Robotics

Introduction to Arduino

School of Computing, Gachon University

Youngmin Oh

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What is Arduino?

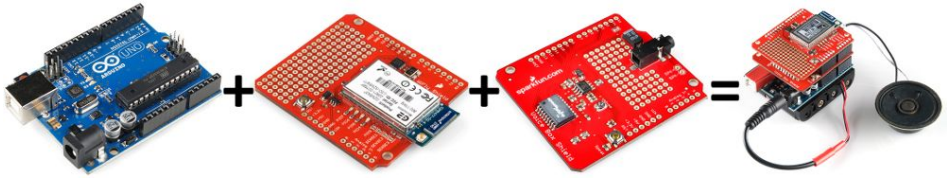
- **Arduino (meaning: best friend in Italian)**
  - Started in 2005 as a project for students
  - A family of single-board microcontrollers
  - To make it easier to build interactive devices
  - Consists of
    - Open-source hardware board using a microprocessor
    - USB interface, analog input pins, digital I/O pins for various extension boards
    - Support various add-on modules called as *Shield*
  - IDE (Integrated Development Environment)
    - C-style programming language

Hardware for Arduino

Arduino Board

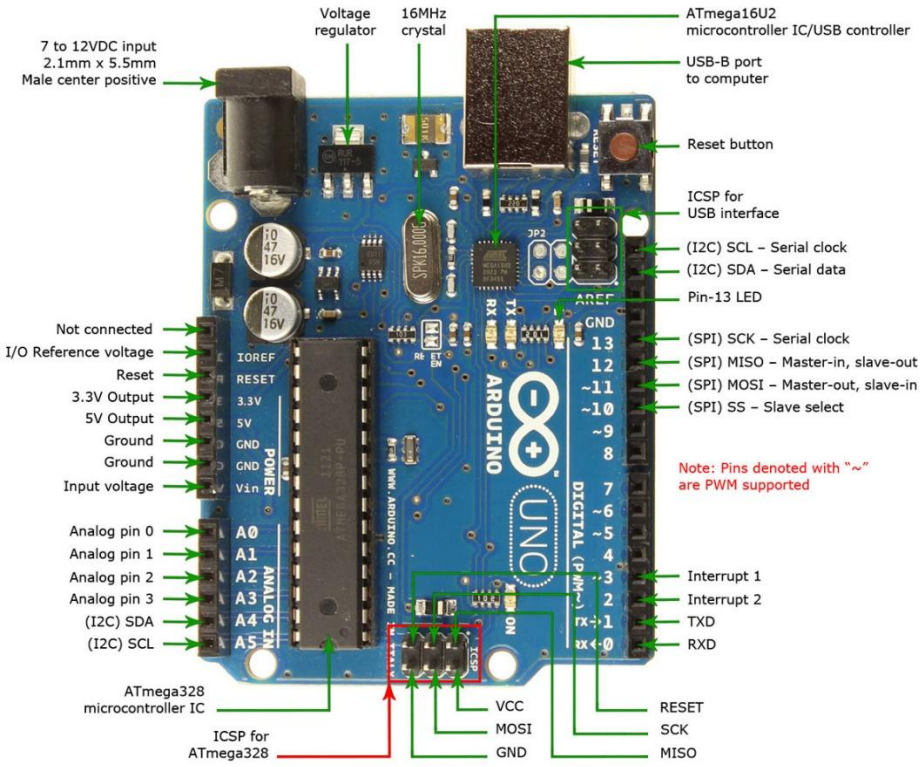
+

Shield (sensor, actuator, accessory)

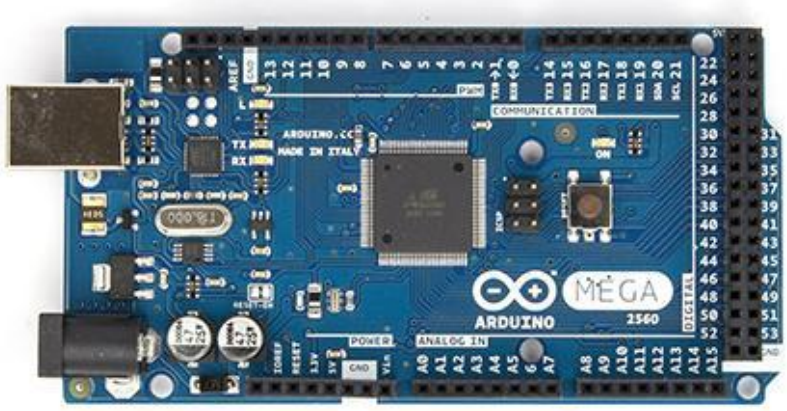


Arduino UNO

- One of the most widely-used official Arduino boards
- ATmega328P microprocessor
  - 8-bit RISC-based microcontroller
  - 16MHz operating frequency
  - 32 KB flash memory

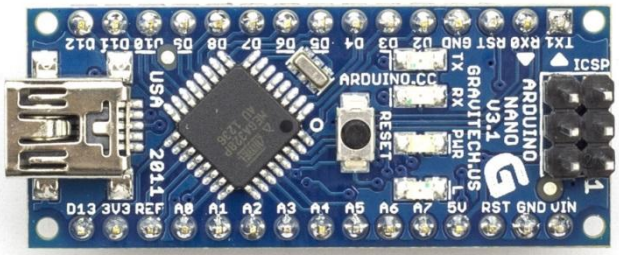


Arduino MEGA



- ATmega2560 microcontroller
- Input voltage: 7~12V
- 54 Digital I/O Pins (6 PWM outputs)
- 16 Analog Inputs
- 4 UARTs
- 256KB Flash Memory
- 16Mhz Clock Speed

Arduino Pro NANO

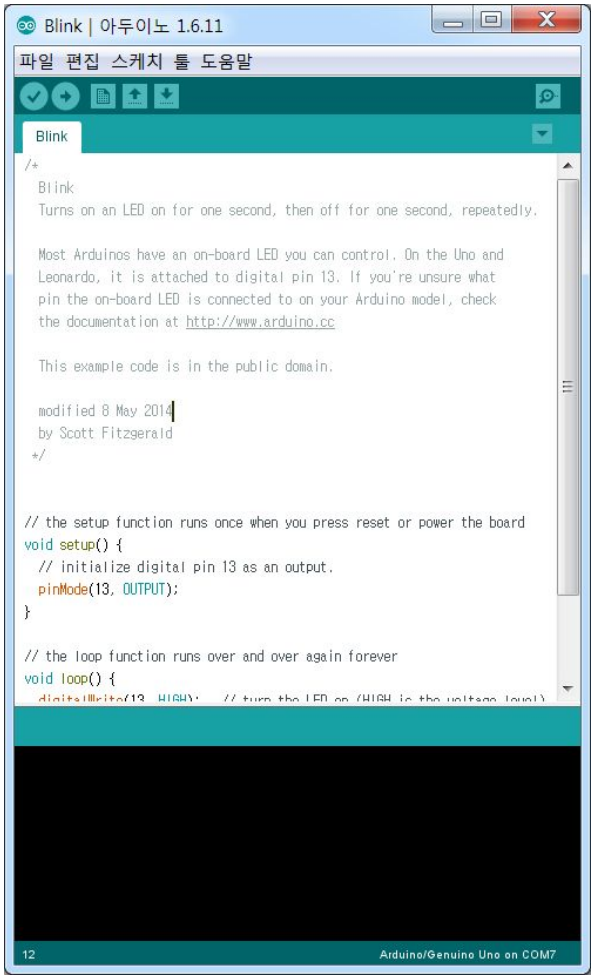


- · ATmega168/328 microcontroller
- · Input voltage: 7~12V
- · 14 Digital I/O Pins (6 PWM outputs)
- · 8 Analog Inputs
- · 16KB Flash Memory
- · 16Mhz Clock Speed

Preparation

- **Software download at Arduino homepage**
  - http://arduino.cc/en/Main/Software
  - Download the latest version
    - Windows Installer which includes both IDE and drivers
    - Mac OS X and Linux are also supported
- **Install the downloaded software**
- **Connect computer and Arduino via USB**

Software for Arduino - Sketch



Verify

Checks your code for errors compiling it.

Upload

Compiles your code and uploads it to the configured board. See uploading below for details.

Note: If you are using an external programmer with your board, you can hold down the "shift" key on your computer when using this icon. The text will change to "Upload using Programmer"

New

Creates a new sketch.

Open

Presents a menu of all the sketches in your sketchbook. Clicking one will open it within the current window overwriting its content.

Note: due to a bug in Java, this menu doesn't scroll; if you need to open a sketch late in the list, use the **File | Sketchbook** menu instead.

Save

Saves your sketch.

Serial Monitor

Opens the serial monitor.

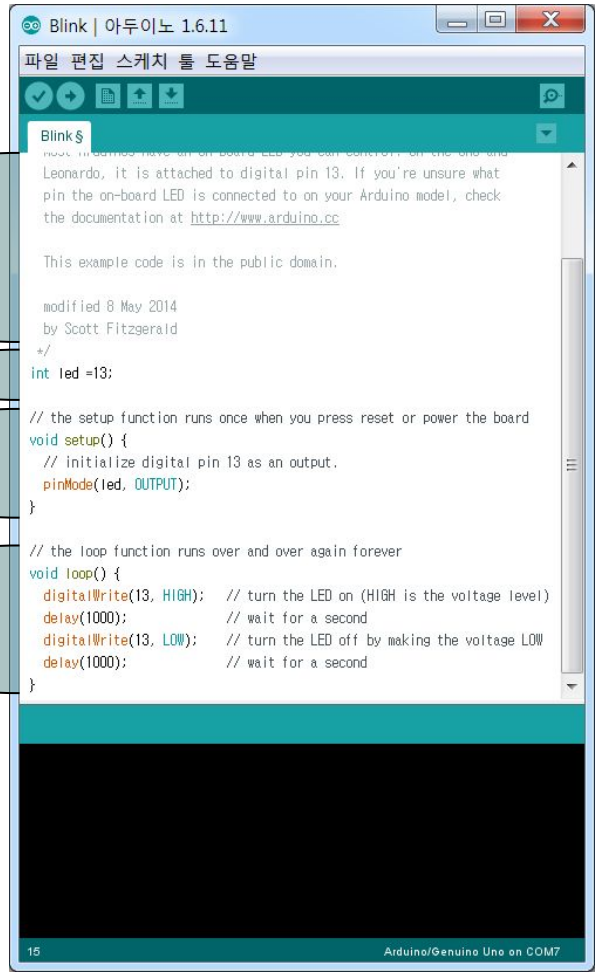
Sketch

Introductory comments / Describe the program

Variable declaration section

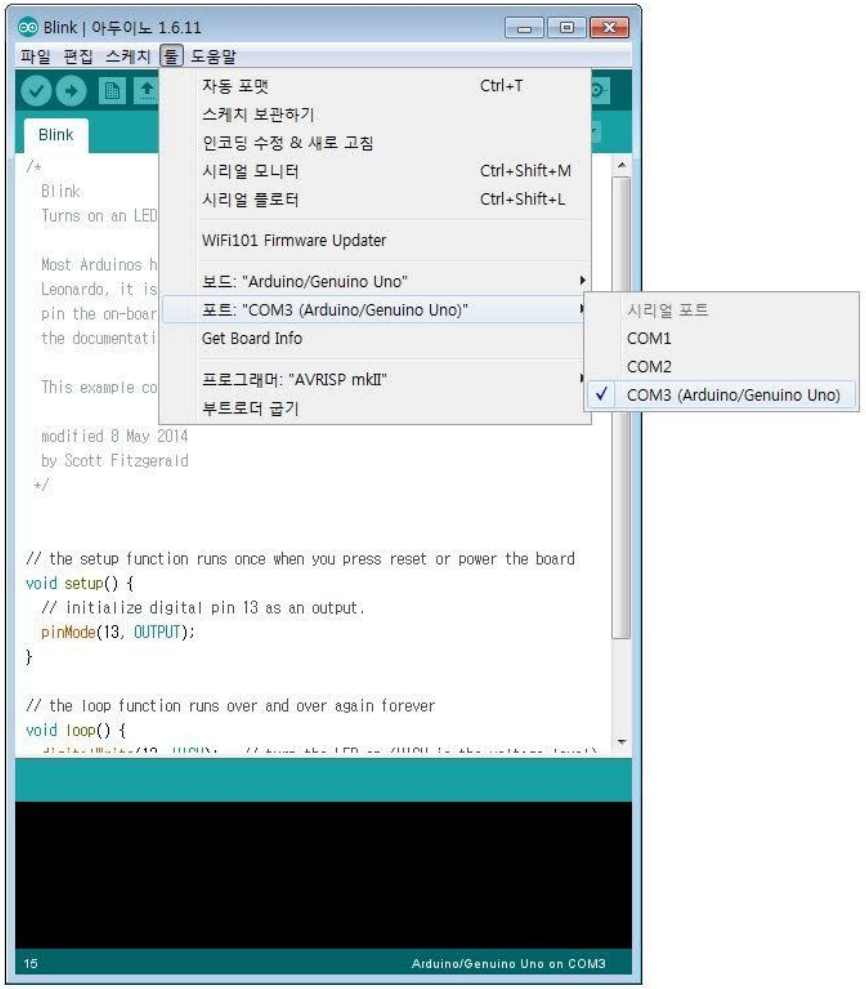
Setup section
INPUT/OUTPUT pins, Serial communication

Loop section



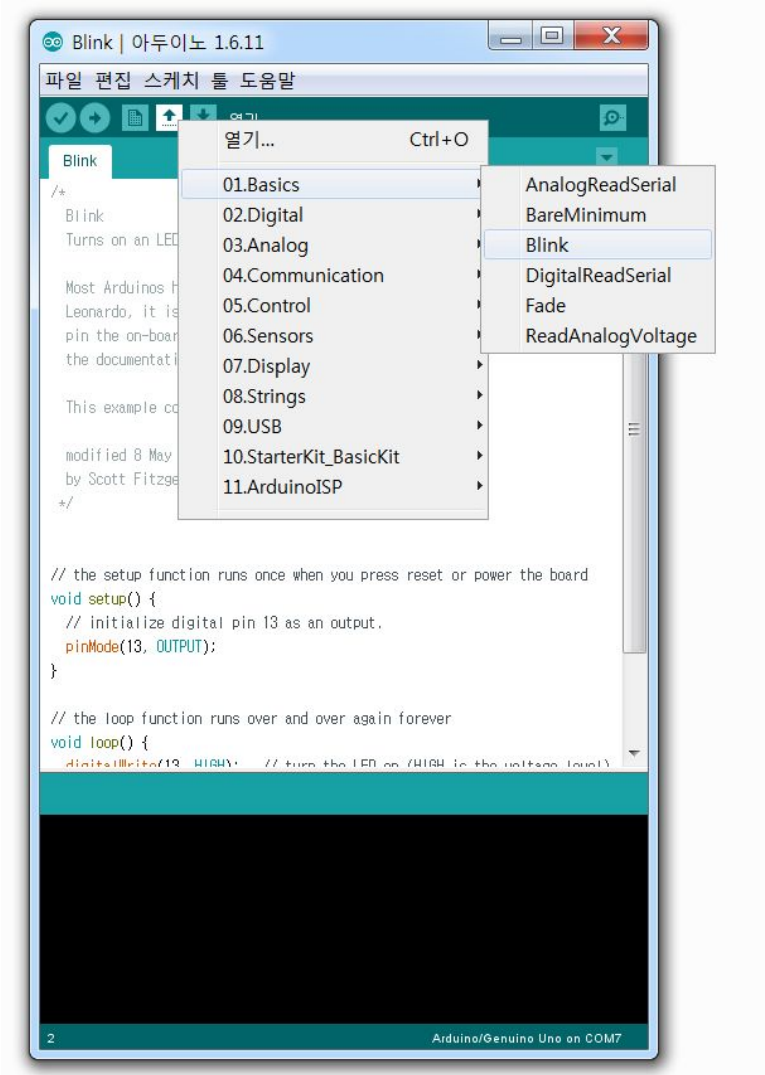
Check installation

- Run Arduino IDE
- Select serial port



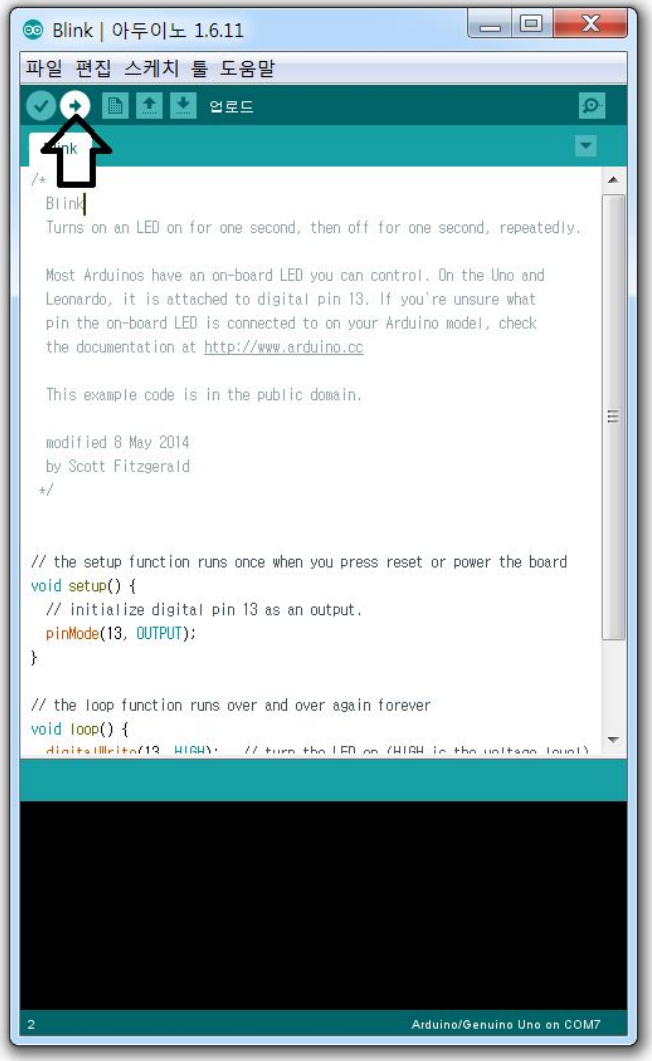
Check installation [cont.]

- Load “Blink” example



Check installation [cont.]

- **Click “Upload” button**
  - It compiles “sketch” and upload it to the board
  - Once uploaded, automatically executed
- **Can you see LED blink?**
  - Otherwise, check your driver installation



Quick Look at Sketch Examples

- **Sketch = source code**
- **C-like language**
- **Two special functions – setup and loop**
  - Blink.ino

```
// the setup function runs once when you press reset or power the board
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
}
```

Quick Look at Sketch Examples

- **Setup function**
  - Initialization function which is executed *before* loop function
- **Loop function**
  - Similar as main function
  - Executed infinitely

Quick Look at Sketch Examples

- **pinMode(LED_BUILTIN, OUTPUT)**
  - Initialize digital Pin13 as OUTPUT
    - Note: digital Pin13 is attached to a LED for test purpose
- **digitalWrite(LED_BUILTIN, HIGH)**
  - Put high voltage to digital Pin13
  - Since a LED is attached to the pin, it turns on the LED
- **digitalWrite(LED_BUILTIN, LOW)**
  - Put low voltage to digital Pin13
  - It turns off the LED
- **delay(1000)**
  - Wait one second

Arduino Simulation

https://www.tinkercad.com/