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CS 350 Thermostat Report

For my final project in CS 350, I built a thermostat prototype using a Raspberry Pi and several parts, including an AHT20 temperature sensor, PWM-controlled LEDs, three buttons, and a 16x2 LCD display. The system has three modes: Off, Heat, and Cool. Each mode responds to real-time temperature and shows the system status on the LCD.

I wrote the program in Python and ran it on the Raspberry Pi. I used libraries like gpiozero, adafruit\_circuitpython, and python-statemachine to connect the hardware and manage the program's flow. The LEDs indicated system activity: the red LED pulsed when heating below the setpoint, and the blue LED pulsed when it was cooling above it. The LCD alternated between the system time and thermostat status.

During testing, I noticed an issue where the red and blue LEDs were swapped. I fixed this by changing the GPIO pin assignments for the lights.

If I turn this prototype into a commercial product, the next step would be adding Wi-Fi capabilities to send data to a cloud service. I would consider several hardware options:

- Raspberry Pi Zero W: Affordable and easy to use, but has limited processing power.

- Microchip PIC32: Small and power-efficient, but has less community support.

- NXP (Freescale) i.MX RT: More expensive, but powerful and ready for industry.

I recommend the Raspberry Pi Zero W for prototyping because it is easy to use and compatible with many components. This project gave me valuable hands-on experience creating cyber-physical systems and helped me understand embedded programming and real-time feedback. The system works well and meets all the requirements from the project guide.