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GSM based SPY Robot

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Abstract

Currently, a lot of research is being carried out in the development of USVs (Unmanned surface vehicles), UAVs (Unmanned Aerial Vehicles).

Traditional technology we used is wireless using RF circuits which suffer from many drawbacks such as working range & frequency range.

Use of a GSM network can overcome these drawbacks. It provides the advantages of robust control, working range as large as the coverage area of the service provider.

This paper illustrates on an approach to control a mobile robot using DTMF tone through the GSM network which can be used to remotely send streams of data for control of robot. The robot is controlled by a mobile phone that makes a call to the mobile phone attached to the robot. In the course of a call, if any button is pressed a tone corresponding to the button pressed is heard at the other end called Dual Tone Multiple frequency. The robot receives these tones is processed by the microcontroller with the help of DTMF, these IC sends a signal to the motor driver IC which derives the motor.

Keywords: DTMF (Dual Tone Multiple frequency), GSM (Global system for mobile communication), RC (Radio Control), RCV (Remote Control Vehicle), USV (Unmanned Surface Vehicle), UAV (Unmanned Aerial Vehicle), DTMF Tones, Mobile Robot, Mobile Navigation, Processing Unit, Robotics..

Introductions

RF control is the use of radio signals to remotely control a device. The term is used frequently to refer to the control of model vehicles from a handheld radio transmitter. The IR system follows the line of site approach of actually pointing the remote at the device being controlled; this makes communication to be impossible over obstacles and barriers.

Since IR systems suffer from these problems so to overcome this; a signaling scheme utilizing voice frequency tones is employed. This scheme is known as Dual Tone Multi-Frequency (DTMF).

In this paper, phones using GSM network interfaced with a microcontroller is used to remotely control an unmanned robotic vehicle thus overcoming distance barrier problem and communication over obstacles with very minimal or no interference but is solely network dependent. We present the design and implementation of an unmanned vehicle (i.e. a robotic vehicle) consisting of a GSM network (a mobile phone), DTMF decoder, microcontroller and a motor driver. The transmitter is a handheld mobile phone.

Description

DTMF

DTMF (Dual Tone Multi Frequency) better known as touch-tone is a system of signal tones used in telecommunication. There are twelve DTMF signals, each of which is made up of two tones from the following selection: 697 Hz, 770 Hz, 852 Hz, 941 Hz, 1209 Hz, 1336 Hz, and 1477 Hz.

The tones are divide into two groups (low and high), and each DTMF signal uses one from each group as shown in Figure 1. As its acronym suggests, a valid DTMF signal is the sum of two tones, one from a low group (697-941Hz) and the other from a high group (1209-1633Hz) with each group containing four individual tones.

DTMF assigns a specific frequency (consisting of two separate tones) to each key so that it can easily be identified by the electronic circuit. The signal generated by the DTMF encoder is a direct algebraic summation, in real time, of the amplitudes of two sine (cosine) waves of different frequencies, i.e., pressing ‘5’ will send a tone made by adding 1336 Hz and 770 Hz to the other end of the line.

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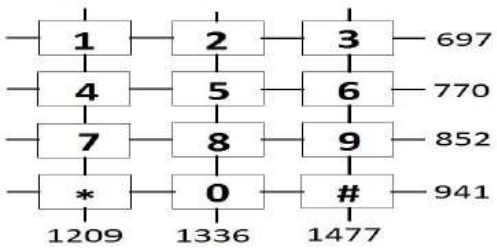

Figure 1

DTMF Decoder

The DTMF tone is decoded by DTMF decoder that gives a four bit data at the output of decoder. This four bit data can be used for making the decision as for each key pressed on the mobile keypad the data have different for a different key.

Software Description

The software is written in 'C' language and compiled using 'C' compiler. The source program is converted into hex code by the compiler. Burn this hex code into microcontroller.

Source program:

SpyRobit.c

```
#include <avr/io.h>
int main(void)
{
unsigned int k;
DDRA= 0x00;
DDRD=0xFF;
PORTD=0x00;
while (1)
{
k=PINA;
switch (k)
{
case 0x02:
{
PORTD=0x0A;
break;
}
case 0x08:
{
PORTD=0x05;
break;
}
case 0x04:
{
PORTD=0x08;
break;
}
case 0x06:
{
PORTD=0x02;
break;
}
case 0x05:
{
PORTD=0x00;
break;
}
}
}
}
```

Block Diagram

Here is the block diagram of mobile operated spy robot, which consists of a transmitting mobile unit, DTMF decoder, microcontroller, motor driver and a receiver mobile unit.

As shown in the block diagram (Figure 2), first block is the cell phone. So it acts as a DTMF generator with tone depending upon key pressed. DTMF decoder decodes the received tone and gives binary equivalent of it to the micro controller is programmed such that appropriate output is given to motor driver which will drive the two DC motors connected to it. The concept used for driving is "differential drive". So, ultimately the two motors rotate according to the key pressed on the keypad of the cell phone.

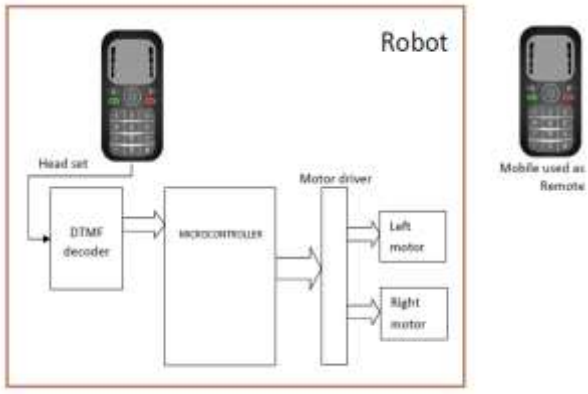

Figure 2

Working

In order to control the robot, we need to make a call to the cell phone attached to the robot from any phone, which sends DTMF tunes on pressing the numeric buttons. The cell phone in the robot is kept in 'auto answer' mode. (If the mobile does not have the auto answering facility, receive the call by 'OK' key on the mobile and then made it in hands-free mode.) So after a ring, the cell phone accepts the call.

Now you may press any button on your mobile to perform actions as listed in Table 1. The DTMF tones thus produced are received by the cell phone in the robot. These tones are fed to the circuit by the headset of the cell phone. The decoder

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decodes the received tone and sends the equivalent binary number to the microcontroller. According to the program in the microcontroller, the robot starts moving.

When you press key '2' (binary equivalent 00000010) on your mobile phone, the microcontroller outputs '10001001' binary equivalent. The output of the microcontroller drives the motor driver in different direction (as per Table 1).

No. pressed	Output of DTMF decoder	Input to the microcontroller	Output from the microcontroller	Action performed
2	0x02	0xFD	0X89	Forward motion
4	0x04	0xFB	0x85	Left Turn
6	0x06	0xF9	0x8A	Right Turn
8	0x08	0xF7	0x86	Backward motion
5	0x05	0xFA	0x00	Stop

Table 1

Usage

Spy robot is the robot that has ability to spy and to survey the environment. This project will build a spy robot that has ability to detect obstacle and stop moving.

From a performance standpoint, the perceived benefits of a robotic security or surveillance capability are numerous and well documented. Humans are removed from direct exposure to potentially dangerous situation. Robotic systems can perform many security and surveillance functions more effectively than humans. They can perform certain tasks better & faster than humans and much more consistently and accurately.

Result

With help of this paper, the mobile operated spy robot will be formed in which DTMF & microcontroller were used in motion of robot through programming in microcontroller. It has ability to detected obstacles & stop moving.

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