Serial Peripheral Interface also known as SPI is a synchronous serial data protocol used by microcontrollers. It is used for quick communication over short distance for one or more devices, microcontrollers, sensors, and shift registers.

SPI is synchronous, full duplex master-slave interface. This means that the data coming from the master, which generates the clock, which is usually a microcontroller and can control one or more peripheral devices called slaves, these are synchronised to the clock generated by the master, are synchronized so that on the rising (low to high) or falling (high to low) clock edge they both (master and slave) can transmit data at the same time. When the receiver detects a change in edge it will look at the data line to red the next bit (shown in Figure 1).

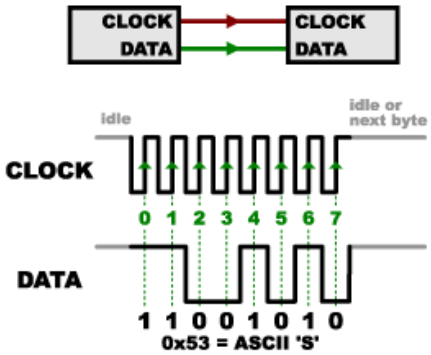

Figure.1. Receiver showing change in edge [1]

SPI has four channels to allow communication between the master and the slave devices these are:

1. MISO (Master in Slave Out): Dedicated data line to send data from the slave to the master.
2. MOSI (Master Out Slave In): Dedicated line for the master to send data to the slave.
3. SCK (Serial Clock): The clock pulse the synchronizes data transmission that is generated by the master.
4. SS (Slave Select): The pin on each device that the master can use to enable and disable specific devices.

SPI has four modes of transmission, these modes control whether data is shifted in and out on the rising edge or the falling edge of the data clock signal this is called the **clock phase** and whether the clock is idle when high or low this is called the **clock polarity**:

SPI mode	Clock Polarity	Clock Phase	Clock Edge
0	0	0	1
1	0	1	0
2	1	0	1
3	1	1	0

Figure.2. Table of the four mode of SPI transmission

- Mode 0: Data is sampled on the rising edge of the clock signal and is shifted out on the falling edge of the clock.
- Mode 1: Data is sampled on the falling edge of the clock signal and is shifted out on the rising edge of the clock.

- Mode 2: Data is sampled on the falling edge of the clock signal and is shifted out on the rising edge of the clock.
- Mode 3: Data is sampled on the rising edge of the clock signal and is shifted out on the falling edge of the clock.

Advantage of using SPI are:

- Has a simplistic structure which makes it use less power in a circuit.
- Faster performance than I2c.
- Communication between master and slave a fill duplex which means they can send data to each other at the same time.

Main Disadvantage of SPI:

- Restricted to small distance communication.

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