Introduction to Arduino

Instructor: Plamena Milusheva

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Set up: Drivers and IDE

Download the Arduino Software

The open-source Arduino environment makes it easy to write code and upload it to the board. It runs on Windows, MacOS X, and Linux. The environment is written in Java and based on Processing, ar-pj, and other open-source software.

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Getting Started with Arduino

**Introduction:** What Arduino is and why you’d want to use it.

**Installation:** Step-by-step instructions for setting up the Arduino software and connecting it to an Arduino Uno, Mega2560, Duemilanove, Mega, or Diecimila.

- **Windows**
- **Mac OS X**
- **Linux** (on the playground wiki)

**Environment:** Description of the Arduino development environment.

**Troubleshooting:** Advice on what to do if things don’t work.
Some Arduino applications:

...and so much more!
Microcontroller: The brain of your Arduino

ATmega328p

**Miniature computer**
- processor
- long term memory (program storage)
- short term memory (calculations)

**Input and Output**
- digital (binary: High, Low)
- analog (data sequence)
What makes your Arduino Duemilanov board work:

- Runs at 16 MHz
- 32 KB Flash memory
- 2 KB RAM (for calculations)
- 1 KB EEPROM (re-writable read-only memory)
- 14 Digital Input/Output pins
- 6 Analog Output pins
The essentials of the Arduino board
The Arduino IDE

```cpp
void setup() {
    // initialize the digital pin as an output.
    // Pin 13 has an LED connected on most Arduino boards:
    pinMode(13, OUTPUT);
}

void loop() {
    digitalWrite(13, HIGH);  // set the LED on
    delay(1000);             // wait for a second
    digitalWrite(13, LOW);   // set the LED off
    delay(1000);             // wait for a second
}
```

/*
Blink
Turns on an LED on for one second, then off for one second, repeatedly.

This example code is in the public domain.
*/
Basic button controls

- Serial Monitor
- Upload
- Save
- Open
- New
- Stop
- Compile
Language Reference

Arduino programs can be divided in three main parts: structure, values (variables and constants), and functions.

Structure

- setup()
- loop()
- Control Structures
  - if
  - if...else
  - for
  - switch case
  - while
  - do...while
  - break
  - continue
  - return
  - goto
- Further Syntax
  - ; (semicolon)
  - () (curly braces)
  - "" (double quotes)
  - , (comma)
  - . (dot)
  - = (assign)
  - == (equality)
  - != (inequality)
  - && (AND)
  - || (OR)

Variables

- Constants
  - HIGH | LOW
  - INPUT | OUTPUT
  - true | false
  - integer constants
  - floating point constants

- Data Types
  - void
  - boolean
  - char
  - unsigned char
  - byte
  - int
  - unsigned int
  - word
  - long
  - unsigned long

Functions

- Digital I/O
  - pinMode()
  - digitalWrite()
  - digitalRead()

- Analog I/O
  - analogReference()
  - analogRead()
  - analogWrite() - PWM

- Advanced I/O
  - tone()
  - noTone()
  - shiftOut()
  - shiftIn()
  - pulseIn()

- Time
  - millis()
Getting your Arduino to do things...

void setup() {
    Serial.begin(9600);
}

void loop() {
    Serial.println("success!");
}

*You may need to change the rate of the serial monitor to 57600 in order to get a read.*

Setup () function: 
Runs once at beginning of program execution

Loop () function: 
Loops the dynamic elements of the program
Digital Output: Make an LED blink
Digital Output: Code

```
void setup() {
  pinMode(3, OUTPUT);
}

void loop() {
  digitalWrite(3, HIGH);
  delay(500);
  digitalWrite(3, LOW);
  delay(500);
}
```

- Play around with the delay length
- Create a variable blinking sequence
- Add more LEDs
Digital Input: Controlling your LED with a button
Digital Output: Code

```cpp
void setup() {
  pinMode(3, OUTPUT);
  pinMode(2, INPUT);
}

void loop() {
  if (digitalRead(2) == HIGH) {
    digitalWrite(3, HIGH);
  } else {
    digitalWrite(3, LOW);
  }
}
```

How IF statements work

Switch the result produced by pressing the button

`==` vs. `=`
Analog Input: Reading a variable resistor using Serial
Analog Input serial read: Code

```java
void setup() {
    // no setup required for analog inputs
    // need to set up Serial
    Serial.begin(9600);
}

void loop() {
    Serial.println(analogRead(0));
    delay(30);
}
```
Analog Input: Controlling LED with a potentiometer
Analog Input: Code

```c
int sensorValue = 0;     // value read from the pot
int outputValue = 0;     // value output to the PWM (analog out)

void setup() {

    // initialize serial communications at 9600 bps:
    Serial.begin(9600);
}

void loop() {

    // read the analog in value:
    sensorValue = analogRead(analogInPin);
    // map it to the range of the analog out:
    outputValue = map(sensorValue, 0, 1023, 0, 255);
    // change the analog out value:
    analogWrite(analogOutPin, outputValue);

    delay(10);
}
```
Expanding the capabilities of the Arduino board

Using external power supplies
- USB vs. DC adapter
- Vin pin vs. 5V pin

Using shields: modular pre-made circuit boards for various functions (touch screen, ethernet, blue tooth, and much more)