

# SIMPLE LORA GATEWAY AND NODE

## 1. Introduction

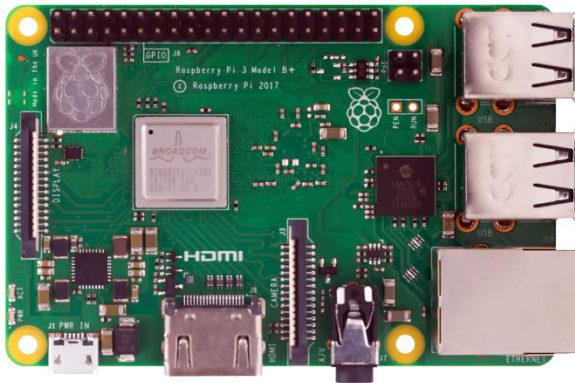
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This page describes our low-cost simple LoRa gateway based on a Raspberry PI and Lora node based on a Arduino nano. The gateway can receive messages from any LoRa device. This project is simple communication with lora. Arduino Nodes send to temperature and humidity values to gateway. I used RadioHead library on arduino and added to SHT21 communication codes.

## 2. Hardware

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- Raspberry pi 2/3



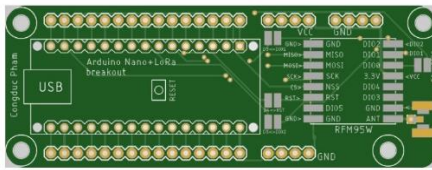
- HopeRF RFM95W buy-Link <https://bit.ly/2QnZxY8>



- SHT21 Temperature and Humidity Sensor buy-Link <https://bit.ly/2JDVvKZ>



- Arduino Nano v2 breakout, 2 layer board of 30x81mm <https://bit.ly/2X7UY72>



- RFM95 breakout, 2 layer board of 29x37mm <https://bit.ly/2JHp2TL>

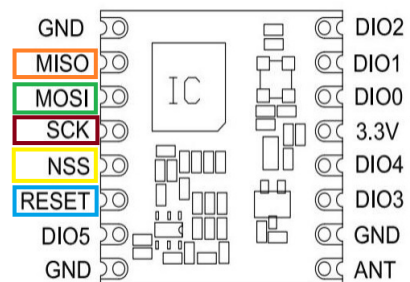


## Gateway Electrical Connection

RFM95 and raspberry pi communicate with SPI.

### Raspberry Pi 3 GPIO Header

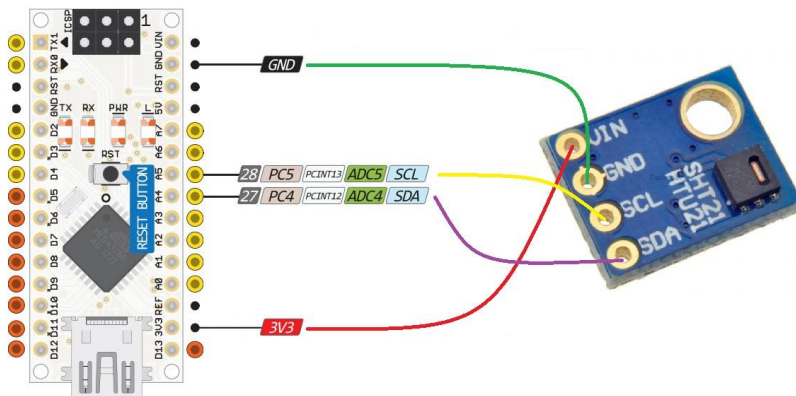
Pin#	NAME	NAME	Pin#
01	3.3v DC Power	DC Power 5v	02
03	GPIO02 (SDA1 , I <sup>2</sup> C)	DC Power 5v	04
05	GPIO03 (SCL1 , I <sup>2</sup> C)	Ground	06
07	GPIO04 (GPIO_GCLK)	(TXD0) GPIO14	08
09	Ground	(RXD0) GPIO15	10
11	GPIO17 (GPIO_GEN0)	(GPIO_GEN1) GPIO18	12
13	GPIO27 (GPIO_GEN2)	Ground	14
15	GPIO22 (GPIO_GEN3)	(GPIO_GEN4) GPIO23	16
17	3.3v DC Power	(GPIO_GEN5) GPIO24	18
19	GPIO10 (SPI_MOSI)	Ground	20
21	GPIO09 (SPI_MISO)	(GPIO_GEN6) GPIO25	22
23	GPIO11 (SPI_CLK)	(SPI_CE0_N) GPIO08	24
25	Ground	(SPI_CE1_N) GPIO07	26
27	ID_SD (I <sup>2</sup> C ID EEPROM)	(I <sup>2</sup> C ID EEPROM) ID_SC	28
29	GPIO05	Ground	30
31	GPIO06	GPIO12	32
33	GPIO13	Ground	34
35	GPIO19	GPIO16	36
37	GPIO26	GPIO20	38
39	Ground	GPIO21	40



RPI 2/3	RFM95W
GND pin 6	-----GND (ground in)
3V3 pin 1	-----3.3V (3.3V in)
GPIO4 pin 7	-----RST (Reset)
CS/CE0 pin 24	-----NSS (CS chip select in)
SCK pin 23	-----SCK (SPI clock in)
MOSI pin 19	-----MOSI (SPI Data in)
MISO pin 21	-----MISO (SPI Data out)

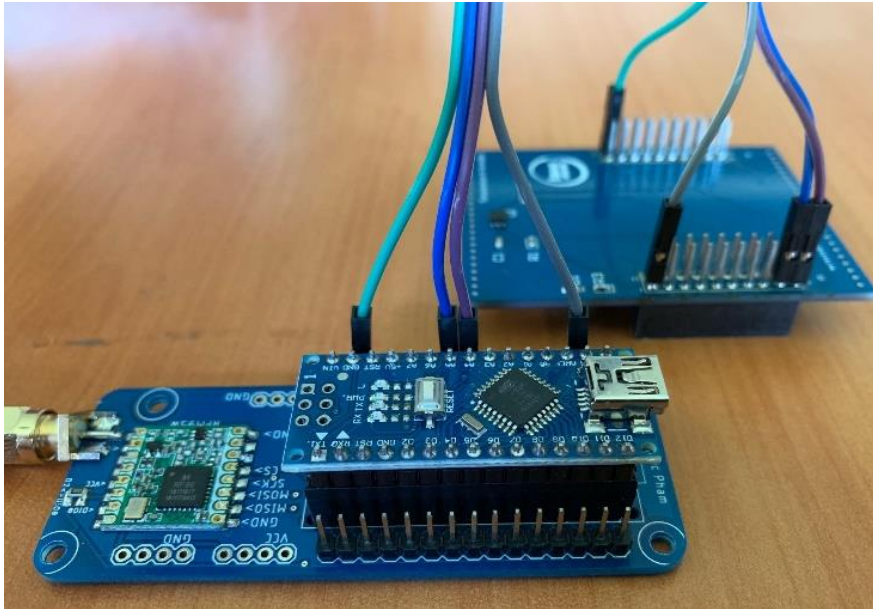


## Node Electrical Connection





Arduino	SHT21	
GND-----GND	(ground in)	
3V3-----VIN	(3.3V in)	
SCL pin A5-----SDA	(I2C Data pin)	
SDA pin A4-----SCL	(I2C Data clock)	



### 3. Software

#### Ardunio Software

Ardunio program uses RadioHead library for lora and communicate I2C with SHT21 temperature and humidity sensor.

This code uses some defines.

```
#define RF95_FREQ 865.2
```

If you want to change freq, you must change gateway too.

```
// So called LoRa mode 1 (BW125, CR45, SF12) with CRC on
```

```
RH_RF95::ModemConfig my_Bw125Cr45Sf4096 = {0x72, 0xc4, 0x0C};
```

LoRa mode 1 settings

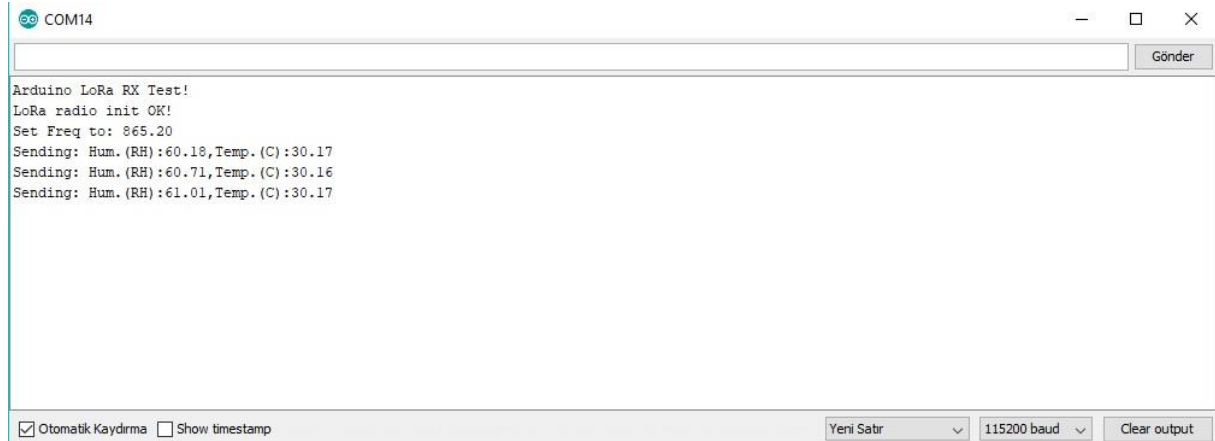
	LoRa mode	BW	CR	SF	time on air in second for payload size of					
					5 bytes	55 bytes	105 bytes	155 Bytes	205 Bytes	255 Bytes
↑ Range ↓ Throughput	1	125	4/5	12	0.95846	2.59686	4.23526	5.87366	7.51206	9.15046
	2	250	4/5	12	0.47923	1.21651	1.87187	2.52723	3.26451	3.91987
	3	125	4/5	10	0.28058	0.69018	1.09978	1.50938	1.91898	2.32858
	4	500	4/5	12	0.23962	0.60826	0.93594	1.26362	1.63226	1.95994
	5	250	4/5	10	0.14029	0.34509	0.54989	0.75469	0.95949	1.16429
	6	500	4/5	11	0.11981	0.30413	0.50893	0.69325	0.87757	1.06189
	7	250	4/5	9	0.07014	0.18278	0.29542	0.40806	0.5207	0.63334
	8	500	4/5	9	0.03507	0.09139	0.14771	0.20403	0.26035	0.31667
	9	500	4/5	8	0.01754	0.05082	0.08154	0.11482	0.14554	0.17882
	10	500	4/5	7	0.00877	0.02797	0.04589	0.06381	0.08301	0.10093

// CHANGE HERE THE NODE ADDRESS

#define node\_addr 1

Node address

And in code delay time is 10sn. If you want to change time delay, edit delay time in loop code.



\*\*\*You must install RadioHead and SHT21 library to Ardunio IDE. Copy "library" folder to your ardunio library folder (my documents/Ardunio/Library)\*\*\*

Download Ardunio lora node code:

[https://github.com/ozknScalebor/SimpleLora\\_Gateway\\_and\\_Node/tree/master/Ardunio\\_Node](https://github.com/ozknScalebor/SimpleLora_Gateway_and_Node/tree/master/Ardunio_Node)

## Gateway Software

First, download rasbian last version and install on Raspberry pi.

<https://www.raspberrypi.org/downloads/raspbian/>

Update your raspberry:

```
sudo apt-get update
```

```
sudo apt-get -y dist-upgrade
```

and clone repostory:

```
git clone https://github.com/ozknScalebor/SimpleLora\_Gateway\_and\_Node.git
```

after download,

```
cd SimpleLora_Gateway_and_Node
```

```
cd Lora_Gateway
```

```
make clean
```

```
make lora_gateway_pi2
```

and run gateway program:

```
sudo ./lora_gateway --mode 1 --freq 865.2
```

You can change lora mode and freq. with parameters

## Terminal screen, running gateway and node

```
--- rxlor. dst=1 type=0x10 src=1 seq=0 len=29 SNR=7 RSSIpkt=-36 BW=125 CR=4/5 SF=12
^p1,16,1,0,29,7,-36
^r125,5,12
^t2018-11-14T01:41:56.119
==Hum. (RH):60.20,Temp. (C):30.10
--- rxlor. dst=1 type=0x10 src=1 seq=0 len=29 SNR=6 RSSIpkt=-37 BW=125 CR=4/5 SF=12
^p1,16,1,0,29,6,-37
^r125,5,12
^t2018-11-14T01:42:06.412
==Hum. (RH):60.20,Temp. (C):30.10
--- rxlor. dst=1 type=0x10 src=1 seq=0 len=29 SNR=6 RSSIpkt=-36 BW=125 CR=4/5 SF=12
^p1,16,1,0,29,6,-36
^r125,5,12
^t2018-11-14T01:42:16.705
==Hum. (RH):59.90,Temp. (C):30.10
█
```