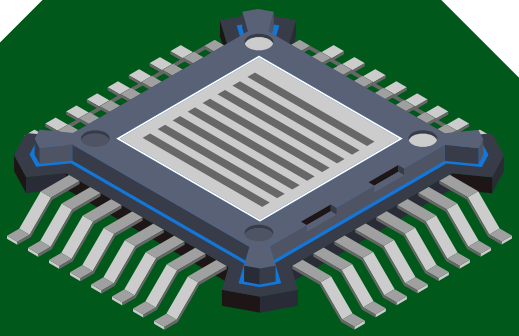
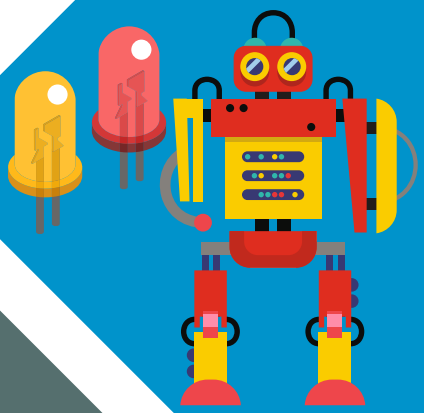
DELL Technologies

LEARNING LINKS FOUNDATION
WHERE EDUCATION MEETS LEARNING





Emerging Technolgogies

Internet of Things

Project 2

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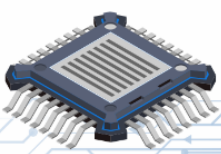


Project 2: Industrial Machine Monitoring system

In this project you will build a circuit that monitors the temperature of a machine, the values of the temperature will be visible on the serial monitor and any abnormal values recorded can be monitored. This data can also be viewed in the form of a graph which will allow the user to analyse the performance of the machine. Exciting? Let's get started!

Software:

1. **cloud.arduino.cc**

   This website helps in building the IoT applications and programming the Node MCU.

2. **Arduino Create Agent**

   This application helps in communicating with the Node MCU and the computer. It helps in dumping the code in the controller.

Components Used:

STEP by STEP Instructions

To build this project we will need the following hardware. Let's quickly look at the hardware and recall the purpose and function of the hardware in our circuit.

1. **ESP8266 Node MCU**

   Node MCU is an open-source platform based on ESP8266 which can connect objects and let data transfer using the ESP8266 Wi-Fi module integrated in it. This board had two buttons "reset" and "flash". We can power up the board using the 3.3V DC through the "Vin" pin or 5V through a micro USB port. It has one "A0" Analog pin and 16 GPI/O pins. It has a flash memory of 4MB.

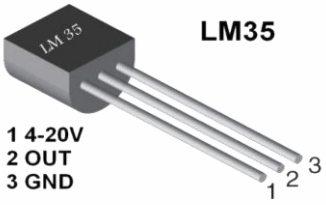
   You will need 1 ESP8266 Node MCU for this project.

2. **LED**

   LED stands for "Light Emitting Diode". It is a two terminal device. The shorter terminal is called the cathode and the longer terminal is the Anode.

   You will need 1 red coloured LED for this project.

3. LM35 Temperature Sensor



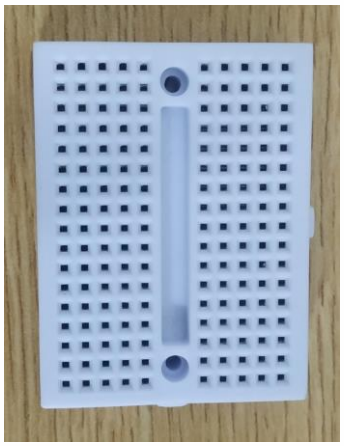
LM-35 is a Temperature Sensor with 3 terminals Vcc, OUT and GND. This device gives the analog (Voltage) data from the OUT Terminal. The analog data is the temperature readings in Celsius. Hence, no other calibration is required.

4. Male to Female jumper wires

Male to Female Jumper Wires are used to connect the LM35 Temperature Sensor to the Breadboard where Node MCU is mounted. These jumper wires have a male pin at one end and female pin at the other end. A male pin is commonly referred to a solid pin that stands up. A female connector is commonly referred to as a jack with a hole in it to accept the male pin.

You will need 10 Male to Female Jumpers for this project.

5. Breadboard



Breadboards are used for building circuits easily. We can easily make and break the circuit. No soldering or PCB is required.

You will need 1 Breadboard for this project.

6. Micro USB Cable.

Micro USB is used to dump the program in the Node MCU board. It is also used to power-up the board.

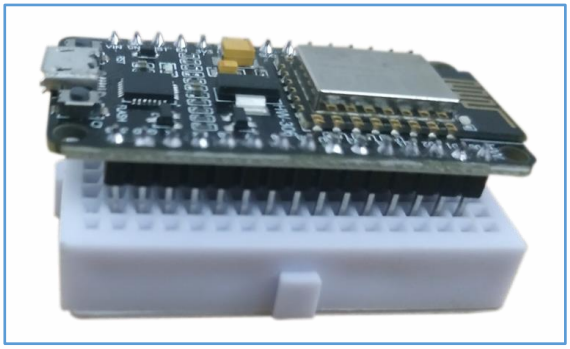
You will need 1 Micro USB Cable for this project.

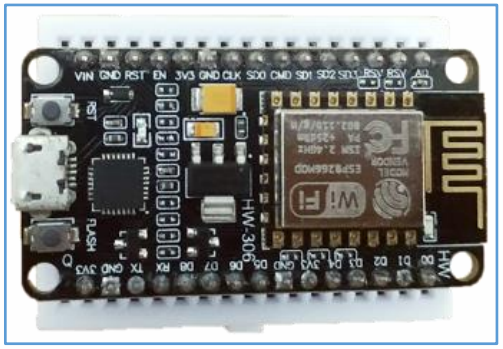
PART 1: Building the Circuit

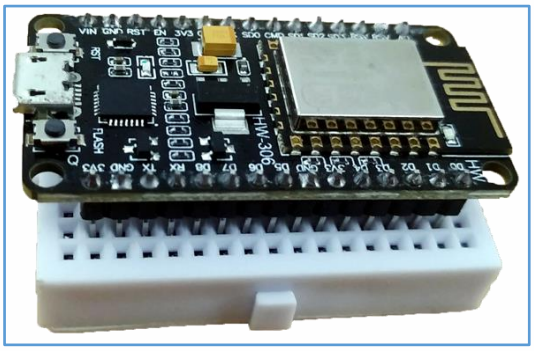
Step 1

Take a Node MCU board and mount it on the breadboard as shown in the figure.

The Node MCU has all the Male pins. These male pins are not user friendly to build a circuit with different connections hence we are placing the Node MCU on a breadboard.



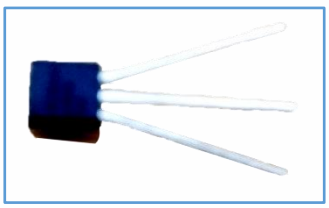


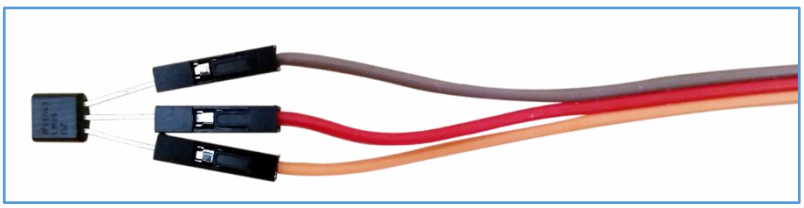


Step 2

Take LM35 Sensor and connect the terminals of the sensor to the jumper wires as shown in the image given below.

Connect the orange wire to Vcc, red wire to OUT and black wire to GND.

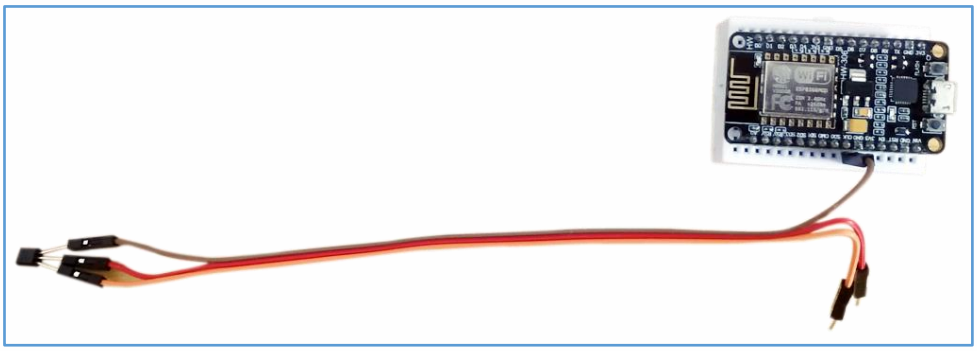




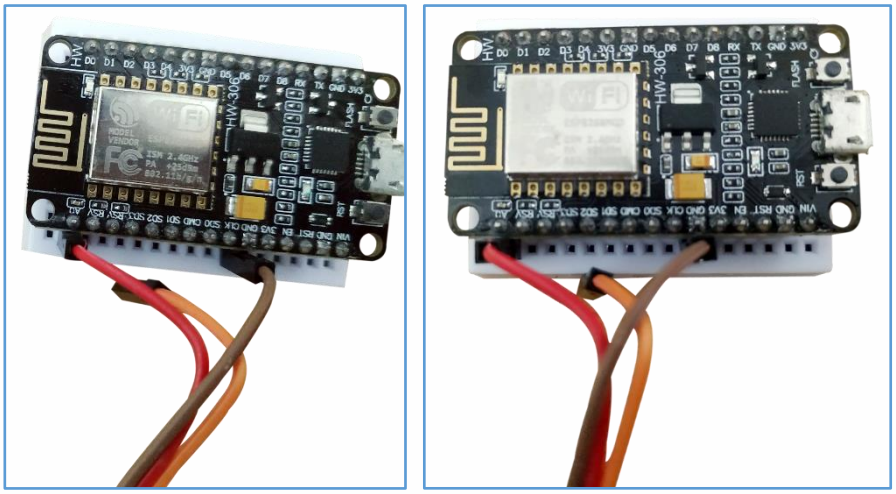
Step 3

Now let's connect the temperature sensor to the Node MCU board.

a. Connect the black wire from the sensor to the "GND" terminal of the Node MCU as shown in the image given below.

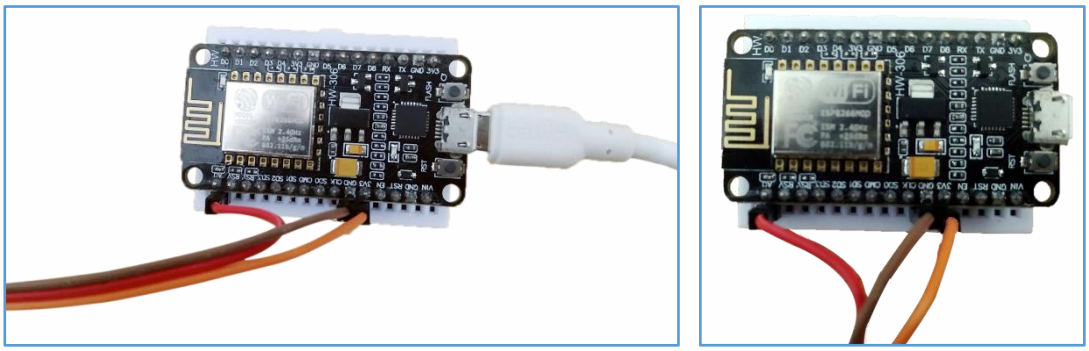


b. Connect the Red wire from the sensor to the "A0" pin of the Node MCU as shown in the image.

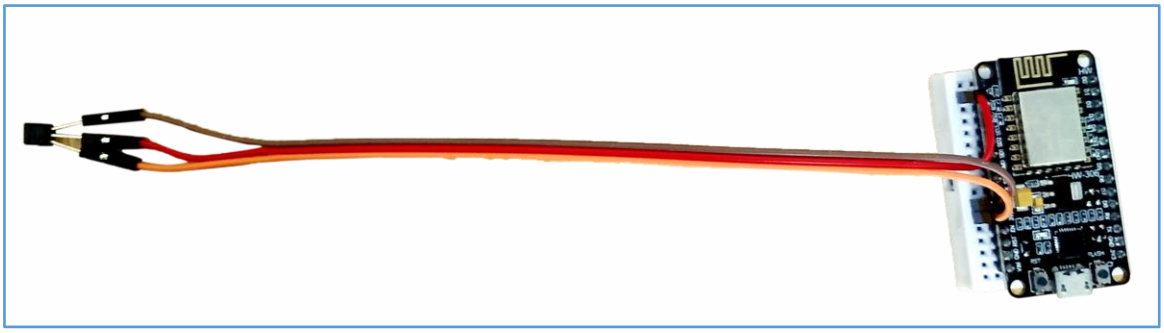


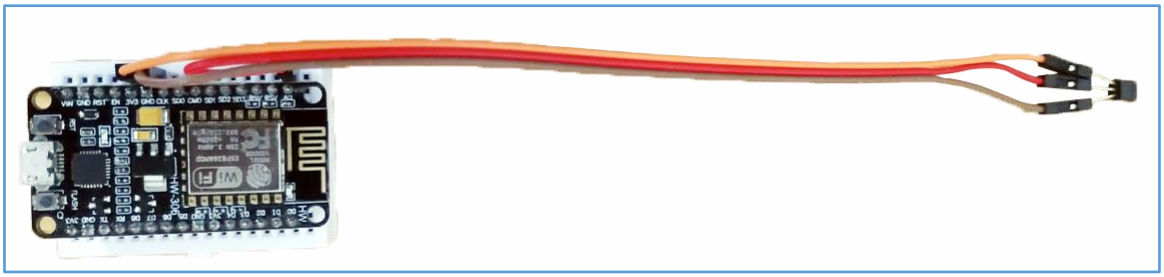
c. Now let's connect the VCC of the sensor.

Take the orange wire of the sensor and connect it to the "3V" pin of the Node MCU as shown in the image given below.



d. We have successfully built our circuit.

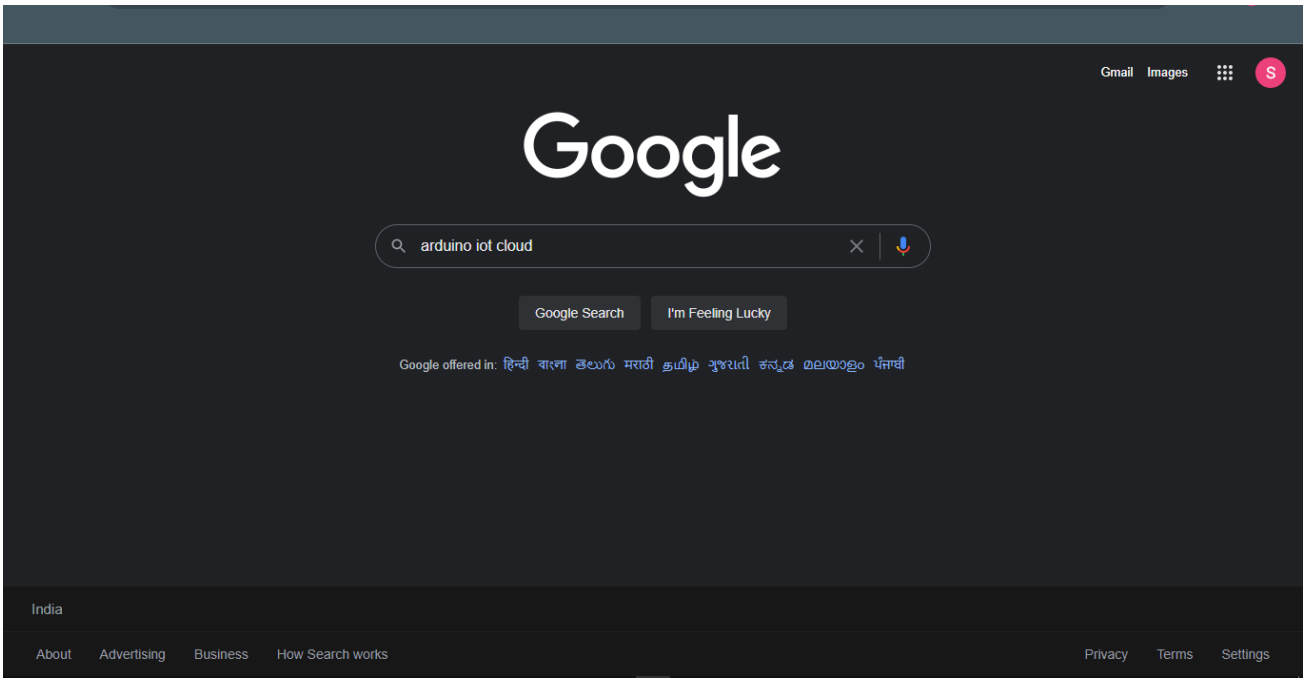




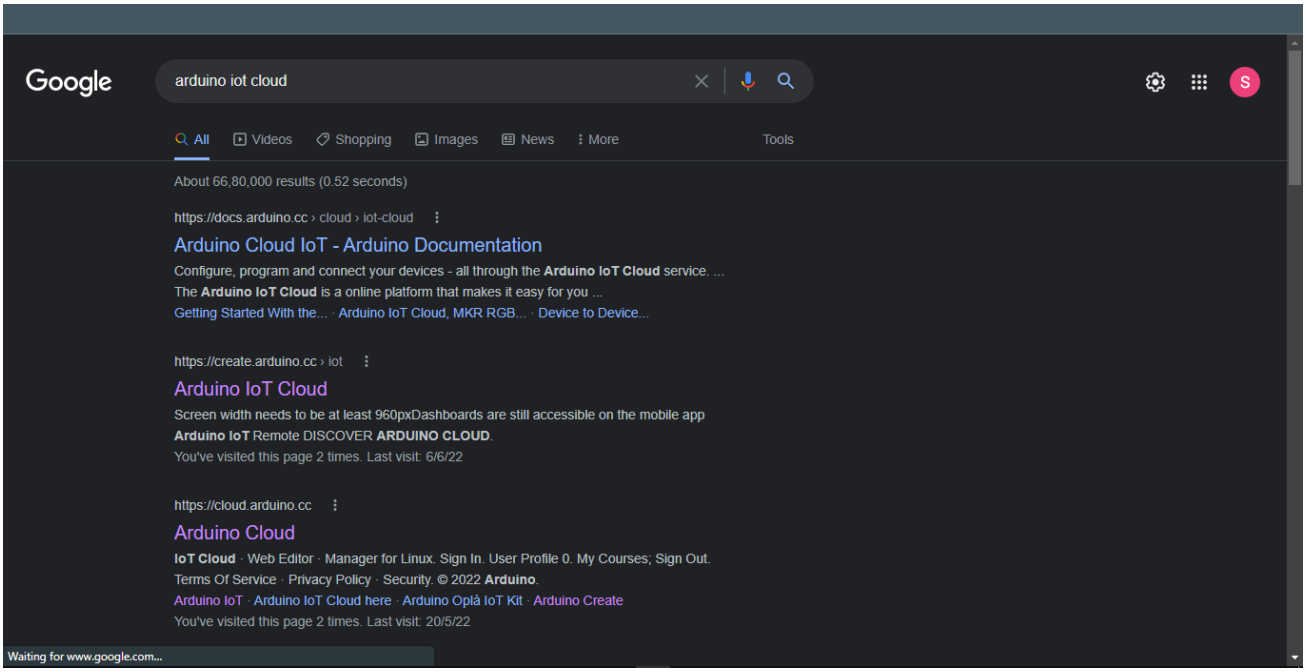
PART 2: Setting up the device

Step 4

Open any browser and then search for “Arduino IoT Cloud” in the google search bar.

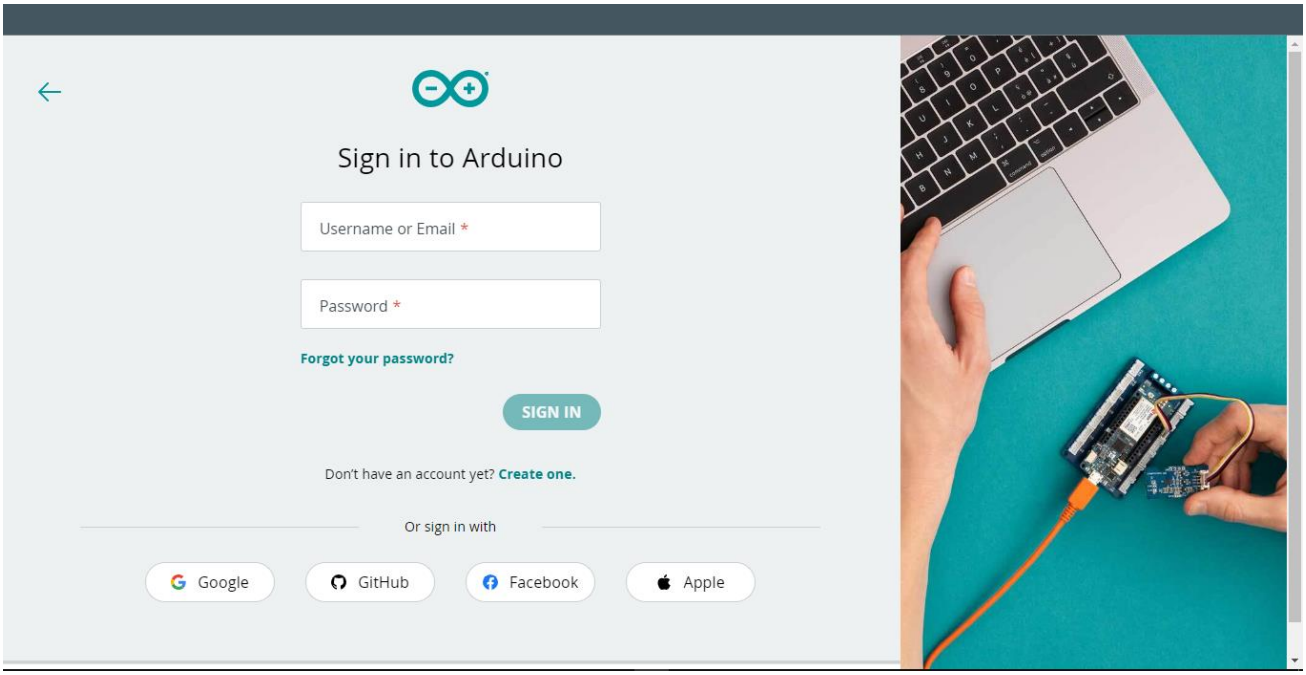


Click on the search result https://cloud.arduino.cc/ .



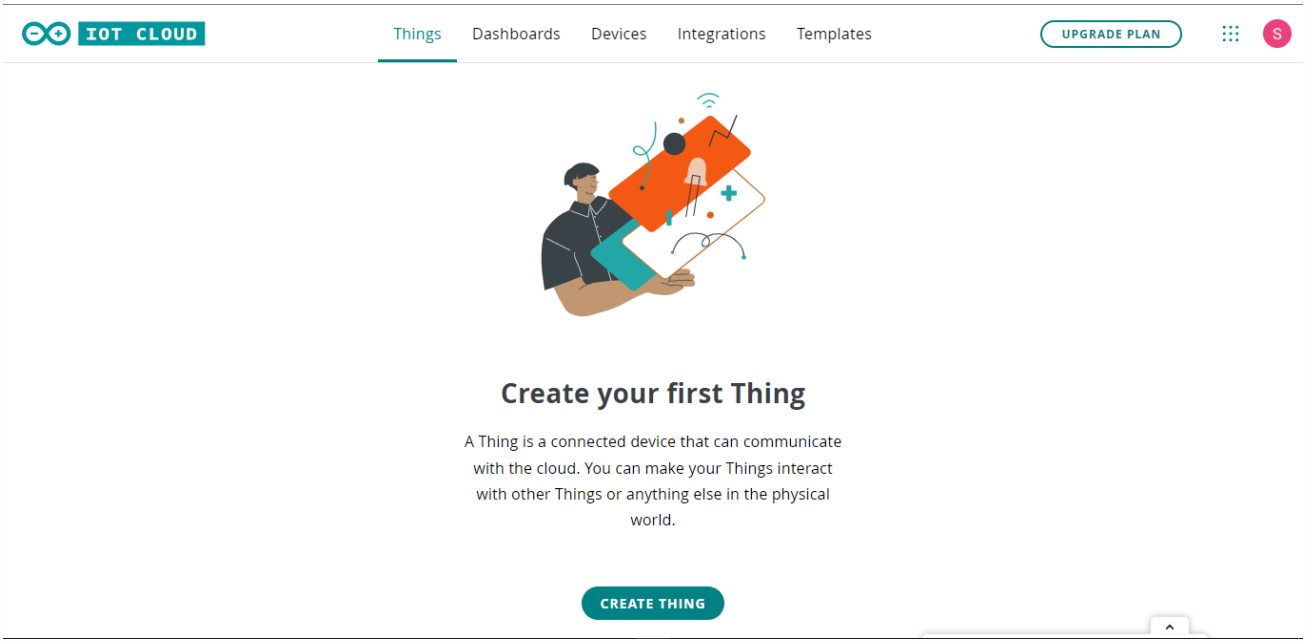
Step 5

To sign-in, click on “Google” and sign in using “Google Account”



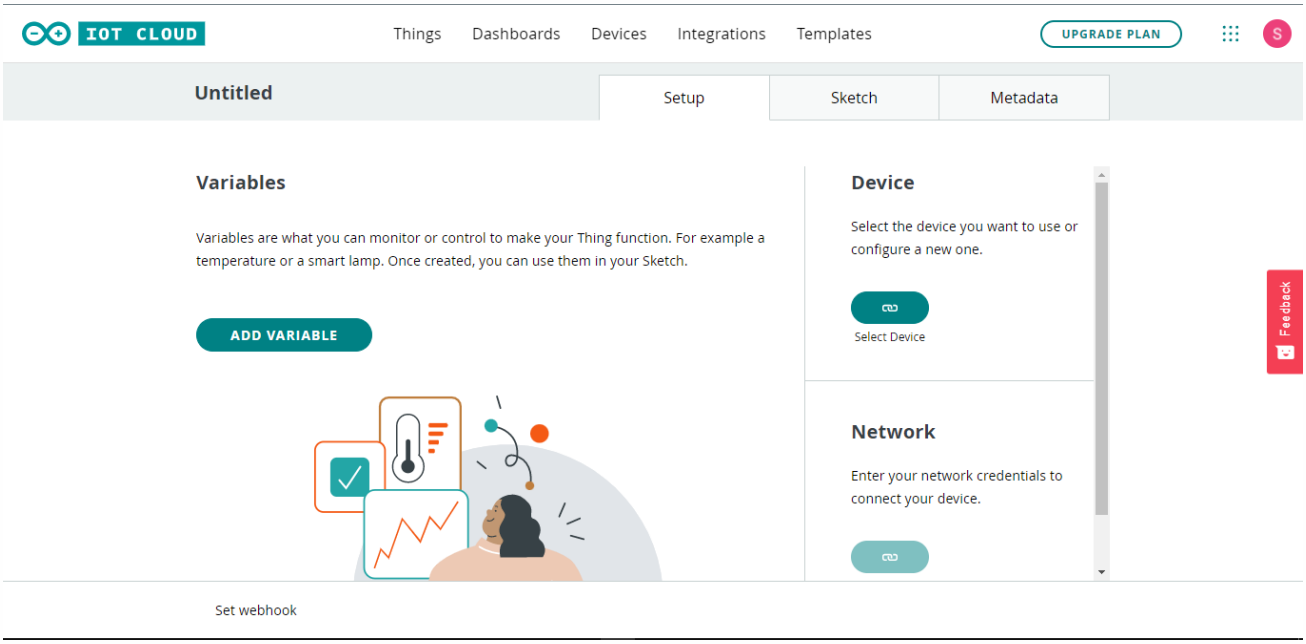
Step 6

After signing in, you will find, “Create Thing”. Click on the “Create Thing” button.



After clicking you are redirected to “creating a thing” page.

Let's first rename the thing. Click on the untitled and enter the name as “Temperature Monitoring”



Click on the “Add Variable” button.

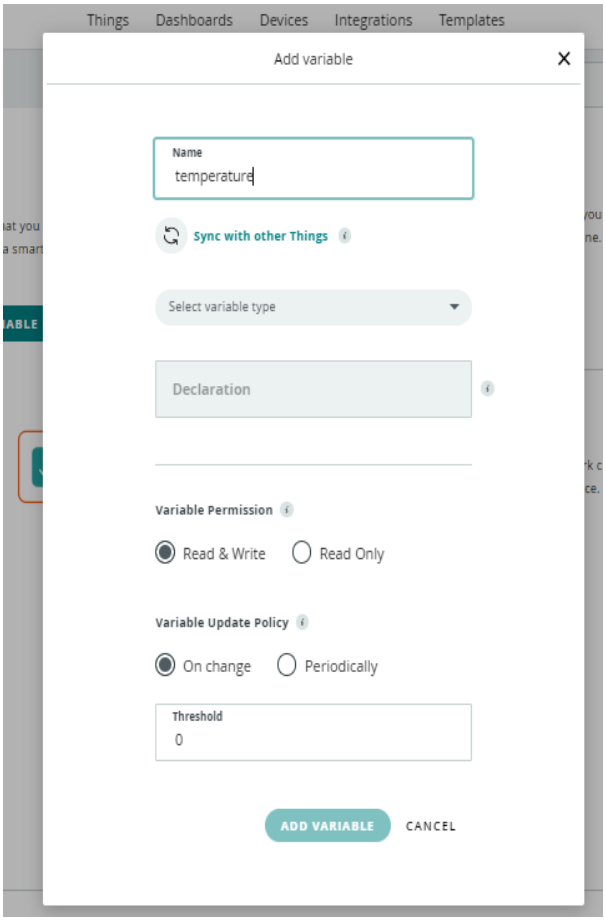
A popup will appear asking for the details of the variable.

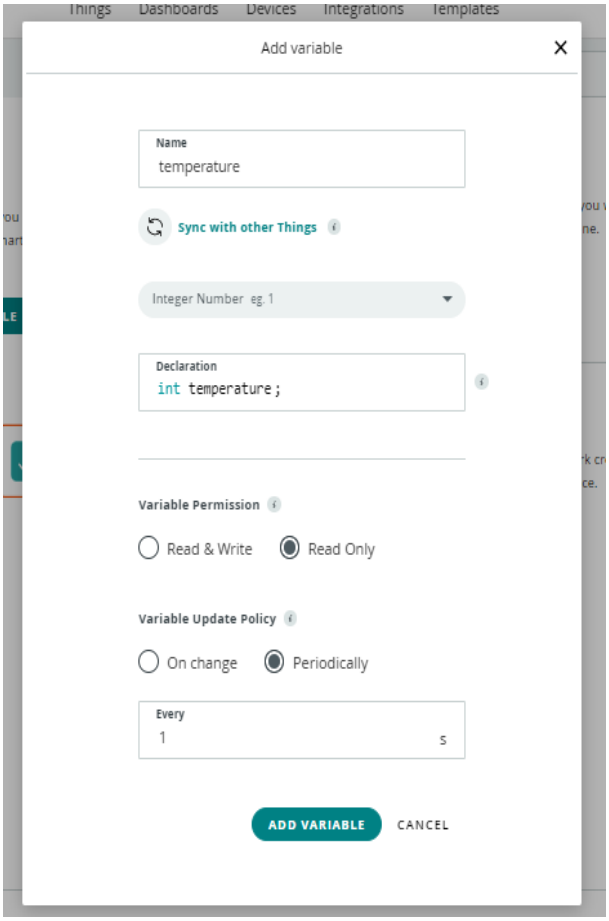
a. Name the variable as “temperature”.

b. Type of the variable is “Integer number” because we would like to check the temperature.

c. Change the variable permission to “read only” as we only want to read data from sensors and variable update policy to “periodically” to give continuous data.

d. Update the Threshold to 1 s. Then click on “Add variable”

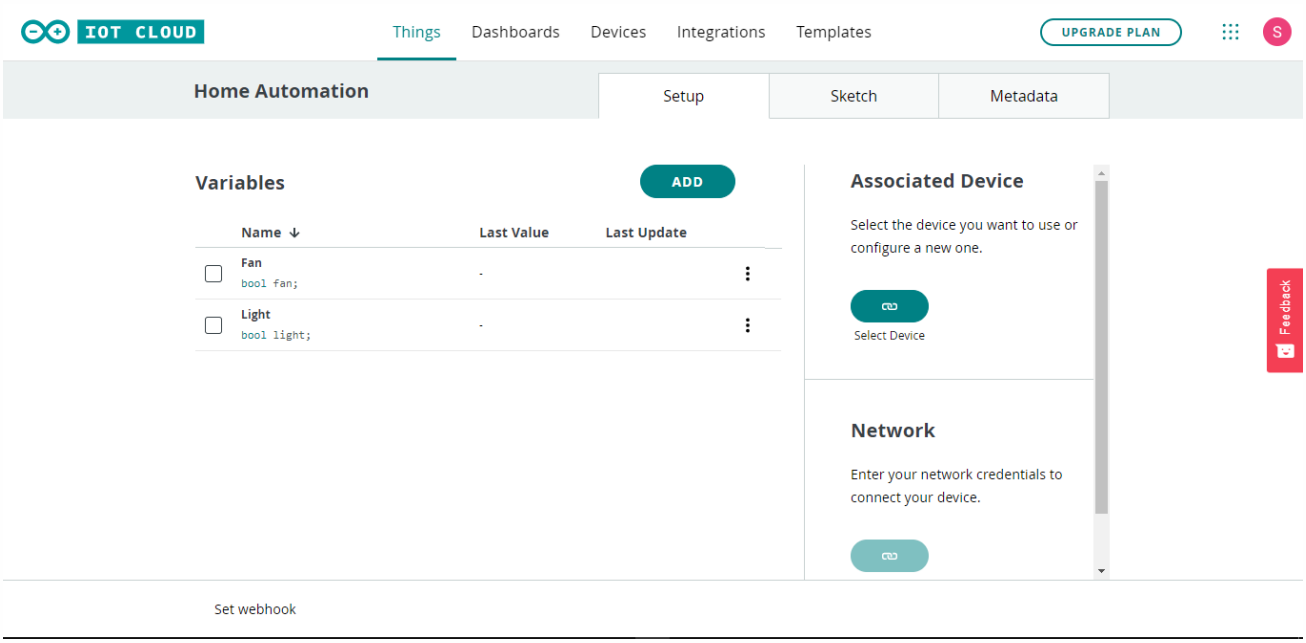




Step 7

Now let's link the circuit as a device.

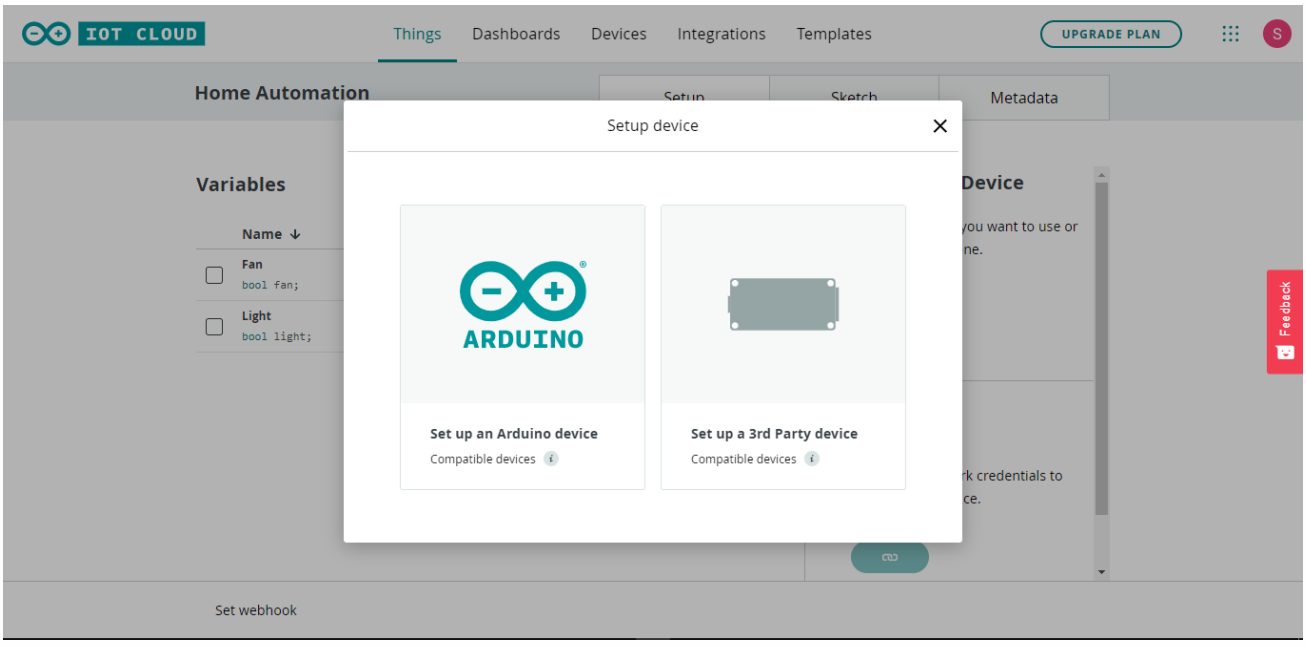
Click on the "Select device" button then a popup will open.



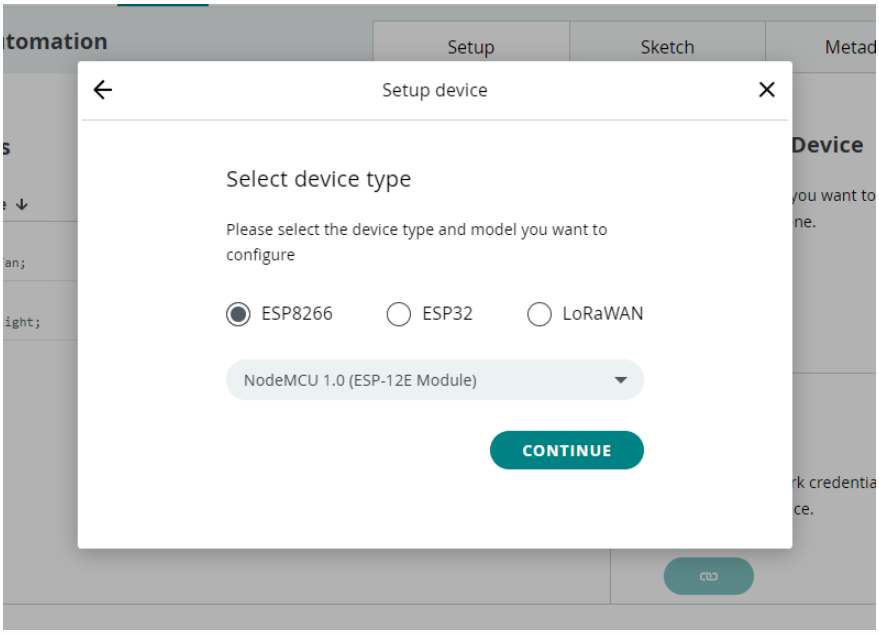
Step 8

Now in the popup, we have to select the type of board. Here we are using "Node MCU" which is a 3rd party device.

So click on "Set up a 3rd Party device"



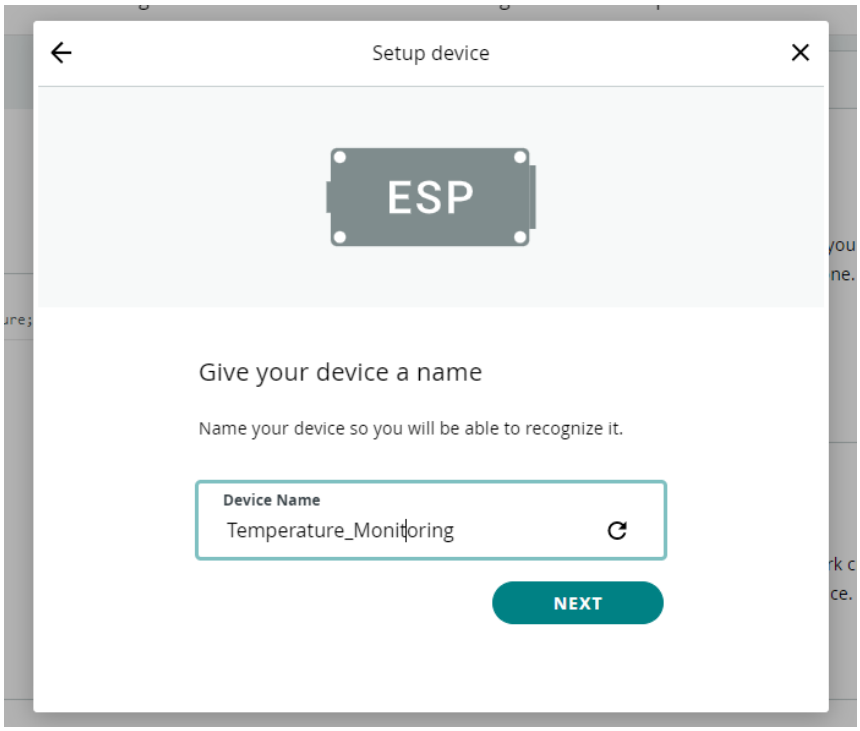
In the dropdown search for Node MCU 1.0 board and click on continue.



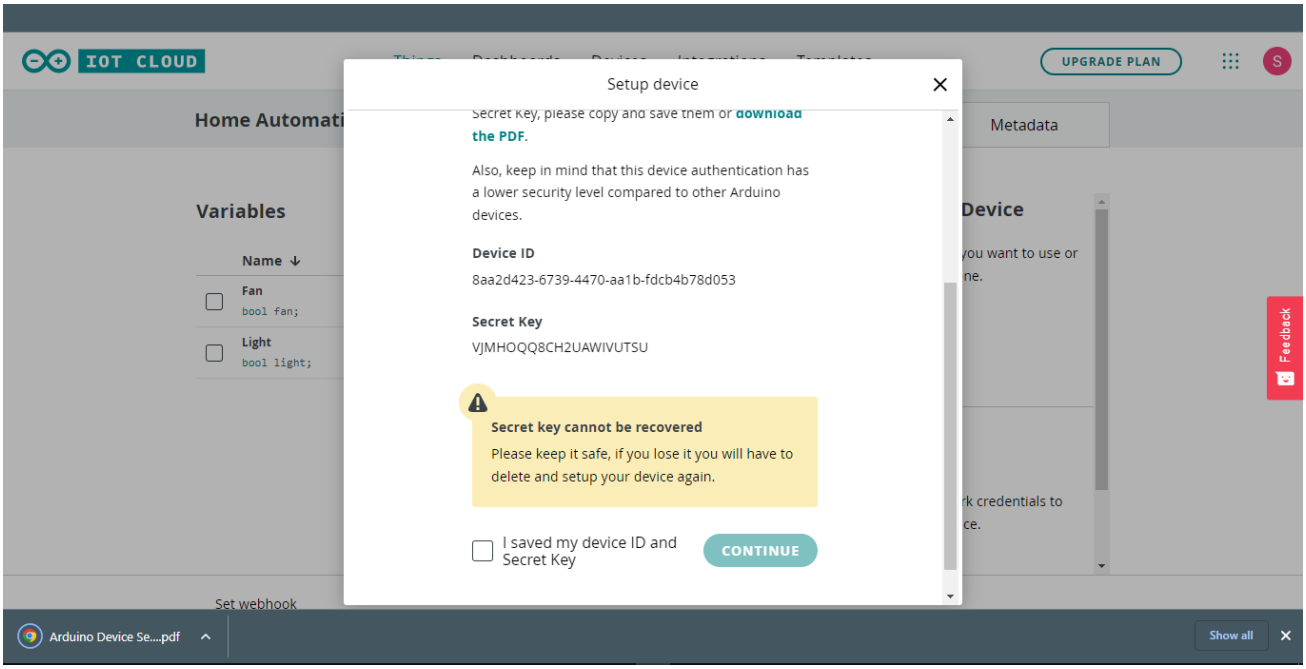
Step 9

Now let's name the device.

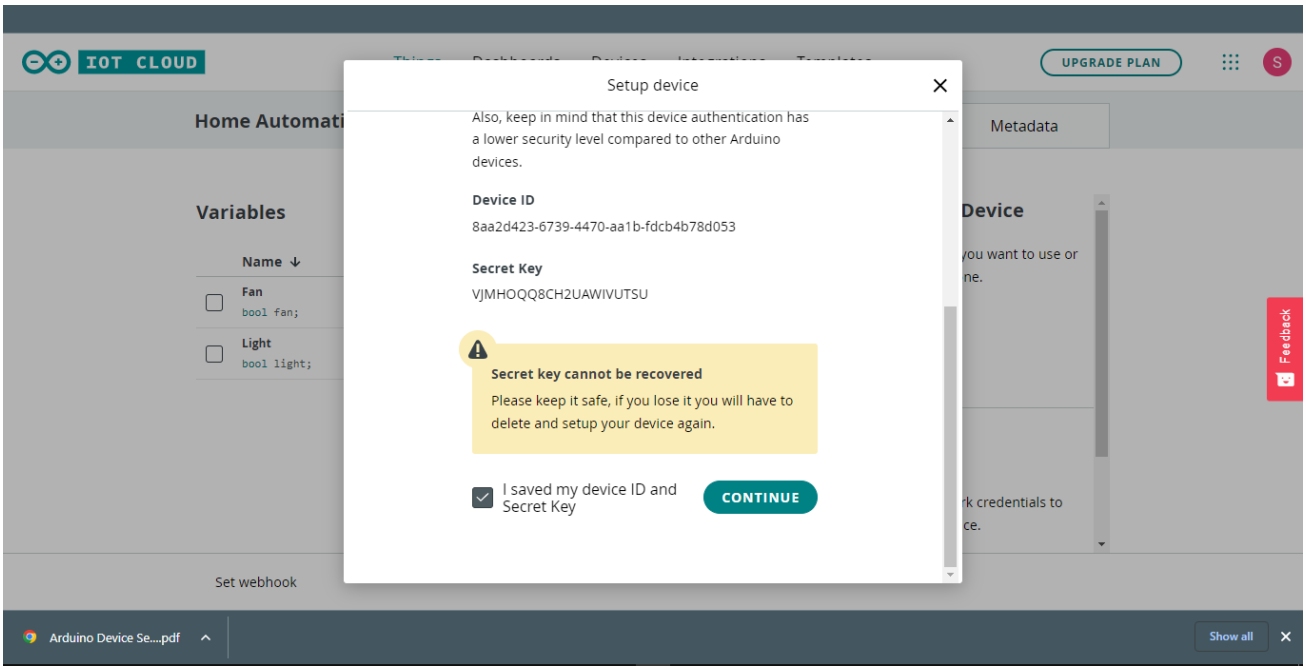
a. A random name is assigned to the device. Delete the name and enter the name as “Temperature_Monitoring” and then click on the “Next” button.



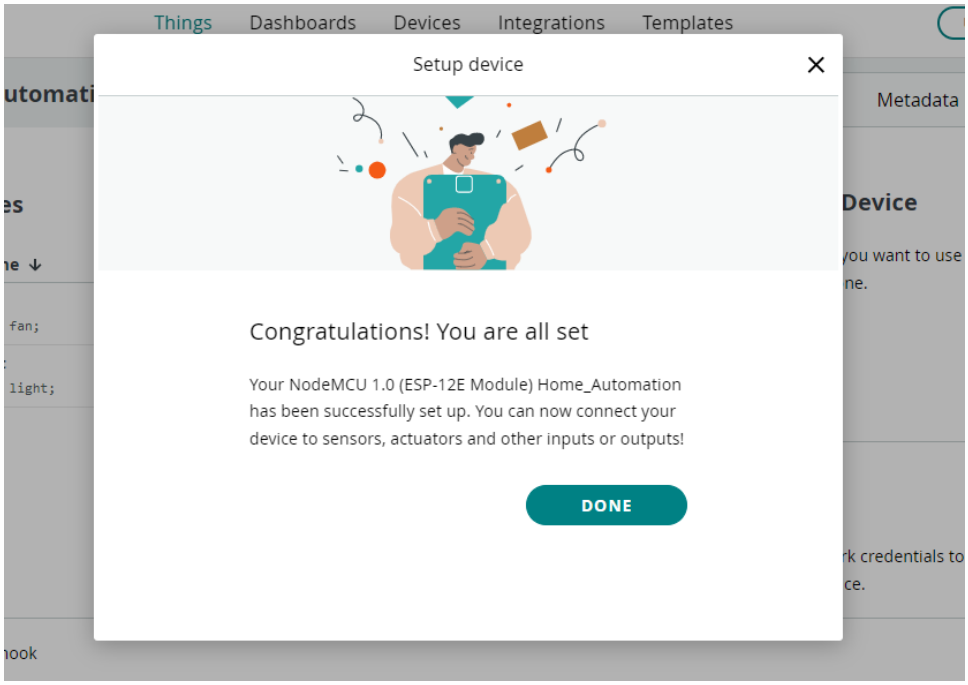
b. After clicking on “Next” a new page will open with “Device ID” and “Security Key”. These two details are very important, so click on the “download pdf” and save the file.



c. Then check the “I saved my device ID and Secret key” check box and then click on “Continue”.



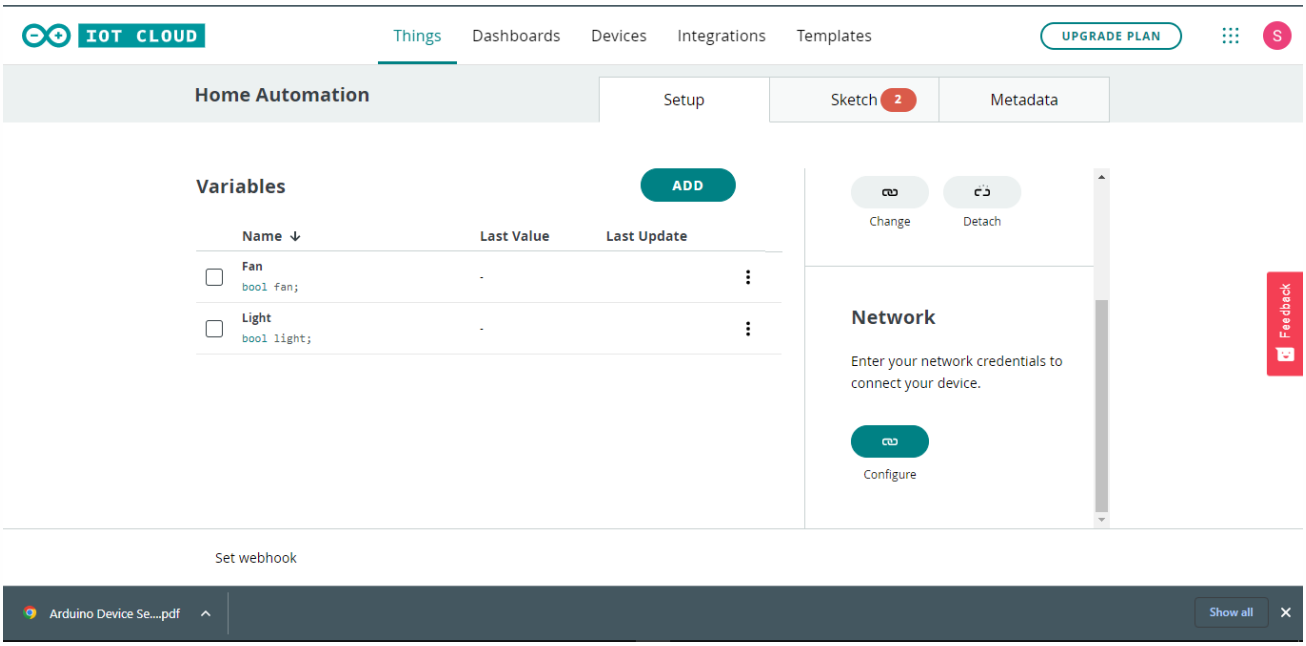
Congratulations! your device setup is successful.



PART 3: Setting up the Network & Building the Dashboard

Step 10

Click on the “Configure” button then a popup will appear.

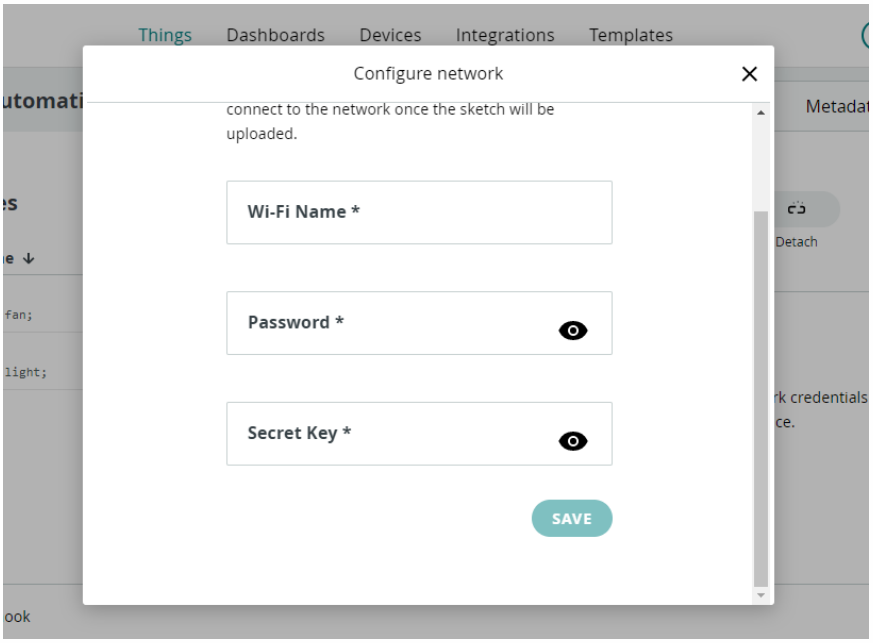


Enter the details of the network.

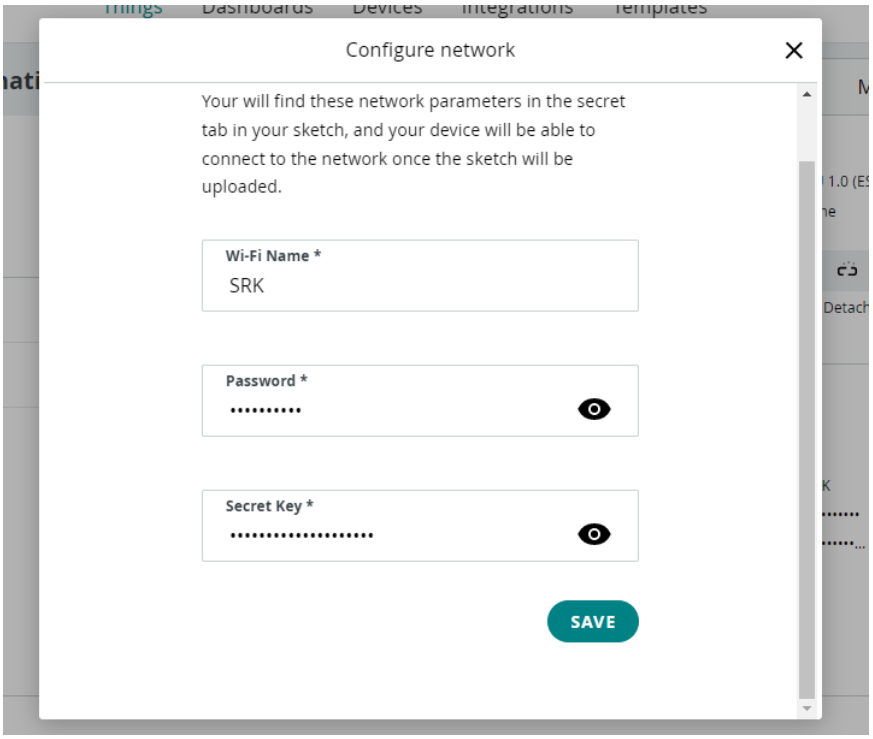
Wifi Name–

Password–

Secret Key– (Available in the pdf downloaded)

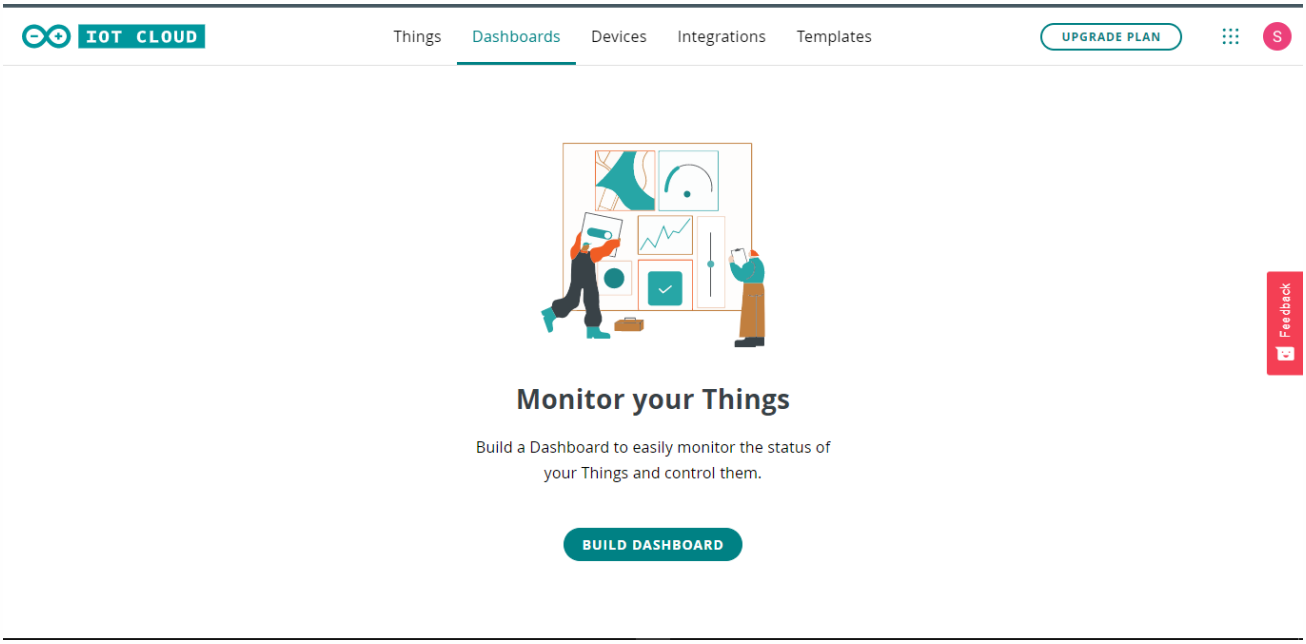


After entering all the details click on the “Save” button.

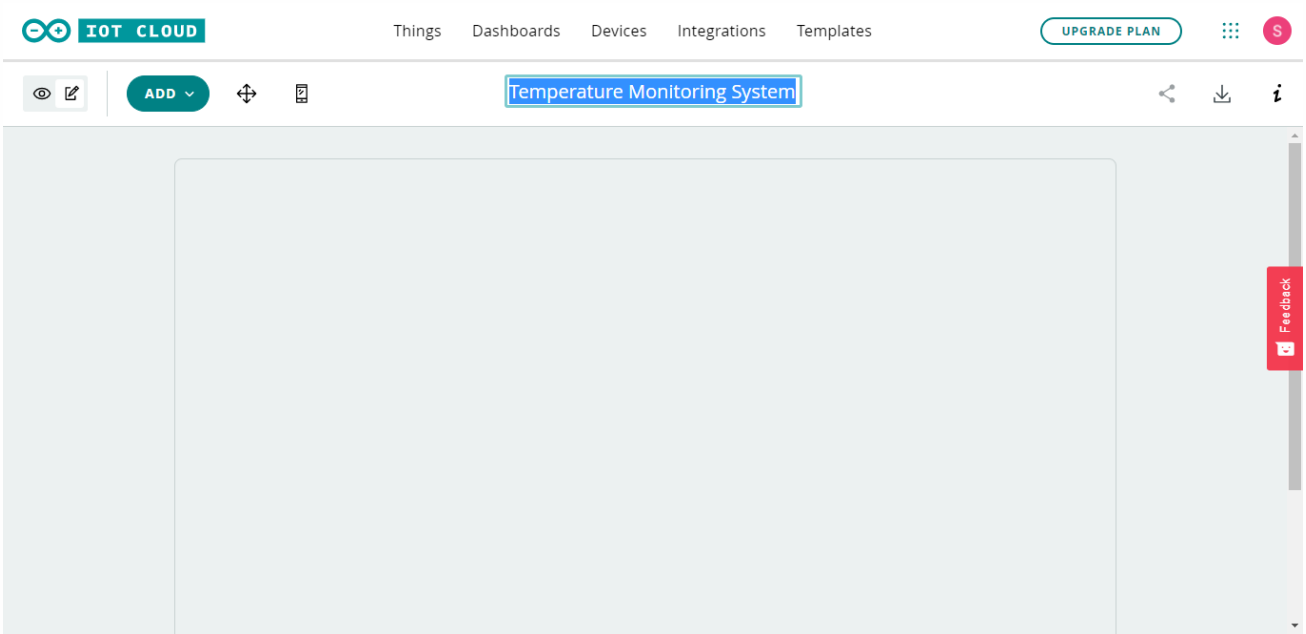


Step 11

Now let's build the dashboard. Click on the "Dashboards" button beside the "Things" button.

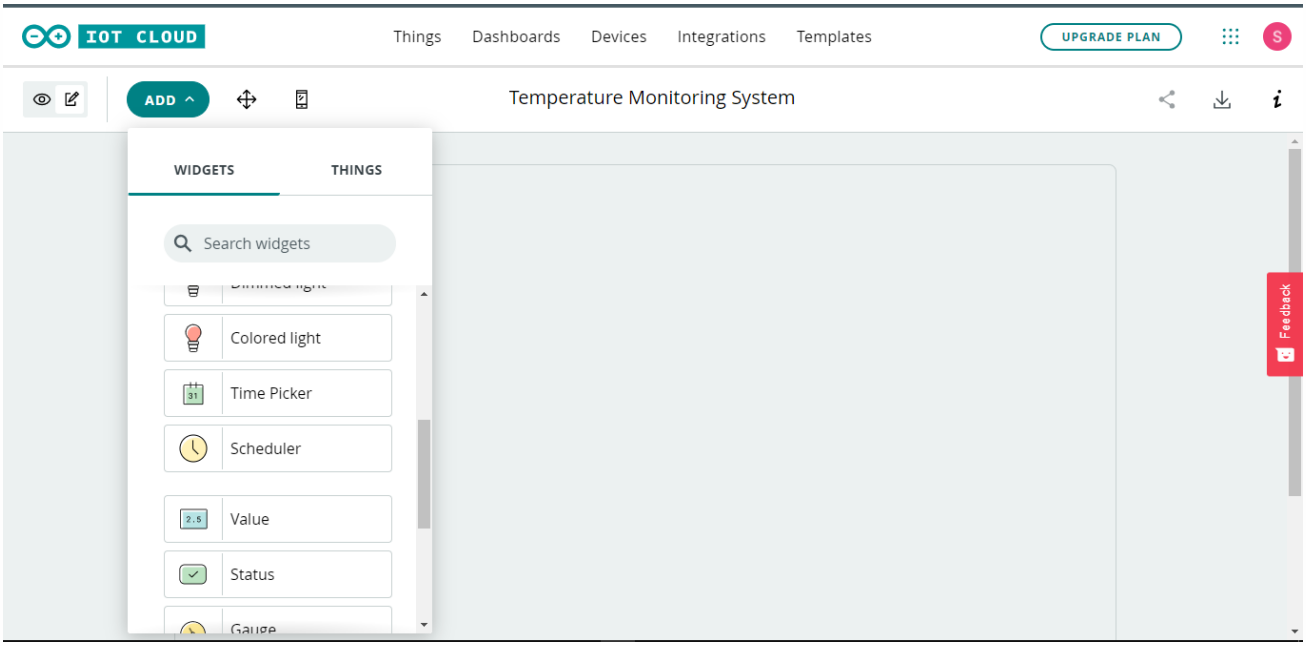


a. Click on the "Build Dashboard" button. Then a new page will appear. Click on the untitled Dashboard name and enter the name as "Temperature Monitoring System"

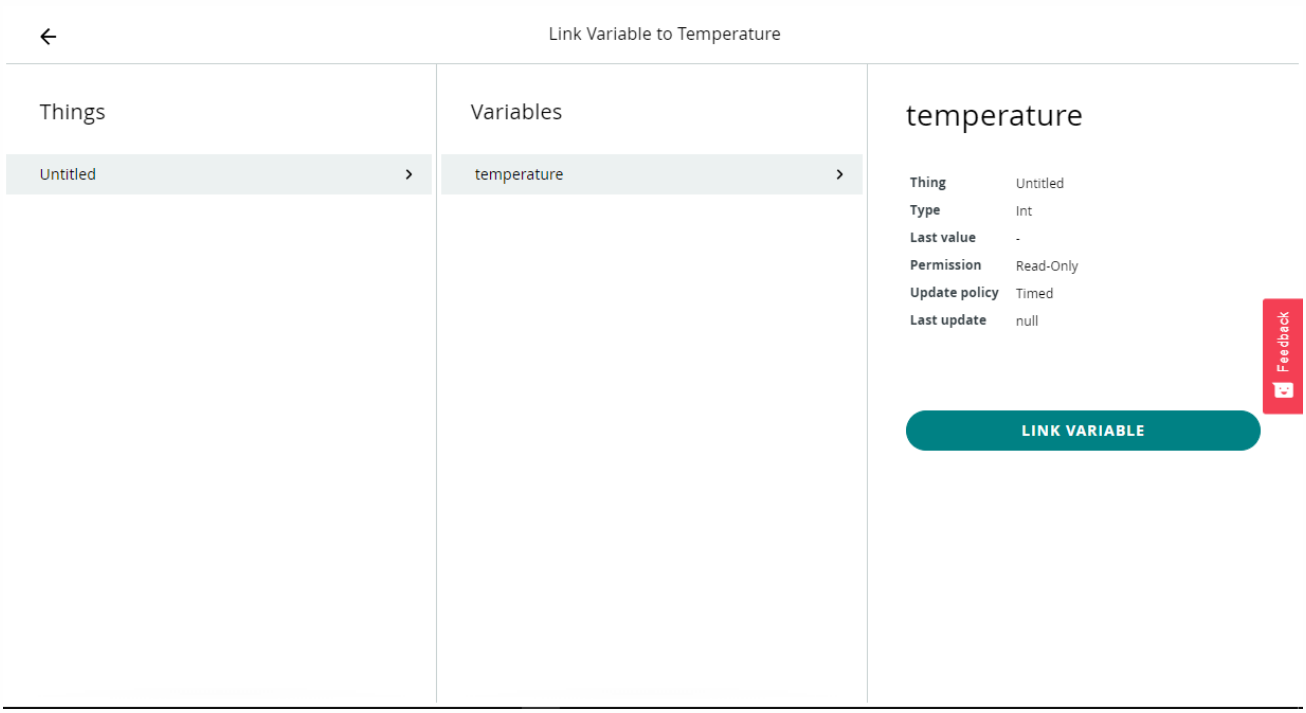


Step 12

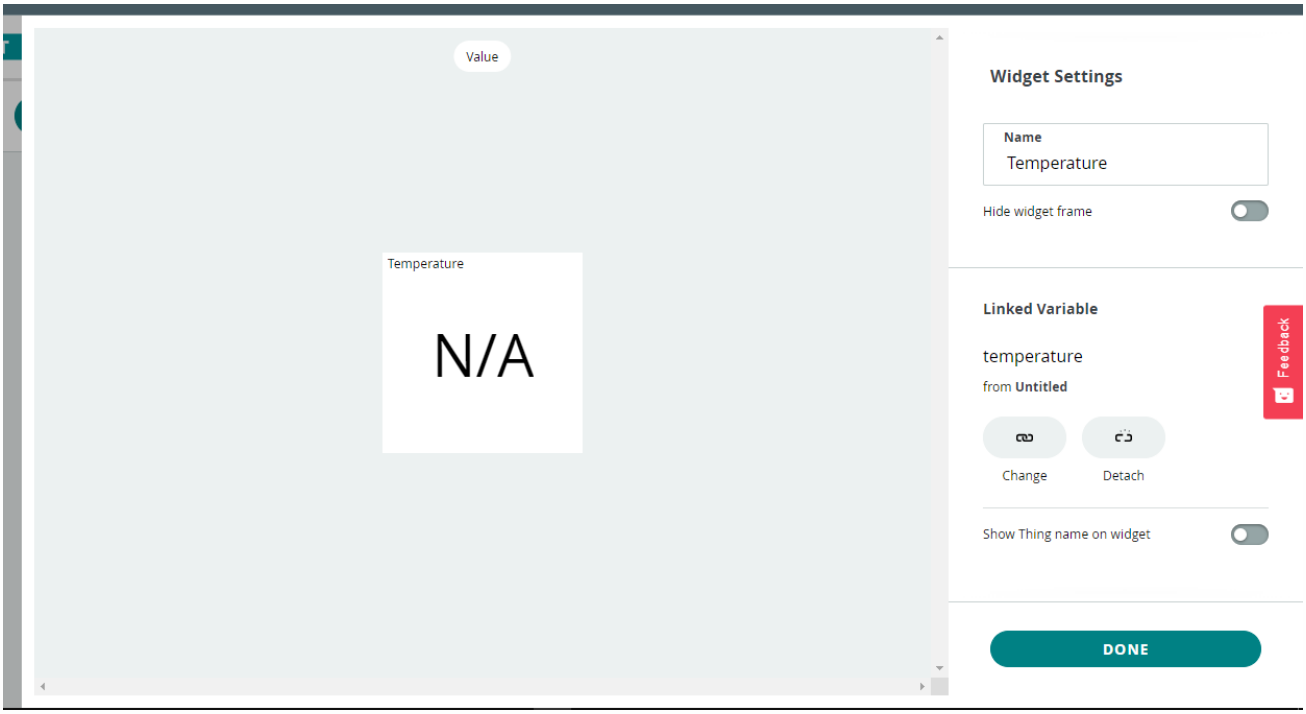
Now let's add the User Interface. Click on the "Add" button and click on the value in the dropdown.



a. Then in the popup select the variable "temperature" and then click on "Link variable" button.

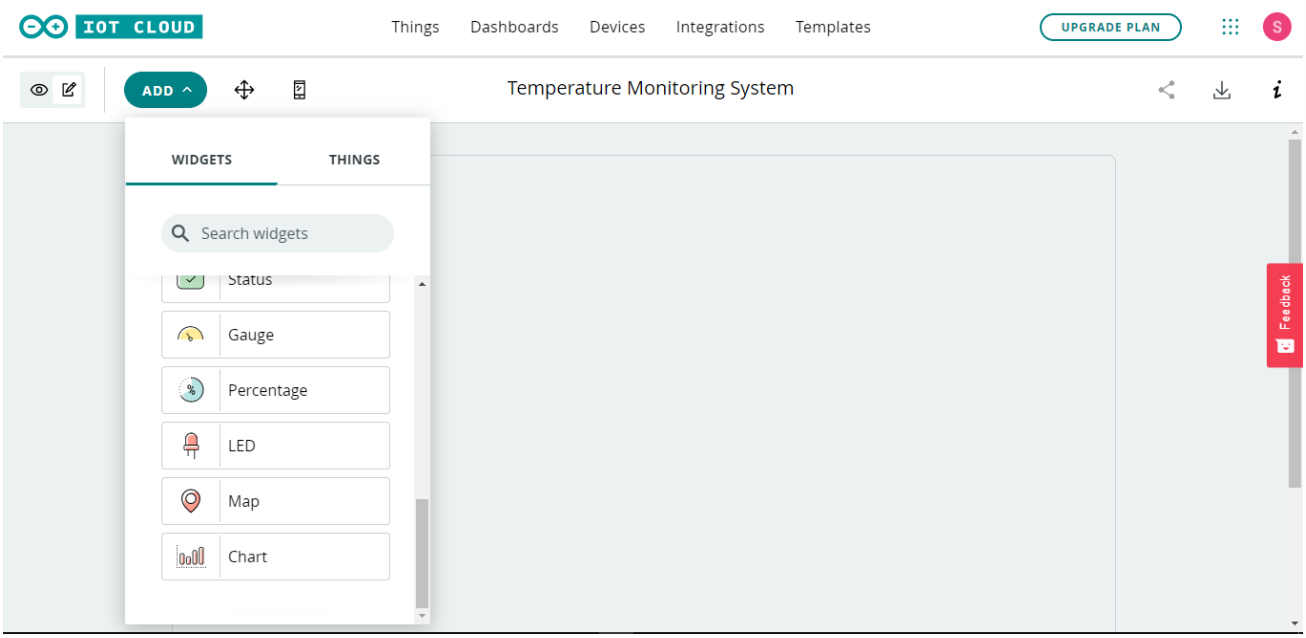


b. Then rename the label as "Temperature" and then click on the "done" button.



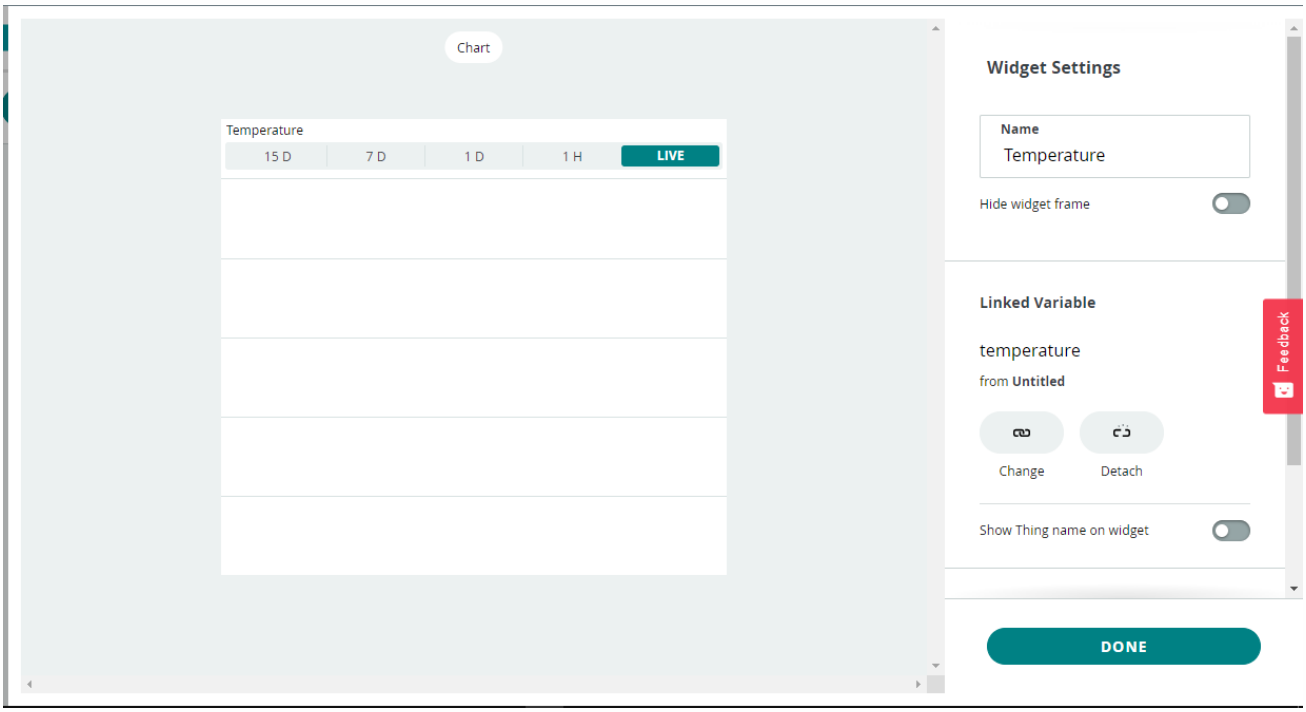
Step 13

Now let's add a Chart. Click on the "Add" button and click on the "Chart" and then a popup will appear.

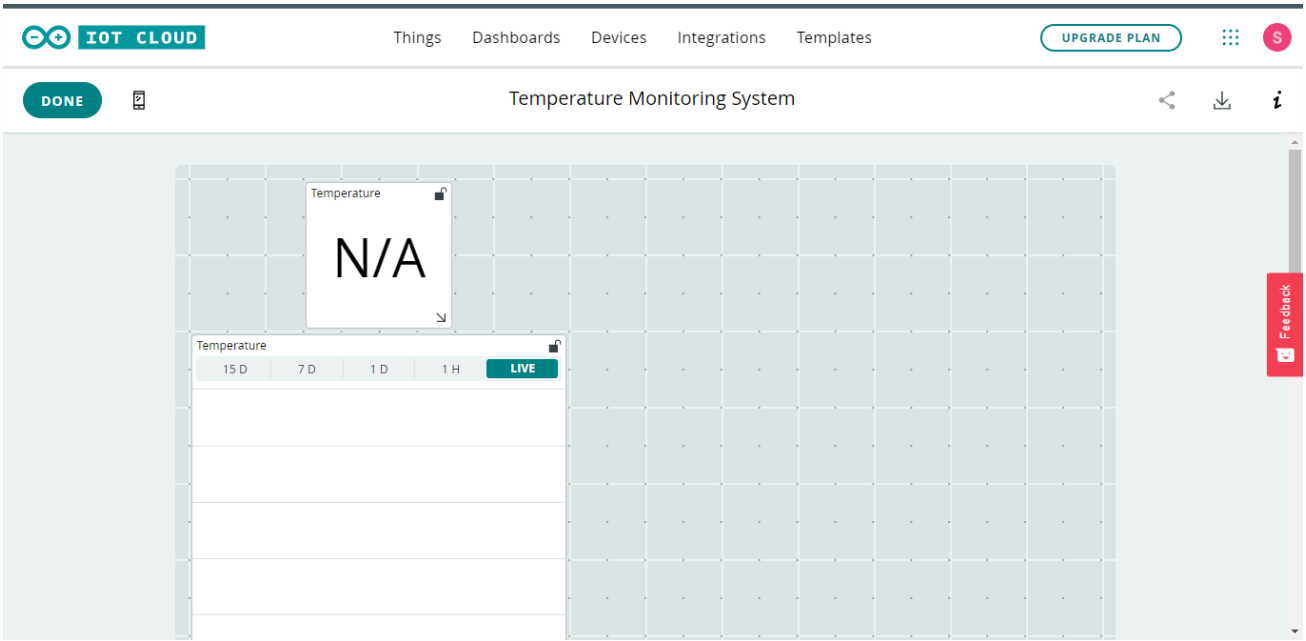


a. In the popup select the “temperature” and then click on the “link variable” option.

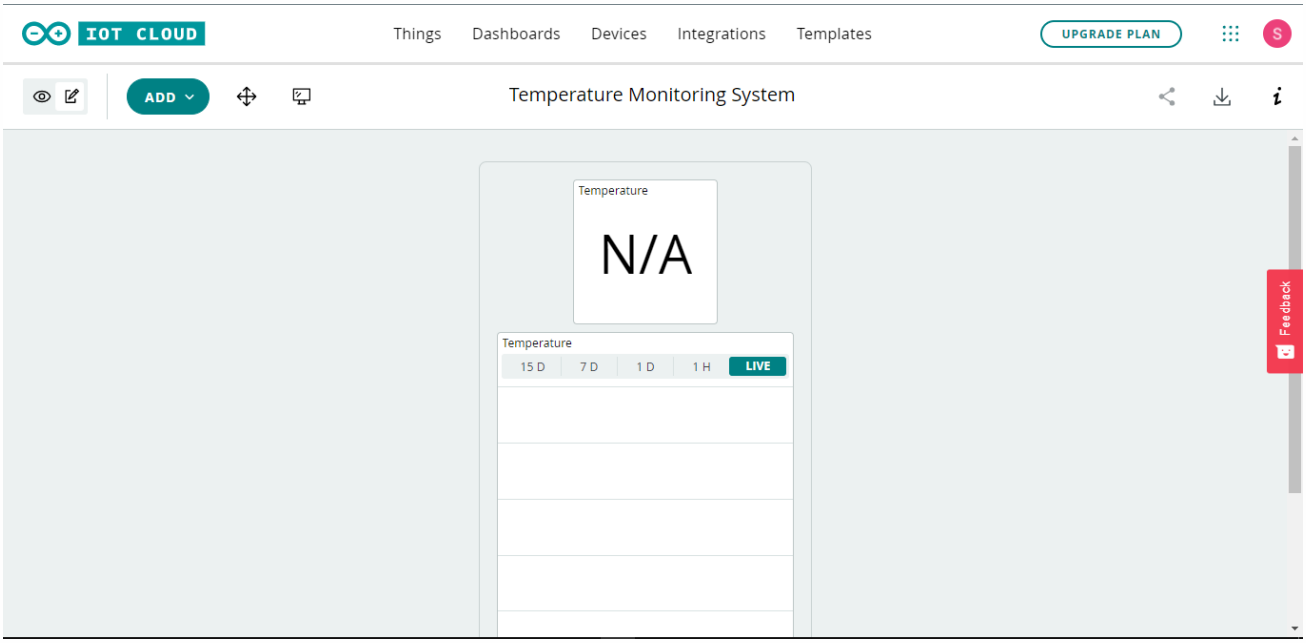
Enter the name of the chart as Temperature and then click on “Done”.



b. To adjust the position of the object click on the button beside the “add” button and move the objects to the required position then click on "done".



If you want to adjust for mobile mode also, click on the mobile icon and then adjust the objects.

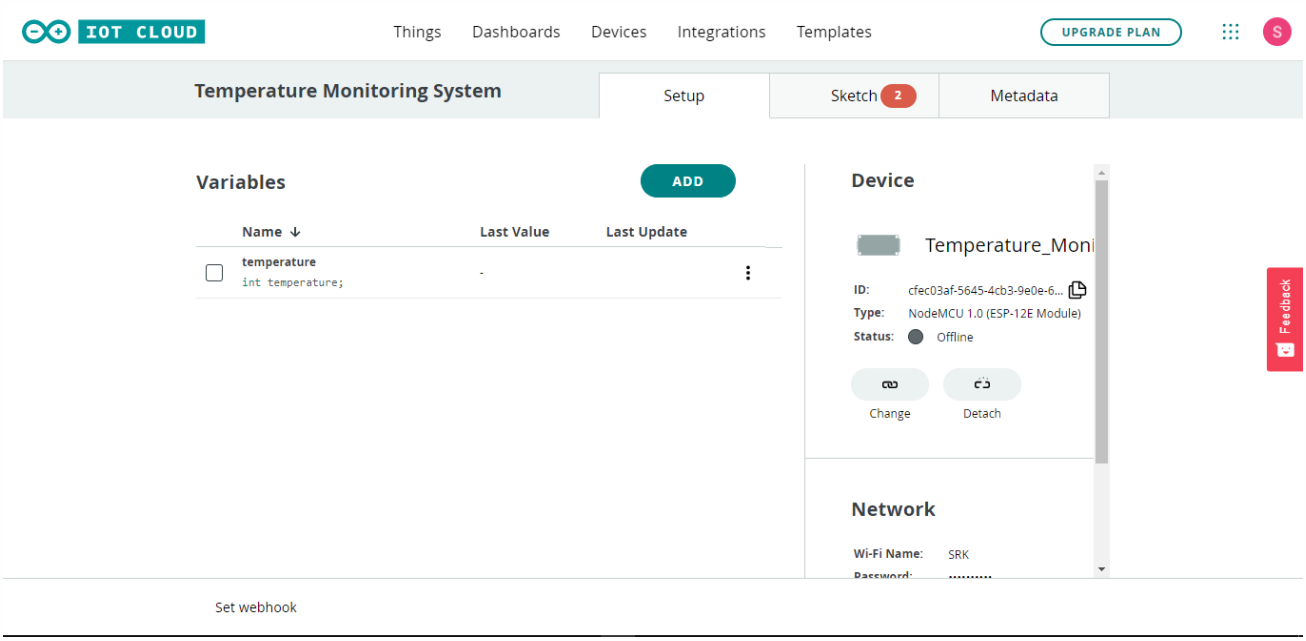


Now we are done with the interface

PART 4: Writing the Code

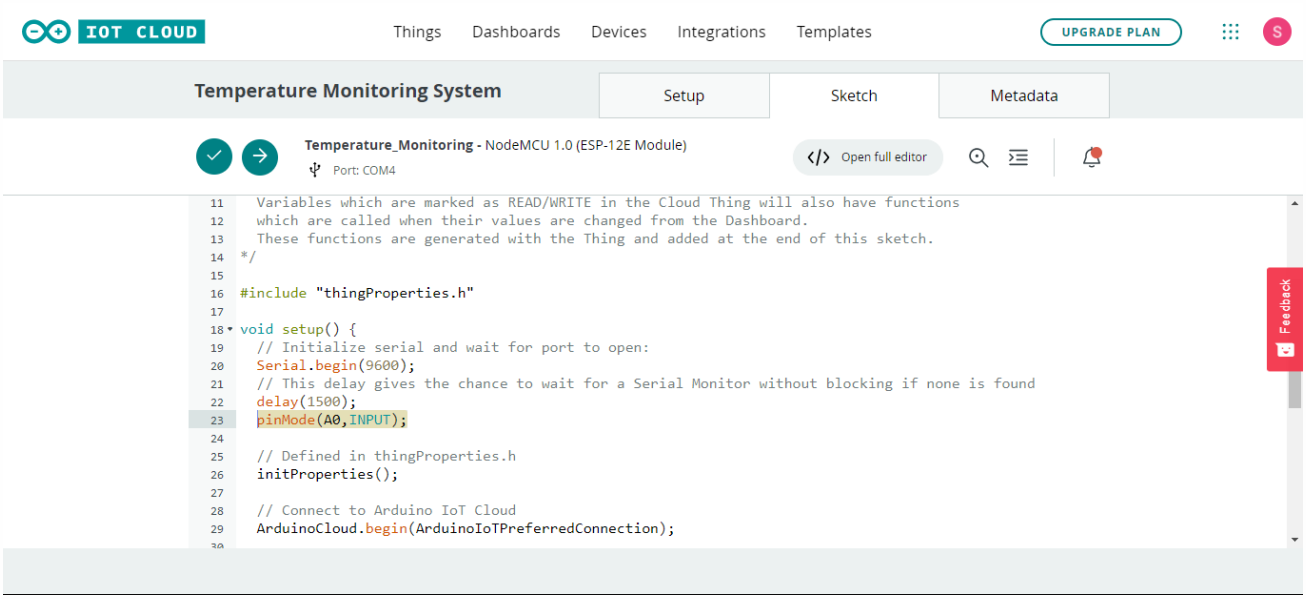
Step 14

Now let's start writing the code. Click on the "Sketch" button beside the setup button.



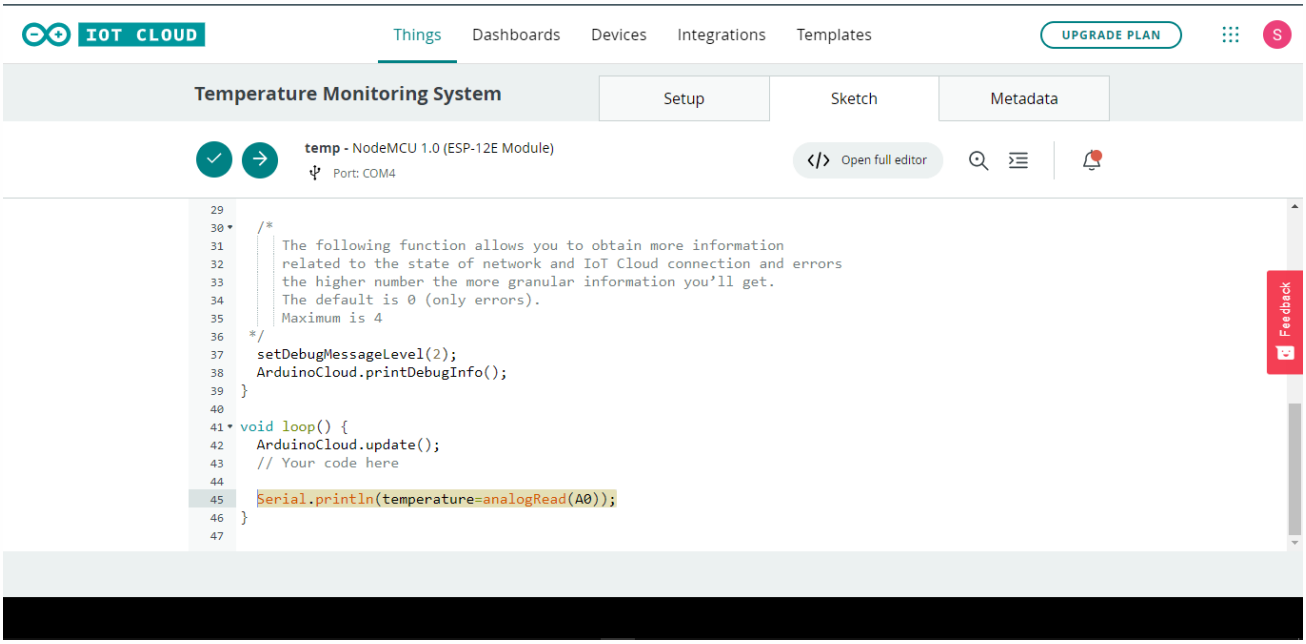
We have connected the OUT pin of the LM35 sensor to the A0 pin of the Node MCU. So let's setup the pin mode. In the "void setup" function write the code as

pinMode(A0,INPUT);



Since it's a monitoring system and the data has to be updated periodically, let's write the following command in "void loop" function.

Serial.println(temperature = analogRead(A0));

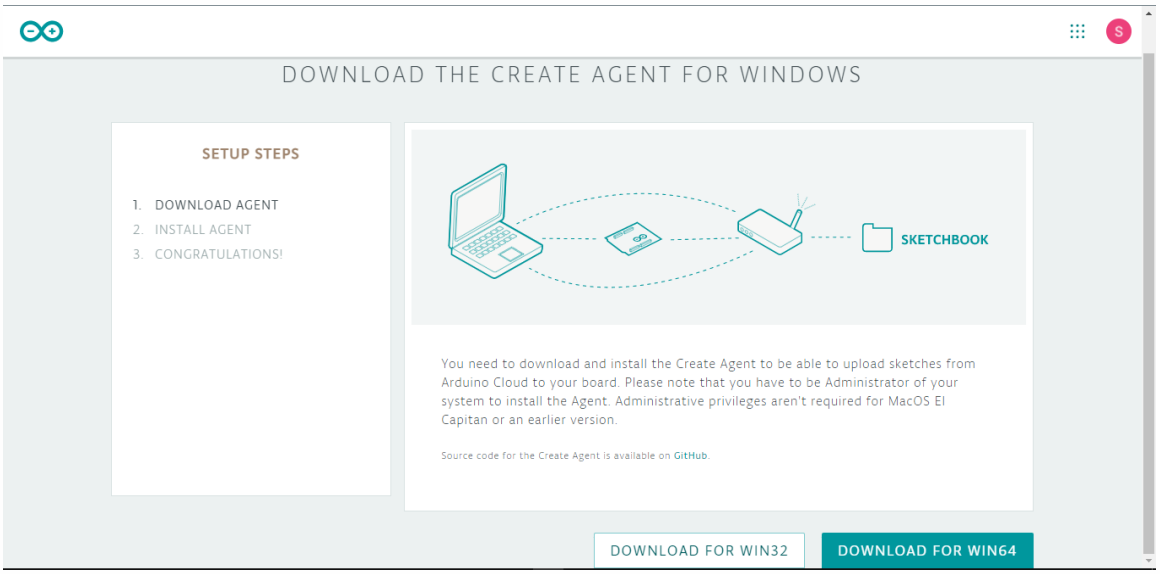


Step 15

Downloading the Arduino Create Agent.

Click on the link to download the Arduino Create Agent

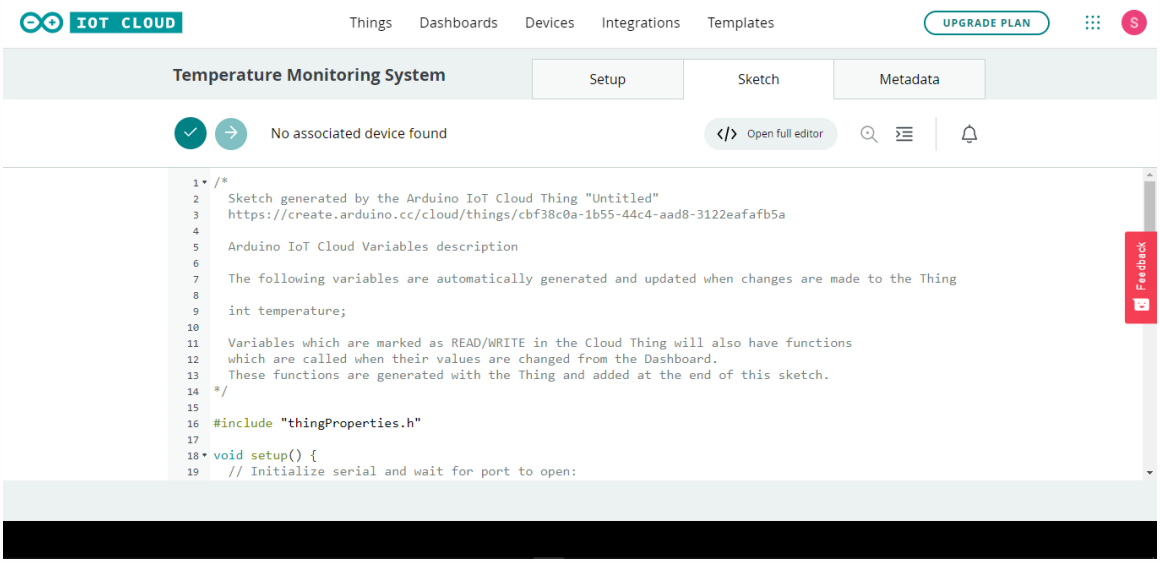
Install the application once your download is complete.



Step 16

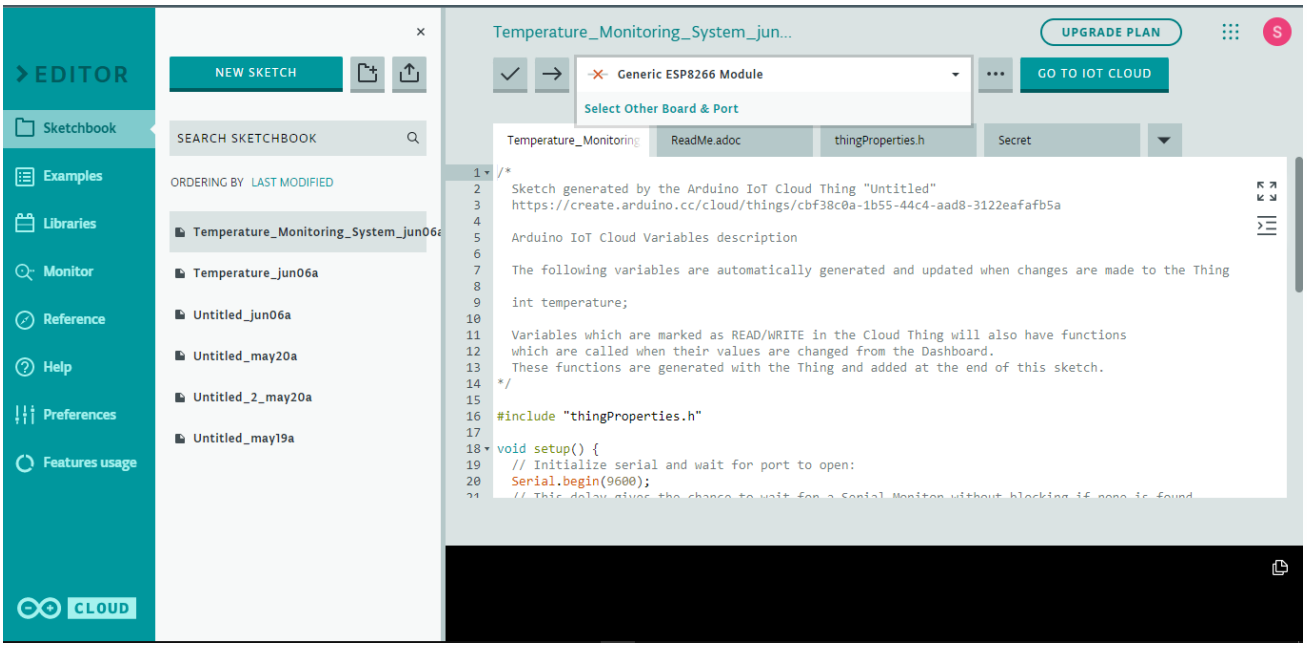
Uploading the Code

a. Click on the “open full editor” button. Then you are redirected to a new page where all the libraries and other options are shown.

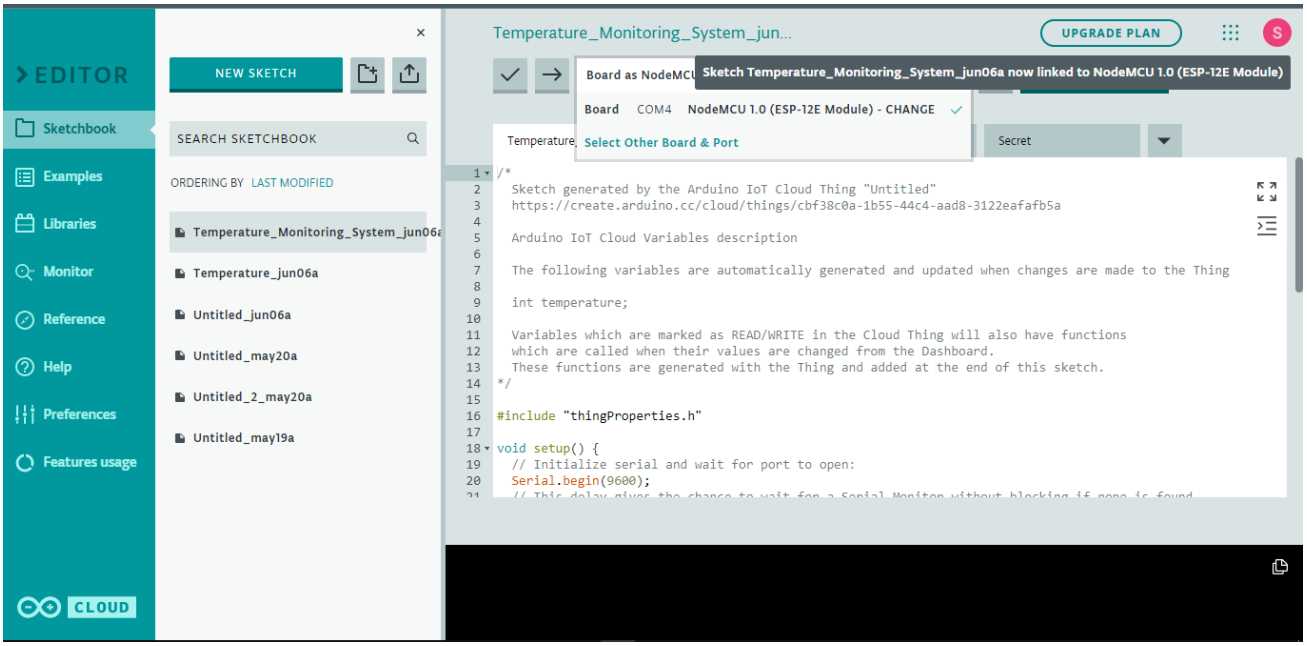


b. Click on “Select other boards and ports” option and search for Node MCU 1.0 and select the port.

Note: Before selecting the port connect the Node MCU to the computer using the micro USB cable.



c. After selecting the port click on the board and COM4 port as shown in the list. Then click on the “arrow ⟶ “ button to upload the code to the board.



While uploading the code percentage will be displayed at the bottom of the screen.

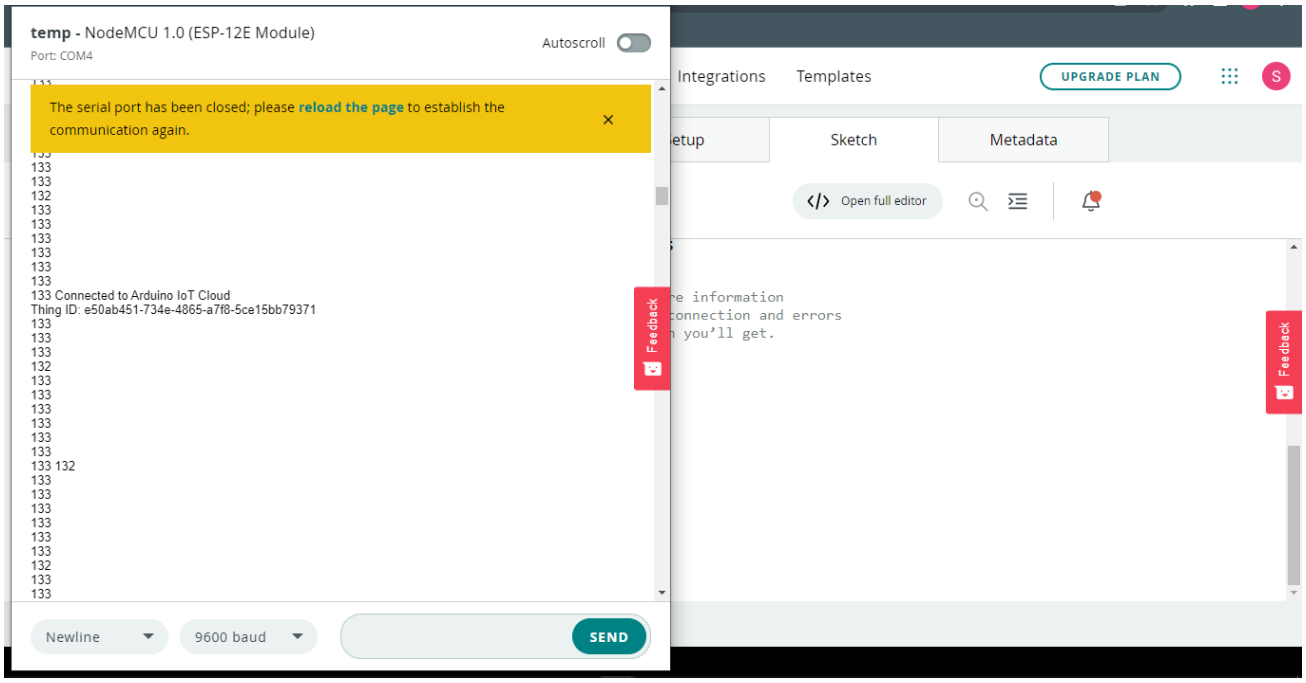
Note: if there is an error in uploading the code press hold the flash button on the NodeMCU and try uploading the code again.

Step 17

Now let's check the serial monitor for the Wi-Fi connection and temperature reading.

Click on the "Monitor" option from the editor section on the right side of the screen.

Check if the status is "Connected to Arduino IoT Cloud" this means that your connection is successful.

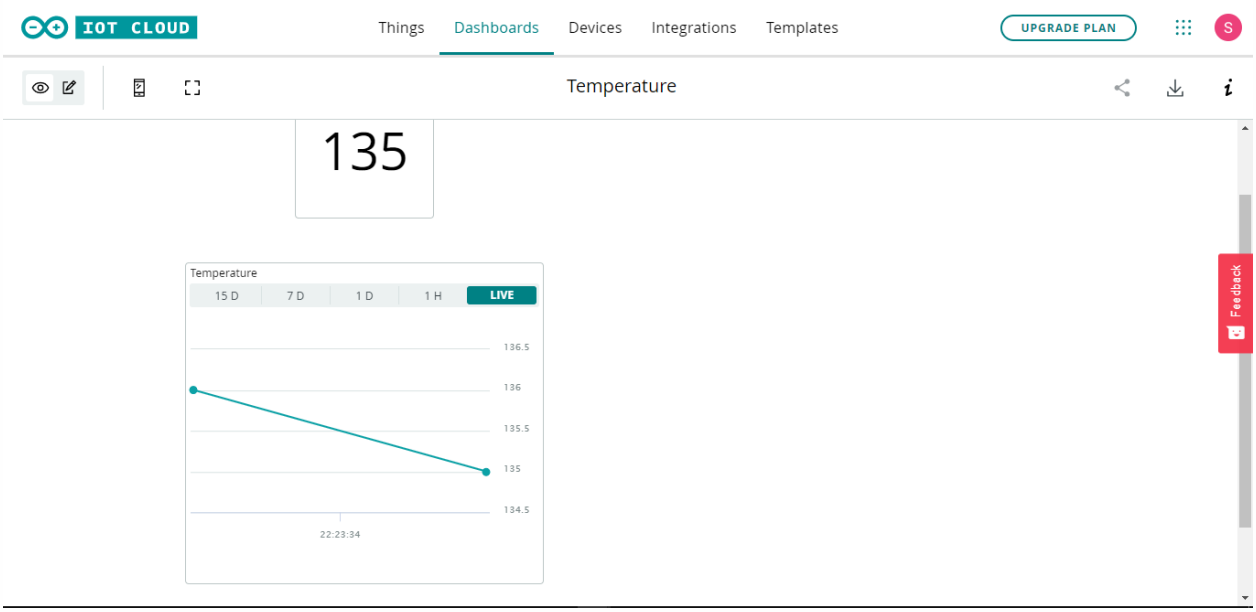


Step 18

Now let's check the data in the dashboard.

Click on the "Dashboard" and see the data there. If possible try adding different heat sources near the LM 35 sensor to check and record different temperatures.

You may place a glass of warm water and let it cool and monitor the drop in temperature.

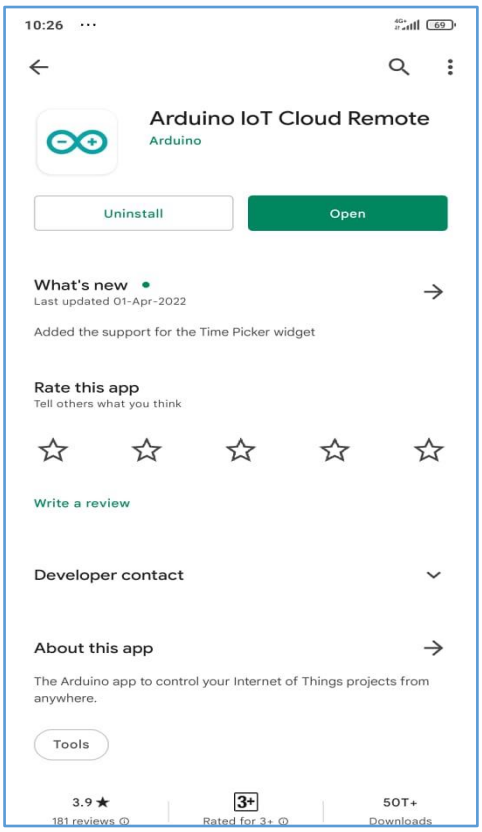


PART 5: IoT Application (Optional)

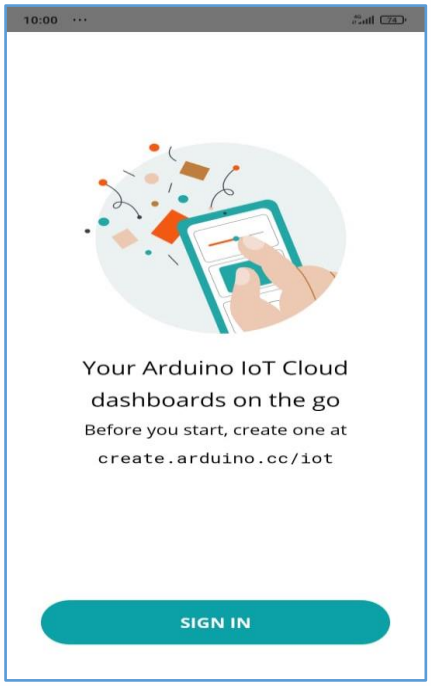
Step 19

Now let's try controlling the devices using an android application.

Open "Playstore" on your mobile and search for "Arduino IoT" click on the Install button.



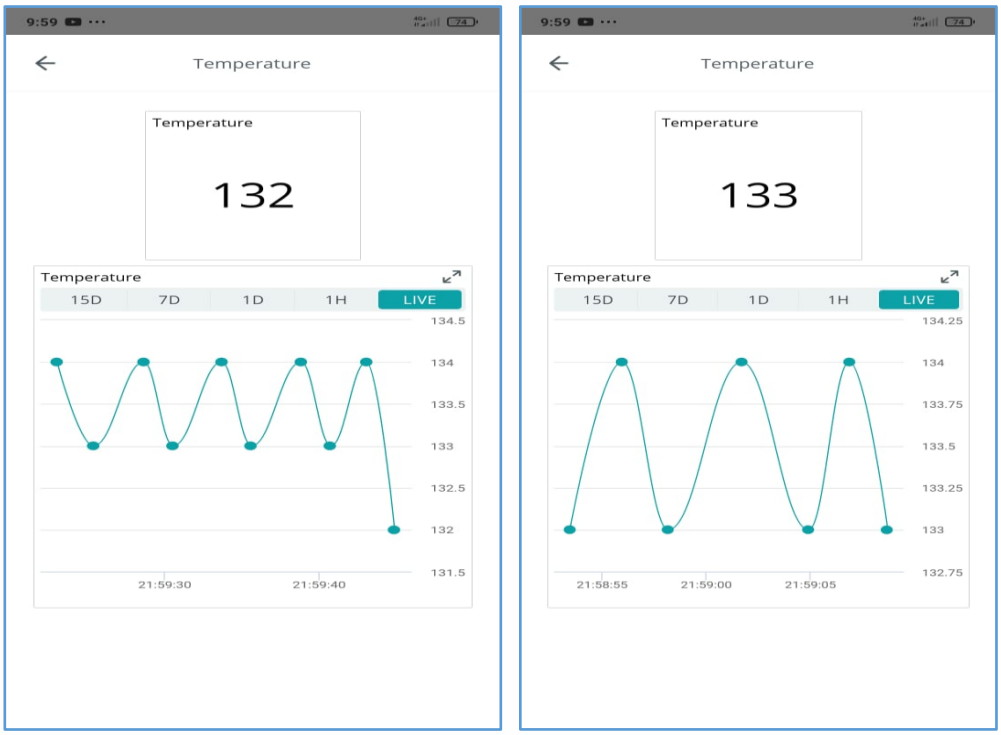
After installation open the application and sign in.



Note: Login with the same Email ID which you have used for creating the IoT project.

Step 20

You will find the dashboard once you log in. Click on the Temperature and you will find the values.



Step 21

Congratulations you have successfully completed the Industrial Machine Monitoring System project.

Reflection:

1. Research and find out the differences between LM 35 Temperature sensor and Thermistor.
2. What is the purpose of “void loop” function?
3. What improvements do you recommend to this circuit? What other sensors you would like to incorporate
4. What were your observations when the LM35 was exposed to different temperatures?
5. How do you think machine monitoring systems can save lives in industries?

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