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Smart Room Temperature Controller Atmega

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Abstract: *This paper presents designing and implementing an Automatic room temperature control system using the Arduino and DHT11 sensor. The fan speed control system has also been proposed. Here, the user sets the minimum and the maximum reference temperature range from the keypad. The DHT11 sensor senses the surrounding room temperature and gives the result in degrees Celsius. Both the reference and the measured values are displayed on the Liquid Crystal Display (LCD). The Arduino microcontroller, being the processing unit of the system, gets the sensor's measured value and compares it with the set threshold. The results are: when the measured room temperature is less than the minimum of the threshold value; then, the microcontroller turns on the heater. If the measured room temperature is greater than the maximum threshold value, then the fan triggered on. The speed of the fan will be controlled by the pulse width modulation (PWM) technique based upon the temperature difference between the sensor reading and the maximum threshold*

Keywords: Arduino Uno, DHT11(temperature and humidity) sensor, Keypad, Microcontroller, LCD (Liquid Crystal Display), Pulse width modulation (PWM).

I. INTRODUCTION

With the gradual advancement of technology, automation has become part of human life. In this regard, modern technologies have brought several innovations that automatically implement a particular task. Among these discoveries, microcontroller plays a vital role in the smart system of the electronic world. A microcontroller is a control system on a single chip that makes possible for the automation of the designed system and control process and produces precise results. Among all places occupied by a human being, a home is the most important and needs to be maintained in the proper temperature. Nowadays, keeping living and working places at a conducive temperature is not only crucial to be healthy and productive, but also maintaining the room at average temperature helps to prevent spoiling of foods, medicine, and other goods in the room. Commonly, people use the manually controlled system, air-condition (AC), to regulate the temperature in their living environment. However, this manually operated system has notable limitations. The drawback is that if the user forgets to switch on or adjust the AC when the temperature becomes abnormal, children, disabled persons, and perishable items could be affected. The other problem with the mechanical AC system is, sometimes even if the air condition (AC) is still working, it is difficult to maintain the room temperature. Furthermore, if not appropriately managed, it may result in unnecessary expense and power usage. In general, its operations always require the user to turn it on and off regardless of the room temperature condition. Therefore, to address these drawbacks, the Automatic Room Temperature Control System is proposed. An automatic room temperature control system is a self-automated temperature control system that can control the speed of the fan depending on the current room temperature. It comprised of a control unit (MCU), temperature sensor (DHT11), heater, fan, and keypad (3x4) to monitor the room temperature. According to the value of the ambient temperature, the microcontroller compares sensor temperature reading with a set value. Then the microcontroller makes a decision in accordance. This system's main advantages are easy to use, less energy usage, economical, more convenient to control temperature, and user-friendly.

II. PROPOSED SYSTEM

The proposed system is an automatic self-regulating system that use the fan speed control system, the heater and the keypad to automatically monitor the room temperature depending on the current room temperature and the predefined

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reference temperatures. Arduino is used for the central controlling system. The keypad is used to input the reference temperature ranges. Every time the users need to change (set) his /her own desired range of temperature, they use the keypad device to set the ranges of temperature values. In this case, the user can set his / her own desired reference temperature anytime. The sensor senses the temperature and sends it to the Arduino microcontroller. Afterwards, the microcontroller compares the sensor read value with the set point, then automatically makes a decision. If the temperature is below the minimum of the reference room temperature, then the heater automatically turned on to warm up the room until the temperature gets back to the desired value and then turned off. If the room temperature is larger than the maximum of the desired room temperature, then the microcontroller automatically triggered on the fan to cool the room until it returns to the desired value and then turned off. The fan's speed is controlled and changed based upon the current temperature and the maximum of the reference temperature. Fig.1 demonstrates the block diagram of the proposed automatic room temperature control system. The Arduino Uno being the heart of this system, accessed the inputs signal from the DHT11 sensor's serial data (output) pin. The analogue-digital converter (ADC) converts the accessed information into an equivalent digital value and execute them one by one. Additionally, the microcontroller allows the relay switch to control and monitor the heater and fan's operation. In this project, we proposed the fan speed control system as well. Pulse width modulation techniques (PWM) is introduced to control the speed of the fan. In this case, the pulse width modulation (PWM) will significantly control the power supplied to the fan. The status of the speed of the fan is divided into zero speed, slow speed, medium speed, fast speed, and very-fast speed. The relay switches keep both the fan and the heaters from damage due to overcurrent. Both the fan and the heater used an external power supply of 12V battery while Arduino used a maximum input voltage of 5V. The signal from the microcontroller passed through a network of transistors (BC108 NPN bipolar junction transistor). The base is connected to a resistor. Both the collector and the emitter are connected to diode, relay switch and ground in series. Fig.1 below shows the block diagram of the proposed system of this paper.

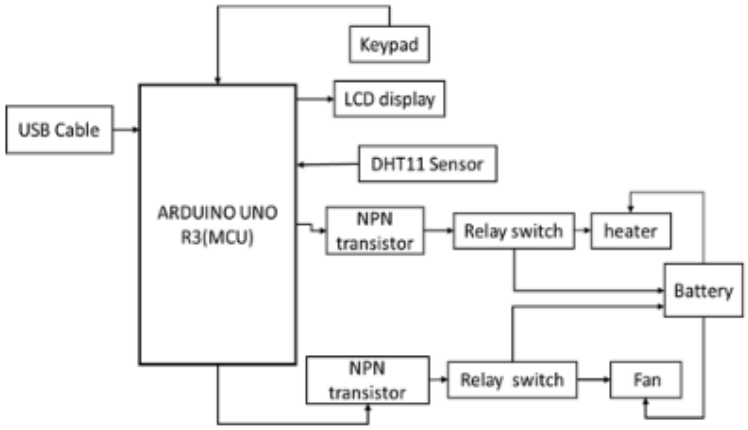

Figure 1- Block diagram of the proposed system

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III. FLOWCHART

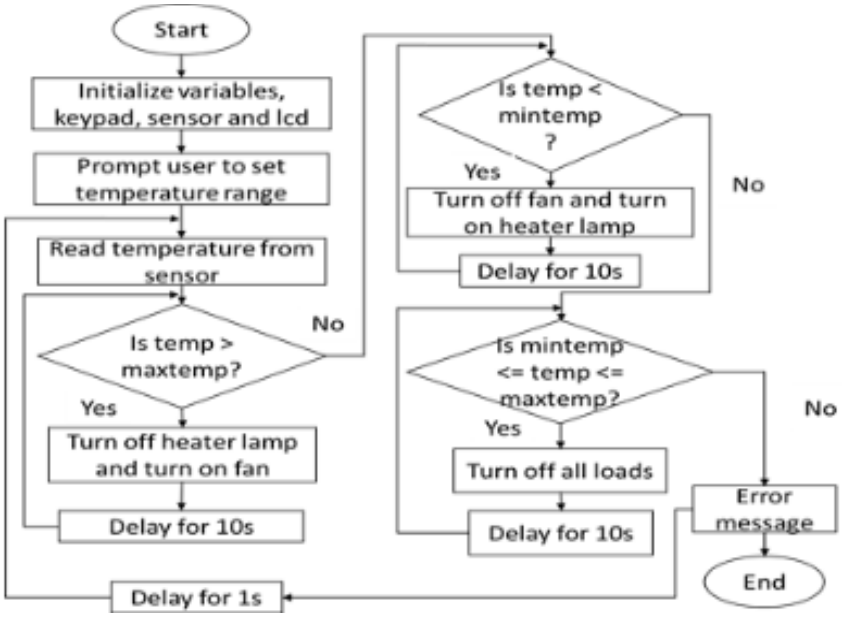

Figure 2-The flowchart shows how the entire system works

IV. TEMPERATURE CONTROLLER ATMEGA

The microcontroller measures the temperature from the Digital Integrated Circuit (DIC) DHT11 sensor, which senses the humidity and temperature from the surrounding. This sensor can measure a temperature ranges from 0 °C to 50 °C and humidity range from 20% to 90% with an accuracy of ±1 °C and ±1%. It works within operating voltages of 3.5V to 5.5V and operating currents of up to 0.3mA. The DHT11 sensor module gives the measured value of the temperature in degree Celsius.

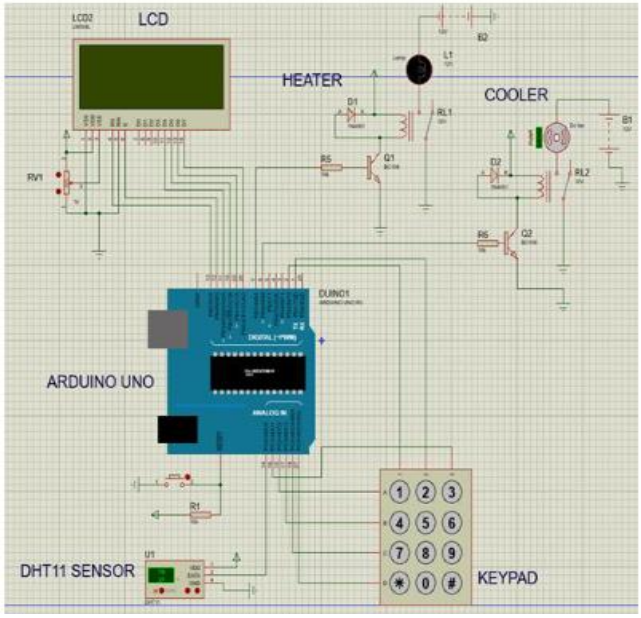

Figure 3- Schematic diagram of the proposed system simulated by proteus

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When a room temperature increased by one-degree Celsius, the sensor generates a voltage of 10mV. Fig.2 demonstrates the schematic diagram of the proposed system simulated by proteus software. For the cooling purpose, we connected the battery and the dc fan, relay switch, an NPN transistor in series and the base of the NPN transistor connected to a 10 KΩ resistor and Pin 6 of Arduino. Meanwhile, Pin 2 of DHT11 connected to Pin 14 of the Arduino, while Pin 4 and Pin 1 are connected to GND and +5V power, respectively. However, Pin 3 has no connection (NC). The relay switches are used to control the power transmitted to the dc fan and the heater (lamp). The Liquid Crystal Display (LCD) was connected to the pin (13,12,11,10,22,20) of Arduino to display the data feed into the microcontroller and the output information. The value of the DHT11 sensor reading is displayed on the LCD screen every second. The potentiometer measures the voltage used by LCD. It has three connected pins, in which Pin1 connected to the ground, Pin 2 connected to 5V power, and Pin 3 connected to Pin 3 (V_{EE}) of LCD.

V. COMPONENTS USED

The proposed system was composed of several circuit components. Table 1 below shows the name of the components and its specification.

Name of Components	Description
Rectifier diode	1N4001
Resistors	10 KΩ
Relay switch	Two relay switches
Arduino	Arduino Uno R3
Humidity and Temperature sensor	DHT11 sensor
Transistor	BC108
Fan	DC fan
Heater	heater lamp
Keypad	3x4 Keypad
LCD	LM044L (20x4) LCD
Battery	12 volts battery
Potentiometer	POT-HG potentiometers

Table 1- The components and specification of materials used

VI RESULT AND DISCUSSION

The system has been tested by setting up hardware components and using the Arduino program to execute the decoded instructions. Firstly, when turned on the system, then it prompts the user to the input reference temperature, as shown in Fig.5.

Figure 4- The hardware implementation of the proposed model

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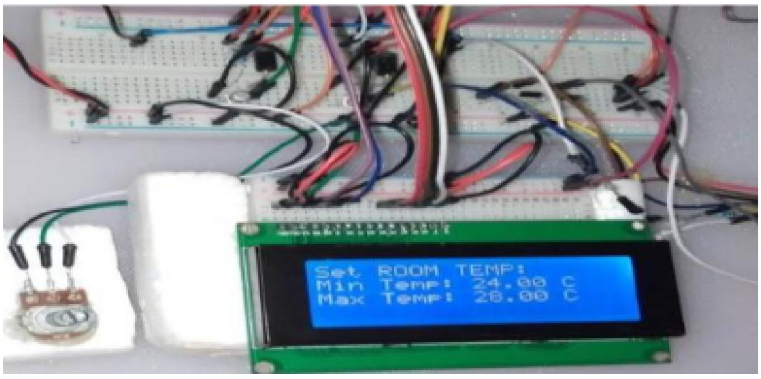

Figure 5- (a)

Figure 5- (b)

Then the user has set the minimum, and maximum reference temperature ranges as in Fig.5 (a). Fig.5 (a) The user entered the minimum and the maximum reference temperature 24 and 28 °C, respectively, (b) the sensor reads the current room temperature 28.3 °C. Fig.5 (b) sows that the sensor reads the current room temperature value of 28.30 °C. Here, the measured value of room temperature is higher than the maximum of the set-point, so the fan is turned on, and the heater kept off until the condition changes. This system is helpful for disabled persons and infants. It is applicable in areas such as manufacturing industry, computer server room, classroom, conference room, automobile to adjust the temperature automatically. This system's disadvantage is that it depends on the microcontroller, DHT11 sensor, heater, fan, and keypad to control and monitor the room temperature. If any of them got damaged, this system is interrupted. So, it is dependent on individual preferences. For this system to function correctly, we should make sure that the fundamental components are connected correctly and work properly.

VII. CONCLUSION

In this paper, an automatic room temperature control system using Arduino and DHT11 sensor has been designed and constructed. The system used an Arduino microcontroller, keypad and DHT11 sensor to control and monitor both the heater and the fan simultaneously. The DC fan is on when the room temperature is higher than the reference temperature, and its speed is controlled based upon the room temperature. When the room temperature is lower than the minimum of the reference temperature, then the heater lamp is turned on while the DC fan triggered off. When the room temperature is within the reference range, all the loads are automatically off. The main advantages of this system are for its low cost, ease of installation, simplicity, low power consumption, small size, and user-friendly. This project efficiently optimizes energy consumption in a room while keeping the room at a comfortable temperature.

REFERENCES

[1] Dilruba Yamin, Automatic Room Temperature Controlled Fan Speed Controller Using PT100, International Journal of Scientific and Engineering Research, Volume 6, Issue 8, August 2015.
[2] M. Kumaran, I. Vikram, S. Kishore Kumar, R. Rajesh Kumar, S. Lokesh, Design of An Automatic Fan Speed Controlling System Using Arduino UNO. International Journal of Intellectual Advancements and Research in Engineering Computations, Volume-6 Issue-2, 2018 [2039-2042].
[3] Joseph Chuma, Design and Simulation of an Automatic Room Heater Control System, Botswana International University of Science and Technology, 2018.
[4] Siddika, S. F. Nasrin, Design, and Arduino-based Automatic Fan Control System Using PIR Sensor and LM35 Sensor. GSJ: Volume 6, Issue 8, August 2018.
[5] M. M. San, C. K. Win & K. Z. Mon, Design and Simulation of Fan Speed Control using Arduino UNO and LM35DZ, International Journal of Engineering Research and Advanced Technology (IJERAT), (E-ISSN: 2454-6135) Volume.6, Issue 6 June -2020.
[6] Suraj Kaushik, Automatic Fan Speed Control using Temperature and Humidity Sensor and Arduino, International Journal of Advance Research Ideas and Innovations in Technology Volume 2, Issue 8, 2018.
[7] Components101, January 5, 2018, DHT11 – Temperature and Humidity sensor, Available: [8] Dilruba Yamin, Automatic Room Temperature Controlled Fan Speed Controller Using PT100, International Journal of Scientific and Engineering Research, Volume 6, Issue 8, August 2015.
[9] M. Kumaran, I. Vikram, S. Kishore Kumar, R. Rajesh Kumar, S. Lokesh, Design of An Automatic Fan Speed Controlling System Using Arduino UNO. International Journal of Intellectual Advancements and Research in Engineering Computations, Volume-6 Issue-2, 2018
[2039-2042].
[10] Joseph Chuma, Design and Simulation of an Automatic Room Heater Control System, Botswana International University of Science and Technology, 2018.
[11] Siddika, S. F. Nasrin, Design, and Arduino-based Automatic Fan Control System Using PIR Sensor and LM35 Sensor. GSJ: Volume 6, Issue 8, August 2018.
[12] M. M. San, C. K. Win & K. Z. Mon, Design and Simulation of Fan Speed Control using Arduino UNO and LM35DZ, International Journal of Engineering Research and Advanced Technology (IJERAT), (E- ISSN: 2454-6135) Volume.6, Issue 6 June -2020.
[13] Suraj Kaushik, Automatic Fan Speed Control using Temperature and Humidity Sensor and Arduino, International Journal of Advance Research Ideas and Innovations in Technology Volume 2, Issue 8, 2018.