**Final Fahrenheit**

**CS-350**

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February 18, 2025

SysTec is in the process of developing a WiFi-connected thermostat that will adhere to a small set of criteria. The thermostat must have a display that outputs the date, temperature, and status of the device; it must feature a minimum of three buttons for controlling the device’s state; it will host at least two indicator light LED’s; it must connect to a server using WiFi; and a system must be chosen with enough resources to operate these functionalities. The WiFi connectivity will replace the prototype feature of serial debugging, but a serial connection may optionally be left on the device for maintenance and repair debugging, if feasible.

The connectivity of peripherals used in the prototype consisted of power and GPIO connections, as well as a single i2c connection for the temperature and humidity chip. Three connections to each 3V and 5V power were used, along with various connections to ground. Eleven GPIO pins were utilized on the prototype to communicate with the LED display, buttons, and LED indicator lights.

As for memory requirements, the python virtual machine, along with the prototype code and libraries being used, occupies slightly less than 500 MB of RAM. If it is desireable to run an operating system with the python virtual machine, a total of around 1 GB of RAM would be desireable. If the code were rewritten to interface directly with the devices being installed to the microcontroller, in a compiled binary rather than an interpretted script, and without the overhead of running a general purpose operating system, the amount of memory being used by the device could be drastically lowered.

The prototype developers have been asked to analyze three potential sources of microcontrollers for the project: Raspberry Pi, Microchip, and Freescale. Freescale was merged with NXP, and shall be referenced only as NXP or Freescale/NXP moving forward. Each manufacturer offers a microcontroller that features wifi connectivity, a suitable number of GPIO pins, and a varying amount of memory. For example, Raspberry Pi offers the Raspberry Pi Zero W, which has the capability of WiFi connectivity, 40 GPIO pins, and 512 MB of memory (Raspberry Pi, n.d.). Microchip offers the WFI32E04, featuring 640 MB of memory, 60 GPIO pins, and WiFi connectivity (Microchip, n.d.). NXP’s wireless single-board solutions offer less memory: the RW612 hosts only 1.2 MB of SRAM, with between 41 and 64 GPIO pins (NXP, n.d.). They also offer separate wireless modules to be paired with a non-wireless controller, like the IW610.

Ultimately, each manufacturer provides controllers that will be sufficient for the production version of the thermostat. If the production version is shipped with a full Linux operating system and running python interpretted code, then options will have to be found with larger memory capacities. The more important aspect to consider will be pricing and availability. Using smaller, compiled binaries will allow SysTec to seek out more affordable microcontrollers with less SRAM available, and may even make sourcing from multiple manufacturers using the same processor a possibility, and so this is the recommendation of the prototype team.

References

Microchip. (n.d.). *WiFi Product Comparison Chart*. Retrieved February 18, 2025, from <https://ww1.microchip.com/downloads/aemDocuments/documents/WSG/P>

NXP. (n.d.). *RW612 Datasheet*. Retrieved February 18, 2025, from <https://www.nxp.com/docs/en/data-sheet/RW612.pdf>

Raspberry Pi. (n.d.). *Raspberry Pi Zero W*. Retrieved February 18, 2025, from <https://www.raspberrypi.com/products/raspberry-pi-zero-w/>