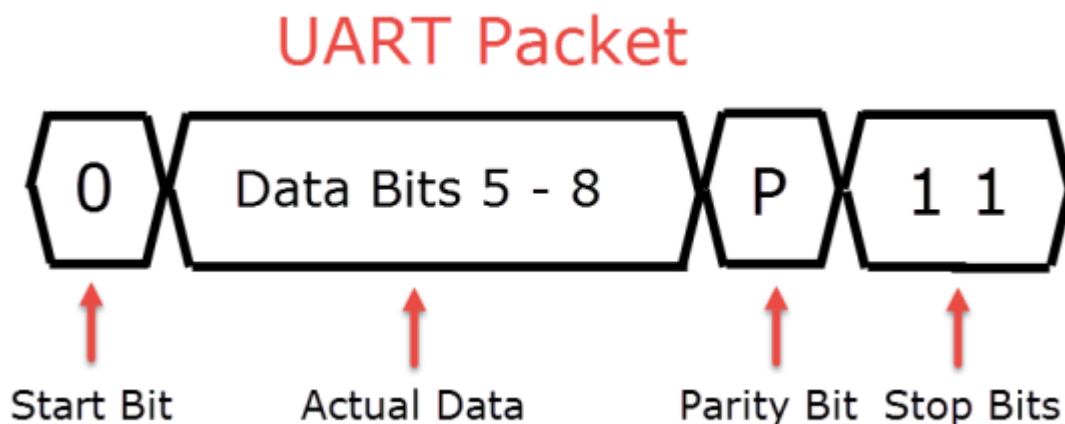


External Communication

4)UART :

UART is the name for the hardware used for a RS-232 Serial Interface. UART stands for **Universal Asynchronous Receiver Transmitter**. Early PCs had a UART chip, but this functionality is now found inside a larger chip that also contains other I/O features. A UART may be used when high speed is not required or an inexpensive communication link between two devices is required. UART communication is very cheap. Asynchronous because no clock signal is transmitted.



UART adds start and stop bits to the data packet being transferred. These bits define the beginning and end of the data packet so the receiving UART knows when to start reading the bits. When the receiving UART detects a start bit, it starts to read the incoming bits at a specific frequency known as the *baud rate*. Baud rate is a measure of the speed of data transfer, expressed in bits per second (bps).

Advantages and Disadvantages of UART:

Advantages :

- Single wire.
- Easy interface to PCs.
- Range of standard physical interfaces (TTL, RS232, RS422, RS485).

Disadvantages :

- Needs reasonable clock accuracy both ends.
- Max data rate in practice about 1mbit/sec (typically limited by UART capabilities).

Application of UART :

- Transmitting and receiving UARTs must be set for the same bit speed, character length, parity, and stop bits for proper operation.

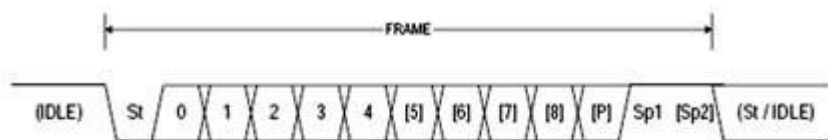
- Very low-cost home computers or embedded systems dispense with a UART and use the CPU to sample the state of an input port or directly manipulate an output port for data transmission.
- Typical serial ports used with personal computers connected to modems use eight data bits.

5)USART :

The USART module is a full duplex, serial I/O communication peripheral. It contains all shift registers, clock generators and data buffers needed for serial communication. It can work in synchronous mode, or in asynchronous mode. The USART uses two I/O pins to transmit and receive serial data. Both transmission and reception can occur at the same time i.e. 'full duplex' operation.

Asynchronous Mode:

- Data transfer happens in the following way:
- In idle state, data line has logic high (1).
- Data transfer starts with a start bit, which is always a zero.
- Data word is transferred (8 or 9 bit), LSB is sent first.
- Each word ends with a stop bit, which is always high (1).



St Start bit, always low.

(n) Data bits (0 to 8).

P Parity bit. Can be odd or even.

Sp Stop bit, always high.

IDLE No transfers on the communication line (RxD or TxD). An IDLE line must be high.

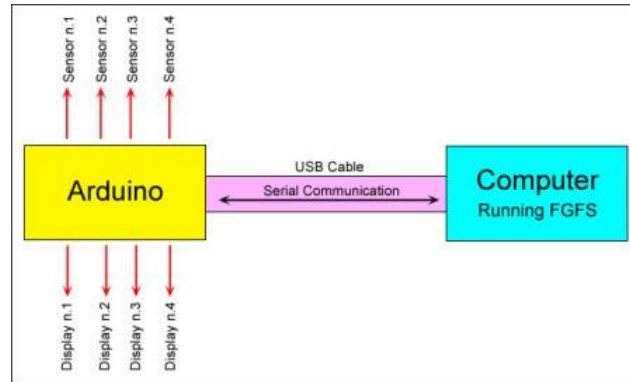
6)USB :

It is a representative peripheral interface. USB stands for **Universal Serial Bus**. It provides a serial bus standard for connecting devices, usually to a computer, but it also is in use on other devices such as set-top boxes, game consoles and PDAs.



USB Standard :

- USB 1.0 specification introduced in 1994
- USB 2.0 specification finalized in 2001 : Became popular due to cost/benefit advantage.
- E.g. IEEE 1394 — high bandwidth, high cost
- Three generations of USB : USB 1.0 , USB 2.0 , USB 3.0



Advantages and Disadvantages of USB :

Advantages :

- Flash drives use little power, have no fragile moving parts, and for most capacities are small and light.
- Data stored on flash drives is impervious to mechanical shock, magnetic fields, scratches and dust.

Disadvantages :

- Flash drives can sustain only a limited number of write and erase cycles before the drive fails.
- A drawback to the small size is that they are easily misplaced, left behind, or otherwise lost.

Below Image differentiates between UART,USART and USB.

UART	USART	USB
1. UART stands for Universal Asynchronous transmitter and receiver.	1. USART stands for universal synchronous and asynchronous Data transmitter and receiver	1. USB stands for universal serial bus.
2. It is a two wire protocol Rx and TX.	2. It is a two wire protocol Rx and TX.	2. It is a two wire protocol D+ and D-.
3. It is transmitting and receiving packets of The data byte by byte without classes pulses	3. It is send and receives a block of data along with classes pulses.	3. Send and receives a data along with clock pulses
4. It is a half duplex communication	4. It is a full duplex Communication	4. It is also full-communication
5. It is slow compare with : USART	5. It is slow compare with USB	5. It is fast compare with USART and USB