



Lecture (04)

Arduino Microcontroller Programming and interfacing



By:

Dr. Ahmed ElShafee

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Arduino Board

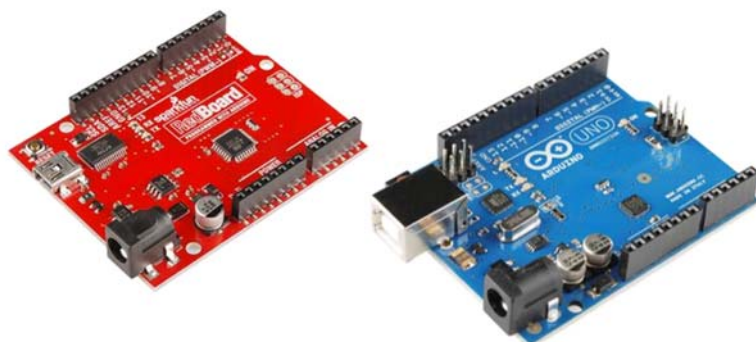
“Strong Friend” Created in Ivrea, Italy
in 2005 by Massimo Banzi & David Cuartielles

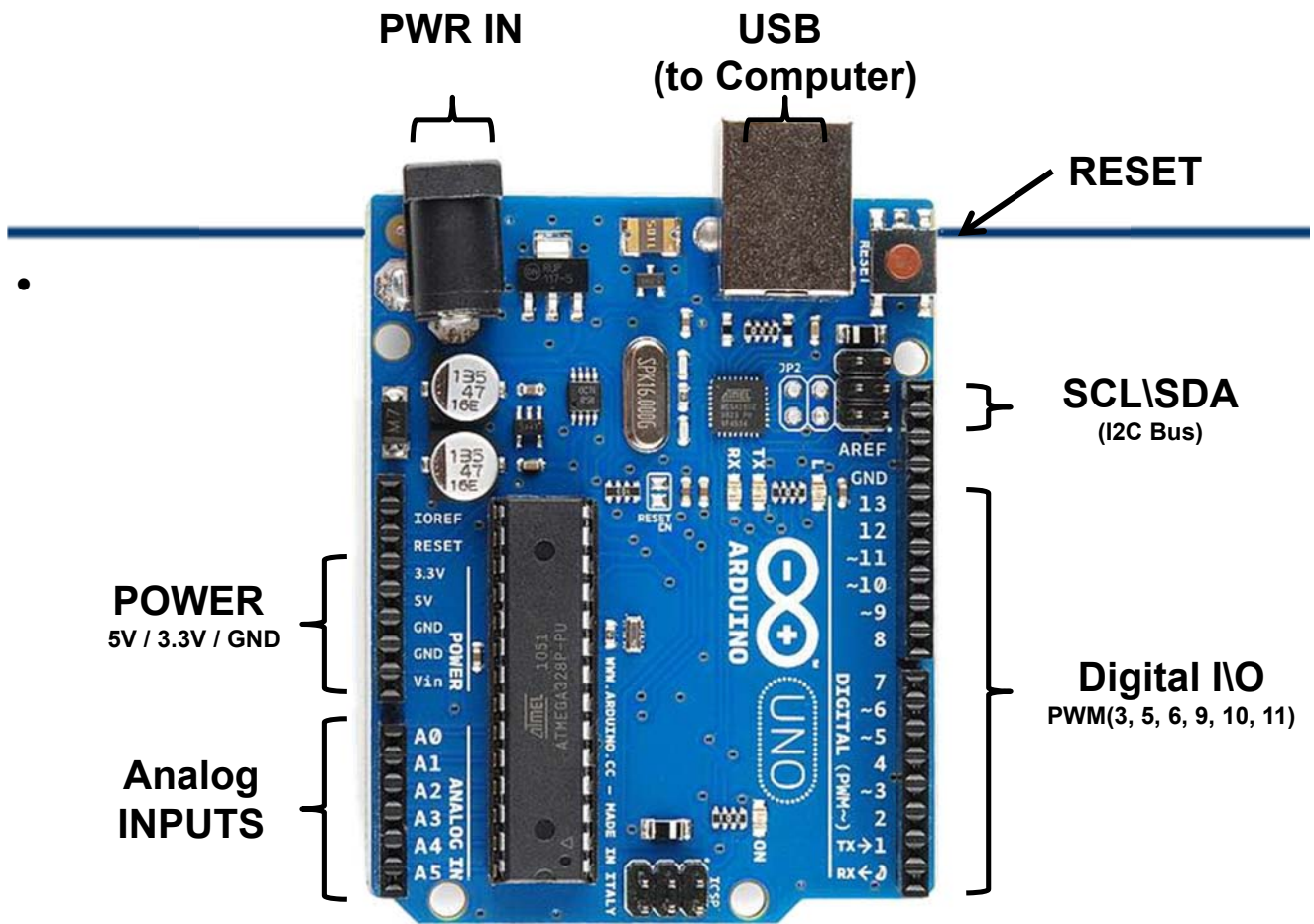
Open Source Hardware



 Processor

Coding is accessible & transferrable → (C++, Processing, java)





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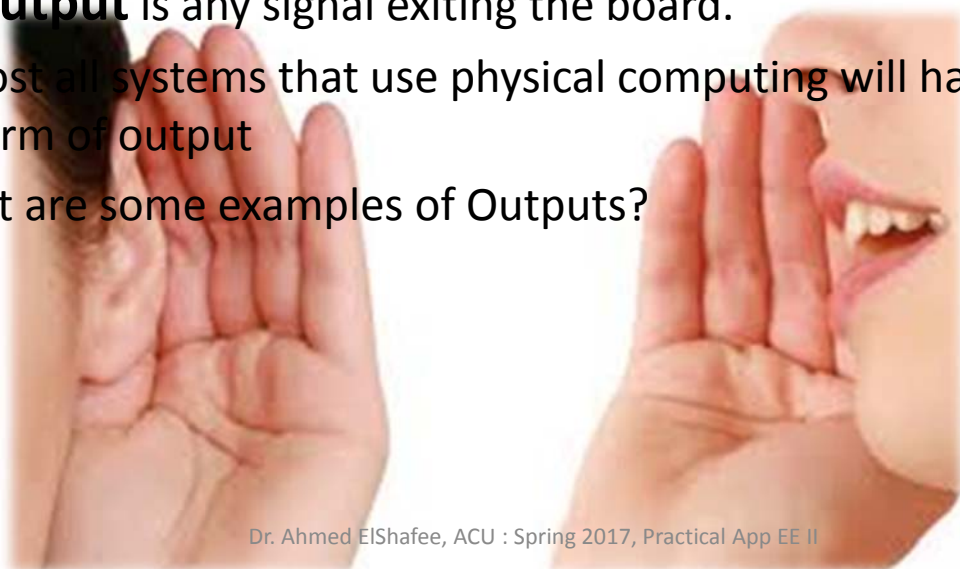
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Concepts: INPUT vs. OUTPUT

- Referenced from the perspective of the microcontroller (electrical board).
- **Inputs** is a signal / information going into the board.
- **Output** is any signal exiting the board.

Almost all systems that use physical computing will have some form of output

What are some examples of Outputs?



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- Referenced from the perspective of the microcontroller (electrical board).

Inputs is a signal / information going into the board.

Output is any signal exiting the board.

Examples: Buttons Switches, Light Sensors, Flex Sensors, Humidity Sensors, Temperature Sensors...

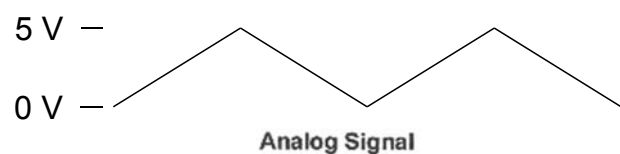
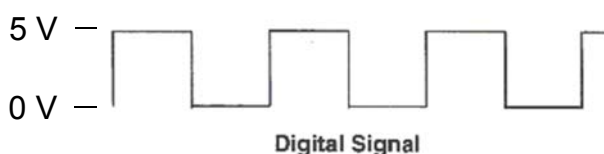
Examples: LEDs, DC motor, servo motor, a piezo buzzer, relay, an RGB LED

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Concepts: Analog vs. Digital

- Microcontrollers are **digital** devices – ON or OFF. Also called – discrete.
- analog** signals are anything that can be a full range of values. What are some examples? More on this later...



7

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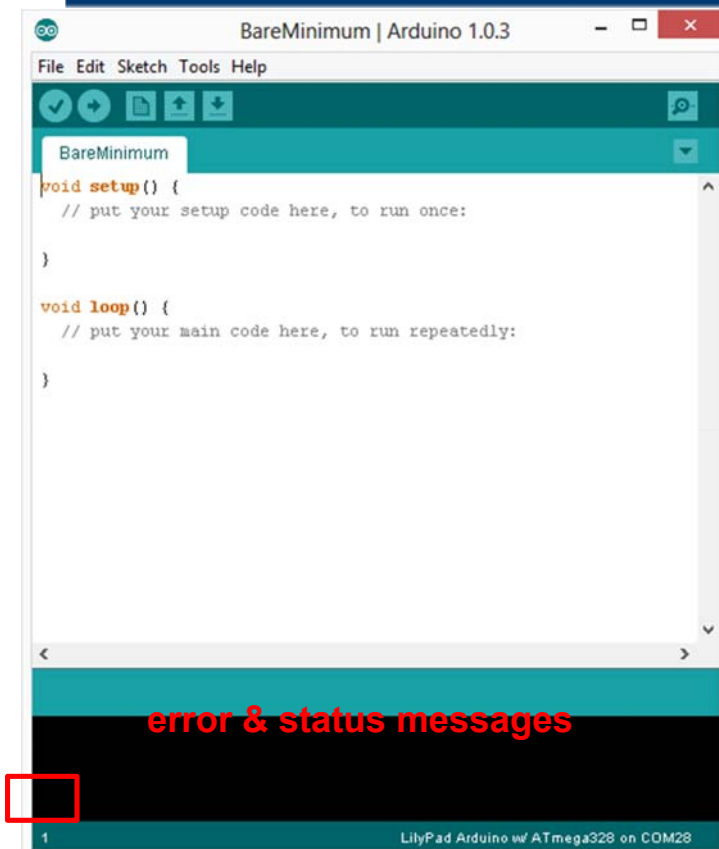
Arduino Integrated Development Environment (IDE)

Two required functions / methods / routines:

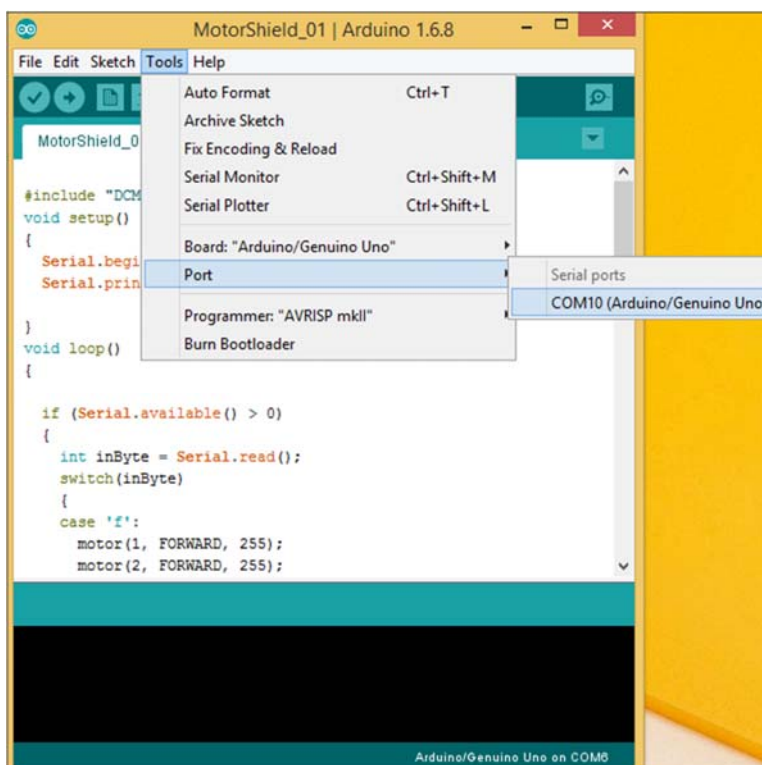
```
void setup()  
{  
    // runs once  
}
```

```
void loop()  
{  
    // repeats  
}
```

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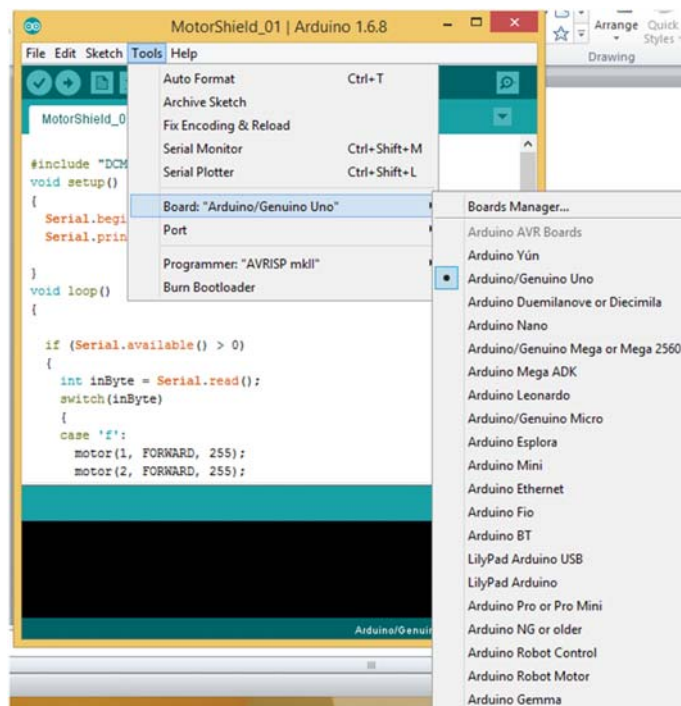
Settings: Tools → Serial Port



•Your computer communicates to the Arduino microcontroller via a serial port → through a USB-Serial adapter.

•Check to make sure that the drivers are properly installed.

Settings: Tools → Board



Next, double-check that the proper board is selected under the Tools → Board menu.

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BIG 6 CONCEPTS



digitalWrite()



analogWrite()



digitalRead()



if() statements / Boolean



analogRead()



Serial communication

Project #1 – Blink

–“Hello World” of Physical Computing

- *Pseudo-code – how should this work?*



-
- Comments are for you – the programmer and your friends...or anyone else human that might read your code.
 - `// this is for single line comments`
 - `// it's good to put a description at the top and before anything 'tricky'`
 - `/* this is for multi-line comments`
 - `Like this...`
 - `And this...`
 - `*/`

sketch_mar11a | Arduino 1.6.8

```
File Edit Sketch Tools Help
```

sketch_mar11a

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

comments

Arduino/Genuino Uno on COM8

13

sketch_mar11a | Arduino 1.6.8

```
File Edit Sketch Tools Help
```

sketch_mar11a

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

Arduino/Genuino Uno on COM8

Review the two main parts of the sketch – void setup() and void loop()

Provide rationale for good commenting.

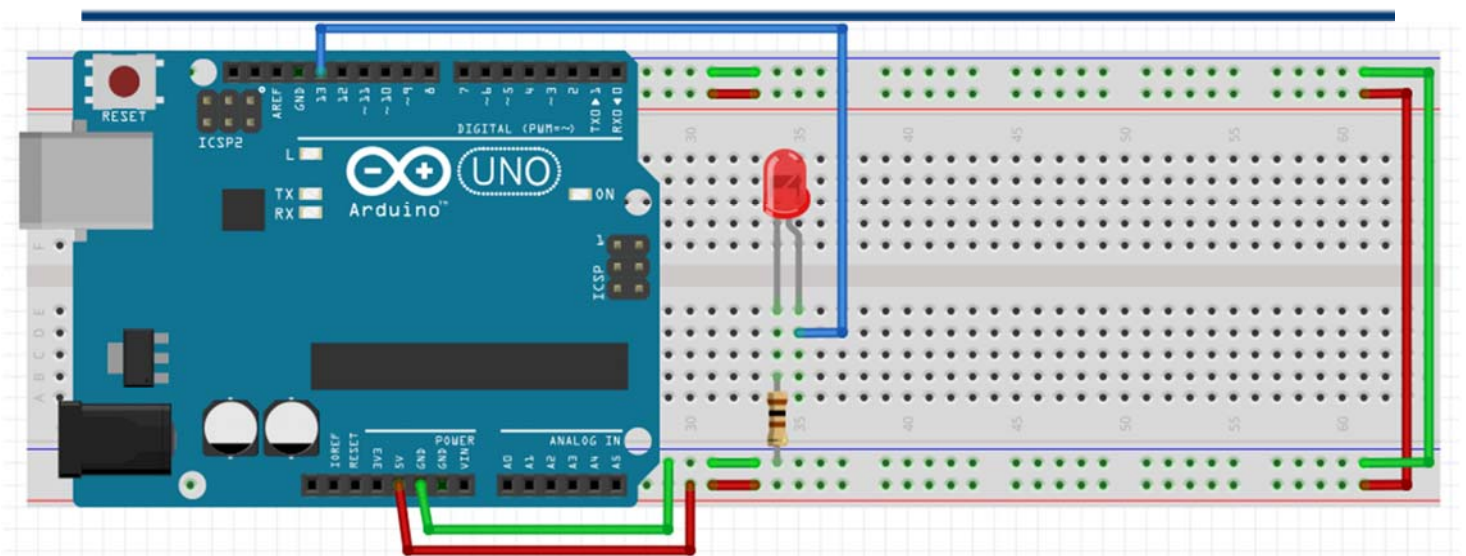
Emphasize the need for good / clean coding practices like indenting.

- Three commands to know...
- `pinMode(pin, INPUT/OUTPUT);`
- ex: `pinMode(13, OUTPUT);`
- `digitalWrite(pin, HIGH/LOW);`
- ex: `digitalWrite(13, HIGH);`
- `delay(time_ms);`
- ex: `delay(2500); // delay of 2.5 sec.`
- **// NOTE: -> commands are CASE-sensitive**

10

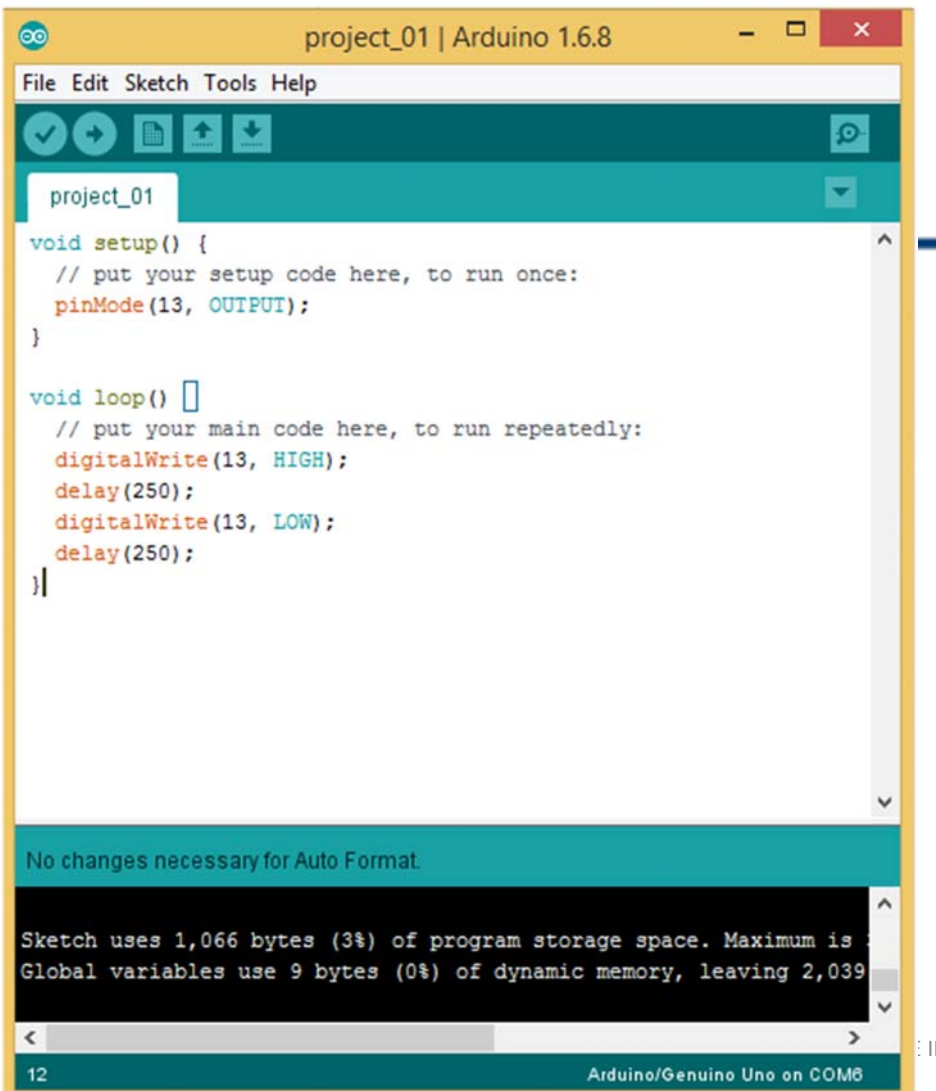
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Project 01, led flasher



11

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Programming Concepts: Variables

```
// Comments go here
// Written by:
// Date:

int sensorValue;
int ledPin;

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

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

Variable Scope

- *Global*
- *Function-level*

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Programming Concepts: Variable Types

- Variable Types:



8 bits

byte
char



16 bits

int
unsigned int



32 bits

long
unsigned long
float



Thanks,..
See you next week (ISA),...