Clark College

Electrical Engineering & Computer Science

"http://www.engrcs.com/institute/workshop.pdf"

Electrical Engineering & Computer Science

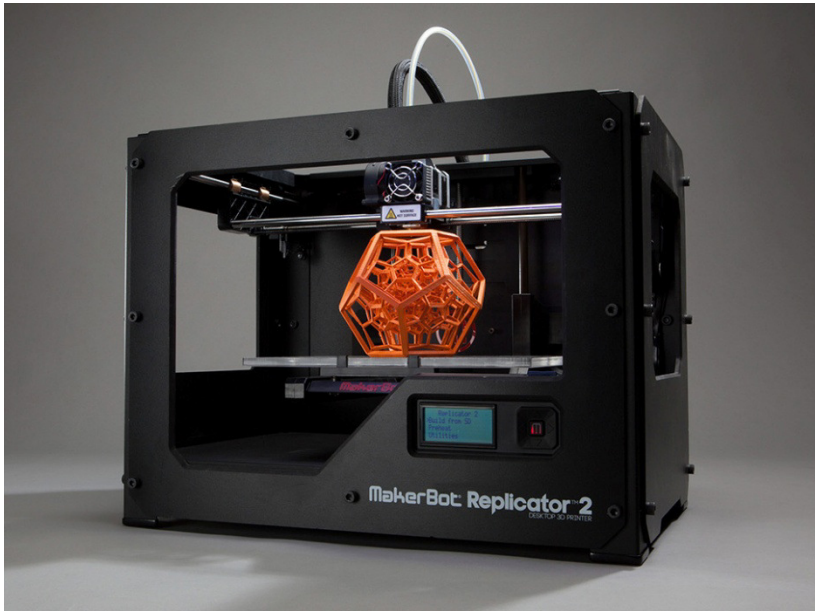
Artificial Intelligent (AI)
Bio Medical
Computers & Digital Systems
Electrical
Electronics
Gaming
Optics/Laser
Power & Reusable Energy
Programming
Robotics & Automation
Signal Processing & Artificial Intelligence
…

What they do…

Fuel Injector

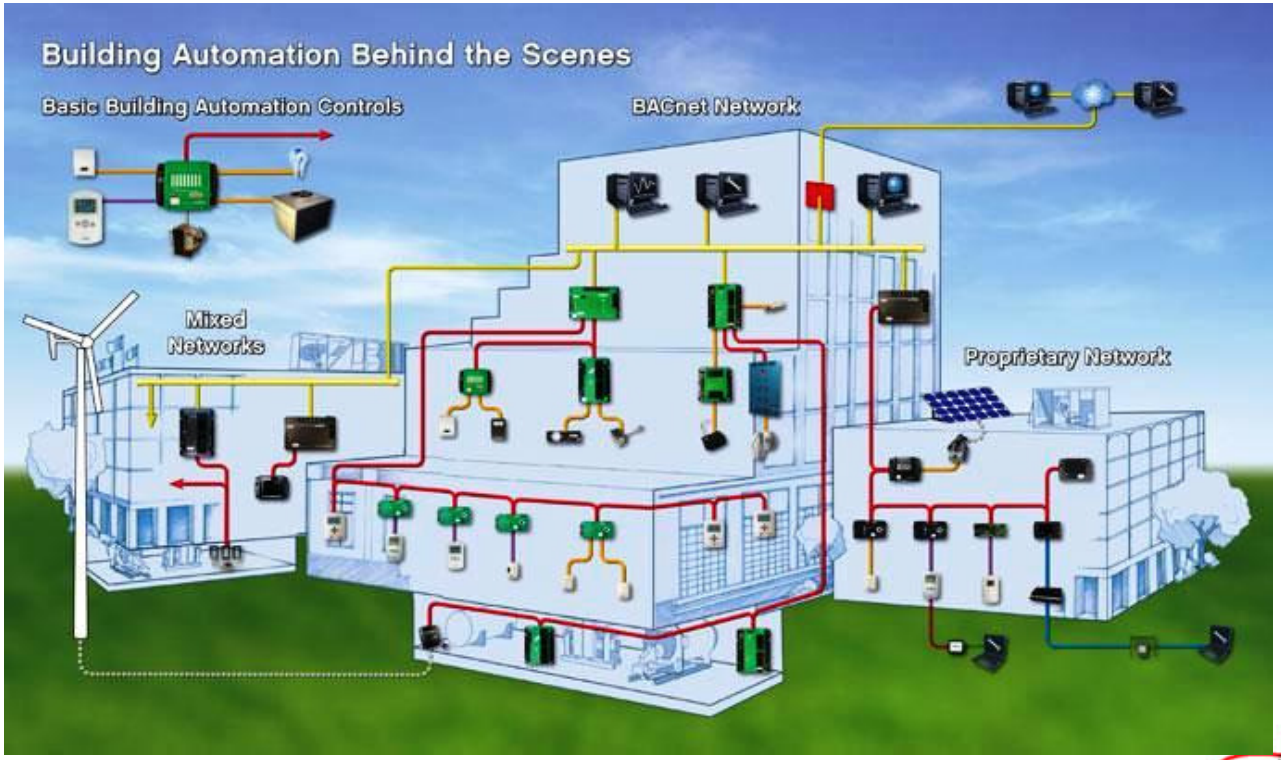
Computer Systems: Hewlett Packard, Apple, Microsoft, Sharp, Logitech …

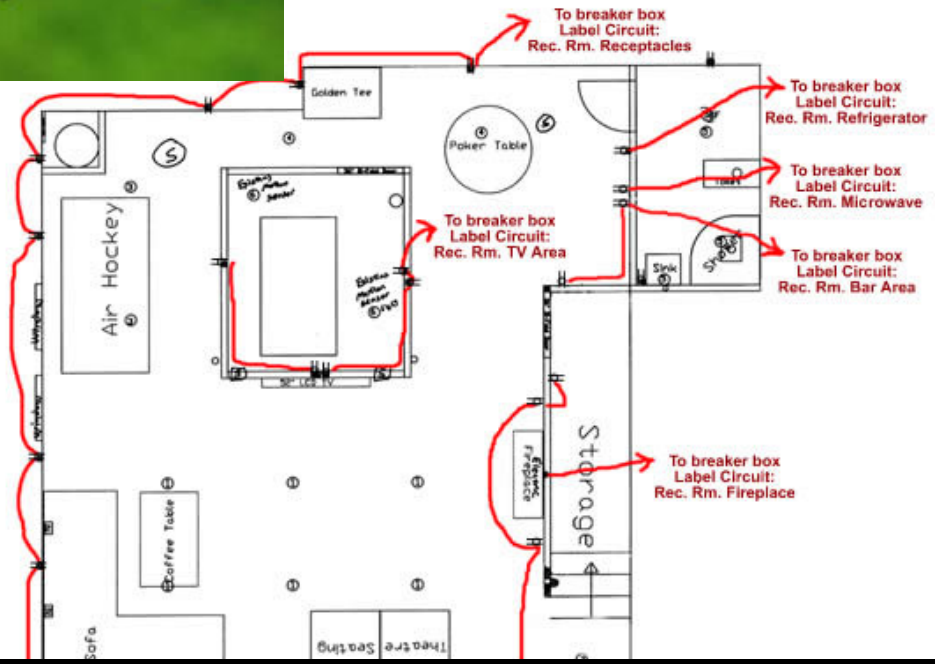
Communications: Verizon, AT&T, Alphabet, Cisco, …



2D/3D Printers & Scanners: Hewlett-Packard, Xerox, Epson, …

Power Generation & Distribution: BPA, PGE, Avista Power, Clark PUD, …



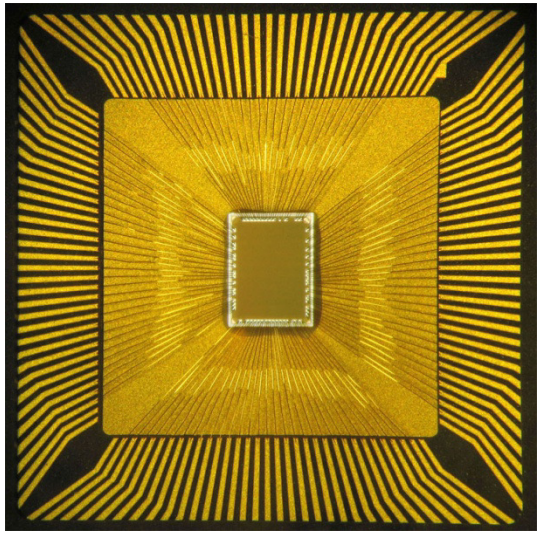


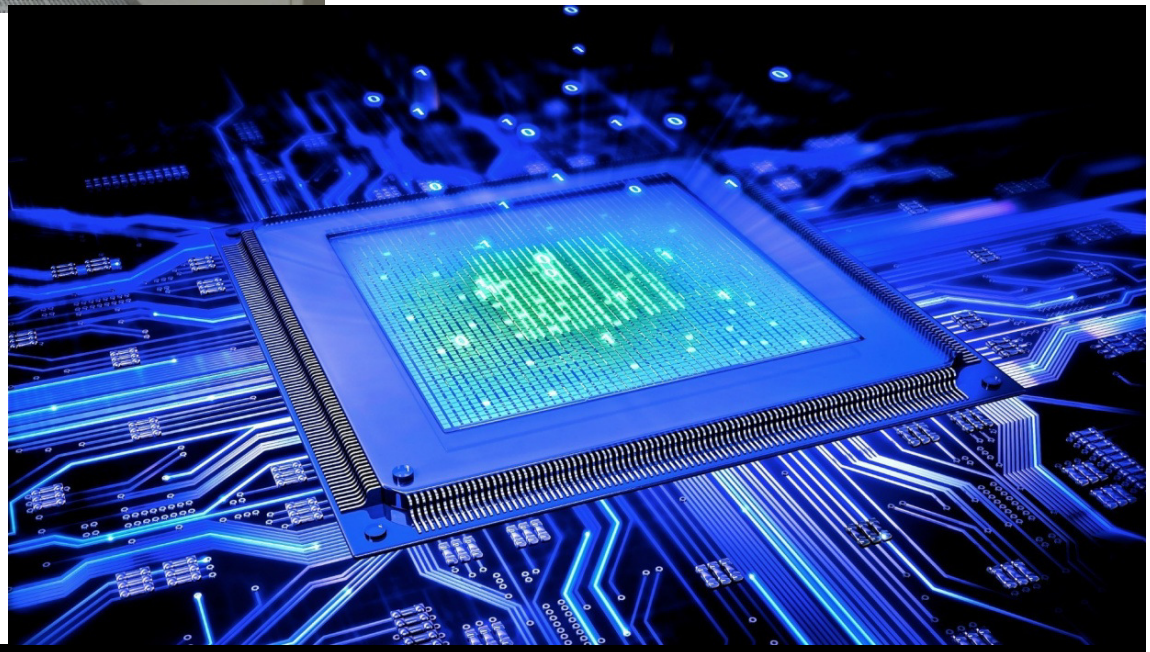
Building Systems: Christian Electric, MP Electric, …

Appliances: GE, Whirlpool, Google-Nest Labs, Cadet, …

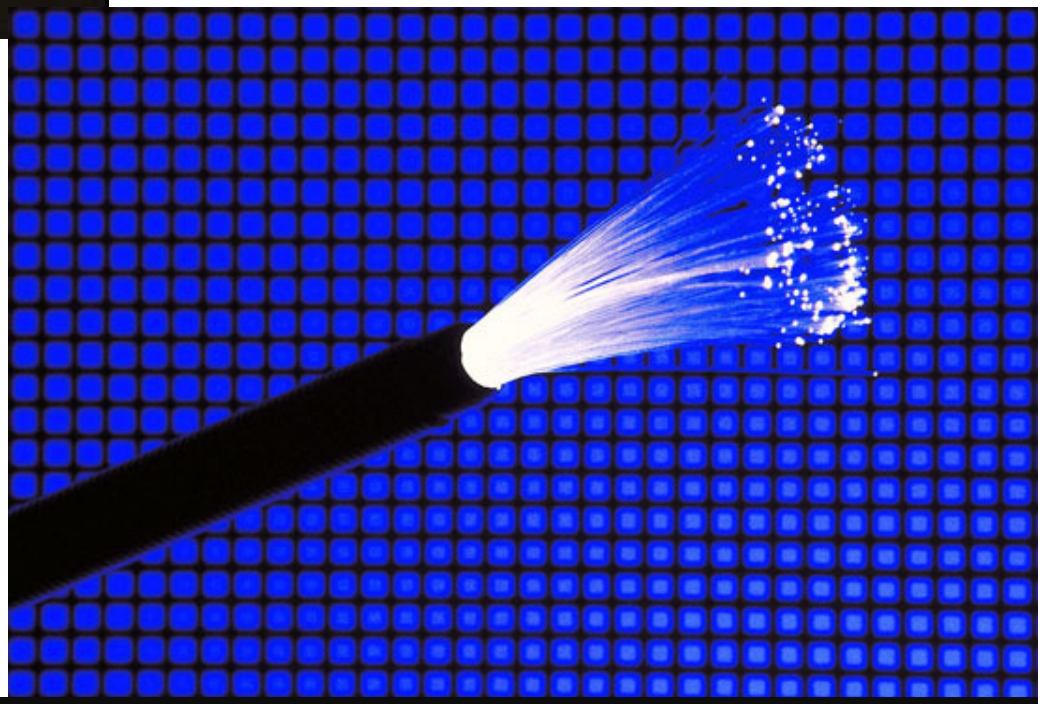
Electric Cars: Tesla Motors, GM, Ford, Nissan …

Bio Medical: Siemens , General Electric, Medtronic, Hospitals, ...



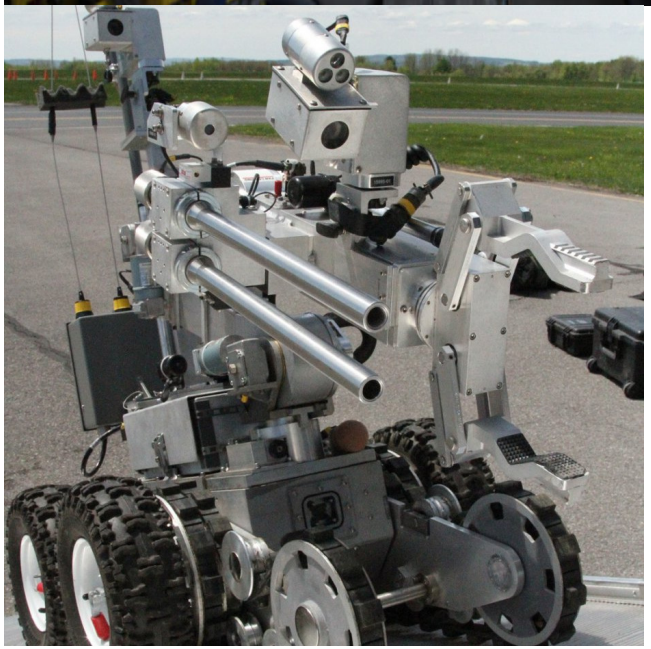


Semiconductors: Intel, SEH America, Microchip, Micron, Nvidia, AMD



Laser & Photonics: Nlight, Synrad, Axcel Photonics, …

Satellite & Space: Space X, Rockwell, Boeing, …



Robotics & Automation: Columbia Machine, ABB Ltd, Honda, …

Drones: Boeing-Insitu, Amazon, Inven Sense, …

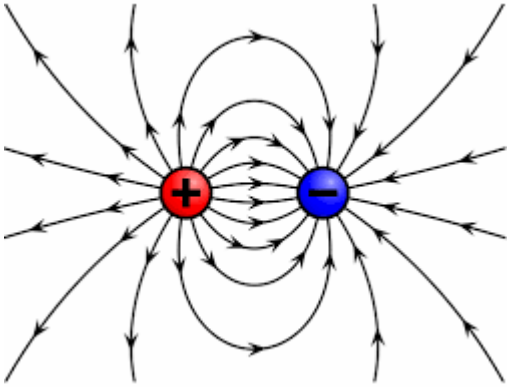
Self-Driving Cars: Ford/Uber, Google, Apple, Tesla, …

ID & Virtual Reality: Motorola, Alien, Facebook-Oculus, Google, Microsoft, …

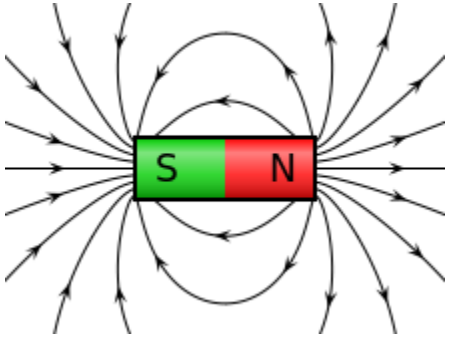
Electrical & Programming Projects …

Electromagnetism - Project

- Use the knowledge of Electromagnetism to build a motor with a battery, magnet, nail and Piece of wire.

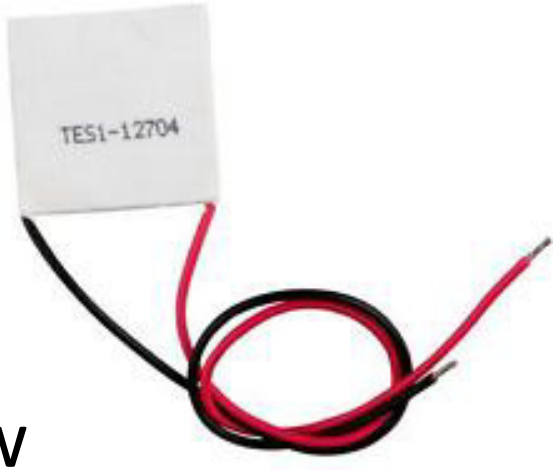


Electric Field



Magnetic Field

Peltier Device - Project



- Your company has developed a new material capable of converting thermal energy to/from electrical energy.

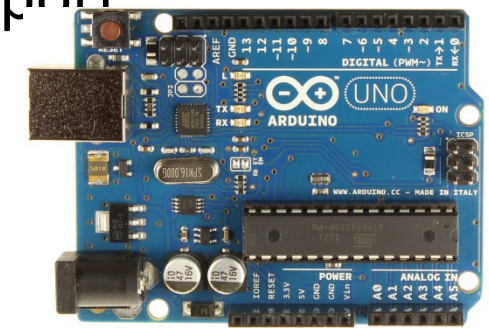
- Your Team's objective is to come up with a product idea, present it to your managers and convince them that your idea is the best use of this new material.

Automation Projects Using Arduino

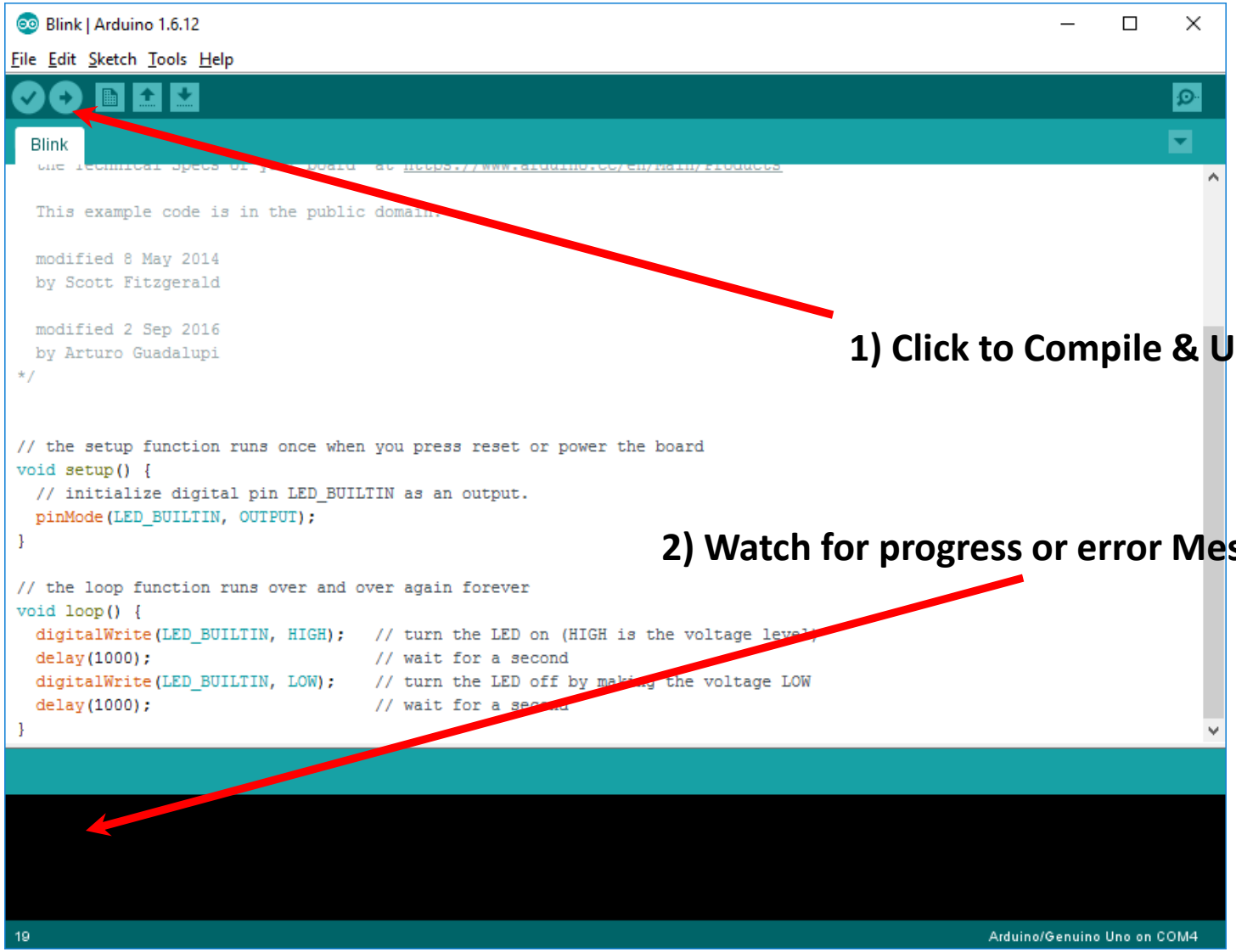
"Great source of tutorials and Arduino projects : https://www.arduino.cc/en/Tutorial/HomePage"

Arduino - Login and Set up

1) Turn on the computers and login (labs):
   a) User:
   b) Password:
2) Connect Arduino Board to computer with USB cable
3) Click on Arduino Logo to start Arduino IDE
4) User “Tools>Board:..” to select “Arduino Uno”
5) Use “Tools>Port” menu to select <COM> port
6) Load sample LED blink example from File>Examples>01.Basics>Blink menu



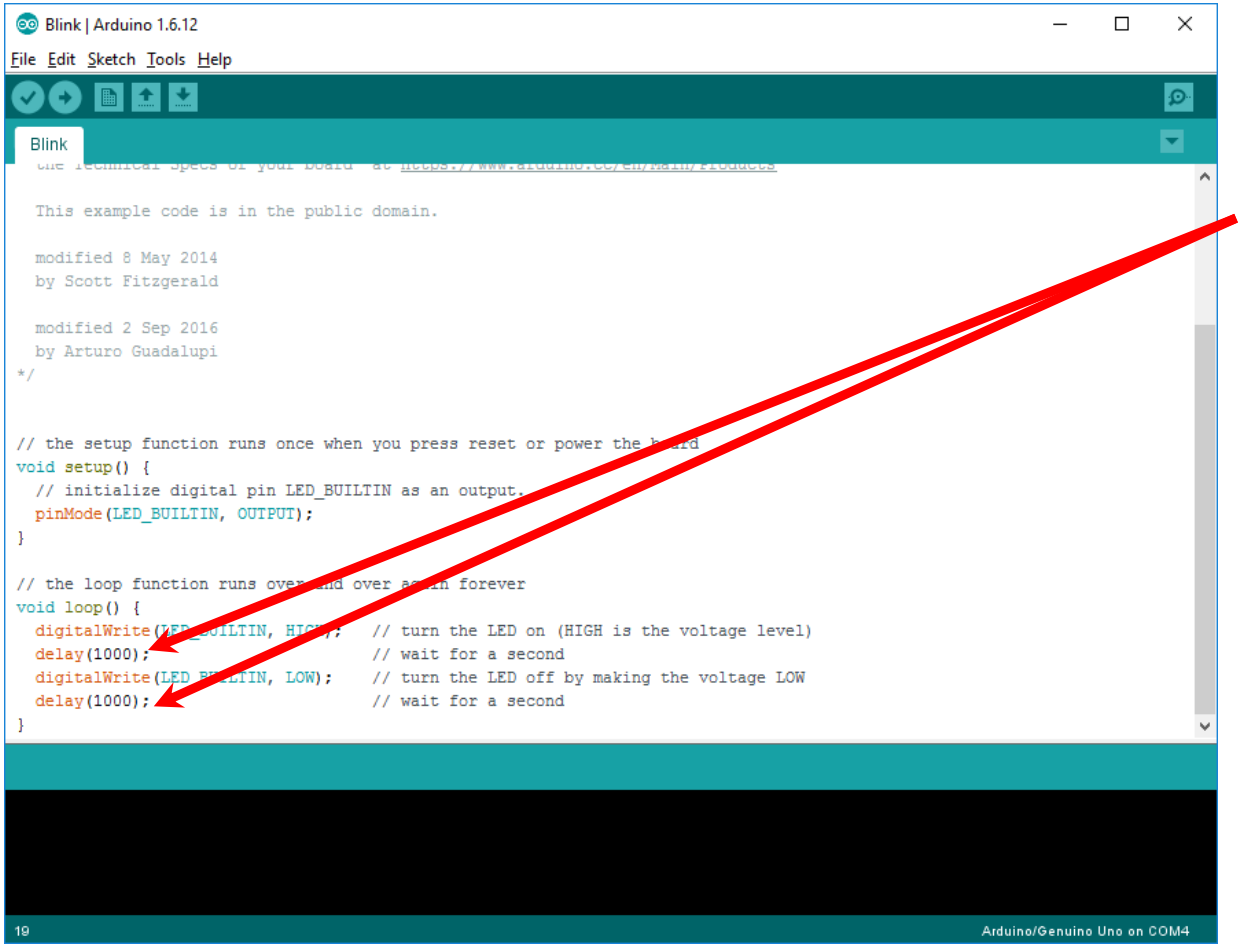
Arduino – First Program



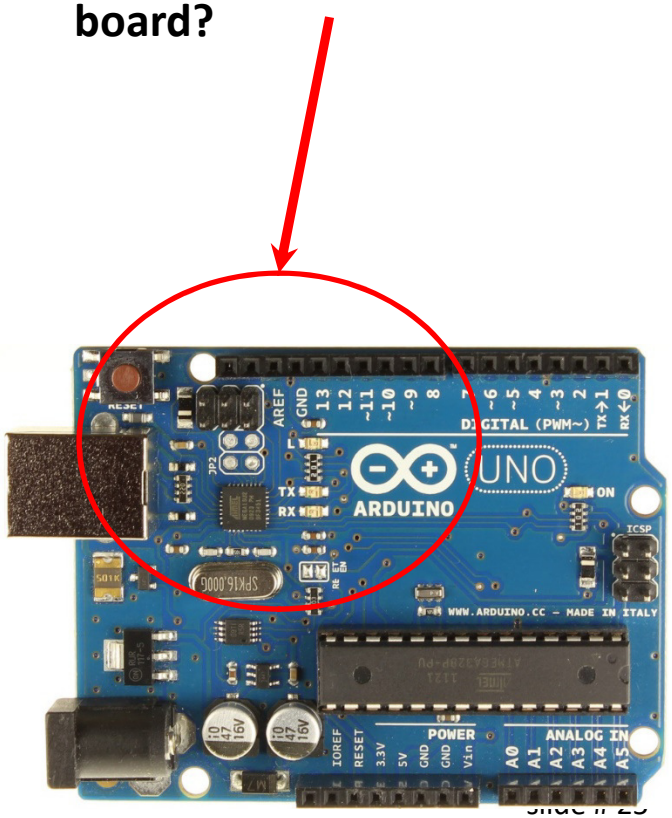
1) Click to Compile & Upload

2) Watch for progress or error Messages

Arduino – First Modification



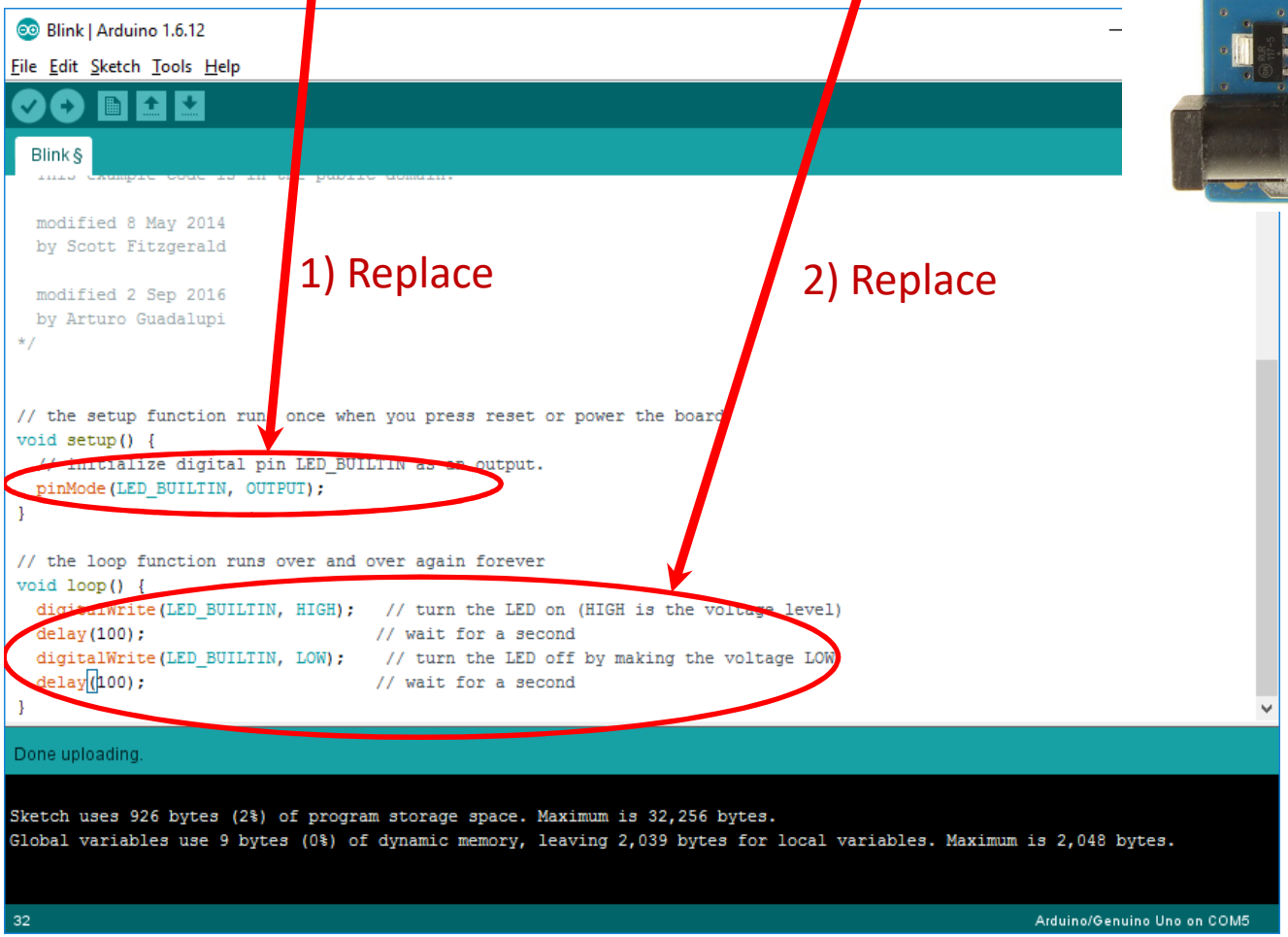
1) **Change from 1000 to 100**
2) **Compile & upload**
3) **Did anything change on the board?**



Arduino – Motor driver

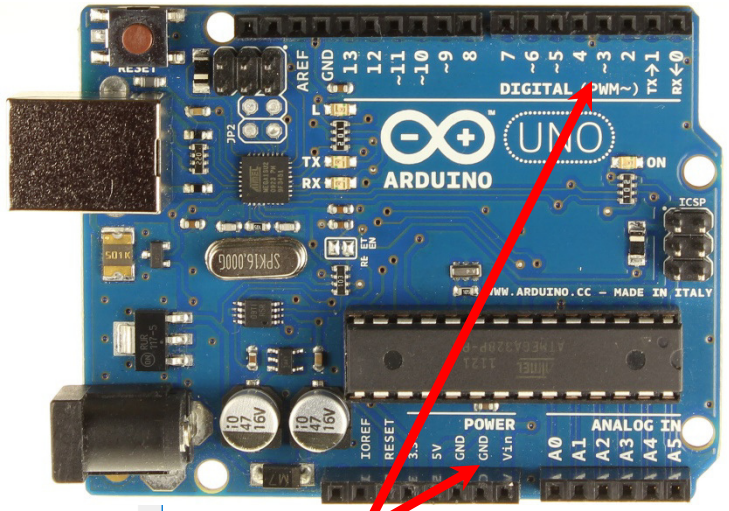
pinMode(3,OUTPUT);

digitalWrite(3,HIGH);
delay(2000);
digitalWrite(3,LOW);
delay(2000);



1) Replace

2) Replace



3) Connect one motor wire to GND pin and the other wire pin ~3.

4) Compile and Upload the program.

Arduino – Solar Cell

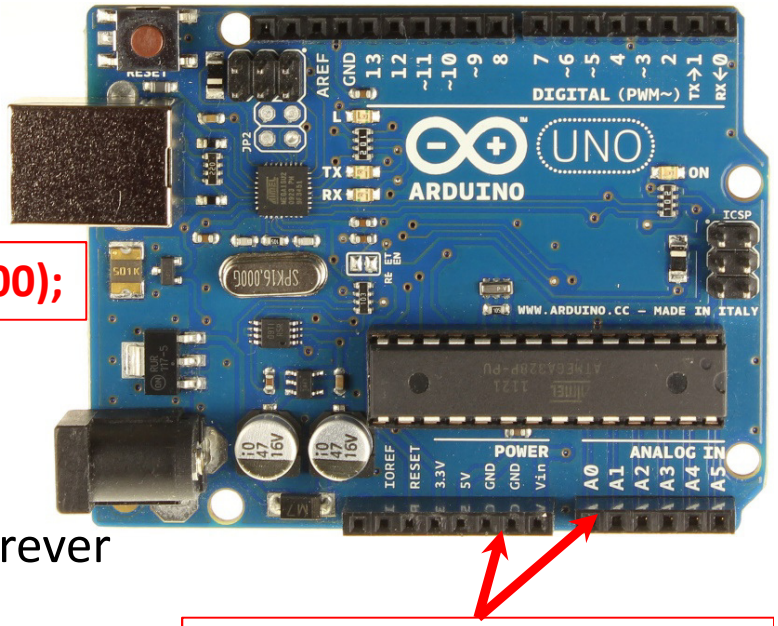
1) Add **int value;**

```
// the setup function runs with power board
void setup() {
  // initialize digital pin as an output.
  pinMode(3,OUTPUT);

 }

// the loop function runs over and over again forever
void loop() {
  digitalWrite(3,HIGH);
  delay(2000);
  digitalWrite(3,LOW);
 delay(2000);
}
```

2) Replace **Serial.begin(9600);**

3) Replace

```
value = analogRead(0);
Serial.println(value);
delay(100);
```



4) Connect solar cell red wire to pin A_0 and black wire to GND pin.

5) Compile and Upload the program.

Arduino – Solar Cell

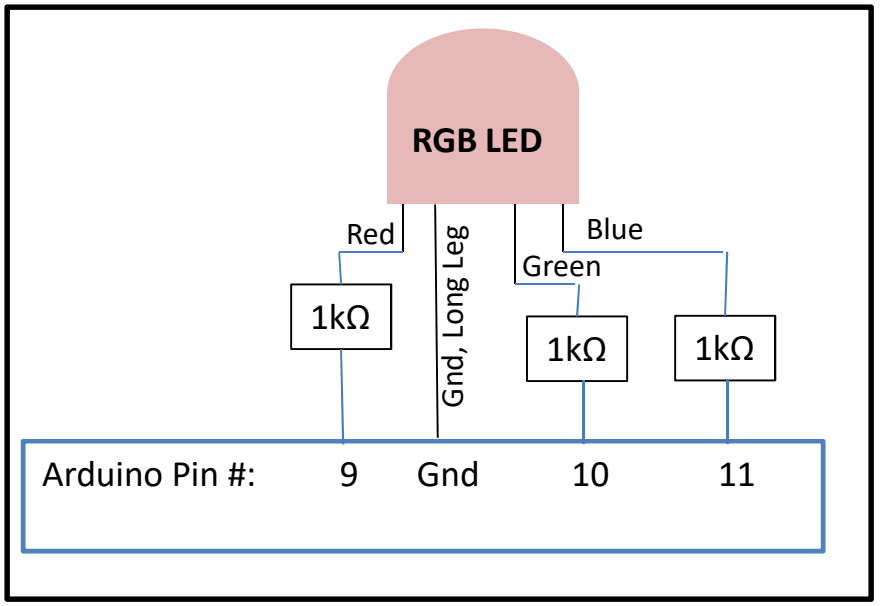
```
int value;

// the setup function runs once
void setup() {
   Serial.begin(9600);
}

// the loop function runs over and over
void loop() {
  value = analogRead(0);
  Serial.println(value);
  delay(100);
}
```

Use "Tool>Serial Plotter" menu to monitor Solar Cell Output .

0 → represents 0 volt
1023 → represents 5 volts

RGB LED

```
// RGB color test code for Arduino

// Digital pins controlling RGB
const int RED= 9;
const int GREEN = 10;
const int BLUE = 11;

// one-time execution
void setup() {
  pinMode(GREEN, OUTPUT);
  pinMode(BLUE, OUTPUT);
  pinMode(RED, OUTPUT);
 }

// repeated execution
void loop() {
   analogWrite(RED,100);   analogWrite(GREEN,0);   analogWrite(BLUE,0);
  delay(1000);
  analogWrite(RED,0);   analogWrite(GREEN,100);   analogWrite(BLUE,0);
  delay(1000);
  analogWrite(RED,0);   analogWrite(GREEN,0);   analogWrite(BLUE,100);
  delay(1000);
}
```



RGB LED Color Exploration

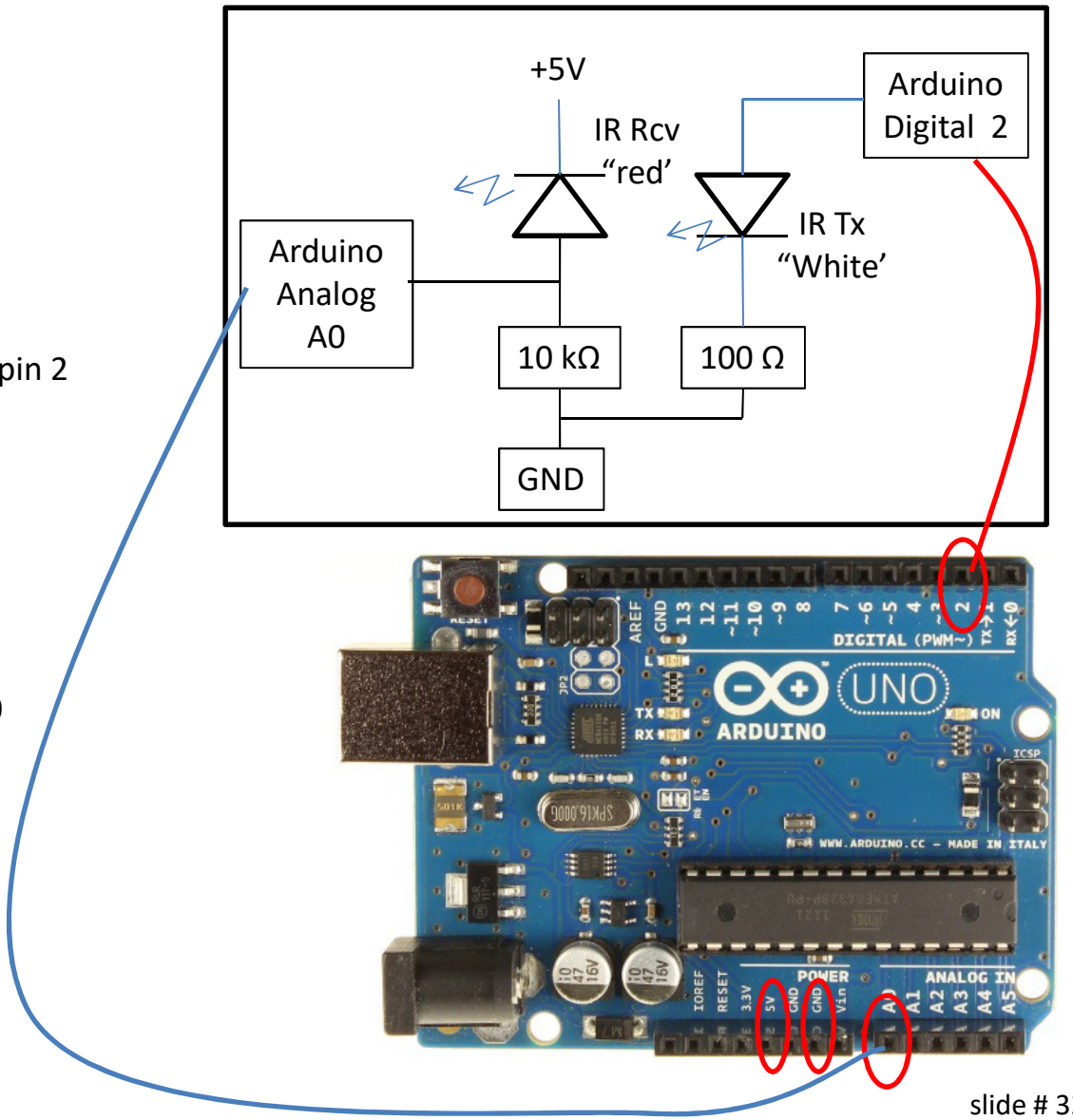
- Modify the program to make the following colors:
  - Pink
  - Yellow
  - Make your favorite color

Solar & Motor Exploration

Connect the Solar Cell and Motor as described earlier. Now run the motor when solar cell is not blocked and stop the motor when solar cell is exposed to light.

Infrared (IR) Detector

```
// IR Sample Code for Arduino

int sense;

// one-time execution
void setup() {
  pinMode(2, OUTPUT);       // IR Transmitter on pin 2
  Serial.begin(9600);       // Set up serial monitor
}

// repeated execution
void loop() {
  digitalWrite(2, HIGH);    // Turn tx on
  delay(10);
  sense = analogRead (0);   // read voltage on A0
  Serial.println(sense);
  digitalWrite(2, LOW);     // Turn tx off
  delay(100);
}
```



HexBug Project

Use Arduino to create a autonomous robot using simple HexBug (http://linux.engrcs.com/HexBug).

Human Computer

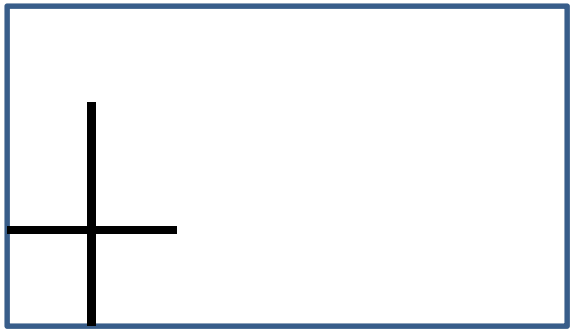
- Use the following Human Computer (HC) instruction set to write a program that can be executed by a human acting as a computer.

Command, Data	Code	Action
Start, 00	00,00	Start from bottom left corner of paper
Move Up, inches	01, #	Move the pen Up without drawing
Move Down, inches	02, #	Move the pen Down without drawing
Move Left, inches	03,#	Move the pen Left without drawing
Move Right, inches	04,#	Move the pen right without drawing
Draw Up, inches	05, #	Move the pen Up while drawing
Draw Down, inches	06, #	Move the pen Down while drawing
Draw Left, inches	07,#	Move the pen Left while drawing
Draw Right, inches	08,#	Move the pen right while drawing
Done, 255	255, 255	Done - Stop

- Example Code:

Seq.	Code
1	00,00
2	01,02
3	08,04
4	01,02
5	03,02
6	06,04
7	255,255

Code Execution Results:



Addition Project/Learning Resources

- Scratch Programming Environment (https://scratch.mit.edu/)
  Free programming language and online community where you can create your own interactive stories, games, and animations.

- Arduino (https://www.arduino.cc/)
  Open-source electronic prototyping platform enabling users to create interactive electronic objects.

- Raspberry Pi (https://www.raspberrypi.org/)
  Low-cost, high-performance computers that people use to learn, solve problems and have fun.

- Unity Game Engine (https://unity3d.com/)
  Unity is a platform offering everything you need to create an engaging game.

- Tutorials Point (https://www.tutorialspoint.com/codingground.htm)
  Self-guided tutorial for a wide range of programming languages with a built-in development environment.