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ECE411 Part 1 Hierarchical Test Plan

Unit Tests

- Test power supply(portable battery) to microcontroller is compatible
- Test power to the OLED screen and that it functions correctly with 3.3V
- Test power to Ultrasonic Sensor and make sure that it is running correctly on 5V
- Test power to Colored LEDs and make sure it lights up
- Test for correct voltage for each device
- Ensure sensor reading changes appropriately when object distance changes
- Verify each LED turns on individually
- Confirm microcontroller can switch LEDs rapidly without overlap
- Confirm display updates with new distance values without freezing
- Verify program uploads successfully

Verification Tests

- Verify system calculates distance (in cm)
- Confirm distance updates at expected refresh rate
- When the object is close (0-100 cm), the red LED turns on and other LEDs stay off.
- When the object is at a medium distance (100-150 cm), the yellow LED turns on and other LEDs stay off.
- When the object is far (>150cm), the blue LED turns on and other LEDs stay off.
- Confirm LEDs switch correctly when object moves between ranges
- OLED shows numerical distance in cm
- ESP32 reads sensor, updates OLED, and changes LED colors in real time
- System remains responsive during continuous use

Validation Tests

- Make sure colored LEDs correspond to correct distance
- Make sure system shuts off all LEDs if no object detected
- Make sure display doesn't read anything if no object present
- System measures distance using an ultrasonic sensor
- System updates distance indication (LED + OLED) in real time
- System accuracy is within ± 2 cm for distances under 1 meter
- System is portable and operates for at least 10 minutes on battery