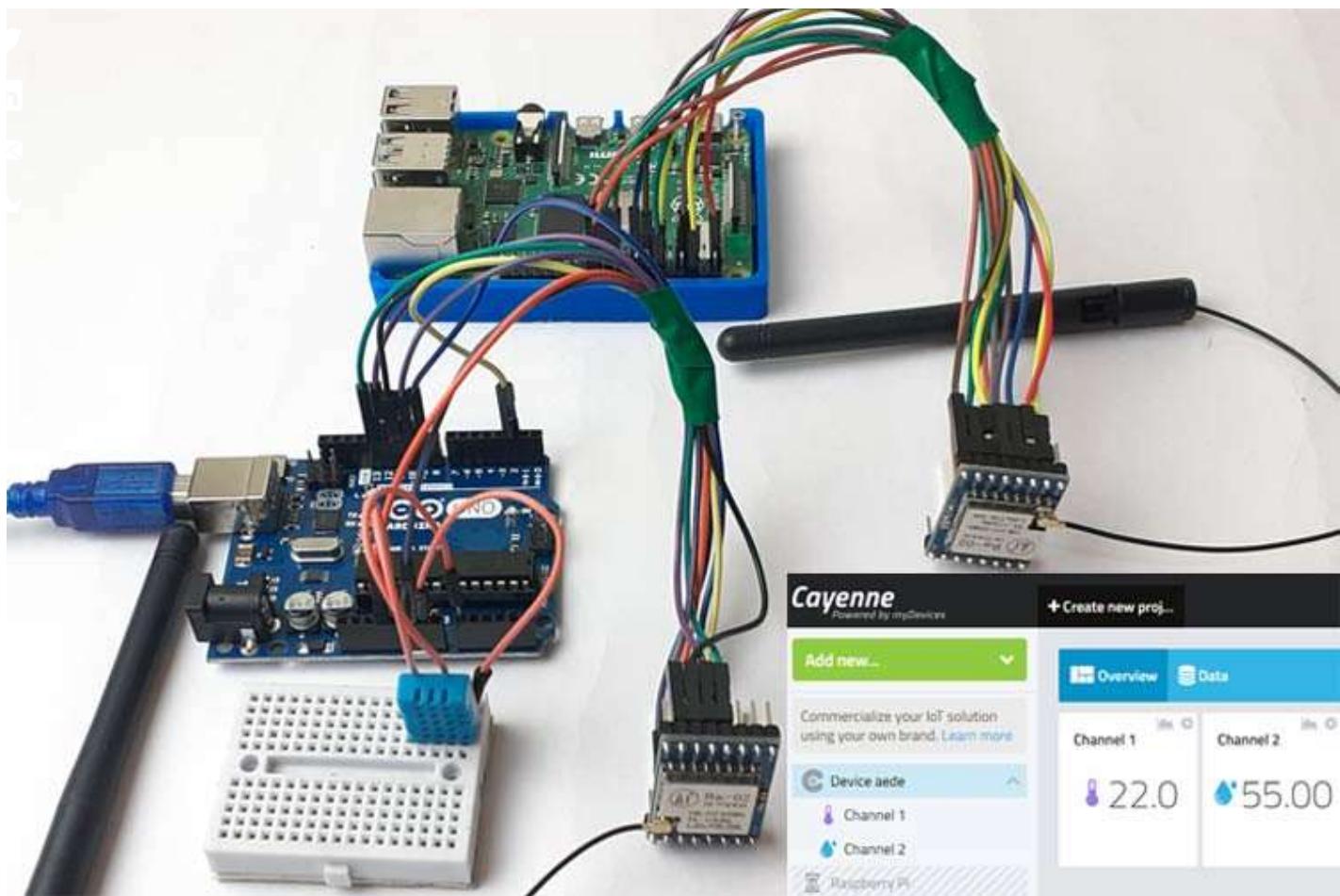


ARDUINO

RASPBERRY PI

26 Mar, 2020 / 18 Comments

12 Share Wireless Communication between Arduino & Raspberry Pi using LoRa Module SX1278



Whether it is IoT, M2M, or Industry 4.0, LoRa is one of the most popular wireless communication medium. LoRa is getting popular day by day and there are many LoRaWAN networks all around. It consumes very low power and can communicate over a long-range. Previously we used LoRa for Arduino to Arduino (<https://iotdesignpro.com/projects/lora-communication-between-two-arduino-using-LoRa-Module-SX1278>) and ESP32 to ESP32 (<https://iotdesignpro.com/projects/esp32-lora-communication-using-arduino-ide>) communications.



12 Shares Here in this tutorial, we will use **LoRa module SX1278 for peer to peer communication between Raspberry Pi and Arduino.** Here Arduino will act as Transmitter/Server and Raspberry Pi as Receiver/Client. A **DHT 11 sensor** is connected to the transmitter side which will send temperature and humidity data to the receiver side. On the receiving side, Raspberry pi will publish these readings on the Cayenne dashboard.

Components Required

- Raspberry Pi 4
- Arduino Uno
- SX1278 433MHz LoRa Transmitter- Receiver Module
- DHT11



Circuit Diagram

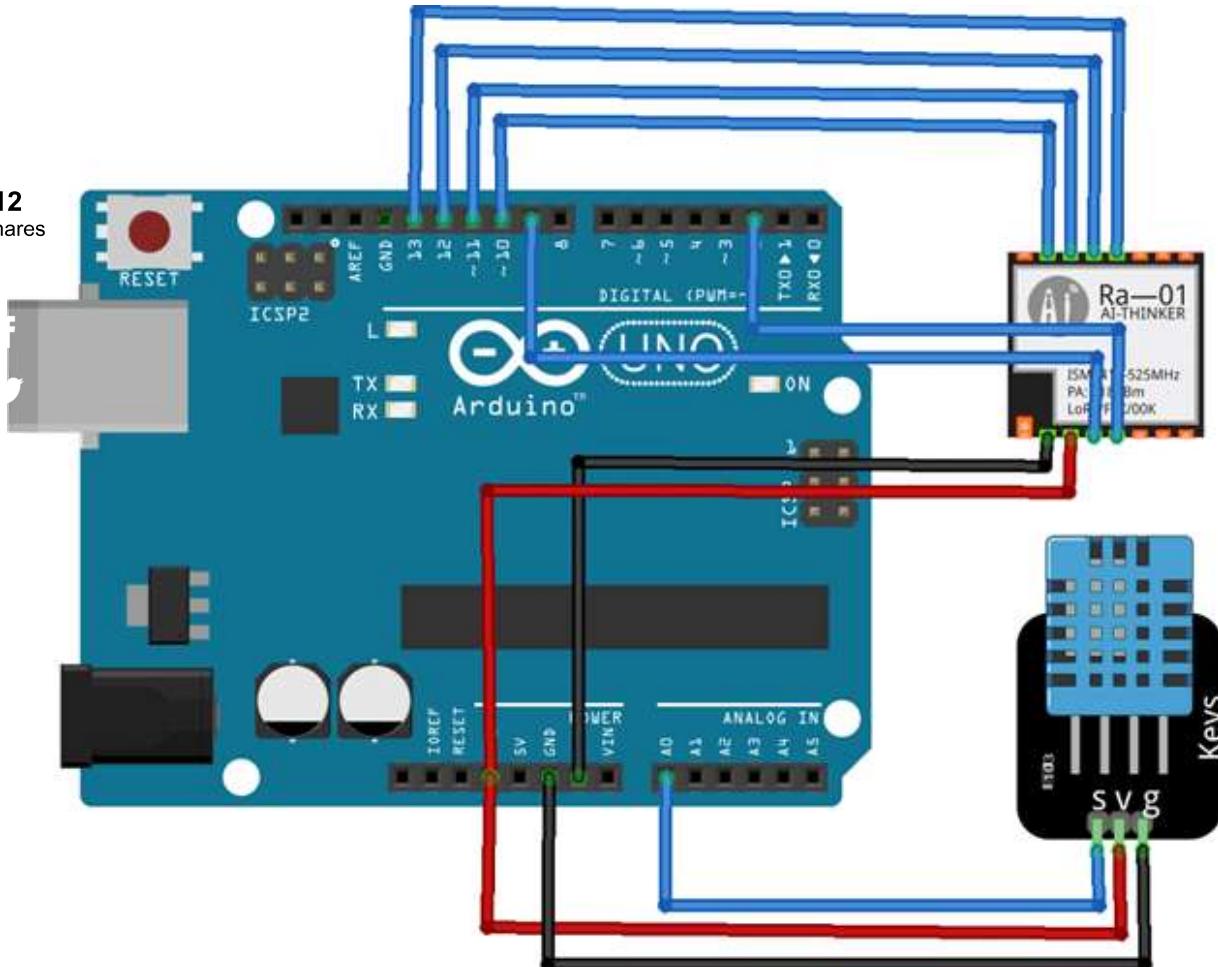
The circuit diagrams for the LoRa transmitter/Server and Receiver/Client section are given below. In this project, we are going to **send temperature and humidity values from Arduino to Raspberry Pi using the LoRa SX1278 module.** The DHT11 sensor (<https://www.iotdesignpro.com/tags/dht11>) is connected to the transmitting side where Arduino will get temperature and humidity values from DHT11 and then sends it to Raspberry Pi via the LoRa SX1278 module. These humidity and temperature values will be uploaded to the Cayenne IoT platform which can be monitored from anywhere in the world using the internet.

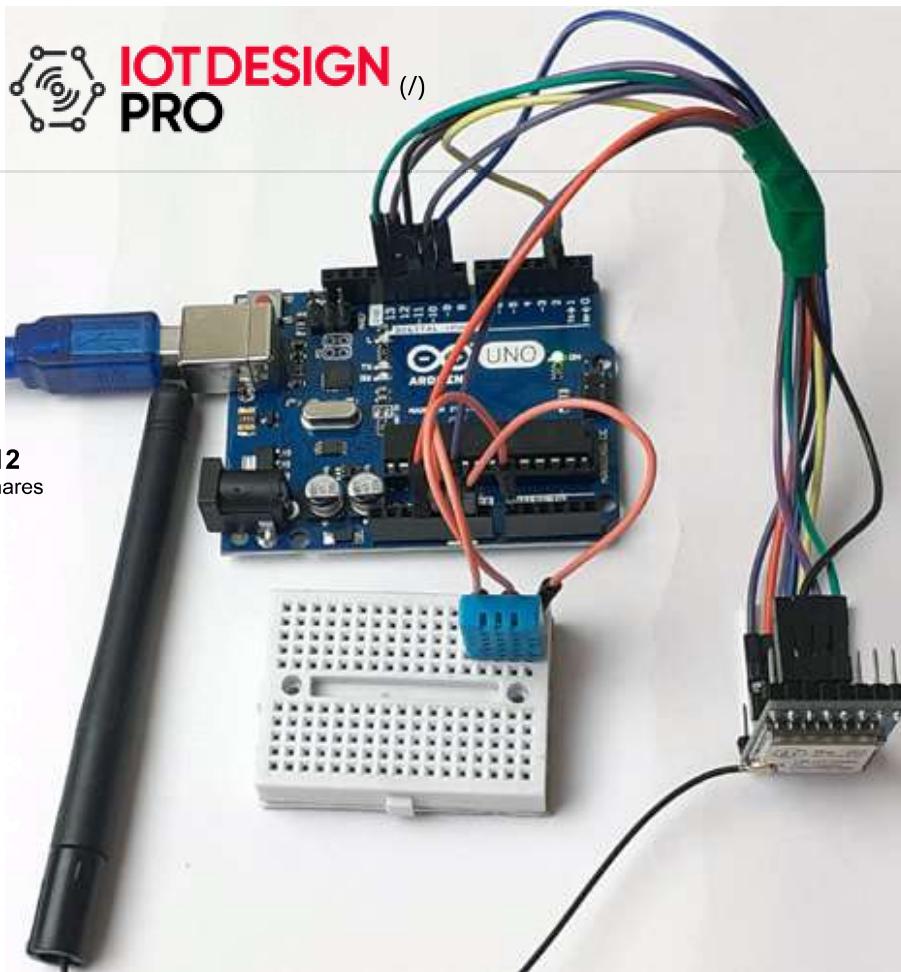
Transmitter Section- Interfacing LoRa with Arduino UNO



On the transmitter side, an Arduino UNO is interfaced with the LoRa module and DHT11 sensor. The interfacing of the Arduino UNO with LoRa and DHT11 is shown below. Also, check the detailed explanation of interfacing Arduino Uno with LoRa (<https://iotdesignpro.com/projects/lora-communication-between-two-arduino-using-LoRa-Module-SX1278>).

12 Shares





12
Shares



The LoRa module consists of 16 pins, out of these six pins are GPIO pins, and four are Ground pins. This LoRa module operates at 3.3V, and so the 3.3V pin on LoRa is connected to the 3.3v pin on the Arduino UNO board. Complete connections are given in the below table. The DHT11 sensor is connected to the A0 pin of Arduino.

LoRa SX1278 Module	Arduino Uno
3.3V	3.3V
GND	GND
NSS	D10
DIO0	D2
SCK	D13
MISO	D12
MOSI	D11
RST	D9
DHT 11 Sensor	Arduino Uno

	IOTDESIGN PRO	(/)	3.3V
			GND
DATA			A0

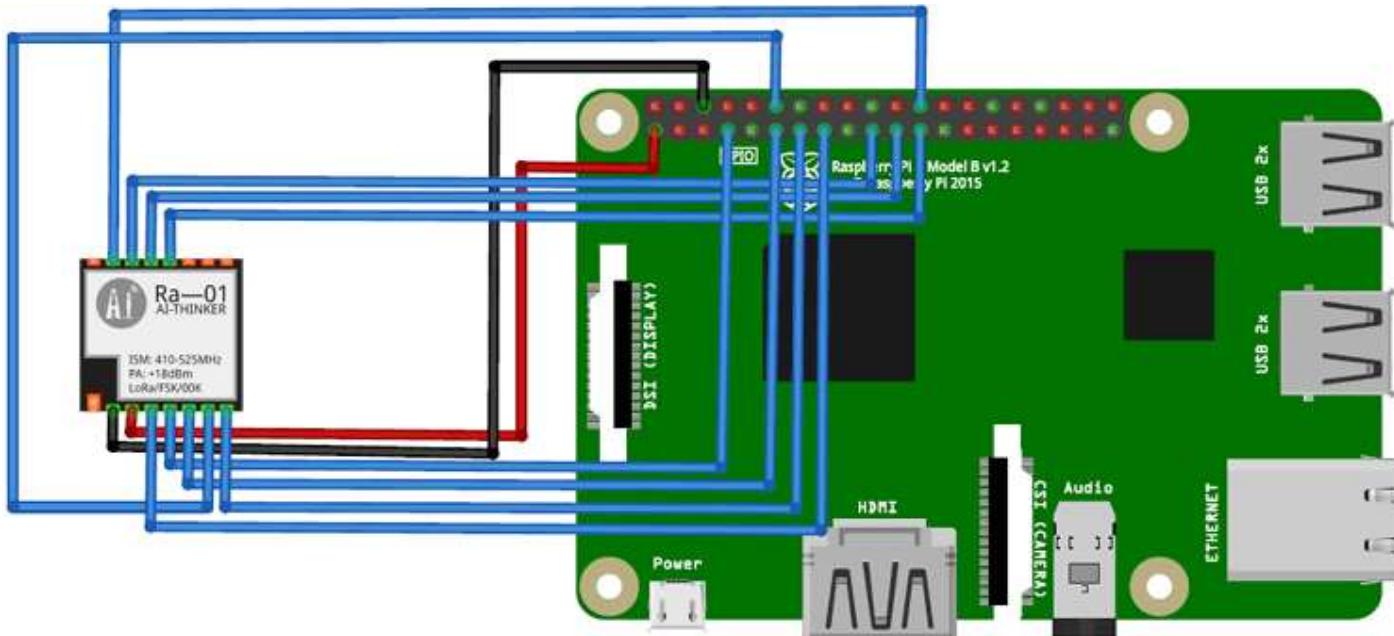
12
Shares

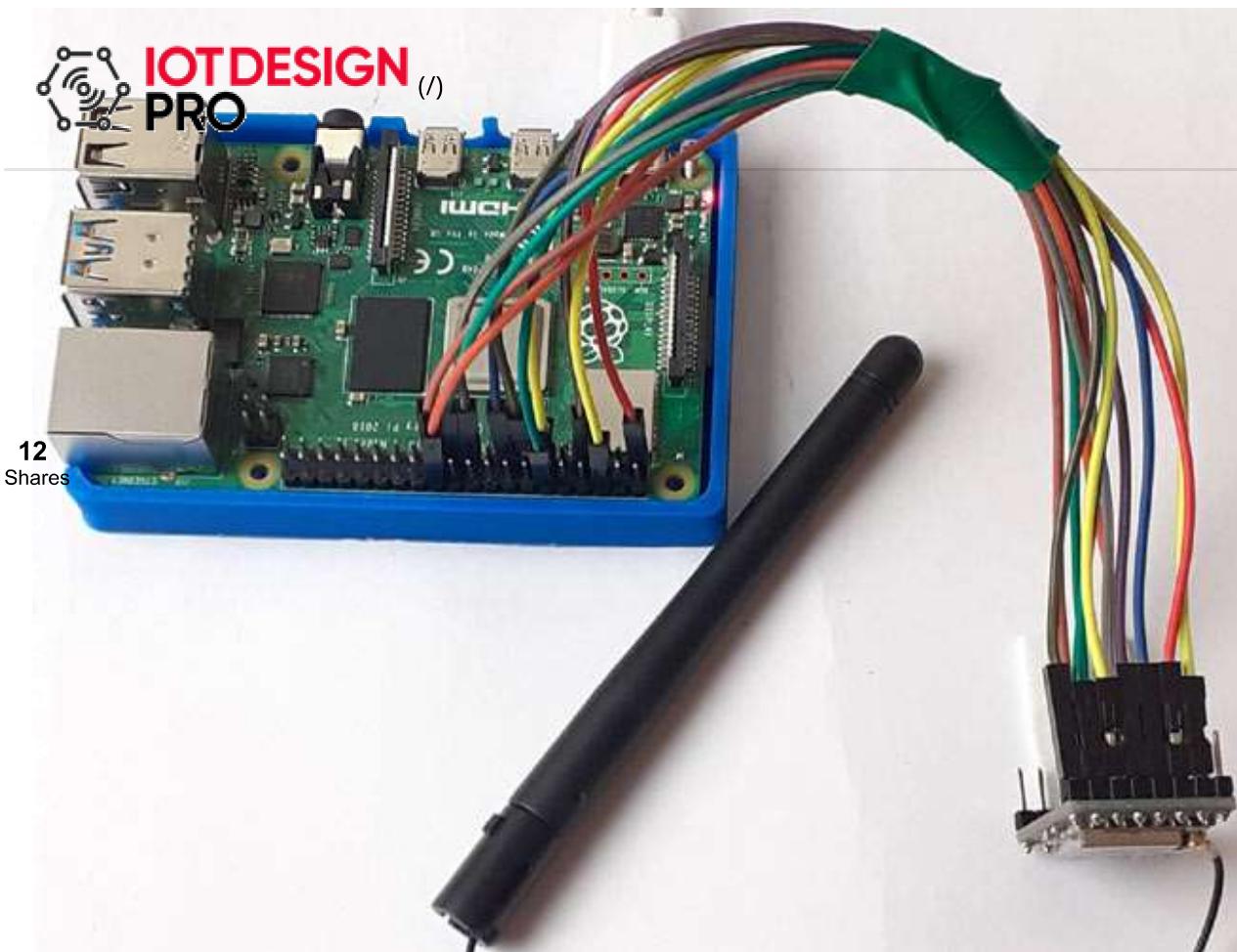
Ultra High-Density Circuit

Advanced PCB source factory manufac
providing EMS manufacturing.

Receiver Section- Interfacing Raspberry Pi with LoRa Module

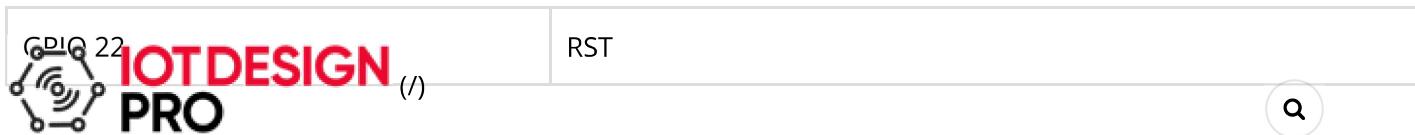
On the receiver side, a Raspberry Pi is used to get the data from the LoRa Receiver and send it to the Cayenne platform.





Complete connections between the LoRa module and Raspberry Pi are given in the below table.

Raspberry Pi	Lora – SX1278 Module
3.3V	3.3V
Ground	Ground
GPIO 10	MOSI
GPIO 9	MISO
GPIO 11	SCK
GPIO 8	Nss / Enable
GPIO 4	DIO 0
GPIO 17	DIO 1
GPIO 18	DIO 2
GPIO 27	DIO 3



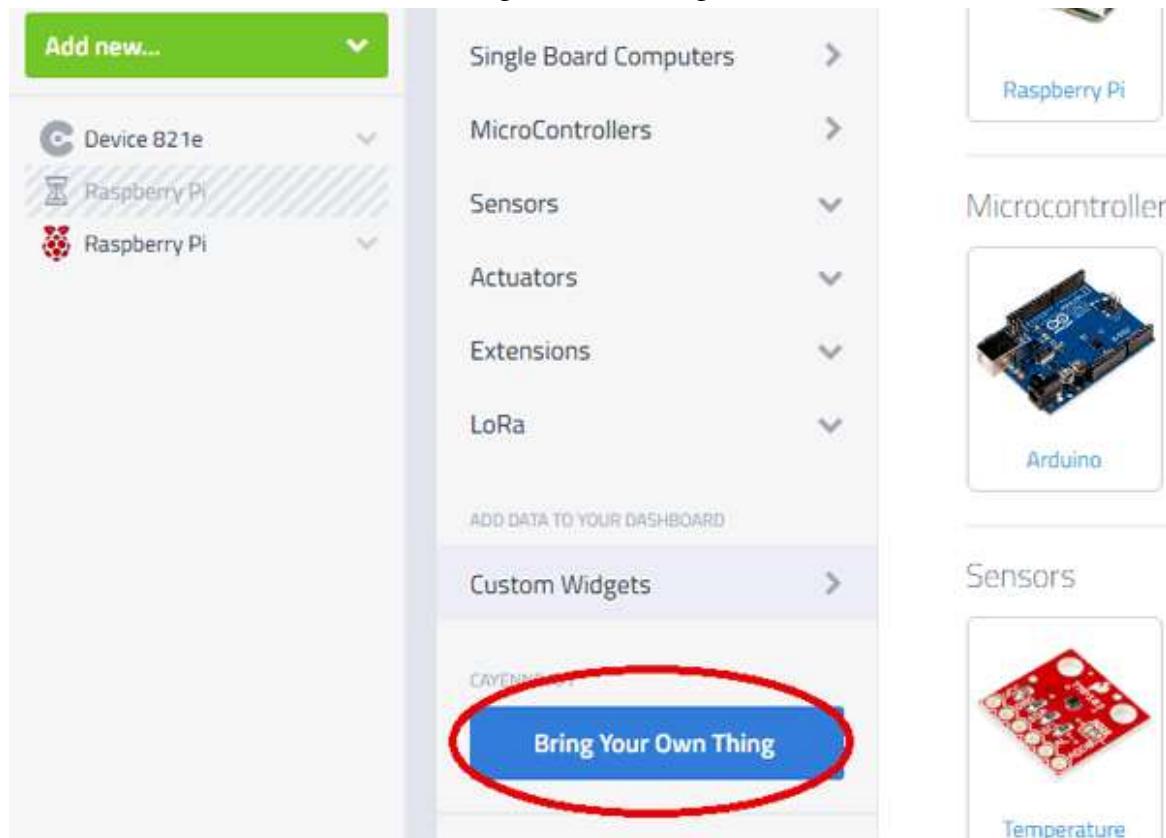
Cayenne Setup for LoRa Communication

Cayenne is an IoT platform that allows you to control the microcontrollers. It is also used to upload any sensor data to the Cayenne cloud. Here temperature and humidity data from the DHT11 sensor will be uploaded to Cayenne.

First, sign-in/Signup into your Cayenne account and then go to the Cayenne dashboard and click on 'Add new' and then click on 'Device/Widget.'



After this, scroll down and click on 'Bring Your Own Thing.'



A window with your device details will appear. Copy these details; it will be used in the python code.



Arduino MQTT

Cayenne MQTT mbed

Embedded C

C++
Shares

Cayenne MQTT Python

Node.js

MQTT USERNAME:

MQTT PASSWORD:

CLIENT ID:

MQTT SERVER:

MQTT PORT:

NAME YOUR DEVICE (optional):

[View all SDKs on GitHub](#)

Programming Arduino for LoRa Communication

For **communication between Arduino and Raspberry Pi**, Radiohead library is used. This library can be downloaded from here (<https://github.com/PaulStoffregen/RadioHead>). Here Arduino is working as Transmitter/Server and sending DHT sensor data to Raspberry Pi.

Complete Arduino code is given at the end of the page. Here we are explaining some important parts of the code.

As usual, start the code by including all the required libraries. **SPI library** is used for SPI communication between Arduino and LoRa modules. **RH_RF95 library** is used for LoRa communication, and the **DHT library** is used to read the temperature and humidity values from the DHT sensor.

```
#include <SPI.h>
#include <RH_RF95.h>
#include "DHT.h"
```

Then define the DHT type and pin where you connected the DHT sensor.

```
#define DHTPIN A0      // what pin we're connected to
#define DHTTYPE DHT11    // DHT type
DHT dht(DHTPIN, DHTTYPE);
```

Inside the **void loop**, read the temperature and humidity values.



Now to send the temperature and humidity values to Raspberry Pi, you have to convert them into a char array. To do that, first, convert the integer values to a string and then add both the temperature and humidity values into a single string.

```
String humidity = String(hum); //int to String
String temperature = String(temp);
12 Shares String data = temperature + humidity;
```

Now convert the string values into a char array. Here '*data*' is the string and '*d*' is the char array.

```
char d[5];
data.toCharArray(d, 5); //String to char array
```

Finally, send the values to the LoRa receiver.

```
rf95.send(d, sizeof(d));
rf95.waitPacketSent();
```

Raspberry Pi Setup for LoRa Communication

As mentioned earlier that Radiohead library is used for **peer to peer communication between Arduino and Raspberry Pi**. LoRa module works with SPI protocol, so we have to enable the SPI interface in Raspberry pi. Use the below command to get into the configuration window.

```
sudo raspi-config
```

Now in the configuration window, go to interfacing options and **enable the SPI interface**.

After enabling the SPI interface, now install the **spidev package** using the below command. It is a python module for interfacing SPI devices from user space via the *spidev* Linux kernel driver.

```
pip install spidev
```

Then install the **pyLoRa** package using the below command. This package installs the required models for LoRa communication.

```
pip install pyLoRa
```



IOTDESIGN PRO

Programming Raspberry Pi for LoRa Communication



Here Raspberry Pi is used as Receiver/client and receives the DHT sensor data transmitted by Arduino.

The complete Python program is given at the end of the page. Here I am explaining some important parts of the code.

At the beginning of the code, import all the required libraries. **MQTT library** is used for sending the temperature and humidity values to the cayenne platform.

```
from time import sleep
12 from SX127x.LoRa import *
Shares
from SX127x.board_config import BOARD
import paho.mqtt.client as mqtt
```

Now enter the required credentials for MQTT communication between Raspberry Pi and Cayenne.

```
username = "20f70690-4976-11ea-84bb-8f71124cfdfb"
password = "3d7eaaf9a7c9e28626fcab4ec5a61108cfbb8be0"
clientid = "cccb41b0-4977-11ea-b73d-1be39589c6b2"
```

After that, create two channels for temperature and humidity values.

```
topic_dht11_temp = "v1/" + username + "/things/" + clientid + "/data/1"
topic_dht11_humidity = "v1/" + username + "/things/" + clientid + "/data/2"
```

Now create a LoRa class with three functions i.e. *init*, *class* and *on_rx_done*. The *init* function is used to initialize the LoRa module in 433MHz with 125 kHz bandwidth.

```
def __init__(self, verbose=False):
    super(LoRaRcvCont, self).__init__(verbose)
    self.set_mode(MODE.SLEEP)
    self.set_dio_mapping([0] * 6)
```

The **start** function is used to configure the module as a receiver and to get RSSI value, operating frequency, etc.



```

def start(>1):
    self.reset_ptr_rx()()
    self.set_mode(MODE.RXCONT)

while True:
    sleep(.5)
    rssi_value = self.get_rssi_value()
    status = self.get_modem_status()
    sys.stdout.flush()

```

**12**

The **on_rx_done** function is used to read the incoming values. Then received values are moved into a variable called **payload** and decoded with utf-8 and moved into a variable called **data**.

```

def on_rx_done(self):
    self.clear_irq_flags(RxDone=1)
    payload = self.read_payload(nochek=True)
    data = bytes(payload).decode("utf-8",'ignore')

```

Now split the temperature and humidity values and publish them on Cayenne platform

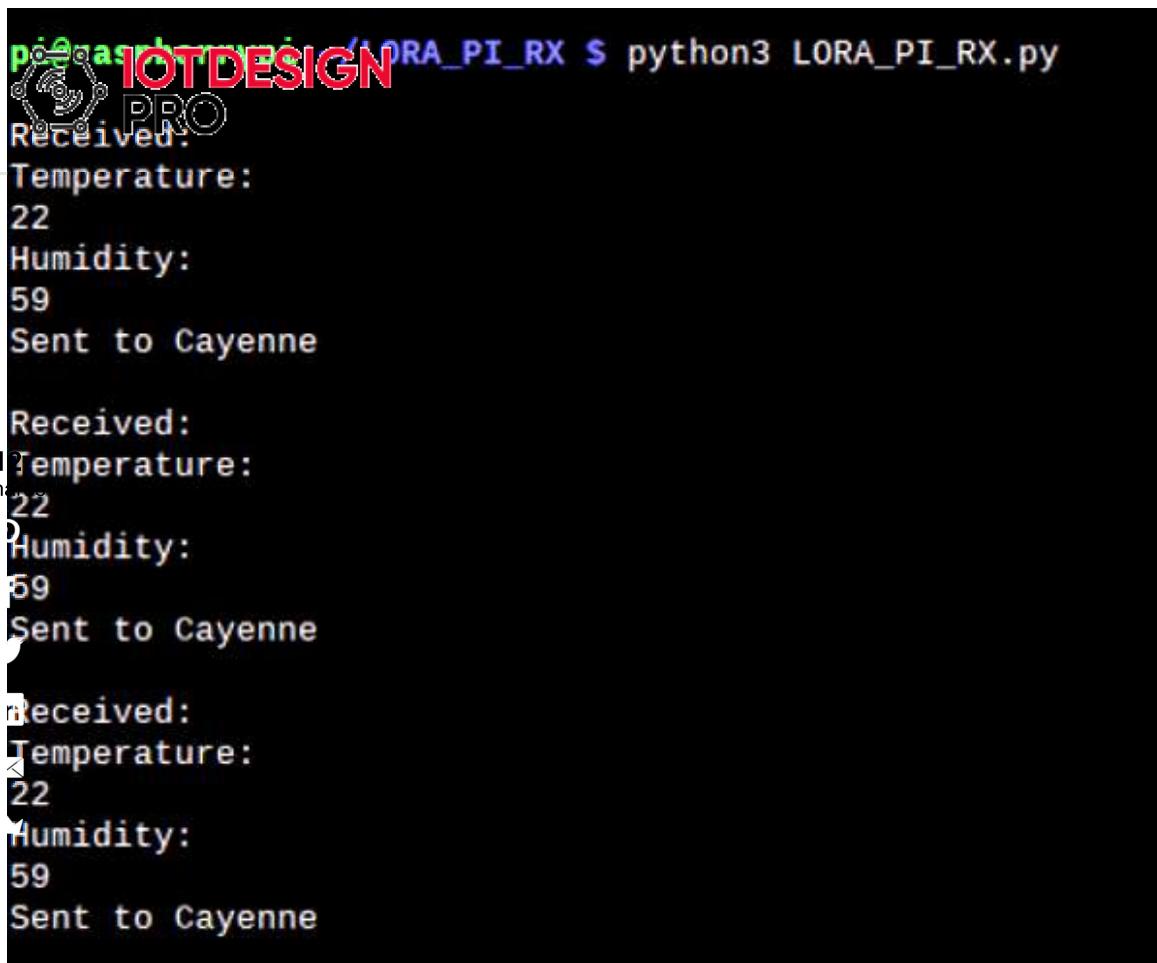
```

temp = (data[0:4])
humidity = (data[4:6])
mqttc.publish(topic_dht11_temp, payload=temp, retain=True)
mqttc.publish(topic_dht11_humidity, payload=humidity, retain=True)

```

Establishing Communication between Arduino & Raspberry Pi

Once the hardware and program are ready, upload the Arduino code to the Arduino board and launch the python code in Pi. If everything is working properly, you should see the temperature and humidity values received in pi through the shell window, as shown below.



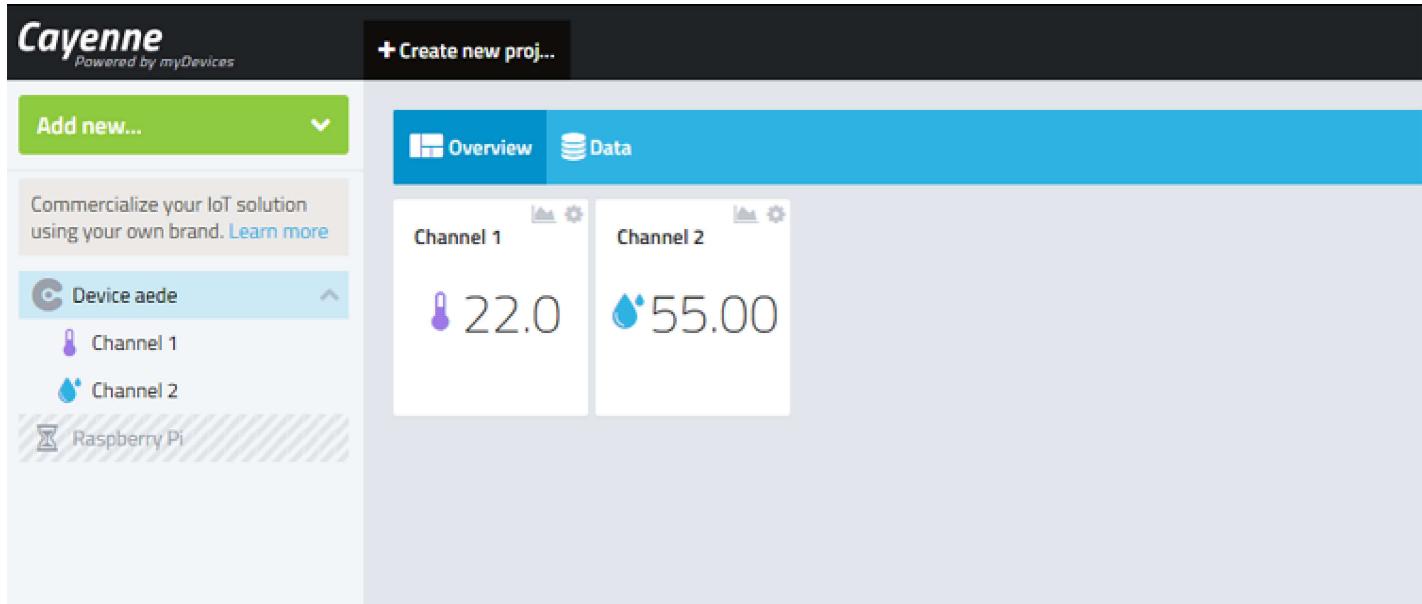
The terminal window displays the output of the Python script LORA_PI_RX.py. It shows three sets of received data from the Arduino, each consisting of temperature and humidity values, followed by a message indicating they were sent to Cayenne.

```
pi@raspberrypi:~/IOTDESIGN$ python3 LORA_PI_RX.py
Received:
Temperature: 22
Humidity: 59
Sent to Cayenne

Received:
Temperature: 22
Humidity: 59
Sent to Cayenne

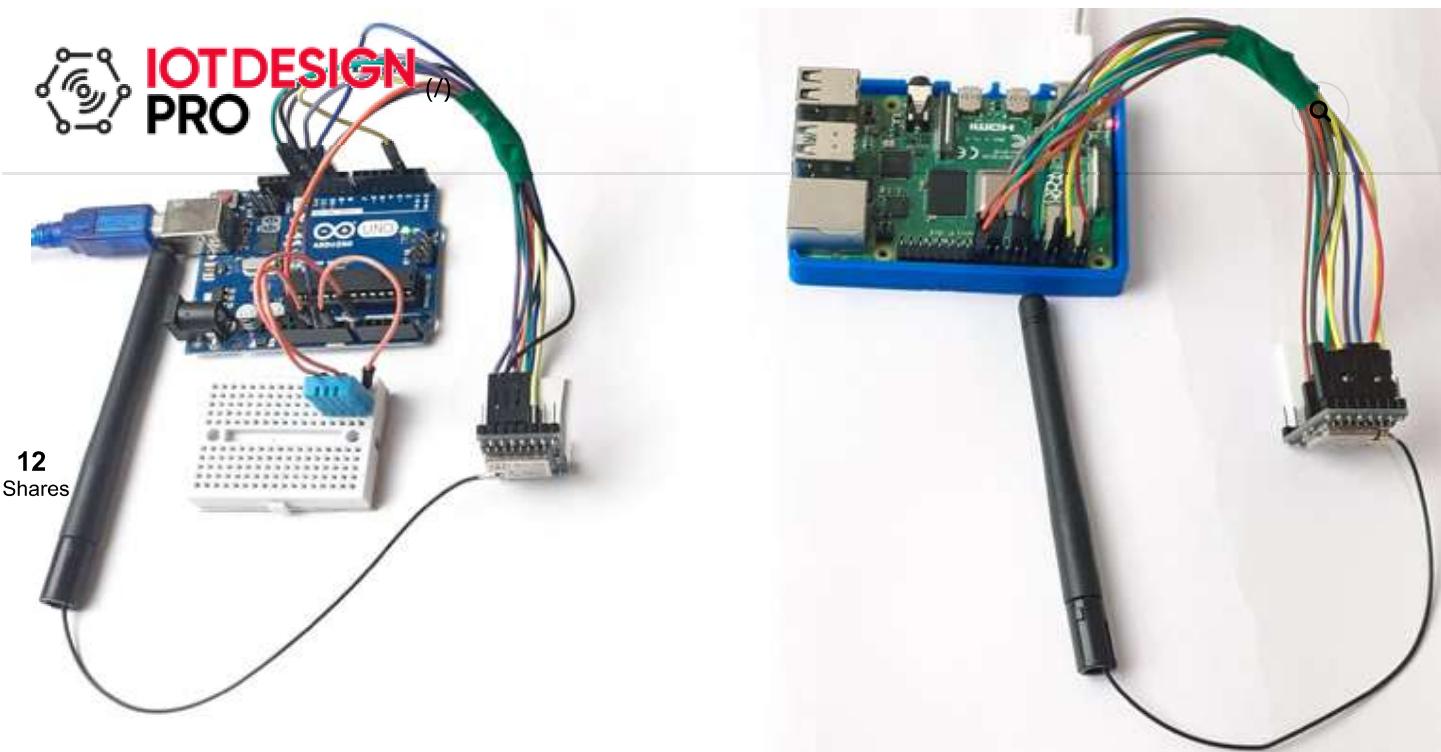
Received:
Temperature: 22
Humidity: 59
Sent to Cayenne
```

Now open the Cayenne using your default browser and you should see the temperature and humidity value on your Dashboard as shown below.



The Cayenne Dashboard shows the received data. Channel 1 displays a temperature of 22.0 and a humidity of 55.00. Channel 2 displays a temperature of 22.0 and a humidity of 55.00. The left sidebar lists the device 'Device aede' with two channels and the 'Raspberry Pi' node.

Channel	Value
Channel 1	22.0
Channel 2	55.00



This is how an **Arduino can wirelessly communicate with Raspberry Pi** using the LoRa Module and further Raspberry pi can upload the sensor data to any cloud so that it can be monitored from anywhere. A demonstration video with a complete code is shown below.

Code

```

from time import sleep
from SX127x.LoRa import *
from SX127x.board_config import BOARD
import paho.mqtt.client as mqtt
username = "20f70690-4976-11ea-84bb-8f71124cfdfb"
password = "3d7eaaf9a7c9e28626fcab4ec5a61108cfbb8be0"
clientid = "cccb41b0-4977-11ea-b73d-1be39589c6b2"
mqttc = mqtt.Client(client_id=clientid)
mqttc.username_pw_set(username, password=password)
mqttc.connect("mqtt.mydevices.com", port=1883, keepalive=60)
mqttc.loop_start()
topic_dht11_temp = "v1/" + username + "/things/" + clientid + "/data/1"
topic_dht11_humidity = "v1/" + username + "/things/" + clientid + "/data/2"
BOARD.setup()
class LoRaRcvCont(LoRa):
    def __init__(self, verbose=False):
        super(LoRaRcvCont, self).__init__(verbose)
        self.set_mode(MODE.SLEEP)
        self.set_dio_mapping([0] * 6)
    def start(self):
        self.reset_ptr_rx()
        self.set_mode(MODE.RXCONT)
        while True:

```



```

sleep(.5)
rs.read_value = self.get_rx_value()
self.get_modem_status()
sys.stdout.flush()

def on_rx_done(self):
    print ("\nReceived: ")
    self.clear_irq_flags(RxDone=1)
    payload = self.read_payload(nocheck=True)
    #print (bytes(payload).decode("utf-8",'ignore'))
    data = bytes(payload).decode("utf-8",'ignore')
    print (data)
    temp = (data[0:4])
    humidity = (data[4:6])
    print ("Temperature:")
    print (temp)
    print ("Humidity:")
    print (humidity)
    mqttc.publish(topic_dht11_temp, payload=temp, retain=True)
    mqttc.publish(topic_dht11_humidity, payload=humidity, retain=True)
    print ("Sent to Cayenne")
    self.set_mode(MODE.SLEEP)
    self.reset_ptr_rx()
    self.set_mode(MODE.RXCONT)

lora = LoRaRcvCont(verbose=False)
lora.set_mode(MODE.STDBY)
# Medium Range Defaults after init are 434.0MHz, Bw = 125 kHz, Cr = 4/5, Sf = 128chips/symbol, CRC on 13 dBm
lora.set_pa_config(pa_select=1)
try:
    lora.start()
except KeyboardInterrupt:
    sys.stdout.flush()
    print ("")
    sys.stderr.write("KeyboardInterrupt\n")
finally:
    sys.stdout.flush()
    print ("")
    lora.set_mode(MODE.SLEEP)
    BOARD.teardown()

```

Arduino Code:

```

#include <SPI.h>
#include <RH_RF95.h>
#include "DHT.h"
#define DHTPIN A0 // what pin we're connected to
#define DHTTYPE DHT11 // DHT type
DHT dht(DHTPIN, DHTTYPE);

```

```
int hum; //Stores humidity value
int temp; //Stores Temperature value
RH_RF95 rfh;
void setup()
{
    Serial.begin(9600);
    dht.begin();
    if (!rf95.init())
        Serial.println("init failed");
    // Defaults after init are 434.0MHz, 13dBm, Bw = 125 kHz, Cr = 4/5, Sf = 128chips/symbol, CRC on
12}
Shares void loop()
{
    temp = dht.readTemperature();
    hum = dht.readHumidity();
    String humidity = String(hum); //int to String
    String temperature = String(temp);
    String data = temperature + humidity;
    Serial.print(data);
    char d[5];
    data.toCharArray(d, 5); //String to char array
    Serial.println("Sending to rf95_server");
    rf95.send(d, sizeof(d));
    rf95.waitPacketSent();

    delay(400);
}
```



Video

Wireless Communication betw...



Tags

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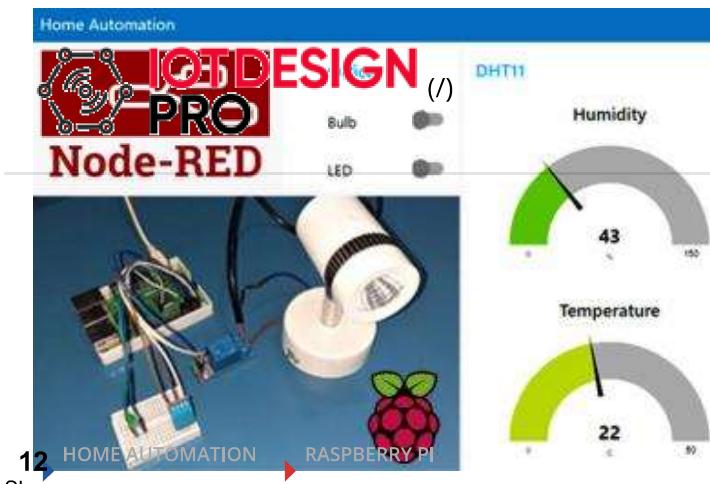
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8 COMMENTS**SURYAPRAKASH.K...**

22 August 2020

Permalink
[\(/comment/29#comment-29\)](/comment/29#comment-29)**Arduino Code (/comment/29#comment-29)**

Please upload Arduino Code.

REPLY (/COMMENT/REPLY/NODE/167/COMMENT/29)**ASHEESH**

29 September 2020

Permalink
[\(/comment/98#comment-98\)](/comment/98#comment-98)**Hi SURYAPRAKASHThank you... (/comment/98#comment-98)**

Hi SURYAPRAKASH

Thank you for pointing out the mistake. Arduino code is uploaded now.

REPLY (/COMMENT/REPLY/NODE/167/COMMENT/98)
how to lose we... (https://www.is-mg.com)

20 September 2021

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[\(/comment/80945#comment-80945\)](/comment/80945#comment-80945)**Brilliant web site! Do you... (/comment/80945#comment-80945)**

Brilliant web site! Do you have any techniques for aspiring writers? I'm intending to start out my own Web page before long but I'm somewhat shed on almost everything. Would you endorse commencing that has a free of charge System like WordPress or Choose a paid solution? There are plenty of possibilities out there that I'm wholly overwhelmed .. Any tips?

Many thanks a good deal!

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26
September
2021
Permalink
(/comment/81479#comment-81479)

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ANDREW
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(/comment/92719#comment-92719)

please show me how to... (/comment/92719#comment-92719)

please show me how to program on the raspberry pi to get the LoRa project SNR value

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TARUN DHOLARIYA
28 October
2020
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(/comment/16933#comment-16933)

is i want to transmit... (/comment/16933#comment-16933)

is i want to transmit string in cloud how can you give me the example?>

[REPLY \(/COMMENT/REPLY/NODE/167/COMMENT/16933\)](#)

NARENTHIRAPRASATH D
11 February
2021
Permalink
(/comment/66019#comment-66019)

Greetings Sir, Where... (/comment/66019#comment-66019)

Greetings Sir,

Where can I find the exact LoRa module, sir? Can you please provide a link for the same. Thanks in advance

[REPLY \(/COMMENT/REPLY/NODE/167/COMMENT/66019\)](#)

RAM
12 February
2021
Permalink
(/comment/66041#comment-66041)

how I change frequency ... (/comment/66041#comment-66041)

how I change frequency (868mah) in my raspberry pi code

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MOUHEB BELDI
30 March
2021
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(/comment/67151#comment-67151)

Great Job (/comment/67151#comment-67151)

Great Job

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RUTWIK
GANASKI
IOT DESIGN
PRO
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(/comment/71797#comment-
71797)

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Can you provide the link to buy the antenna
REPLY (/COMMENT/REPLY/NODE/167/COMMENT/71797)



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19 July
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12
(/comment/74849#comment-
74849)
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Sir/Mam can you tell the range or bandwith will the project will work

REPLY (/COMMENT/REPLY/NODE/167/COMMENT/74849)

MANOKUMAR

15 August
2021

Permalink
(/comment/77350#comment-
77350)

I am getting from SX127x... (/comment/77350#comment-77350)

I am getting
from SX127x.LoRa import *

ModuleNotFoundError: No module named 'SX127x'

What is the solution for this ?

Can anyone tell me?

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(<https://loveawake.ru>)
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(/comment/89869#comment-
89869)

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loveawake.ru

(<https://loveawake.ru>)
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(/comment/90513#comment-
90513)

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ANDREW

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2022

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(/comment/92687#comment-
92687)

please show me how to... (/comment/92687#comment-92687)

please show me how to program on the raspberry pi to get the LoRa project SNR value

REPLY (/COMMENT/REPLY/NODE/167/COMMENT/92687)

loveawake.ru<https://loveawake.ru>

April 2022

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(/comment/94141#comment-94141)

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(/comment/94141#comment-94141)

REPLY (/COMMENT/REPLY/NODE/167/COMMENT/94141)**RACHMAD**24 June
2022

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(/comment/100973#comment-100973)

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can you make a tutorial... (/comment/100973#comment-100973)

can you make a tutorial change cayenne with website

REPLY (/COMMENT/REPLY/NODE/167/COMMENT/100973)**loveawake.ru**<https://loveawake.ru>25 June
2022

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(/comment/101143#comment-101143)

Welcome to the world of... (/comment/101143#comment-101143)

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