

# Dual Tone Multi Frequency Based Control Robot- A Review Paper

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**Abstract-** The present scenario has witnessed a host of advancements in the field of Robotics and Communications on a large scale. Through this paper, we will show the use of both technologies. We have made use of DTMF (Dual Tone Multi Frequency) in this paper. Control of our robot is through the means of a cell phone, through which we can make the robot communicate over a larger distance, even from different cities. A mobile phone is positioned on the robot which helps to control it by receiving a call from another phone whatsoever the distance between the two may be. Whenever a call is being processed a tone is received and this tone is known as ‘Dual Tone Multiple Frequency’ (DTMF) tone. The robot gets aware of this DTMF tone with the help of the phone placed on it and this tone is decoded with the help of a DTMF decoder MT8870, connected to the ATMEGA 89S52. The function of a decoder is to decode the tone into its equivalent binary digit. The microcontroller is pre-programmed through a set of instructions so as to make a decision for a given input and the decision is showed by the motor drivers, which consequently, drive the motors for forward or backward motions or turns. So, in this robotic project of ours, construction of receiver and transmitter units are not required.

**Keywords-** Dual Tone Multi Frequency (DTMF), Integrated Circuit (IC), Robot Chassis, Arm, Camera, GSM (Global System for Mobile Communication).

## I. INTRODUCTION

A ROBOT is a system that can be operated automatically and reduces or replaces human effort. With the increase in demand of intelligent systems in every fields, automated systems are being much preferred for improvements in society. Wireless Communication has become the upcoming field of application, where such systems can be obtained in a flexible, reliable as well as an accurate manner.

Conventionally, wireless controlled robots used RF circuits, which had the drawbacks of- (i) limited working range, (ii) limited frequency range and (iii) limited control. Use of GSM technology for robotic control overcomes such limitations. It provides

the following advantages- (i) robust control, (ii) working range as large as the coverage area of the service provider, (iii) no interference with other controllers and (iv) up to twelve controls. Thus this system becomes a powerful and flexible tool that offers such services at anytime, anywhere with the constraints of the technology being applied.

## II. AN OVERVIEW OF THE TECHNOLOGY THAT IS BEING USED

DTMF expands as Dual Tone Multiple Frequency. DTMF is a term frequently used in the telephone industry. DTMF generation requires a composite audio signal which is a combination of two tones between the frequencies of 697Hz and 1633Hz. The DTMF keypad is arranged in such a way that each row and column has its own unique frequency as depicted below.

When any key on the mobile keypad like "1", "2", "\*", "#" etc is pressed, a corresponding tone to that code is transmitted which consists of a combination of two frequencies among which one is the higher frequency and the second one is the lower frequency.

		HIGH GROUP TONES			
		H1 = 1209 Hz	H2 = 1336 Hz	H3 = 1477 Hz	H4 = 1633 Hz
L1 = 697 Hz		1	2	3	A
L2 = 770 Hz		4	5	6	B
L3 = 852 Hz		7	8	9	C
L4 = 941 Hz		*	0	#	D

Fig. 1 Dual Tone Multi Frequency

A code received by a mobile phone can be made audible through the use of a speaker. Speaker's output is connected to IC MT8870 which is DTMF decoder IC used in decoding DTMF code. A four-bit digital output is given i.e. q1, q2, q3, and q4 according to the key received. The following figure shows the equivalent digital output for each key-

Key	Q4	Q3	Q2	Q1
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
0	1	0	1	0
*	1	0	1	1
#	1	1	0	0
A	1	1	0	1
B	1	1	1	0
C	1	1	1	1
D	0	0	0	0

Fig .2 Equivalent digital output for each key

### III. A BASIC CONCEPTUAL STRUCTURE OF THE SYSTEM

#### Basic block diagram

The actions performed by microcontroller are similar to the functions performed by the heart of the body, therefore the microcontroller is known as the heart of the robot, which is configured by programming in Assembly language for 89S52 Microcontroller.

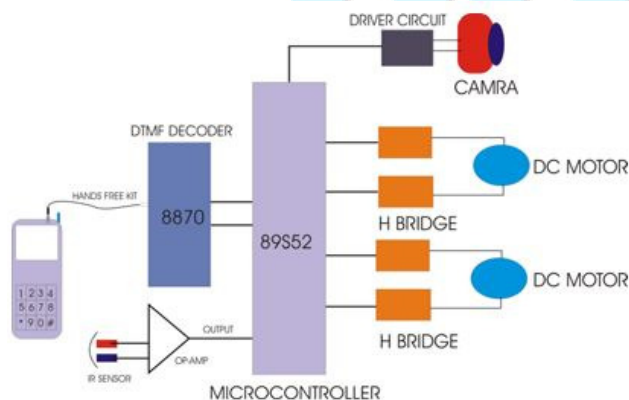


Fig .3 Block diagram of basic mobile control robot (for only robotic vehicle movement and with direction viewing facility)

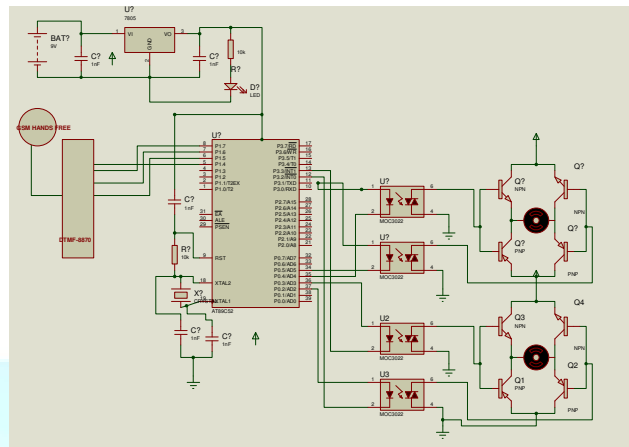


Fig .4 Basic circuit diagram (for only robotic vehicle movement and with direction viewing facility)

#### Vehicle Movement

The most important platform of the Robotic Vehicle is said to be the Robot Chassis which, using DTMF circuitry, is connected to a mobile. A mobile phone is circuited to the vehicle through a 3.5mm audio jack which receives calls from the calling mobile. DTMF decoder will get activated and the H-bridge Module will begin its functioning. According to the DTMF frequencies which are generated by the cell phone, the robotic movement is thus being controlled by the caller

#### Robotic Arm for picking and placing

The design of a robotic arm depends upon the imagination of its maker and can have a wide range of motion. The joint that connects the various parts of the arm can rotate as well as move like a hinge. The end of the robotic arm actually does the work that it is designed for, so is known as the end effectors. Many tasks can be performed like painting, tightening screws and more. Tasks are divided into two categories, one being that these robots are fixed in one place as along an assembly line, or they can be mobile to do a variety of tasks in different places at some distances. Autonomous robotic arms are programmed and then left alone to repeat their tasks that may or may not be independent of human control.

Here, we have connected a robotic arm to the microcontroller with the help of DC geared motors and mount it onto the robot chassis for giving an added facility of picking and placing which can be done according to the instructions provided by the user through dialing and then decoding of DTMF tones. The gripper in the arm can be used for picking light weight objects and then placing them at some distance. This is only one application of the robot. This robot can be made to work for various other applications as discussed in the next section by adding sensors etc.

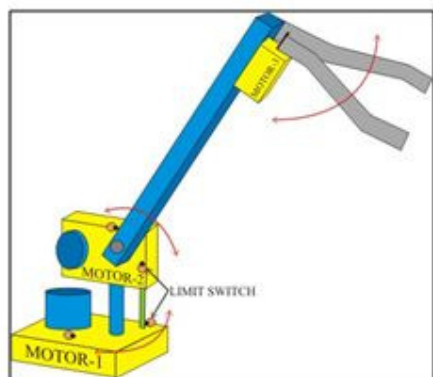


Fig .5 Robotic Arm

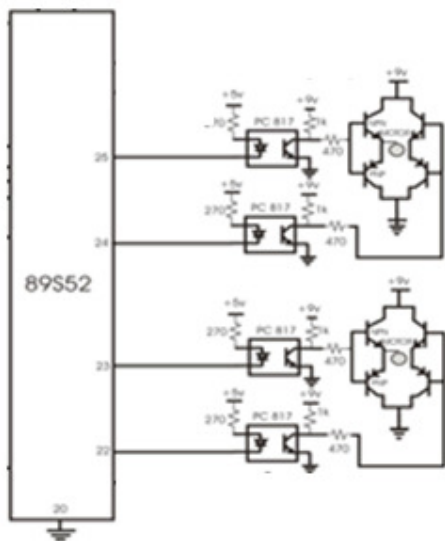


Fig. 6 Robotic Arm Circuit

IV. APPLICATIONS AND FURTHER SCOPE

- A. *Military use:* Used in military for remotely control of military vehicle.
- B. *Search and Rescue:* Unmanned Aerial Vehicles (UAVs) play an important role in search and rescue operations.
- C. *Alarm Phone Dialer:* By replacing DTMF Decoder IC CM8870 by a 'DTMF Transceiver IC CM8880, DTMF tones are generated from the robot. We can use it as sensing device generating alarms.
- D. *Space exploration:* Robotic arms can be used to manipulate a heavy payload or do other work in space.
- E. *Automobile manufacturing and aircraft industry:* Making use of robotic devices along with the use of computerized instruments to sort as well as test finished products

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VII. REFERENCES

- [1] Lian, S.H., "Fuzzy Logic Control of an Obstacle Avoidance Robot", IEEE International Conference of Fuzzy Systems, New Orleans, LA, September 8-11, 1996, vol.1, pp.26-30.
- [2] Yen-Sheng chen, "Intelligent Obstacle Avoidance Control Strategy for Wheeled Mobile Robot", ICROS-SICE International Joint Conference 2009 August 18-21, 2009, Fukuoka International Congress Center, Japan.
- [3] Sehgal, V.K.; Singhal, M.; Mangla, B.; Singh, S.; Kulshrestha, S., "An Embedded Interface for GSM Based Car Security System," Computational Intelligence, Communication Systems and Networks (CICSyN), 2012 Fourth International Conference on , vol., no., pp.9,13, 24-26 July 2012 doi: 10.1109/CICSyN.2012.12
- [4] Dong-ying Ju, "Development of Remote Control and Monitor System for Autonomous Mobile Robot Based on Virtual Cell Phone", IEEE 5-7 September 2007 Innovating Computing, Information and Control, 2007, ICICIC'07, Second International Conference.
- [5] Manish Kumar., "Design of Cell Phone Operated Robot Using DTMF for Object Research", IEEE Wireless and Optical Communications Networks (WOCN), 2013 Tenth International Conference on 26-28 July 2013.
- [6] Patil, B.C.; Henry, R., "Dual functional reconfigurable mobile robot," TENCON 2008 - 2008 IEEE Region 10 Conference , vol., no., pp.1.5, 19-21 Nov.2008, doi:10.1109/TENCON.2008.4766699