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DC MOTOR SPEED CONTROL BY USING IC 555 TIMER AND IC 7805

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Abstract:

In Industry DC motor is widely uses for speed control and load characteristics, it's easy controllability provide effective and precise output. So, application of DC motor is large for commercial purpose. Speed control of DC motor is very crucial in application where required speed is precision and correcting signal representing and to operate motor at constant speed ,so we used PWM method which are fulfil all requirements to speed control of DC motor. PWM based speed control system consists of electronic components(integrated circuit ,Potentiometer etc).In this Project 555 timer (NE55P) is being operated in astable mode, which produce a continuous HIGH and LOW pulses. The 555 Timer is capable of generating PWM signal when set up in an astable mode. In this mode, the 555 IC can be used as a pulse width modulator with a few small adjustments to the circuit. The frequency of operation of the circuit is provided by the passive parameters of resistances and capacitors attached to it. The speed control of DC motor is important in applications where precision and protection are of essence.

The variable speed drives, till a couple of decades back, had various limitations, such as poor efficiencies, larger space, lower speeds, etc., However, the advent power electronic devices such as power MOSFETs, IGBTs etc., and today we have variable speed drive systems which are not only in the smaller in size but also very efficient, highly reliable and meeting all the stringent demands of various industries of modern era. Direct currents (DC) motors have been used in variable speed drives for a long time. The versatile characteristics of dc motors can provide high starting torques which is required for traction drives. Control over a wide speed range, both below and above the rated speed can be very easily achieved. The methods of speed control are simpler and less expensive than those of alternating current motors. There are different techniques available for the speed control of DC motors.

The phase controlmethod is widely adopted in which ac to dc converters are used to supply the dc motors, but has certain limitations mainly it generates harmonics on the power line and it also has poor p.f.when operated at lower speeds. The second method is pwm technique, which has got better advantages over the phase control. In order to have better open loop speed control as demand varies frequently like in traction system and many operations in industry must be control manually, PWM is most efficient and cheap speed control method for dc drives. By varying resistor pot only, we can control thespeed of motor states that simple and easy method.

INDEX TERMS: 555 Timer IC, DC Motor, Potentiometer, Step Down Transformer,Speed Control.

I. INTRODUCTION

In this project, we will show How Speed Control of DC Motor can be implemented using 555 timer and Pulse Width Modulation (PWM). Most of the industrial process requires to be run on the certain parameters where speed of the drive is concerned. The electric drive systems used in many industrial applications require higher performance, reliability, variable speed due to its ease of controllability. The speed control of DC motor is important in applications where precision and protection are of essence. Purpose of a motor speed controller is to take a signal representing the required speed and to drive a motor at that speed. In this project controller presented uses the pulse width modulation (PWM) technique for speed control of DC motor.

We use DC Motors in many systems in our day to day life. For example, CPU fans, fume extinguishers, toy cars etc. are all DC Motors which are operated by DC power supply. Most of the times we will have to adjust the speed of the motors as per our requirement. A CPU Fan for example, must be operated at high speed when the CPU is preforming heavy tasks like games or video editing. But for normal usage like editing documents, the speed of the fan can be reduced. Although some systems have an automatic adjustment system for fan speed, not all systems possess this functionality.

So, we will have to adjust the speed of the DC Motor ourselves occasionally. The circuit is used to control speed of DC motor by using PWM technique. Series Variable Speed DC Motor Controller 12V uses a 555 timer IC as a PWM pulse generator to regulate the motor speed DC12 Volt. IC 555 is the popular Timer Chip used to make timer circuits. In the Astable mode (AMV), the IC works as a free running multivibrator. The output turns high and low continuously to give pulsating output as an oscillator.

II. SCOPE OF PROJECT

DC motor plays a significant role in modern industries. They are widely used in industry because of its low cost, less complex control structure and wide range of speed and torque so better future of this project. In this project we are used pulse width modulation technique, it is a modern technology in solid state field and it provide smooth speed control of motor. Now a day PWM technique are using in fuzzy logic control system, so PWM method is veryefficient and reliable method to control the speed of motor so it future is also bright in the modern era with fuzzy logic

III. SPEED CONTROL METHODS OF DC MOTOR

- Armature or Rheostatic control method.
- Flux control method. It is seen that speed of the motor is inversely proportional toflux.
- Armature control method
- Voltage Control Method
- Variable resistance in series with armature.

IV. PWM TECHNIQUE

Pulse width modulation control works by switching the power supplied to the motor on and off very rapidly. The DC voltage is converted to a square wave signal, alternating between fully on (nearly 12v) and zero, giving the motor a series of power “kicks”. Pulse width modulation technique (PWM) is a technique for speed control which can overcome the problem of poor starting performance of a motor. PWM for motor speed control works in a very similar way. Instead of supplying a varying voltage to a motor, it is supplied with a fixed voltage value (such as 12v) which starts it spinning immediately. The voltage is then removed and the motor ‘coasts. By continuing this voltage on/off cycle with a varying duty cycle, the motor speed can be controlled. The major reason for using pulse width modulation in DC motor control is to avoid the excessive heat dissipation in linear power amplifiers. The heat dissipation problem often resultsin large heat sinks and sometimes forced cooling. PWM amplifiers greatly reduce this problem because of their much higher power conversion efficiency. Moreover, the input signal to the PWM driver may be directly derived from any digital system without the need for any D/A converters.

V. IC 555 TIMER

The 555 timer IC is an integral part of electronics projects. The 555 timer IC is an integrated circuit (chip) used in a variety of timer, pulse generation, and oscillator applications. The 555 can be used to provide time delays, as an oscillator, and as a flip-flop element. For a 555 timer working as a flip flop or as a multi-vibrator, it has a particular set of configurations. Some of the major features of the 555 timer would be: • It operates from a wide range of power ranging from +5 Volts to +18 Volts supply voltage. • The external components should be selected properly so that the timing intervals can be made into several minutes along with the frequencies exceeding several hundred kilohertz. • The output of a 555 timer can drive a transistor-transistor logic (TTL) due to its high current output. • The duty cycle of the timer is adjustable. • The maximum power dissipation per package is 600 mW and its trigger and reset inputs has logic compatibility.

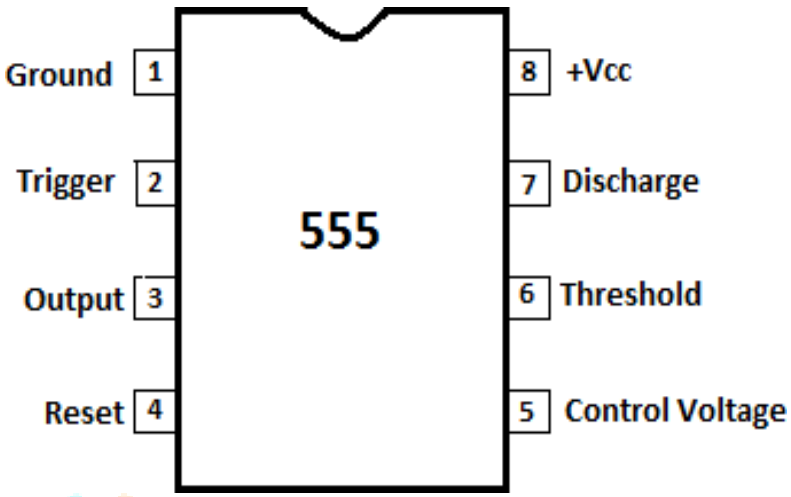

FIG. 1: PIN DIAGRAM OF IC 555 TIMER

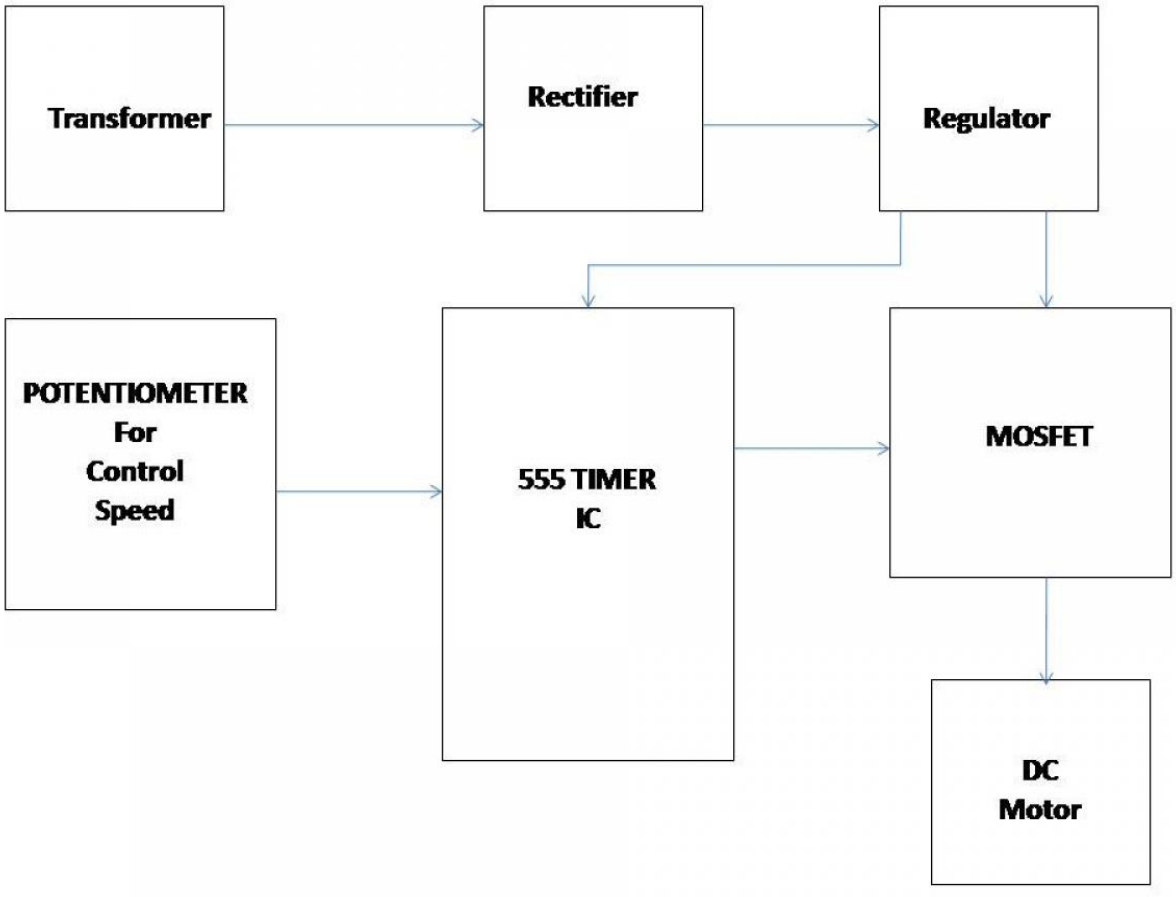

FIG. 2: BLOCK DIAGRAM

VI. PRINCIPLE

Pulse width modulation control works by switching the power supplied to the motor on and offvery rapidly. The DC voltage is converted to a square wave signal, alternating between fully on (nearly 12v) and zero, giving the motor a series of power "kicks". Pulse width modulation technique (PWM) is a technique for speed control which can overcome the problem of poor starting performance of a motor. PWM for motor speed control works in a very similar way. Instead of supplying a varying voltage to a motor, it is supplied with a fixed voltage value (such as 12v) which starts it spinningimmediately. The voltage is then removed and the motor 'coasts. By continuing this voltage on/off cycle with a varying duty cycle, the motor speed can be controlled

VII. RESULT AND DISCUSSION

By varying the ohmic pot we have done the speed control DC shunt motor by means of PWM method for triggering the base of controlled device called IGBT. We found out that this is very cheap and efficient speed control method where all components give reliable operation and we have checked it experimentally where the efficiency of rheostatic method is better than the PWM control method. Figure 4 shows the pulses at different duty cycles.

The pulse with higher duty cycle turns 'ON' at longer time than that of lower duty cycle. The duty cycle, d is governed by equation d = ton/T where T is the duration of one period and ton is the 'ON' time. The ratio of ON to OFF time is called as duty cycle which determines the speed of the motor. The desired speed can be obtained by changing the duty cycle. The PWM pulse is used to control duty cycle of DC motor drive. Power is supplied to the motor in square wave of constant voltage but varying pulsewidth or duty cycle. Duty cycle refers to the percentage of one cycle during which duty cycle of a continuous train of pulses. Since the frequency is held constant while the on-off time is varied, the duty cycle of PWM is determined by the pulse width. Thus, the power increases duty cycle in PWM.

The PWM ON period at 60 % of duty cycle is higher than at 40 % duty cycle. This contributes to higher motor speed at 60 % duty cycle compared to 40 % duty cycle. Figure 5 shows the pulses at switching frequency of 500 Hz and 1500 Hz. The frequency of operation, f is defined as f = 1/(ton + toff) = 1/T Where ton is the ON time of the PWM pulse, toff is the 'OFF' time in which the value of PWM pulse is at zero level and T is the total time period of one duty cycle. Higher switching frequency increases the output voltage.

VIII. CONCLUSION

The dc motor speed is controlled by using power electronic device and the PWM is used whichto control the speed of dc motor. The speed pulse train will be based on required input speed. This circuit is useful to operate the dc motors at required speed with very low losses and low cost. The circuit response time is fast. Hence high reliability can be achieved. The designed circuit was tested for various speed inputs satisfactorily. The method already employed in traction system and has a good scope ahead

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