Design process of room temperature monitor

Your Name

BU ID: Your BU ID

1 Summary

2 Introduction

Maintaining a stable indoor temperature is key to both comfort and energy efficiency. Commercial thermostats can be costly and rigid, so this project explores a low-cost, modular alternative. We build a room temperature monitor using a TMP36 sensor, a 16×2 I^2C LCD, and an Arduino Uno, powered by a 9 V battery, with green and red LEDs (with 1 kΩ and 220 Ω resistors) and a buzzer for status indication.

The aims are to mimic basic thermostat functions using components we explored during the semeter and to gain hands-on experience in electronics assembly, firmware development, and CAD design. We modeled and fabricated a enclosure, lid, battery holder, and base plate in CAD (OnShape), wiring everything with 22 AWG and female-to-female jumper cables for the I^2C monitor.

This report details the component selection, mechanical design, circuit assembly, and code implementation, and evaluates the system's performance in achieving the design objectives.

3 Design elements

Explain your design decisions. Address each of the following:

1. **List all components used in your design** electronic components, hardware, etc.
2. **Precision measurements** Make a table of relevant dimensions (see example below).

Table 1: Relevant dimensions of all components

Item	Sketch identification	W [mm]	L [mm]	H [mm]	Diameter [mm]
ABS enclosure					
Arduino Board					
Switch					
LCD 2X16					
Buzzer					
Temperature sensor					
LED					

3. **CAD drawings**

   Include a screenshot of your final assembly.

Figure 1: CAD assembly of the prototype.

4. **Prototype photographs**

   Top view of actual prototype, with and without lid, powered on.

(a) With lid (b) Without lid

Figure 2: Top views of the working prototype.

5. **Purpose of using an Arduino board**

   Explain role of the Arduino in the circuit.

6. **Wiring diagram and methods**

   Show diagram and discuss soldering, jumper wires, twist nut caps, spade connectors, etc.

Figure 3: Circuit wiring diagram.

7. **Wire gauge and resistor values**

   Specify wire gauge used and justify choice (jumper vs. 22 AWG). State resistor values in series with green/red LEDs, calculate operating currents using KVL.

8. **Internal power supply**

   Discuss why a 9 V battery, its charge capacity, expected runtime, and external power options.

9. **Arduino code**

   Provide the code listing used in your design.

Listing 1: Arduino sketch for temperature monitoring

```
// Example placeholder code
void setup() { Serial.begin(9600);
// initialization...
} void loop() { float temp = readTemperature(); Serial.println(temp);
// control LEDs...
delay(1000); }
```

10. **Prototype specifications**

    List:

    - Voltage of power supply
    - Operating voltage of circuit
    - Total current drawn (measured with DMM)
    - Battery operating time
    - Sensor temperature range (from datasheet)
    - Comfortable temperature range
    - Use KVL to explain resistor choices (1 k Ω for green LED, 220 Ω for red LED)

4 Evaluation of Results

- Degree to which design objectives were met
- Summary of outcomes and comparison to standard thermometers
- Limitations and recommendations for future work (battery life, size, weight, etc.)
- Highlight usefulness of the design

A Supporting Materials