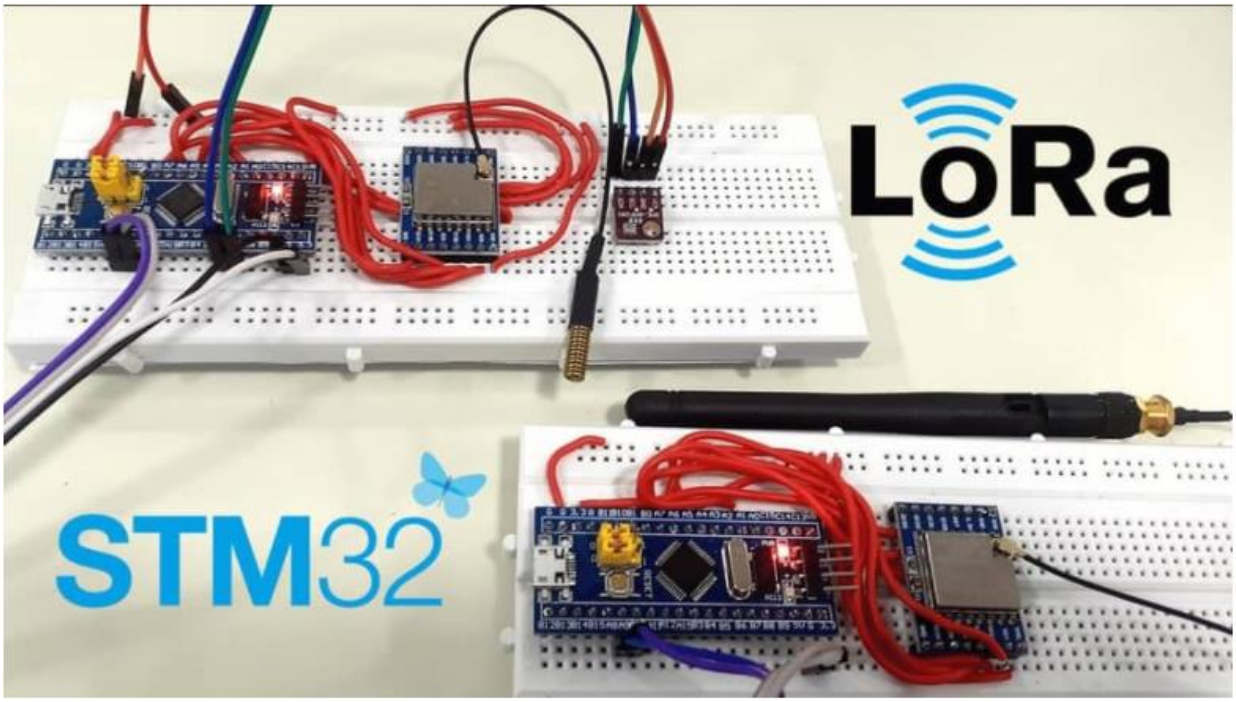
Interfacing LoRa SX1278 with STM32 – Sender & Receiver



Overview

In this tutorial, we will learn **Interfacing of LoRa Module SX1278 with STM32** Bluepill Microcontroller. The **Ra-02** module uses SX1278 IC and works on a **433MHz** frequency. Using the Frequency hopping, it gives the sweet balance of quality signal transmission—will cover a range of 420-450MHz. The LoRa SX1278 works with SPI communication protocol so it can be used with any microcontroller that supports **SPI**. The SX1278 module can be easily interfaced with the STM32F103 chip.

The tutorial consists of two examples. In the first example, we will send a simple "**Hello World**" message from LoRa Sender/Transmitter to Receiver. But in the second example, we will send the sensor data wirelessly. The **BME280** Barometric Pressure Sensor gives the information of Barometric Pressure, Temperature, Humidity & Approx. Altitude. The **STM32 LoRa Sender** will send the sensor data to the **STM32 LoRa Receiver**.

Bill of Materials

All the components required for this Project

S.N.	COMPONENTS NAME	DESCRIPTION	QUANTITY
1	STM32 Microcontroller	STM32F103C Bluepill Board	2
2	LoRa Module	Ra-02 SX1278	2
3	Barometric Pressure Sensor	BME280	1
4	Power Supply	5V DC Adapter or 3.7V Battery	2
5	Connecting Wires	Jumper Wires	20

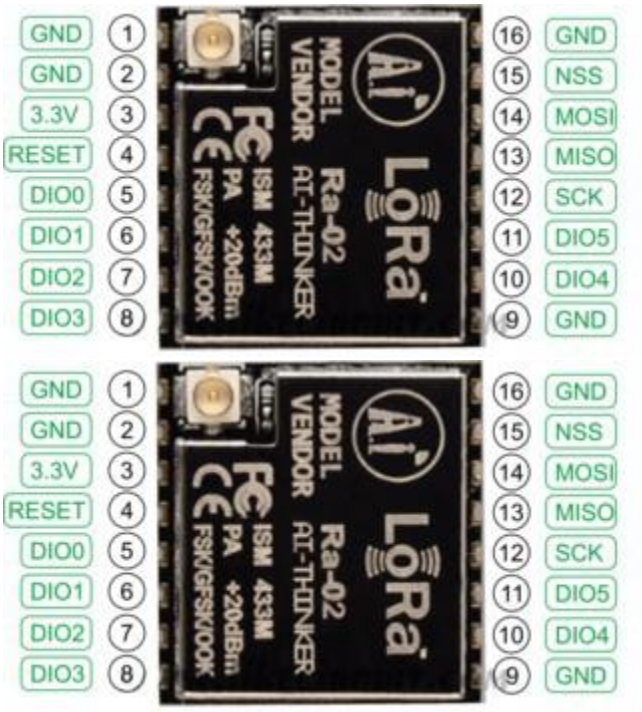
LoRa Module SX1278

The **SX1278 Ra-02** Chip is manufactured by Semtech. The SX1278 RF module is mainly used for long-range spread spectrum communication. It can resist Minimize current consumption & has a high sensitivity of **-148 dBm** with a power output of **+20 dBm**. A long transmission distance with almost 5km can be achieved with high reliability. Thus SX1278 is great for **IoT applications** to send sensor data to the cloud over long ranges.

This module uses SX1278 IC from **SEMTECH** and works on a **433MHz frequency**. Frequency hopping—which gives you that sweet balance of quality signal transmission will cover a range of 420-450 MHz. This

long-range wireless capability is packed into a small (17 x 16mm) package and delivered without an antenna.

SX1278 Pinout



Pin 1: ANT – This pin is to attach to the antenna.

Pin 2, 9, 16: GND – Ground pin of common ground with power supply and controllers.

Pin 3: 3.3V – To power up the device pin 3 will help for power input.

Pin 4: RESET – Pin 4 is to reset the module through an external signal.

Pin 5, 6, 7, 8, 10, 11: DIO0, DIO1, DIO2, DIO3, DIO4, DIO5 – To perform the general, I/O function through module the DIO pins will help. These pins is customizable as an interrupt pin.

Pin 12: SCK – SCK pin is for the clock pulse during the SPI communication.

Pin 13: MISO – MISO means Master in and Slave out that transfers data transfer from the Module to the Controller. The Master is a controller & SX1278 is Slave.

Pin 14: MOSI – MOSI means Master out Slave In. So, this pin will receive the data from Controller.

Pin 15: NSS – NSS is a chip select/enable pin will help to activate the slave.

LoRa Frequency Allocation

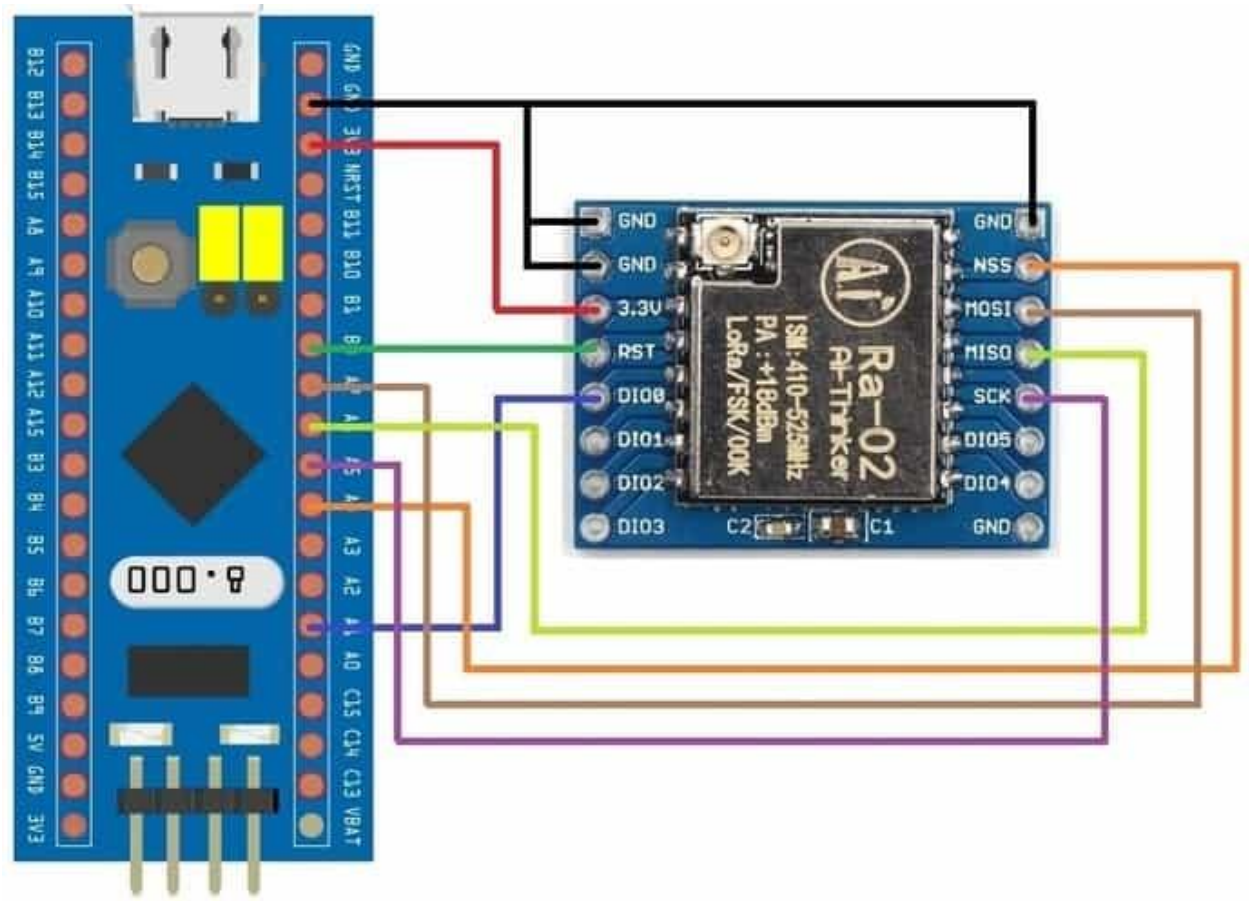
LoRa frequency is not legal everywhere. I am from India and here the unlicensed Frequency range is from 865MHz to 867MHz. So I am only allowed to use this frequency range. The SX1278 has a frequency of 433MHz so I am not allowed to use it for an extended time aside from for an academic purpose. Similarly, check the allowed Ranges in your country and confirm you're allowed to use the actual frequency range. LoRa modules do are available different frequency ranges, the foremost common being the 433MHz, 915MHz, and 868MHz.

Interfacing LoRa SX1278 with STM32

Now let us interface LoRa Module SX1278 with STM32F103C Board and make a simple STM32 LoRa Sender Receiver Device. The connection between SX1278 & STM32F103 is as follows:

SX1278 Pins	STM32F103C	SX1278 Pins	STM32F103C
GND	GND	GND	GND
VCC	3.3V	VCC	3.3V
RST	PB0	RST	PB0
SCK	PA5	SCK	PA5
MISO	PA6	MISO	PA6
MOSI	PA7	MOSI	PA7
NSS	PA4	NSS	PA4
DIO0	PA1	DIO0	PA1

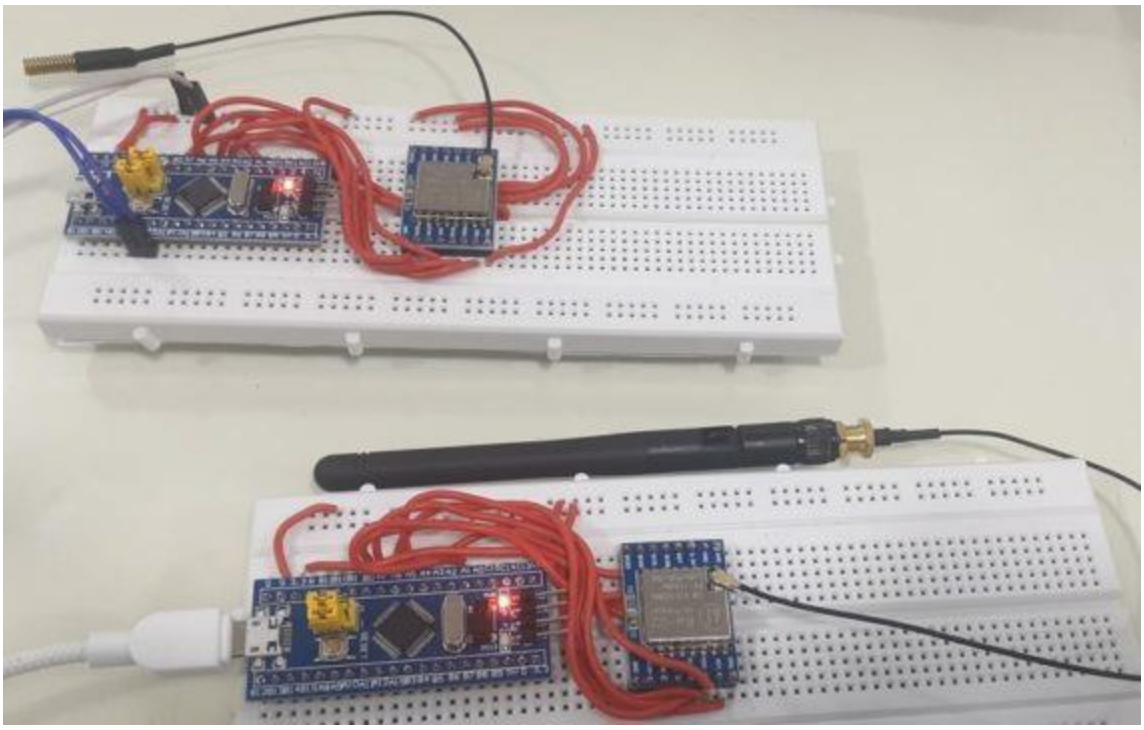
The schematic is given below. You can assemble the pair of the circuit on the breadboard. One of the circuits will act as a transmitter or sender and the other as a receiver.

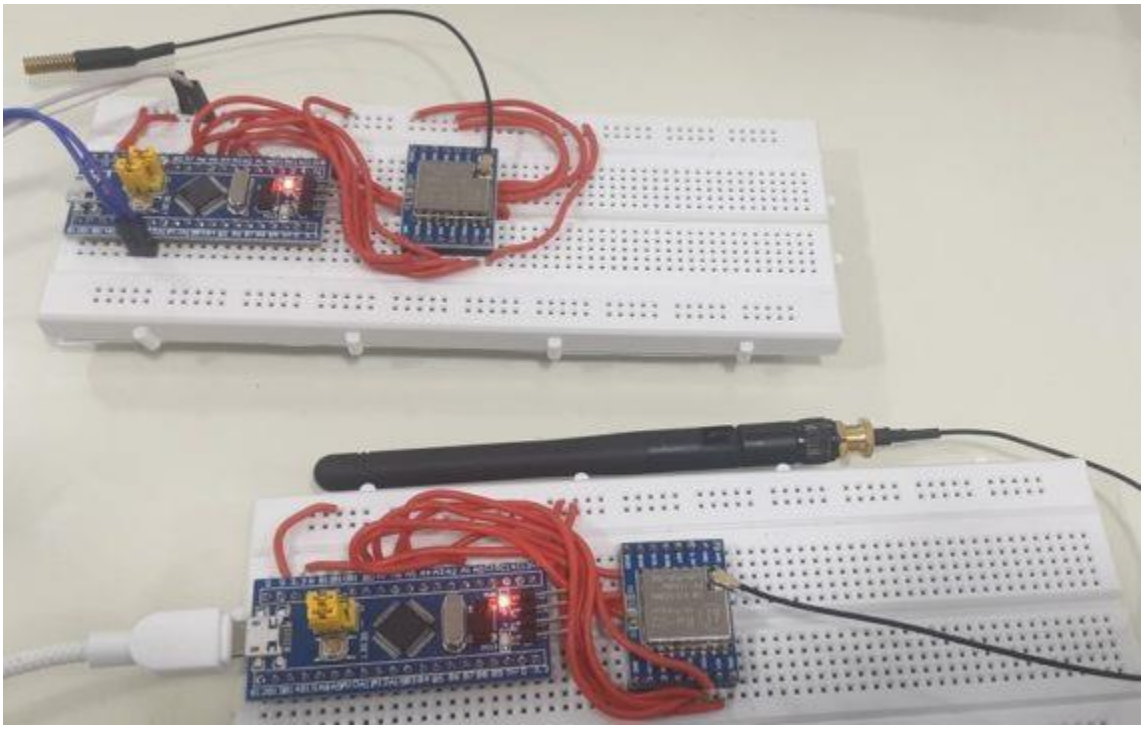


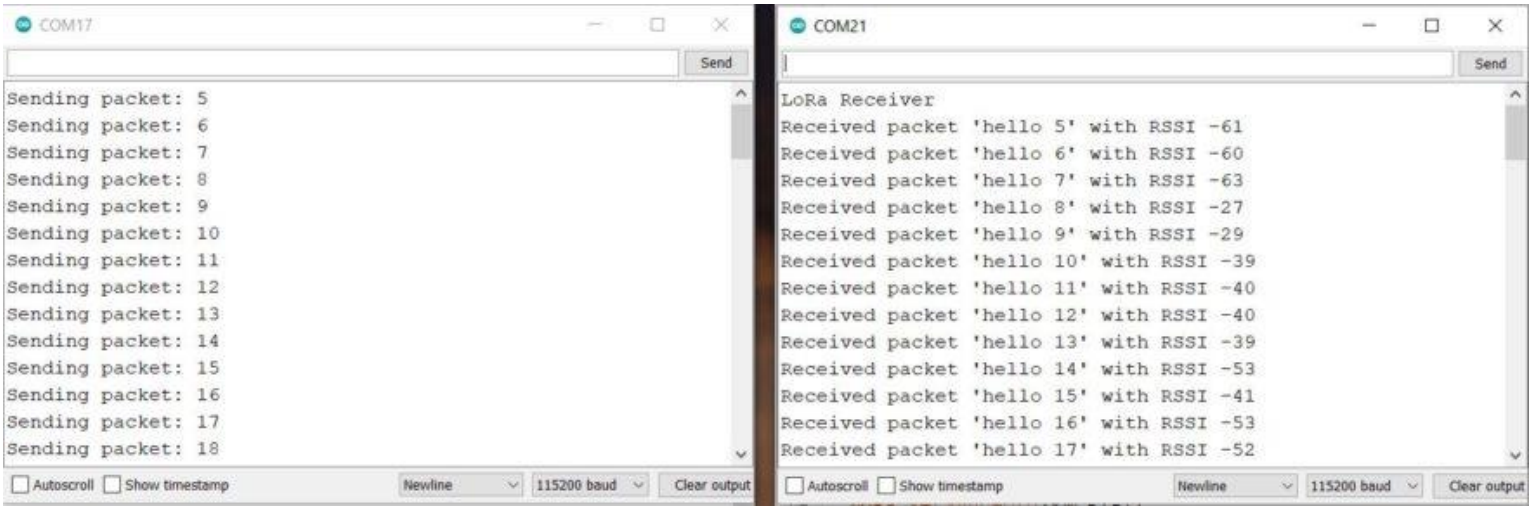
LoRa Library for STM32

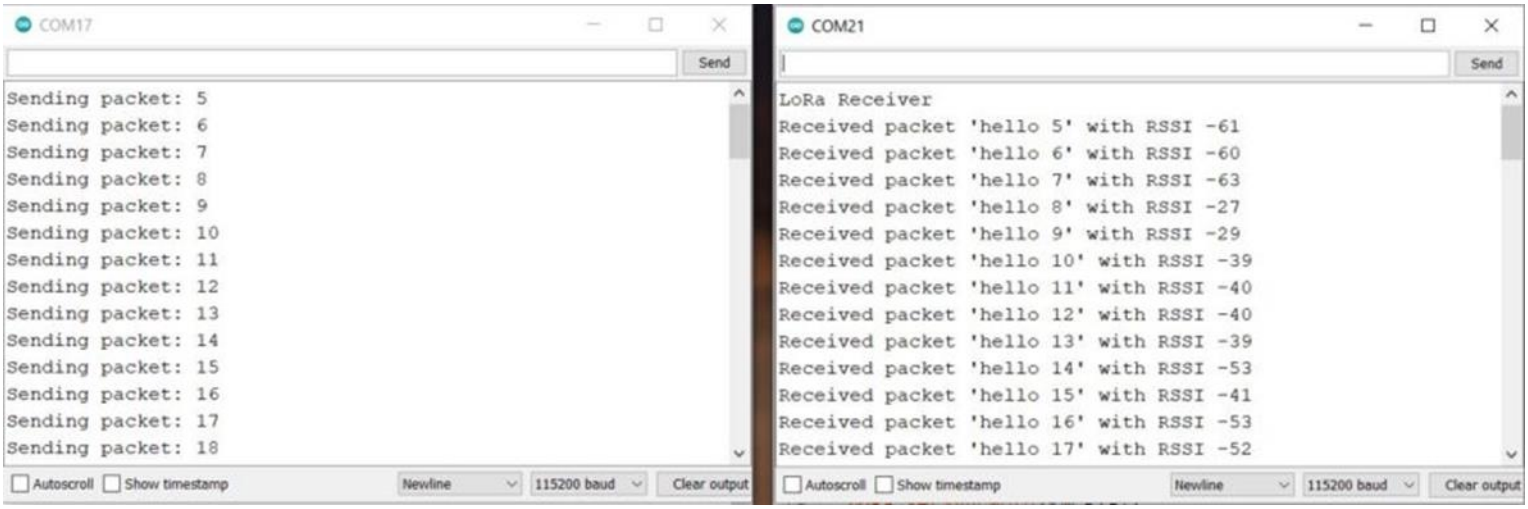
The Arduino LoRa Library is not supported by **STM32F103 Board**. That is why there is a modified library for STM32F103 Board for Arduino IDE. The STM32 LoRa library is used for sending and receiving data using **LoRa radios**.

This library exposes the LoRa radio directly and allows you to send data to any radios in range with the same radio parameters. All data is broadcasted and there is no addressing.



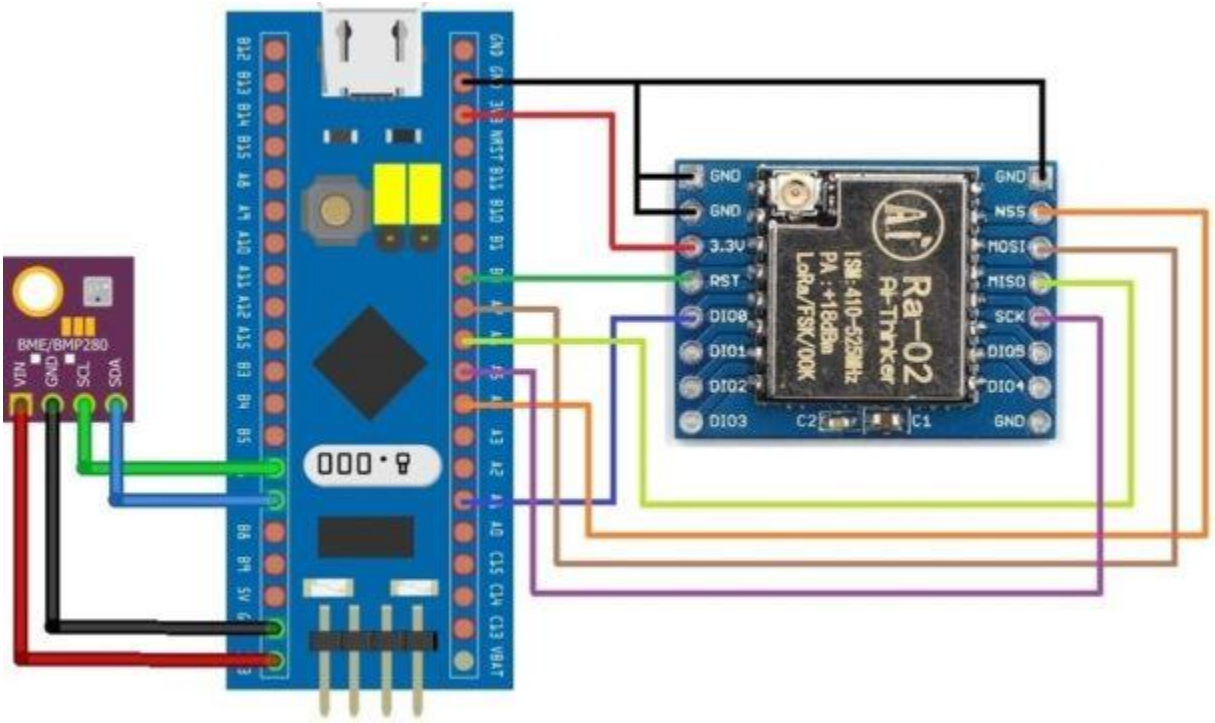


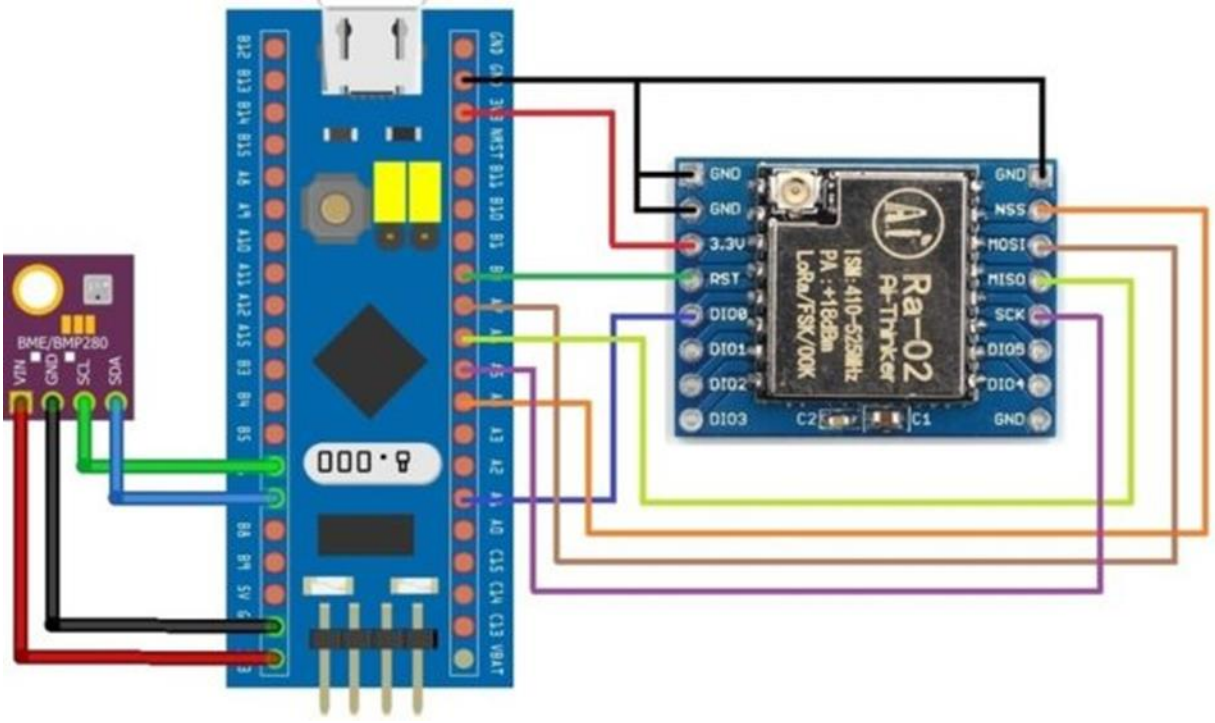




Sending Sensor Data Wirelessly using LoRa Module

Let us go through the second example now. In this example, we will be Interfacing SX1278 with STM32 and BME280 sensor to the Sender Circuit. The BME280 is an integrated environmental sensor developed specifically for mobile applications that have high linearity & accuracy for pressure, humidity and temperature measurements.


BME/BMP280
VIN
GND
SCL
SDA
GND
GND
3.3V
RST
DIO0
DIO1
DIO2
DIO3
GND
NSS
MOSI
MISO
SCK
DIO5
DIO4
GND
Ra-02
A-Thinker
ISM:410~525MHz
PA:+18dBm
LoRa/FSK/OOK
C2
C1


BME/BMP280
VIN
GND
SCL
SDA
GND
GND
3.3V
RST
DIO0
DIO1
DIO2
DIO3
GND
NSS
MOSI
MISO
SCK
DIO5
DIO4
GND
Ra-02
A-Thinker
ISM:410~525MHz
PA:+18dBm
LoRa/FSK/OOK
C2
C1

The Sensor works on I2C Protocol so its I2C Pins, i.e SDA & SCL is connected to PB7 & PB6 respectively. We will send the BME280 Sensor reading wirelessly from STM32 LoRa Sender to STM32 LoRa Receiver.

The LoRa SX1278 STM32 Sender and Receiver Code is given below. The Sender Code requires a BME280 Library.