Version 1 OBJECTIVES:

- To design and implement robust temperature control system initially by bang-bang technique and PID if required
- To design, implement and integrate phase protection circuit that can
  - Detect Voltage overshoot above threshold
  - Detect RYB phase order
  - Supply cutoff incase of voltage overshoot and different phase order
- To push the data to the server
- To create a user interface to set the temperature and show errors after the completion of above tasks

Week 1: Temperature Control System Implementation

Day 1-2: Project Setup and Component Integration

- **Task**:
  - Gather all necessary components: microcontroller Arduino mega, ESP32, relays, temperature sensors DS18B20, contractor, compressor, ZMPT101B voltage sensor for phase monitoring, and any additional components.
  - Set up the basic wiring for the temperature sensor and relay connected to the compressor's contractor.
  - Verify that the components are functioning correctly by running basic tests on individual components (e.g., reading temperature values and manually triggering the relay).

Day 3-5: Control System Development

- **Task**:
  - Develop the code for the microcontroller to read the temperature from the sensor.
  - Implement bang-bang control system initially and PID controller later on to control the relay based on the set temperature. This will involve:
    - Setting a desired temperature.
    - Turning the compressor on (via the relay) when the temperature rises above the setpoint.
    - Turning the compressor off when the temperature falls below the setpoint.
  - Test the control system with varying temperatures to ensure it works as expected.

Day 6-7: Testing and Debugging

- **Task**:
  - Integrate the temperature control system with the compressor.

- Perform thorough testing in different conditions to ensure the control logic is reliable and responds correctly to temperature changes.
- Debug any issues that may be encountered.
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Week 2: Protection System Implementation

Day 8-9: Phase Protection System Design

- **Task**:
  - Design the phase protection system using the ZMPT101B voltage sensor. Alternative can be using transformer with rectifier circuit.
  - Develop the logic to detect phase loss or incorrect phase sequence using the microcontroller.
  - Plan the integration of this protection system with the existing control logic to ensure that the compressor only runs when the phase sequence is correct.

Day 10-11: Phase Protection System Development

- **Task**:
  - Implement the phase protection system in code, integrating it with the control system developed in Week 1.
  - The system should shut down or prevent the compressor from running if a phase issue is detected.
  - Test the phase protection system by simulating phase loss or incorrect phase sequence to verify that the system responds correctly.

Day 12-13: Integration and System Testing

- **Task**:
  - Fully integrate the temperature control and phase protection systems.
  - Conduct full system tests to ensure that the refrigerator control system works seamlessly with the phase protection logic.
  - Test the system under various scenarios, including temperature fluctuations and phase faults, to ensure reliability.

Day 14-15: Final Adjustments and Documentation

- **Task**:
  - Make any final adjustments or optimizations to the system based on the testing results.
  - Document the system design, including wiring diagrams, code explanations, and instructions for use.