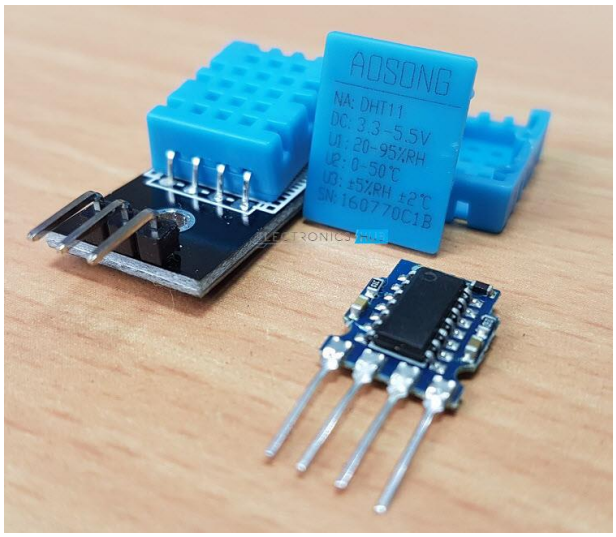
Ex. No: 5 Interface DHT11 sensor with Raspberry Pi, write a program to print temperature and humidity readings.

- DHT11 is a Digital Sensor consisting of two different sensors in a single package.
- The sensor contains an NTC (Negative Temperature Coefficient) Temperature Sensor, a Resistive-type Humidity Sensor and an 8-bit Microcontroller to convert the analog signals from these sensors and produce a Digital Output.
- DHT11 sensor measures and provides humidity and temperature values serially over a single wire.
- It can measure relative humidity in percentage (20 to 90% RH) and temperature in degree Celsius in the range of 0 to 50°C.
- It has 4 pins; one of which is used for data communication in serial form.
- Pulses of different TON and TOFF are decoded as logic 1 or logic 0 or start pulse or end of a frame.



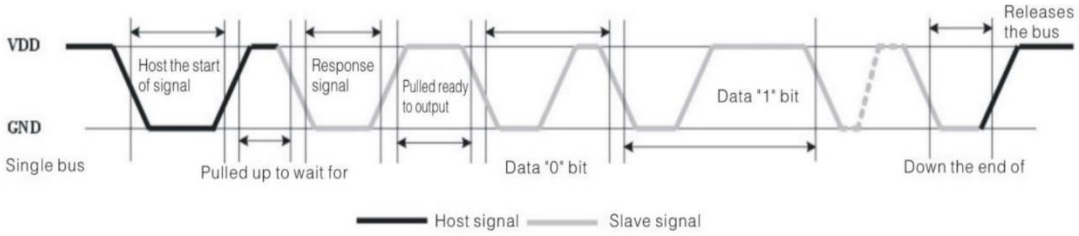
Reading Digital Output from DHT11

- DHT11 uses a Single bus data format for communication. Only a single data line between an MCU like Arduino or Raspberry Pi and the DHT11 Sensor is sufficient for exchange of information.

- Microcontroller acts as a Master and the DHT11 Sensor acts as a Slave. The Data OUT of the DHT11 Sensor is in open-drain configuration and hence it must always be pulled HIGH with the help of a 5.1KΩ Resistor.

- This pull-up will ensure that the status of the Data is HIGH when the Master doesn't request the data (DHT11 will not send the data unless requested by the Master).

- Whenever the Microcontroller wants to acquire information from DHT11 Sensor, the pin of the Microcontroller is configured as OUTPUT and it will make the Data Line low for a minimum time of 18ms and releases the line. After this, the Microcontroller pin is made as INPUT.



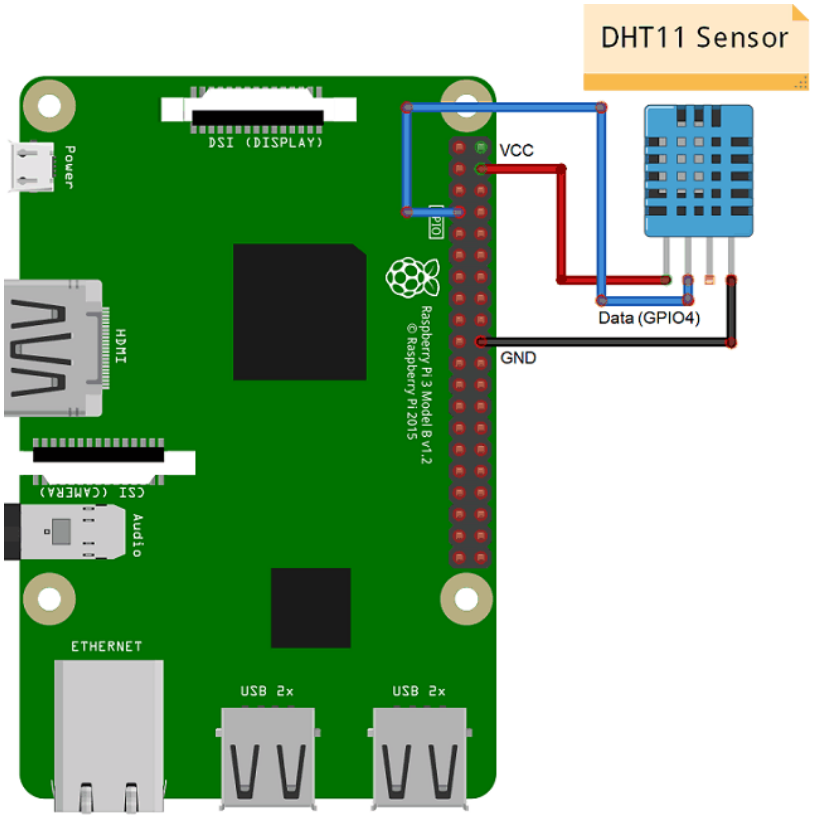
- The data pin of the DHT11 Sensor, which is an INPUT pin, reads the LOW made by the Microcontroller and acts as an OUTPUT pin and sends a response of LOW signal on the data line for about 80µs and then pulls-up the line for another 80µs.

- After this, the DHT11 Sensor sends a 40 bit data with Logic '0' being a combination of 50µs of LOW and 26 to 28µs of HIGH and Logic '1' being 50µs of LOW and 70 to 80µs of HIGH.

- After transmitting 40 bits of data, the DHT11 Data Pin stays LOW for another 50µs and finally changes its state to input to accept the request from the Microcontroller.

Raspberry Pi DTH11 Humidity and Temperature Sensor Interface

Circuit Diagram
The following is the circuit diagram of the DHT11 and Raspberry Pi Interface.



1. Connect GND pin to Ground Pin (39)
2. Connect DATA Pin to GPIO18
3. Connect VCC Pin to 5V (2)

Installation of required Libraries

Run the following command to **install the** CircuitPython-DHT library:

```
pip3 install adafruit-circuitpython-dht
```

```
sudo apt-get install libgpiod2
```

Create a new file called **code.py** with **Thonny Editor.**

Python Code : code.py

```
import time
import board
import adafruit_dht

# Initial the dht device, with data pin connected to:
dhtDevice = adafruit_dht.DHT11(board.D18)

while True:
    try:
        # Print the values to the serial port
        temperature_c = dhtDevice.temperature
        temperature_f = temperature_c * (9 / 5) + 32
        humidity = dhtDevice.humidity
        print(
            "Temp: {:.1f} F / {:.1f} C    Humidity: {}% ".format(
                temperature_f, temperature_c, humidity
            )
        )

    except RuntimeError as error:
        # Errors happen fairly often, DHT's are hard to read, just keep going
        print(error.args[0])
        time.sleep(2.0)
        continue
    except Exception as error:
        dhtDevice.exit()
        raise error

    time.sleep(2.0)
```

Sample Output: