35V. Pin (1) is input and Pin (6) is output. When changes in the current of the supply that will determine the signal of output i.e. when metal object is closer than current will be high and in opposite the current is low due to there is no metal object present. The output pin is high then register will give positive voltage to transistor. Then transistor become on and buzzer will produce sound. The principle on which the metal detector can work is that, when the electric current is passing through a magnetic coil they produce a magnetic field inside the coil. The metal detector produces alternating current with the help of oscillator.
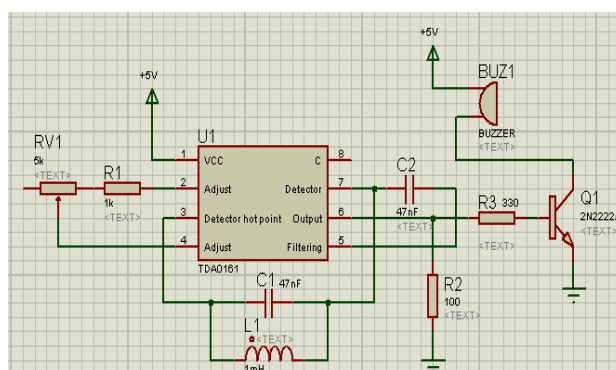

Figure 3. Metal Detector circuit

2. PIC16F877A:

PIC16F877A is 40 pin IC and has timers one 16 bit and two 8 bits. In this IC there are five I/O ports like port A, port B, port C, port D, port E. These ports are analog and digital form. The analog port used only for I/P but digital port used for I/P or O/P. There are total 33 I/O pins. In IC EEPROM is available and it is 256 bytes. The IC has 20MHz operating frequency.
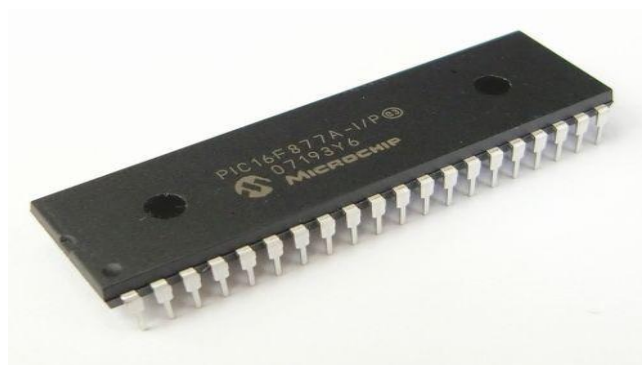
Figure 4. PIC16F877A IC

3. RF MODULE:

RF means Radio Frequency. It is used for wireless connection. This module has transmitter and receiver separate module. It works on 433MHz frequency. There are two IC HT12D and HT12E are interface with TX and RX devices. This module is used the ASK (Amplitude Shift Keying) technique of modulation. The cost of device is less. It can be easily available in market. The TX consist of 8 pin and RX consist of 4 pins. The main purpose of used of this module is wireless communication between two devices. The receiver has 3V to 12Voperatingvoltage. The TX has 3.2 to 5.5v. The range of RF module in open source area is 100m.
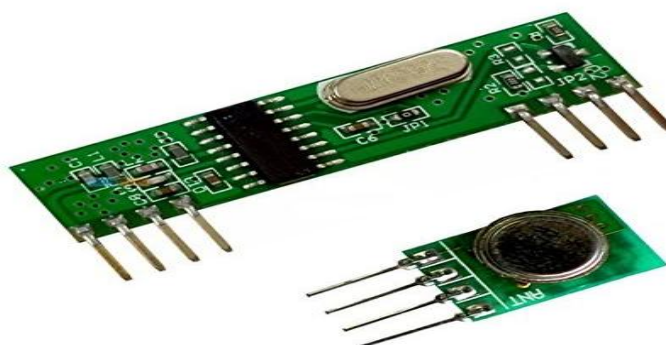

Figure 5. RF Module

5. LCD DISPLAY:

LCD display is basically used to display the command, etc. The LCD has 16 pins. LCD is 16*2 module, there are 16 characters in first row and 16 characters in second row. Pin1(Vss) is ground pin. Pin2(VDD) is power supply pin, power supply will be providing(+5V). Pin(3) is used to adjust the contrast of LCD by using 10k potentiometer. The pins of D0 to D7 is data line used to display the data on LCD. Pin (5) is provide the Read/Write mode.
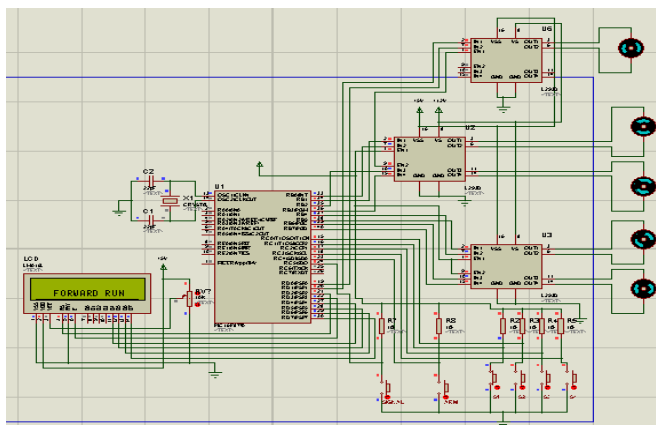

Figure 6. 16*2 LCD Module

6. SIMULATION:

Figure 7. Simulation Diagram

7. HARDWARE IMPLEMENTATION:

Figure 8. Actual Model (a)   Figure 8. Actual Model (b)

8. CONCLUSION:

After completion of this project, we will be able to have a system that is successful in detecting the metal object using metal detection circuit with wirelessly robotic operation. The metal detector robot provides the efficient way in order to reduce the human effort, time and a system to help detecting the metal object in safe manner for the growing difficulties and thus creating dangerous issues to human life, this system provides the way to find the solution to difficulties, entity and improves the quality of engineering.

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