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CS 350: Emerging Systems Architecture and Technologies

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**7-1 Project Report**

For creating a working smart thermostat prototype there are several requirements of the microcontroller. The microcontroller must support the use of I2C (Inter-Integrated Circuit) for reading the room temperature via a temperature sensor, an LED (Light Emitting Diode) to indicate the output to the thermostat where the LED is on when the heat is on which can be implemented via GPIO (General-Purpose Input/Output), two buttons to increase and decrease the set temperature via GPIO interrupt, the UART (Universal Asynchronous Receivers/Transmitters) will simulate sending thermostat data to the server, the thermostat must be connected to the cloud via Wi-Fi, and lastly the prototype must have enough RAM and Flash to support the required code.

The three architectures to analyze are Texas Instruments (TI), Microchip, and NXP (formerly Freescale). Looking at the criteria, each architecture supports GPIO, UART, and I2C, however only TI supports LEDs and Microchip requires additional setup. As for the Wi-Fi connectivity, TI has the best option as it is IoT ready and has an integrated Wi-Fi module. Microchip and NXP require external Wi-Fi modules. Both TI and NXP have 256 KB of Flash and Microchip has 512 KB of Flash. One of the biggest selling points for the use of TI’s architecture is the cloud connectivity which is pre-integrated with AWS among other platforms. Both Microchip and NXP require third party libraries for cloud connectivity. Lastly, the ease of prototyping varies for each architecture. For TI, it is specifically designed for rapid IoT prototyping. For Microchip, it is modular but requires an external Wi-Fi adapter. NXP is more suitable for general-purpose applications due to its robustness.

Overall, the best choice of architecture is Texas Instruments. Its integrated Wi-Fi module, simple cloud connectivity, and its IoT-specific design align with SysTec’s business needs. The integration process can be streamlined thanks to TI’s robust development tools and support for cloud platforms, helping to accelerate deployment.

**References**

Texas Instruments. (2022). *CC3220 SimpleLink Wi-Fi and Internet-of-Things solution, a single-chip wireless microcontroller user’s guide* (Rev. C). <https://www.ti.com/lit/ug/swru463c/swru463c.pdf>

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