Module Three Journal

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Interfaces: GPIO, SPI, and I2C

Explain the differences between the three interfaces chosen

A basic interface called General-Purpose Input/Output (GPIO) enables an embedded system to send and receive digital signals. It is frequently used for simple on/off functions, including reading button states or turning on or off LEDs. While GPIO is simple to use, takes little setup, and works well for basic tasks, it is not good for complicated data transmission or high-speed connectivity.

For short range communication in embedded systems, serial protocols like the Serial Peripheral Interface (SPI) are utilized. It has a master slave design and allows for full duplex communication, which enables simultaneous data sending and receiving. SPI is good for its quick data transfer, few pins, and multi-device connectivity. It is less efficient over long distances, requires more pins than I2C, and does not have integrated error checking.

An additional synchronous serial communication bus for attaching peripherals to microcontrollers is called Inter-Integrated Circuit (I2C). It makes use of a multi master, multi-slave configuration that requires less wiring to enable several devices to communicate on a single bus. I2C is slower and unsuitable for high-speed communication than SPI, but it is easier to build and has fewer pins.

Explain why you would use one interface over another

GPIO is best utilized for simple operations where speed is not a priority, such as turning devices on or off or reading inputs from switches. Applications requiring quick data transfer over small distances, such as attaching a microcontroller to a sensor or display, are best suited for SPI.

When numerous devices need to be connected to a single microcontroller with little to no wire, like when attaching various sensors to a single board, I2C is an excellent option.