Matthew Trembley

12/11/2022

Southern New Hampshire University

CS350

Thermostat Architecture

The microcontroller used for this smart thermostat is the CC3220 LaunchPad from Texas Instruments. There are many other hardware architectures similar, like Microchip’s [Curiosity Development Board](https://www.microchip.com/en-us/development-tool/DM320103) or NXP’s [FRDM-KEO2Z40M](https://www.nxp.com/design/development-boards/freedom-development-boards/mcu-boards/freedom-development-platform-for-kinetis-ke02-mcus:FRDM-KE02Z40M) board. Each of these 3 microcontrollers have their pros, as well as their own cons – but the CC3220 as the strongest.

The controller from TI has Wi-Fi connectivity through “internet-on-a chip” solution with integrated MCU. This microcontroller also has the very important thermistor to read ambient temperature for reporting back to the display. With 256KB of On-Chip SRAM and 1024KB of Flash memory, there is ample room for both code and data and application code to execute. The large flash memory allows SRAM freed up and used for read-write data. Also, with multiple LED’s, this microcontroller can create a physical user interface to the consumer to identify the state of the thermostat.

Microchip’s hardware is similar, but does not have the WiFi integration to support the system requirements. It has Bluetooth compatibility, but Bluetooth can not directly connect to the cloud without an accompanying device. This microcontroller has 512KB of flash memory, and 128KB of RAM. The flash memory is enough to support the thermostat, but without a large enough RAM, the program will need to be proficient in memory management. If not, it could potentially crash and behave unexpectedly/erroneously. With three LED’s and one RGB LED, it is possible to create a physical user interface to inform the user of heater controls. Paired with a GPIO expansion header, it can become more diverse in the various inputs and outputs it may deal with.

NXP’s Freedom board is incredibly small and could not work as a thermostat, despite having the required thermistor. It does contain a tri-color LED, in which it could show a physical representation of the state to the user depending on software functionality. With only 64KB of flash memory and 4 KB of SRAM, any code and data will have to be incredibly small as to not use up the insufficient amount of memory. This controller also does not have any wireless capabilities, and although it could work in tandem with a second controller that does, it would prove to be not nearly as cost effective.

Although all 3 manufacturers have a wide variety of controllers to be used, the controllers identified do not all work. The controller from Texas Instruments is to be the most justified architecture, due to its large memory, peripherals such as thermistor, buttons, and LED’s, and wireless internet connectivity. The other two are out of the running, although the manufacturers may produce comparable chips elsewhere on the market.

References

Microchip. (2022, March 16). Retrieved from https://www.microchip.com/en-us/development-tool/DM320103

NXP. (2014, March 9). Retrieved from https://www.nxp.com/design/development-boards/freedom-development-boards/mcu-boards/freedom-development-platform-for-kinetis-ke02-mcus:FRDM-KE02Z40M

Texas Instruments. (2017, February). Retrieved from https://www.ti.com/lit/ug/swru465/swru465.pdf?ts=1670633821202&ref\_url=https%253A%252F%252Fwww.google.com%252F