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Temperature based fan controlling system

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***Abstract*—This project showcases an Arduino-based temperature-controlled fan system, which automatically adjusts the fan speed to a set temperature. The system is composed of an Arduino Uno, a temperature sensor (TMP36, or equivalent), a transistor-based motor driver circuit, and an LCD screen. Surrounding temperature gets tracked and reported to the Arduino-powered system that changes fan speed via Pulse Width Modulation (PWM). The system displays real-time readings on the LCD screen. This system is an upgrade in the energy efficiency as well as automation, which can be used in a home, office, and industrial settings.**

I. INTRODUCTION

The efficiency with which automation is applied in the modern world helps to improve and conserve energy at the same time. Conventional fans have a set speed and may require some degree of manual effort for efficient use. In order to solve this problem, we set forth to design a temperature-controlled fan control gantry using Arduino where the interfaced fan is set to work at different speeds depending on the temperature of the surrounding environment.

A temperature sensor (TMP36) used to measure the surrounding temperature transmits the sensor's data to an Arduino Uno microcontroller. The Arduino boards are programmed so that they increase or decrease the fan speed depending on the ambient temperature level using Pulse Width Modulation (PWM). Another transistor circuit was added in order to facilitate the control of the motor. An LCD screen displays the real time temperature for the user

To enhance comfort, lower the electric bill, lower the need for human interaction, and solve the requirements for homesteads, offices, and industrial buildings, this project aims to achieve lower electric energy consumption and create a more cost effective, energy efficient, and automated cooling system in modern smart environments.

II. LITERATURE SURVEY

Smart Temperature-Based Fan Control System Using Arduino and IoT
This paper presents a fan system that is controlled by surroundings' temperature. The fan speed is regulated with the help of temperature sensors and is automatically increased or decreased with the change of ambient temperature. It has integrated IoT features that allow mobile app to control the fan, in real-time. Its purpose is to enhance energy automation in the smart home and industrial systems. [1]
This paper articulates the implementation of an automatic fan system that is capable to detecting temperature changes and alters fan RPM accordingly. The fan speed is adjusted through a PWM (Pulse Width Modulation) circuit along with a motor driver transistor circuit. This innovation allows for better power saving and time saving than constant manual fan use. [2]
Design of Microcontroller-Based Temperature Control System – This research introduces a microcontroller-based system for monitoring temperature in real-time and controlling the fan. It compares various temperature sensors (LM35, TMP36, and DHT11), assessing their accuracy and response times in regulating fan speed. The results indicate that automated temperature control can lower energy consumption and improve indoor comfort. [3]
Energy-Efficient Temperature Control System for Smart Environments – This study offers a detailed overview of automated cooling systems that leverage temperature sensors and microcontrollers. It reviews different sensor technologies, including infrared, thermistors, and digital temperature sensors, as well as PWM-based fan control algorithms to enhance cooling efficiency in smart environments. [4]
Temperature Monitoring and Display System Using Arduino – This project features an LCD display paired with a temperature sensor to deliver real-time

temperature readings. The research emphasizes the significance of showcasing environmental conditions for enhanced control and monitoring. It also underscores the importance of user-friendly interfaces in temperature-based automation. [5]

Comparison of Relay-Based and Transistor-Based Fan Control Circuits – This paper examines various methods of temperature-based fan speed control, contrasting relay switching mechanisms with transistor-driven PWM circuits. The study concludes that transistor-based control offers smoother fan speed adjustments, which helps reduce wear and enhances efficiency. [6]

IoT-Enabled Smart Cooling Systems for Industrial Applications – This research investigates IoT-based temperature control systems that facilitate remote monitoring and automatic fan control through Wi-Fi-enabled microcontrollers. The study proposes that incorporating cloud-based data logging can enhance predictive maintenance and optimize energy consumption in industrial cooling settings. [7]

III. METHODOLOGY

The temperature-based fan control system is created using an Arduino Uno, a temperature sensor (LM35/TMP36), a transistor-based motor driver, an LCD display, and a DC fan. The temperature sensor continuously tracks the ambient temperature and relays the data to the Arduino, which processes the information and adjusts the fan speed through PWM signals. The fan operates according to set temperature thresholds: it is OFF below 25°C, runs at low speed between 25°C and 30°C, medium speed from 30°C to 35°C, and high speed above 35°C. The LCD display provides real-time temperature readings.

The system undergoes testing for accuracy, responsiveness, and power efficiency to ensure smooth transitions in fan speed. Calibration is performed to enhance sensor performance, and power consumption is evaluated to verify energy savings. Future improvements may involve IoT integration for remote monitoring and control. The final system delivers automated, energy-efficient cooling, making it ideal for homes, offices, and industrial settings.

IV. ARCHITECTURE

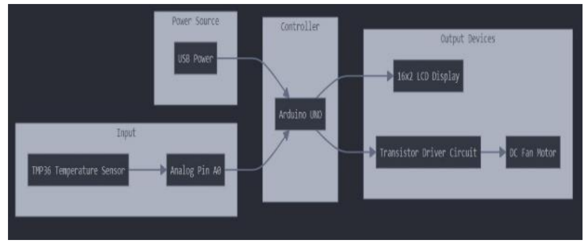

Fig 4.1: - Block Diagram

V. RESULT

The temperature-based fan control system using Arduino successfully adjusted the fan speed based on real-time temperature changes, showcasing automation, energy efficiency, and user convenience. It utilized an LM35/TMP36 sensor to accurately detect temperature fluctuations and displayed the readings on an LCD screen. The PWM-based motor driver allowed for smooth control of the fan speed, ensuring a gradual shift between different settings. Testing revealed that the fan remained off below 25°C, operated at low speed between 25°C and 30°C, medium speed from 30°C to 35°C, and high speed above 35°C, effectively adapting to changing environmental conditions. The system's quick response time provided optimal cooling while minimizing unnecessary power usage, making it more efficient than traditional manually operated fans. Furthermore, the system was stable, reliable, and easy to implement in home, office, and industrial settings. The results demonstrated that this automated cooling solution improves energy efficiency, reduces manual effort, and supports smart home and industrial automation applications.

VI. OUTPUT

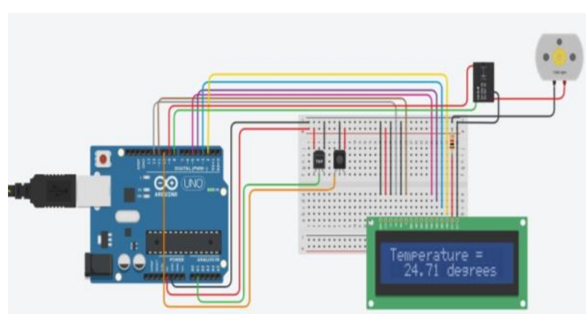

Fig 6.1: - controlling fan speed based on temperatur

VII. CONCLUSION

The temperature-based fan control system using Arduino automates fan speed regulation based on real-time temperature changes, ensuring efficient cooling and energy savings. By using a temperature sensor (LM35/TMP36), an Arduino microcontroller, a PWM-based motor driver, and an LCD display, the system effectively monitors temperature and adjusts the fan speed accordingly. Testing has confirmed its reliable performance, quick response time, and lower power consumption, making it more efficient than manual fan operation. The system is cost-effective, user-friendly, and suitable for home, office, and industrial applications. Future improvements, such as IoT integration for remote monitoring and control, could enhance its functionality even further. Overall, the project showcases an automated, smart, and energy-efficient cooling solution.

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