DHT11 (temperature and humidity sensor)

1. Basic Structure and Working Principle

The DHT11 sensor consists of two main components:

- **Humidity Sensing Component**: This part has a moisture-holding substrate with electrodes applied to it. When the air humidity changes, the conductivity of the substrate changes, causing variations in the resistance between the electrodes. This change is measured and processed to give a digital humidity reading.
- **Temperature Sensing Component**: This uses an NTC (Negative Temperature Coefficient) thermistor or a thermocouple to measure temperature. In an NTC thermistor, resistance decreases as temperature increases. The sensor reads these changes in resistance and translates them into temperature values.

2. Data Output and Communication Protocol

The DHT11 uses a single-wire serial communication protocol to send data to a microcontroller. The data packet consists of 5 bytes

- **Byte 1 and Byte 2**: Represent the humidity integer and decimal parts.
- **Byte 3 and Byte 4**: Represent the temperature integer and decimal parts.
- **Byte 5**: Checksum byte, used for data validation.

❖ The protocol works as follows:

- **Start Signal**: The microcontroller sends a start signal by pulling the data line low for at least 18 milliseconds.
- **Response**: The DHT11 sends a response signal, pulling the line low for 80 microseconds and then high for another 80 microseconds.
- **Data Transmission**: The sensor sends 40 bits of data (5 bytes). Each bit is either a short pulse for "0" or a long pulse for "1."
- **Checksum**: The microcontroller validates the data by checking the checksum. If it matches, the data is valid.