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DTMF Based Speed Control of DC Motor

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Abstract:- DTMF based motor control is a method which uses Dual Tone Multi Frequency(DTMF) technology to control a dc motor by using a mobile phone. A call is made to the mobile phone connected to the dc motor and during the course of the call, whatever key is pressed on the mobile phone is heard at the other end. This tone is perceived by the Arduino and decoded using a DTMF decoder. The Arduino then directs the IC to drive the motor which causes the motor to move. The motor is operated at different speeds.

Keywords:- *Dual Tone Multi Frequency (DTMF), Integrated Circuits (IC), Arduino.*

I. INTRODUCTION

Motors are one of the most important components of the electrical industry and have their applications in every sphere of the sciences and engineering. The DC motors are used at various places such as industries, households, electric cars and a whole lot of other places. So,their speed and position control is a very important aspect of electrical engineering. A lot of speed drives are present which are used for the control ofand high power drives both for AC and DC motors. In this paper our research is mainly focused on the operation of low power motor and low power motor drives however the research can be extended for application to high power motors and high power drives.

Here in our research we use the DTMF technology used by mobile phones to generate frequencies which are then processed by the ARDUINO UNO Microcontroller which is used to power a L293D motor driver circuit. This gives a wireless control of the motor and motor can be made to move forward and reverse with varying speeds and made to stop. When operated with two motors, both the motors can be made to synchronize and function like they do in an actual car. DTMF technology or the Dual tone Multi Frequency signals are a combination of signals generated by dial tone phones which emit a particular frequency on the basis of the sound generated by the phone. The IC MT8870 is used for detecting and catching this signals or frequencies and then these signals are converted into binary form and fed to the Arduino UNO. Using this microprocessor, we can input or feed signals to motor driver circuit which is then ultimately used to drive the motor circuit. Generally, a dial mobile is connected with the DTMF module using an AUX cable and another remote phone from anywhere in the world with an active network signal can be used to call the connected phone. Once the phone is picked up by the connected phone we can operate the DC motor as we wish to operate in the system.

This technology has a lot of future prospects and can be extended to use for various purposes such as robotic cars, surveillance bots, automated bots, maintenance bots, irrigation pumps, defense purposes and a lot of applied sciences and engineering field. This paper proposes a method to control this motors in a very simple and cost effective way.

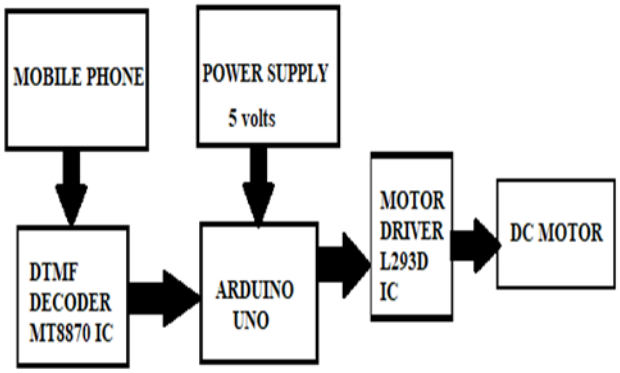

Fig 1:- Block diagram of DTMF based speed control of DC Motor

II. HARDWARE USED

A. DTMF (Dual Tone Multi Frequency)

DTMF technology or Dual Tone Multi Frequency Technology is a form of communication through signals which involves recognizing the tones produced on a DTMF keypad. Two frequencies combine to produce a DTMF tone, one is of high frequency tone and the other is of low frequency. A mobile phone consists of numbers (0-9), symbols and letters (A-D). For each letter and number, a specific set of frequency are paired which combine to generate a DTMF tone whenever a key is pressed.

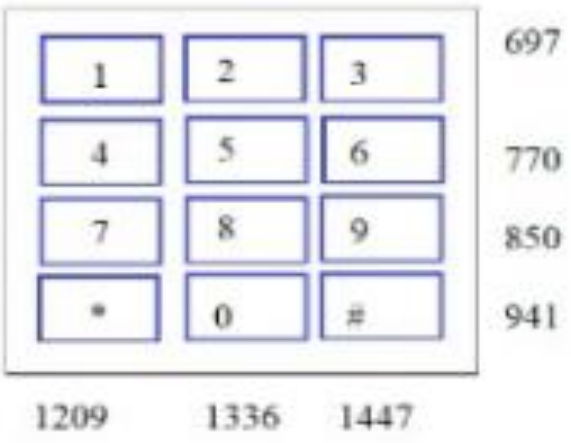

Fig 2:- DTMF Keypad Frequencies

For example, if the "8" key is pressed then generated frequency tone is
850 + 1336 = 2186 Hz.

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DTMF controlled motor is operated through commands which are sent via mobile phone. Here we are using the DTMF function of mobile phone. One is the user mobile phone that will call 'remote phone' and second one is the phone which is connected to the motor. This mobile phone is called as the 'Receiver phone'.

The remote phone is used to call the receiver phone which receives the call manually.

B. Arduino a Microprocessor

Arduino Uno microcontroller board is a board which has 14 digital input/output pins (six PWM outputs) and sixanalog inputs, provided with a USB port for connection, a power jack, and a reset button. It has all the components to support the. microcontroller; It is connected to the computer with a USB port or it powered from an adapter and then it is used.

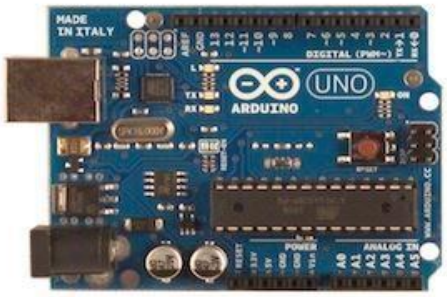

Fig 3:- Arduino UNO

C. Motor Driving IC L293D

L293D is a 16 pin Texas instruments IC which is used for the motor control. It has dual H bridge circuit and acts as current amplifier as they take a low signal and provide a comparatively higher current signal which is used to drive the various DC motor. Using this IC two DC motors can be operated simultaneously in forward and reverse directions. The L293D is operated by receiving signals from the ARDUINO UNO Atmega board and then uses that signals to drive the motor. This IC is one of the most common used component for driving a motor for the low voltage applications.

III. WORKING

The main objective is to design a system which can be used to control the speed of a dc motor remotely. The mobile connected to motor will be controlled via an android platform or pc. The camera in the mobile can also be used to visually control the motor.

A mobile phone that makes a call to another mobile phone attached to the motor. During a call if any button is pressed, a tone corresponding to the button can be heard at the other end. The received tone is then processed by a DTMF decoder and digital form of the button is generated. These digital signal is sent to the microcontroller which transmits the PWM signal to the motor driver circuit. The code for interfacing DTMF decoder is dumped into the microcontroller.

The working of the motor can be explained in following steps:

Step 1: Initially power supply is given to motor.
Step 2: Call is made from a mobile to mobile connected to DTMF decoder.
Step 3: Call is picked by the mobile automatically.
Step 4: Directions are given by the mobile phone operator.

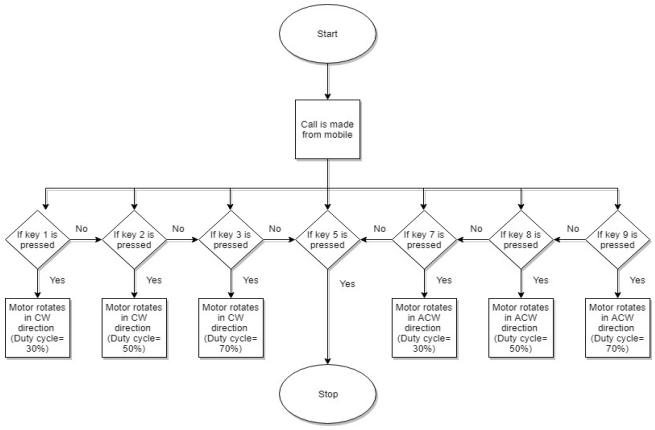

Fig :-4 Working

Step 5: When 1 is pressed, the controller will provide PWM signal to motor driver with 30% duty cycle such that motor rotates in CW direction.
Step 6: When 2 is pressed, the controller will provide PWM signal to motor driver with 50% duty cycle such that motor rotates in CW direction.
Step 7: When 3 is pressed, the controller will provide PWM signal to motor driver with 70% duty cycle such that motor rotates in CW direction.
Step 8: When 7 is pressed, the controller will provide PWM signal to motor driver with 30% duty cycle such that motor rotates in ACW direction.
Step 9: When 8 is pressed, the controller will provide PWM signal to motor driver with 50% duty cycle such that motor rotates in ACW direction.
Step 10: When 9 is pressed, the controller will provide PWM signal to motor driver with 70% duty cycle such that motor rotates in ACW direction.
Step 11: when 5 is pressed, the motor will stop rotating.

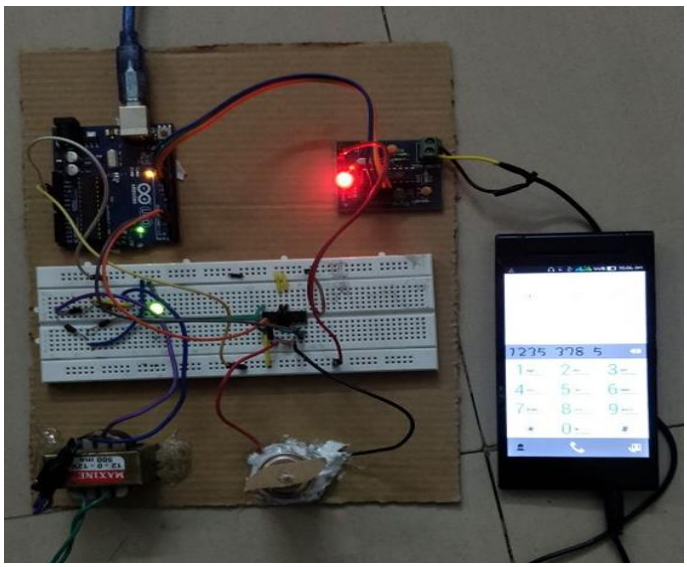

Fig :-5

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INPUT KEY	INPUT				OUTPUT		DUTYCYCLE OFPWM(%)
	D3	D2	D1	D0	M1	M2	
1	0	0	0	1	LOW	HIGH	30
2	0	0	1	0	LOW	HIGH	50
3	0	0	1	1	LOW	HIGH	70
7	0	1	1	1	HIGH	LOW	30
8	1	0	0	0	HIGH	LOW	50
9	1	0	0	1	HIGH	LOW	70
5	0	1	0	1	LOW	LOW	-

Table 1

IV. FUTURE SCOPE& APPLICATIONS

The DTMF technology can be applied to a wide variety of applications and fields of sciences. This technology can be used combined with the DC motor control to operate in a wide area of fields. The DTMF technology is low cost, flexible and comparatively simple as compared to other wireless technologies presently in the market. Some of the applications of the DTMF technology are

A. Robotic cars:- The DTMF and motor technology combined can be used in the construction of various robotic and wireless cars which are useful in various applications as they can be modified for use as a surveillance car, for maintenance purposes and also as a recreational activity. This technology can be used as for the development and research of wireless and automated electric vehicles and unmanned vehicles. This technology can also be used for the making of a solar car and a room cleaner robot. Some fun and recreational RC cars and robots are also in use in the past where the so called toys and robots are very popular amongst adults and children alike. There also have been some developments towards researching robots which can detect faults on wind turbine and solar farms. As we can see from the above examples the use of this applications is far and varied and can be applied to a lot more applications by using the DTMF and speed control techniques.

B. Irrigation Pumps:- The DTMF technology for the operation of DC motors can be used for the water pumping process of irrigation canals. Using the DTMF technology we can perform wireless pumping of water using the combined technology of the DC motor and DTMF technology in the systems.

C. Research work:- Research can be extended in the DTMF technology area with work undergoing in various automation projects using this technology and its further usage for the automation purpose. The DTMF technology also has undergoing work in unmanned vehicles with unmanned cars operated from mobile phones also being in the lead. Some military research work is also under the process with the technology used on spying and sending information to various places incorporated.

This can be said to be some the applications of the DTMF technology which is used comprehensively because of its long coverage, less sensitivity to environment and weather conditions and better efficiency.

V. CONCLUSION

Speed Control is an important concept which has various applications in industries. Depending upon the requirement of the industry,the size of the motor varies from small to big. To vary the speed of these motors, as per requirement, various DC motor drivers are used for efficient speed control.
In this paper we haveproposed a method to control the speed of a low power DC Motor.

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