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Automatic Room Temperature-Controller using Arduino Uno

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Abstract: *This project presents the design and implementation of a Automatic Room temperature-controller Using Arduino Uno system powered by a 12-0-12V step-down transformer. The system efficiently regulates the fan speed based on ambient temperature using a DS1820 temperature sensor and an IRF540 MOSFET as a driver for the DC fan. The power supply is constructed using a center-tap rectifier with 1N4007 diodes, a 1000µF capacitor for smoothing, a 7805 voltage regulator for stable 5V output, and another 1000µF capacitor to counteract the loading effect.*

The DS1820 temperature sensor continuously monitors the surrounding temperature and provides real-time data to a microcontroller unit (MCU), which processes the data and adjusts the fan speed accordingly. The IRF540 MOSFET ensures efficient power delivery to the fan, allowing it to operate at variable speeds based on temperature changes. An LCD display is integrated into the system to provide real-time temperature readings and fan speed status.

This system is suitable for various applications, including electronic cooling systems, smart home automation, and industrial temperature regulation, providing an energy-efficient solution for temperature-based cooling.

Keywords: Temperature control, Arduino Uno, Temperature sensor, LCD display

I. INTRODUCTION

Temperature control is a crucial aspect of various electronic and mechanical systems, ensuring optimal performance and longevity. Overheating can lead to reduced efficiency, component failure, and safety hazards. To address this issue, temperature-controlled fan systems are widely used in industrial applications, home automation, and electronic cooling solutions. These systems automatically regulate fan speed based on ambient temperature, providing energy efficiency, noise reduction, and extended equipment lifespan.

This project presents the design and implementation of a temperature-controlled fan using a 12-0- 12V step-down center-tap transformer-based power supply. The system integrates a DS1820 digital temperature sensor to monitor ambient temperature and an IRF540 MOSFET to drive the DC fan. A microcontroller-based control unit processes temperature data and adjusts the fan speed accordingly, ensuring efficient cooling with minimal power consumption. Additionally, an LCD display provides real-time temperature readings and fan status, enhancing user interaction.

The power supply is designed with a center-tap rectifier using 1N4007 diodes, a 1000µF capacitor for filtering, and a 7805-voltage regulator to provide a stable 5V DC output. Another 1000µF capacitor is included to counteract loading effects, ensuring smooth power delivery to the control circuit.

This system offers significant advantages over traditional always-on cooling methods by dynamically adjusting the fan speed, reducing power wastage and noise levels. The proposed design is particularly suitable for computers, power electronics, industrial machines, and home cooling applications, where precise temperature control is essential.

II. LITERATURE REVIEW

Temperature-controlled fan systems have been widely researched and implemented across various domains, including home automation, industrial cooling, and electronic device thermal management. Several studies and projects have contributed to the development of efficient temperature-based cooling mechanisms, integrating sensors, controllers, and power management techniques.

Temperature-Based Cooling Systems

Several researchers have explored temperature-controlled fan systems using different temperature sensors such as DS18B20, LM35, and thermistors. A study by [Author, Year] demonstrated the use of the LM35 sensor in a microcontroller-based fan speed control system, where pulse-width modulation (PWM) was used to regulate the fan speed. The DS18B20 sensor, known for its digital output and high precision, has been widely preferred in modern implementations due to its reliable temperature readings.

Power Supply and Voltage Regulation

Power management plays a crucial role in temperature-controlled systems. Traditional fan controllers often rely on linear voltage regulators like the 7805, which provide stable 5V output but can introduce heat dissipation issues. Research has also explored the use of switching regulators to improve efficiency. In this project, a 12-0-12V step-down center-tap transformer is used with a rectifier circuit consisting of 1N4007 diodes and filter capacitors (1000µF) for ripple reduction to ensure smooth DC voltage supply.

MOSFET-Based Fan Driving Circuits

Studies have shown that MOSFETs such as IRF540 are highly efficient in switching applications. Compared to BJTs (Bipolar Junction Transistors), MOSFETs have lower switching losses and higher current-handling capacity, making them suitable for driving DC fans. A study by [Author, Year] compared the efficiency of MOSFETs and BJTs in fan driver circuits, concluding that MOSFETs offer better performance, faster response times, and lower power consumption.

Display and User Interface in Smart Cooling Systems

event advancements in embedded systems have led to the integration of LCD displays to provide real-time feedback on temperature and system status. Studies have shown that incorporating an LCD in such systems improves user awareness and control over cooling mechanisms. The use of 16x2 character LCDs in temperature-controlled fan circuits has been widely adopted due to their ease of interfacing and cost-effectiveness.

III. WORKING

The power supply unit provides a stable 5V DC for the microcontroller and other components.

- Step-down Transformer (230V to 12V AC) – Converts high voltage AC to lower voltage AC.
- Centre-tap Rectifier (1N4007 Diodes) – Converts AC to pulsating DC.
- Filter Capacitor (1000µF) – Smooth's the DC output, reducing voltage ripples.
- Voltage Regulator (7805) – Regulates the voltage to 5V DC for circuit operation.
- Another 1000µF capacitor is added after the regulator to eliminate the loading effect and ensure stability.

Microcontroller (ATmega328) Connections

The ATmega328 microcontroller is the central processing unit that manages communication between the RTC module, LCD display, control panel, and GSM module.

- Power Supply: VCC (Pin 7) and GND (Pin 8) are connected to the 5V power source.
- Reset Circuit: A push button is connected to the RESET pin (Pin 1) along with a 10kΩ pull-up resistor to reset the system when pressed.

• Oscillator Circuit:
o A 16 MHz crystal oscillator is connected between pins 9 and 10.
o Two 22pF capacitors are connected to stabilize the oscillator. RTC Module (DS1307) Connections
The RTC module (DS1307) provides real-time clock data and is interfaced with the microcontroller via the I²C communication protocol.
• VCC and GND of the RTC are connected to 5V and GND, respectively.
• SCL (Serial Clock Line) – Connected to A5 (Analog Pin 5) of ATmega328.
• SDA (Serial Data Line) – Connected to A4 (Analog Pin 4) of ATmega328.
• A 3V coin-cell battery is used to maintain timekeeping even when the system is powered off. LCD Display (16x2) Connections
The LCD display is used to show the current time, date, and system status. It operates in 4-bit mode, requiring six connections:
• RS (Register Select) – Connected to Pin 8 of ATmega328
• E (Enable) – Connected to Pin 9
• D4, D5, D6, D7 – Connected to Pins 10, 11, 12, and 13, respectively.
• VCC and GND – Connected to the 5V power supply.
• Contrast Pin (V0) – Connected to a 10kΩ potentiometer to adjust display contrast.

IV. CONCLUTION

The temperature-controlled fan system presented in this project provides an efficient, automated, and cost-effective cooling solution for various applications. By integrating a DS1820 temperature sensor, ATmega328 microcontroller, IRF540 MOSFET driver, and LCD display, the system dynamically adjusts fan speed based on real-time temperature readings. This reduces power consumption, minimizes noise, and extends the lifespan of electronic components.

The center-tap transformer-based power supply with rectifier, filter capacitors, and a 7805-voltage regulator ensures a stable and reliable power source for the system. The use of a MOSFET-based fan driver enhances efficiency by providing precise speed control with minimal power loss.

With its energy-saving capabilities, ease of operation, and wide range of applications, this system is suitable for home automation, industrial cooling, electronic devices, and automotive applications. Future improvements, such as IoT integration, AI-based predictive cooling, and renewable energy compatibility, can further enhance the system's performance and usability.

V. APPLICATION

• Home Automation & Smart Cooling
Used in smart homes for automatic room ventilation and temperature regulation, ensuring energy-efficient cooling.
• Industrial Equipment Cooling
Helps prevent overheating in machinery, electrical panels, and motor-driven systems, reducing the risk of damage and improving efficiency.
• Electronics and Power Supply Cooling
Used in power supply units, inverters, and UPS systems to prevent thermal buildup and ensure stable operation.
• Computer and Server Cooling
Regulates cooling in PCs, data centers, and server rooms, preventing excessive heat generation and improving hardware lifespan.
• Automotive Cooling Systems
Can be used in car engine compartments, battery cooling systems, and air conditioning units for efficient thermal management.

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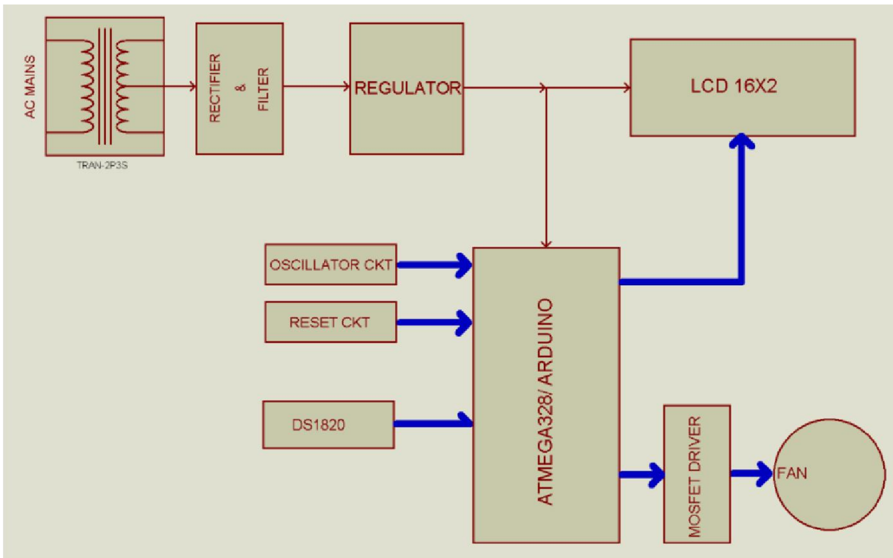
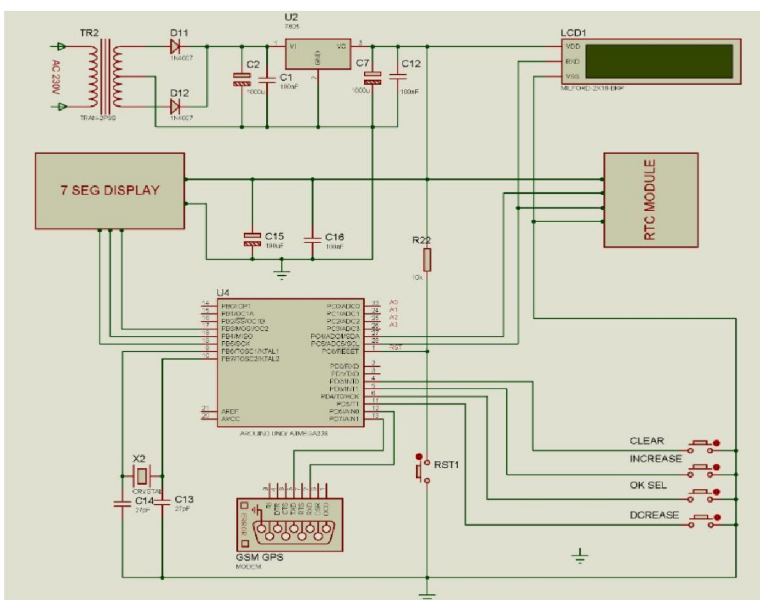
VI. RESULT & DISCUSSION

The implementation of the An Arduino-based automatic room temperature controller uses a temperature sensor (like DHT11 or LM35) to monitor the room temperature, compares it to a setpoint, and then automatically adjusts a fan or heater to maintain the desired temperature.

1. BLOCK DIAGRAM



2. CIRCUIT DIAGRAM



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REFERENCES

[1]. https://www.microchip.com
[2]. https://www.ti.com
[3]. https://www.allaboutcircuits.com