1. Communication Protocol

- A communication protocol is a set of rules.
- It helps devices send data.
- It helps devices receive data.
- It helps devices understand data.
- It defines how data starts and ends.

2. UART (Universal Asynchronous Receiver Transmitter)

Overview

- UART is a serial communication method.
- Data is sent one bit at a time.
- Only two devices communicate.
- Communication is direct.

Wires Used

- TX sends data.
- RX receives data.
- GND is a common reference.

Working

- UART does not use a clock signal.
- Devices use the same speed.
- Speed is called baud rate.

Data Format

- Start bit shows data start.
- Data bits carry information.
- Stop bit shows data end.

Advantages

- Simple communication method.
- Uses fewer wires.
- Easy to implement.

Limitations

- Only two devices can communicate.
- Not suitable for large systems.

Applications

- Serial communication.
- Debugging.
- Bluetooth modules.
- GPS modules.

3. I^2C (Inter-Integrated Circuit)

Overview

- I^2C is a serial communication method.
- Multiple devices can communicate.
- Devices share the same bus.

Wires Used

- SDA carries data.
- SCL carries clock signal.

Working

- One device acts as master.
- Other devices act as slaves.
- Master controls communication.

Addressing

- Each slave has a unique address.
- Master selects slave using address.

Communication Steps

- Start condition.
- Address selection.
- Data transfer.
- Stop condition.

Advantages

- Uses only two wires.
- Supports many devices.
- Saves board space.

Limitations

- Slower than UART.
- Slightly complex.

Applications

- Sensors.
- Displays.
- RTC modules.
- Memory devices.
- I^2C is slightly complex.

5. Summary

- UART is used for simple communication.
- UART connects only two devices.
- I^2C is used for multiple devices.
- I^2C uses fewer wires.

- Both are important in electronics.