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7-1 Final Project: Thermostat Lab Report

The type of hardware architecture implemented for project two utilizing the GPIO, UART and I2C peripherals, was the Raspberry Pi embedded system. The various peripherals integrated into the thermostat prototype were two LEDs, a temperature sensor, three buttons, and an LCD screen for displaying messages. The Raspberry Pi does an excellent job in supporting functionality for each of these peripherals by providing the respective libraries which can be accessed through Python. WiFi connectivity is also an available feature on the Pi as many models include ethernet ports for wired connection, as well as built-in wireless capabilities. Having WiFi onboard the Pi allows for updates, installation of libraries, as well as access to the embedded system through the cloud. The Raspberry Pi 4 has an abundant amount of flash and ram compared to its Microchip and Freescale counterparts, as it has an external SD/SSD and 8 GB of RAM installed which can effortlessly support GPIO, I2C sensors, and a decent amount of code for compiling.

A counterpart to the Raspberry Pi hardware architecture would be a Microchip, which is an all-in-one integrated circuit that includes the CPU, flash memory, RAM, and all its peripherals connected to it. An MCU also has the capabilities of supporting GPIO, UART, and I2C peripherals. Several home appliances such as modern thermostats, washing machines, microwaves, and coffee makers use this type of hardware architecture because of its low power consumption and swift boot times compared to the Pi. The MCU supports WiFi through separate modules for remote access and driver update capabilities. The amount of Flash and RAM heavily depends on the model used for each use case. For example, there are smaller MCUs that have Flash of about 16-32 KB and RAM between 1-2 KB, which are primarily used for basic LED and sensor functionality, while larger MCUs containing about 1 MB of flash and 256 KB of RAM are capable of running drones, medical devices, and smart home systems.

Finally we step into Freescale hardware architectures which are often used in industrial and automotive settings. Freescale embedded systems have the ability to support peripherals such as: GPIO, UART, I2C, etc. WiFi connectivity does have to be externally installed, which may seem inconvenient; however, this gives the user the ability to have direct control over performance and capabilities of the system. Flash and RAM capacity is similar in size to MCUs containing about 1 MB and 256 KB of RAM as well, which is more than enough for Thermostat state machine, LCD processing, GPIO, and LED use cases.

Of all the hardware architectures mentioned, I would highly recommend the MCU system for the project two thermostat use case as it boots up faster, uses less power, is more compact, and has an ample amount of Flash and RAM compared to its Raspberry Pi and Freescale counterparts. I would say the Raspberry Pi is an excellent apparatus for prototyping but not efficient for real-world deployment. As mentioned, Freescale hardware architectures are best suited for industrial and automotive settings.

References

Raspberry Pi Ltd. (n.d.). *Raspberry Pi documentation – Computers*.

https://www.raspberrypi.com/documentation/computers/raspberry-pi.html