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Full Length Research Paper

Surveillance Robot Using Microcontroller and DTMF Technology

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ABSTRACT

The present paper discusses a surveillance robot controlled by a mobile phone that makes a call to another 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 of the call by means of a "Dual Tone Multiple-Frequency" (DTMF) tone. The robot perceives this DTMF tone with the help of the phone attached to it. The received tone is processed by the microcontroller with the help of a decoder IC. The microcontroller then transmits the signal to the motor driver ICs. One of the motor drivers IC is used to operate the motors connected to the chassis in order to drive the motors for forward or backward motion or take a turn. Other motor driver IC is used for driving the motors used for the rotation of the mobile phone which acts as camera and cause it to rotate through an angle of 360 degrees horizontally as well as vertically. The mobile that makes a call to the mobile phone stacked in the robot acts as remote control. So this research does not require the construction of receiver and transmitter units.

Key words: DTMF, Remote Control, Mobile Phone, Robotics

1. INTRODUCTION

Robotics is an interesting field where every engineer showcases his creative and technical skills. Pleasing aspect of robotics is that a robot can be made indigenously by anyone. In this competitive world there is need for every enthusiastic, from amateur to professional, to make a simple robot having innovated applications and with robust control. Mobile phones today became an essential entity for one and all and so, for any mobile-based application there is great reception. In this scenario making a mobile phone operated robot is a good idea. In this paper 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 (DTMF) tone.

The robot receives these tones with help of phone stacked in the robot. The received tone is processed by the Microcontroller with the help of DTMF decoder IC MT8870. This decoded signal is sent to the microcontroller and further microcontroller sends corresponding signal to the motor driver IC L293D which drives the motor in forward direction, reverse direction, turn left, turn right. There is another IC L293D which is used to rotate the structure having a camera within it. This

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camera is used for surveillance and its movement is controlled in the same way by the microcontroller IC according to the DTMF tones it receives which causes the rotation of the motor attached to the camera in vertical and horizontal directions, clockwise as well as anticlockwise. Conventionally, wireless controlled robots use RF circuits, which have the drawbacks of limited working range, limited frequency range and limited control. Use of mobile phone for robotic control can overcome these limitations. It provides the advantage of robust control, working range as large as the coverage area of the service provide.

2. WORKING PRINCIPLE

In order to control the robot, one need to make a call to the cell phone attached to the robot (through head phone) 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 rover-connected mobile and then made it in hands-free mode. The DTMF technique outputs distinct representation of 16 common alphanumeric characters (0-9, A-D, *, #) on the telephone. The lowest frequency used is 697Hz and the highest frequency used is 1633Hz. The DTMF keypad is arranged such that each row will have its own unique tone frequency and also each column will have its own unique tone frequency. By pressing a key, for example 5 will generate a dual tone consisting of 770 Hz for the low group and 1336 Hz for the high group.

3. CIRCUIT DESCRIPTION

An MT8870 series DTMF decoder is used here. All types of the MT8870 series use digital counting techniques to detect and decode all the 16 DTMF tone pairs into a 4-bit code output. The built-in dial tone rejection circuit eliminates the need for pre-filtering. When the input signal given at pin 2 (IN-) in single-ended input configuration is recognized to be effective, the correct 4-bit decode signal of the DTMF tone is transferred to Q1 (pin 11) through Q4 (pin 14) outputs. Q1 through Q4 outputs of the DTMF decoder (IC1) are connected to port pins PD0 through PD3 of microcontroller (IC2). Outputs from port pins PB0 to PB3 and PB4 to PB7 of the microcontroller are fed to inputs IN1 to IN4 and enable pins (EN1 and EN2) of motor driver L293D(1) and L293D(2) to drive two geared DC motors of chasses and to drive the two DC geared motors for camera rotation respectively.

The L293D consists of four drivers. Pins IN1 through IN4 and OUT1 through OUT4 are input and output pins, respectively, of driver 1 through driver 4. Drivers 1 and 2, and drivers 3 and 4 are enabled by enable pin 1 (EN1) and pin 9 (EN2), respectively. When enable input EN1 (pin 1) is high, drivers 1 and 2 are enabled and the outputs corresponding to their inputs are active. Similarly, enable input EN2 (pin 9) enables drivers 3 and 4.

Frequencies	1209 Hz	1336 Hz	1477 Hz	1633 Hz
697 Hz	1	2	3	A
770 Hz	4	5	6	B
852 Hz	7	8	9	C
941 Hz	*	0	#	D

Table 1: Generation of DTMF Tone

4. APPLICATIONS

Scientific

Remote control vehicles have various scientific uses including hazardous environments, working in the Deep Ocean, and space exploration. The majority of the probes to the other planets in our solar have been remote control vehicles, although some of the more recent ones were partially autonomous. The sophistication of these devices has fueled greater debate on the need for manned spaceflight and exploration. The voyager I spacecraft is the first craft of any kind to leave the solar system. The Martian explorer's spirit and opportunity have provided continuous data about the surface of Mars since January 3, 2004.

Military and law enforcement

Military usage of remotely controlled military vehicles dates back to the first half of 20th century. Soviet red army used remotely controlled teletanks during 1930s in the winter war and early stage of World War II. There were also remotely controlled cutters and experimental remotely controlled planes in the red army.

Remote control vehicles are used in law enforcement and military engagement for some of the same reasons. The exposures to hazards are mitigated to the person who operates the vehicle from a location of relative safety. Remote controlled vehicles are used by many police department bomb-squads to defuse or detonate explosives.

Unmanned aerial vehicles have undergone a dramatic evolution in capability in the past decade. Early UAVs were capable of reconnaissance missions alone and then only with a limited range.

Search and rescue

UAV's will likely play an increased role in search and rescue in various areas. This was demonstrated by the successful use of UAV's during the 2008 hurricanes that struck Louisiana and Texas.

Recreation and hobby

Small-scale remote control vehicles have long been popular among hobbyists. These remote controlled vehicles span a wide range in terms of price and sophistication. There are many types of radio-controlled vehicles. These include on-road cars, off-road trucks, boats, airplane, and even helicopters. The "robots" now popular in television shows such as robot war, are a recent extension of this hobby. Remote control submarine also exist.

5. ADVANTAGES

- A wireless controlled robot overcomes the limitation of wired robotics completely by using latest mobile phone technology.
- The project used cell phone technology with the limitation of radio transmission range being no more constraint and with almost limitless area coverage being the main advantage.
- No line of sight is needed as it can be controlled remotely.
- Not sensitive to light.
- Not much sensitivity to environmental and weather conditions.

6. CONCLUSION

Conventionally, wireless-controlled robots use RF circuits, which have the drawbacks of limited working range, limited frequency range and limited control. In this paper with the use of a

mobile phone for robotic control, I have overcome these limitations. 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. The control of robot involves three distinct phases: reception, processing and action. Generally, the preceptors are sensors mounted on the robot, processing is done by the on-board microcontroller or processor, and the task (action) is performed using motors. So the motive is that to increase the range of remote controlled products. For this mobile phone operated control is best because we can globalize this paper and no limitation of range. Along with this the idea of attaching a camera to the robot and controlling its movement also through the mobile phone proved to be a good idea as we can keep a track of all the activities going around the robot and we can control the robot remotely which helps us to use this for spying, security purposes, in military and defense applications and also monitoring the activities of the areas where human access is physically not possible.

7. REFERENCES

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8. FIGURES

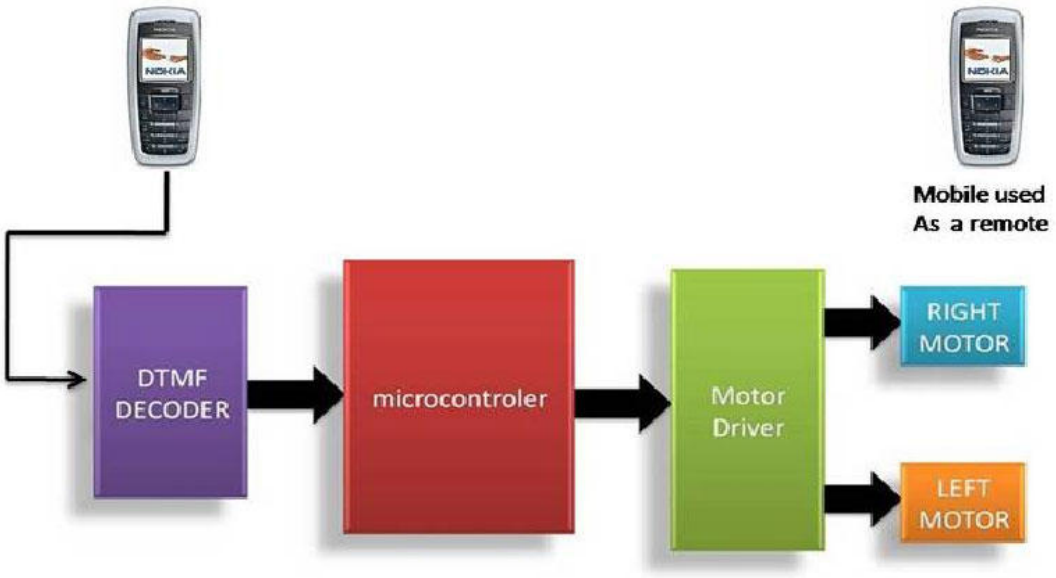

Figure 1: block diagram of surveillance robot

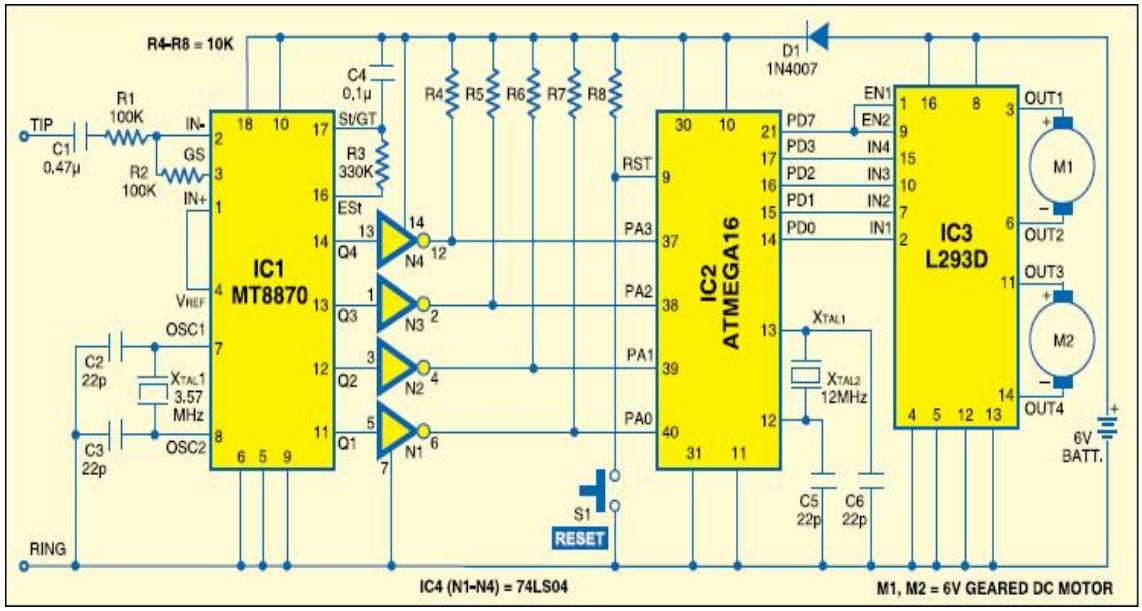

Figure 2: Circuit Diagram for Robot Surveillance