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CS-350

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CS-350 Final Project

In order to create the functional thermostat prototype, I used a Raspberry Pi 4 to interface with the peripherals and run the application and server. An Adafruit AHT20 temperature sensor was used to retrieve temperature data using I2C. A GPIO breakout board was used to enable communication between the Raspberry Pi and a solderless breadboard. While our test server is being run locally on this prototype, the full product will need wireless in order to connect to the internet and communicate with our cloud servers. When evaluating which hardware architecture should be used for the final product, we need to consider whether the hardware architecture can support the peripherals we used. Our hardware requirements for this project are integrated wireless, I2C support, UART support, GPIO support, and sufficient memory.

Microchip has a number of hardware products that may be viable. For example, let us look at the WFI32E02UC. This microcontroller unit module supports UART, I2C, and GPIO. With 1MB of flash memory and 256KB of RAM, this should be sufficient for our use case. Integrated wireless is included, allowing the device to communicate with our cloud servers. The WFI32E02UC is also designed for IoT applications and would consume less power than our Raspberry Pi 4 prototype. In conclusion, Microchip offers a number of hardware products like the WFI32E02UC which could be used to power our thermostat.

NXP (previously Freescale) similarly have a number of hardware products that meet our needs. For example, let us examine the RW612. This microcontroller unit module comes equipped with integrated wireless which is suitable for the cloud functionality of our product. The RW612 meets the requirements for supporting UART, I2C, and GPIO. While the RW612 has 1.2MB of RAM, flash memory would require external storage. Solutions from NXP like the RW612 appear to meet all the requirements for our thermostat.

As demonstrated with the thermostat prototype, the Raspberry Pi 4 meets all the requirements for our thermostat. However, there are other offerings from Raspberry Pi that may be a better fit as the Raspberry Pi 4 is more expensive than alternatives and exceeds the specifications needed for this project. For example, the Raspberry Pi Pico 2 W may be suitable for this project. It comes equipped with integrated wireless functionality and support for UART, IC2, and GPIO. The Raspberry Pi Pico 2 W also has 4MB of flash memory and 520KB of RAM. However, there is some additional software setup required to support cloud applications.

While each of the hardware options that we have looked at meet the requirements, there are considerations that must be made when deciding which hardware architecture to choose. Firstly, the RW612 and the WFI32E02UC have additional security features that the Raspberry Pi Pico 2 W lacks. Secondly, the RW612 and the WFI32E02UC are designed for IoT applications whereas the Raspberry Pi Pico 2 W is not. While the WFI32E02UC has internal flash memory, the RW612 requires external memory. For these reasons, I would recommend the Microchip WFI32E02UC for our hardware architecture.

References

WFI32E02UC. (n.d.). https://www.microchip.com/en-us/product/wfi32e02uc

*RW612*. RW612: Wireless MCU with Integrated Tri-radio: 1x1 Wi-Fi® 6 + Bluetooth® Low Energy 5.4 / 802.15.4 | NXP Semiconductors. (n.d.). https://www.nxp.com/products/wireless-connectivity/wi-fi-plus-bluetooth-plus-802-15-4/wireless-mcu-with-integrated-tri-radio-1x1-wi-fi-6-plus-bluetooth-low-energy-5-4-802-15-4:RW612

Buy A raspberry pi pico 2 – raspberry pi. (n.d.-a). https://www.raspberrypi.com/products/raspberry-pi-pico-2/