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Temperature Based DcFan Control for Home Appliances

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ABSTRACT

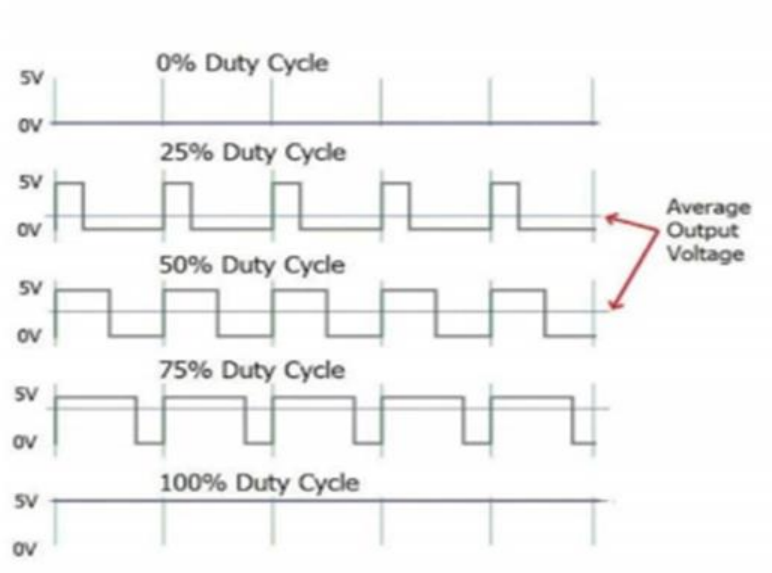
The topic of this project is temperature-based DC fans, which are used to cool electronics. The fan speed is automatically adjusted by the system based on the temperature. A microcontroller receives data from a temperature sensor (LM35) that measures the ambient temperature. Using PWM signals, the microcontroller modifies the fan speed. The fan runs faster when the temperature rises and slows down or stops when the temperature falls. This lessens noise, conserves electricity, and keeps the equipment from overheating. The technology works well with a variety of electronic gadgets and is inexpensive and easy to use. essential elements: N channel MOSFET, Arduino UNO board, breadboard, DC motor, transistor, external battery, and wiring connections

Keywords: Arduino Uno, Capacitive regulator, Automatic speed control, Energy saving

Introduction

A temperature-based DC fan for electronics automatically adjusts its speed or operation to maintain an optimal operating temperature for an electronic device, preventing overheating and damage. These systems use a temperature sensor, such as a thermistor, to detect heat, which then triggers a control circuit (often an op-amp or microcontroller) to power a DC fan only when necessary, leading to efficient cooling and energy conservation. This creates a stable operating environment and increases the longevity and reliability of the connected electronic appliance we use electronic devices like laptops, gaming consoles, or amplifiers, they produce some heat. Due to the continuous flow of electricity through the components. If heat is not controlled, it can cause the system to slow down, crash, or even components can damage the sensitive parts..For example in a class room keeping the fan running atfull speed all the time is not efficient. It wastes energy, creates unnecessary noise, and reduces the fan's lifespan. One of the better approach is to control the fan speed based on temperature. Then the device like fan is cool, The fan runs slowly or stays off. As the temperature rise, The fan gradually speed up to remove heat more effectively. Methodology

A temperature sensor is placed very close to the heating component of the electronic device to continuously monitor the temperature. .The sensor output is send to a microcon -troller, which collects the temperature data. .A DC fan is connected to the microcontroller through a driving circuit (such as a transistor or MOSFET) to allow on controlled op eration. .The microcontroller generates a PWM (Pulse Width Modulation) signal, where the cycle collects the effective speed of the fan. .A temperature range is predefined: at lower temperatures the fan turns off or runs at low speed, and at higher temperatures it turns at high speed. .As the temperature increases within the defined range, the PWM duty cycle is increased with respect to the speed of cooler(fan). .When the temperature reach to the maximum heat or over heating then the cooler get to the its maximum speed range. .The system is tested under different operating conditions to ensure efficient cooling, reduced noise, and optimized power consumption. .It can helpfull to use to control heat which is produced by the electronic devices so, this process helpfull to give the devices the longer time and it very speed working.



The speed of the DC fan is controlled using the PWM technique. Instead of just switching the fan fully ON or OFF, PWM allows us to adjust how much time the fan stays ON compared to OFF in each cycle. This balance between ON and OFF time is called the duty cycle. If the duty cycle is low (fan gets power for a short time, rests for a longer time), the fan spins slowly. If the duty cycle is high (fan gets power for most of the cycle), the fan spins faster. At 100 duty cycle, the fan runs at full speed. By linking this PWM signal with the temperature sensor's readings, the fan speed automatically adjusts At low temperatures, the fan runs slowly (saving energy and reducing noise).As the temperature rises, the PWM duty cycle increases, so the fan speeds up and provides more cooling. This way, PWM ensures the fan only works as hard as needed, making the system more efficient, quieter, and extending the fan's life compared to running it at full speed all the time

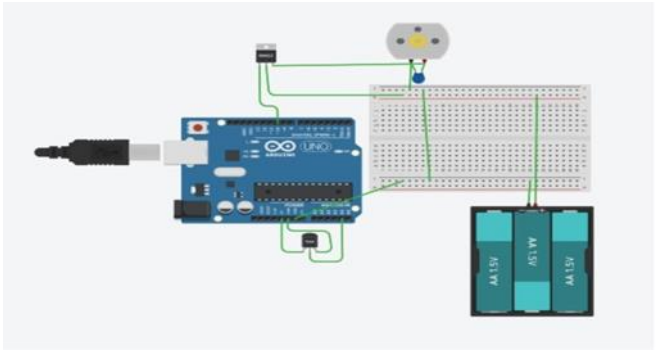


Fig:-1

COMPONENTS USED

1.Arduino UNO Board The microcontroller that manages the circuit is an Arduino UNO, which is the blue board on the left of the bread board.

• It has input/output (I/O) pins, which are digital and analogue.

• The USB cable on the left side powers it. • To turn the motor on or off, the Arduino communicates with the transistor via control signals.

2. Breadboard: A breadboard is a white board with holes that is used to connect components without soldering. • It makes it simple to connect wires and components.

3. DC Motor • The grey circular part in the upper right is a DC motor. • Motors are typically driven by an external battery pack because they need more current than the Arduino pins.

4. Transistor (Switching Device)

• A black, three-legged component (NPN transistor, such as TIP120 or 2N2222) is located at the bottom, close to the Arduino.

• Function: It controls the motor by acting as a switch. o Base → Attached to an Arduino digital pin (not shown here, but via a resistor). The motor is connected to the collector. GND is connected to the emitter.

• The transistor receives a signal from the Arduino and permits current to pass through the motor from the batteries.

5. Diode (Flyback Diode): Usually utilised, but not shown well in the picture, this component is positioned across the motor.

• Goal: Guards against voltage spikes when the motor is turned off by protecting the transistor and Arduino.

6. External Battery Pack: Three AA 1.5V batteries (totalling 4.5V) are placed in a battery holder on the bottom right, which supplies sufficient power for the engine. This battery pack powers the motor rather than the Arduino directly since the pins on the Arduino cannot provide enough current. 7. Connections for Wiring

• The motor's positive terminal is attached to the battery pack's positive rail.

• The transistor collector is connected to the motor's negative terminal. Operational:

• The transistor base receives a HIGH signal from Arduino. • The transistor turns on, enabling the motor to receive current from the external battery.

• When instructed by the Arduino, the motor starts; when the signal is LOW, it stops.

N channel MOSFET

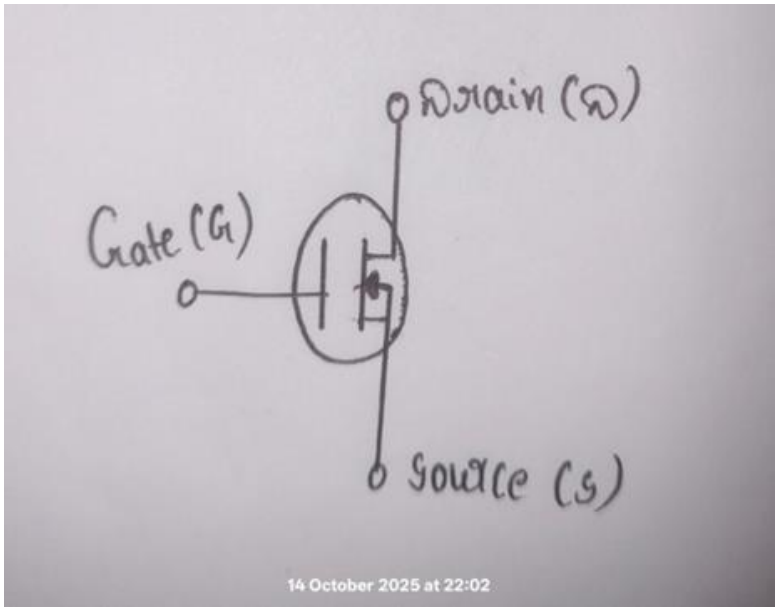
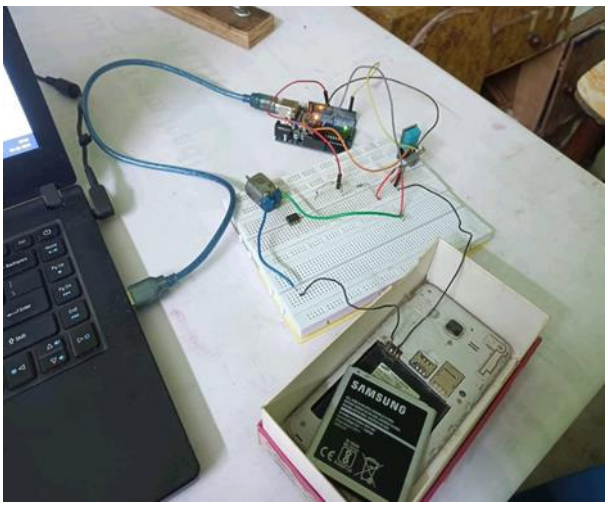


Fig 2

Fig 2 Here, we don't use transistors directly because they can be damaged when dc power is applied at high voltages. Because of its high voltage capability, which is adequate for our procedure, we employ n channel MOSFETs

Results

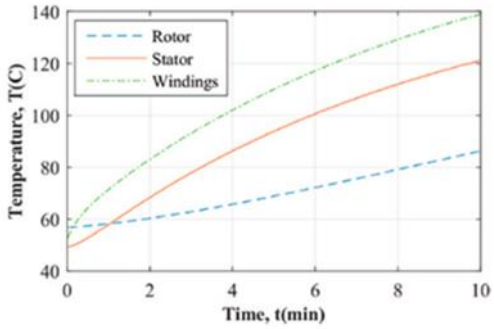


Table

Level	Temperature	Speed(rpm)
1	Less than 25	0
2	25-40	187(slow)
3	40-60	474(fast)
4	Above 60	919(very fast)

The four stages of the capacitive regulator are shown in this table. The servo motor adjusted the level according to the temperature, and each level had a distinct revolutions per minute (rpm). A fan with a lower rpm will run more slowly and use less power. A higher speed produces a greater breeze. For moderate wind, use the other two settings..

Graph



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