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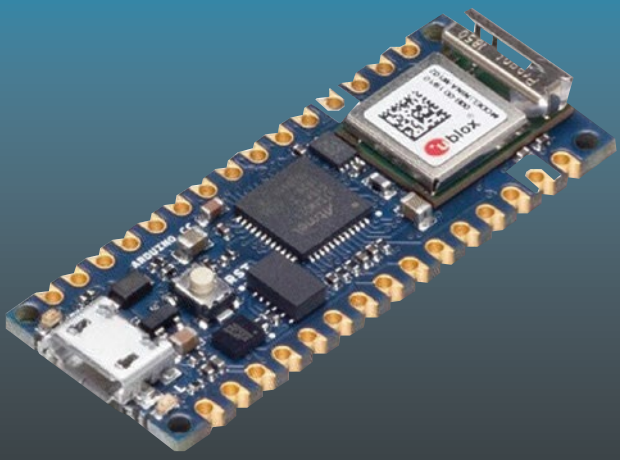

Beginning Arduino Nano 33 IoT

Step-By-Step Internet of Things Projects

Agus Kurniawan

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Table of Contents

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Agus Kurniawan is a lecturer, IT consultant, and author. He has 15 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 14 years in a row.

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C/C++, Arduino, Python, Processing, JS, Node-Red, NodeJS, Lua.

CHAPTER 1

Setting up Development Environment

Arduino Nano 33 IoT is an internet of things (IoT) solution to perform sensing and actuating on physical environment. The Arduino Nano 33 IoT board comes with WiFi and BLE modules that enable communication with other entities for exchanging data. This chapter will explore how to set up the Arduino Nano 33 IoT board for development.

The following is a list of topics in this chapter:

- Reviewing Arduino Nano 33 IoT board
- Setting up development environment
- Building LED blinking program
- Applying Arduino web editor

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Introduction

Arduino Nano 33 IoT is one of IoT platforms from Arduino. This board uses WiFi and Bluetooth modules to connect to a network. WiFi is a common network that people use to access Internet. Bluetooth is a part of wireless personal network (WPAN) that enables communication with other devices within a short distance.

Arduino Nano 33 IoT board is designed for low-cost IoT devices to address your IoT problems. Arduino Nano 33 IoT has a small-size factor, 45 x 18 mm (length x width). You can see my Arduino Nano 33 IoT board in Figure 1-1.

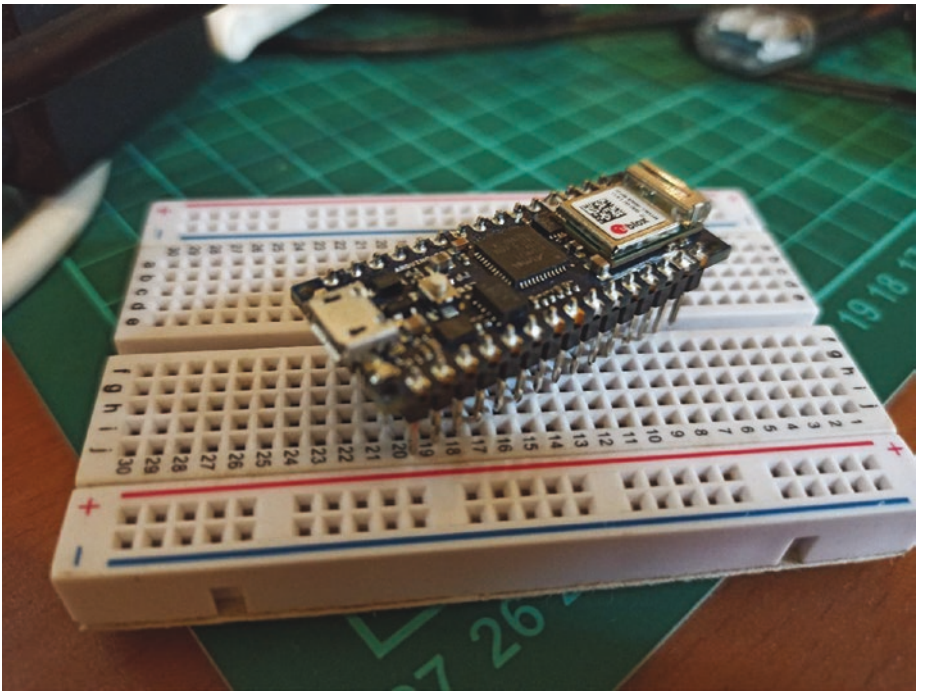

Figure 1-1. *Arduino Nano 33 IoT board*

Review Arduino Nano 33 IoT Board

Arduino Nano 33 IoT is built from ARM Cortex M0 32-bit SAMD21. The board also has a radio module, NINA-W102, from u-blox. This module is designed for data communication over WiFi and Bluetooth. You can read a detailed specification of Arduino Nano 33 IoT on Table 1-1.

Since Arduino Nano 33 IoT has some digital and analog I/O, we extend the board capabilities by wiring with other sensors or actuators. We also use universal asynchronous receiver/transmitter (UART), serial peripheral interfact (SPI), and interintergrated circuit (I2C) protocols to communicate with other devices.

Table 1-1. *A Specification of Arduino Nano 33 IoT*

Features	Notes
Microcontroller	SAMD21 Cortex-M0+ 32-bit
Radio module	u-blox NINA-W102
Secure module	ATECC608A
Operating voltage	3.3V
Input voltage	21V
DC current per I/O pin (limit)	7 mA
Clock speed	48 Mhz
CPU flash memory	256 KB
SRAM	32 KB
EEPROM	None
Digital I/O	14
PWM pins	11 (2, 3, 5, 6, 9, 10, 11, 12, 16 / A2, 17 / A3, 19 / A5)

(*continued*)

Table 1-1. *(continued)*

Features	Notes
UART	1
SPI	1
I2C	1
Analog Input	8 (ADC 8/10/12 bit)
Analog Output	1 (DAC 10 bit)
LED_BUILTIN	13
USB	Native in the SAMD21 processor
IMU	LSM6DS3
Size (Length x Width)	45 mm x 18 mm

Key: CPU, central processing unit; SRAM, static random-access memory; EEPROM, electrically erasable programmable read-only memory; PWM, pulse width modulation; UART, universal asynchronous receiver/transmitter; SPI, serial peripheral interfact; I2C, interintergrated circuit; USB, universal serial bus; IMU, inertial measurement unit.

Next, we will set up Arduino Nano 33 IoT on your computer so you can build programs for Arduino board.

Set Up Development Environment

Arduino provides software to build programs for all Arduino board models. We can use Arduino software. You can download Arduino software on the following link: `https://www.arduino.cc/en/Main/Software`. This software is available for Windows, Linux, and macOS.

The installation process steps are easy. Just follow the installation guideline from Arduino setup. After finished installation, you will see the Arduino application menu on main menu from your OS platform.

Open the Arduino application. Then, we will obtain the Arduino application as shown in Figure 1-2. You will see skeleton codes on the application dialog. 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:
}
```

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

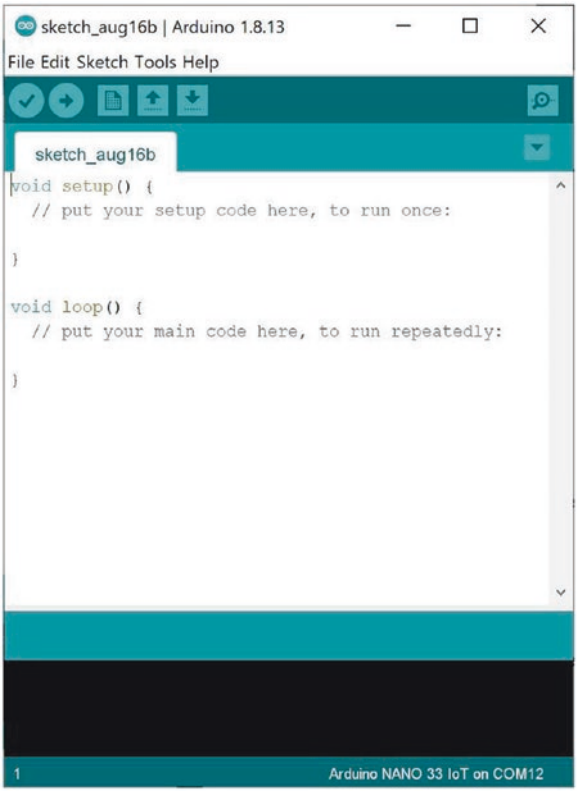

Figure 1-2. *Arduino software for Windows*

To work with the Arduino Nano 33 IoT board, we need to configure Arduino software. First, we add Arduino SAMD Boards so the Arduino software will recognize our Arduino Nano 33 IoT board. You can open a menu on Arduino software by clicking the menu **Tools ➤ Board ... ➤ Boards Manager...**

After clicking the Board Manager menu, we will obtain the Boards Manager dialog, as shown in Figure 1-3. Select All on the Type menu from Boards Manager. Then, type `Arduino&NANO&33&IoT` in the textbox. You will see Arduino SAMD Boards. Click and install this package. Make sure your computer is connected to an Internet network.

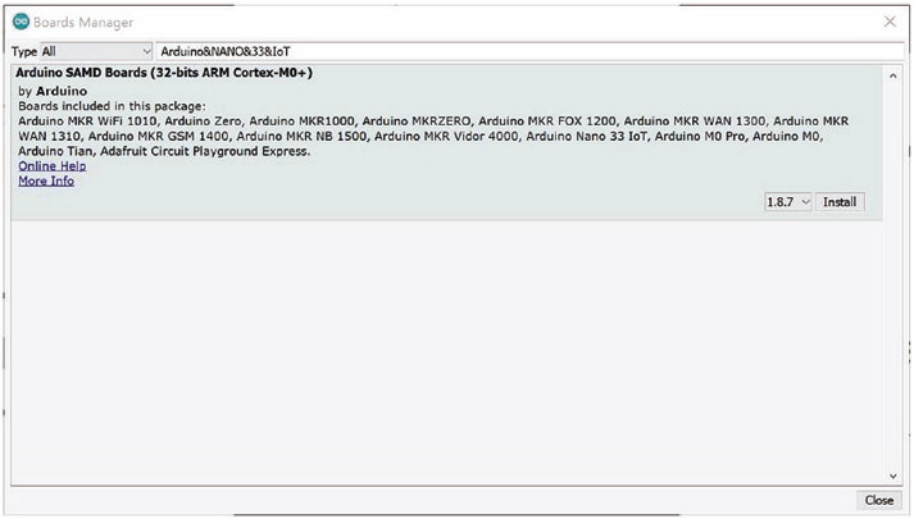

Figure 1-3. *Adding supported boards for Arduino Nano 33 IoT*

This installation takes several minutes to complete. After completed installation, you can see the Arduino Nano 33 IoT board on the targeted board. You can verify it by clicking the menu **Tools ➤ Board ... ➤ Boards Manager...**on Arduino software. You will see your board list. Figure 1-4 shows Arduino Nano 33 IoT on Arduino software.

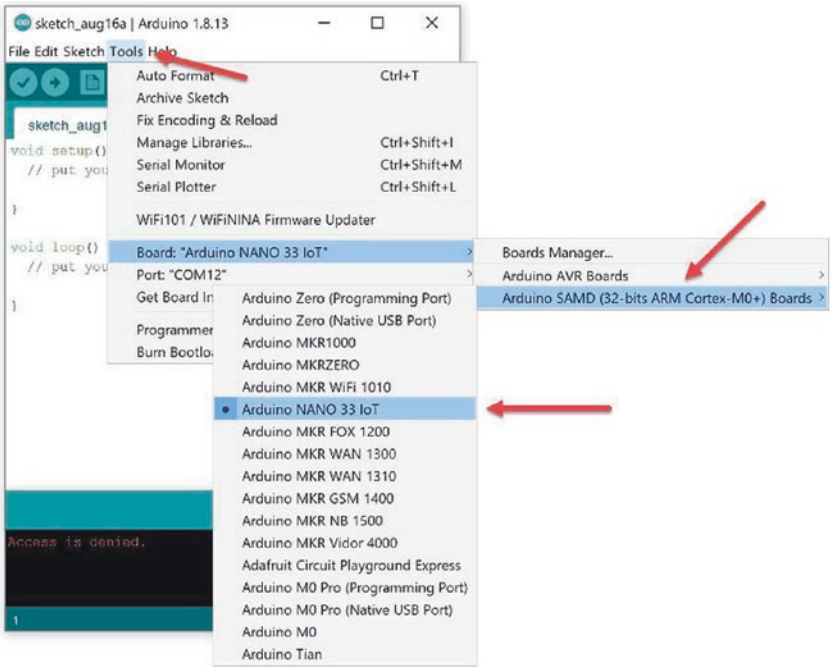

Figure 1-4. *A list of targeted boards for Arduino*

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

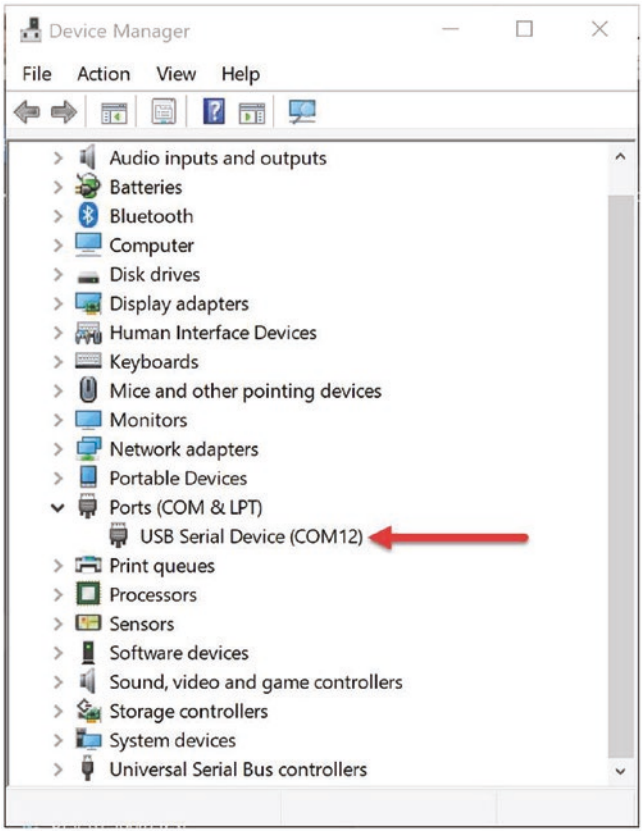

Figure 1-5. *Detected Arduino Nano 33 IoT on Device Manager—Windows 10*

If you are working on Linux, you can verify the Arduino Nano 33 IoT using this command on the terminal.

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

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

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

You should see the USB device on your terminal.

Hello Arduino: Blinking LED

We first build a Arduino program. The Arduino Nano 33 IoT board has a built-in LED that is attached on digital pin 13. In this section, we build a simple blinking LED. Now you can connect Arduino Nano 33 IoT into a computer. Then, we can start to write the Arduino program.

You can open Arduino software. We create a program from the project template. You can click menu and then File ➤ Examples ➤ 01.Basics ➤ Blink. After clicked, you will obtain program codes as shown in Figure 1-6. This is a program sample from Arduino.

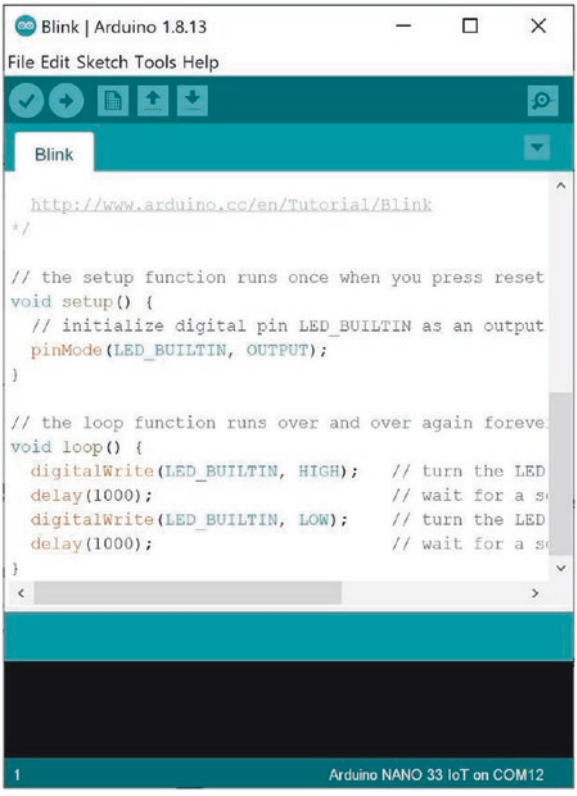

Figure 1-6. *Blink application on Arduino software*

You can see the program codes are written as follows.

```
void setup() {
  // initialize digital pin LED_BUILTIN as an output.
  pinMode(LED_BUILTIN, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {
  digitalWrite(LED_BUILTIN, HIGH);   // turn the LED on (HIGH
                                        is the voltage level)
  delay(1000);                       // wait for a second
  digitalWrite(LED_BUILTIN, LOW);    // turn the LED off by
                                        making the voltage LOW
  delay(1000);                       // wait for a second
}
```

Save this program. Now we can compile and upload the Arduino program into Arduino Nano 33 IoT. You can click the Verify icon to compile the Arduino program. To upload the Arduino program into the board, click the Upload icon on Arduino software. You can see these icons in Figure 1-7.