**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.

**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.