



Building Leaders for Advancing Science and Technology (BLAST) 2021

Internet of Things Hands-on Activities with Arduino

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Outline

- Internet of Things (IoT)
- Arduino
- ThingSpeak
- Hands-on Activities

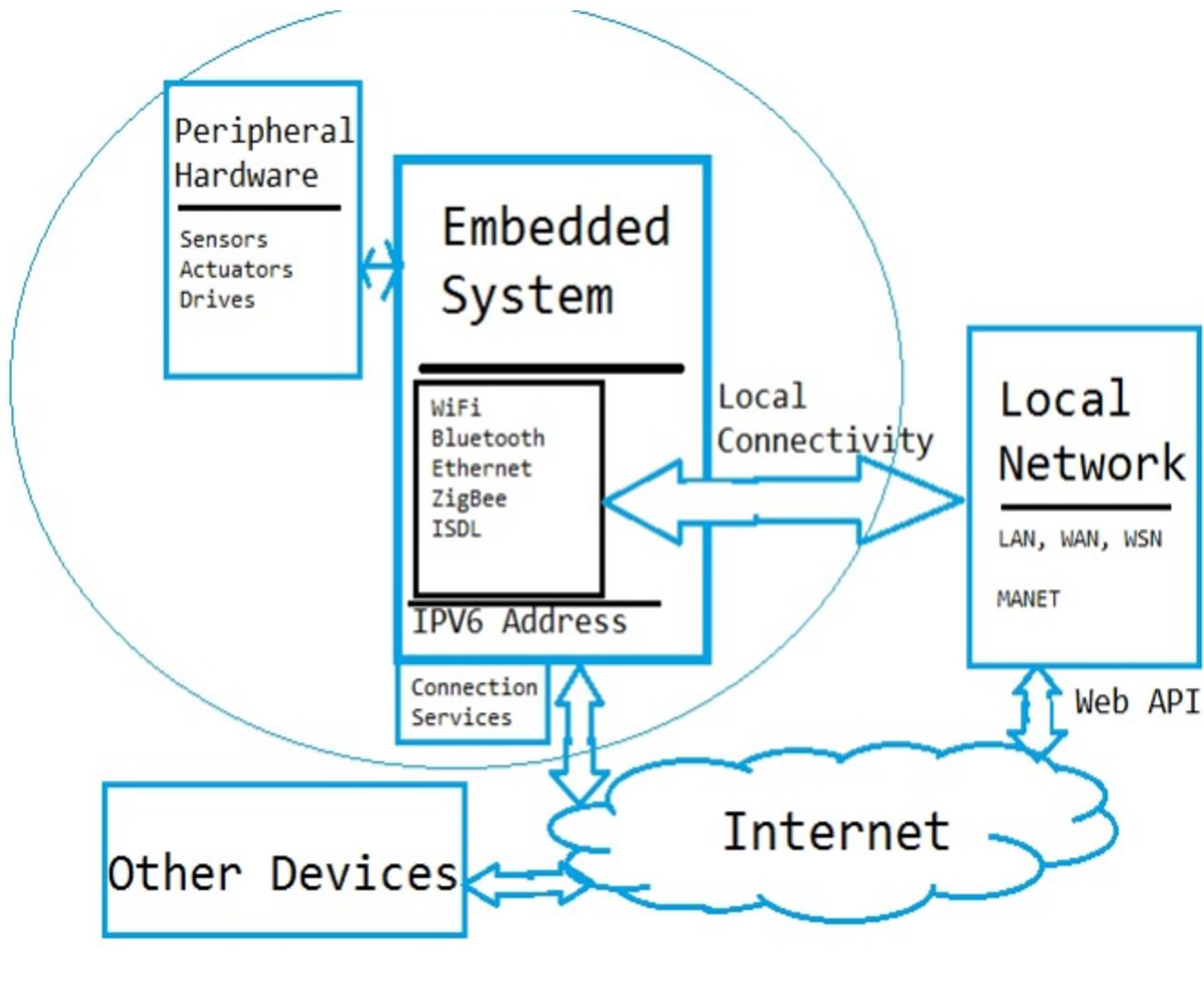


<https://medium.com/@otavioguastamacchia/creating-a-simple-iot-case-8102f22908a7>

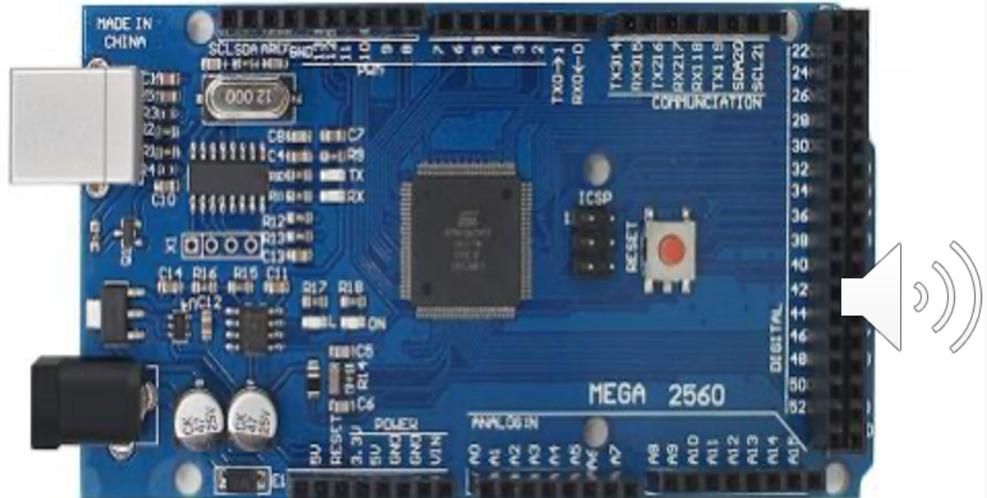
The Internet of Things (IoT)

IoT

- *Network of physical objects*
- *Embedded System*
- *Network connectivity*
- *Collect and exchange data*



Arduino



Mega2560 R3 ATmega2560-16AU
CH340 Development Board



ESP8266 NodeMCU LUA
CP2102 ESP-12E

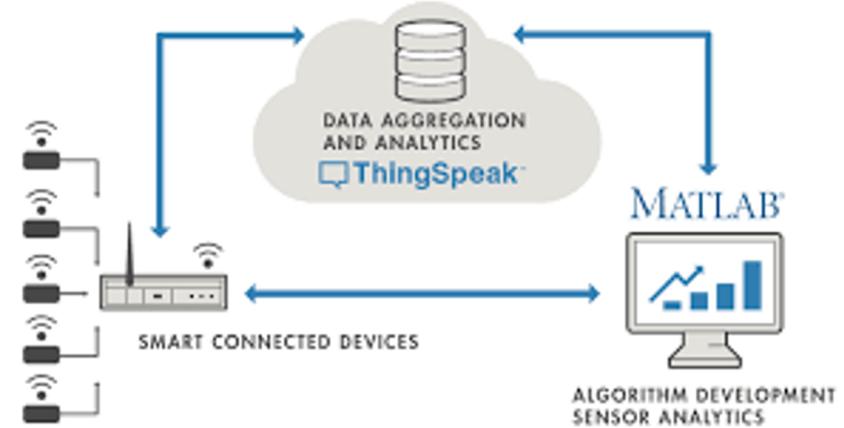
ThingSpeak

- ThingSpeak is an IoT analytics platform service that lets you collect and store sensor data in the cloud and develop Internet of Things applications.
- It works with Arduino, Raspberry Pi and MATLAB (premade libraries and APIs exists).
- But it should work with all kind of Programming Languages, since it uses a REST API and HTTP.

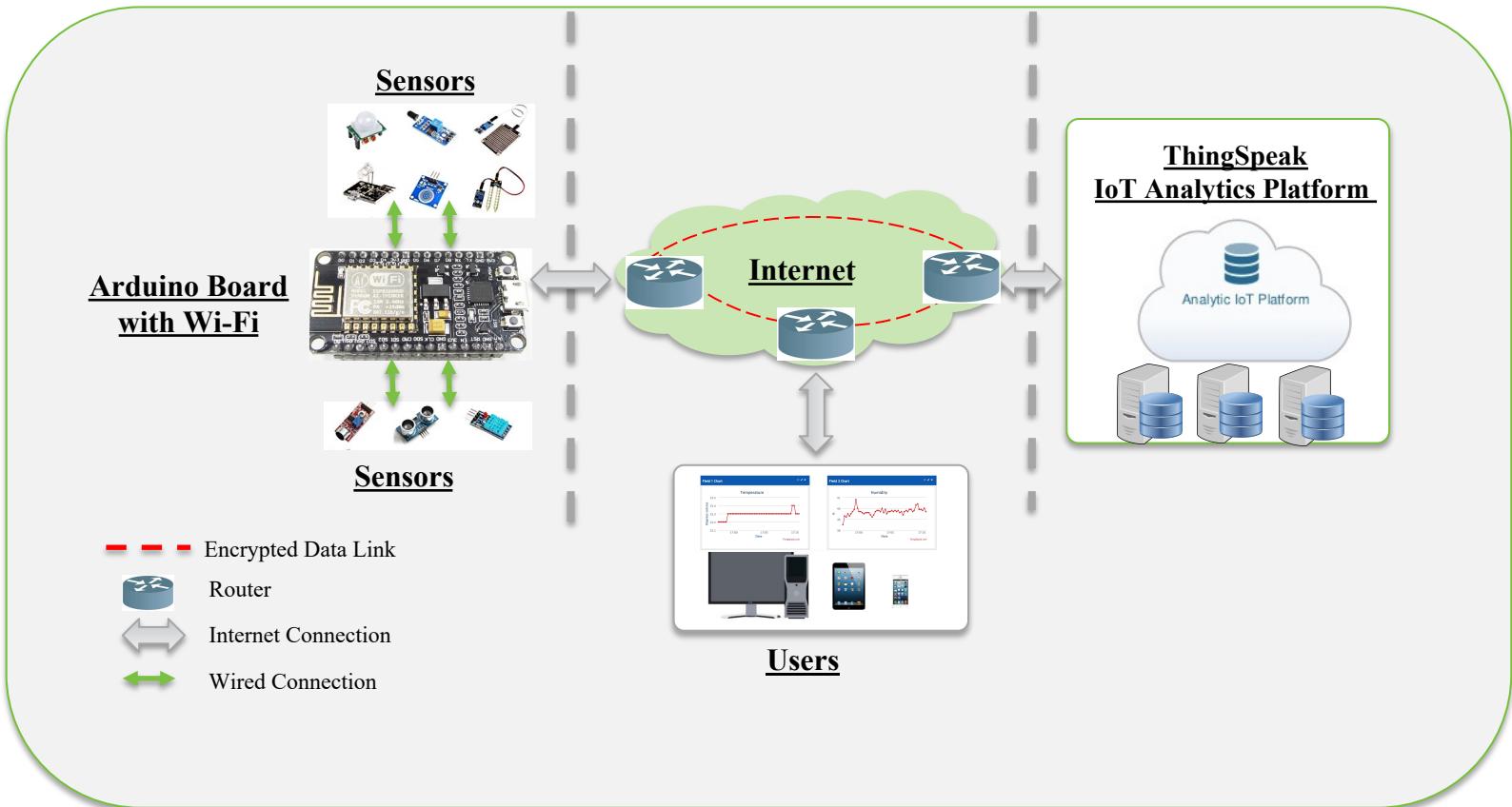


ThingSpeak.com

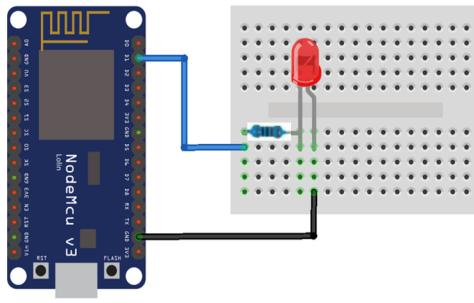
- <https://thingspeak.com>



Architecture of an IoT-based System



Hands-on Activities

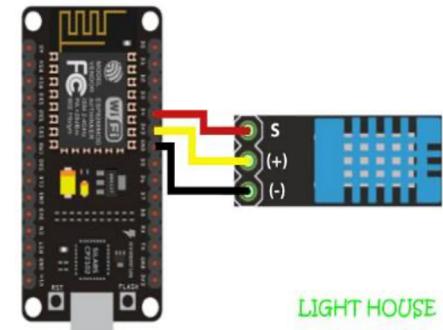


```
#define LED D1 // Led in NodeMCU at pin GPIO5 (D1).
```

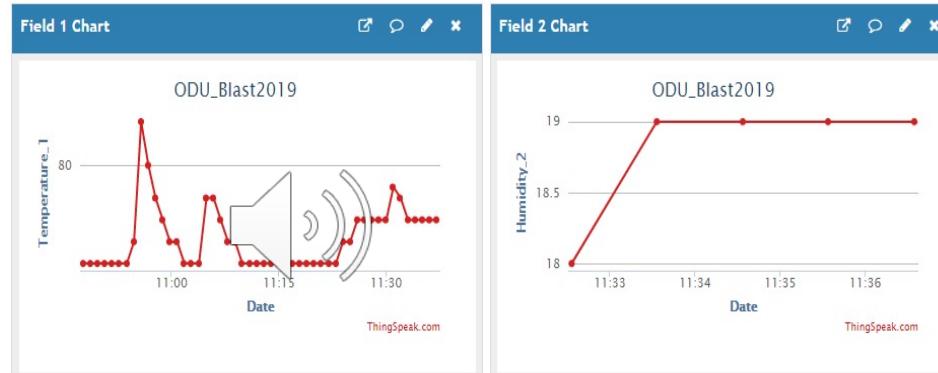
```
void setup()
{
pinMode(LED, OUTPUT); // set the digital pin as output.

}

void loop()
{
digitalWrite(LED, HIGH); // turn the LED off.
delay(1000); // wait for 1 second.
digitalWrite(LED, LOW); // turn the LED on.
delay(1000); // wait for 1 second.
}
```



LIGHT HOUSE



https://github.com/muratkuzlu/ODU_BLAST2021



Hands-on Activity - IV

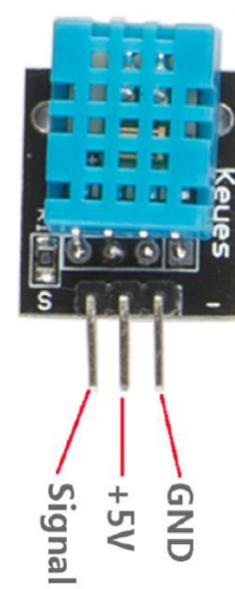
NodeMCU

Temperature & Humidity Sensor DHT11

The DHT11 sensor can detect temperature (C and F) & humidity.

The DHT11 detects water vapor by measuring the electrical resistance between two electrodes. The humidity sensing component is a moisture holding substrate with electrodes applied to the surface.

It has everything it requires built into it, so it will work very well with the NodeMCU. This sensor is used in conjunction with the DHT11 Library.



Wiring a switch with Arduino

We will learn how to set up the DHT11 Humidity and Temperature sensor on your NodeMCU. And learn about how the Humidity sensor works, and how to check output readings from the Serial monitor.

Hardware

- NodeMCU
- DHT11 Humidity and Temperature sensor
- Breadboard
- Jumper Wires (Optional)
- Micro USB Cable

Software

- [Arduino IDE\(version 1.6.4+\)](#)

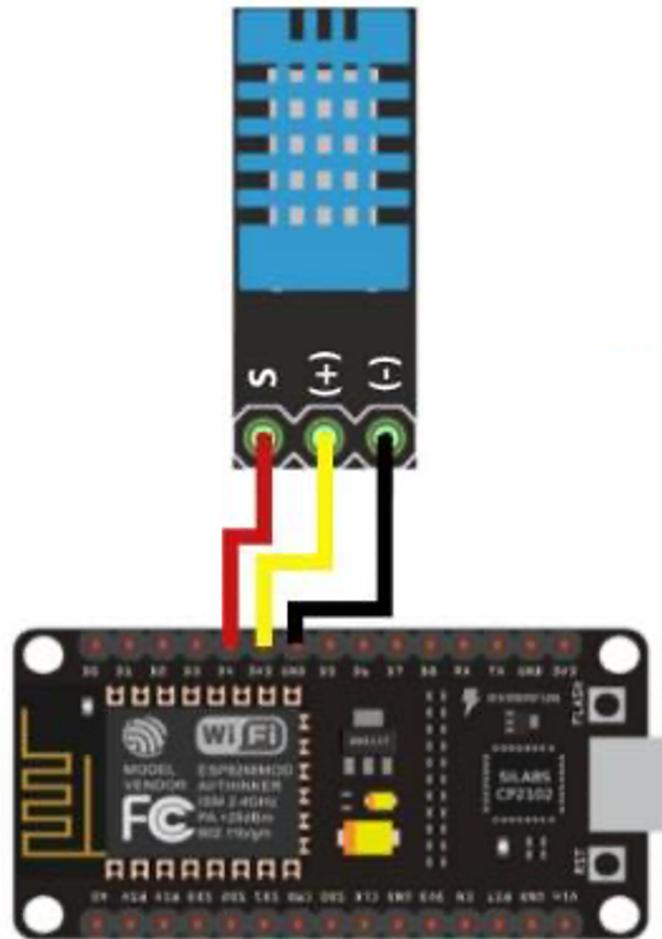
Digital input with Arduino

Set up

Wiring the **DHT11** to the NodeMCU is really easy, but the connections are different depending on which type you have either 3-pins or 4-pins

The **wiring connections** are made as follows:

- **Pin 1** of the DHT11 goes into Digital Pin **D4** of the NodeMCU.
- **Pin 2** of the DHT11 goes into **+3.3v** of the NodeMCU.
- **Pin 3** of the DHT11 goes into Ground Pin (**GND**) of the NodeMCU.



Digital input with Arduino

Code

→ Copy the following code to the IDE

Add the DHTesp.h library

Define Variables

Initialize variables.
Runs once

Used to actively control
the Arduino board. Run
repeatedly

```
#include "DHTesp.h"  
  
int temperature, humidity, k=0, l=0;  
  
#define DHTPIN D4      //pin where the dht11 is connected  
DHTesp dht;  
  
void setup()  
{  
    Serial.begin(115200);  
    delay(10);  
    //dht.begin();  
    dht.setup(DHTPIN, DHTesp::DHT11); // data pin 4  
}  
  
void loop()  
{  
    static boolean data_state = false;  
    float humidity = dht.getHumidity();  
    float temperature = dht.getTemperature();  
    temperature = CelsiusToFahrenheit(temperature);  
    Serial.print("Temperature Value is :");  
    Serial.print(temperature);  
    Serial.println("F");  
    Serial.print("Humidity Value is :");  
    Serial.print(humidity);  
    Serial.println("%");  
    delay(5000);  
}
```

Functions

//Functions

```
float FahrenheitToCelsius(float fahrenheit)
{
    float celsius;
    celsius = (fahrenheit - 32.0) * 5.0 / 9.0;
    return celsius;
}
```

```
float CelsiusToFahrenheit(float celsius)
{
    float fahrenheit;
    fahrenheit = (celsius * 9.0) / 5.0 + 32;
    return fahrenheit;
}
```

NOTE:

When you check the serial monitor make sure the baud rate and the serial begin number in your code is the same.

→ Upload

Digital input with Arduino and IoT - I

Now we are going to connect to IoT

→ Copy the following code to a new IDE sketch

```
#include "DHTesp.h"
#include "ThingSpeak.h"
#include <ESP8266WiFi.h>

const char *ssid = "AS2L-Room"; // replace with your wifi ssid and wpa2 key
const char *pass = "as2l214c";
const char* server = "api.thingspeak.com";
const char * myWriteAPIKey = "3M0SBN71PI6UD1A4"; // Enter your Write API key from ThingSpeak
unsigned long myChannelNumber = 803487;
uint8_t temperature, humidity, k=0, l=0;

#define DHTPIN D4      //pin where the dht11 is connected
DHTesp dht;

WiFiClient client;
```

Private View Public View Channel Settings Sharing API Keys Data Import / Export

Help API keys enable you to write data to keys are auto-generated when you c

API Keys Settings

Write API Key

Key 3M0SBN71PI6UD1A4

Generate New Write API Key

Private View Public View Channel Settings Share

Channel Settings

Percentage complete 50%

Channel ID 803487

Name ODU_Blast2019

Description Hands-on IOT Activities

Field 1 Temperature

Field 2 Humidity

Field 3 LED_Status

Digital input with Arduino and IoT - II

```
void setup()
{
    Serial.begin(115200);
    delay(10);
    //dht.begin();
    dht.setup(DHTPIN, DHTesp::DHT11); // data pin 2
    Serial.println("Connecting to ");
    Serial.println(ssid);
    WiFi.begin(ssid, pass);
    while (WiFi.status() != WL_CONNECTED)
    {
        delay(500);
        Serial.print(".");
    }
    Serial.println("");
    Serial.println("WiFi connected");

    // Print the IP address
    Serial.println(WiFi.localIP());
    ThingSpeak.begin(client);
}
```

Digital input with Arduino and IoT - III

```
void loop()
{
    static boolean data_state = false;
    float humidity = dht.getHumidity();
    float temperature = dht.getTemperature();
    temperature = CelsiusToFahrenheit(temperature);
    Serial.print("Temperature Value is :");
    Serial.print(temperature);
    Serial.println("F");
    Serial.print("Humidity Value is :");
    Serial.print(humidity);
    Serial.println("%");
    // Write to ThingSpeak. There are up to 8 fields in a channel, allowing you to store up to 8 different pieces of information in a channel.
    Here, we write to field 1.
    if(temperature < 255)
    {
        k=temperature;
    }
    if(humidity < 255)
    {
        l=humidity;
    }
    if( data_state )
    {
        ThingSpeak.writeField(myChannelNumber, 1, k, myWriteAPIKey);
        data_state = false;
    }
    else
    {
        ThingSpeak.writeField(myChannelNumber, 2, l, myWriteAPIKey);
        data_state = true;
    }
    delay(30000); // ThingSpeak will only accept updates every 15 seconds.
}
```

→ Upload

¹⁷ `delay(30000);` // ThingSpeak will only accept updates every 15 seconds.

Digital output with Arduino and IoT -IV

→ Check ThingSpeak

ODU_Blast2000

Channel ID: 803487
Author: mkuzlu123
Access: Public

Hands-on IOT Activities

Private View Public View Channel Settings Sharing API Keys Data Import / Export

Add Visualizations

Add Widgets

Export recent data

MATLAB Analysis

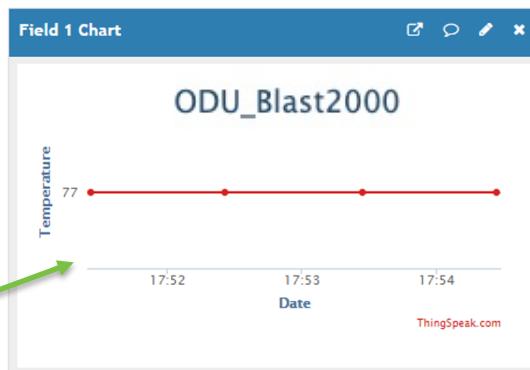
MATLAB Visualization

Channel Stats

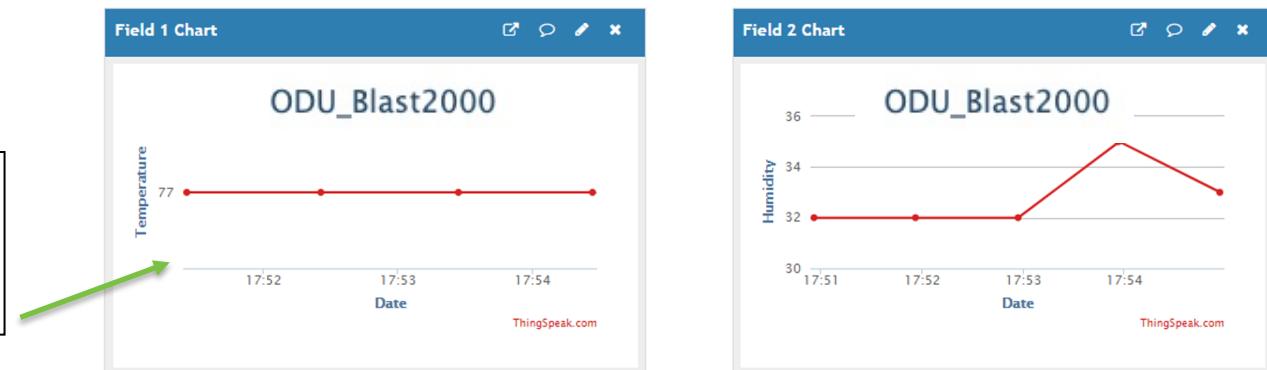
Created: about 24 hours ago

Last entry: 5 minutes ago

Entries: 64



Changes in
Temperature and
Humidity





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