**Thermostat Architecture Comparison**

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A foundational design choice in the development of Internet of Things (IoT) enabled devices is the platform chosen to implement the device. With the goal of an IoT-enabled thermostat in mind, this report will compare three different evaluation kits made expressly for this purpose. Specifically, Freescale, Microchip, and Texas Instruments (TI) were requested. However, an NXP board will be used in place of one from Freescale since Freescale merged with NXP in 2015 (NXP Semiconductors, 2015). The candidates are: The NXP LPCXpresso55S69, the TI CC3220S Launchpad XL, and the Microchip Curiosity PIC32MZ.

# Peripheral Support

The peripherals required by the project include I2C, used for reading temperature and UART, used to send data out of the thermostat. The NXP LPCXpresso board supports I2C and UART (NXP Semiconductor, 2019, pp. 17-18) via expansion ports, although the pins are shared for each protocol. The Microchip Curiosity board implements I2C and UART, albeit through a single “Graphics connector” (Microchip, 2019, p. 16-18). The TI Launchpad also supports I2C via four pins (Texas Instruments, 2017, p.13), and UART communication (Texas Instruments, 2017, p. 8). Since all of these systems support these peripherals, no candidates stand out in this category.

# Wi-Fi Support for Internet Connectivity

The primary goal of the system under design is to be able to connect to the internet wirelessly via Wi-Fi. The NXP LPCXpresso board enables WiFi connectivity via a Secure Digital Input Output (SDIO) port (NXP Semiconductor, 2019, p. 16) or via its expansion ports (NXP Semiconductor, 2019, p. 17). The Microchip Curiosity board allows Wi-Fi connectivity through its expansion interfaces or its ethernet interface (Microchip, 2021, p. 4). The TI Launchpad XL implements Wi-Fi connectivity with a single chip with an integrated microcontroller (Texas Instruments, 2017, p. 8).

# Flash Memory and RAM

The NXP LPCXpresso supports up to 320KB of RAM and up to 630KB of flash memory (NXP Semiconductors, 2018, p. 2). The Microchip Curiosity board has 2MB of flash memory, and 512KB of RAM (Microchip, 2021, p. 1). The Texas Instruments Launchpad offers 256KB of RAM and 1MB of flash memory (Texas Instruments, n.d.). In this category, the Microchip offering has the most flash and RAM of the three.

# Architecture Recommendation

With the idea of an IoT thermostat in mind, the TI board is probably the best candidate from these manufacturers. While all the boards supported I2C and UART, and although the TI board is the lightest in terms of RAM, it is the only one of the candidates that has built-in Wi-Fi capability. Since no external Wi-Fi module is required, adopting this architecture will reduce costs, points of failure, and manufacturing complexity.

# References

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