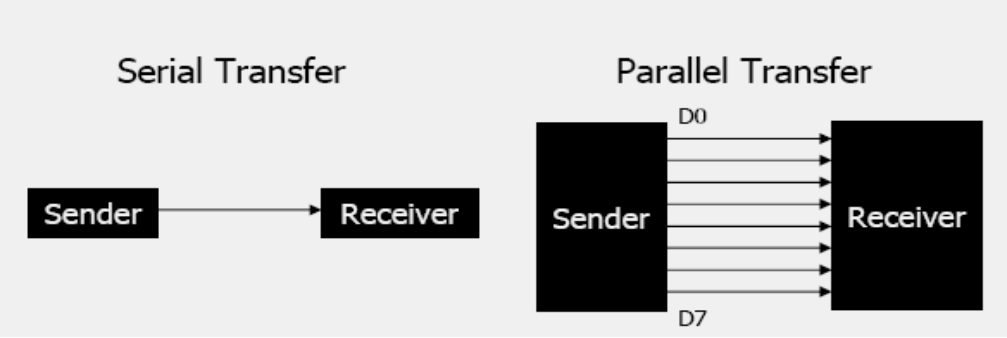
UNIT- IV

8051 Serial Communication

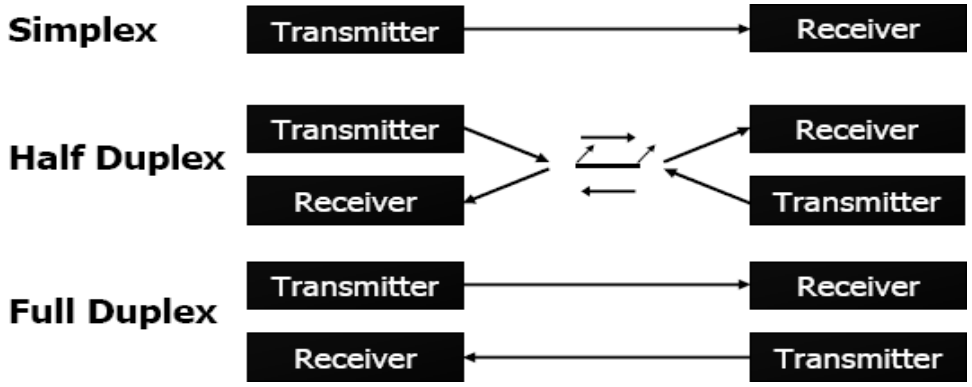
When a microcontroller communicates with the outside world, it provides the data in byte-sized chunks. In some cases, such as printers, the information is simply taken from the 8-bit data bus and presented to the 8-bit data bus of the printer. This can work only if the cable is not too long, since long cables diminish and even distort signals. Furthermore, an 8-bit data path is expensive. For these reasons, serial communication is used for transferring data between two systems located at distances of hundreds of feet to millions of miles apart. Fig(1) shows serial versus parallel data transfers. The fact that serial communication uses a single data line instead of the 8-bit data line of parallel communication. For serial data communication to work, the byte of data must be converted to serial bits using a parallel-in-serial-out shift register, then it can be transmitted over a single data line. At the receiving end there must be a serial-in-parallel-out shift register to receive the serial data and pack them into a byte.

When the distance is short, the digital signal can be transferred as it is on a simple wire and requires no modulation. However, for long-distance data transfers, serial data communication requires a modem to modulate (convert to 0s and 1s to audio tones) and demodulate (converting from audio tones to 0s and 1s).

Serial data communication uses two methods, asynchronous and synchronous. The synchronous method transfers a block of data(characters) at a time, while the asynchronous method transfers a single byte at a time. There are special IC's made by many manufacturers for serial data communications. These chips are commonly referred to as UART (universal asynchronous receiver transmitter) and USART (universal synchronous asynchronous receiver transmitter).



Fig(1)

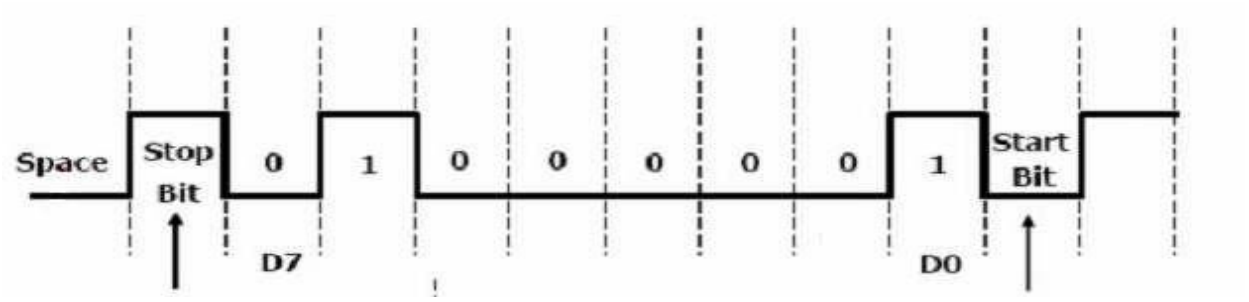


In data transmission if the data can be transmitted and received, it is a duplex transmission. This is in contrast to simplex transmission such as with printers, in which the computer only sends data. Duplex transmissions can be half o full duplex, depending on whether or not the data transfer can be simultaneous. If data is transmitted one way at a time, it is referredto as half duplex. If the data can go both ways at the same time, it is full duplex. Full duplex requires two wire conductors for the data lines, one for transmission and one for reception, in order to transfer and receive data simultaneously.

Asynchronous Serial Communication.

The data coming in at the receiving end of the data line in a serial data transfer is all 0s and 1s, it is difficult to make sense of the data unless the sender and receiver agree on a set of rules, a protocol, on how the data is packed, how many bits constitute a character, and when the data begins and ends.

Asynchronous serial data communication is widely used for character oriented transmissions. In this method, each character is placed between start and stop bits. This is called framing. In data framing for asynchronous communications, the data such as ASCII characters, are packed between a start bit and stop bit. The start bit is always one bit, but the stop bit can be one or two bits. The start bit is always a 0 (low) and the stop bit is 1(high). Look at below figure in which the ASCII character “A” (8-bit binary 0100 0001) is framed between the start bit and a stop bit. Notice that the LSB is sent out first.



Figure(2)

Data Transfer Rate

The rate of data transfer in serial data communication is stated in bps (bits per second). Another widely used terminology for bps is baud rate. The baud rate is the modem terminology and s defined as the number of signal changes per second.