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**Project One Report: Architecture Analysis**

In this project we created a thermostat prototype with heater control and remote server reporting functionality. The prototype was built and run on a TI CC3220 LaunchPad, which includes a processor and a hardware peripheral suite that allows the thermostat to function properly. For this discussion, we will first examine this architecture, and then compare two other competing board types and their architecture. We will briefly look at peripherals, cloud support capabilities, and onboard flash memory and RAM, and analyze suitability for continued development of this project into the next stage.

The TI CC3220 LaunchPad is a fitting device to prototype thermostat functionality. A key inclusion, of course, is the onboard TMP116 digital temperature sensor, which can operate in the range of -55 to 150 degrees C, well within requirements. It may communicate easily with an I2C interface, which made development for the project simple. It also includes onboard UART hardware, which we were able to use to simulate server communication.

For the next stage, we would want to integrate this thermostat with a cloud server via Wi-Fi. The TI board also allows this out of the box, using an integrated Wi-Fi chip, and the board is marketed as IoT ready. Connecting the board via Wi-Fi would allow us to upload information directly to any internet connected server source, which then may be disseminated as needed. Importantly, internet security features such as HTTPS and SSL are built right in. Finally, the included RAM on this TI embedded board is 256KB (Texas Instruments, 2021). This is not a lot in the greater world of PCs and smartphones but is more than sufficient for our needs. Our program’s temperature logic memory requirement can be counted in bytes. Overall, the TI CC3220 could be a suitable platform for continued development.

The Microchip brand WFI32-IoT board is a similar type of embedded device that was chosen for comparison (Microchip, n.d.). Like the TI board, this board was designed with Wi-Fi capability with bundled security features with the idea of connecting to cloud-based servers. It similarly includes an onboard debugger which helps ease development, and a temperature sensor (-20 – 100 C). An ambient light sensor is also included which may be useful, for example, if we were making a local UI display for the sensor. 256KB of flash memory is included along with an option for 32-Mbit of external flash memory. This board has all of the same set of features as the TI that are necessary for continued development of this project and may be considered as an option.

Finally, to compare something a bit different, we can look at the Kinetis KL03 by NXP Semiconductor (who bought Freescale in 2015). This is not a ready-to-go development board like the others; however, it is a very low-cost, small size, power efficient MCU. An MCU is a Microcontroller Unit, the brains of most embedded systems. This MCU runs an ARM processor and includes 32kB of flash memory and 2 KB of SRAM (NXP Semiconductors, 2017). Further, it has both a UART communication interface as well as an I2C module.

This MCU is marketed as a solution for IoT edge nodes like our temperature sensor. However, for this to work for this project, a temperature sensor and Wi-Fi module would need to be integrated separately. NXP makes a wide range of temperature sensors and Wi-Fi modules that can be chosen.

In this choice, the hardware platform can be made more customizable and possibly built at a lower cost in our own desired form factor. The downside would be the increased engineering costs needed for designing the architecture.

**References**

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