### Southern New Hampshire University

Project 2: Embedded Architecture Options

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# Overview

The goal for this demonstration is to program four basic functions of a thermostat onto an embedded system. The thermostat should read the current temperature via an I2C peripheral, have an adjustable setpoint temperature via a GPIO peripheral, turn a heater on or off based on the current temperature and setpoint temperature via a GPIO peripheral, and send a status report to a server through a UART peripheral at regular intervals detailing the previous functions. For the final product, it is desired that the UART be able to send information via Wi-Fi to a server on the cloud. Below is a run down of the different hardware architectures that were considered for this project.

# Texas Instruments

The board used for this project had an 80 Mhz Arm Cortex-M4 processor and 256KB of RAM. If a customer chooses, they can get the “SF” version of the board in order to get 1MB of executable flash RAM. This board also features built in Wi-Fi functionality, I2C, UART, and 27 GPIO pins.

# Microchip

When looking at Microchip’s lineup, I found a board of similar cost to that of the TI CC3220S-LAUNCHXL. That board is the dsPIC33CH Curiosity Dev Board DM330028-2. This board has a dual core 16-bit dsPIC33CH CPU. The master core has a clock frequency of 180 MHz, 256-512 KB of flash memory, and 32-48 KB of RAM. The slave core has a clock frequency of 200 MHz, 72 KB of flash memory, and 16 KB of RAM. The Micorchip board also has three UART modules, three I2C modules, and GPIO pins. This board unfortunately does not come with on-board Wi-Fi capabilities, which is a requirement for the end product.

# Freescale

A comparable board from NXP (formerly Freescale) would be the FRDM-K32L3A6. This board has an Arm Cortex M4 processor with a clock speed of 72 MHz, 1.25 MB of flash RAM, and 384 KB of static RAM. It also has four UART modules, four I2C modules, and 104 GPIO pins. The board also has a FlexIO module that can be used to emulate UART, I2C, SPI, etc. Unfortunately, this board also lacks on-board Wi-Fi capability.

# Conclusion

In conclusion, there are many different boards capable of being programmed to take advantage of on-board I2C, GPIO, and UART peripherals in order to build a thermostat type system. The TI CC3220S-LAUNCHXL would be my recommendation because of its ability to meet all the requirements, including having on-board Wi-Fi. For this prototype, I used the TI board and was able to program all four functions required for the thermostat system. The board is Wi-Fi capable, but that was beyond the scope of this prototyping endeavor. The board meets the form, fit, and function requirements for a smart thermostat.