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CS-350 Emerging Sys Arch & Tech

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Module 7 Final Project

Thermostat Lab

The prototype thermostat created for SysTec to enter the thermostat market was created by using a Raspberry Pi 4B with a I2C connection to the AHT20 temperature and humidity sensor along with a 16x2 display and buttons, wires, and resistors on a breadboard. The code for this thermostat to operate was created with python and uses the state machine library to switch between off, heating, and cooling and outputs to LED’s and the LCD display along with a UART connection to communicate with the server. When the device is powered on and the python program is run the state of the thermostat is defaulted to off and the LCD display shows the thermostat information. When the state button is pressed it changes to the heat state which will turn on a red LED if the set temperature is less than or equal to the room temperature. If the set temperature is greater than the room temperature the red LED will pulse. The setpoint of the thermostat is defaulted to 72 F but can be adjusted with 2 other buttons for increasing and decreasing set points. When the state button is pressed again it exits the heating state and turns off the red LED. It then enters the cooling state which turns on a blue LED. If the set temperature is greater than or equal to the room temperature it will be a solid indicator and when the set point is lower, it will pulse. Pressing the state button again will exit the cooling state turning off the blue light and returning to the off state.

Comparing hardware that would be best for the thermostat we have our three options of Raspberry Pi, Microchip, and Freescale. Although the Raspberry Pi worked well for the prototype thermostat and has all the functionality needed it is better suited for larger projects or prototype testing rather than being used in smaller IoT devices as it has a large form factor and high price point compared to alternatives. A better alternative would be to use a microchip microcontroller such as a PIC32 along with ATWINC1500. The PIC32 microcontrollers run on the ARM Cortex-M23 architecture which is power efficient and powerful enough to easily run the thermostat. There is a comfortable amount of flash memory and ram contained in these chips up to 8192KB flash and 1024KB ram to run our thermostat without issues. It supports I2C, UART, and GPIO which means it will have the same functionality and paired with the ATWINC1500 Wi-Fi module from microchip it gives the ability to wirelessly connect to the server. This will require more engineering to deploy, and it will need to be written in C or C++, but the price point is much lower as both these modules can be purchased for less than $10 whereas the Raspberry Pi is many times more expensive. Another option comparable to microchip would be the Freescale microcontrollers, however these are no longer manufactured, and the company was bought out by NPX in 2015. It would not be wise to design a product with obsolescent hardware.