

MES Wadia College of Engineering Pune-01
Department of Computer Engineering

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| Name of Student: | Class: |
| Semester/Year: | Roll No: |
| Date of Performance: | Date of Submission: |
| Examined By: | Experiment No: 04 |

ASSIGNMENT NO: 04

AIM: Understanding the connectivity of Raspberry-Pi /Beagle board circuit with temperature sensor. Write an application to read the environment temperature. If temperature crosses a threshold value, the application should indicate user using LEDs.

OBJECTIVES:

- To understand the concept of Temperature-Humidity sensor (DHT11)
- To interface Temperature-Humidity sensor with Raspberry Pi model
- To program the Raspberry Pi model to measure the real time Temperature and Humidity of the Environment

APPARATUS:

- Raspberry-Pi 3 module, Micro-SD Card, Power Adapter, HDMI to VGI cable
- Breadboard, LEDs, Jumping Wires.
- Operating System recommended: Raspberry pi OS
- DHT11 Temperature and Humidity Sensor

THEORY:

- Physical quantities like Humidity, temperature, pressure etc. are monitored to get information about the environmental conditions.
- Temperature is basically amount of heat present in environment. Humidity is the presence of water vapors in air. The Temperature & amount of water vapor in air can affect human comfort as well as many manufacturing processes in industries. The presence of water vapor also influences various physical, chemical, and biological processes.
- In our module we are using “DHT11 Temperature and Humidity Sensor”.
- The features of this sensor are, calibrated digital signal output, and high reliability and excellent long-term stability.
- This sensor has a resistive-type humidity measurement component in which resistivity of semiconductor material changes as per humidity in environment changes.
- This sensor also includes NTC temperature measurement component which detects the change in temperature.
- DHT11 basically provides two outputs from single data pin semiconductor material

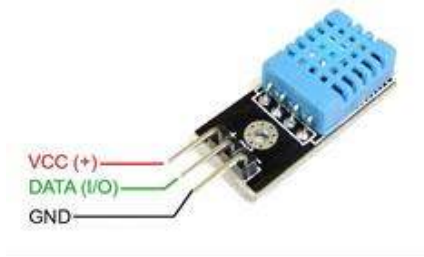


Fig. 1. DHT11 Temperature and Humidity Sensor Module Pinout

DHT11 Specifications

- Operating Voltage: 3.5V to 5.5V
- Operating current: 0.3mA (measuring) 60uA (standby)
- Output: Serial data
- Temperature Range: 0°C to 50°C
- Humidity Range: 20% to 90%
- Resolution: Temperature and Humidity both are 16-bit
- Accuracy: $\pm 1^\circ\text{C}$ and $\pm 1\%$

Connections:

1. Connect GPIO 18 (Pin No. 12) of Raspberry Pi to the Data pin of DHT11 sensor through connecting jumper wires and Breadboard.
2. Connect Power (5V) and Ground of Raspberry Pi to DHT11 sensor through connecting wires and breadboard.
3. Now power up your Raspberry Pi and boot.
4. Download Adafruit_Python_DHT.tar.gz package
5. Open terminal and type `tar -xvzf Adafruit_Python_DHT.tar.gz` command to extract Adafruit package.
6. In the same terminal, type `nano temp.py`
7. It will open the nano editor. Use following pseudo code in the python to blink LED and save

Installing the Adafruit DHT11 library on Raspberry Pi:

1. Enter this at the command prompt to download the library:
`git clone https://github.com/adafruit/Adafruit_Python_DHT.git`
2. Change directories with:
`cd Adafruit_Python_DHT`
3. Enter this:
`sudo apt-get install build-essential python-dev`
4. Install the library with:
`sudo python setup.py install`

Once it is done you will have both the libraries successfully installed on our Raspberry Pi. Now we can proceed with the hardware connection.

Circuit Design

- Connect the VCC and GND pins of the DHT11 Sensor to +5V and GND of Raspberry Pi
- Connect the Data OUT of the Sensor to the GPIO4 i.e. Physical Pin 7 of the Raspberry Pi.

Circuit Diagram

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

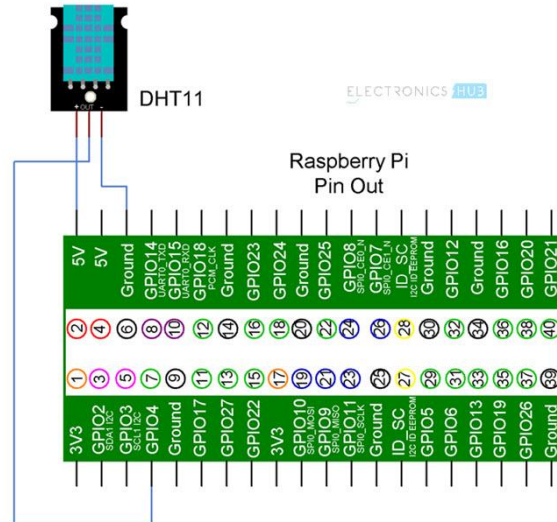


Fig. 2. Circuit diagram of the DHT11 and Raspberry Pi Interface

CONCLUSION: Thus, we have successfully designed an application to read the environment temperature and humidity.

QUESTIONS:

1. Discuss different types of temperature sensors available.
2. What is the working Principle of DHT11 Sensor including capturing moisture and temperature.
3. Is the DHT11 waterproof?
4. What's the sampling rate of a DHT11 sensor?
5. What is the significance of using Adafruit library in this assignment?