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Automated Temperature Control System by Using Atmega 328 Micro-Controller and DC Fan

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Abstract- The main aim of this project is to design the system by using the micro-controller (ATmega328) and temperature sensor for sensing the room temperature with a small DC fan. The system was designed to maintain the constant and comfortable room temperature by automatically activating the DC fan when the temperature exceeds the normally fixed temperature value and deactivates the DC fan when the temperature value falls below the fixed value. The temperature sensor used here will statically monitors the temperature value of the room. By using the reading data the controller makes the decision either to activate the DC fan or to deactivate the DC fan. This system is the energy saving way that activate the DC fan when only the temperature exceeds the fixed value else the fan will be deactivated. It is one of the best solution for maintaining indoor conditions, minimizing the manual interaction of the user and provide the overall comfort to the user.

Index Terms- Microcontroller; Temperature sensor; activating; deactivating; automation; statically;

I. INTRODUCTION

Temperature controlling is the critical and important issues in many sources. It includes the industries, households and the commercial application. Controlling the temperature leads to the energy saving way. If the temperature was not controlled, it leads to the several economic and social damage.

As the report it was highlighted that during the academic year of 2024, more than 3200 people were dead. As much as 3.2 billion hectares of crops damaged, around 2.3 lakh houses and buildings destroyed and more than 9400 livestock dead all due to the extreme weather events that occurred on 255 of 274 days of the first nine months of this year across India.

As per the fire statistics in India, about over people die everyday in India due to fire. Every year, about 25000 people die due to fires and related causes in India. Women account for about 66% of those killed in fire accidents. Fire accounts for about 6% of total deaths reported due to natural and unnatural causes. Close to 3 lakh people lost their lives in fire accident. The trend in the number of deaths more or less followed the trends in the number of such fire accident cases. For instance, the Indian climate Report 2023 [ICR] reported that 235 of 273 days in the first nine months of 2023, 2932 people were died that year and the weather events damaged cropland of about 684 million hectares. The frequency and impacts of extreme weather events are increasing every year.

The existing of this system involves in the manual temperature monitoring and adjustment of the speed of the operation based on the room temperature. This manual interaction is often not easy and leads to large amount of waste of the energy.

The proposed of this system aims to the automatic operation. The temperature sensor will constantly monitors the temperature of the room. If the temperature raise above the fixed temperature. The sensor automates to on the fun. If the temperature full below the fixed temperature the sensor automate to off the fan.

Here is the small system with a ATmega328 micro - controller thermistor, a DC transformer, temperature sensor are used. These components plays the major role in this system and are used to automatically sense the temperature to on (or) off the DC fan.

This writing provide the clear and detailed discussion of the automation techniques that are used is the automated temperature control system by using AT maga328.

II. LITERATURE REVIEW

[1] Joshua Dada Babatunde et.al (2022) had highlighted that the power supply of the DC fan is used to power the DC Fan and also to charge the battery of the microcontroller. The DC battery was used to power the operation of the temperature-controlled DC fan, this is so that the power will

not destroy the microcontroller. Once the power is on, the temperature sensor senses the temperature of the room and sends it to the microcontroller, the Liquid Crystal Display connected to the microcontroller reads the temperature measured by the temperature sensor's value. The Transistor connected to the microcontroller switches the speed of the fan to its corresponding temperature range. It switches to either high, medium, or low depending on the temperature of the room. As the room temperature increases in the room, the speed of the fan increases, that is, the speed 5 displayed on the Liquid Crystal Display denotes that the room temperature is cold, while the speed 1 (one) on the Liquid Crystal Display denotes that the room temperature is hot, therefore, the higher the temperature, the lower the speed reading on the fan.

Indushan Senavirathna et.al (2023) had lighlighted that the system was tested by varying the temperature of the room and observing the changes in the fan speed. The fan speed increases as the temperature increased and decreased as the temperature decreased. This demonstrated that the system was able to control the speed of the fan based on the temperature variation of the laptop.

Snehashis Das et.al(2024) had highlighted that higher efficiency is indeed achieved using the surrounded system. With a common digitalized platform, these latest instruments will enable increased flexibility in control, operation, and expansion; allow for entrenched intelligence, essentially foster the resilience of the instruments; and eventually benefit the customers with improved services, reliability and increased convenience. This project presents the major features and functions of the various concepts that could be used in this field in detail through various categories. Since this initial work cannot address everything within the proposed framework and vision, more research and development efforts are needed to fully implement the proposedframework through a joint effort of various entities.

[4] Ravi Tega et.al(2024) had highlighted that temperature controlled fan using 8051 microcontroller, in which the fan is automatically turned ON or OFF according to the temperaturethe LM35 temperature sensor will give continuous analog output corresponding to the temperature sensed by it. This analog signal is given to the ADC, which converts the analog values to digital values. If the temperature exceeds more than 50 deg Celsius (as per the code), the microcontroller will turn on the relay to start the fan. If the temperature drops below 40 deg Celsius.

[5] Priyank Sadhu at.al had highlighted that using LM35 series analog temperature sensor. This is a precision integrated circuit, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. It is rated to operate over a -55 degree to degree Celsius temperature range. It has +10.0mV/Celsius linear scale factor. The output of this sensor will be connected to ATMEGA-32 Micro-controller's PORT-A. The inbuilt ADC in ATMEGA is used for converting into Digital format. That will be used by ATMEGA to generate control logic. Then the PWm output fromATMEGA micro-controller is given to variable speed dc motor micro-controller is given to variable speed dc through a motor driver stage.

[6] Tushar H.Kumbalkar et.al (2022) had highlighted that Automated fan speed control is the goal of this project, which is a stand-alone electric fan speed controller. Powering up Arduino UNO, a built- in program checks the current temperature against the specified value. Through the o/p connection, Arduino UNO gets the operation's output on the LCD display.

[7] Rrabin at.al (2024) had highlighted that the fan speed will increase automatically if the temperature will increase. As conclusion, the system which is designed in this work performs very well for any temperature change and can be classified as automatic control.

[8] K.Rajesh Kumar et.al (2024) had highlighted that the Arduino based smart fan system controls the regulation of fan speed based on the temperature of the room and automatic ON/OFF of fan system based on the presence and absence of the human inside the room. Its flexibility and reliable functioning controls the action of regulation without manual operation.

[9] Sivashnmathi et.al(2022) had highlighted that Arduino based temperature control fan is implemented. Thus, here fan speed has been controlled and Arduino board according to the temperature sensed by the help of Temperature sensor (LM35). The idea of the project is to change the fan temperature automatically. The system is working properly. The speed of fan depends on the temperature and there is no need for regulating the fan speed manually again.

[10] BL.Tanmai et.al(2020) had highlighted that Arduino based temperature-controlled fan is implemented. Thus, here fan speed has been controlled by using Pulse Width Modulation and Arduino board according to the temperature sensed by the help of Temperature. PWM technique is found to be the best technique for controlling the fan speed using the sensed temperature. The system is working properly. The speed of fan depends on the temperature and there is no need for regulating the fan speed manually again and again.

III. METHODOLOGY

Thermistor is a resistance thermometer, whose resistance depends on temperature. It is the combination of thermal and resistor. It is the temperature dependent resistors changing resistance with changes in temperature. It is very sensitive.

Here the thermistor is used to indicate whether the temperature is high or low. Thermistor heating indicates that the temperature is higher than the fixed value and the thermistor cooling indicates that the temperature is below the fixed temperature.

The figure given below shows the working of internal and external steps followed in this system.

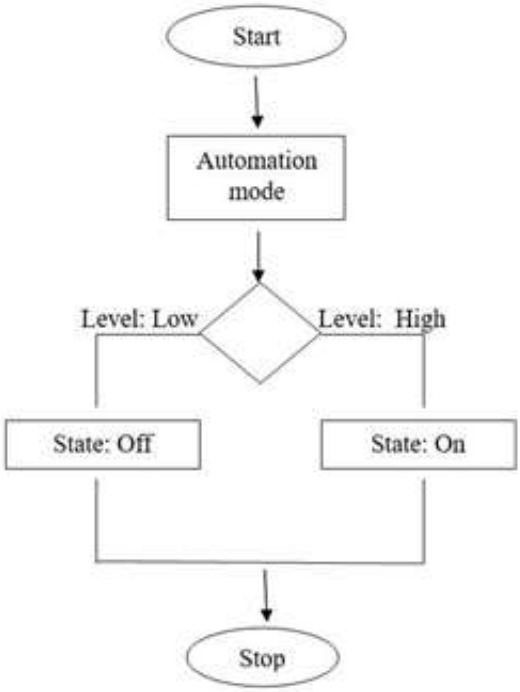

Figure 2: External workflow of the system

First switch on that small mini board micro-controller system. As this is automation mode it checks for the level low or level high. If the level is low the state of the fan will be deactivated else the fan will be activated.

At first evaluate the state of thermistor. The temperature sensor starts sensing the state. If the thermistor is heated the fan will be automated to switch on the fan. If the thermistor is cooled the fan will be automated to off the fan.

Hardware Requirements

- ATmega328
- Temperature sensor LM35 or DHT11
- DC fan
- Single board power supply
- Resistors and Capacitors
- Diodes
- Connecting wires

Software Requirements:

- PC with atleast windows 7 os
- Arduino IDE
- AVR – gcc (Compiler)
- Proteus (Simulation) LANGUAGE USED
- Embedded ‘C’ WORKING

At first switch on the board. The DC transformer is used to step up or step down the transformer. The thermistor is heated or cooled. Heating the thermistor indicates that the temperature value is high. The temperature sensor statically sense the temperature. When the temperature exceeds than the fixed temperature, the temperature sensor considers it as a high temperature and automatically starts the DC fan to rotate at the faster rate. When the temperature falls below than the fixed temperature, the temperature sensor considers it as a low temperature and automatically starts the DC fan to stop rotate at the slower rate.

The steps given below shows how the system works,

Step-1: Switch on the system designed with the DC transformer, DC fan and temperature sensor. Here two light emitting diodes are used to indicate that the system is on. One LED is for single board power supply from DC transformer and one is to indicate that ATmega328 board is in working condition.

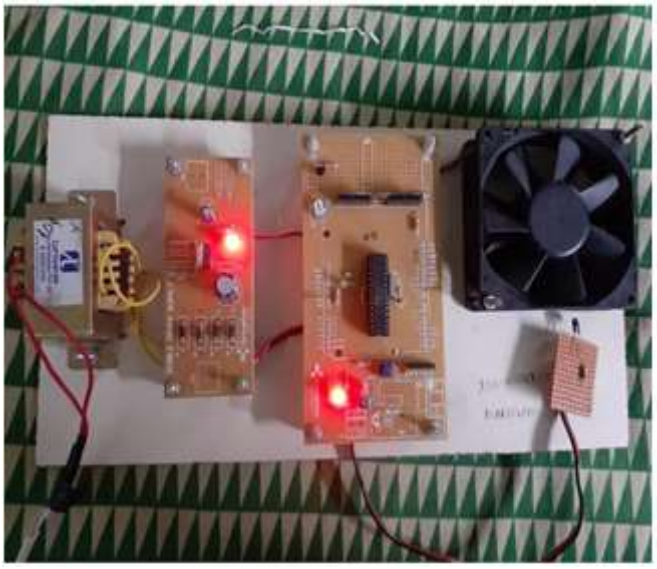

Figure 3: Switching on the board

Step-2: At this step, the thermistor heating indicates that the temperature exceeds the fixed temperature value. When the sensor value = 510 then the temperature data =100. When the temperature exceeds more than 45°c then the temperature sensor considers as the high temperature and automates the DC fan to rotate at the faster rate. The figure given below shows the function of system when temperature raises. Here

the thermistor is heated by using fire to indicate that the temperature is higher (i.e)temperature_value>=45°.

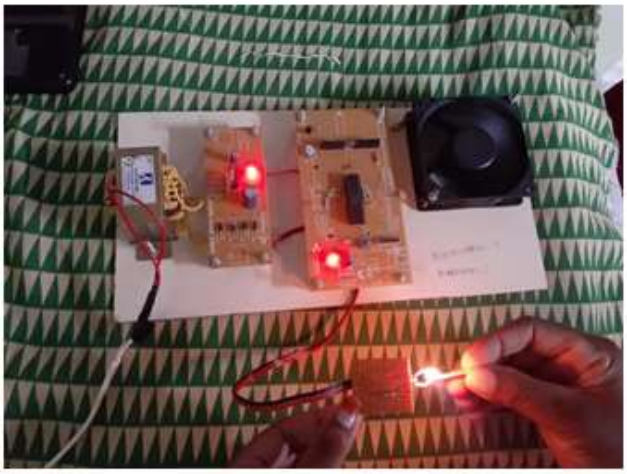

Figure 4: Heating the thermistor

Step 3: At this step, the thermistor cooling indicates that the temperature falls below the fixed temperature value. When the sensor value = 0 then the temperature data =0. When the temperature falls below than 45°c then the temperature sensor considers as the low temperature and automates the DC fan to stop rotating at the slower rate. The figure given below shows the function of system when the temperature falls below the point. Here the thermistor is cooled by using ice cubes or ice water to indicate that the temperature is higher(temperature_value < = 45 °).

Figure 5: Cooling the thermistor

IV. MODEL ANALYSIS

Atmega328 is commonly used as the Arduino ATmega which was developed by microchip technology. It is well known for its versatility, reliability and easy to use cases. It helps in making the preferred choice. These systems are RISC architecture which is straight forwarding instruction sets, which separates data memory and instruction. It allows the simultaneous access to both the data and instruction. This system reduces the coding risk and are easy to learn and use.
The Arduino IDE is used as the coding platform which is used to control the working of ATmega328 board. The IDE should be installed in the PC or Computer to control the performance and the working. The USB connector is used to transfer the code from IDE to the board and it acts like a bridge.

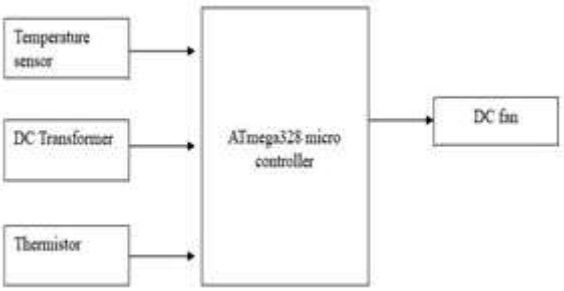

Figure 6: Model analysis diagram

Thermistor is a resistance thermometer, whose resistance depends on temperature. It is the combination of thermal and resistor. It is the temperature dependent resistors changing resistance with changes in temperature. It is very sensitive.

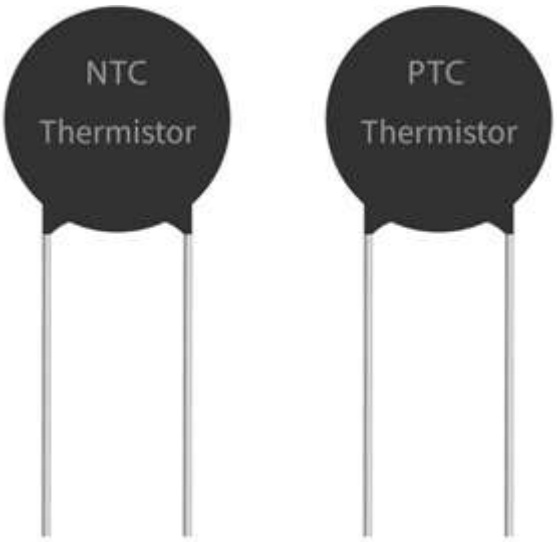

Figure 7: Thermistor

The primary function of the DC fan is to dissipate the heat generated by the components inside the DC units.

DC units can generate heat during the operations and efficient cooling is essential to maintain their proper functioning and prevent overheating.

Figure 8: DC fan

Temperature sensors are precise, extremely reliable and have low cost. Temperature sensors are suitable for both embedded and surface application. They provide low thermal mass resulting in a fast response time.

Figure 9: Temperature sensor LM35

The DC transformer is used to step up or step down the transformer. The thermistor is heated or cooled.

Figure 10: DC transformer

V. RESULT AND DISCUSSION

As the result to develop an automated system that maintain optional room temperature by using an ATmaga microcontroller to automate the DC fan motor based on real time data from the temperature was one of the best energy saving efficiency and provide the indoor comfort by automatic regulation fan operation.

Thus based on the temperature reading the controller makes real-time decisions to switch off or on ensuring efficiency and effective temperature this system also minimizes the need for manual intervention and enhance overall comfort.

VI. CONCLUSION

In the conclusion the automated temperature control system by using ATmaga328 microcontroller and DC fan provides the greater advancement in the indoor and outdoor climate management system automated and regularly monitor the indoor temperature.

The main advantage of the ATmega328 microcontroller is known for its versality and case of usage a by statically monitoring the room temperature which helps in the activating of the DC fan when high temperature thus this system minimizes the energy optimization and unnecessary wastage of the energy. Thus this system using ATmaga328 microcontroller and DC fan provides the efficient solution for the indoor environment and steps towards enhancing the quality of the and space for living and working.

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