

4. Configuration of XBee S2C and LoRa Devices to Create a WSN

4.1. Introduction

Wireless Sensor Networks (WSNs) consist of spatially distributed devices (nodes) that collect and transmit environmental data wirelessly to a central hub or gateway. XBee S2C (Zigbee-based) and LoRa (Long Range) modules are commonly used for creating such networks due to their energy efficiency and reliable communication in different ranges and environments.

4.2. XBee S2C Configuration (Zigbee Protocol)

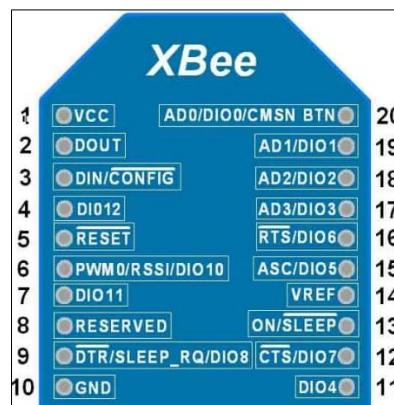
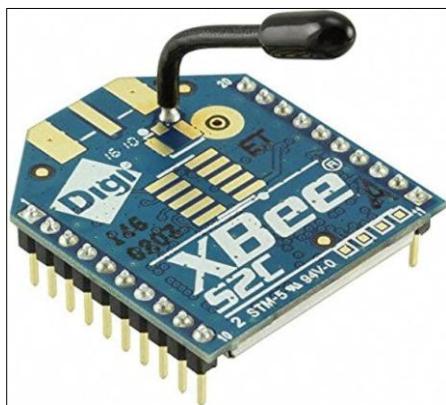
Required Components:

- 2 or more XBee S2C modules
- XBee USB adapter or Arduino with XBee shield
- XCTU software (from Digi)

Steps to Configure:

1. **Connect the XBee to PC** using USB adapter.
2. **Open XCTU** and detect the XBee module.
3. **Set Roles:**
 - One XBee as **Coordinator (COORD)**: CE = 1
 - Other XBees as **Router or End Devices**: CE = 0
4. **Set PAN ID** (same for all nodes, e.g., PAN ID = 1234)
5. **Assign DH (Destination High)** and **DL (Destination Low)** to define the target XBee address.
6. **Set CH (Channel)** if required to avoid interference.
7. **Write settings** to each module.
8. **Test communication** using the console in XCTU.

-A typical setup will have one Coordinator and multiple Router/End devices sending data to it.



4.3. LoRa Device Configuration

Required Components:

- 2 or more LoRa modules (e.g., SX1278)
- Microcontroller (Arduino, ESP32)
- LoRa library (e.g., LoRa.h by Sandeep Mistry)

Steps to Configure:

1. Connect LoRa module to Arduino:

- VCC → 3.3V
- GND → GND
- MOSI → D11, MISO → D12, SCK → D13, NSS/CS → D10

2. Upload Sender Sketch on one Arduino:

```
1 #include <SPI.h>
2 #include <LoRa.h>
3
4 void setup() {
5     LoRa.begin(433E6); // Frequency
6 }
7
8 void loop() {
9     LoRa.beginPacket();
10    LoRa.print("Sensor data");
11    LoRa.endPacket();
12    delay(2000);
13 }
```

3. Upload Receiver Sketch on the second Arduino:

```
1 #include <SPI.h>
2 #include <LoRa.h>
3
4 void setup() {
5     Serial.begin(9600);
6     LoRa.begin(433E6);
7 }
8
9 void loop() {
10    int packetSize = LoRa.parsePacket();
11    if (packetSize) {
12        while (LoRa.available()) {
13            String data = LoRa.readString();
14            Serial.println("Received: " + data);
15        }
16    }
17 }
```

-LoRa nodes can operate in peer-to-peer or LoRaWAN mode depending on configuration.



4.4. WSN Architecture Diagram

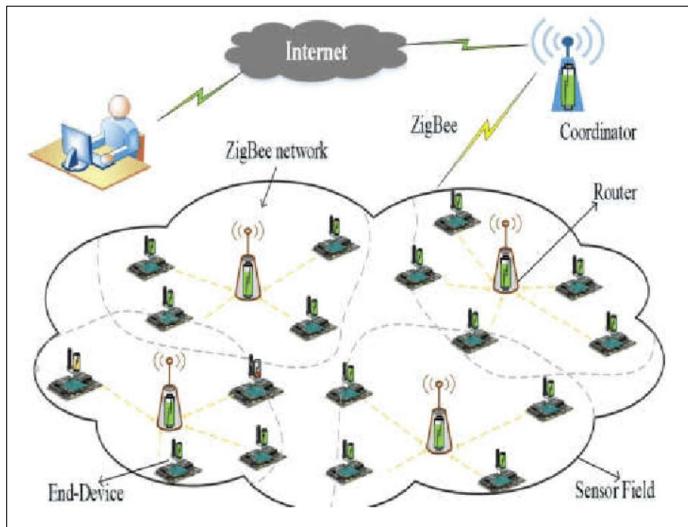


Figure 1: Zigbee WSN architecture

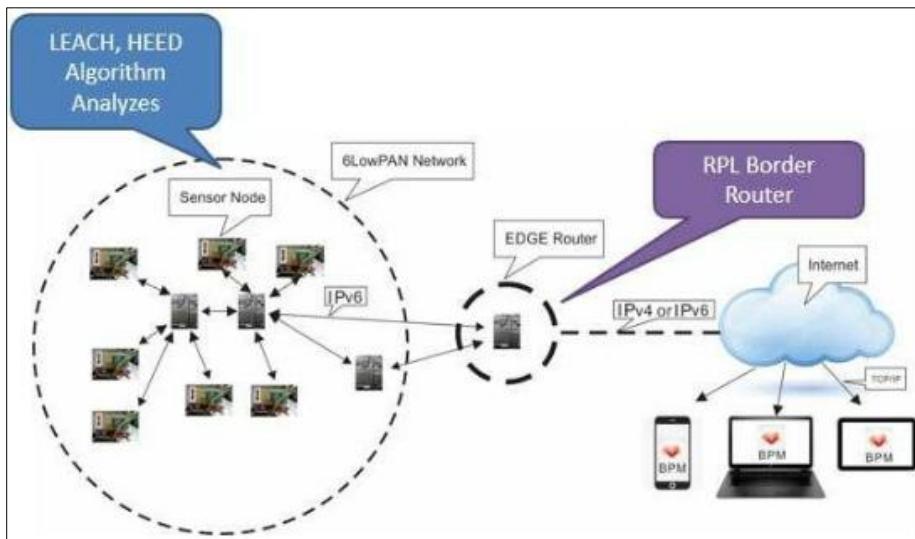


Figure 2: LoRA WSN architecture

4.5. Conclusion

Configuring XBee and LoRa devices for a Wireless Sensor Network allows efficient and reliable communication between nodes. XBee is ideal for short-range mesh networking, while LoRa supports long-distance communication with minimal power consumption. Both are essential technologies in modern IoT and WSN applications.