PROJECT : MOSFET BASED SPEED CONTROLLER BY 555 TIMER

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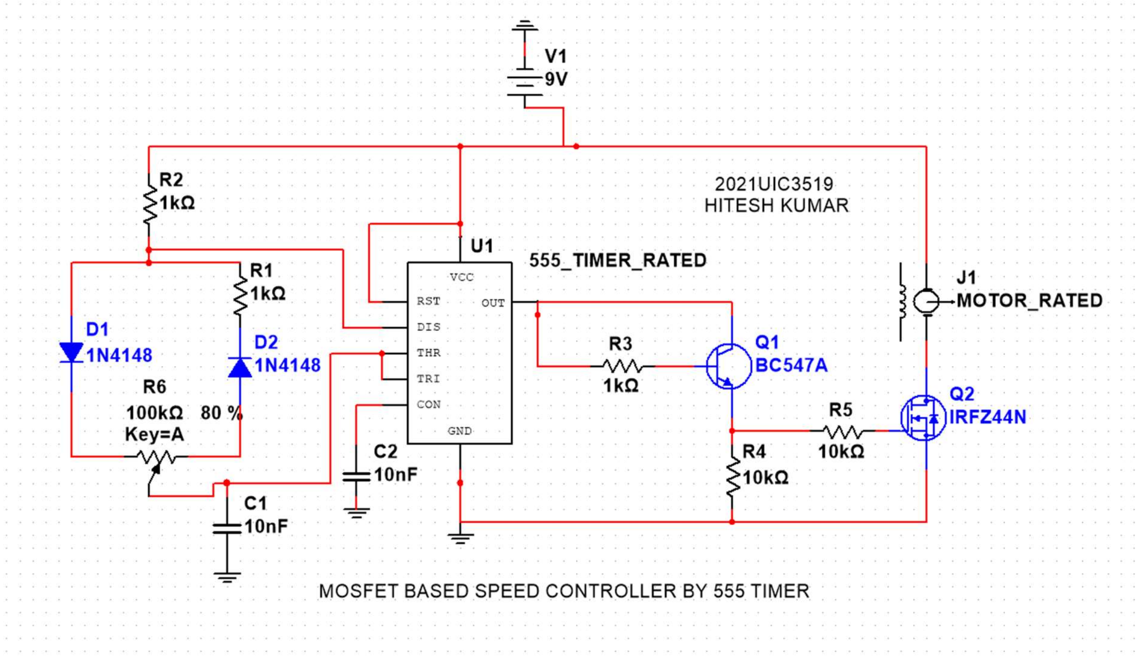
INTRODUCTION:

This project focuses on creating a motor speed control system utilizing an IRFZ44N MOSFET, a 555 timer IC, and a BC547A transistor. The combination of these components enables precise control over the motor's speed by generating pulse-width modulation (PWM) signals.

SOFTWARE USED: MULTISIM

CIRCUIT DESIGN:

The circuit integrates a 555 timer configured in astable mode to produce square wave pulses, controlling the switching frequency. These pulses are then directed to the gate terminal of the IRFZ44N MOSFET, regulating the power supplied to the motor. Additionally, a BC547A transistor is connected to the output of the 555 timer.



COMPONENT SELECTION:

<u>IRFZ44N MOSFET:</u> Chosen for its high current-handling capacity and low ON resistance, the IRFZ44N efficiently controls the motor's power supply. Its robust nature makes it suitable for driving moderate to high-power loads such as motors.

<u>555 Timer IC:</u> The 555 timer is a versatile integrated circuit commonly used in timing and pulse generation applications. Configured in astable mode, it generates stable square wave pulses with adjustable frequency and duty cycle, ideal for PWM control.

BC547A Transistor: Placed between the 555 timer output and the MOSFET gate, the BC547A transistor serves as a buffer amplifier. It enhances the driving capability of the 555 timer output, ensuring sufficient current and voltage levels to effectively switch the MOSFET. This amplification ensures that the MOSFET receives a sufficiently strong signal to switch efficiently, minimizing switching losses and enhancing the overall performance and reliability of the motor speed control system.

Operation:

The 555 timer generates square wave pulses, which are amplified by the BC547A transistor before being applied to the gate of the IRFZ44N MOSFET. The MOSFET then switches on and off at the frequency determined by the 555 timer, controlling the average voltage supplied to the motor. By adjusting the duty cycle of the PWM signal, the motor's speed is varied accordingly.

The frequency is the number of pulses per second. The formula to calculate the frequency of the output voltage is:

$$f = \frac{1.44}{(R_1 + 2R_2)C}$$

The period is the time covered for one pulse. This is just the reciprocal of the frequency:

$$T = \frac{1}{f} = 0.694(R_1 + 2R_2)C$$

The high time (T1 1) and low time (T0 0) can be calculated using the formulas below. Note that the period is the sum of the high time and the low time.

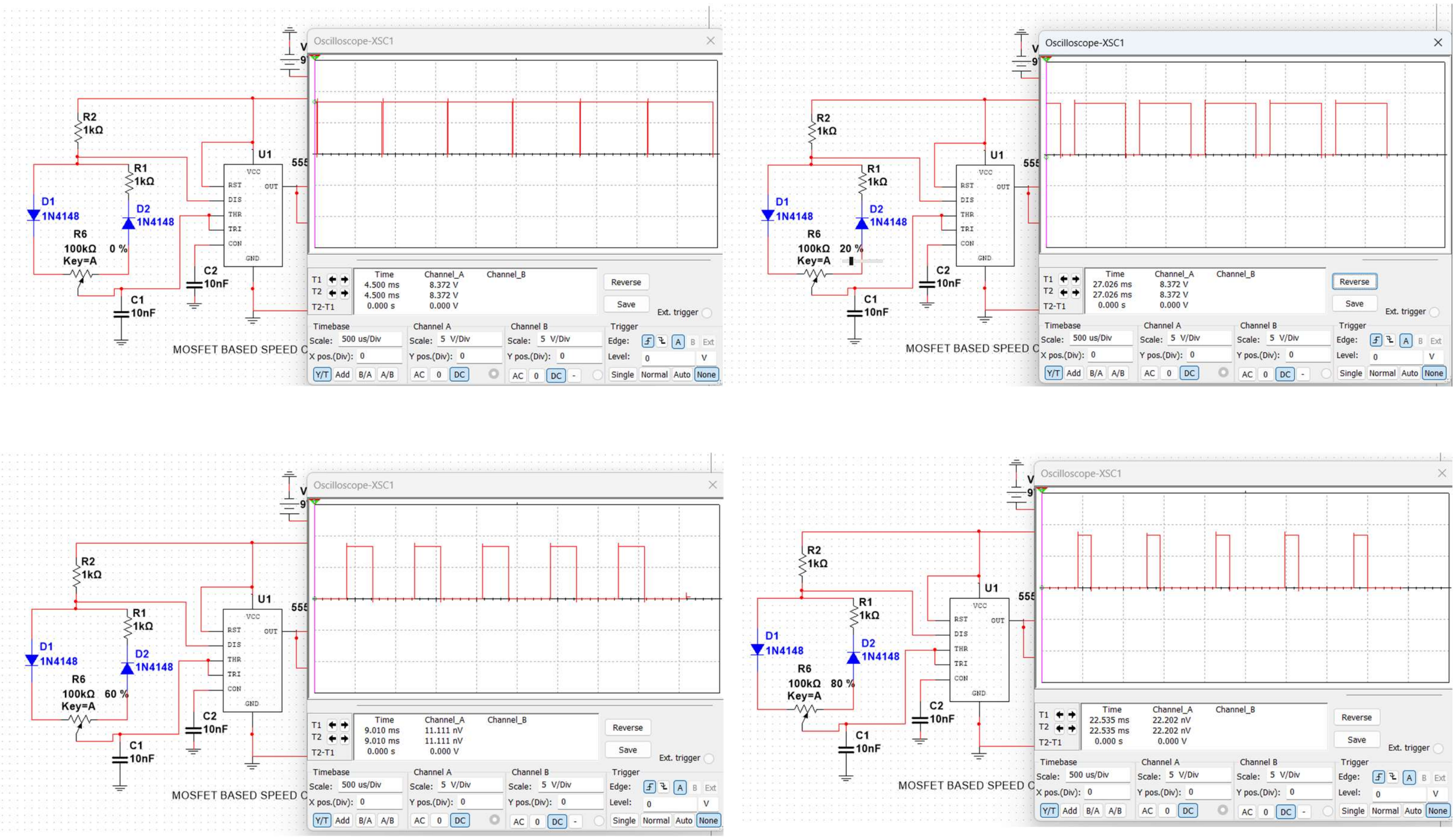
$$T_1 = 0.694(R_1 + R_2)C$$

$$T_0 = 0.694R_2C$$

The duty cycle is more commonly used than the mark space ratio. The formula for the duty cycle is:

$$\text{Duty Cycle} = \frac{T_1}{T} \text{ x } 100$$

Increase R2 2 to increase High Time (T1), increase Low Time (T0) and decrease the duty cycle



Conclusion:

In conclusion, the project successfully demonstrates the utilization of IRFZ44N MOSFET, 555 timer, and BC547A transistor in designing a motor speed control system. These carefully chosen components work synergistically to provide precise and efficient control over the motor's speed, making the system suitable for various industrial and DIY applications. Further enhancements could involve implementing feedback mechanisms or integrating protective features for optimized performance and safety.