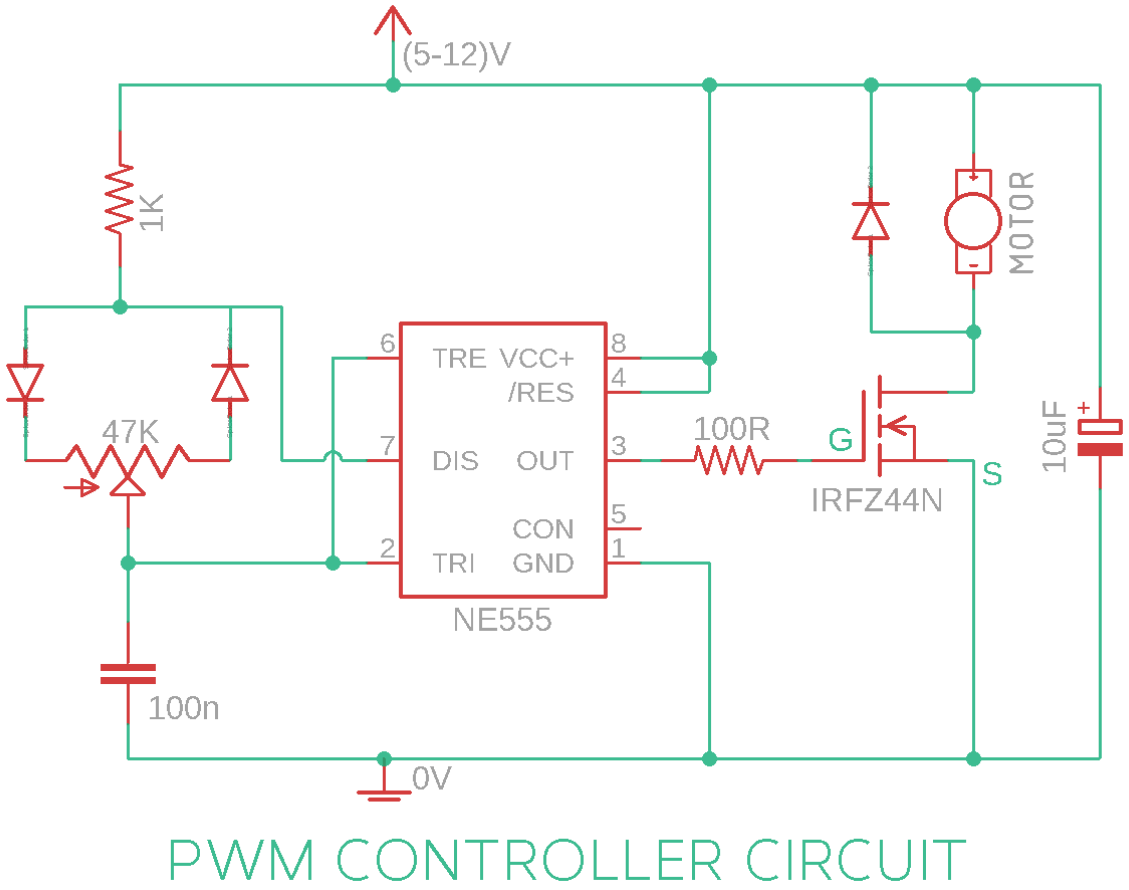
AIM:

The aim of this project is to design and construct PWM (Pulse Width Modulated) controller circuit for controlling the speed of DC Motors.This circuit uses 555 timer IC to generate continuous ON-OFF pulses which control the speed of DC motors.

Materials Required:

- 555 Timer IC
- Resistors: 1K, 100 Ohm
- 47K Potentiometer
- 100n Capacitor
- 10uF Capacitor (For smoothening power input)
- PN Diodes * 2
- N Channel Mosfet (I used IRFZ44N)
- Breadboard
- Few Breadboard Connectors
- (5-12)V Power Supply

Circuit Diagram:



PWM CONTROLLER CIRCUIT

Theory:

This circuit controls the speed of an output by pulsing the output ON and OFF continuously. The speed of a DC motor can be controlled by adjusting the duration of ON time with respect to the total time. In other words, if speed needs to be increased, we increase the width of ON pulse and vice versa. This process is known as pulse width modulation or PWM in short.

Each pulse is a combination of ON and OFF signal. The ratio of ON time with respect to total pulse time is called as duty cycle. So increasing the duty cycle will increase the speed of motor, and vice versa.

Duty Cycle = (ON Time) / (ON + OFF Time)

Motor Speed = Duty Cycle * Maximum Motor Speed

we pulse the output ON and OFF and also control the duty cycle at the same time as follows:

And because the total resistance of the potentiometer is constant, increasing one portion of resistance automatically reduces the other portion and vice versa.In order to toggle the output ON and OFF at regular intervals of time, we use 555 timer IC in astable mode. Here is how it works:

The 555 timer IC plays a crucial role in generating the Pulse Width Modulated (PWM) signal that controls the speed of DC motors.

In astable mode, the 555 timer IC functions as an oscillator, continuously generating a square wave output.By adjusting the values of resistors (R1 and R2) and a capacitor (C), we can precisely control the frequency of the square wave generated by the 555 timer. The frequency determines how quickly the motor's speed can be adjusted.

Now the ON time depends on the speed at which 100nF capacitor charges, which in turn depends on how big the left portion of potentiometer’s resistance is.

Similarly, the OFF time depends on the speed at which the capacitor discharges, which in turn depends on how big the right portion of potentiometer’s resistance is.

So increasing left portion of resistance means that we are increasing the resistance through which the capacitor charges and so it takes more time for the capacitor to charge and so it increases the ON time. At the same time, the resistance through which the capacitor discharges reduces and so the capacitor will be able to discharge quickly and so it reduces the OFF time.
In short, because of the potentiometer and diode arrangement, if ON time increases, the OFF time automatically reduces and vice versa. As a result, we are able to keep the sum of ON and OFF times constant while being able to change the ON time and therefore duty cycle. This is what PWM (Pulse Width Modulation) is.

Conclusion:

In conclusion, the project to design and construct a Pulse Width Modulated (PWM) controller circuit for controlling the speed of DC motors using a 555 timer IC has been successfully explained. This project provides an effective way to control the speed of DC motors by varying the duty cycle of a square wave signal generated by the 555 timer IC.
This PWM motor controller can be applied to various projects and applications that require precise motor speed control, such as robotics, automation, and electronics projects for precise control of servo motors,Used in inverter circuits for generating pulses that drive step up transformers.