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DTMF CONTROLLED ROBOT USING ARDUINO

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ABSTRACT

In this paper, we can control the Robot using Dual Tone Multi Frequency (DTMF) technology. DTMF technology is most useful technique at present days. It is worked on to methods digital signal processing (DSP). Wireless-control of robots uses RF circuit that has the drawbacks of limited working range and limited control. This DTMF is gives advantage over the RF; it increases the range of working and also gives good results in case of motion and direction of robot using mobile phone through micro controller. This type of wireless communication gives the remote handling operation of Robot using DTMF.

Keywords: Atmega328p microcontroller, DTMF, Mobile module, Motor drive IC, motor.

I. INTRODUCTION

A robot is electro-mechanical machine which is guided by computer, Mobile phone or programming, and is thus able to do tasks on its own. The Robot Institute of America define "A robot is a reprogrammable multifunctional manipulator -designed to move material parts, tools or specialized device through variable programmed motions for the performance of a variety of tasks." Conventionally, wireless controlled robots use RF circuits, which have drawbacks of limited working range & frequency range, use of mobile phones can overcome this limitation. 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. DTMF Mobile ROBOT is a machine that can be controlled with a mobile. In this project, 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 of the call. This tone is called "Dual Tone Multiple-Frequency" (DTMF) tone. The robot perceives this DTMF tone with the help of the phone stacked on the robot. The received tone is processed by the Arduino microcontroller with the help of DTMF decoder MT8870 IC the decoder decodes the DTMF tone is to its equivalent binary digit and this binary number is send to the microcontroller, the microcontroller is pre-programmed to take decision for any give input and output its decision to motor drivers in order to drive the motors for forward or backward motion or a turn.

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II.BLOCK DIAGRAM OF DTMF CONTROLLED ROBOT

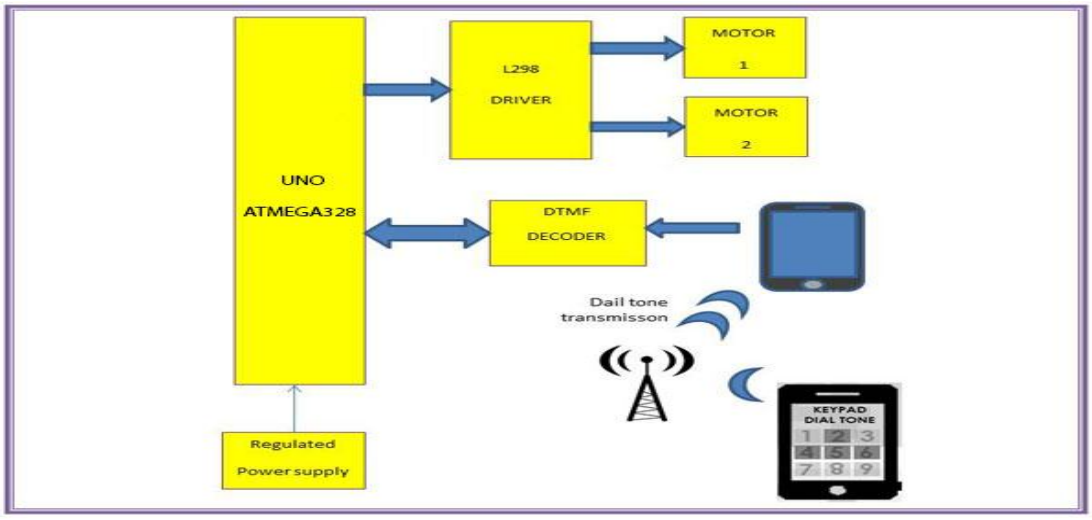

Figure 1: block diagram of DTMF controlled robot using Arduino

II HARDWARE DESCRIPTION

3.1 DTMF DECODER

DTMF means Dual-Tone-Multi-Frequency. DTMF signaling is used for telecommunication signaling over analog telephone lines in the voice-frequency band between telephone handsets and other communication devices and the switching centre. The DTMF system generally uses eight different frequency signals transmitted in pairs to represent sixteen different numbers, symbols and letters. When someone presses any key in the key pad of the handset, a DTMF signal is generate unique tone which consists of two different frequencies one each of higher frequency range (>1KHz) and lower frequency (<1KHz) range. The resultant tone is convolution of two frequencies.The frequencies and their corresponding frequency are shown in Table 3.1. Each of these tones is composed of two pure sine waves of the low and high frequencies superimposed on each other. These two frequencies explicitly represent one of the digits on the telephone keypad.

Thus generated signal can be expressed mathematically as follows:

$$f(t) = A_H \sin(2\pi f_H t) + A_L \sin(2\pi f_L t) \quad (1)$$

Where:

A_H, A_L: are the amplitudes

f_H : high frequency range

f_L : low frequency range

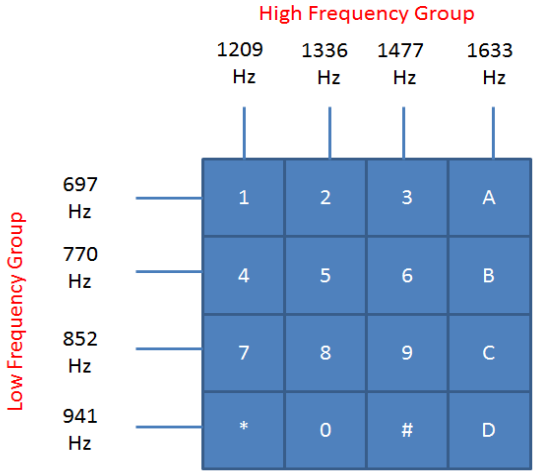

Table 1: DTMF Keypad Frequency

Each key has a specific Tone frequency. For example if the "5" key is pressed then generated frequency tone is 770 + 1336 = 2106 Hz. The key "1" is pressed then frequency of 697 + 1209 = 1906 Hz which is shown in below figure.

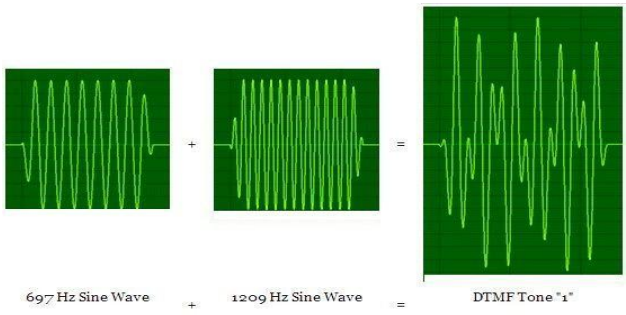

Figure 2: Two Pure Sine Waves combine for form the DTMF Tone for "1"

3.2 CM8870 DTMF DDECODER IC

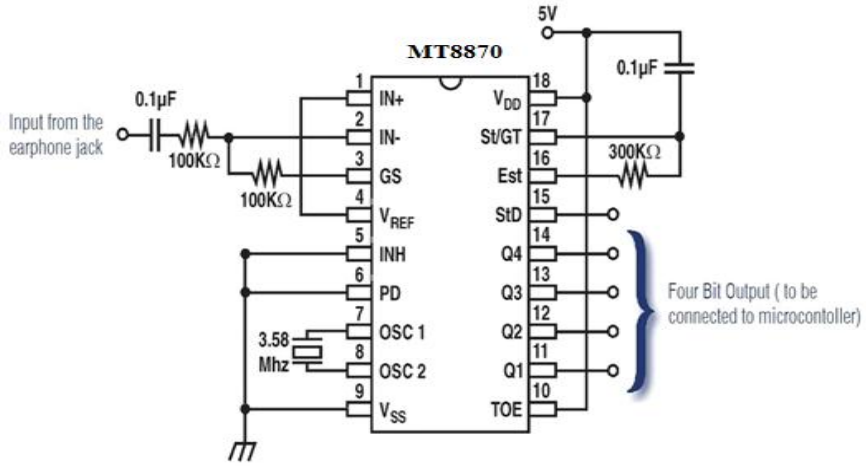

Figure 3: MT-8870 DTMF Decoder Configuration

The MT-8870 is a DTMF Receiver that integrates both band split filter and decoder functions into a single 18pin DIP package. It is manufactured using CMOS process technology. The MT8870 offers low power consumption (35 mW max) and precise data handling. Its decoder uses digital counting techniques to detect and

decode all 16 DTMF tone pairs into a 4-bit code. The DTMF signal from the user mobile phone is picked up by the system mobile phone. The tip and ring of the microphone is connected to the specified pin of CM8870 as shown in the Fig. 4. C1, R1 and R2 have been adjusted for gain control of the input signal. Resistance R3 and capacitor C2 has been used to set the "guard time " which is a time duration through which a valid DTMF tone must be present for its recognition. The "Q-test " signal (pin15) indicates that the valid DTMF tone has been detected. Increase the resistor between pin2 and pin3 (not the one connects to 100nF) from 100K to 220k, 330K or 470K. This increases the input gain from 1 to 2.2, 3.3 or 4.7 to suit your input signal strength.

3.3 ATMEGA328P MICROCONTROLLER

ATmega328P is a 32K 8-bit microcontroller based on AVR architecture. ATmega328P is commonly used in many projects and autonomous systems where a simple, low powered, low-cost micro-controller is needed. It has 14 digital input/output pins (out of which 6 can be exploited as PWM outputs), 6 analog input, 16 MHz crystal oscillator.

The high-performance Atmel AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts

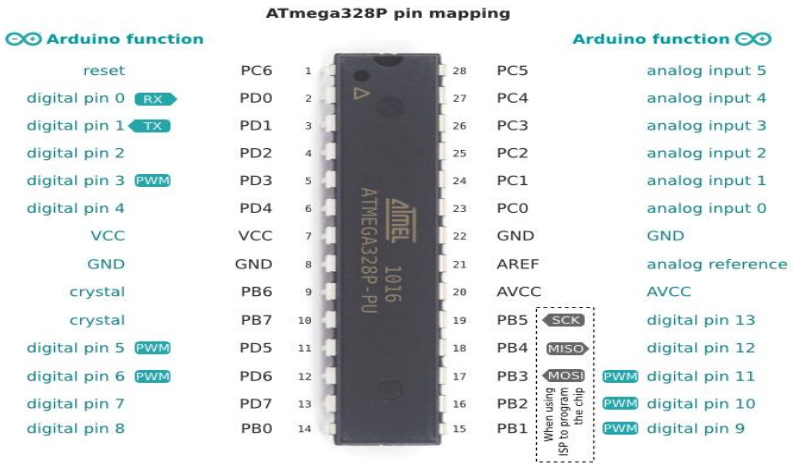

Figure 4: Pin Diagram of Atmega328P

3.4 DC MOTOR DRIVE

DC motor is electromechanical device that converts electrical energy into mechanical energy that can be used to do many works. It can produce mechanical movement to moving the wheels of the robot. DC motor has two wires, we can say them positive terminal and negative terminal, when these wires are connected with power supply the shaft rotates. We can reverse the direction of the rotation. L293d chip is very safe to use for DC motor control. This L293D is 16bit chip. Chip is design to control four DC motor, there are two inputs and two outputs for each motor.

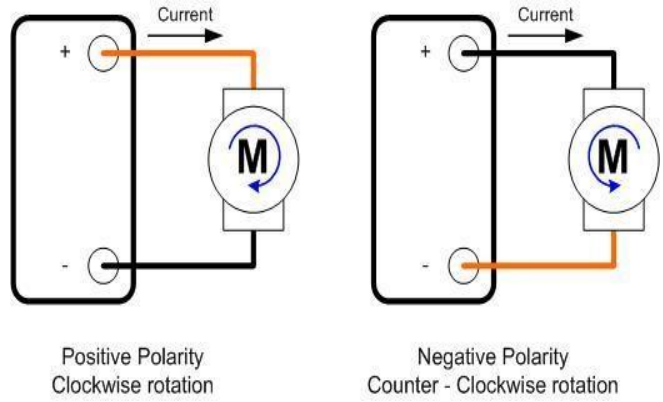

Figure 5: working of motor

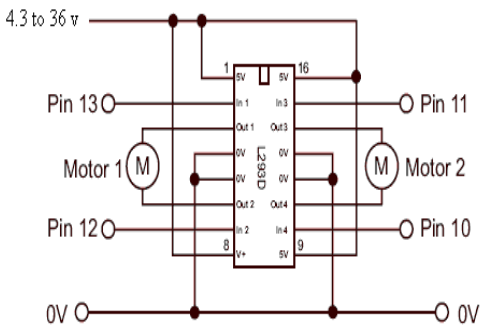

Figure 6: L293D IC

3.4.1 WORKING OF L293D

The 4 input pins for this L293D, pin 2,7 on the left and pin 15 ,10 on the right as shown on the pin diagram. Left input pins will regulate the rotation of motor connected across left side and right input for motor on the right hand side. The motors are rotated on the basis of the inputs provided across the input pins as LOGIC 0 or LOGIC 1.

3.4.2 L293D LOGIC TABLE

Pin 1 Enable	Pin 2	Pin 7	Function
HIGH	HIGH	LOW	Anticlockwise
HIGH	LOW	HIGH	Clockwise
HIGH	HIGH	HIGH	No Rotation
HIGH	LOW	LOW	No Rotation
LOW	X	X	No Rotation

Table 2: L293D Logic Table

3.5 OPERATION OF THE CIRCUIT

The DTMF signal from the user (Sender) mobile phone is picked up by the system (Receiver) mobile phone. Then the connection is established between the two phones, whatever phone key is pressed at the Sender mobile phone, the corresponding DTMF tone is heard in the ear piece of the receiver phone. Received DTMF tone is fed to the DTMF decoder. The DTMF decoder will give the corresponding BCD value of the tone. This Output is connected to Q4, Q3, Q2, Q1 pin of MT8870 Decoder IC and this output is fed to ATmega328P Microcontroller pin 4,5,6,7 respectively. Based on the equivalent binary digit of the DTMF tone received by the Atmega328P Microcontroller, a decision is made for Pins 8,9,10 and 11 regarding which pins should be high or low. These pins are fed to the L293D IC as input. Based on the Controller decision, the Pins are either high or low which activates the motors and moves the vehicle.

3.6 DTMF TONE DECODING ALGORITHM

Low Frequency Group	High Frequency Group	Digit	OE	D3	D2	D1	D0
697	1209	1	H	0	0	0	1
697	1336	2	H	0	0	1	0
697	1477	3	H	0	0	1	1
770	1209	4	H	0	1	0	0
770	1336	5	H	0	1	0	1
770	1477	6	H	0	1	1	0
852	1209	7	H	0	1	1	1
852	1336	8	H	1	0	0	0
852	1477	9	H	1	0	0	1
941	1209	*	H	1	0	1	0
941	1336	0	H	1	0	1	1
941	1477	#	H	1	1	0	0

Table 3: DTMF tone decoding algorithm

IV. OPERATIONAL FLOWCHART OF THE SYSTEM

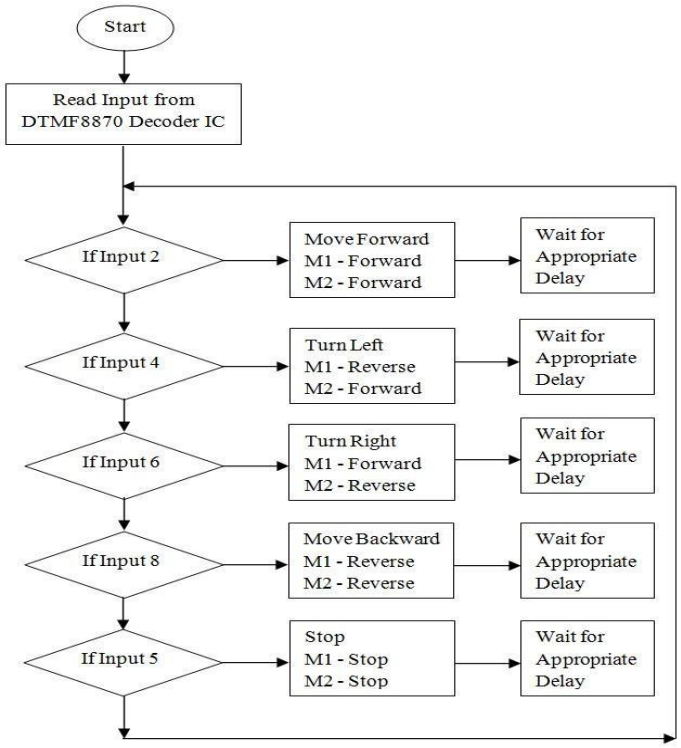

Figure 7: Operational flowchart of the system

V. CIRCUIT SIMULATION

The Simulation of the circuit is shown in figure 6. Atmega328P Microcontroller has been used in simulation. Four DC Motor are connected to Port B (Pin 2,3,4,5) of Microcontroller through H-Bridge driver Circuit.

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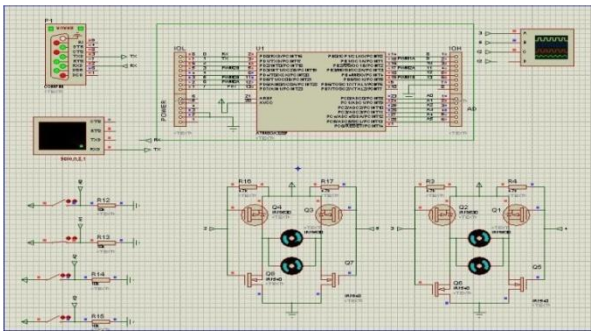

Figure 8: Circuit Simulation in Proteus Simulator

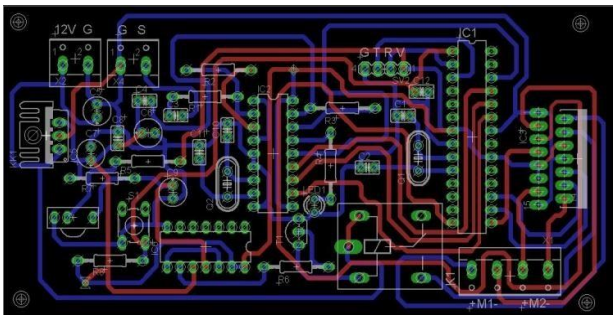

Figure 9: Printed Circuit Board for DTMF Controlled robot

Figure 10: Simulation Result when Press Key is '6'

Figure 11: Simulation Result when Press Key is '8'

Figure 12: Simulation Result when Press Key is '4'

Figure 13: Simulation Result when Press Key is '2'

VI. RESULT

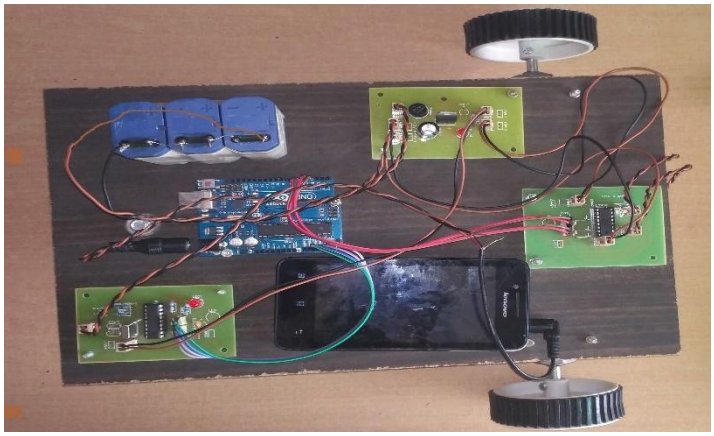

Figure 14: Designed Robot

VII. CONCLUSION

By developing this robotic vehicle, we have overcome the drawbacks of RF communication which have a limited range whereas this car can be controlled from anywhere just using this DTMF technology. In these project with the use of a mobile phone for robotic control can 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.

REFERENCES

[1] Awab Fakih, Jovita Serrao, "Cell Phone Operated Robotic Car." International Journal of Scientific & Engineering Research, ISSN 2229-5518.

[2] Yun Chan Cho and Jae Wook Jeon "Remote Robot control System based on DTMF of Mobile Phone", IEEE International Conference INDIN 2008, July 2008.

[3] http://www.dialabc.com/sound/dtmf.html

[4] http://www.robotplatform.com/howto/L293/motor_driver_1.html

[5] http://www.atmel.in/devices/ATMEGA328.aspx

[6] Datasheet MT8870 Zarlink Semiconductor page 6.