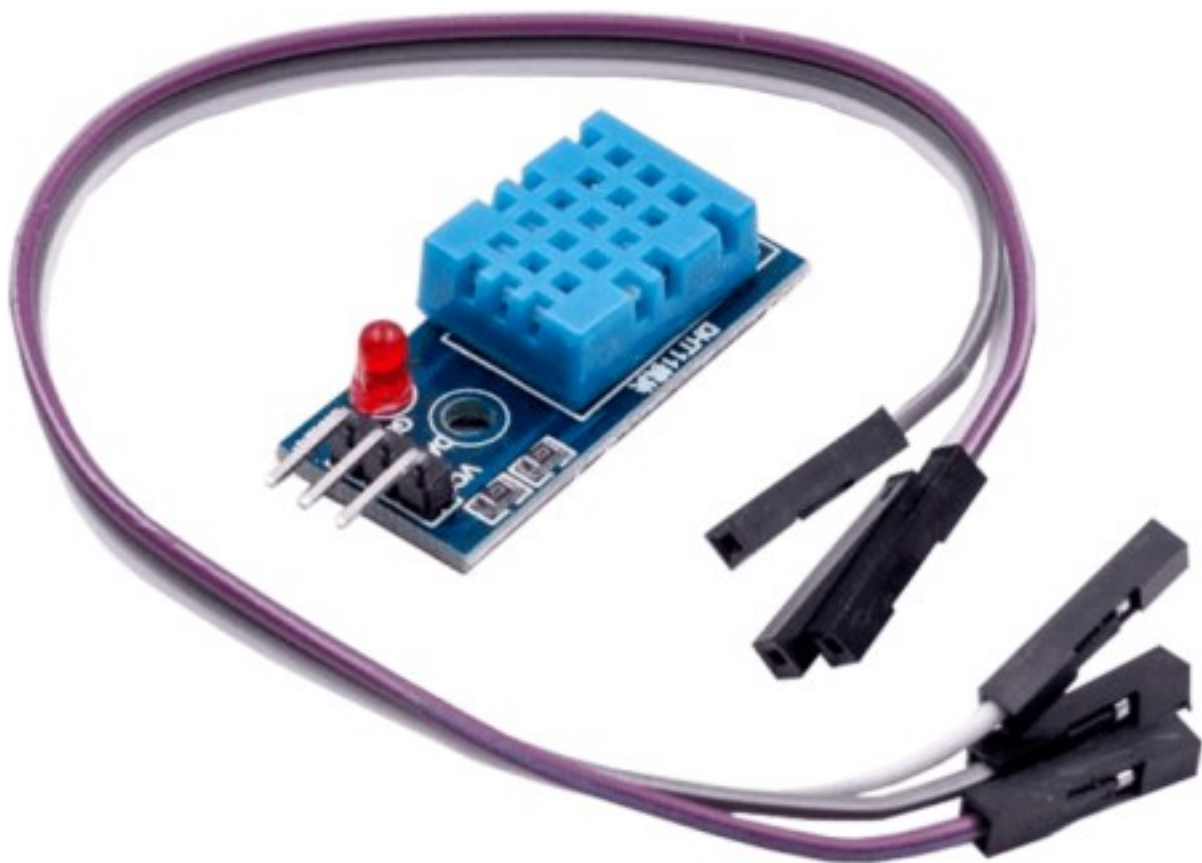




## Welcome!

Thank you for purchasing our AZ Delivery DHT11 Temperature Control Module. In the following pages, we will show you how to use and configure this handy device.

**Have fun!**



## Areas of application

Education and teaching: Use in schools, universities and training institutions to teach the basics of electronics, programming and embedded systems. Research and development: Use in research and development projects to create prototypes and experiments in the fields of electronics and computer science. Prototype development: Use in the development and testing of new electronic circuits and devices. Hobby and Maker Projects: Used by electronics enthusiasts and hobbyists to develop and implement DIY projects.

## Required knowledge and skills

Basic understanding of electronics and electrical engineering. Knowledge of programming, especially in the C/C++ programming language. Ability to read schematics and design simple circuits. Experience working with electronic components and soldering.

## Operating conditions

The product may only be operated with the voltages specified in the data sheet to avoid damage. A stabilized DC power source is required for operation. When connecting to other electronic components and circuits, the maximum current and voltage limits must be observed to avoid overloads and damage.

## Environmental conditions

The product should be used in a clean, dry environment to avoid damage caused by moisture or dust. Protect the product from direct sunlight (UV)

## Intended Use

The product is designed for use in educational, research and development environments. It is used to develop, program and prototype electronic projects and applications. The Sensor product is not intended as a finished consumer product, but rather as a tool for technically savvy users, including engineers, developers, researchers and students.

## Improper foreseeable use

The product is not suitable for industrial use or safety-relevant applications. Use of the product in medical devices or for aviation and space travel purposes is not permitted

## disposal

Do not discard with household waste! Your product is according to the European one Directive on waste electrical and electronic equipment to be disposed of in an environmentally friendly manner. The valuable raw materials contained therein can be recycled become. The application of this directive contributes to environmental and health protection. Use the collection point set up by your municipality to return and Recycling of old electrical and electronic devices. WEEE Reg. No.: DE 62624346

## electrostatic discharge

Attention: Electrostatic discharges can damage the product. Note: Ground yourself before touching the product, such as by wearing an anti-static wrist strap or touching a grounded metal surface.

## safety instructions

Although our product complies with the requirements of the RoHS Directive (2011/65/EU) and does not contain any hazardous substances in quantities above the permitted limits, residues may still be present. Observe the following safety instructions to avoid chemical hazards: Caution: Soldering can produce fumes that can be harmful to health. Note: Use a solder fume extractor or work in a well-ventilated area. If necessary, wear a respirator mask. Caution: Some people may be sensitive to certain materials or chemicals contained in the product. Note: If skin irritation or allergic reactions occur, stop use and, if necessary, consult a doctor. Caution: Keep the product out of the reach of children and pets to avoid accidental contact and swallowing of small parts. Note: Store the product in a safe, closed container when not in use. Attention: Avoid contact of the product with food and drinks. Note: Do not store or use the product near food to prevent contamination. Although our product complies with the requirements of the RoHS Directive (2011/65/EU) and does not contain any hazardous substances in quantities above the permitted limits, residues may still be present. Observe the following safety instructions to avoid chemical hazards: Caution: Soldering can produce fumes that can be harmful to health. Note: Use a solder fume extractor or work in a well-ventilated area. If necessary, wear a respirator mask. Caution: Some people may be sensitive to certain materials or chemicals contained in the product. Note: If skin irritation or allergic reactions occur, stop use and, if necessary,

consult a doctor. Caution: Keep the product out of the reach of children and pets to avoid accidental contact and swallowing of small parts. Note: Store the product in a safe, closed container when not in use. Attention: Avoid contact of the product with food and drinks. Note: Do not store or use the product near food to prevent contamination. The product contains sensitive electronic components and sharp edges. Improper handling or assembly can result in injury or damage. Observe the following safety instructions to avoid mechanical hazards: Attention: The product's circuit board and connectors may have sharp edges. Use caution to avoid cuts. Note: Wear appropriate protective gloves when handling and assembling the product. Caution: Avoid excessive pressure or mechanical stress on the board and components. Note: Only mount the product on stable and flat surfaces. Use appropriate spacers and housings to minimize mechanical stress. Attention: Make sure the product is securely fastened to prevent accidental slipping or falling. Note: Use appropriate support or secure mounting in enclosures or on mounting plates. Caution: Make sure all cable connections are connected securely and correctly to avoid strain and accidental unplugging. Note: Route cables so that they are not under tension and do not pose a tripping hazard. The product operates with electrical voltages and currents that, if used improperly, can result in electric shocks, short circuits or other hazards. Observe the following safety instructions to avoid electrical hazards: Attention: Use the product only with the specified voltages. Note: The performance limits of the product can be found in the associated data sheet Caution: Avoid short circuits between the connectors and components of the product Note: Make sure that no conductive objects touch or bridge the circuit board. Use insulated tools and pay attention to the arrangement of connections. Caution: Do not perform any work on the product when it is connected to a power source. Note: Disconnect the product from power before making any circuit changes or connecting or removing components. Caution: Do not exceed the specified current ratings for the product's inputs and outputs. Note: The performance limits of the product can be found in the technical specifications or in the data sheet Attention: Make sure that the power sources used are stable and correctly sized. Note: Only use tested and suitable power supplies to avoid voltage fluctuations and overloads. Attention: Maintain sufficient distance from live parts to avoid accidental contact. Note: Ensure that the cabling is arranged safely and clearly according to the voltage used. Caution: Use insulating housings or protective covers to protect the product from direct contact. Note: Place the product in a non-conductive case to avoid accidental touching and short circuits. The product and the components on it may become warm during operation. Improper handling or overloading the product can result in burns, damage or fire. Observe the following safety instructions to avoid thermal hazards: Caution: Make sure the product is used within recommended operating temperatures. Note: The recommended operating temperature range is typically between -40°C and +85°C. Check the specific information in the product data sheet. Attention: Do not place the product near external heat sources such as radiators or direct sunlight. Note: Ensure that the product is operated in a cool and well-ventilated area. Attention: Make sure the product is well ventilated to avoid overheating. Note: Use fans or heat sinks when operating the product in a closed enclosure or in an environment with limited air circulation. Attention: Mount the product on heat-resistant surfaces and in heat-resistant housings. Note: Use enclosure materials that can withstand high temperatures to avoid damage or fire hazard. Caution: Implement temperature monitoring when using an enclosure and, if necessary, protection mechanisms that shut down the product if it overheats. Note: Note: Use temperature sensors and appropriate software to monitor the temperature of the product and shut down the system if necessary. Caution: Avoid overloads that can cause excessive heating of components. Note: To prevent overheating, do not exceed the specified current and voltage limits. Caution: Short circuits can generate significant heat and cause fires. Note: Make sure that all connections are correct and secure and that no conductive objects can accidentally cause short circuits.



The DHT-11 is a relative humidity/temperature sensor that outputs a digital signal. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air.

The temperature measurement range of the DHT11 is from 0° C to + 50° C, with accuracy of  $\pm 2^{\circ}\text{C}$ , and a range of humidity measurement, from 20% to 90% with accuracy of  $\pm 5\%$ .

## Technical Specifications:

Operating Voltage: 3 to 5V

Operating Voltage Max: 2.5mA max

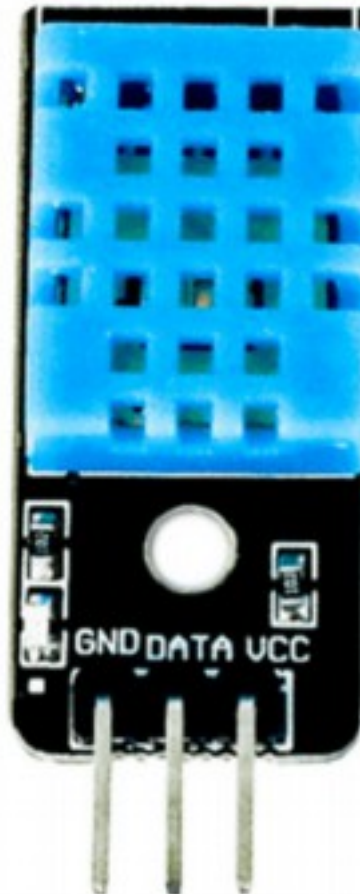
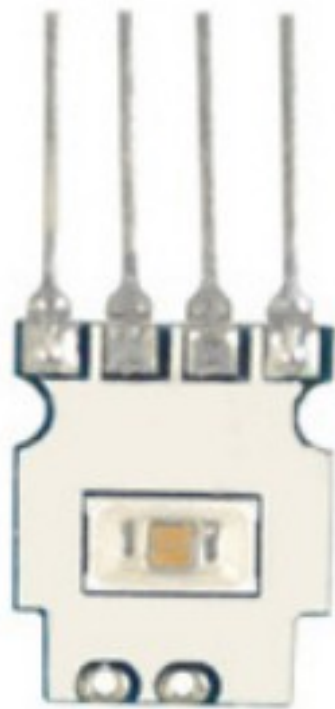
Humidity range: 20% - 90% with 5% accuracy Temperature range: 0°C - 50°C with  $\pm 2^{\circ}\text{C}$  accuracy Sampling rate: 1Hz (reading every 1s)

Dimensions: 15x32x9mm

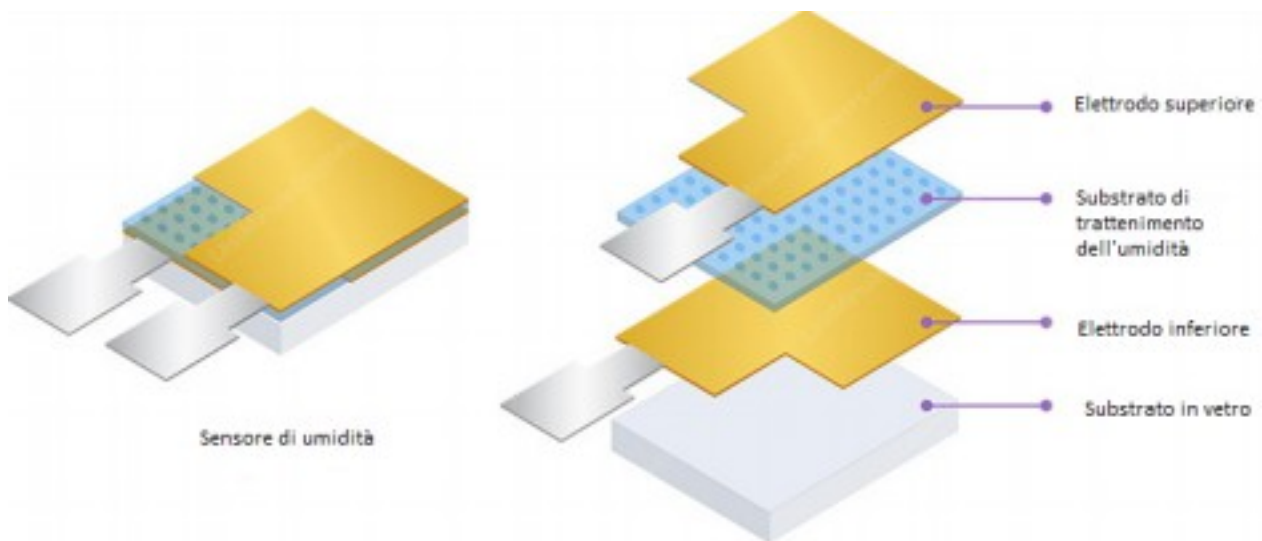
Inside the enclosure, on the sensing side of the DHT11 sensor, is

# Az-Delivery

present a humidity sensing component together with an NTC temperature sensor (or thermistor).



# Az-Delivery

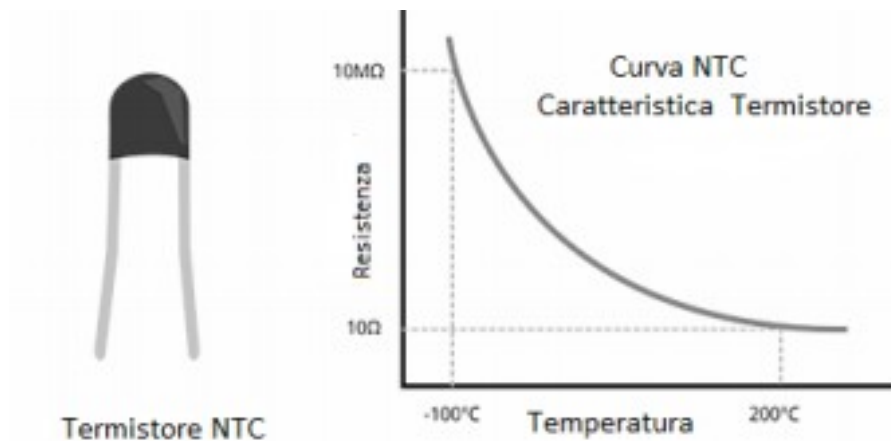


The moisture sensing component is used, of course, to measure moisture, and it has two electrodes with moisture-retaining substrate (usually a conductive plastic polymer or salt) sandwiched between the electrodes. Ions are released from the substrate when water vapor is absorbed by it, which in turn increases the conductivity between the electrodes. The change in resistance between the two electrodes is proportional to relative humidity. Higher relative humidity decreases the resistance between the electrodes, while low relative humidity increases the resistance between the electrodes.

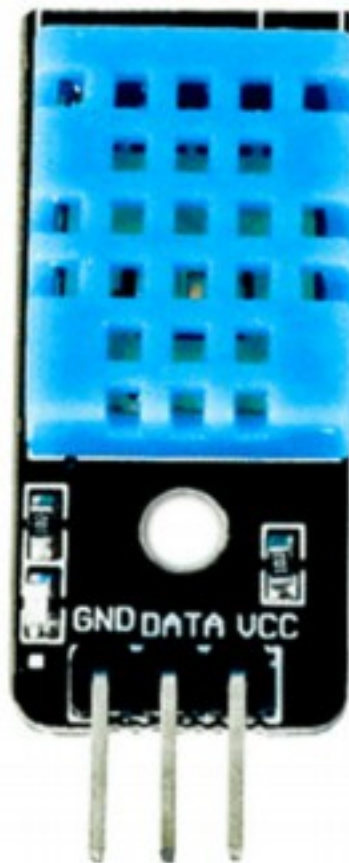
The temperature sensing part of the sensor is an NTC temperature sensor (thermistor) to measure temperature. A thermistor is a thermal resistor, a resistor that changes its resistance with temperature. Technically, all resistors are thermistors; their resistance changes slightly with temperature, but the change is generally small and difficult to measure. Thermistors are made of

# Az-Delivery

such that the resistance changes dramatically with temperature so that they can have  $100\Omega$  or more change per degree of temperature. The term "NTC" means "Negative Temperature Coefficient," which means that the resistance decreases with increasing temperature.



On the other side, there is a small PCB with an IC equipped with 8-bit SOIC-14. This IC measures and processes the analog signal with stored calibration coefficients, performs analog-to-digital conversion, and outputs a digital signal with data containing information on temperature e humidity.



**Pin "VCC"**- provides power to the sensor. Although the supply voltage can vary between 3.3V and 5.5V, we recommend the power supply at 5 V. In the case of 5V power supply, a cable connecting the sensor and microcontroller up to 20 meters can be used. However, with a supply voltage of 3.3V, the length of the cable should not exceed one meter. Otherwise, line voltage drop will lead to errors in the measurement.

**"DATA" pin** - is a data pin and is used for communication between the sensor and the microcontroller.

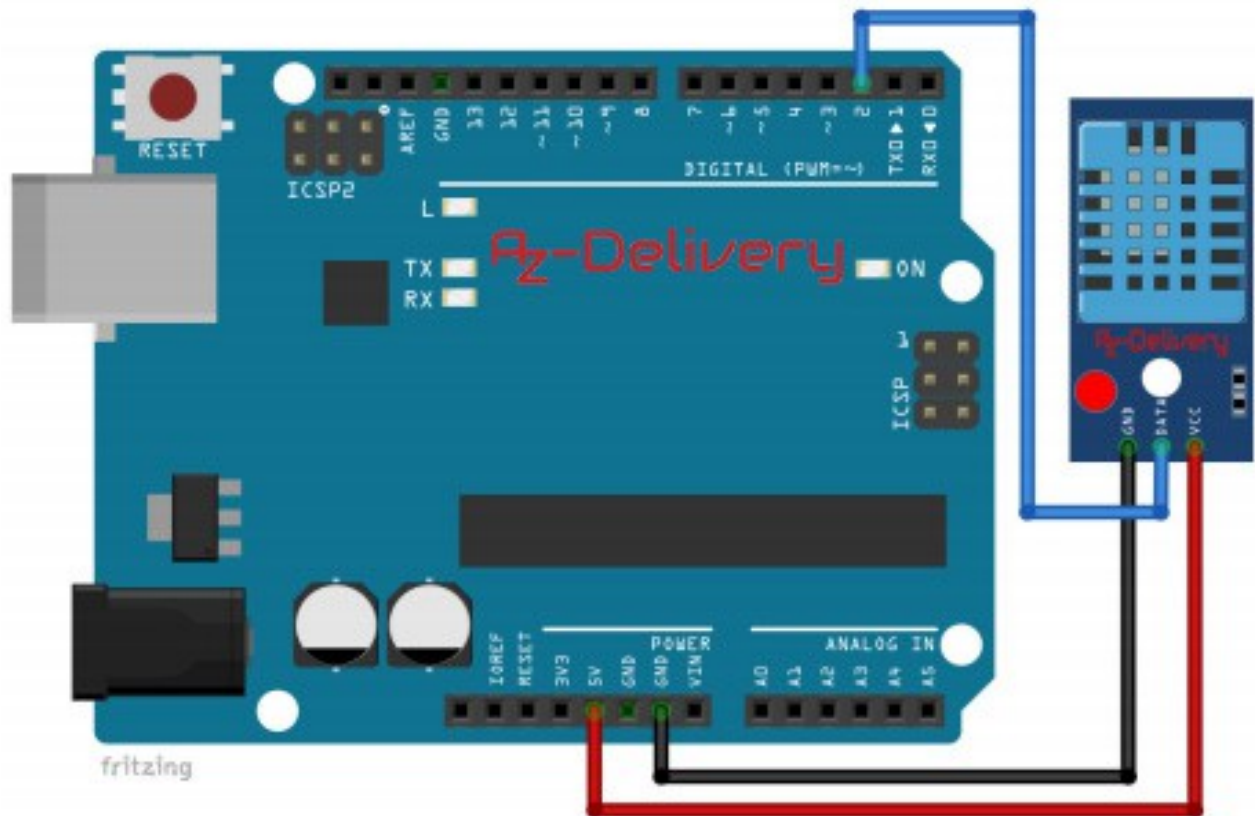
**"GND" pin** - is a ground pin and should be connected to common ground, or 0 V (on Atmega328p or Raspberry Pi)

## Connecting the module with Microcontroller



## ATmega328p, ATmega16U2

Connect the ATmega328p microcontroller, ATmega16U2, and DHT11 as shown in the connection diagram below:



Pin Module	Pin Mc	Couleur du câble
<u>DATA</u>	<u>D2</u>	<a href="#">Blue Thread</a>
GND	GND	<b>Black Thread</b>
<u>VCC</u>	<u>5V</u>	<a href="#">Red Thread</a>



## Microcontroller Example Sketch

To write a sketch for the DHT11 module we first need the library. The simplest library we recommend is the SimpleDHT library which can be downloaded here: <https://github.com/winlinvip/SimpleDHT>. When you download the ".zipper" file, open the ATmega328p Microcontroller and go to: *Sketch > Include Library > Add .ZIP Library* and add the downloaded zipper file. After that go to:

*File > Examples > SimpleDHT > DHT11Default* and open the sketch.

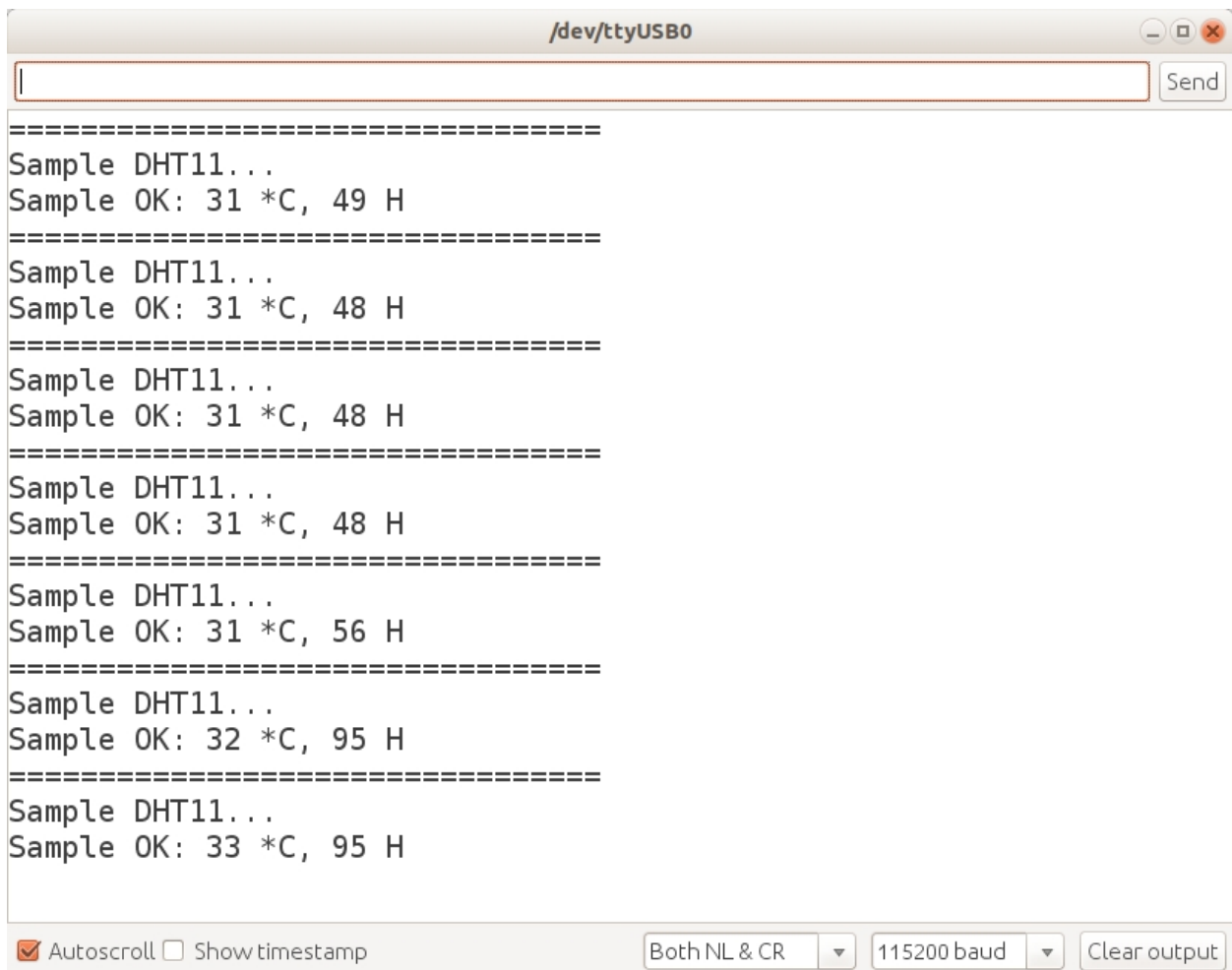
Here is the sketch:

```
#include <SimpleDHT.h>
int pinDHT11 = 2;
SimpleDHT11 dht11(pinDHT11);
void setup() { Serial.begin(115200); }
void loop() {
  Serial.println("=====");
  Serial.println("Sample DHT11...");
  float temperature = 0;
  float humidity = 0;
  int err = SimpleDHTErrSuccess;
  if((err=dht11.read2(&temperature, &humidity, NULL)) != SimpleDHTErrSuccess){
    Serial.print("Read DHT11 failed, err=");
    Serial.println(err);
    delay(2000);
    return;
  }
  Serial.print("Sample OK: ");
```

# Az-Delivery

```
Serial.print((float)temperature);  
Serial.print(" *C, ");  
Serial.print((float)humidity);  
Serial.println(" RH%");  
delay(1500); // DHT11 sampling rate is 1HZ.  
}
```

And when you open the Serial Monitor (*Tools > Serial Monitor*), the output should look like this:



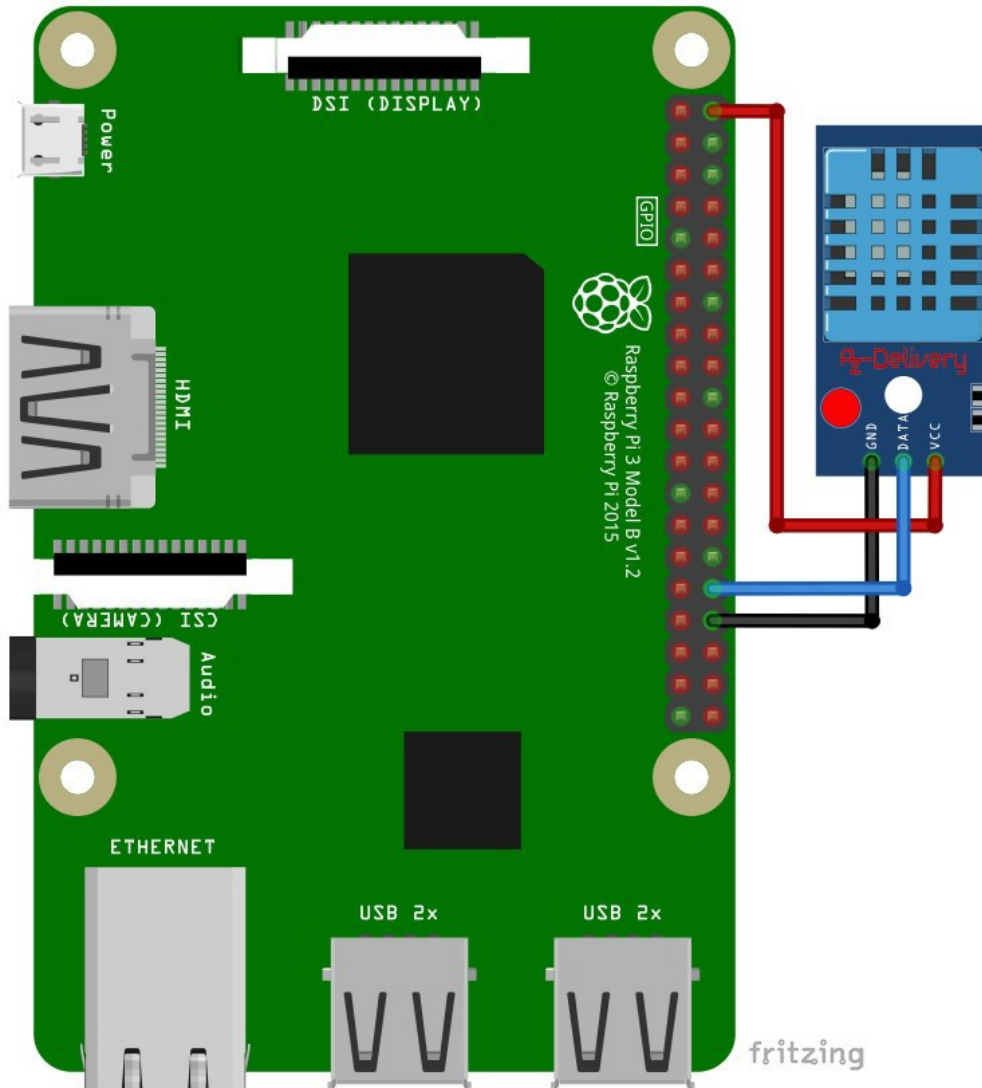
The screenshot shows the Serial Monitor window for the device `/dev/ttyUSB0`. The window displays a series of sensor readings from a DHT11 sensor, separated by horizontal lines of equals signs. Each line shows the temperature in degrees Celsius and the humidity in percent. The data is as follows:

Sample	Temperature (*C)	Humidity (H)
Sample DHT11...	31	49
Sample DHT11...	31	48
Sample DHT11...	31	48
Sample DHT11...	31	48
Sample DHT11...	31	56
Sample DHT11...	32	95
Sample DHT11...	33	95

At the bottom of the window, there are several controls: a checkbox for `Autoscroll` (checked), a checkbox for `Show timestamp` (unchecked), a dropdown menu for line endings set to `Both NL & CR`, a dropdown menu for baud rate set to `115200 baud`, and a `Clear output` button.

## Connecting the module with Raspberry Pi

Connect the Raspberry Pi and the DHT11 as shown in the connection diagram below:



### DHT11 Pin > Raspberry Pi Pin

VCC > 5V [PIN 2] **Red wire** DATA > GPIO12 [PIN 32] **Blue wire** GND > GND [PIN 30] **Black Wire**



## Sample script

Before we start creating scripts for DHT11, we must first install a library. The library we are going to use is called "*Adafruit\_DHT*." To install it we must first make sure that Raspbian is up to date. Start your Raspberry Pi, open the terminal and run these commands:

The first command is to update the system:

```
sudo apt-get update && sudo apt-get upgrade -y
```

The second command is for installing the python3-pip app. We will use the pip app to install the library:

```
sudo apt-get install python3-pip
```

The third command is for installing other apps used by the pip app during installation:

```
sudo python3 -m pip install --upgrade pip setuptools wheel
```

And once that is completed, we can install the library we need. Run this command in the terminal:

```
sudo pip3 install Adafruit_DHT
```

A screenshot of a terminal window on a Raspberry Pi. The prompt is 'pi@raspberrypi:~ \$'. The user has entered 'sudo pip3 install Adafruit\_DHT'. The terminal output shows the process of looking in indexes, collecting the package, downloading it from a URL, and successfully installing it. The output is as follows:

```
pi@raspberrypi:~ $ sudo pip3 install Adafruit_DHT
Looking in indexes: https://pypi.org/simple, https://www.piwheels.org/simple
Collecting Adafruit_DHT
  Downloading https://www.piwheels.org/simple/adafruit-dht/Adafruit_DHT-1.4.0-cp35-cp35m-linux_armv7l.whl
Installing collected packages: Adafruit-DHT
Successfully installed Adafruit-DHT-1.4.0
```

# Az-Delivery

After everything is installed, we can start writing scripts. Open the text editor in Raspbian and copy and paste this script:

```
import Adafruit_DHT
from time import sleep
sensor = Adafruit_DHT.DHT11
# DHT11 sensor connected to GPIO12.
pin = 12
print("[press ctrl+c to end the script]")
try: # Main program loop
    while True:
        humidity, temperature =
Adafruit_DHT.read_retry(sensor, pin)
        sleep(1.5)
        if humidity is not None and temperature is not
None: print("Temp={0:0.1f}*C Humidity={1:0.1f}%"
            .format(temperature, humidity))
        else:
print("Failed to get reading.Try again!")

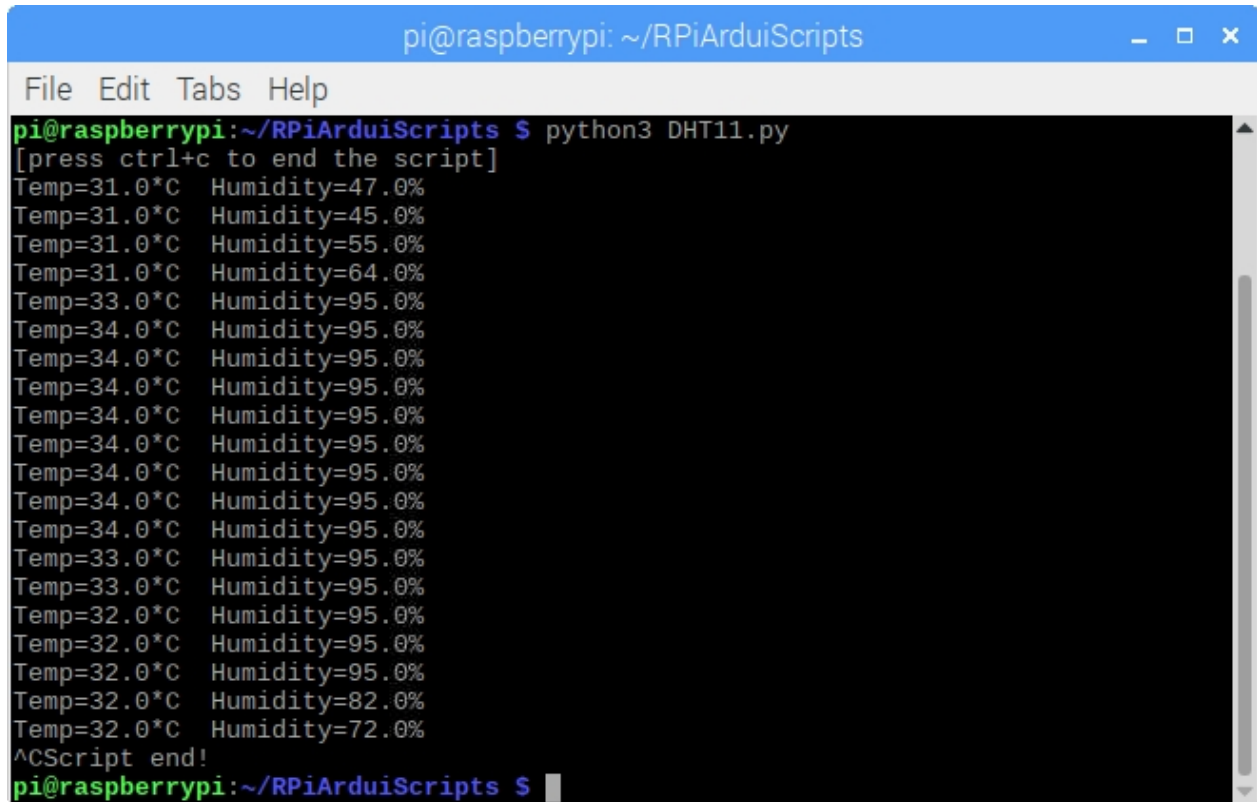
# Scavenging work after the end of the
program except KeyboardInterrupt:
    print("Script end!")
```

Save this script as "*DHT11.py*" and to execute it, run this command in the terminal:

# Az-Delivery

```
python3 DHT11.py
```

The output should look like this:



```
pi@raspberrypi: ~/RPiArduiScripts
File Edit Tabs Help
pi@raspberrypi:~/RPiArduiScripts $ python3 DHT11.py
[press ctrl+c to end the script]
Temp=31.0*C Humidity=47.0%
Temp=31.0*C Humidity=45.0%
Temp=31.0*C Humidity=55.0%
Temp=31.0*C Humidity=64.0%
Temp=33.0*C Humidity=95.0%
Temp=34.0*C Humidity=95.0%
Temp=34.0*C Humidity=95.0%
Temp=34.0*C Humidity=95.0%
Temp=34.0*C Humidity=95.0%
Temp=34.0*C Humidity=95.0%
Temp=34.0*C Humidity=95.0%
Temp=34.0*C Humidity=95.0%
Temp=33.0*C Humidity=95.0%
Temp=33.0*C Humidity=95.0%
Temp=32.0*C Humidity=95.0%
Temp=32.0*C Humidity=95.0%
Temp=32.0*C Humidity=95.0%
Temp=32.0*C Humidity=82.0%
Temp=32.0*C Humidity=72.0%
^CScript end!
pi@raspberrypi:~/RPiArduiScripts $
```

**You did it, now you can use your form for your projects.**



And now it is time to learn and create Projects on your own. You can do this with the help of many sample scripts and other tutorials, which you can find on the Internet.

**If you are looking for high-quality microelectronic products and accessories, AZ-Delivery Vertriebs GmbH is the right company where you can find them. We will provide you with numerous application examples, complete installation guides, e-books, libraries, and assistance from our technical experts.**

<https://az-delivery.de>

**Have fun!**

**Impressum**

<https://az-delivery.de/pages/about-us>