Report
of
Automated Room Temperature Controller

SUBMITTED BY:

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Submission Date: November 6, 2023

1. Project Name: Automated Room Temperature Controller.

2. Project Description

An IoT-based “Automated room temperature controller” is a system that uses the Internet of Things (IoT) to automatically control the temperature of a room. The system consists of a temperature sensor, a microcontroller, and an actuator. The temperature sensor measures the current temperature of the room and sends the data to the microcontroller. The microcontroller then compares the current temperature to the desired temperature and activates the actuator accordingly. The actuator can be a heater, a fan, or a combination of both. The IoT connectivity allows the system to be monitored and controlled remotely. The system can also be programmed to send alerts to users if the temperature goes outside of a predefined range. The project maintains the temperature of a room in [20, 25] degree Celsius.

3. Figure

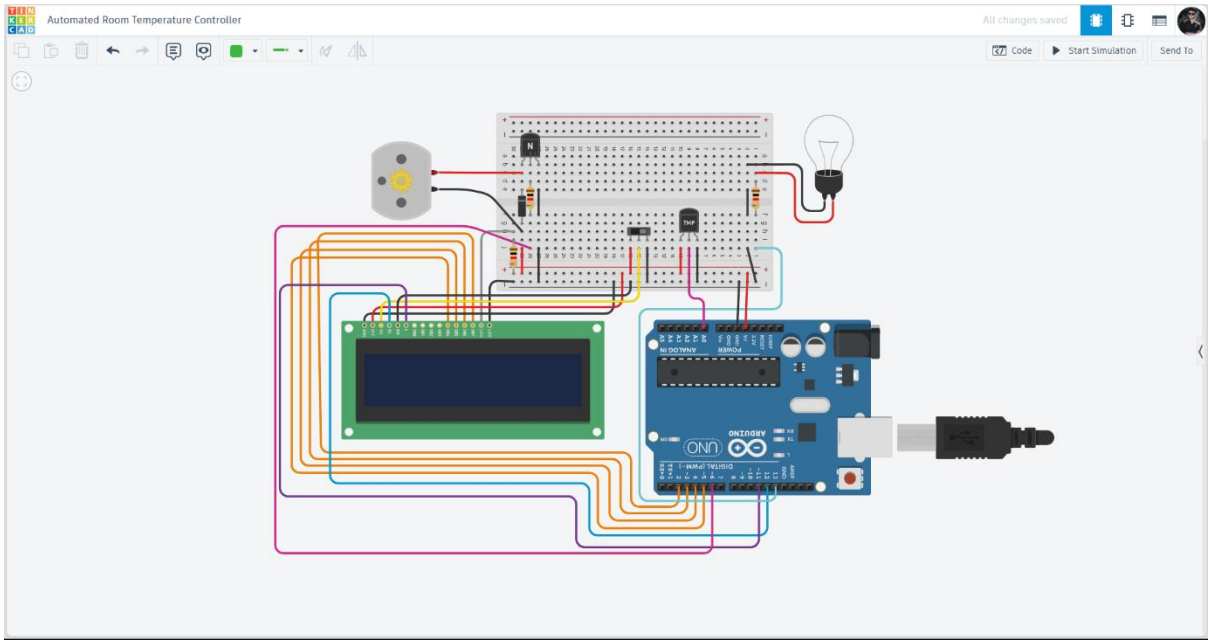

Figure 3.1 Automated Room Temperature Controller

4. Figure Description

The digital screen, breadboard, DC motor as fan, Arduino Uno, resistor, light bulb, temperature sensor TMP36, slide switch, diode, and NPN transistor are all important components of the automated room temperature controller. These components work together to measure the temperature of the room, adjust the desired temperature, and control the fan to maintain the desired temperature.

Digital Screen

A digital screen, also known as a liquid crystal display (LCD), is a type of display that uses liquid crystals to produce images. LCDs are very common in electronic devices, such as televisions, computers, and smartphones. The digital screen in the automated room temperature controller is used to display the current temperature and the desired temperature. It also allows users to adjust the desired temperature.

Breadboard

A breadboard is a prototyping tool that allows users to quickly and easily build circuits without having to solder any components together. Breadboards have rows of holes that are connected to each other electrically. Components can be plugged into the holes to create a circuit. The breadboard in the automated room temperature controller is used to connect the Arduino Uno, the display, and the motor.

DC Motor

A DC motor is a type of motor that runs on direct current. DC motors are very common in a variety of applications, such as electric fans, power tools, and robots. The DC motor in the automated room temperature controller is used to power a fan. The fan is used to circulate the air in the room and help to control the temperature.

Arduino Uno

The Arduino Uno is a microcontroller board that is based on the ATmega328P microcontroller. The Arduino Uno is a popular choice for hobbyists and makers because it is easy to use and relatively inexpensive. The Arduino Uno in the automated room

temperature controller is used to control the display, the motor, and the temperature sensor.

Resistor

A resistor is a component that opposes the flow of current. Resistors are used in a variety of electronic circuits, such as voltage dividers and current limiters. The resistor in the automated room temperature controller is used to protect the Arduino Uno from the current drawn by the motor.

Light Bulb

A light bulb is a device that produces light. Light bulbs are used in a variety of applications, such as lighting homes and offices. The light bulb in the automated room temperature controller is used to indicate whether the heater is turned on or off.

Temperature Sensor

The TMP36 is a temperature sensor that outputs a voltage that is proportional to the temperature. The TMP36 is a popular choice for temperature measurement because it is accurate and easy to use. The TMP36 temperature sensor in the automated room temperature controller is used to measure the temperature of the room.

Slide switch

A slide switch is a type of electrical switch that is actuated by moving a slider back and forth. Slide switches are commonly used in electronic devices to control power, select modes, or adjust settings. In an automated room temperature controller, a slide switch can be used to on and off the LCD display.

Diode

A diode is a semiconductor device that allows current to flow in one direction only. Diodes are used in a variety of electronic circuits, such as rectifiers and voltage regulators. The diode in the automated room temperature controller is used to prevent the motor from back-feeding voltage into the Arduino Uno.

NPN Transistor

An NPN transistor is a type of transistor that can be used to amplify or switch current. NPN transistors are used in a variety of electronic circuits, such as motor drivers and LED drivers. The NPN transistor in the automated room temperature controller is used to amplify the current from the Arduino Uno so that it can drive the motor.

Wire

Wire is used to connect the components in the automated room temperature controller together. Wire is made of a conductive material, such as copper or aluminum. The wire in the automated room temperature controller is used to connect the Arduino Uno, the display, the motor, and the temperature sensor together.

5. Features

The tinkercad circuitry is accessed one can execute the code by pressing on the button named "Start Simulation". Then while it's running, whenever the temperature is within the desired range, the LCD tells that the temperature is normal. Thus, it asks to turn off everything. The default slider position is within the desired room temperature range which is by default 24.78 °C. Figure 5.1 shows the initial room temperature.

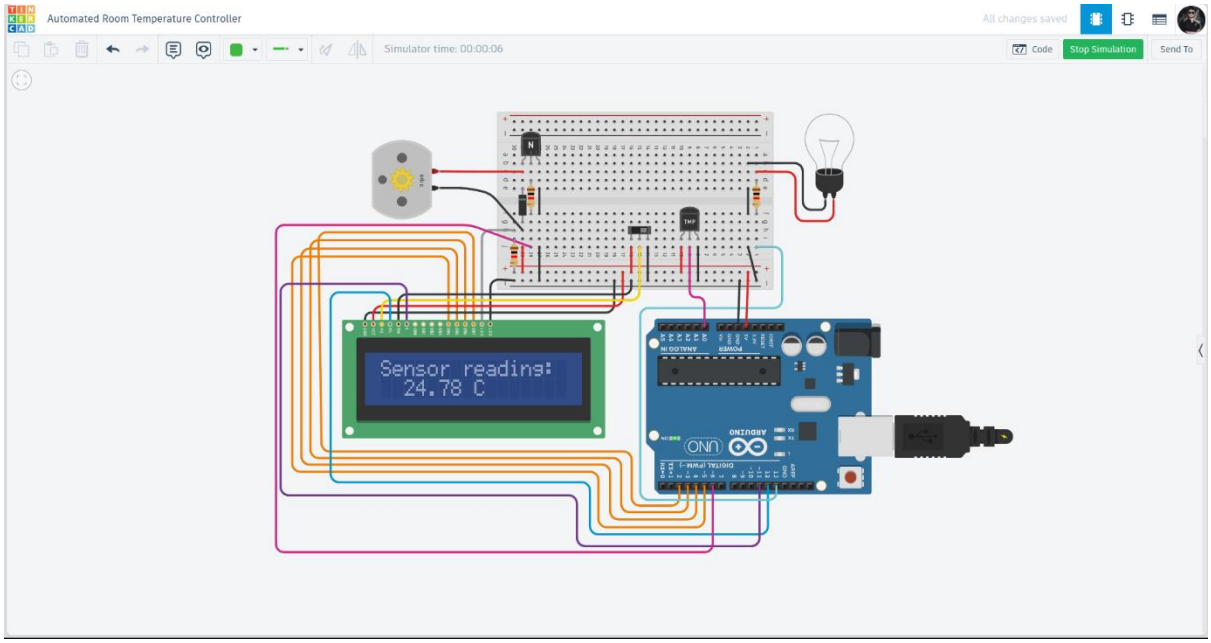

Figure 5.1 The initial room temperature

When the temperature exceeds the maximum of the "desired" range, then the LCD displays that the temperature is higher and informs the FAN to turn on. Then the FAN starts its rotation/vibration, and after a while the temperature gets lowered falling in the range, then the LCD commands the FAN to turn off. Figure 5.2 and 5.3 shows when the temperature is high, LCD tells temperature is higher and turn on FAN.

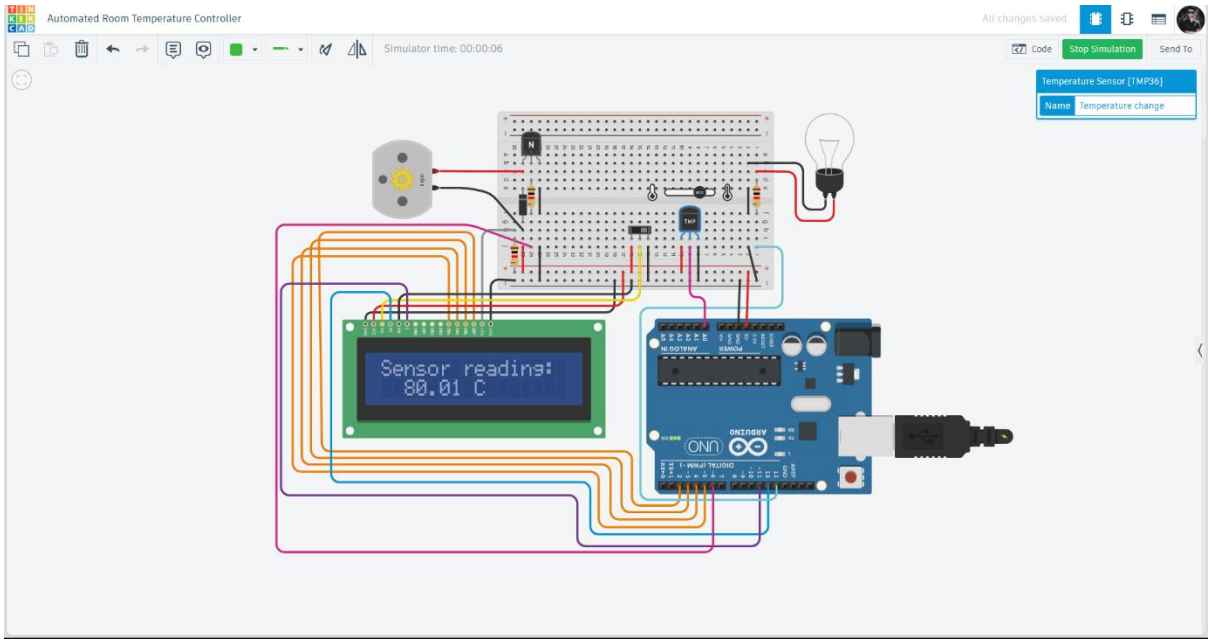

Figure 5.2 Reading High Temperature

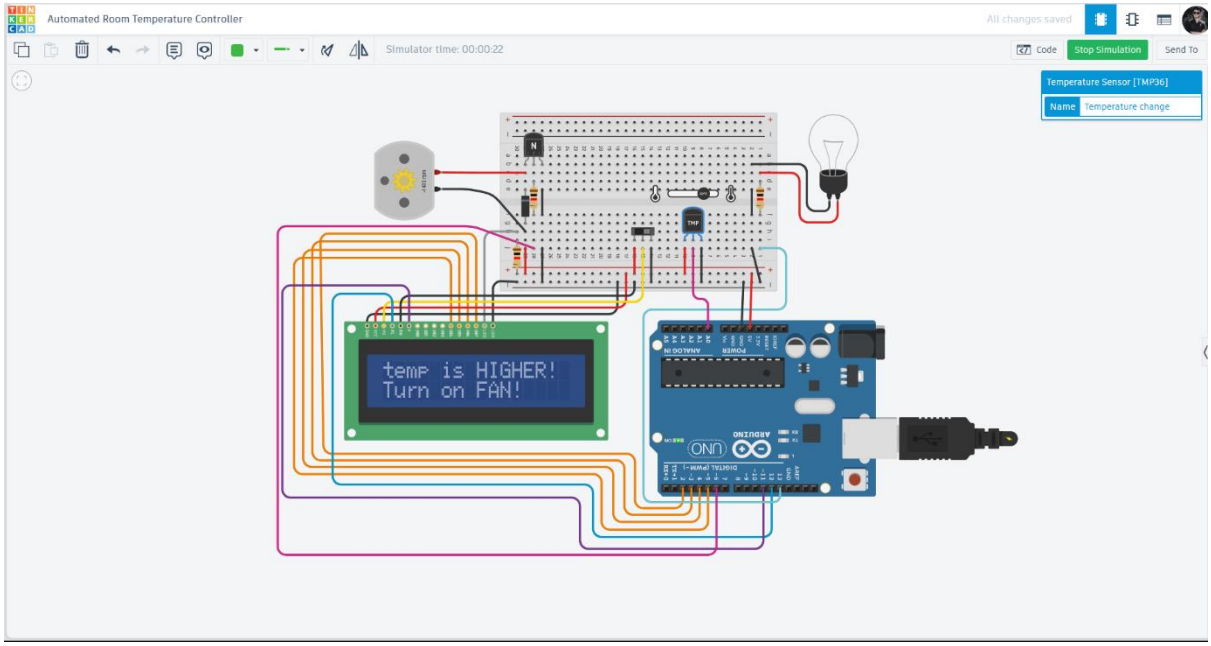

Figure 5.3 Turning Fan ON for Higher Temperature

Whenever the sensor's temperature reading goes down below the possible minimum temperature in the range, the LCD notifies that the temperature is LOWER and tells the heater to be turned on, and after the temperature is in the range, it displays that temperature is OK and orders the heater to be switched off. Figure 5.4 and 5.5 shows when temperature is lower than range and LCD tells turning on heater for lower temperature.

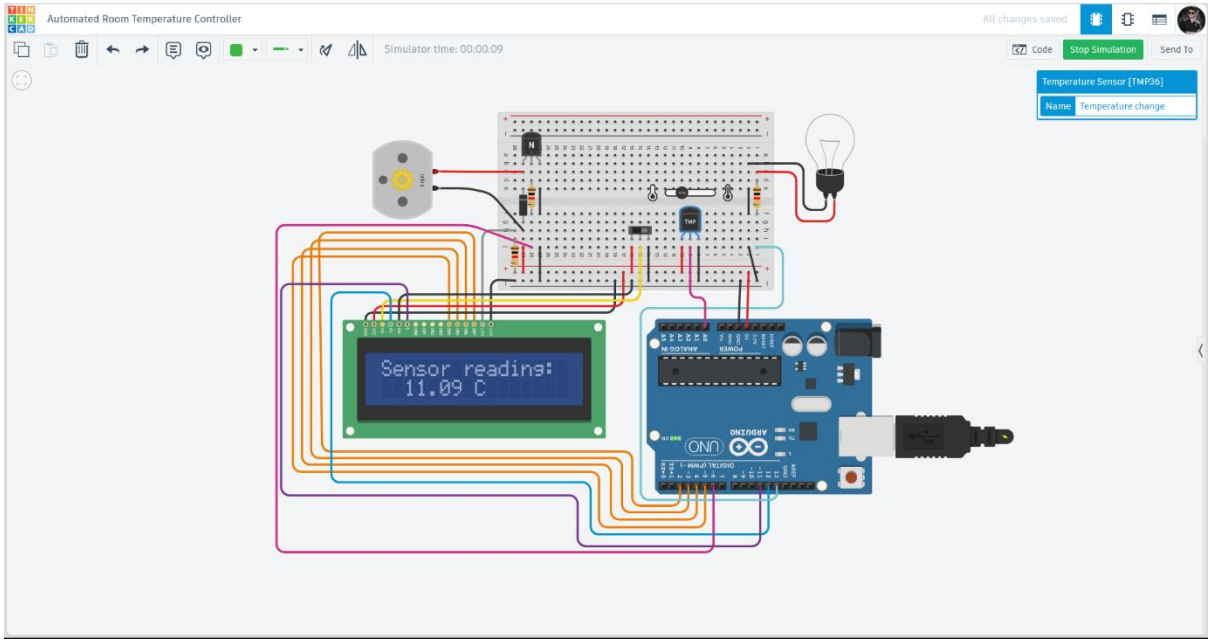

Figure 5.4 Reading Lower Temperature

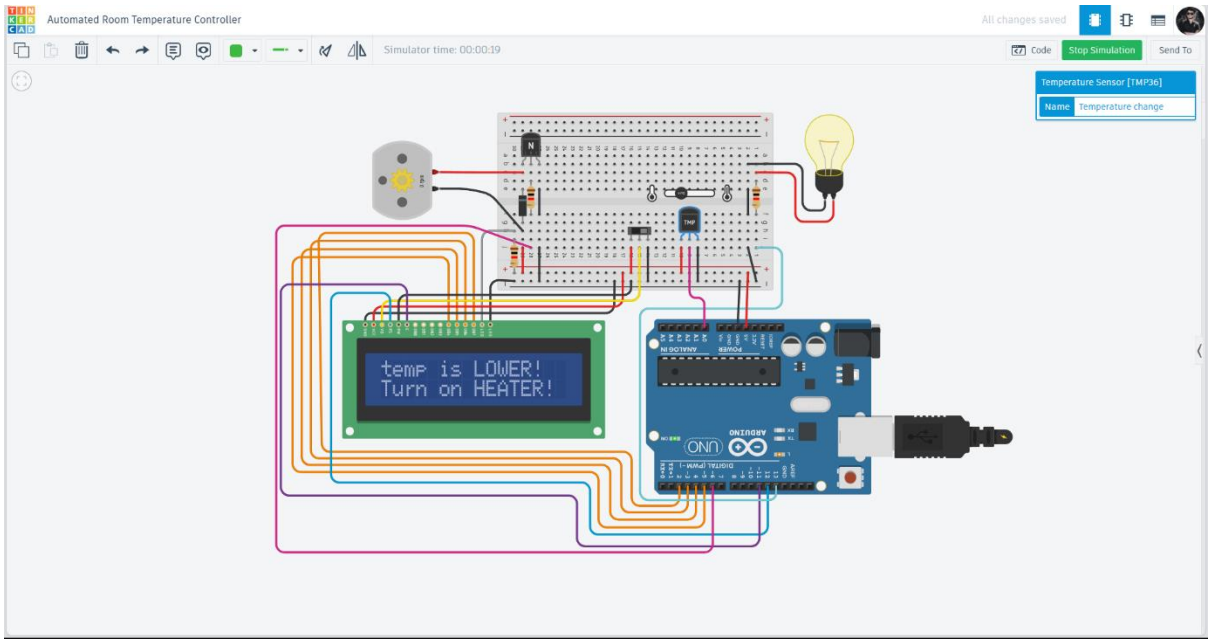

Figure 5.5 Turning on Heater for lower temperature

6. Simulation Code

```
// Declare/assign Arduino IO-pins
const int temp_trans_pin = A0, Heater_pin = 13, FAN_pin = 6;
/*FAN_pin: here I used DC motor instead of FAN because I couldn't find the symbol for it.
Similarly,for the Heater (Heater_pin), I used LED.*/

// Set the range of the desired temperature
  float MinTemp = 20, MaxTemp = 25;/*Room temperature is [20,25] degree C */

// Include the LCD library code
 #include <LiquidCrystal.h>

// Initialize the library with the numbers of the interface pins
 LiquidCrystal LCD(12, 11, 5, 4, 3, 2);

 void setup() {

 // System initialization
   LCD.begin(16, 2);
   pinMode(Heater_pin, OUTPUT);//LED in this case
   pinMode(FAN_pin, OUTPUT);

 // Display the desired range of temperature
   LCD.print("Room temp(C):");
   LCD.setCursor(2,1);
   LCD.print(MinTemp); LCD.print("-");LCD.print(MaxTemp);

   delay(2000);
}

void loop() {
  float Eqv_volt, SensorTemp;

// Read voltage and convert to temperature (Celsius)
  Eqv_volt = analogRead(temp_trans_pin) * 5.0 / 1023;
  SensorTemp = 100.0 * Eqv_volt-50.0;

 // Display the sensor reading
   LCD.clear();
   LCD.print("Sensor reading:");
   LCD.setCursor(2,1);
   LCD.print(SensorTemp); LCD.print(" C");

   delay(2000);

//Compare the sensor reading with the range of acceptable temperatures
 if(SensorTemp > MaxTemp){
    LCD.clear();
```

```
    LCD.print("temp is HIGHER!");    //higher than the max

    //Turn on FAN (dc motor)! to regulate the temp. Increase FAN speed at a slow rate
    LCD.setCursor(0, 1);LCD.print("Turn on FAN!");
    for( int i = 0; i <= 255; i++ ) {
     analogWrite(FAN_pin, i);
    }
    delay(2000);

    LCD.clear();
    LCD.print("Now temp is OK!");
    LCD.setCursor(0, 1);
    LCD.print("Turn off FAN!");

  // Turn off FAN slowly
    for( int i = 255; i >= 0; i-- ) {
     analogWrite(FAN_pin, i);
    }
     delay(2000);
    }
  else if(SensorTemp < MinTemp){
    LCD.clear();
    LCD.print("temp is LOWER!");     //Less than the mini
    LCD.setCursor(0, 1);
    LCD.print("Turn on HEATER!");

    //Turn the heater ON, LED in my case
    digitalWrite(Heater_pin, HIGH);

    delay(3000);

    LCD.clear();
    LCD.print("Now temp is OK!");
    LCD.setCursor(0, 1);
    LCD.print("Turn off HEATER!");

    delay(1000);

    digitalWrite(Heater_pin, LOW);
    LCD.clear();
    }
  else if(SensorTemp > MinTemp && SensorTemp < MaxTemp){
 //Now temperature is perfect. That is,it is in the desired range. Hence no need of changes!!
    LCD.clear();
    LCD.print("Temp is NORMAL!");LCD.setCursor(2,1);
    LCD.print("Turn off all!");

    delay(1000);
    LCD.clear();
  }
```

```
else {
   LCD.clear();
   LCD.print("Something went");
   LCD.setCursor(2,1); LCD.print("WRONG in the ckt");
   delay(1000);
   LCD.clear();
  }
  delay(1000);
 }
```

7. Learning

Understanding the switching operation of transistors: Transistors are semiconductor devices that can be used to switch current on or off. In this project, transistors are used to control the fan and heater.

Unidirectional current flow in diodes: Diodes are semiconductor devices that allow current to flow in one direction only. In this project, diodes are used to prevent the fan and heater from back-feeding voltage into the Arduino Uno.

The principle of operation of motors: Motors are devices that convert electrical energy into mechanical energy. In this project, a motor is used to power the fan.

The resistance from resistors combined with the transformation capability of the transducer: Resistors are components that oppose the flow of current. Temperature sensors are transducers that convert temperature into an electrical signal. In this project, resistors are used to protect the Arduino Uno from the current drawn by the fan and heater. Temperature sensors are used to measure the temperature of the room.

8. Conclusion

This project is a great leaning experience with great success. I have successfully designed and implemented an automated room temperature controller using an Arduino Uno, a temperature sensor, and a fan and heater. The system is able to maintain the temperature of a room within a desired range, even when the outside temperature changes. I am particularly pleased with the simplicity and cost-effectiveness of the system. By automatically controlling the temperature of homes and offices, the system can help to improve comfort, reduce energy consumption, and save money.