# ROBAASTRA the Self Destructive Robot Control by Using DTMF Technology

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*Abstract—In this paper, we described the controlling of a Robot using DTMF technique and are helpful to the Army for making a blast at the target. The robot is controlled by a cell phone that makes call to the other Cell phone connected to the robot. If any button of operator's cell phone is pressed then tone corresponding to that button is received at the other end of the call. This tone is called dual tone multi frequency (DTMF). Using DTMF code, direction of motion of the robot can be controlled. So ROBOT will works in such a way that, by pressing the pre-defined (programmed) key of operator's cell phone it will work accordingly.*

*Index Terms— Decoder, DTMF, Robot, DC Motor, Microcontroller (PIC16F877A), Mobile Phone.*

## I. INTRODUCTION

The self destructive robot controlled can be constructed using the components: IC MT8870D (DTMF decoder), IC 7404 (inverter), (PIC 16F877A) microcontroller and L293D/ULN2003 (motor drivers).   Mobile phone, and controlled by a supplementary mobile phone, which initiates the call. Once the call is associated, any button pressed corresponds to a unique tone at the other end. The tone is termed as 'Dual Tone Multiple Frequency' (DTMF), which is perceived by the robot with the help of a cellular phone stacked in it. The received tone is fed into the DTMF decoder (MT8870D), which decodes the DTMF tone into its equivalent binary. Binary output from the decoder is consequently administered by the microcontroller (PIC16F877A) is pre-programmed to take necessary decisions corresponding to the given set of binary inputs. Output from PIC16F877A is provided to the drivers L293D and ULN2003.The former of which acts as a regulator to drive the DC motor Cellular phone generating the call acts as a remote control obviating the need for construction of superfluous receiver and transmitter units and thus can be used for tele control of electronic appliances. [1].

## II. CIRCUIT DIAGRAM

The block diagram of the microcontroller-based mobile phone operated robot consists of important components a DTMF decoder, microcontroller and motor driver as shown in fig 1. An MT8870 series DTMF decoder is used here. The MT8870D Decoder 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. The microcontroller output is not sufficient to drive the DC motors, so current drivers are required for motor rotation.
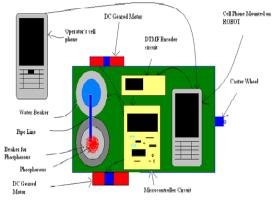


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**Fig.1 The Block Daigram  Of Self Destructive Robot**

The L293D is a quad, high-current, half-H driver designed to provide bidirectional drive currents of up to 600 mA at voltages from 4.5V to 36V. It makes it easier to drive the DC motors. 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 their inputs are active. Similarly, enable input EN2 (pin 9) enables drivers 3 and 4. [2] As shown in fig.2.



**Fig.2 Pin Diagram of DTMF Decoder**

### A.  A  *DTMF Signal*

DTMF refers to the system of representation, coding and decoding of audio signals generated by the superposition of two pure sinusoidal tones. This system is very commonly used for telephone signaling over the line in voice frequency band to the call switching centre. Mark and Space are the significant parameters, affiliated with DTMF tones. A time span, for which DTMF digit tone is actually producing

sound, is called "Mark" time and the silence duration between each one of the digits is termed as "Space". [1]

## B. The DTMF Generation and Decoding

DTMF is Short for *Dual Tone Multi frequency* and the System used by touch-tone telephones. DTMF assigns a Specific frequency (consisting of two separate tones) to each key so that it can easily be identified by a microprocessor as shown in fig.3



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

**Fig.3: Typical DTMF keypad**

DTMF generation is a composite audio signal of two tones between the frequency of 697Hz and 1633Hz [3], [4]. 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. The figure-3 is a representation of the typical DTMF keypad and the associated row/column frequencies. [5]

## C. DTMF Decoder/Receiver

Prior to DTMF, phone systems used a system known as pulse (*Dial Pulse* or DP in the USA) or loop disconnect (LD) signaling to dial numbers, which works by rapidly disconnecting and connecting the calling party's phone line, like flicking a light switch on and off. The repeated connection and disconnection, as the dial spins, sounds like a series of clicks. The exchange equipment counts those clicks or dial pulses to determine the called number. LD range was restricted by telegraphic distortion and other technical problems, and placing calls over longer distances required either operator assistance (operators used an earlier kind of multi-frequency dial) or the provision of subscriber trunk dialing equipment. DTMF was developed at Bell Labs in order to allow dialing signals to dial long-distance numbers, potentially over non wire links such as microwave radio relay links or satellites. For a few non crossbar offices, encoder/decoders were added that would convert the older pulse signals into DTMF tones and play them down the line to the remote end office. At the remote site another encoder/decoder could decode the tones and perform pulse dialing, for example for Strowger switches. It was as if you were connected directly to that end office, yet the signaling would work over any sort of link. This idea of using the existing network for signaling as well as the message is known as in-band signaling. It was clear even in the late 1950s when DTMF was being developed that the future of switching lay in electronic switches, as opposed to the electromechanical crossbar systems then in use. Either switching system could use either dial system, but DTMF promised shorter holding times, which was more important in the larger and more complex registers used in crossbar systems. In this case pulse dialing made no sense at any point in the circuit, and plans were made to roll DTMF out to end users as soon as possible. Tests of the system occurred in the early 1960s, where DTMF became known as Touch Tone. Though Touch Tone phones were already in use in a few places, they were vigorously promoted at the 1964 New York World's Fair. The Touch Tone system also introduced a standardized keypad layout. After testing 18 different layouts, they eventually chose the one familiar to us today, with 1 in the upper-left and 0 at the bottom. The adding-machine layout, with 1 in the lower-left was also tried, but at that time few people used adding machines, and having the 1 at the "start" (in European language reading order) led to fewer typing errors. In retrospect, many people consider that this was a mistake. With the widespread introduction of computers and bank machines, the phone keyboard has become "oddball", causing mistakes. The engineers had also envisioned phones being used to access computers, and surveyed a number of companies to see what they would need for this role. This led to the addition of the number sign (#) and star (*) keys, as well as a group of keys for menu selection, A, B, C and D. In the end the lettered keys were dropped from most phones, and it was many years before the # and * keys became widely used, such as for vertical service codes such as *67 in the United States and Canada to suppress caller ID. Public payphones that accept credit cards use these additional codes to send the information from the magnetic strip. The U.S. military also used the letters, relabeled, in their now defunct Autovon phone system. Here they were used before dialing the phone in order to give some calls priority, cutting in over existing calls if need be. The idea was to allow important traffic to get through every time. The levels of priority available were Flash Override

(A), Flash

(B), Immediate

(C), And Priority

(D), with Flash Override being the highest priority.

Pressing one of these keys gave your call priority, overriding other conversations on the network. Pressing C, Immediate, before dialing would make the switch first look for any free lines, and if all lines were in use, it would hang up any non-priority calls, and then any priority calls. Present-day uses of the A, B, C and D keys on telephone networks are few, and exclusive to network control. For example, the A key is used on some networks to cycle
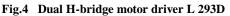
through different carriers at will (thereby listening in on calls). Their use is probably prohibited by most carriers. The A, B, C and D tones are used in amateur radio phone patch and repeater operations to allow, among other uses, control of the repeater while connected to an active phone line. Every modern handheld radio can generate these tones. DTMF tones were also used by some cable television networks to signal the local cable company to insert a local advertisement. These tones were often heard during a station ID preceding a local ad inserts. Terrestrial television stations also used DTMF tones to shut off and turn on remote transmitters. DTMF tones are also sometimes used in caller ID systems to transfer the caller ID information, however in the USA only Bell 202 modulated FSK signaling is used to transfer the data [6].

### D. Dual H-bridge motor driver (L293)

L293D is a dual H-bridge 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. L293D contains two inbuilt H-bridge driver circuits. 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



**Fig.4 Dual H-bridge motor driver L 293D**

Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state. [8].The pin description of L293D are shown in table.1

**Table 1 Pin Description of L293D**

| Pin No | Function | Name |
|---|---|---|
| 1 | Enable pin for Motor 1; active high | Enable 1,2 |
| 2 | Input 1 for Motor 1 | Input 1 |
| 3 | Output 1 for Motor 1 | Output 1 |
| 4 | Ground (0V) | Ground |
| 5 | Ground (0V) | Ground |
| 6 | Output 2 for Motor 1 | Output 2 |
| 7 | Input 2 for Motor 1 | Input 2 |
| 8 | Supply voltage for Motors; 9-12V (up to 36V) | Vcc 2 |
| 9 | Enable pin for Motor 2; active high | Enable 3,4 |
| 10 | Input 1 for Motor 1 | Input 3 |
| 11 | Output 1 for Motor 1 | Output 3 |
| 12 | Ground (0V) | Ground |
| 13 | Ground (0V) | Ground |
| 14 | Output 2 for Motor 1 | Output 4 |
| 15 | Input2 for Motor 1 | Input 4 |
| 16 | Supply voltage; 5V (up to 36V) | Vcc 1 |

## III. WORKING

Firstly make a call from the remote/user phone to the phone attached to the robot and connect the receiving mobile phone with headset in auto answer mode. As the call is received, the connection is established between these two mobile. Now if you press a button then the DTMF tone generates a signal by adding the frequency corresponding to that button and sends to the receiver. Receiver detects it and sends it to MT8870D decoder IC which decodes the DTMF tone and fed the decoded signal to the microcontroller ((PIC16F877A) According to the program in the microcontroller the robot starts moving. The ROBOT is totally dependent on the instruction given by the operator using cell phone. It will follow all the programmed keys if pressed by the operator. e.g.:- Suppose operator will press 2 then it will move forwards, by pressing 4 it'll move in left direction, by pressing 6 it'll move in right direction, by pressing 8 it'll move backward, by pressing 5 it'll stop and by pressing any other key the ROBOT will work according to program burned in microcontroller by programmer. Hence as all the motion of ROBOT is controlled by the pressing of pre-define keys in program. We also used to put the two beakers on the ROBOT which will be connected with each other by a pipe. One of the beakers will be filled with water and a water pump will be placed in it another beaker will having some amount of Use either SI (MKS) or CGS as primary units. (SI units are strongly encouraged.) English units may be used as secondary units (in parentheses). Phosphorous/sodium in it, and there will be bomb's lead above the phosphorus's/sodium's beaker. As the motion of the ROBOT is controlled by the cell phone's pre-defined keys, someway a water pump will also work on the DTMF technology by pressing the corresponding key for the water pump to make the switch ON and Switch OFF of the pump. As the ROBOT is controlled with the cell phone, so the

operator can easily reach the target as per the path reaching at the target and after judging the suitable situations/circumstances for blast operator can destroy the enemy's area. Now question comes how the blast can be done? So the answer is that, when the operator wants to destroy the target then he/she would have to press that particular key of the mobile which is pre-defined for the Switching ON of the water pump. When the water pump will turn ON, then through the pipe line water will reach to the beaker having the phosphorous/sodium in it. When water will come in contact with the phosphorous/sodium then it will burns and in turn the lead of bomb will also burns and a blast can be achieve at the target. The fire section here is made with the help of test tube and funnel and test tube is mounted on the stepper motor, which gives the 67.25 degree rotation to test tube clockwise and anti-clockwise in single step. As the fire section is changed as per pre-decided design, the chemicals which have used here are glycerin and KMnO4. These makes a flame when comes in contact with each other. The need to change the fire section is use to some problems in making the inverter. As the pump required 220V AC and required voltage generation from 12V DC source is

## IV. CONCLUSION

Hence all the motion of the ROBOT is controlled by the cell phone's pre-defined (programmed) keys which works on the DTMF technology, the operator can easily reach at the target as per the path reaching at the target and after judging the suitable situations/circumstances for blast, then operator can destroy the rival force's area, same way a stepper motor will also work on the DTMF technology by pressing the corresponding key for the stepper motor to make the switch ON and Switch OFF of the stepper motor. When the stepper motor will rotate, then glycerin will comes out from the test tube and reacts with the KMnO4 placed beneath the test tube. When both of these chemicals come in contact with each other then a flame is found to be produced, hence the bomb can be ignite using the flame as shown in fig.5.



**Fig.5 ROBAASTRA the Self Destructive Robot**

## V. FUTURE SCOPE

The future application of this robot is that, it can be used as the "Video Recording cum Robotic Bomb". By placing a camera on it, the ROBOT can be used to record the video of the target and can helpful for the operator to make a very important documentation for the Top Level Management of Army regarding the Amount of Weapons and the Man Power which the opposite force has.

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