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"Automatic Temperature control fan"

Kajal Lalchand Kate[1], Prof. Dnyaneshwar Shivaji Waghmode[2]

Student, Department of Electrical Engineering, Shree Siddheshwar Women's College of Engineering, Solapur, India[1]

HOD, Department of Electrical Engineering, Shree Siddheshwar Women's College of Engineering, Solapur, India[2]

Abstract: This project presents the design and implementation of a temperature control fan system that automatically adjusts its speed based on the surrounding temperature. The primary objective is to provide an energy-efficient solution for maintaining optimal environmental conditions, especially in areas where temperature fluctuations can affect comfort, safety, or equipment performance. The system utilizes a temperature sensor (such as LM35 or DHT11) to continuously monitor ambient temperature. The sensor data is processed by a microcontroller (e.g., Arduino), which controls the fan speed using pulse-width modulation (PWM) or relay switching mechanisms. The fan activates or increases its speed proportionally when the temperature exceeds a predefined threshold, but slows down as the temperature decreases. This intelligent fan system is applicable in-home automation, electronics cooling, greenhouses, and other temperature-sensitive environments. The project demonstrates the effective use of sensors and automation to create a responsive and energy-saving cooling solution.

Keywords: temperature sensor, PWM control, microcontroller, fan, HVAC automation

I. INTRODUCTION

temperature control fan is a type of fan system designed to automatically regulate airflow based on the surrounding temperature. These fans play a crucial role in maintaining optimal thermal conditions in various environments, such as electronic devices, industrial systems, greenhouses, and home HVAC systems. An automatic temperature-controlled fan is a system designed to regulate airflow based on ambient temperature, enhancing comfort and energy efficiency. By integrating temperature sensors with microcontrollers, the fan adjusts its speed or operation in response to temperature changes, eliminating the need for manual intervention.

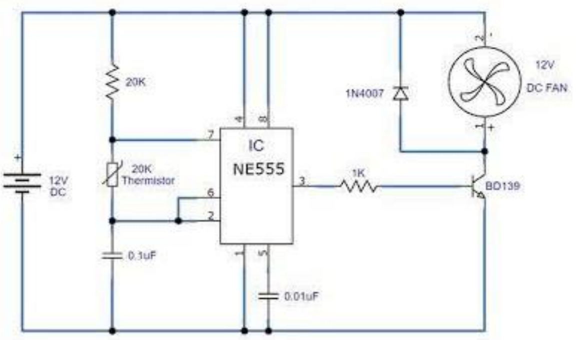
The core components typically include a temperature sensor (such as a thermistor or DHT11), a microcontroller (like an Arduino), and a fan controlled via Pulse Width Modulation (PWM). The temperature sensor continuously monitors the environment, providing real-time data to the microcontroller. When the detected temperature exceeds a predefined threshold, the microcontroller activates the fan or increases its speed to cool the area. Conversely, as the temperature drops below the threshold, the fan slows down or turns off, conserving energy.

This system offers several advantages:

- **Energy Efficiency**: By operating only when necessary, the fan reduces unnecessary power consumption.
- **Enhanced Comfort**: Automatic adjustments maintain a consistent and comfortable environment.
- **Equipment Protection**: In applications like electronics cooling, the system prevents overheating, thereby extending equipment lifespan.
- **Automation**: Eliminates the need for manual fan speed adjustments, providing a hands-free solution.

Overall, automatic temperature-controlled fans are practical solutions for various settings, including homes, offices, and industrial environments, where maintaining optimal temperatures is crucial.

Circuit Digram:



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Temperature Detection The system uses a temperature sensor (like a thermistor or LM35) that measures the surrounding temperature. Signal ProcessingThe sensor changes its electrical output based on temperature (resistance or voltage). This output is sent to a comparator or microcontroller that checks if the temperature is higher or lower than a preset limit. Decision Making If the temperature is below the set limit, the fan stays OFF. If the temperature rises above the set limit, the controller activates the fan.Fan ActivationThe controller sends a signal to a transistor or relay, which acts as a switch to.

II. COMPONENTS DETAILS

1.1 Arduino Nano:

The Arduino Nano is a compact, breadboard-friendly microcontroller board based on the ATmega328P (for the classic Nano**)** or ATmega4809 **(**for the newer Nano Every**).** Below are the details **o**f the components and specifications of the classic Arduino Nano (ATmega328P**)**.[1]

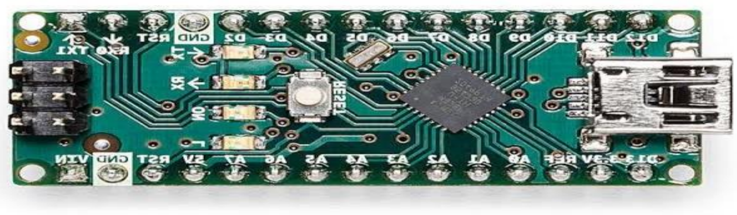

Fig: Arduino Nano

2.2 LCD Display:

An LCD (Liquid Crystal Display) is an electronic display module used to show characters, numbers, and symbols. A 16x2 LCD is capable of showing 16 characters on each of its two lines and utilizes the HD44780 controller. works by controlling liquid crystals with electrical signals to block or pass light [2]

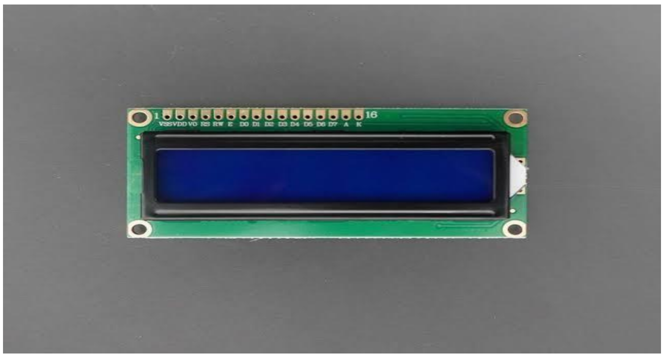

Fig: LCD Display

2.3 Temperature sensor circuit:

A temperature sensor is an instrument utilized to assess how hot or cold an object or environment is converts the thermal energy (heat) into a readable signal (electrical, digital, or analog).[3]

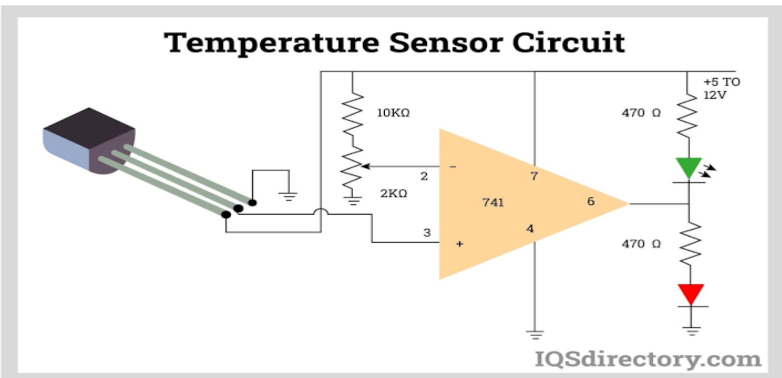

Fig: temperature sensor circuit

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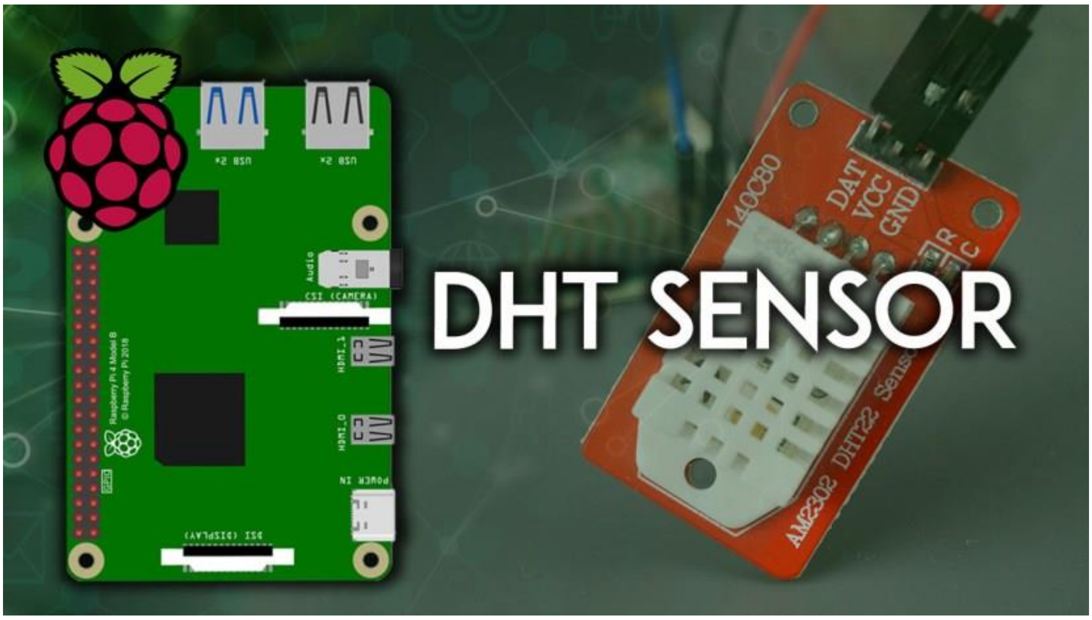
Python Code:

```
import Adafruit_DHT import RPi.GPIO as GPIO import time
# Sensor setup
DHT_SENSOR = Adafruit_DHT.DHT11  # Or Adafruit_DHT.DHT22 DHT_PIN = 4      # GPIO pin where the DHT sensor is connected
# Fan setup
FAN_PIN = 17                          # GPIO pin connected to transistor/relay controlling the fan
GPIO.setmode(GPIO.BCM) GPIO.setup(FAN_PIN, GPIO.OUT)
# Temperature threshold
TEMP_ON = 30            # Fan turns on at 30°C
TEMP_OFF = 25           # Fan turns off at 25°C to avoid flickering
fan_on = False
try:
while True:
humidity, temperature = Adafruit_DHT.read(DHT_SENSOR, DHT_PIN)
if temperature is not None:
print(f"Temp: {temperature:.1f}°C  Humidity: {humidity:.1f}%")
if temperature >= TEMP_ON and not fan_on: GPIO.output(FAN_PIN, GPIO.HIGH)
fan_on = True print("Fan ON")
elif temperature <= TEMP_OFF and fan_on: GPIO.output(FAN_PIN, GPIO.LOW)
fan_on = False print("Fan OFF")
else:
print("Failed to retrieve data from sensor")
time.sleep(2)
except KeyboardInterrupt: print("Program stopped")
finally:
GPIO.output(FAN_PIN, GPIO.LOW)
GPIO.cleanup()
if temperature is not None:
print(f"Temp: {temperature:.1f}°C  Humidity: {humidity:.1f}%")
```



III. ADVANTAGES

1. **Energy Efficiency:** As it works on feedback system so it controls the fan speed with respect to feedback so it doesn't have to run all time or at full speed. That way energy is saved.

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2. **Optimized Cooling:** Enhanced Cooling: Fans with automatic temperature control are designed to function based on the specific conditions of the environment. As it changes its speed according to ambient temperature, they can prevent overheating or overcooling (EV batteries), ensuring that equipment and systems operate within safe temperature ranges with optimizing efficiency.

3. **Extended Lifespan:** As the frequency of full speed running of the fan is low so the life span is long.

4. **Improved Comfort:** The fan speed is controlled by ambient temperature so it regulates the room temperature by controlling fan speed to maintain comfort in residential usage as well as commercial usage (offices)

IV. LIMITATIONS

1. **Limited Temperature Range:** Fans usually operate within a defined temperature range. If the ambient temperature is above or below this range, the fan may not work properly. Therefore, the ambient temperature must be constantly updated by encoding, which complicates the process.
2. **Response Time:** Depending on the technology used, the response time may vary. Long respons times prevent on demand performance in areas with large temperature fluctuations. Therefore, an update was necessary to be able to use it in places where the temperature changes.
3. **Accuracy:** The temperature sensors used in temperature-controlled ventilators vary in accuracy. Small errors in temperature readings can lead to fan speed control errors, resulting in under- or over-cooling.

V. APPLICATIONS

1. **Home and Office Environments**: These fans maintain comfortable indoor temperatures by activating when the room becomes too warm, reducing the need for manual adjustments and conserving energy.
2. **Computer and Electronics Cooling**: In devices like computers and audio amplifiers, these fans prevent overheating by operating only when necessary, thereby prolonging equipment lifespan and reducing noise.
3. **Automotive Systems**: Vehicles utilize temperature-controlled fans to cool engines and radiators, ensuring optimal performance and preventing overheating.
4. **Industrial Machinery**: In industrial settings, these fans help regulate the temperature of machinery and equipment, maintaining operational efficiency and safety.
5. **Greenhouses and Agriculture**: By controlling airflow based on temperature and humidity, these fans create optimal growing conditions for plants, enhancing yield and quality.
6. **IoT and Smart Home Integration**: When integrated with IoT systems, these fans can be remotely monitored and controlled, allowing for automated climate management in smart homes and buildings.
7. **Educational Projects**: Building temperature-controlled fans serves as an educational tool for students and hobbyists to learn about electronics, sensors, and automation.

VI. CONCLUSION

A temperature-controlled fan automatically manages cooling by turning on when the temperature rises above a set point and off when it falls below. It's an efficient, energy-saving solution for preventing overheating in electronic or environmental systems. The project effectively meets its goal of automating fan operation in response to ambient temperature, providing a viable solution for energy-efficient climate management. Its straightforward design and efficiency render it appropriate for a range of applications, such as residential, commercial, and industrial environments. Potential future improvements may include the incorporation of IoT features for remote monitoring and control, thereby increasing its functionality.

REFERENCES

[1]. Badamasi, Y. A. (2014, September). The working principle of an Arduino. In 2014 11th international conference on electronics, computer and computation (ICECCO) (pp. 1-4). IEEE.
[2]. Schadt, M. (1997). Liquid crystal materials and liquid crystal displays. Annual review of materials science, 27(1), 305-379.
[3]. Bakker, A., & Huijsing, J. H. (1996). Micropower CMOS temperature sensor with digital output. IEEE Journal of Solid-State Circuits, 31(7), 933-937.
[4]. Waghmode, D. S., Chavan, K. S., Banasode, P. S., Gangade, S. K., Badgire, D. L., & Dudhalkar,A. S. (2022). Design of Electrical Vehicles.

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BIOGRAPHY

Prof. Dnyaneshwar.S.Waghmode.
HOD of Electrical Engineering, SSWCOE, Solapur, Maharashtra, India.

Kajal Lalchand Kate
Pursuing the Bachelor degree in Electrical Engineering, SSWCOE Solapur