PWM Based DC Motor Speed Controller
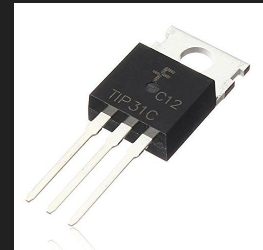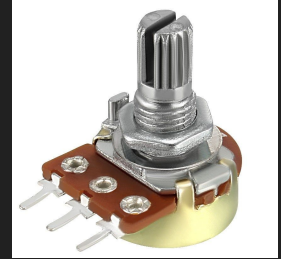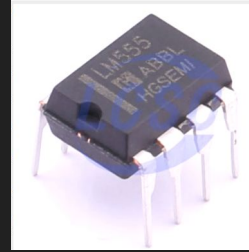
Presented By Avijit Das

Need Of This Project

DC motors are widely and very commonly used motors. From battery operated power tools, CPU fans, toy cars, mixers, even in Industrial use for conveyors etc. When it comes to controlling the speed of these motors it becomes a bit tricky. In order to do that, we have to design a circuit that can regulate the power getting delivered to the motor. Thus by increasing or decreasing the power the speed of the motor gets increased or decreased. This can be done by using variable resistor, but to achieve that high power variable resistors are needed so that it can dissipate plenty amount of power as heat. Since it dissipates power as heat which is use less and gets wasted, this technique is very inefficient and creates a huge power loss.
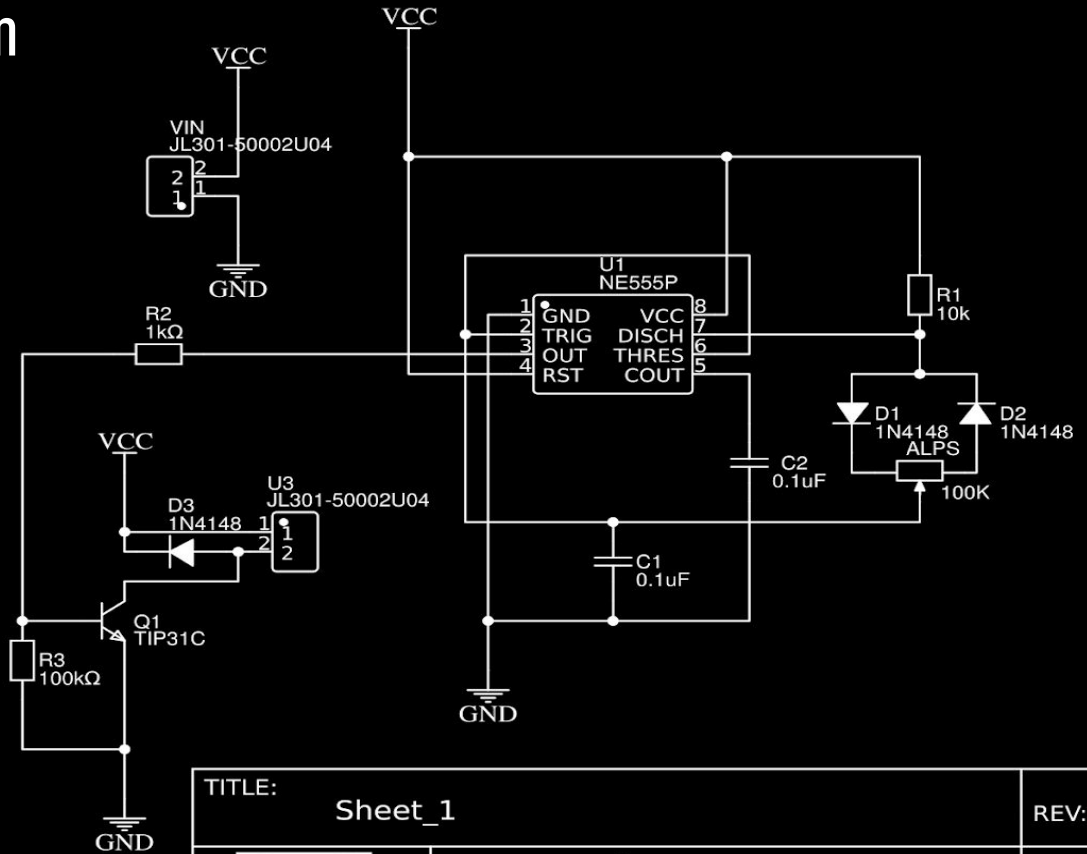An efficient way to do that is by Pulse Width Modulation(PWM).
This PWM circuit is built using a Timer 555 IC and some complementary components. The power is controlled using a potentiometer. And described below in the circuit.

Components Used

1. LM555 IC * 1
2. 0.1μF Capacitor * 2
3. 10k Potentiometer * 1
4. 10k Resistor * 3
5. 1N4148 Diode * 2
6. TIP31C Darlington transistor * 1
7. Screw Terminals

Circuit Diagram

Working Principle

The IC 555 in this circuit is being operated in astable mode, which produces a continuous HIGH and LOW pulses. Now if we change the width of this HIGH and LOW pulse without changing the frequency we call it as Pulse Width Modulation.

By shorting the pin 2(trigger) and 6(threshold) pin of IC 555 making it to run in astable mode, and in turn connected to ground via 0.1μF capacitor, which determines the frequency of the pulses. Now the 100k potentiometer with the fast switching diodes 1N4148, determines the charging time and discharging time of the capacitor. Due to the involvement of the diodes the charging time and the discharging time of the capacitor is equal thus there is no change in frequency. By varying the potentiometer knob the t_{on} increases or decreases which in turn changes the duty cycle since
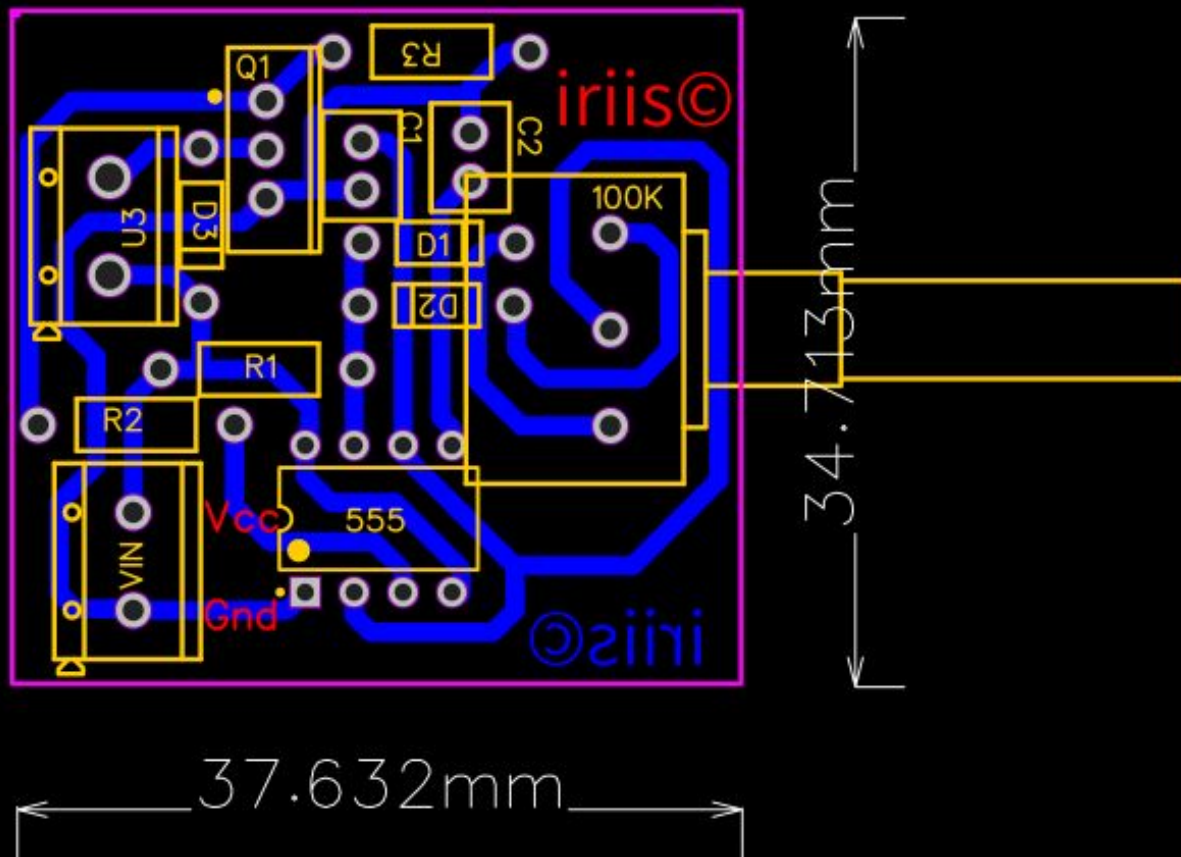
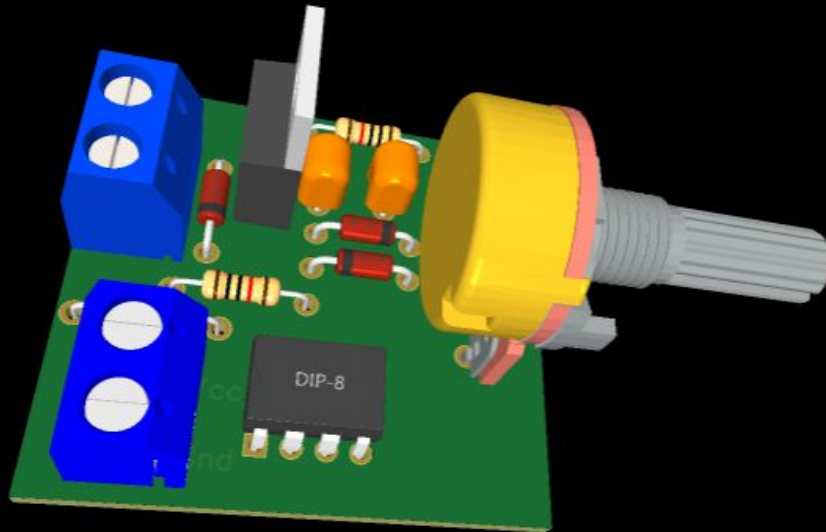Duty Cycle(D) = t_{on} /(t_{on} + t_{off}).

And as we know

Output Voltage = Duty Cycle * Vcc.

By varying the output voltage, it increases or decreases the delivering power to the Motor, thus increasing or decreasing the speed of the Motor.

PCB Layout

3d Model

Conclusion

With PWM we can control the voltage electronically, and this technique is used by microcontrollers to control the voltage and power. Using Timer 555 is the easiest way to generate PWM signal. This circuit can be used to dim Lamps too.

Thank You 😊

Name : Avijit Das
Ph. No : 8777653929
Email : avijitdasxp@gmail.com