**Architecture Comparison and Recommendation**

The hardware architecture most suited to the smart thermostat product is one that supports the use of peripherals like the temperature sensor, allows Wi-Fi communication, and stores the code files needed for execution. Given that the Raspberry Pi 4 (RPi 4) used for the low-level thermostat prototype fulfills each of these criteria, it stands out as an immediate choice, but its merits will be compared to microcontroller unit (MCU) options from Microchip and NXP (formerly Freescale before merger).

Beginning with peripherals, most MCU options from Microchip and NXP support the use of GPIO (Microchip, 2025; NXP, n.d.). This is essential for providing power to each of the thermostat’s hardware components like the LEDs and digital display. Further, many options from both sources support pulse width modulation (PWM), which is essential for the heating and cooling visual indicators of fading lights (Microchip, 2025; NXP, n.d.). Lastly, both companies list many available MCUs that support serial communication, making a temperature sensor possible (Microchip, 2025; NXP, n.d.). The conclusion here is that each manufacturer offers MCUs to support the peripherals used for the thermostat.

Next, Wi-Fi capabilities will be compared. Microchip MCUs all offer multiple forms of wireless communication including Zigbee, which pairs well with smart home devices and can connect to a cloud with additional infrastructure (Microchip, 2025; Charlton, 2021). It was challenging to find information on whether most NXP MCUs offer built-in wireless communication. Given this, and that Microchip MCUs don’t seem to list direct Wi-Fi support, it seems that additional Wi-Fi modules would be needed for either choice to easily connect to a cloud. Conversely, the RPi 4 has built-in Wi-Fi capabilities (Raspberry Pi, n.d.).

Finally, long- and short-term storage are necessary to consider. The architecture needs to have enough flash storage to hold the Thermostat.py program with its imported libraries and enough RAM to run the program functionality in real time, continuously. Offerings from Microchip and NXP list options with flash and RAM values in kilobytes (KB) while the RPi model used ranges in gigabytes (GB) for its options, therefore providing much more space to work with (Microchip, 2025; NXP, n.d.; Raspberry Pi, n.d.).

Overall, **continuing to use the RPi seems like the best choice**. All options support the needed peripherals, but the RPi inherently supports Wi-Fi communication and offers a surplus of storage, of which the higher RAM amounts mean better performance for the thermostat product.

References

Charlton, A. (2021, September 24). *What is Zigbee, and why it’s a must-have for your smart home.* <https://www.techradar.com/news/what-is-zigbee-and-why-its-a-must-have-for-your-smart-home>

Microchip. (2025). *Multi-protocol MCU products.* <https://www.microchip.com/en-us/parametric-search/1642?filters=JTdCJTIyY2F0ZWdvcnlkcm9wZG93biUyMiUzQSU1QiUyMk1pY3JvY29udHJvbGxlcnMlMjBhbmQlMjBNaWNyb3Byb2Nlc3NvcnMlMjIlMkMlMjIlMjIlMkMlMjIlMjIlNUQlN0Q=>

NXP. (n.d.). *Product selector.* Retrieved June 16, 2025, from <https://www.nxp.com/products/product-selector:PRODUCT-SELECTOR?category=c731_c1770_c173&page=1&nrnd=false>

Raspberry Pi. (n.d.). *Raspberry Pi 4 tech specs.* Retrieved June 16, 2025, from <https://www.raspberrypi.com/products/raspberry-pi-4-model-b/specifications/>