

Objective:

Controlling the speed of a fan using PWM and an IR sensor.

Summary:

In part one, we connected the power pin of the fan to the power pin of the 12 V outlet plug. We used a FET to turn the fan on and off and we used the PWM to control the speed. To measure the RPM of the fan, we used timer T3 to calculate the rotations per second. We initialized the T3CON register as 0x03. We then created a routine called get_RPM that returns the calculated RPM derived from the TACH pin. Then we called this routine to display the value on the LCD screen and update every second.

In part two, we set the frequency of the PWM to 25k Hz and calculate the duty cycle factor. After calculating the duty cycle factor we then updated the variables, "FAN_PWM = 1" to "char duty_cycle = 50" and "char duty_cycle = 100" to "do_update_pwm(duty_cycle)". The change in duty cycle was reflected in the speed of the fan and on teraterm. After verifying the code in part two worked, we set up two RGB LEDs to change color depending on the value of the duty cycle and the rpm.

In part three, we used the IR sensor to and its remote to toggle the power to the fan and control the speed of the fan. Button 6 and 7 were used to control the duty cycle of the fan and button 5 was used to toggle the power of the fan. To increase the duty cycle, a routine would check if the duty cycle was 100 and activate the buzzer twice if true or increase the duty cycle by five and update the PWM value if false. The same process was used for decreasing duty cycle. If the power toggle button was pressed, a routine was used to turn on the fan and update the PWM if the fan was off or turn the fan off if the fan was on.

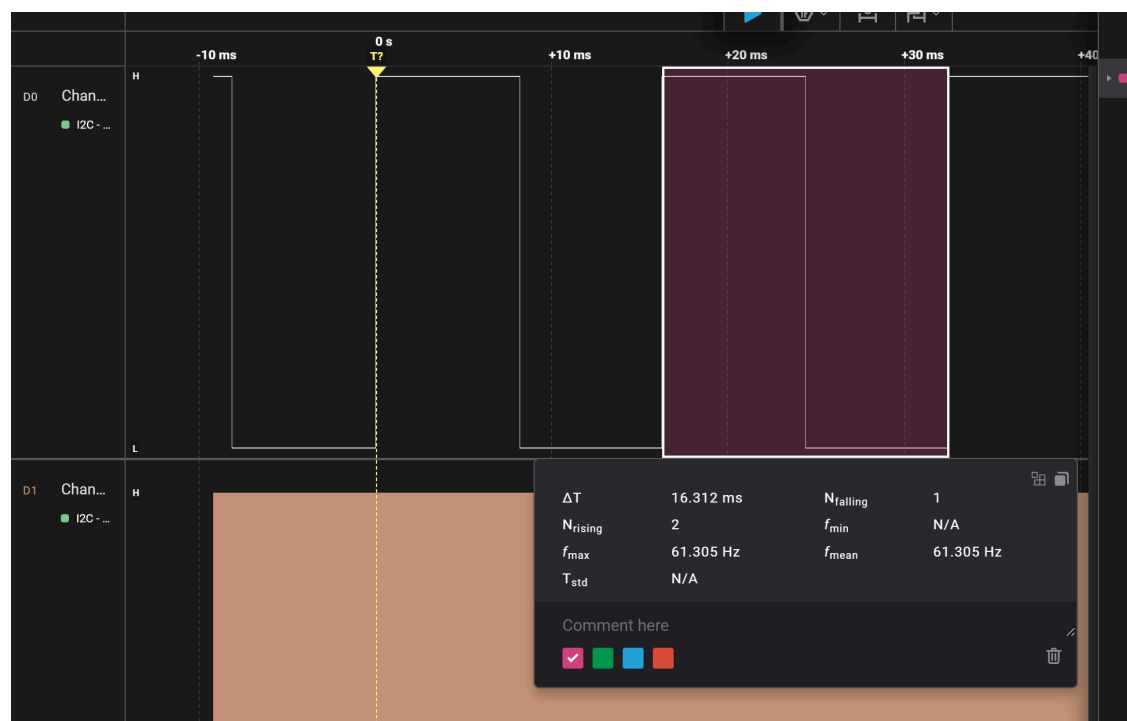
Data Collected:

Below is the information printed to Teraterm and our waveform on the logic analyzer. This is of the fan running at 50% duty cycle.

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02:30:42 10/30/25 Temperature = 22 degreesC = 71 degreesF
RPM = 0 dc = 50
02:30:43 10/30/25 Temperature = 22 degreesC = 71 degreesF
RPM = 0 dc = 50
02:30:44 10/30/25 Temperature = 22 degreesC = 71 degreesF
RPM = 0 dc = 50
02:30:45 10/30/25 Temperature = 22 degreesC = 71 degreesF
RPM = 0 dc = 50
02:30:46 10/30/25 Temperature = 22 degreesC = 71 degreesF
RPM = 0 dc = 50
02:30:47 10/30/25 Temperature = 22 degreesC = 71 degreesF
RPM = 0 dc = 50
02:31:09 10/30/25 Temperature = 22 degreesC = 71 degreesF
RPM = 0 dc = 50
02:31:10 10/30/25 Temperature = 22 degreesC = 71 degreesF
RPM = 660 dc = 50
02:31:11 10/30/25 Temperature = 22 degreesC = 71 degreesF
RPM = 1680 dc = 50
02:31:12 10/30/25 Temperature = 22 degreesC = 71 degreesF
RPM = 1800 dc = 50
02:31:13 10/30/25 Temperature = 22 degreesC = 71 degreesF
RPM = 1800 dc = 50
02:31:14 10/30/25 Temperature = 22 degreesC = 71 degreesF

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Conclusion:

Pulse Width Modulation is a very effective and useful method to control a DC powered fan. The IR sensor made updating the duty cycle of the fan very easy. It is very important to avoid connecting the power pin of the outlet plug to the power rail of the rest of the circuit. A short

between the two powers could result in damage to the laptop that is powering the circuit. The completion of lab 11 is also an important step in completing this lab.