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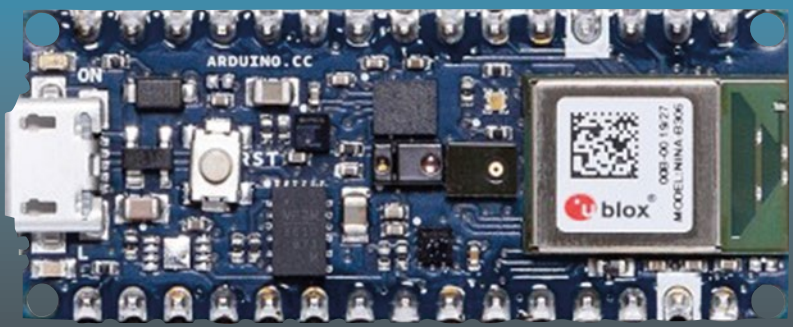

IoT Projects with Arduino Nano 33 BLE Sense

Step-By-Step Projects for Beginners

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Agus Kurniawan

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Agus Kurniawan is a lecturer, IT consultant, and author. He has 20 years of experience in various software and hardware development projects, delivering materials in training and workshops, and technical writing. He has been awarded the Microsoft Most Valuable Professional (MVP) award 16 years in a row.

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Sai Yamanoor is an embedded systems engineer working for an industrial gases company in Buffalo, New York. His interests, deeply rooted in DIY and open source hardware, include developing gadgets that aid behavior modification. He has published two books with his brother and in his spare time, he likes to contribute to building things that improve quality of life. You can find his project portfolio at http://saiyamanoor.com.

CHAPTER 1

Setting up a Development Environment

Arduino Nano 33 BLE Sense is an Internet of Things (IoT) solution to perform sensing and actuating on a physical environment. The Arduino Nano 33 BLE Sense board comes with a Bluetooth low energy (BLE) module and some built-in sensors that enable us to build an IoT application-based BLE network. This chapter explores how to set up the Arduino Nano 33 BLE Sense board for development.

The following topics are covered in this chapter:

- Reviewing the Arduino Nano 33 BLE Sense board
- Setting up a development environment
- Building a blinking LED program
- Using Arduino web editor

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Introduction

Arduino Nano 33 BLE Sense is one of the IoT platforms from Arduino. This board uses an nRF52840 module with some built-in sensors. The nRF52840 module provides the BLE network stack that is used to communicate with other devices. Bluetooth is a component of a wireless personal area network (WPAN) that enables a devices to communicate with other devices within a short distance.

The Arduino Nano 33 BLE Sense board is designed for low-cost IoT devices to address your IoT problems. At 45 × 18 mm (length × width), the Arduino Nano 33 BLE Sense is compact, as you can see in Figure 1-1.

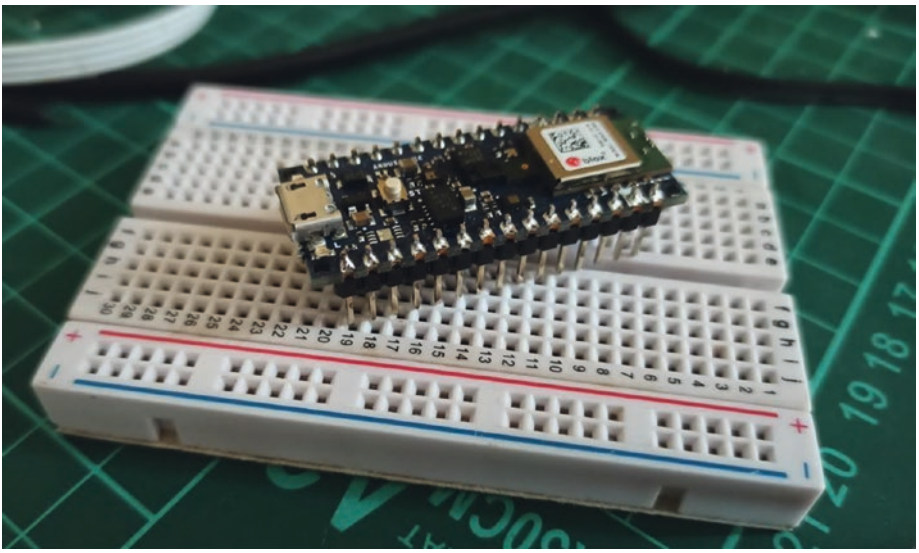

Figure 1-1. *Arduino Nano 33 BLE Sense board*

Reviewing the Arduino Nano 33 BLE Sense Board

Arduino Nano 33 BLE Sense is built from nRF52840. The board also has a radio-module-based BLE. This module is designed for data communication over Bluetooth. The detailed specifications of Arduino Nano 33 BLE Sense are shown in Table 1-1.

Table 1-1. *Specifications of Arduino Nano 33 BLE Sense*

Feature	Notes
Microcontroller	nRF52840
Secure module	ATECC608A
Operating voltage	3.3V
Input voltage	21V
DC current per I/O pin (limit)	15 mA
Clock speed	64 Mhz
CPU flash memory	1 MB (bRF52840)
SRAM	256 KB
EEPROM	None
Digital I/O	14
PWM pins	All digital pins
UART	1
SPI	1
I2C	1
Analog input	8 (ADC 12-bit 200k sample)

(*continued*)

Table 1-1. (*continued*)

Feature	Notes
Analog output	Only through PWM (no DAC)
LED_BUILTIN	13
USB	Native in the nRF52840 processor
IMU	LSM9DSI
Microphone	MP34DT05
Gesture, light, proximity	APDS9960
Barometric pressure	LPS22HB
Temperature, humidity	HTS221
Size (length × width)	45 mm × 18 mm

Because Arduino Nano 33 BLE Sense has some digital and analog input/output (I/O), we extend the board's capabilities by wiring with other sensors or actuators. We also use UART, Serial Peripheral Interface (SPI), and I2C protocols to communicate with other devices.

You can see in Table 1-1 that Arduino Nano 33 BLE Sense has some internal sensor devices that you can use for your IoT solutions. We explore these sensor devices further in Chapter 3.

Next, we set up Arduino Nano 33 BLE Sense on your computer so you can build programs for the Arduino board.

Setting up a Development Environment

Arduino provides software to build programs for all Arduino board models. This software is available for Windows, Linux, and macOS, and it can be downloaded from `https://www.arduino.cc/en/Main/Software`.

The installation process is easy, following the installation guidelines from Arduino setup. After installation is complete, you will see the Arduino application menu on the main menu in your OS platform.

When you open the Arduino application, you will see the application screen shown in Figure 1-2. Skeleton code is included in the application dialog box. The following is a code template.

```
void setup() {
  // put your setup code here, to run once:
}

void loop() {
  // put your main code here, to run repeatedly:
}
```

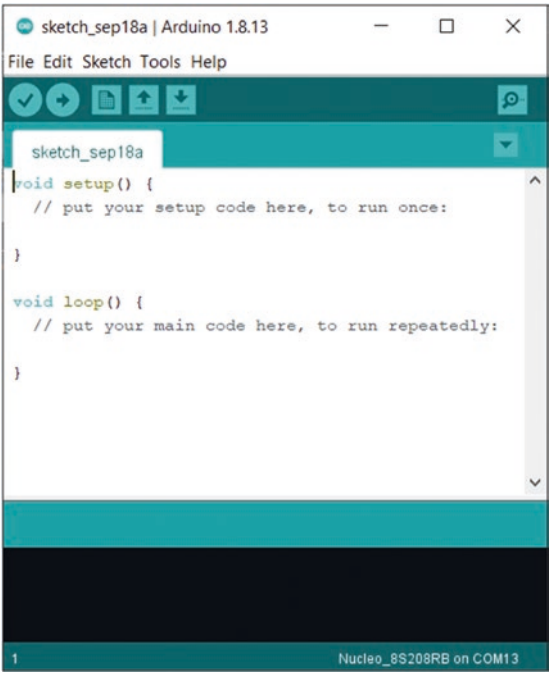

Figure 1-2. *Arduino software for Windows*

The Arduino program adopts C/C++ program language dialects. We can put all data initialization in the `setup()` function. The program will execute codes inside the `loop()` function continuously.

To work with the Arduino Nano 33 BLE Sense board, we need to configure the Arduino software. First, add Arduino nRF528x Boards so Arduino software will recognize the Arduino Nano 33 BLE Sense board. On the Arduino menu bar, click Tools ➤ Board ➤ Boards Manager. That will open the Boards Manager dialog box shown in Figure 1-3. In the Type drop-down list, select All. Type `Arduino&Nano&33&BLE` in the accompanying text box. You will see Arduino nRF528x Boards listed. Click Install to install this package, after you have checked that your computer is connected to the Internet.

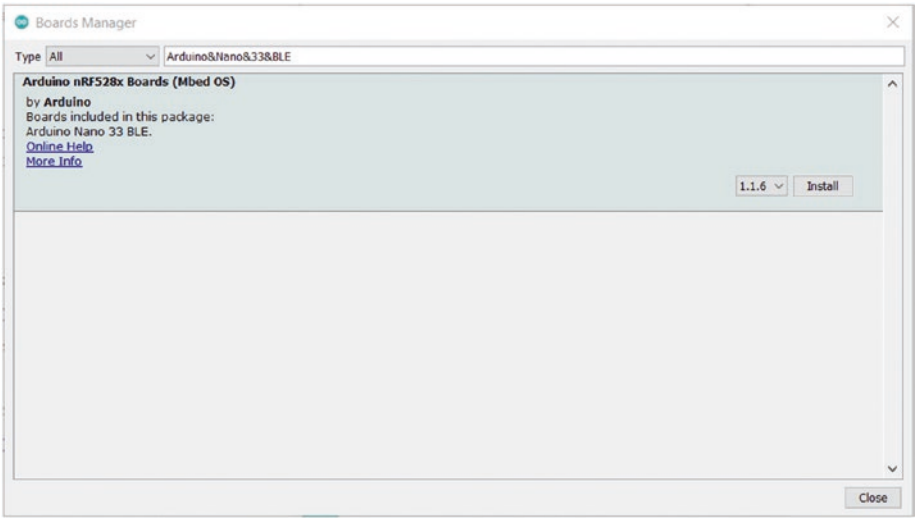

Figure 1-3. *Adding supported boards for Arduino Nano 33 BLE Sense*

This installation takes several minutes to complete. Once it is installed, you can see the Arduino Nano 33 BLE Sense board on the targeted board. You can verify it by selecting Tools ➤ Board ➤ Boards Manager in the Arduino software to view your board list. Figure 1-4 shows the Arduino Nano 33 BLE Sense board in the Arduino software.

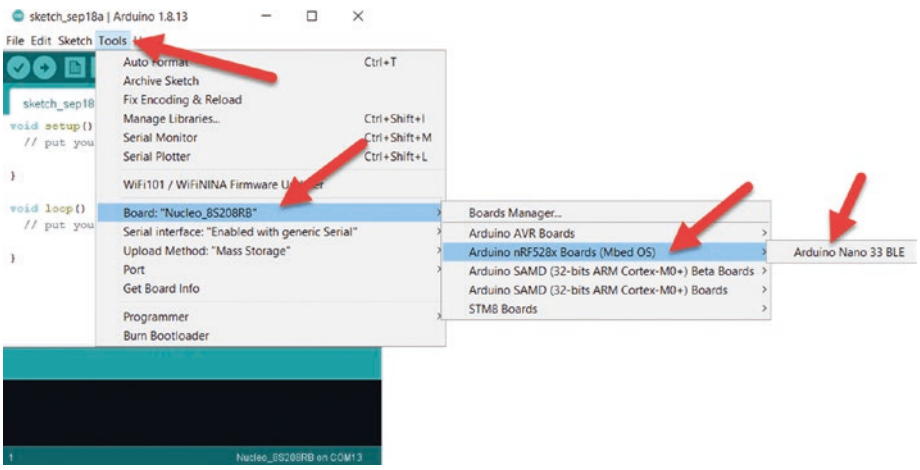

Figure 1-4. *A list of targeted boards for Arduino*

Next, attach the Arduino Nano 33 BLE Sense board to the computer via a micro USB cable. After it is attached, you can verify your board using Device Manager for Windows. Figure 1-5 shows my Arduino Nano 33 BLE Sense on Windows 10.

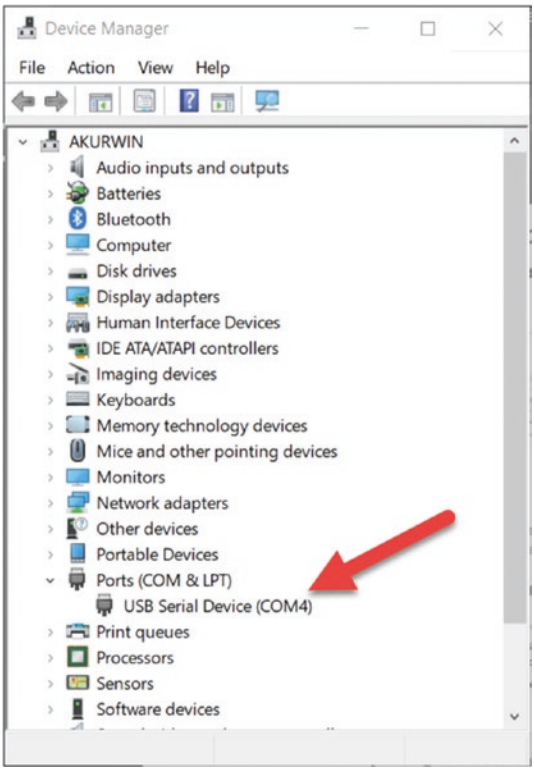

Figure 1-5. *Detected Arduino Nano 33 BLE Sense board on Device Manager in Windows 10*

If you are working on Linux, you can verify Arduino Nano 33 BLE Sense using this terminal command:

```
$ ls /dev/ttyUSB*
```

You will see a list of attached devices over USB. Arduino Nano 33 BLE Sense usually is detected as `/dev/ttyUSB0` or `/dev/ttyUSB1`. For macOS, you can type this command to check for Arduino Nano 33 BLE Sense:

```
$ ls /dev/cu*
```

You should see a USB device on your terminal.

Hello Arduino: Blinking LED

Now that you have connected Arduino Nano 33 BLE Sense to a computer, you can start to write Arduino programs. The Arduino Nano 33 BLE Sense board has a built-in LED that is attached on digital pin 13. In this section, we build a simple blinking LED.

First, open the Arduino software and create a program from project template. Click File ➤ Examples ➤ 01.Basics ➤ Blink. This will display the sample program codes shown in Figure 1-6.

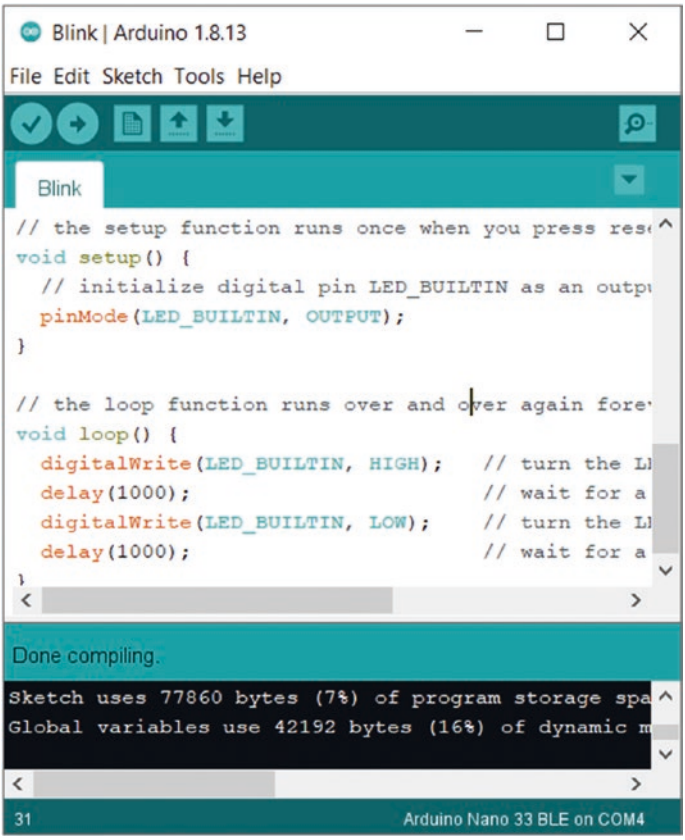

Figure 1-6. *Blink application on Arduino software*