DTMF Based Bomb Detection with Collision Avoidance Robot

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Abstract— Here we presents the wireless bomb detection robot which will help to improve defense of our nation .The bomb detectors system works only with the presence of experts. But this way of analyzing takes more time and make risk to life of experts. This uses wireless technology for controlling action.

The aim of our project is to design a wireless robot for bomb surveillance and detection with a metal detector. This robot can be moved in Omni-direction using geared motors of 100RPM. Also we are interfacing the Obstacle Sensor which avoid collision of the robot with any obstacle in its track when it will be sensing metal body within its range for bomb detection.LCD is use to display all directions along with obstacle sensed and Metal Detected. The robot is controlled by remote control. Wireless control of robot is achieved using DTMF code signals.Micro-controllerPIC18F4520 has been used to control the direction of robot. The motor driver circuit has been used to provide reversible drive to the dc motors.

Keywords- DTMF, DC Motor, PIC Micro-controller 18F4520,Metal Detector ,Obstacle Sensor.

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I. INTRODUCTION

In this project we use micro controller which is programmed to control the input and output modules interfaced to it. The controller makes use drivers; depending upon the indications the DC motors can be rotated. Also a mobile phone which will operate the robot directions based on the DTMF technology. DTMF (Dual Tone Multiple Frequency) depends upon the keypad tones where as each tone can generate certain frequency depending on that, the robot will operate and it will increase or decrease the speed.

Here we are implementing the Bomb detection application which will be run using a Metal detector which will senses or detect metal body in range of 1.5m. A high sensitive induction type metal detector is designed using colpitts oscillator principle and fixed to this robot. When the robot is moving on a surface, the system produces a beep sound when Bomb is detected.

Along with Bomb detection, we are making our robot more feasible to longer distance to be controlled by humans easily. This can be done by interfacing a obstacle sensor at mouth of our robot body which will sense the obstacle within its path which will cause the buzzer to beep. And we

Use to make our mobile phone to move the robot in either direction. Simultaneously LCD will display the message of ongoing operation performed by robot.

This project utilizes two DC Motors. The driver used for DC Motors is L293D.The micro controller interfaced with DTMF decoder is used to control the direction of the robot.LED indicator which it can indicates the motor ON/OFF in case of directions. The mobile phone acts as remote control.

II. RELATED WORK

1. Wireless Bomb Disposal Robot 1 Shinde Pushpa.D., 2 Davane Rahul D., 3 Patil Poonam B. 1,2,3Department of Electronics and telecommunication Annasaheb Dange College of Engineering and Technology, Ashta.

2. Yun Chan Cho and Jae Wook Jeon "Remote Robotcontrol System based on DTMFof Mobile Phone",IEEE International Conference INDIN 2008, July2008.

3. "Obstacle Avoidance Robotic Vehicle Using Ultrasonic Sensor, Android And Bluetooth For Obstacle Detection" Vaghela Ankit1, Patel Jigar2, Vaghela Savan.

III. MAIN BODY OF THE PAPER

A. Principle of Working:

This project uses DTMF technology for controlling Robot in a way such that near the controlling side we are provided with any type of communication device a mobile phone or a land-line.Now coming to the other side we are provided with the mobile phone only because a land-line cannot move accordingly with the movement of the boat. In the mobile phone we allot the number keys as our direction movements for the Robot to move.

Now when we dial the numbers in the mobile phone from the controlling side then it automatically recognizes which number has been recorded and it follows with the corresponding next step to be taken i.e., movement of the robot. This Project uses DTMF Decoder which is controlled by a battery and in turn is connected to the mobile phone. This is controlled by the controller and is again connected to the driver circuit for driving the motor.

Along with robot movement in Omni-direction, when a metallic body or substance come in contact with metal sensor, buzzer will beep that will indicate and display BOMB DETECTED on LCD.As robot is sensing metal if a obstacle is come in its way, then OBSTACLE DETECTED is displayed along with the buzzing action.

B. Block Diagram:

The fundamental interface or inter circuit connection between different modules is shown over here**.** The basic building blocks of this system are

DTMF Decoder CM8870.
PIC18F45520 Controller.
Motor drivers L293D and Motors.
Obstacle Sensor hc-sr04.
Proximity Sensor (Metal Detector).
LCD.
Wheels.
Power supply

Button	Low DTMF frequency (Hz)	High DTMF frequency (Hz)	Binary coded output			
			Q1	Q2	Q3	Q4
1	697	1209	0	0	0	1
2	697	1336	0	0	1	0
3	697	1477	0	0	1	1
4	770	1209	0	1	0	0
5	770	1336	0	1	0	1
6	770	1477	0	1	1	0
7	852	1209	0	1	1	1
8	852	1336	1	0	0	0
9	852	1477	1	0	0	1
0	941	1336	1	0	1	0
*	941	1209	1	0	1	1
#	941	1477	1	1	0	0

Fig.3.1.Block diagram

1. DTMF Encoder and Decoder-

The DTMF stands for 'Dual Tone Multi-frequency' which is one of the techniques for converting the analogue signal to digital using DTMF decoder. The DTMF decoder circuit mostly used in mobile communications system which recognizes the sequence of DTMF tones from the standard Keypad of the mobile phone.

DTMF keypad is placed out on a 4 cross 4 matrices, in which each row represents low frequency, each column represents high frequency, with DTMF, each key passed on a phone generates two tones of the specific frequencies one tone is generated from a high frequency tones and low frequency tone. These tones are converted to digital form using DTMF decoder circuit. These codes are the address of the destination which is read and preceded by the mobile that connects the caller to the destination.

The output of DTMF decoder is the four bit binary number according to which the controller performs the controlling action. IC CM 8870 decodes the DTMF signals and gives 4 bit Binary output according to the key press on the keypad of the transmitter mobile phone
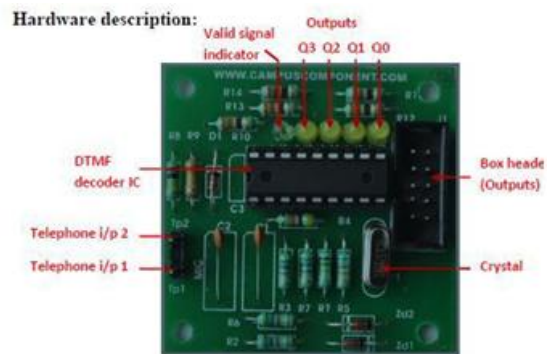

Fig3.1.1.DTMF frequency and Binary O/P and H/W

Almost any mobile (cellular) phone is able to generate DTMF after establishing connection. If your phone can't generate DTMF, you can use a stand-alone "dialer". DTMF was designed so that it is possible to use acoustic transfer, and receive the codes using standard microphone.

2. PIC18F45520 Controller-

The PIC microcontrollers appeal to hobbyists and experimenters, especially in the fields of electronics and robotics. Key features include wide availability, low cost, ease of reprogramming with built-in EEPROM (electrically erasable programmable read-only memory), an extensive collection of free application notes, abundant development tools, and a great deal of information available on the Internet. The PIC microcontrollers often appear under the brand name PIC micro.

Binary output of DTMF receiver is then given to PIC18F45520 Micro controller. Depending on the Binary code at the output of receiver the software program inside the micro-controller controls the direction and selection of the motors on main body.

Due to less complex instruction set in PIC as compare to 8051,we are using here PIC .It is faster than 8051,rich in peripherals, consume less power, smaller pin count many devices to select from as per requirements.

Following are some brief features-

A. Operating speed: DC – 20 MHz clock input.
B. Up to 8K x 14 words of Flash Program Memory,

Up to 368 x 8 bytes of Data Memory (RAM),

Up to 256 x 8 bytes of EEPROM Data Memory.

C . Pinout compatible to other 28-pin or 40/44-pin PIC16CXXX and PIC16FXXX micro-controllers.

3. MOTOR DRIVER CIRCUIT:

We are employing here L293D motor driver. In the design of the motor driver circuit we had considered the following points:

• The required direction of rotation.

• The current and voltage requirement.

• The interfacing with the logic circuit.

L293D is a 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.

In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively.
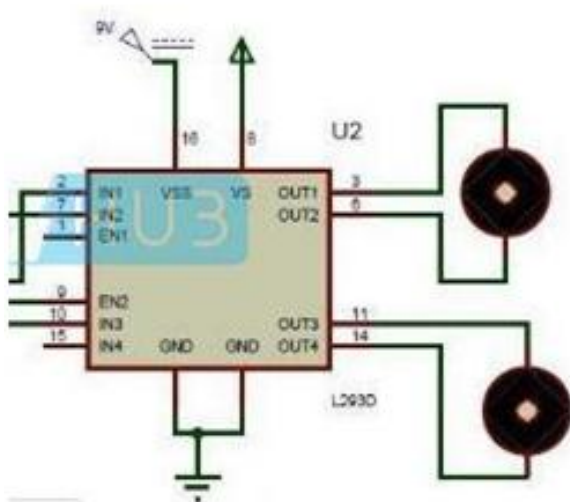
6. DC MOTOR-

A **DC motor** is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor. DC motor has two wires, we can say them positive terminal and negative terminal, when these wires are connected with power supply the shaft rotates. We can reverse the direction of the rotation. L293d chip is very safe to use for DC motor control. This L293D is 16bit chip. Chip is design to control four DC motor, there are two inputs and two outputs for each motor.

There are two Enable pins on l293d. Pin 1 and pin 9, for being able to drive the motor, the pin 1 and 9 need to be high. For driving the motor with left H-bridge we need to enable pin 1 to high. And for right H-Bridge we need to make the pin 9 to high. If anyone of the either pin1 or pin9 goes low then the motor in the corresponding section will suspend working. It's like a switch.

7. OBSTACLE SENSOR-

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:

Using IO trigger for at least 10us high level signal,

(1) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.

(2) IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning.
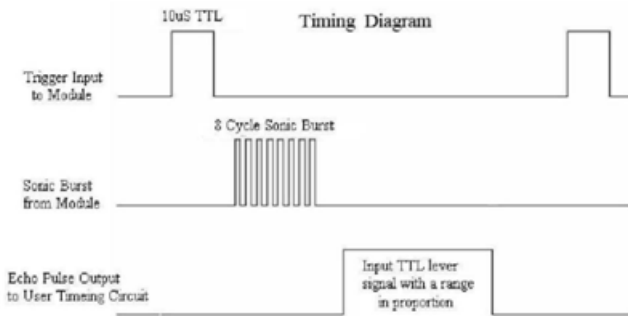
Test distance = (high level time×velocity of sound (340M/S) / 2,

The Timing diagram is shown below. We only need to supply a short 10uSpulse to the trigger input to start the ranging, and then the module will send out an 8 cycle burst of ultrasound at 40 kHz and raise its echo. The Echo is a distance object that is pulse width and the range in proportion .We can calculate the range through the time interval between sending trigger signal and receiving echo signal. Formula: uS / 58 = centimeters or

uS / 148 =inch; or: the range = high level time * velocity (340M/S) / 2; we suggest to use over 60msmeasurement cycle, in order to prevent trigger signal to the echo signal.

8. METAL DETECTOR

Metal Detector is very common device for checking the person in shopping malls, hotels, cinemas to ensure that the person is not carrying any explosive materials or illegal things like guns , bombs etc. Hence, we are using metal detector sensor

This sensor is consist of LC circuit that will trigger the proximity sensor if it detect any metal near it Proximity sensor will give glow the led, and also make the buzz with the help of buzzer. The proximity sensor can detect the objects without any physical interference. The proximity sensor will work same as infrared sensor, proximity also release a signal, it will not give output unless and until there is no change in the reflected back signal, If there is a change in signal it will detect and give the output accordingly. There are different proximity sensors for example to detect plastic material we can use capacitive type proximity and for metals we should use inductive type
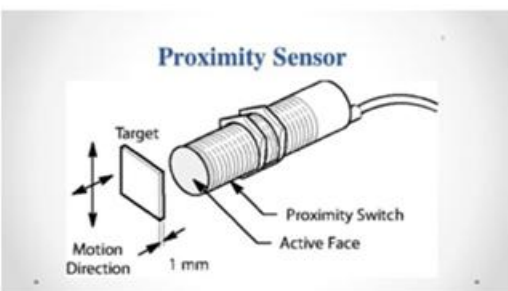

fig. Metal Detector

9. POWER SUPPLY-

We are using 9v HW Battery .IC 7805 is used for converting 9v to 5v to provide a wireless power supply to our underwater robot which is acceptable power supply for all circuit.

IV.PERFORMANCE AND EXPERIMENT

DTMF based robot run by some command that are send via mobile phone. One is user mobile phone that we will call "Remote phone " and secand one that are connected with robot circuit using aux wire this mobile phone wewill call 'Receiver phone'.

First we make a call by using remote phone to receiver phone and then attend the phone by manuly or automatic answer mode. Now here is how this robot is controlled by cell phone.
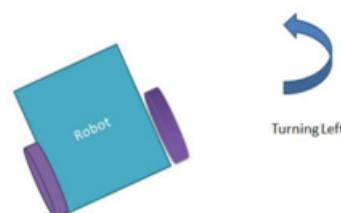
When we press 1 by remote phone robot start to moving forward and moving continues forward until next command comes.
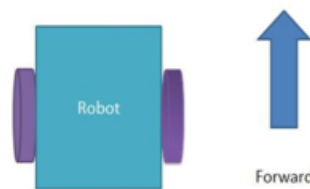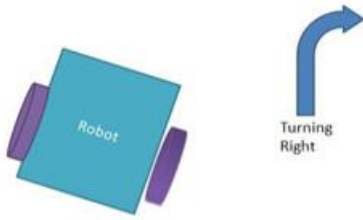

When we press 2 by remote phone robot start to moving backward and moving continues backward until next command comes.
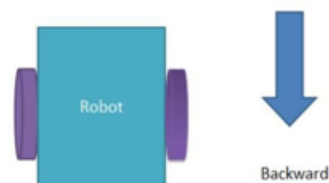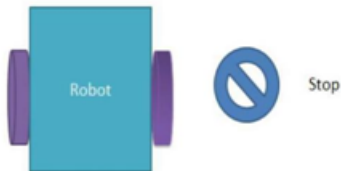

When we press 3 by remote phone robot start to moving left and moving continues left until next command comes.

When we press 4 by remote phone robot start to moving right and moving continues right until next command comes.

When we press key other than this keys by remote phone robot stop moving.

And when the metal is detected it gives Buzz with the help of buzzer. If there is any obstacle in its path then obstacle sensor send the signal to the PIC microcontroller and we will get beeping sound of buzzer.

Sr.no.	Type of metal	Correction coefficient
1.	Iron	1
2.	Brass	0.59 approx
3.	Stainless Steel	0.82 approx

V.   RESULT ANALYSIS

Metal sensor will detect iron metal when the metal is at distance of 3mm .And obstacle sensor detect the obstacle when it is at a distance of 10cm.

PHOTO GALLERY

VI. CONCLUSION

This paper has described the design and implementation of experiments to test the feasibility of using the Dual Tone Multi-Frequency encoding scheme as method for communicating simple messages. When the commands given by the disabled person sitting in one place, according to that commands the motors will move which in turn moves the robot. And it is very useful for military application as it detect the bomb. DTMF's technology is simple, low cost, as well as its already popular status in the telephone industry of today. It provides the advantages of robust control, working range as large as the coverage area of the service provider, no interference with other controllers and up to twelve controls. Although the appearance and capabilities of robots vary vastly, all robots share the features of a mechanical, movable structure under some form of control. And this technique also has its many future scope like with slight modifications can be used in industrial applications. With human detector sensor can be used at the time of disasters like earth quake to detect the human under buildings. With camera can be used in surveillance Systems.

VII. REFRENCE

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