DTMF CONTROLLED UAV
WITHOUT MICROCONTROLLER

ABSTRACT

In the recent past, wireless controlled vehicles had been extensively used in a lot of areas like unmanned rescue missions, military usage for unmanned combat and many others. But the major disadvantage of these wireless unmanned robots is that they typically make use of RF circuits for maneuver and control. Essentially RF circuits suffer from a lot of drawbacks such as limited frequency range i.e. working range, and limited control. To overcome such problems associated with RF control, few papers have been written, describing methods which make use of the GSM network and the DTMF function of a cell phone to control the robotic vehicle. This paper although uses the same principle technology of the GSM network and the DTMF based mobile phone but it essentially shows the construction of a circuit using only 4 bits of wireless data communication to control the motion of the vehicle without the use of any microcontroller. This improvement results in considerable reduction of circuit complexity and of manpower for software development as the circuit built using this system does not require any form of programming. A Mobile Controlled Robot is a mobile device, which provides wide-range of wireless control ability to your robot unless your cell phone gets out of signal.A general concept of mobile controlled robot is that it can be controlled from any part of the world with just an inclusion of a camera.

OBJECTIVE

In principle, RF (Radio Frequency) control deals with the use of radio signals to remotely control any device. A remotely controlled vehicle may be defined as any mobile device which is controlled by means that it does not restrict its motion with an origin external to the device i.e. the possibility of an existence of a radio control device, a cable between the control and the vehicle or an infrared controller. A RCV is always controlled by a human and takes no positive action autonomously.

The IR system follows the line of sight approach which involves the process of actually pointing the remote at the device being controlled; this makes communication over obstacles and barrier quite impossible. To overcome such problems, a signaling scheme utilizing voice frequency tones is employed. This scheme is known as Dual Tone Multi-Frequency (DTMF), Touch-Tone or simply tone dialing. 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 signaling plays an important role in distributed communication systems such as multiuser mobile radio.

In this project, phones making use of the GSM network interfaced directly with the DTMF decoder and the motor driver is used to remotely control an unmanned robotic vehicle thus overcoming the distance barrier problem and communication over obstacles with very minimal or no interference but is solely network dependant. Here we present the design and implementation of an unmanned vehicle (i.e. a robotic vehicle) but without making use of any microcontroller i.e. with the help of only a mobile phone, MT8870 DTMF decoder and L293D motor driver. The transmitter is a handheld mobile phone.

Wireless controlled unmanned vehicles which are used nowadays typically use RF circuits for motion and control. But RF circuits suffer from the disadvantage of limited working range which results in limited control. As RF circuits' follows LOS (Line of sight) approach, it fails miserably in NLOS (Non-Line of Sight) conditions involving obstacles and barriers. To overcome these, one method was proposed using a microcontroller based circuit for maneuver and control of these unmanned robotic vehicles.

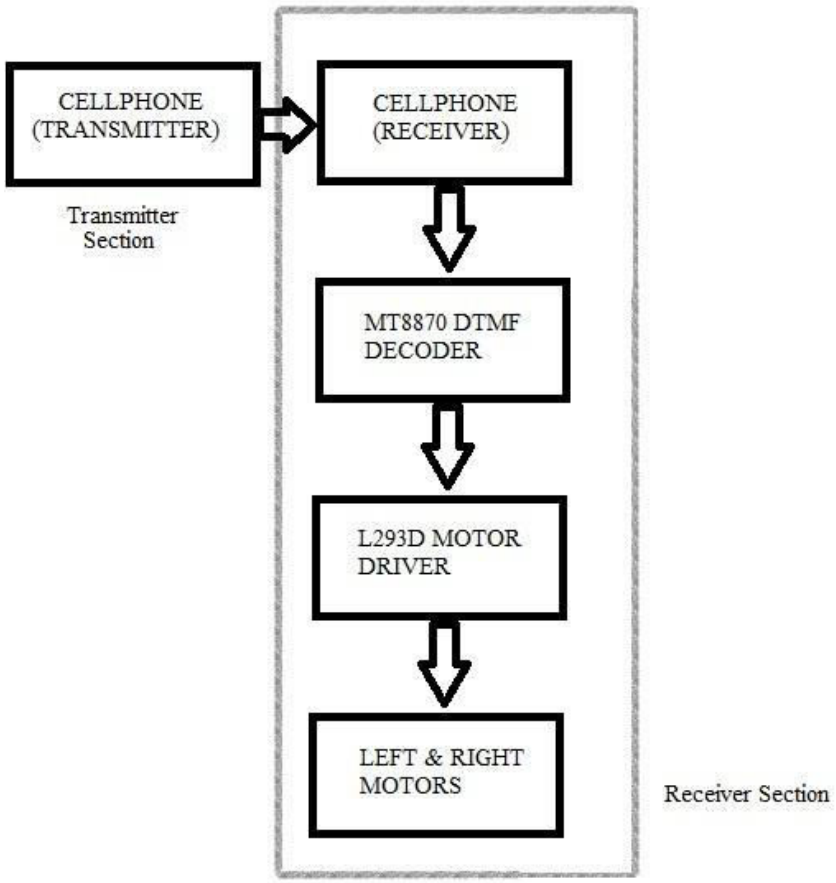
This design of an unmanned vehicle is designed using the same technology; however, the method proposed could also be implemented without using a microcontroller. In case of motion

control as described in these papers. A considerable amount of circuit complexity can be reduced when we omit the use of the microcontroller. Also the need for writing any software code is also absent.

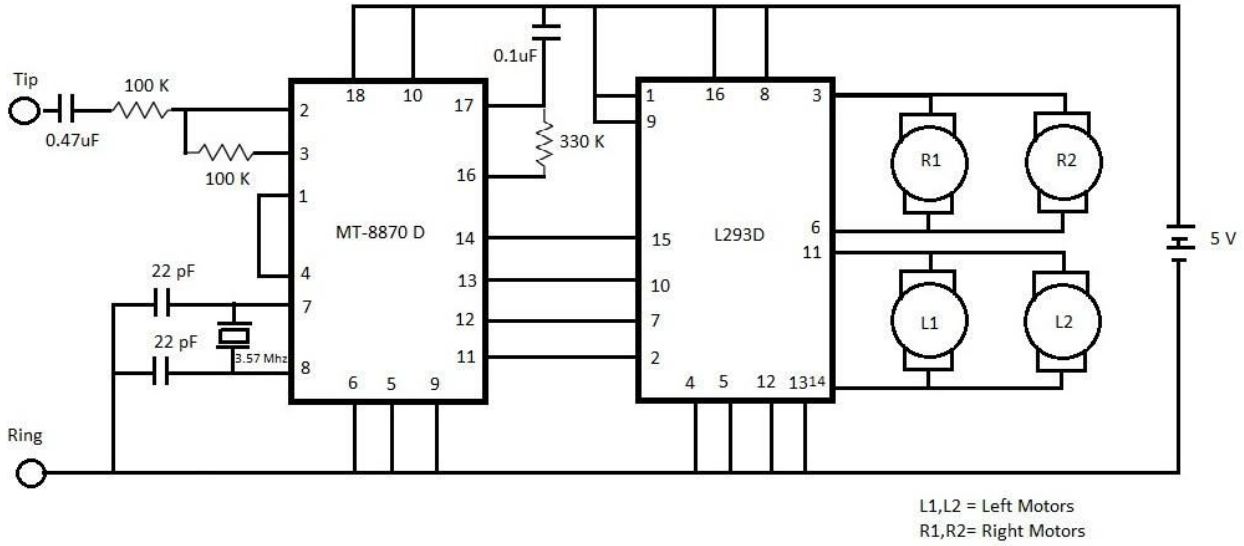
COMPONENTS

- Robot Chassis
- 12V DC Motor (60 RPM) – 2 nos.
- Breadboard – 1 no.
- IC L293D – 1 no.
- IC MT8870 – 1 no.
- 9V Battery – 1 no. (Requires according to the usage)
- Plastic Wheels – 2 or 4 nos. (Based on the chassis)
- Castor Wheel – 1 no. (Requires only when two wheels are used)
- 22 pf Capacitors – 2 nos.
- 0.47 µf Capacitors – 1 nos.
- 0.1 µf Capacitors-1 nos.
- 3.58 MHz Oscillator – 1 no.
- 1K Resistor – 1 no.
- 100 K Resistors – 2 nos.
- 330 K Resistor – 1 no.
- Breadboard Wires – 2 meters
- Battery Holder – 1 no.
- Battery Snap – 1 no.

BLOCK DIAGRAM



CIRCUIT DIAGRAM



WORKING PRINCIPLE

The robotic vehicle is basically operated with the help of any GSM enabled mobile phone which makes a call to the phone stacked on the robot. The phone at the receiver end perceives the DTMF tone from the mobile/cordless phone at the transmitter end and feeds the signal as input to the DTMF decoder. The DTMF decoder processes the tone and feeds the output as input to the motor driver. Accordingly the robotic vehicle operates. The mobile that makes a call to the mobile phone stacked in the vehicle acts as a remote. So this simple robotic vehicle does not require the construction of receiver and transmitter units, reducing the overall circuit complexity.

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

If the button pressed from mobile is ‘1’, it gives a decoded output of ‘0001’. Thus motor connected to the first two pins will get 0 volts and second motor will have 5 volts to one pin and 0 volts to the another pin. Thus second motor starts rotating and first motor is off. So, robot moves in one direction either to left or right. If the robot is to rotate forward or backward then the binary value should be either ‘0101’ or ‘1010’.These values indicate that two motors rotates in the same direction i.e. either forward or backward. The following table gives the low frequency, high frequency and binary output value of each button pressed in the keypad.

PROS AND CONS

- ❖ DTMF based robotic vehicle is less complex because no microcontroller is used
- ❖ No need of programming
- ✓ DTMF robot may not work properly if it is operated with another mobile when there is no signal.
- ✓ Mobiles with particular jacks are only used.

APPLICATIONS DTMF CONTROLLED ROBOTIC VEHICLE

- ➢ DTMF robot with slight modifications can be used in industrial applications.
- ➢ DTMF robot with human detector sensor can be used at the time of disasters like earth quake to detect the human beings under buildings.
- ➢ DTMF robot with camera can be used in surveillance systems.

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