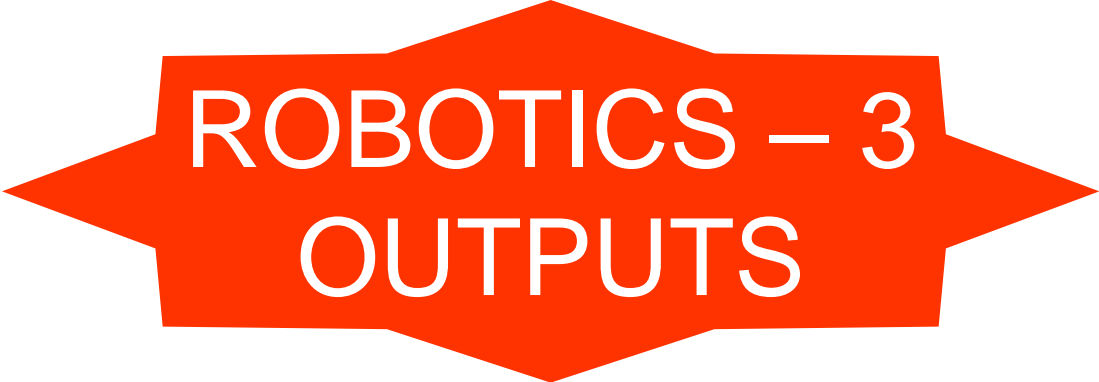




Advanced Manufacturing Academy 2016



**ROBOTICS – 3
OUTPUTS**

College of Engineering and Technology

East Carolina University

Our Robot – Outputs

- Want to use Arduino for control..
- Learn about outputs & programming
- Today's plan.....
 - Arduino – overview - UNO Architecture
 - Arduino programming - IDE
 - Types outputs
 - How to program these outputs
 - Experiment – Try it out

Arduino Background

- Arduino is an Open Source Controller
- All the information is at
 - www.arduino.cc
 - 22 styles controller + MANY accessories

BOARDS (Compare Specs)



Arduino Uno



Arduino Leonardo



Arduino Due



Arduino Yún



SHIELDS



Arduino GSM Shield



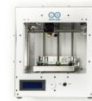
Arduino Ethernet Shield



KITS



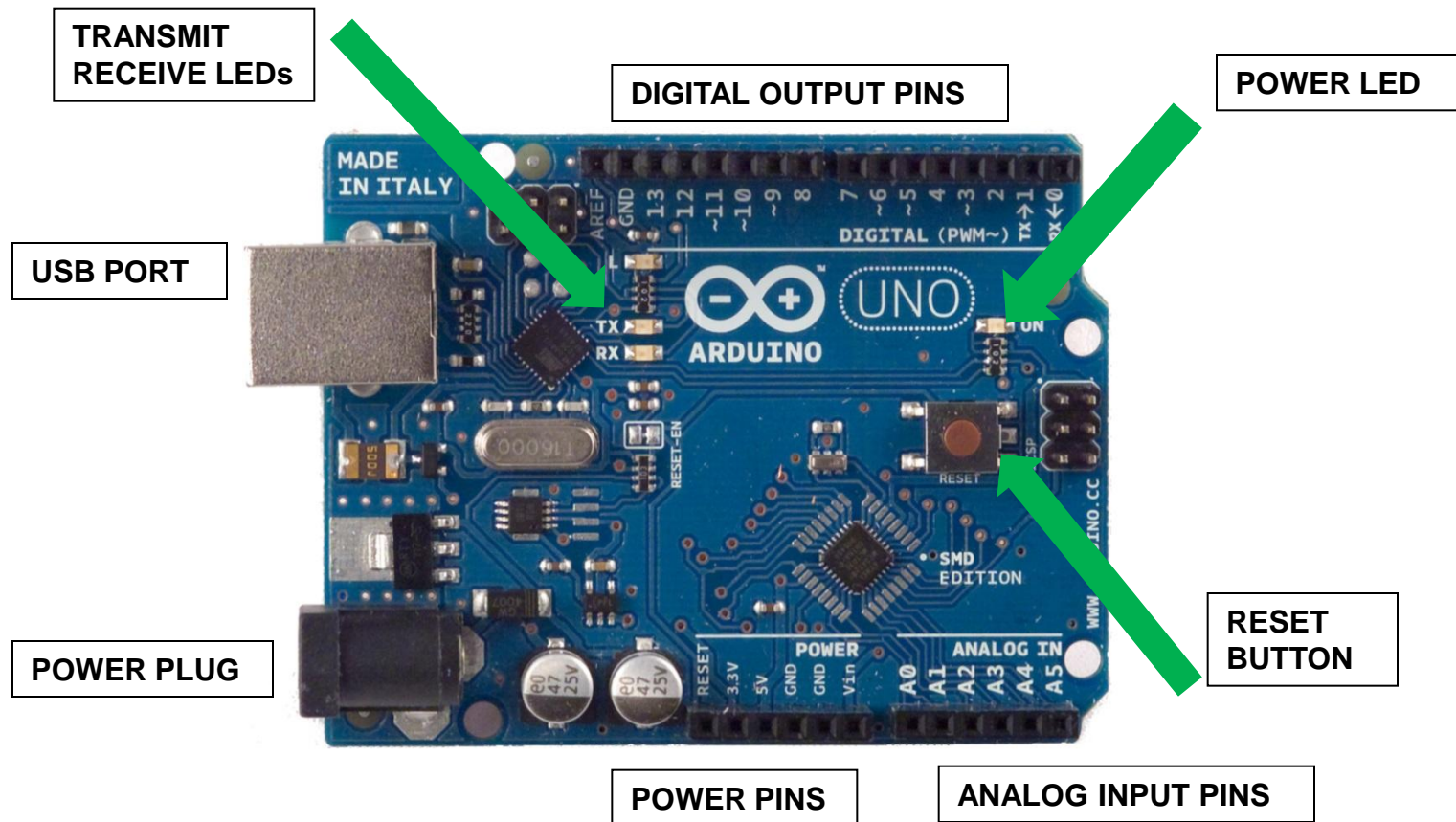
The Arduino Starter Kit



Arduino Matera 101

The Arduino Uno - Parts

- Architecture - Layout



Outputs – Two Options

- Pins 3 – 13 – Output Pins
- Two Options
 - Digital – On/Off
 - PWM – Pulse Width Modification
- 3 – 13 can all be digital outputs
- PWM on Pins 3,5,6,9,10,11
- What does “Digital” mean?
- What does “PWM” mean?

Digital Outputs

- Digital Outputs - Send signal out
 - Can set pins 3 – 13 to outputs
 - Digital is “ON / OFF”
 - No in between
 - On is 5 volts – Off is 0 volts
- Maximum Power output is 40 mA
- What can we do with 5Vdc at 40mA?
 - Lots! But we’ll have to learn some electronics.

Digital Outputs – with PWM

- PWM = Pulse Width Modulation
 - PWM – Create pulses – on/off
 - Change length of pulse
 - Longer = More power
 - Shorter = Less power
- Control length of pulse to control power
- A “digital” way to simulate analog

Loading Code – Getting Started

- Time to start talking to the Arduino
- Need to use the Arduino Programming Language
 - Programming IDE (Integrated Development Environment)
 - Free download from arduino.cc
 - LOW Overhead
 - Easy to use
 - **DON'T PANIC!**



Start Your Software

- Find this Icon on the desktop and click..



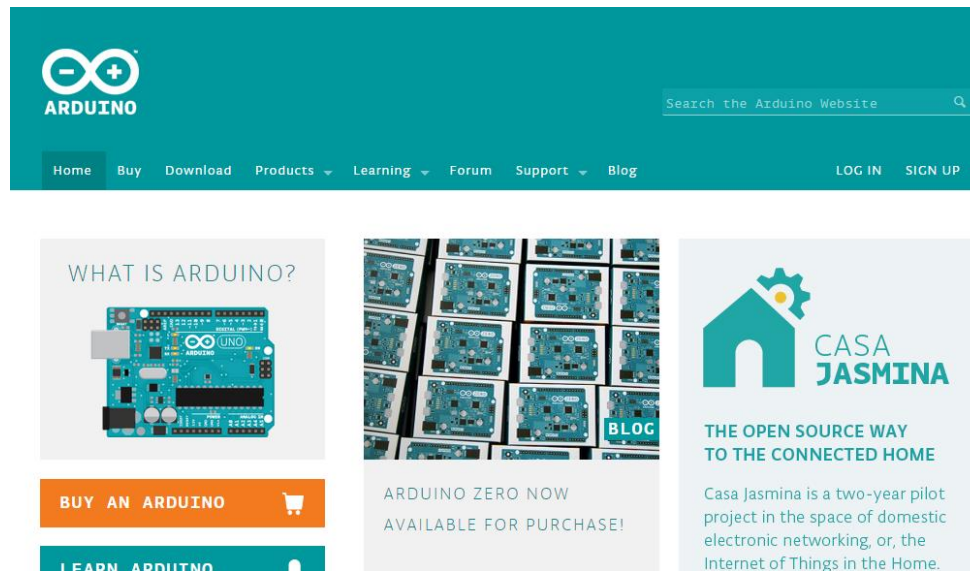
Start Your Software (2)

- Let it start up – It should look like this..



FREE Software

- Don't know how to program?
- Don't worry
- We're going to borrow code
- Go to Arduino.cc – click on Learning



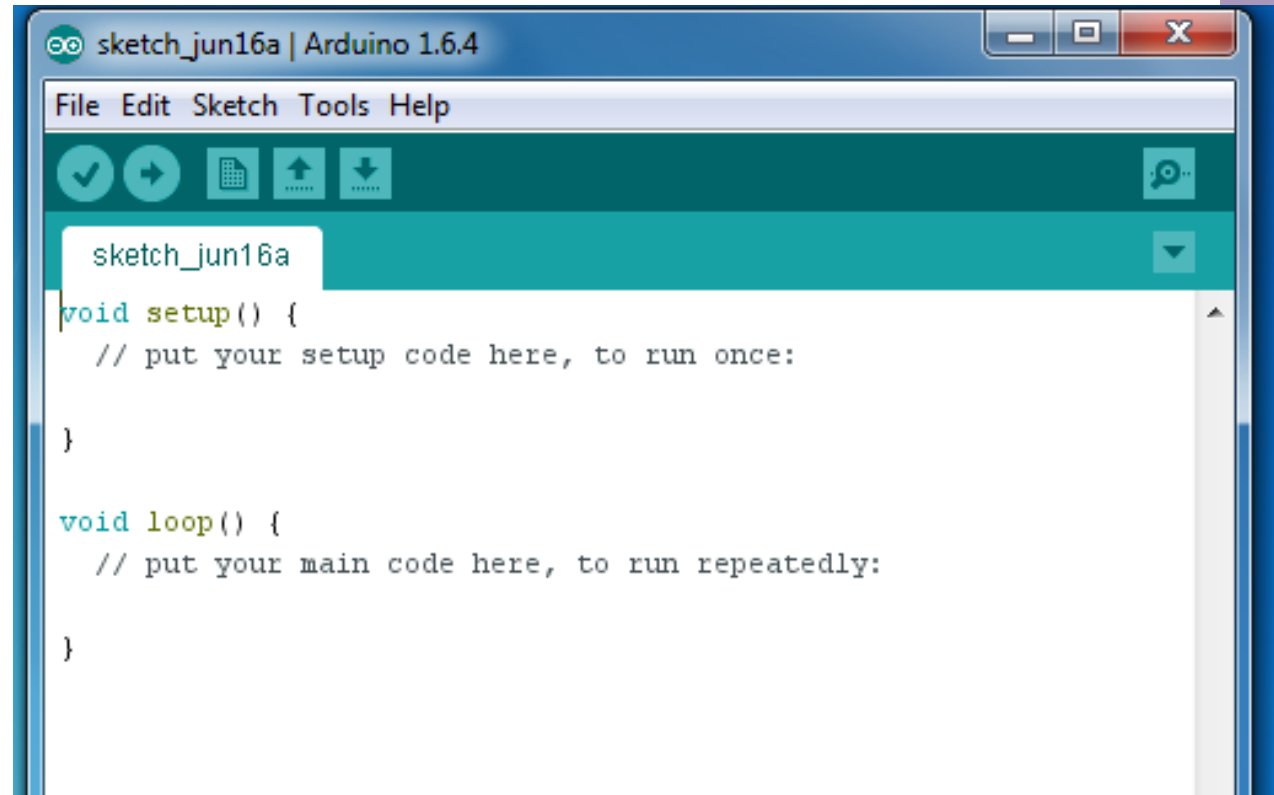
LEARNING AT Arduino.cc

- Go to “Learning” – Click on Examples
- They give us very nice instructions
- AND.....
 - Sample code..
- We will tweak/use the examples!

```
/*  
  Blink  
  Turns on an LED on for one second, then off for one second, repeatedly.  
  
  This example code is in the public domain.  
  */  
  
// Pin 13 has an LED connected on most Arduino boards.  
// give it a name:  
int led = 13;  
  
// the setup routine runs once when you press reset:  
void setup() {  
  // initialize the digital pin as an output.  
  pinMode(led, OUTPUT);  
}  
  
// the loop routine runs over and over again forever:  
void loop() {  
  digitalWrite(led, HIGH);   // turn the LED on (HIGH is the voltage level)  
  delay(1000);              // wait for a second  
  digitalWrite(led, LOW);   // turn the LED off by making the voltage LOW  
  delay(1000);              // wait for a second  
}
```

CODE DETAILS – Blank Code

- The Code... lets explore
 - Void setup
 - Void loop
 - Braces



The screenshot shows the Arduino IDE interface for a sketch named 'sketch_jun16a'. The window title is 'sketch_jun16a | Arduino 1.6.4'. The menu bar includes 'File', 'Edit', 'Sketch', 'Tools', and 'Help'. The toolbar contains icons for a checkmark, a right arrow, a document, an up arrow, a down arrow, and a search icon. The code editor displays the following code:

```
sketch_jun16a
void setup() {
  // put your setup code here, to run once:
}

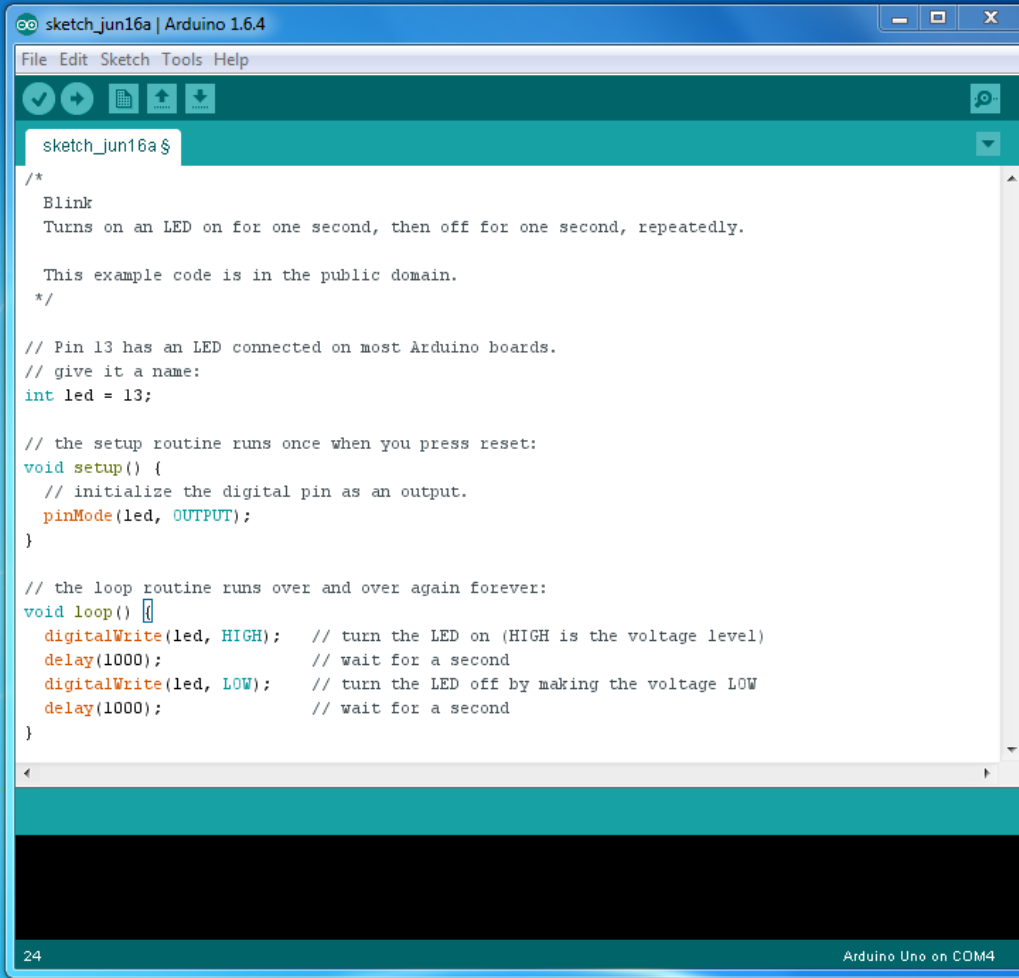
void loop() {
  // put your main code here, to run repeatedly:
}
```

USE THE BLINK CODE

- We will use the blink code provided!
- Navigate to desktop
- Open folder labeled “Software for Presentations”
- Open
- Double click on BLINK
 - Should open new IDE with code

USE THE BLINK CODE (3)

- Should see this in your window

A screenshot of the Arduino IDE window titled "sketch_jun16a | Arduino 1.6.4". The window shows the standard menu bar (File, Edit, Sketch, Tools, Help) and a toolbar with icons for saving, opening, and uploading. The main text area contains the following code:

```
sketch_jun16a $  
/*  
  Blink  
  Turns on an LED on for one second, then off for one second, repeatedly.  
  
  This example code is in the public domain.  
  */  
  
// Pin 13 has an LED connected on most Arduino boards.  
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  delay(1000);             // wait for a second  
}
```

The status bar at the bottom of the window displays "24" on the left and "Arduino Uno on COM4" on the right.

CODE DETAILS – Blink (1)

- The Code... lets explore

```
/*  
  Blink  
  Turns on an LED on for one second, then off for one second, repeatedly.  
  
  This example code is in the public domain.  
*/  
  
// Pin 13 has an LED connected on most Arduino boards.  
// give it a name:  
int led = 13;
```


CODE DETAILS – Blink (2)

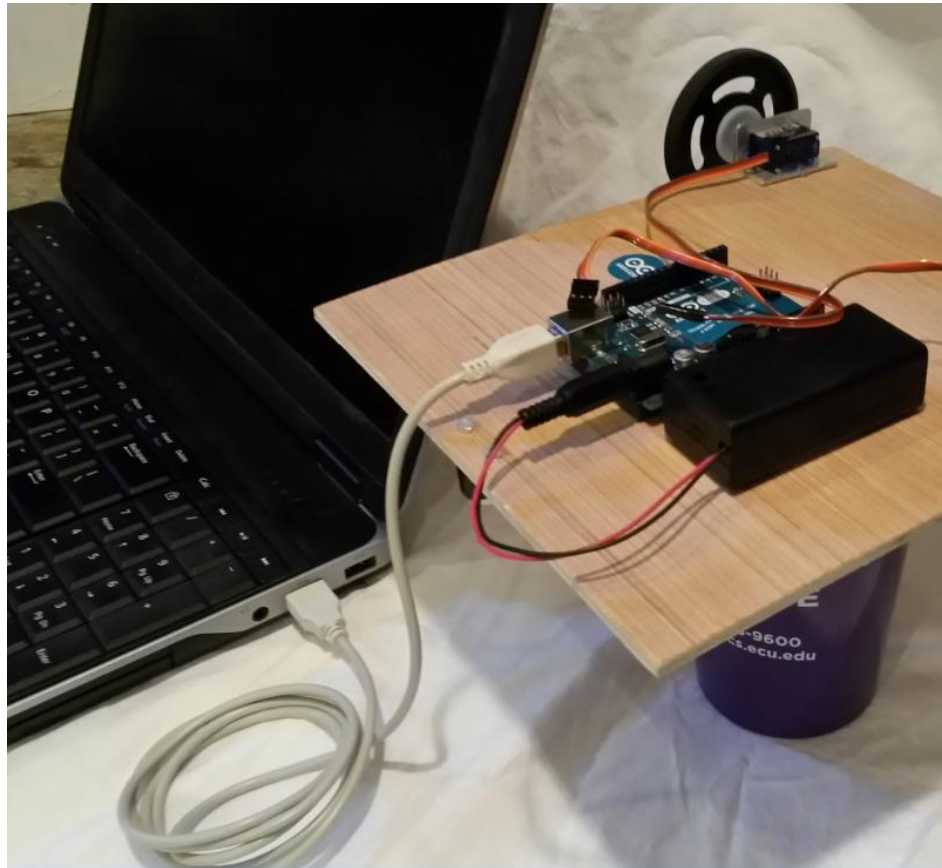
- The Code... lets explore

```
// the setup routine runs once when you press reset:
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  // initialize the digital pin as an output.
  pinMode(led, OUTPUT);
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  delay(1000);             // wait for a second
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  delay(1000);             // wait for a second
}
```

How to connect your Robot

- Plug USB into PC
- Plug USB into Arduino

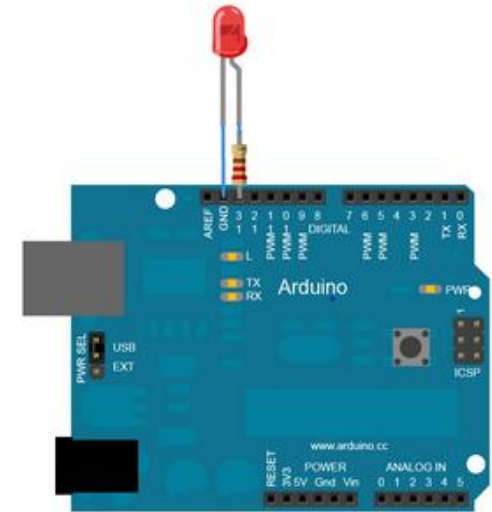


Blink Experiments

- Load and operate the blink code
- Alter the blink code to change blink pattern – Faster? Slower?

Blink Experiments 2

- Add External LED as shown.
 - Resistor in pin 13
 - Clip to resistor then to long leg
 - Short leg to ground
- Operate external LED
- What is an LED?
- Why do we need the resistor?



Blink Experiments 3

- Move external LED to pin 8
- Modify code to operate external LED on pin 8
- Additional code practice activities
 - Make both lights blink
 - Make lights blink together
 - Make lights alternate