Spec Sheet

Device Name: **Smart Temperature Controller**
Description: A device designed to regulate the temperature of an environment by controlling heating and cooling systems based on user-defined settings.

Specifications

Inputs:

- **Current Temperature Sensor**: Measures ambient temperature (Range: -40°C to 125°C).
- **Target Temperature**: User-defined setting (Range: 0°C to 100°C).
- **Mode Selector**: User can switch between **Heating** and **Cooling** modes.

Outputs:

- **Heating System Control**: Activates or deactivates the heating system.
- **Cooling System Control**: Activates or deactivates the cooling system.
- **Status Indicators**: LEDs or display indicators for system status:
    - **Heating**: Indicates heating system is active.
    - **Cooling**: Indicates cooling system is active.
    - **Idle**: Indicates no active heating or cooling.

Functional Requirements:

1. **Temperature Regulation**:
    - **Heating Mode**:
        - Activate heating when **Current Temperature** is at least **0.5°C** below **Target Temperature**.
        - Deactivate heating when **Current Temperature** reaches or exceeds **Target Temperature**.
    - **Cooling Mode**:
        - Activate cooling when **Current Temperature** is at least **0.5°C** above **Target Temperature**.
        - Deactivate cooling when **Current Temperature** reaches or drops below **Target Temperature**.
2. **Hysteresis Threshold**:
    - A default hysteresis of **0.5°C** to prevent rapid on/off cycling.
3. **Safety Features**:
    - **Overheat Protection**:
        - If **Current Temperature** exceeds **120°C**, shut down systems and trigger an alarm.
    - **Sensor Failure Detection**:
        - Detect and handle out-of-range or erratic sensor readings by entering a safe mode and notifying the user.

Non-Functional Requirements:

- **Response Time**: System must respond to input changes within **1 second**.
- **Power Efficiency**: Minimize power consumption in **Idle** mode.
- **User Interface**: Provide a simple interface for setting the **Target Temperature** and **Mode**.
- **Communication Interface**: Optional Wi-Fi module for remote monitoring and control.