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CS-350 Emerging Sys Arch & Tech

Project 7-1: Reflection

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Climate control within homes is something that has become more common place over recent years. Thermostats have had an increase benefit within the home. Thermostats control the climate of the home to create an environment that is comfortable for the user. During cold conditions, the thermostat will heat the house, and during hotter conditions cool the house. There are many kinds of thermostats on the market, with the thermostat from this specific project being considered a “smart” thermostat. The project would be considered a smart thermostat due to its wireless connectivity features, and its ability to inform users of the ambient temperatures in its general location. Additionally, this thermostat works with digital sensors that then connect to the boiler to identify what the current temperature is in the room. The capabilities of the project introduced how microcontrollers work with sensors to effectively communicate the room’s current temperature between the thermostat and the boiler that then decided if the heat should be turned on or off.

The thermostat project incorporates various peripherals to support its functionality across different hardware architectures, including TI, Microchip, and Freescale. Each architecture utilizes specific microcontrollers enhanced for low-power and IoT applications. For instance, Texas Instruments offers microcontrollers like the MSP430 and CC3200 series, which uses integrated Wi-Fi capabilities along with essential peripherals such as GPIO pins, ADCs, and communication interfaces like SPI and UART (Gene A.**)**. These peripherals enable sensor interfacing, user input, and communication tasks necessary for use of a thermostat.

Microchip's PIC series microcontrollers, commonly used in embedded systems, are another option for the thermostat project. With peripherals including GPIO, ADC, PWM, and communication modules, Microchip architectures enable sensor data acquirement, user interaction, and communication functions essential for thermostat operation (Watson, J.**)**. Likewise, Freescale's Kinetis series microcontrollers, well known for IoT applications, provide similar peripherals to support thermostat functionalities across different hardware architectures, ensuring flexibility and compatibility.

Regarding connectivity to the cloud via Wi-Fi, each architecture integrates Wi-Fi modules or capabilities within the microcontrollers to enable remote monitoring and control of the thermostat. Texas Instruments' CC3200 series microcontrollers feature integrated Wi-Fi connectivity, leveraging the SimpleLink™ Wi-Fi SDK to establish secure connections with cloud platforms (Dung**)**. Microchip's Wi-Fi modules like the WINC series can be seamlessly integrated with PIC microcontrollers, enabling Wi-Fi connectivity for cloud communication. Similarly, Freescale's Kinetis series microcontrollers utilize external Wi-Fi modules or integrated solutions to facilitate Wi-Fi connectivity and cloud communication in the thermostat project.

Flash and RAM architecture are pivotal for storing and executing thermostat firmware across all architectures. Texas Instruments, Microchip, and Freescale microcontrollers offer varying amounts of Flash and RAM resources based on the specific models (Dung). The firmware is stored in Flash memory, ensuring persistence across power cycles, while RAM is utilized for runtime data storage and program execution. The sizes of Flash and RAM are selected to meet the firmware's requirements, guaranteeing optimal performance and storage capacity for the thermostat application across TI, Microchip, and Freescale hardware architectures. This ensures that the thermostat can efficiently handle data processing, user interactions, and cloud communication while maintaining reliability and performance in various operational scenarios.

Within the class, the previous milestones have helped give knowledge and better understanding of embedded systems within technology. Additionally, these assignments have demonstrated how embedded systems can incorporate a multitude of different sensors to accomplish the tasks and functions of the product. Based on this specific project, I am now able to understand how using GPIO, UART, and Timers come together to set the ambient temperature of a room, communicate those results to a boiler, and determine if and when the heat needs to be either turned on or off depending on the homes conditions. This project has given be a better understanding of how CCS is incorporated in everyday technology that will only benefit me as I continue working towards my Software Engineering career.

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