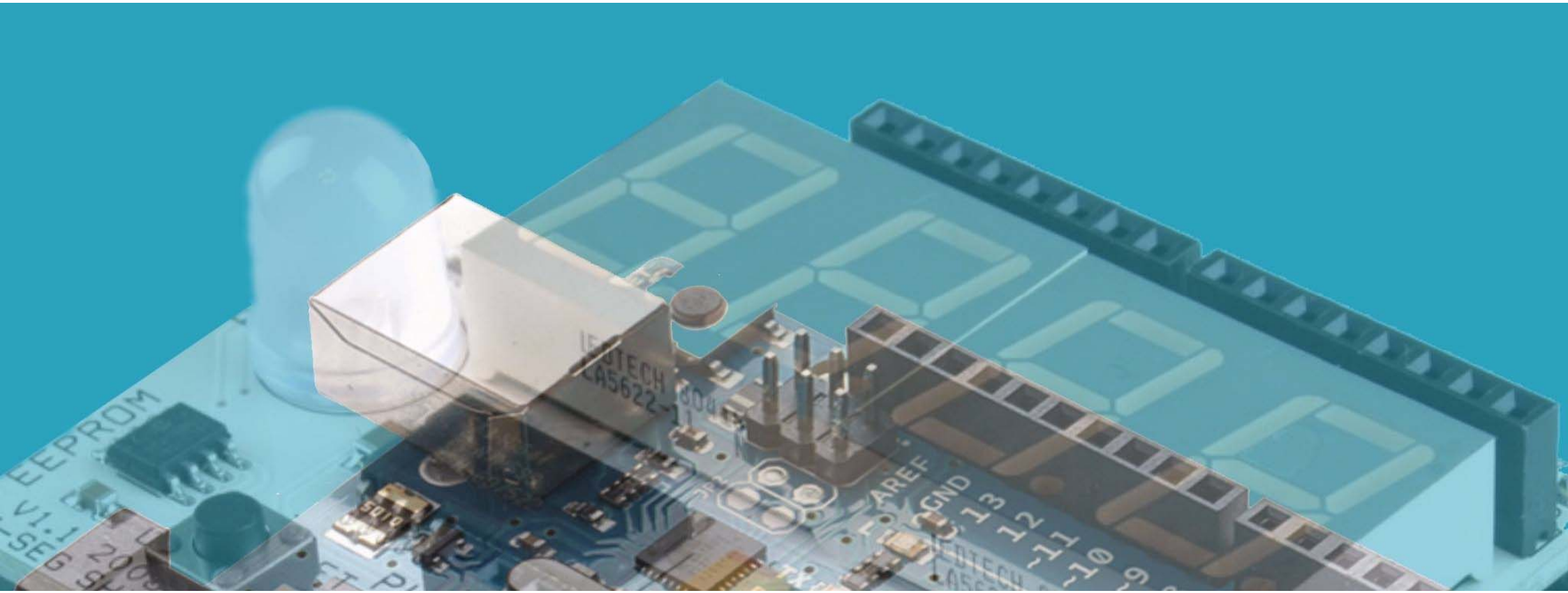


BUILD YOUR OWN ARDUINO UNO SHIELD

SESSION 01

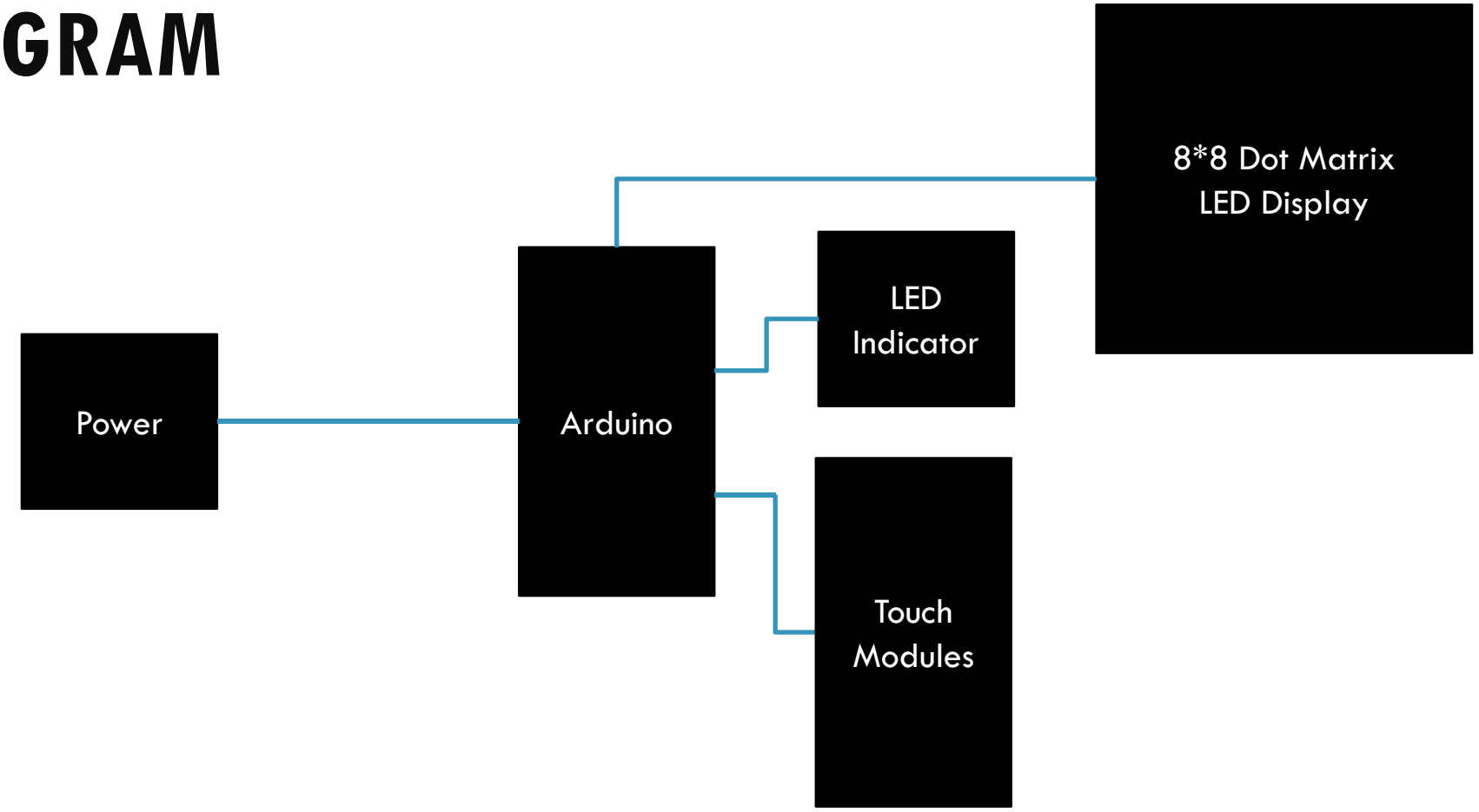
12 GEEKS

AIS CUBE

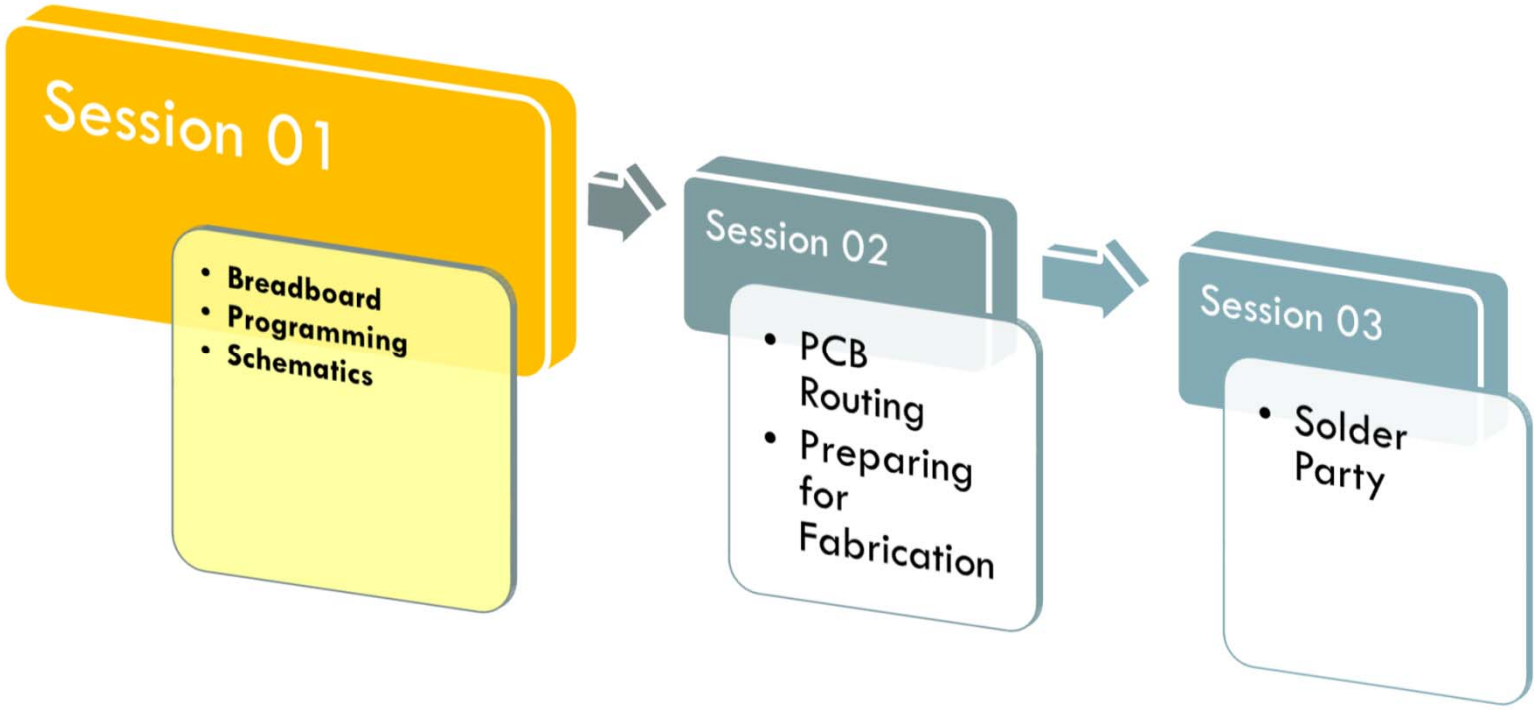
A LITTLE BACKGROUND INTRODUCTION

We've been around since 2002
PS: No, we're not a start up
PPS: No, I'm not a fresh grad

BLOCK DIAGRAM



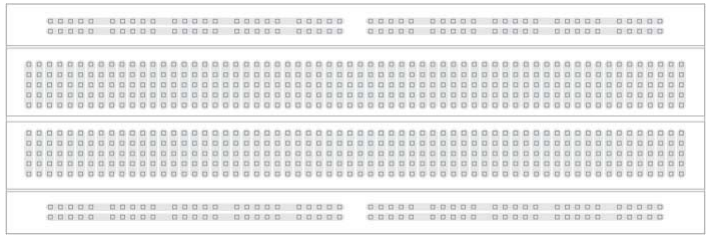
SIMPLIFIED PROTOTYPING PROCESS

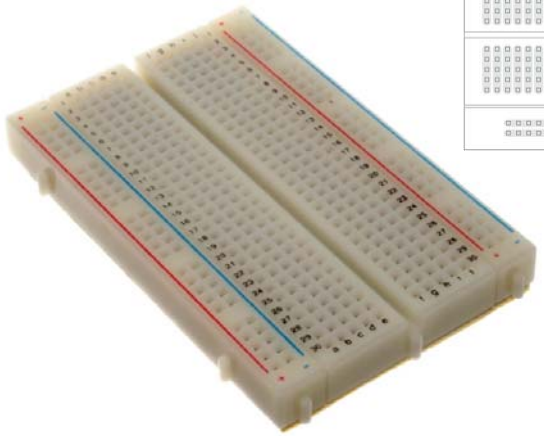


WHAT'S A BREADBOARD?

What's it used for

- Testing circuits
- Making non-permanent connections
- Easily add/remove components

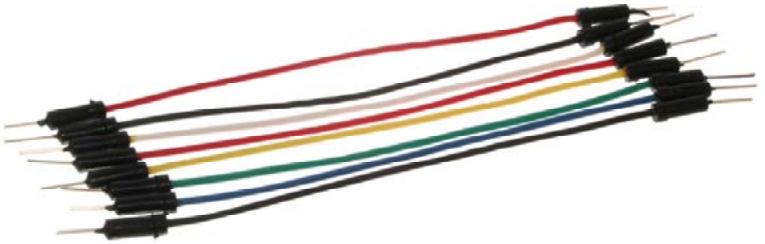


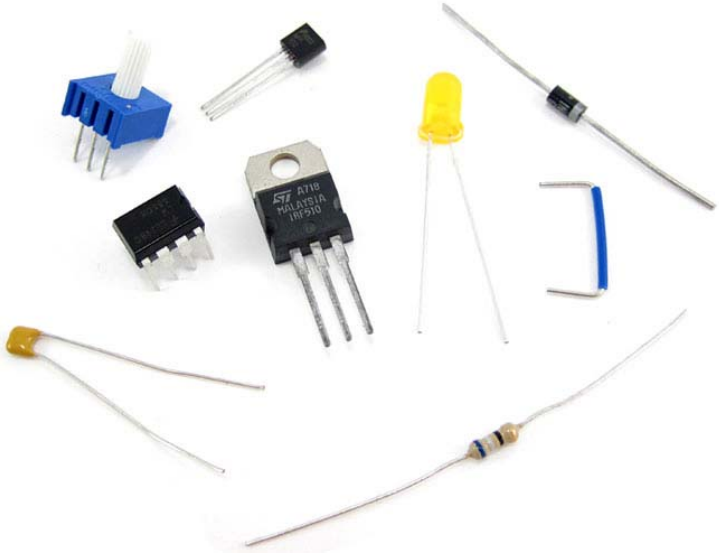


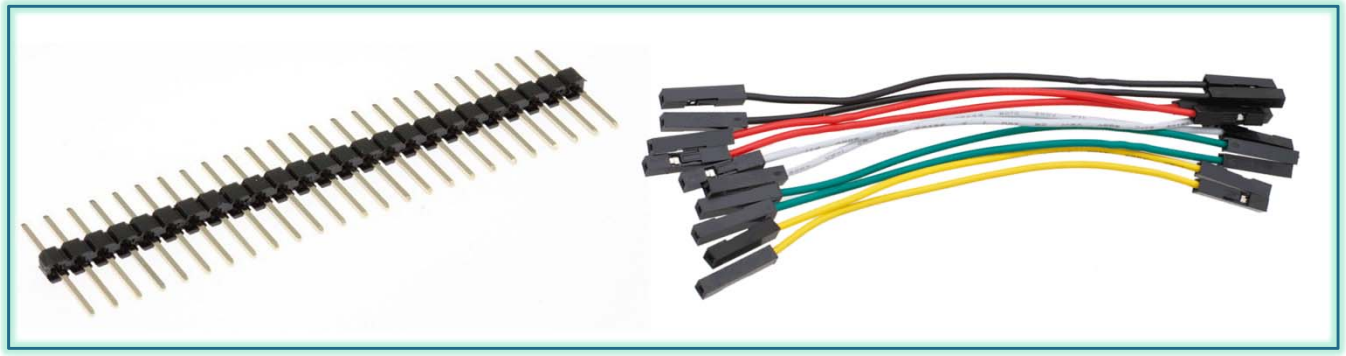
WHAT GOES INTO A BREADBOARD?

Through-hole components

…and wires

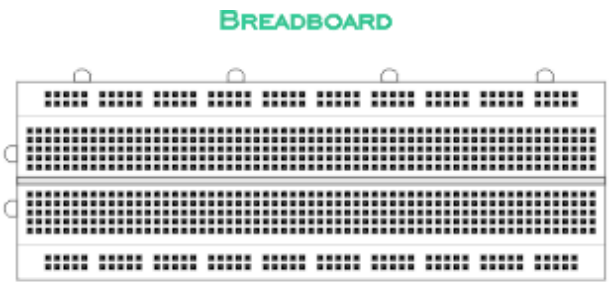


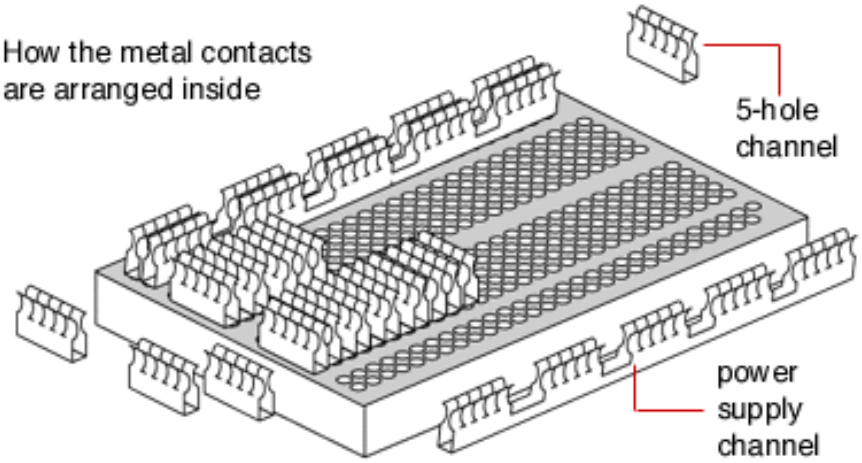


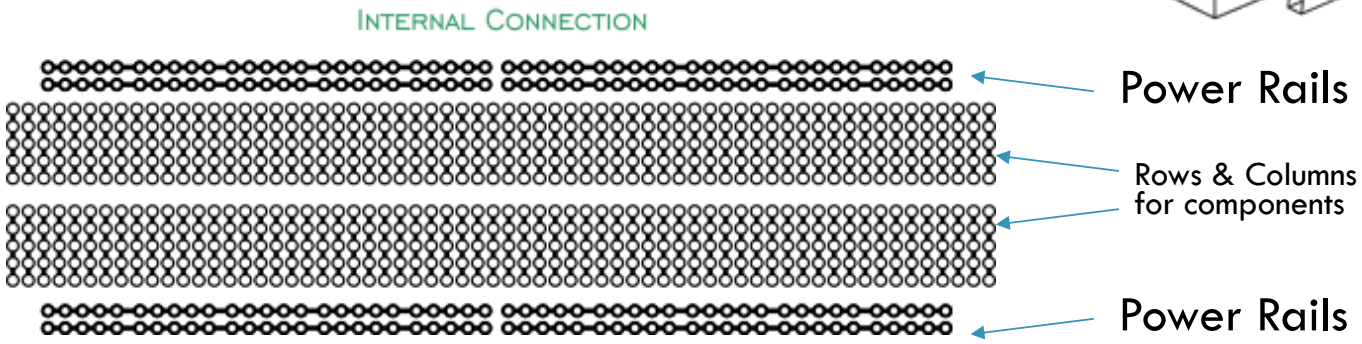


WHAT'S INSIDE A BREADBOARD?

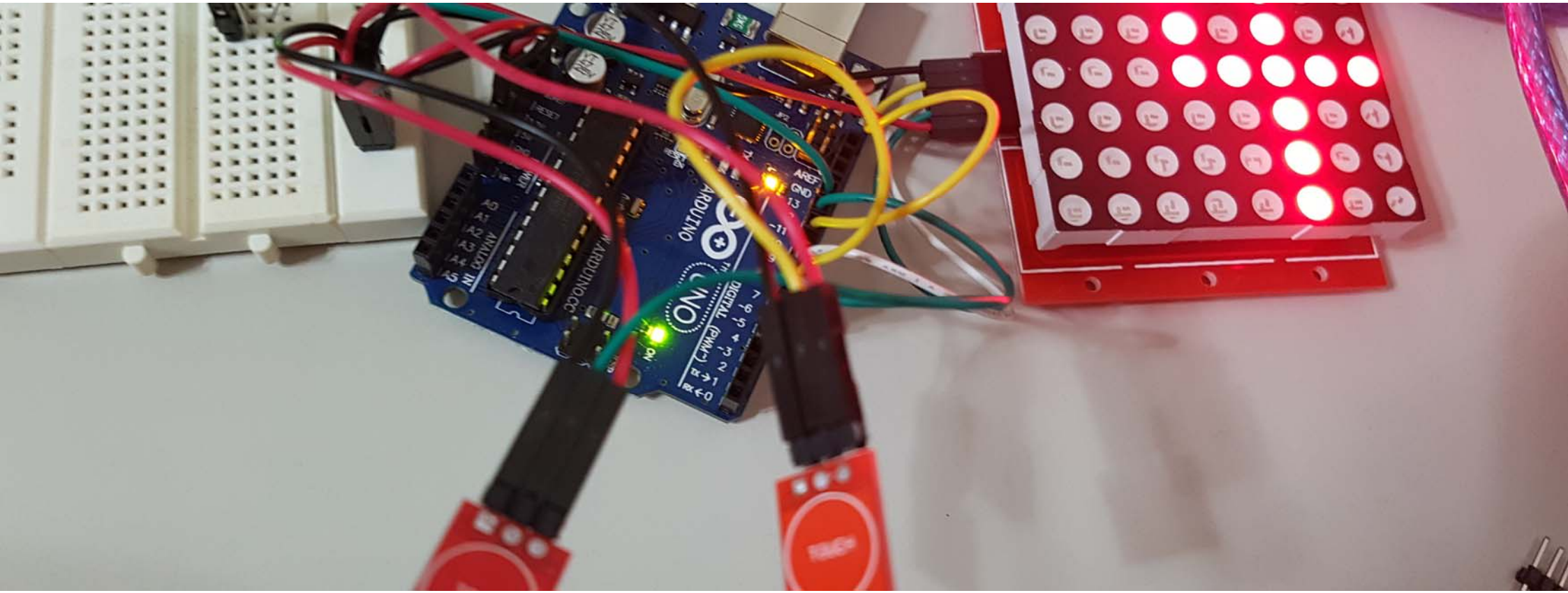
Internals







Doesn't it remind you of paper clips?

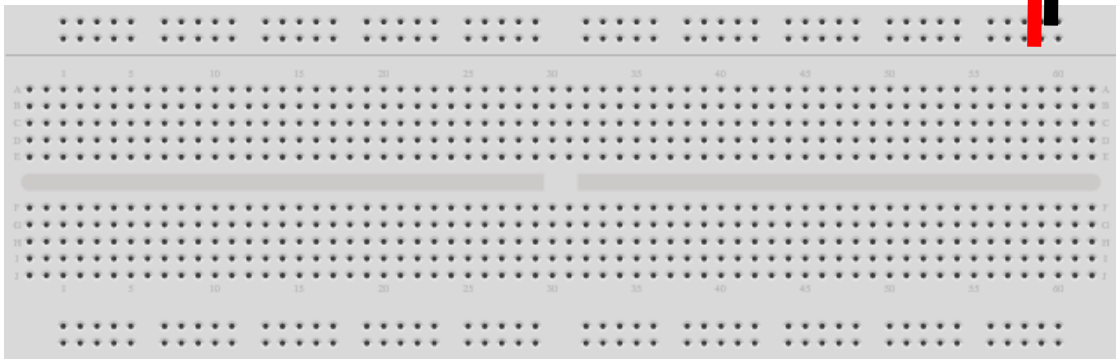


LET'S GET STARTED


BLASTED WORK SAFETY REGULATIONS!
WARNING!!!
HIGH VOLTAGE!
WARNING!!!
HE MAY BE YOUR FATHER!
www.gamepressure.com
Otis

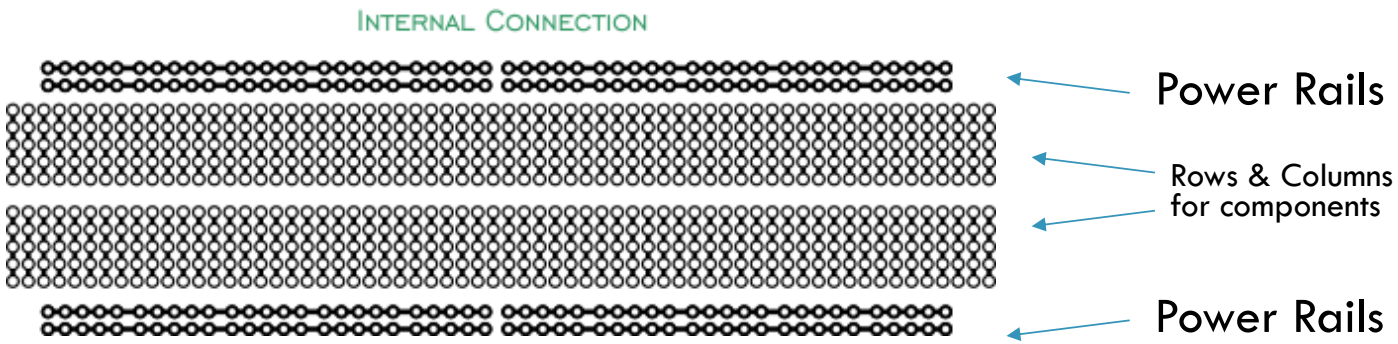
SAFETY FIRST!

LET'S TALK ABOUT POWER

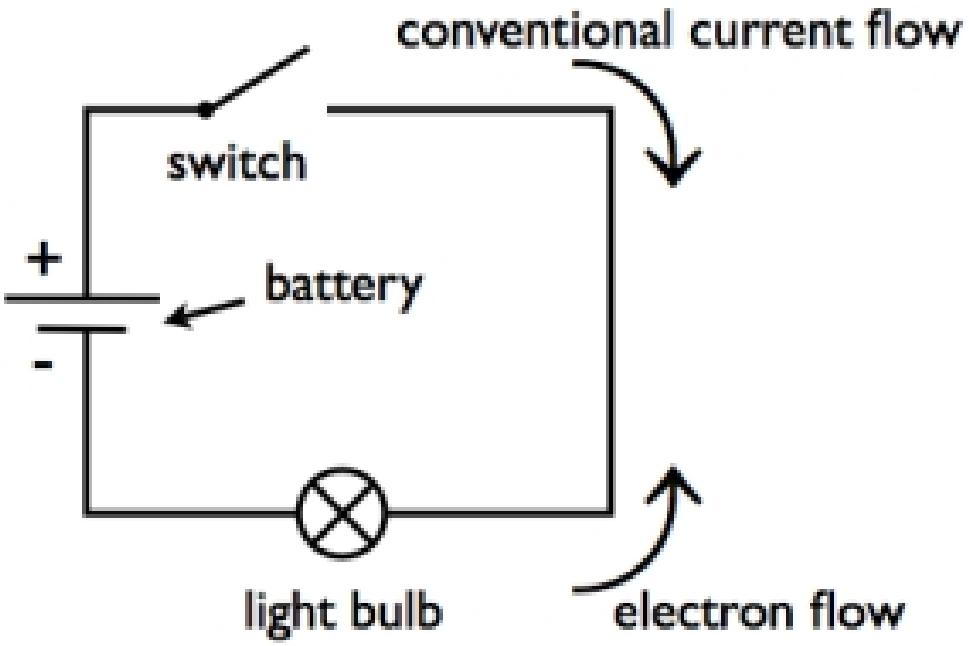


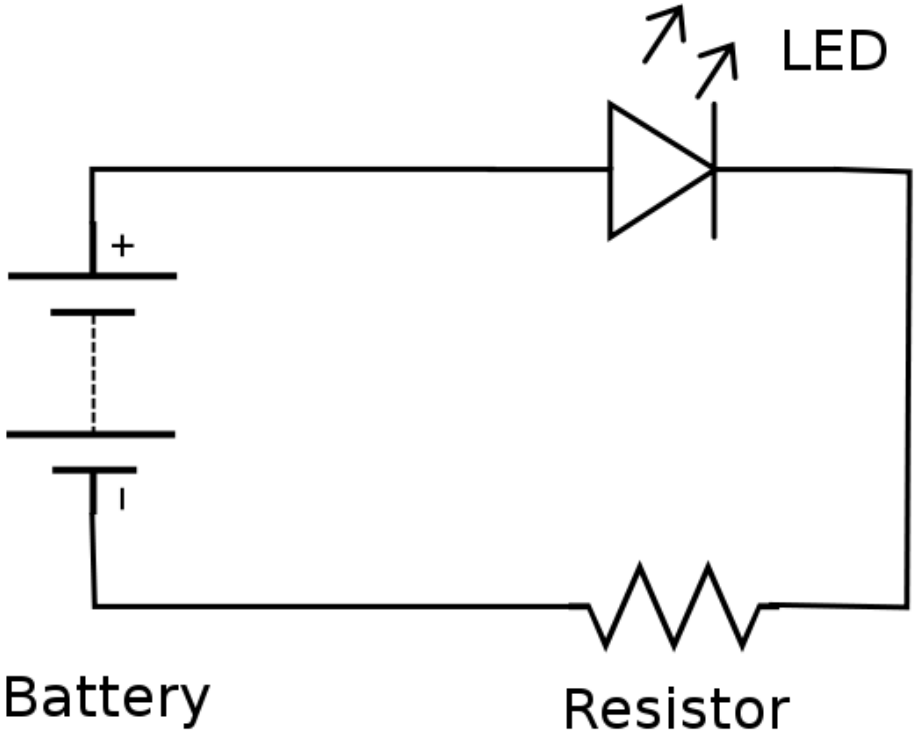
Insert
Dual Row
5 Way Pin Header

LET'S TALK ABOUT POWER



ANYBODY REMEMBER THIS?





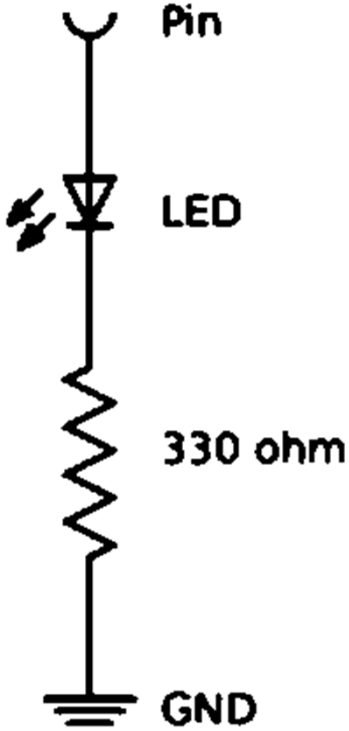
BASIC LED CIRCUIT

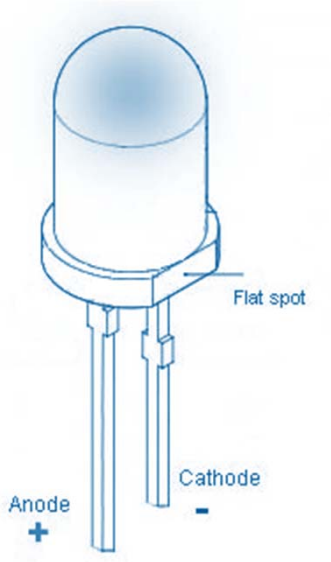
Through hole component

Looking for polarity

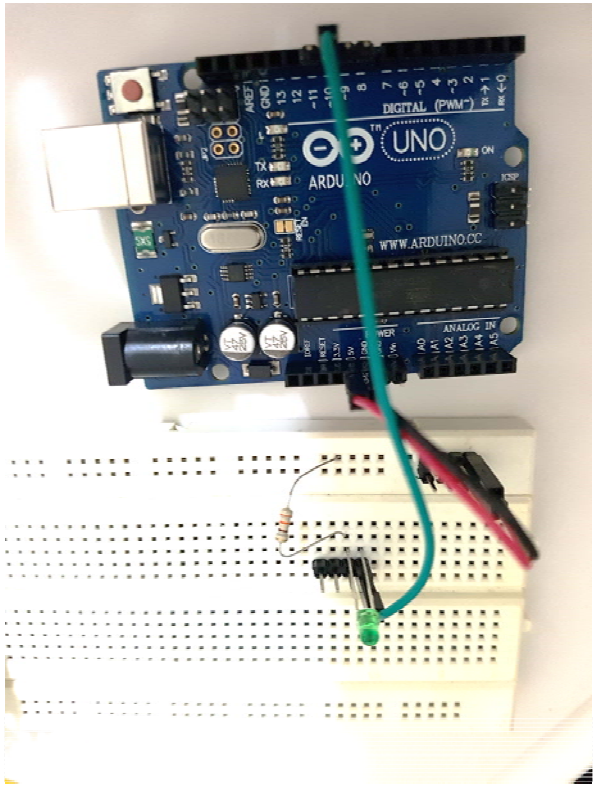
Resistors – 330 ohms

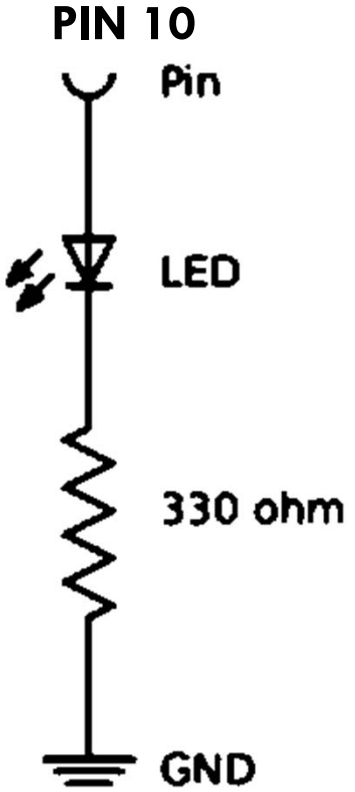
How the circuit works

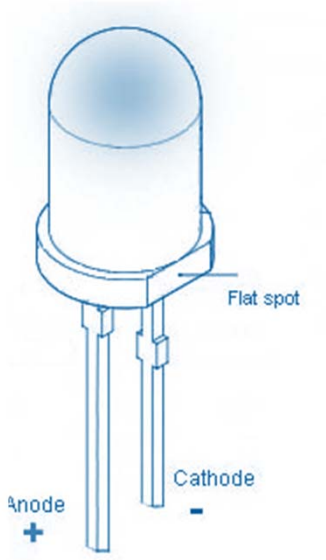




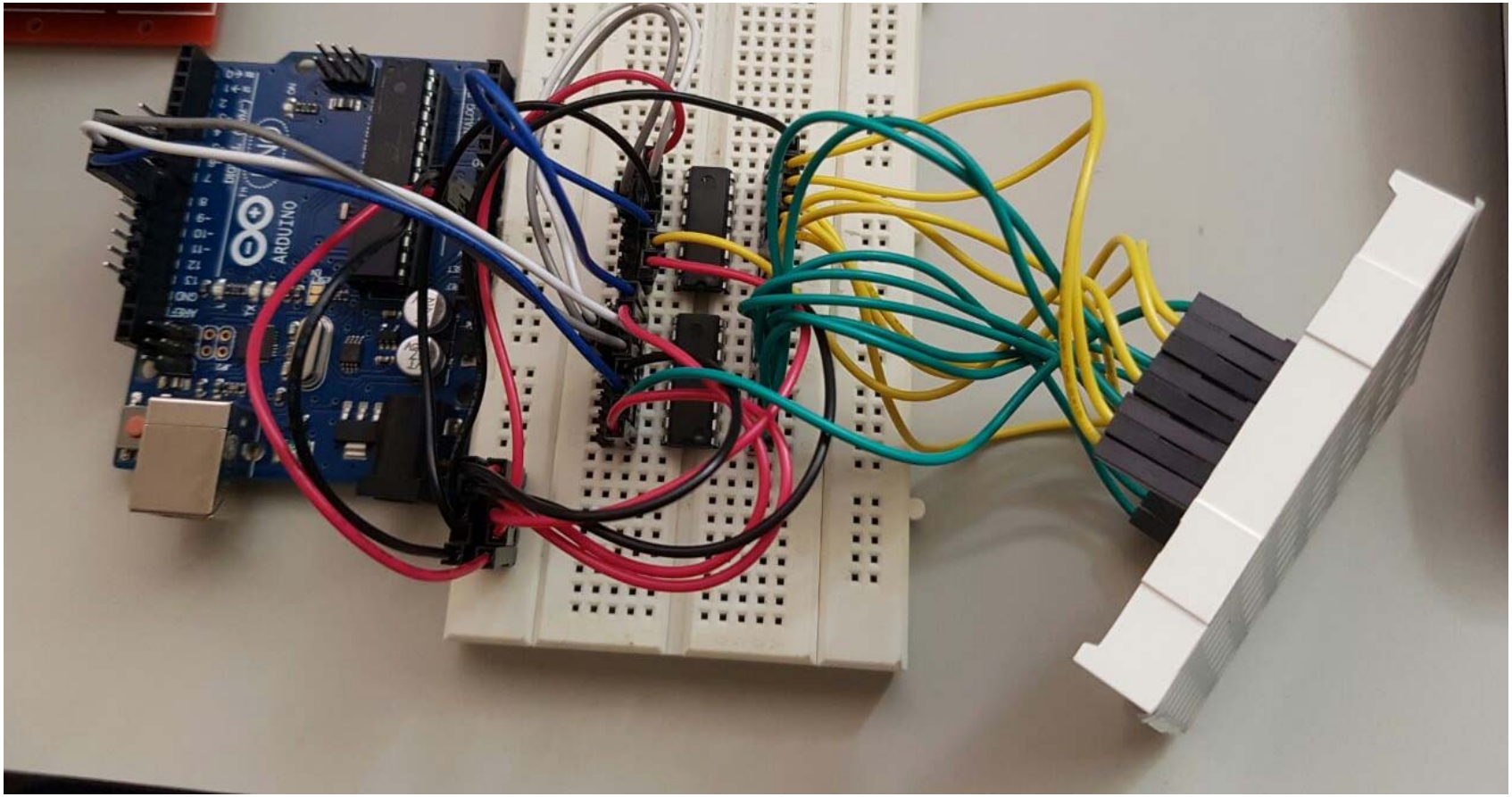
LET'S BUILD THAT LED CIRCUIT







8*8 DOT MATRIX LED DISPLAY

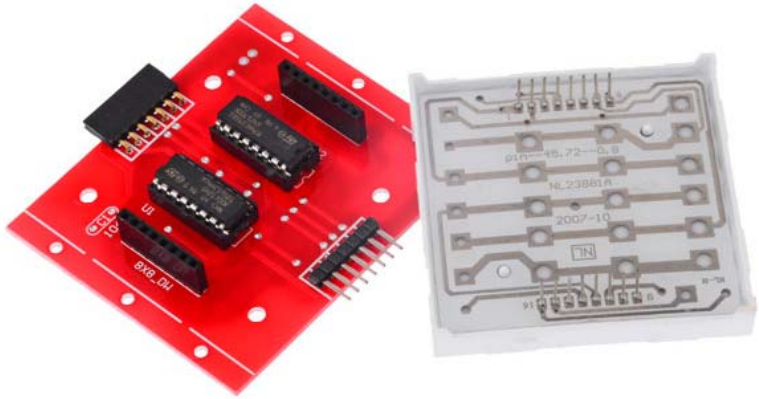


8*8 DOT MATRIX LED DISPLAY MODULE

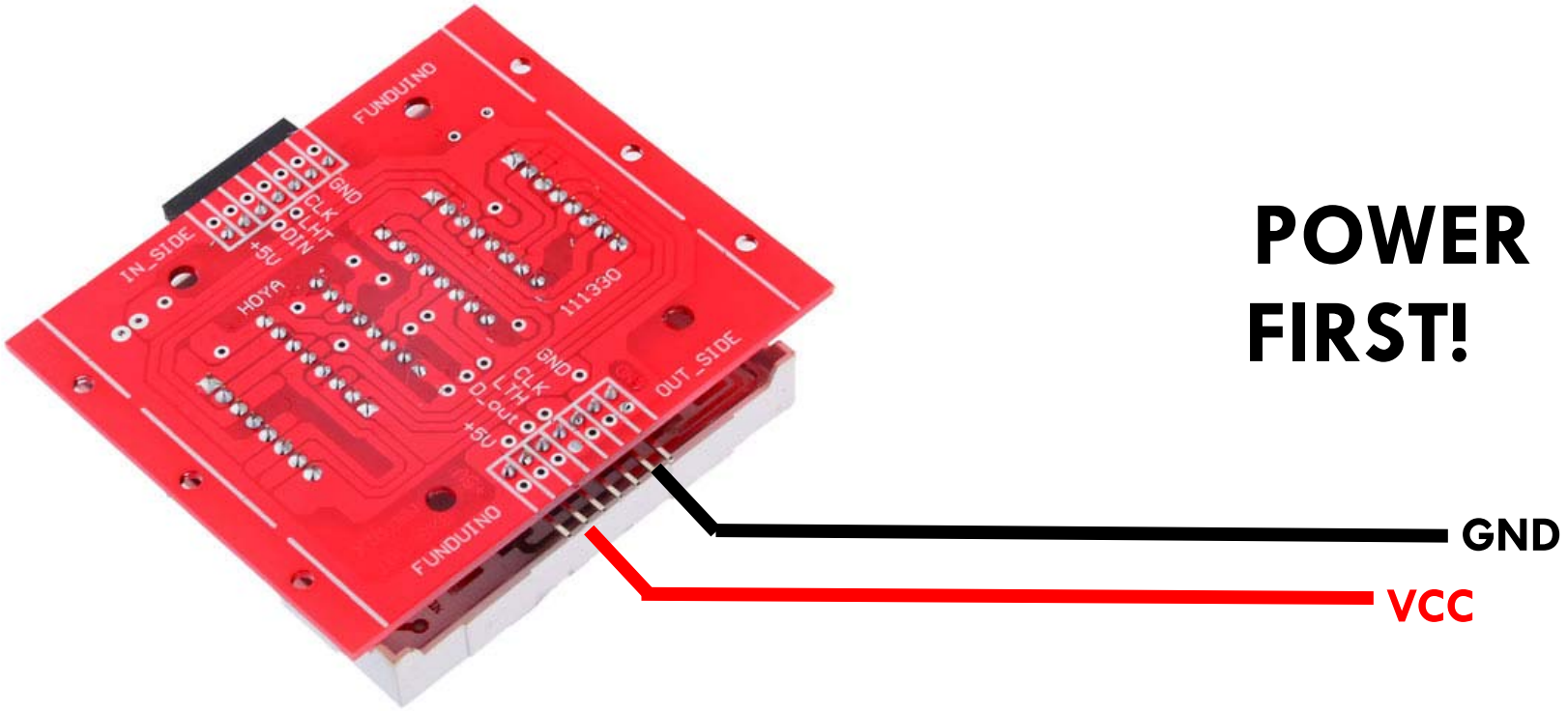
8*8 dot matrix module

Under the hood – 2x 8bit Shift Registers (74HC595)

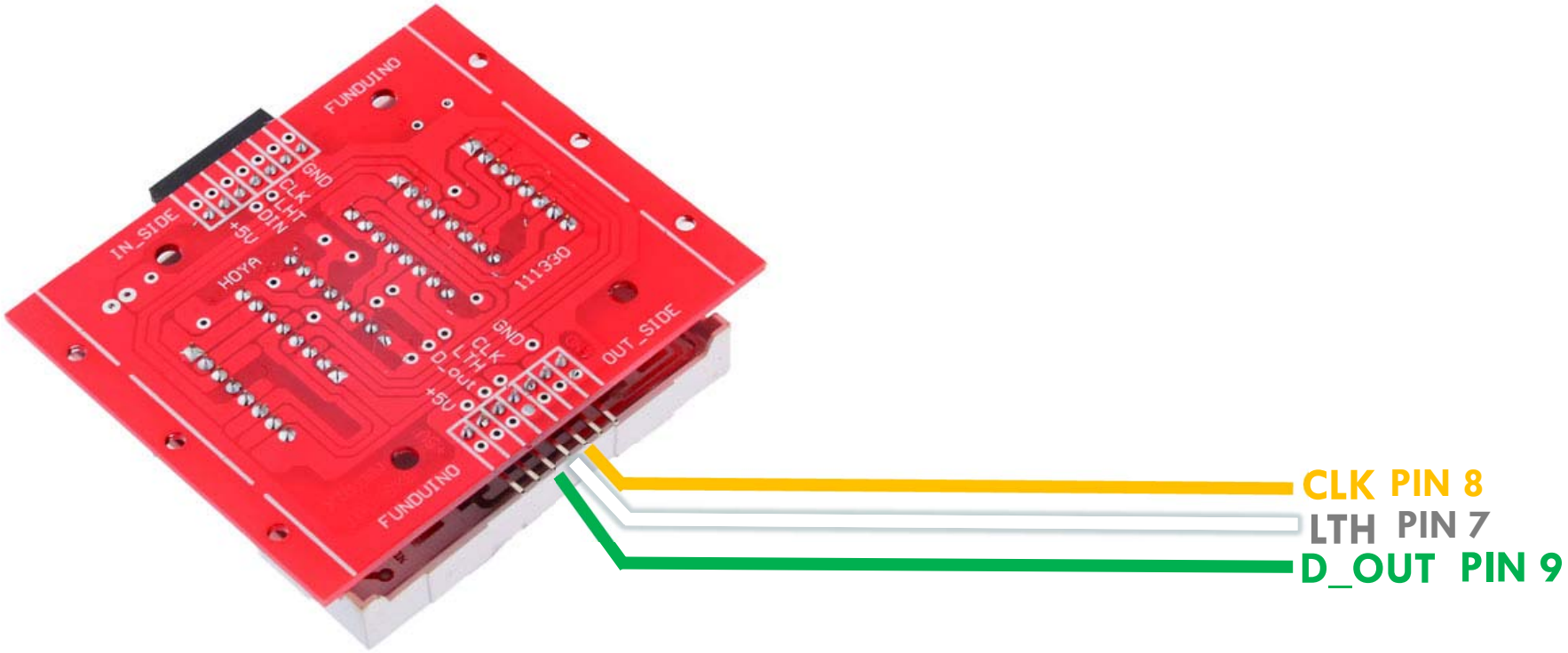
Serial to Parallel



CONNECTING THE DOT MATRIX MODULE



CONNECTING THE SERIAL LINES



AND FOR THE GRAND FINALE

Adding the capacitive touch buttons to pins 5 & 6

By yourself :p

AND THAT'S IT!

Let's program it.

For the next part, you will need to download the Arduino Program

HTTP://WWW.GITHUB.COM/AISCUBE/BYOG_Shield

Arduino Program Examples

SHIELD_8x8_ex1 – Display char at setup.

SHIELD_8x8_ex2– Display 0 to 9.

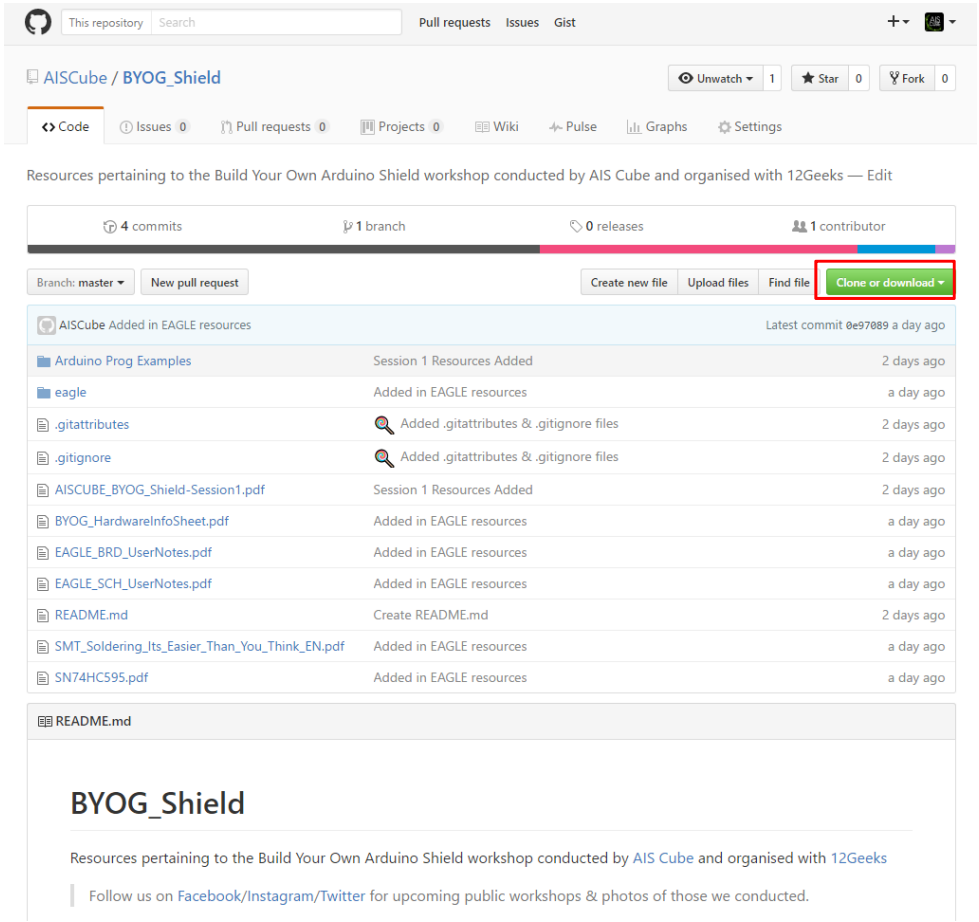
SHIELD_8x8_ex2b – Display A to Z.

SHIELD_8x8_ex3 – Use PB1 to increase.

SHIELD_8x8_ex3b – Use PB1 and PB2 to decrease.

SHIELD_8x8_ex4 – animate Square.

https://github.com/AISCube/BYOG_Shield



1. Download ZIP

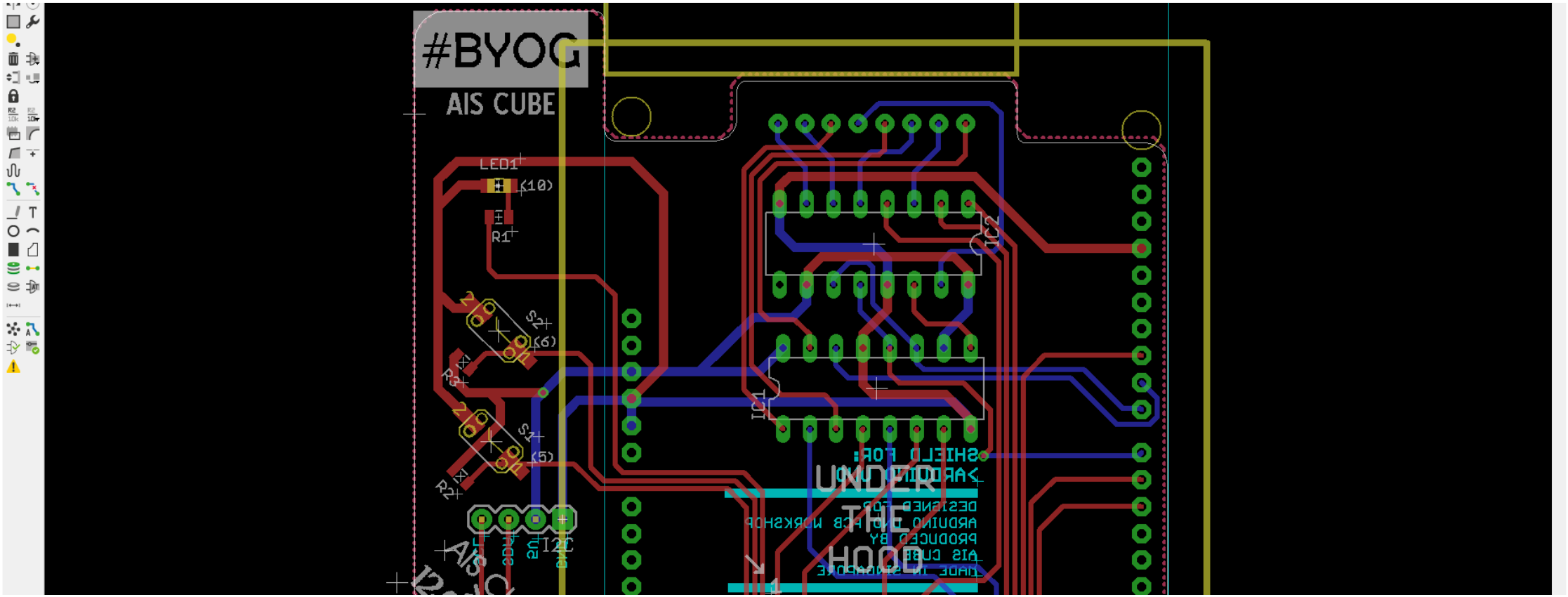
2. Extract the contents

```
int pb1Pin = 5;
int pb2Pin = 6;
int ledPin = 10;

int latchPin = 7;
int clockPin = 8;
int dataPin = 9;

const char data[][8] ={
{0B00000000, 0B00000000, 0B00000000, 0B00000000, 0B00000000, 0B00000000, 0B00000000, 0B00000000},
{0B00000100, 0B00000100, 0B00000100, 0B00000100, 0B00000100, 0B00000100, 0B00000000, 0B00000100},
{0B00001010, 0B00001010, 0B00001010, 0B00000000, 0B00000000, 0B00000000, 0B00000000, 0B00000000},
{0B00000000, 0B00001010, 0B00011111, 0B00001010, 0B00011111, 0B00001010, 0B00011111, 0B00001010},
{0B00000111, 0B00001100, 0B00010100, 0B00001100, 0B00000110, 0B00000101, 0B00000110, 0B00011100},
{0B00011001, 0B00011010, 0B00000010, 0B00000100, 0B00000100, 0B00001000, 0B00001011, 0B00010011},
{0B00000110, 0B00001010, 0B00010010, 0B00010100, 0B00001001, 0B00010110, 0B00010110, 0B00001001},
{0B00000100, 0B00000100, 0B00000100, 0B00000000, 0B00000000, 0B00000000, 0B00000000, 0B00000000},
{0B00000010, 0B00000100, 0B00001000, 0B00001000, 0B00001000, 0B00001000, 0B00000100, 0B00000010},
{0B00001000, 0B00000100, 0B00000010, 0B00000010, 0B00000010, 0B00000010, 0B00000100, 0B00001000},
{0B00010101, 0B00001110, 0B00011111, 0B00001110, 0B00010101, 0B00000000, 0B00000000, 0B00000000},
```

PROGRAMMING THE 8*8 DOT MATRIX



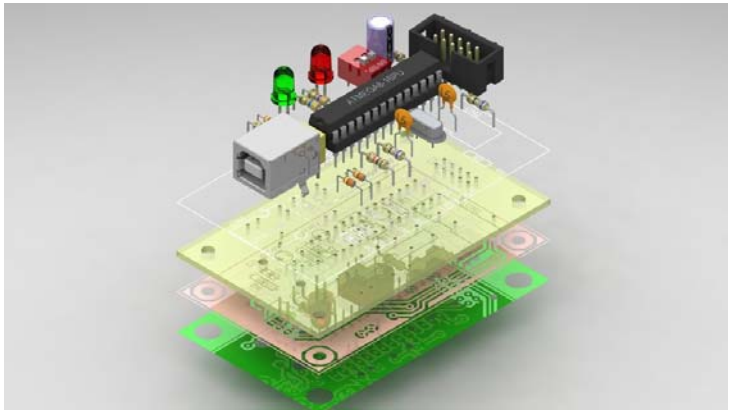
INTRODUCTION TO EAGLE

SO, YOU WANT TO MAKE YOUR OWN PCB

PCB = Printed Circuit Board

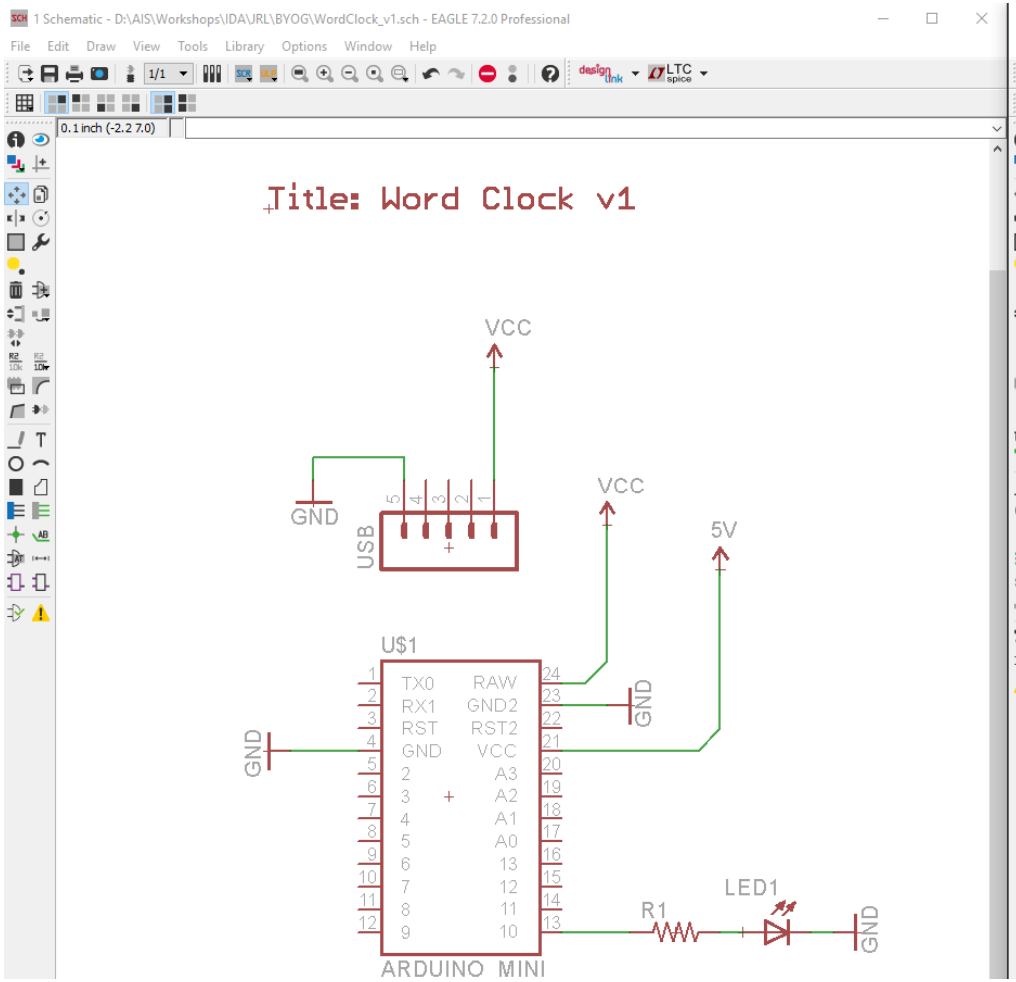
Tools of the trade:

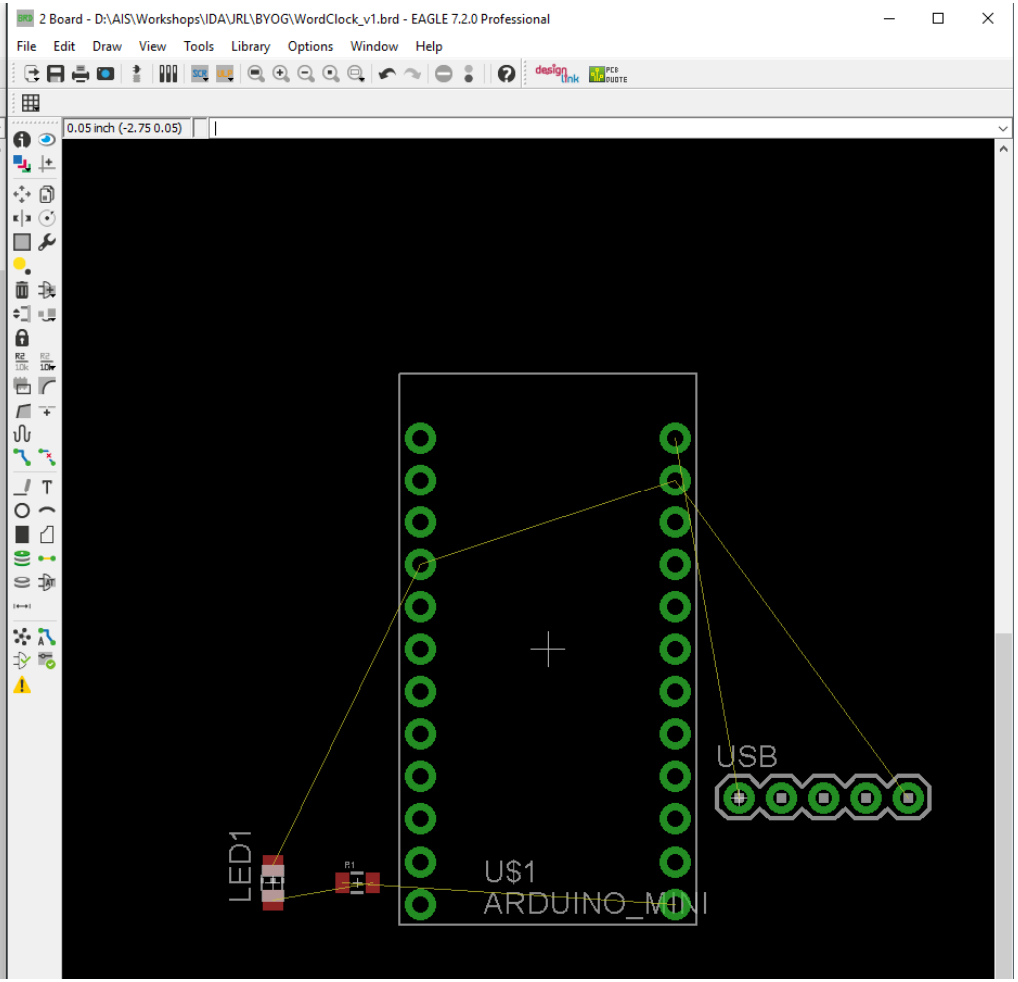
- PCB CAD (Computer Aided Design) Design Software



Schematic (.sch)

Board Layout (.brd)





Electronic **Symbols**

"**Footprint**" of Electronic Parts

DIVING RIGHT IN… WHY EAGLE?

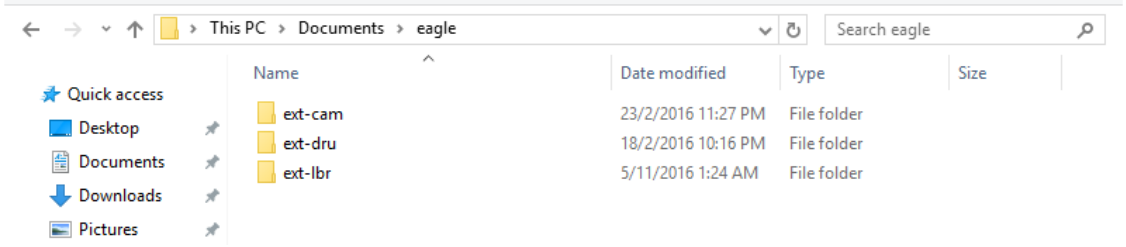
- Cross Platform – Windows/Mac/Linux
- Free version is great for students/hobbyists (non-commercial)
  - **Limitations:**
    - 2 Layer Board
    - Board Dimension: 10 * 8 cm
    - Schematic : Max 2 Sheets
- Great community support
  - Loads of tutorials
  - Many open source hardware designers use EAGLE
  - **Open Source Libraries** – Need a part footprint? It's probably already available somewhere out there.
    - Eagle Community
    - Sparkfun
    - Adafruit
    - Element14
    - (and a lot more)

SETTING UP EAGLE

We've provided some libraries and files that you will find useful in this workshop (and hopefully beyond.) We'll need to let EAGLE know we have these files.

Look for the folder "eagle" inside the contents of the folder you downloaded from github.

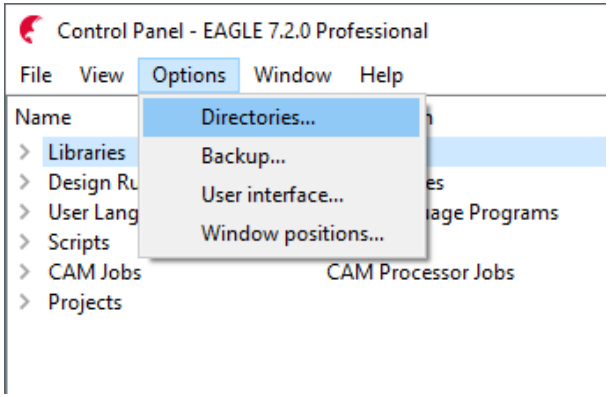
Copy the folder into "Documents" so that it looks like this in file explorer. (or equivalent in MAC/Linux)



STEP 1

In the Control Panel of EAGLE:

Go to Options > Directories

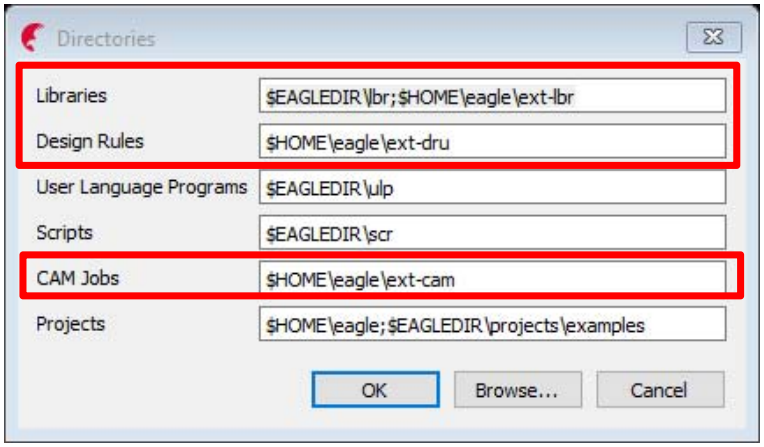


STEP 2

Make the following changes for Libraries, Design Rules & CAM Jobs

For Windows Users,

Follow the screenshot below.

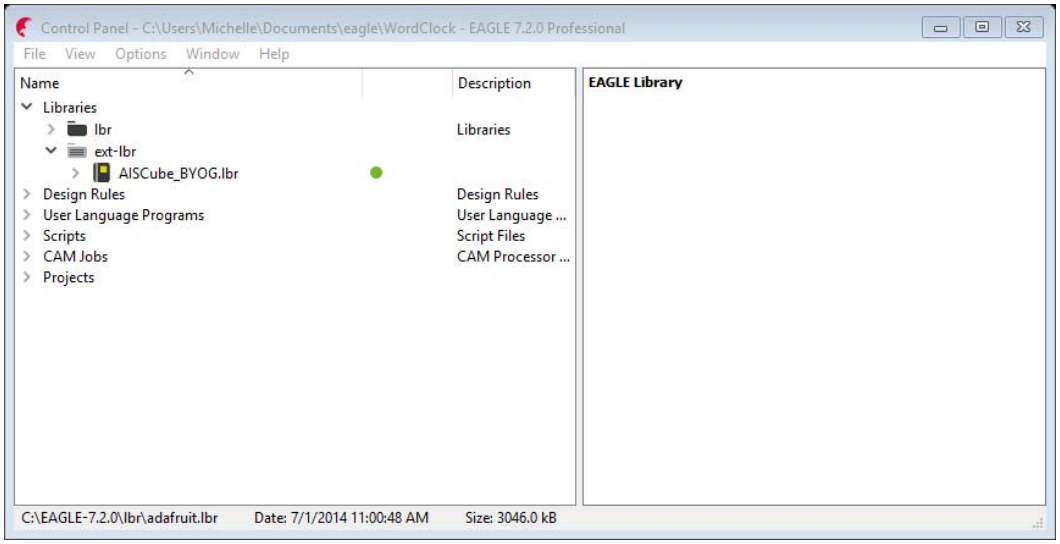


MAC (append using ‘:’)

:/Users/yourComputerName/Documents/eagle/ext-lbr

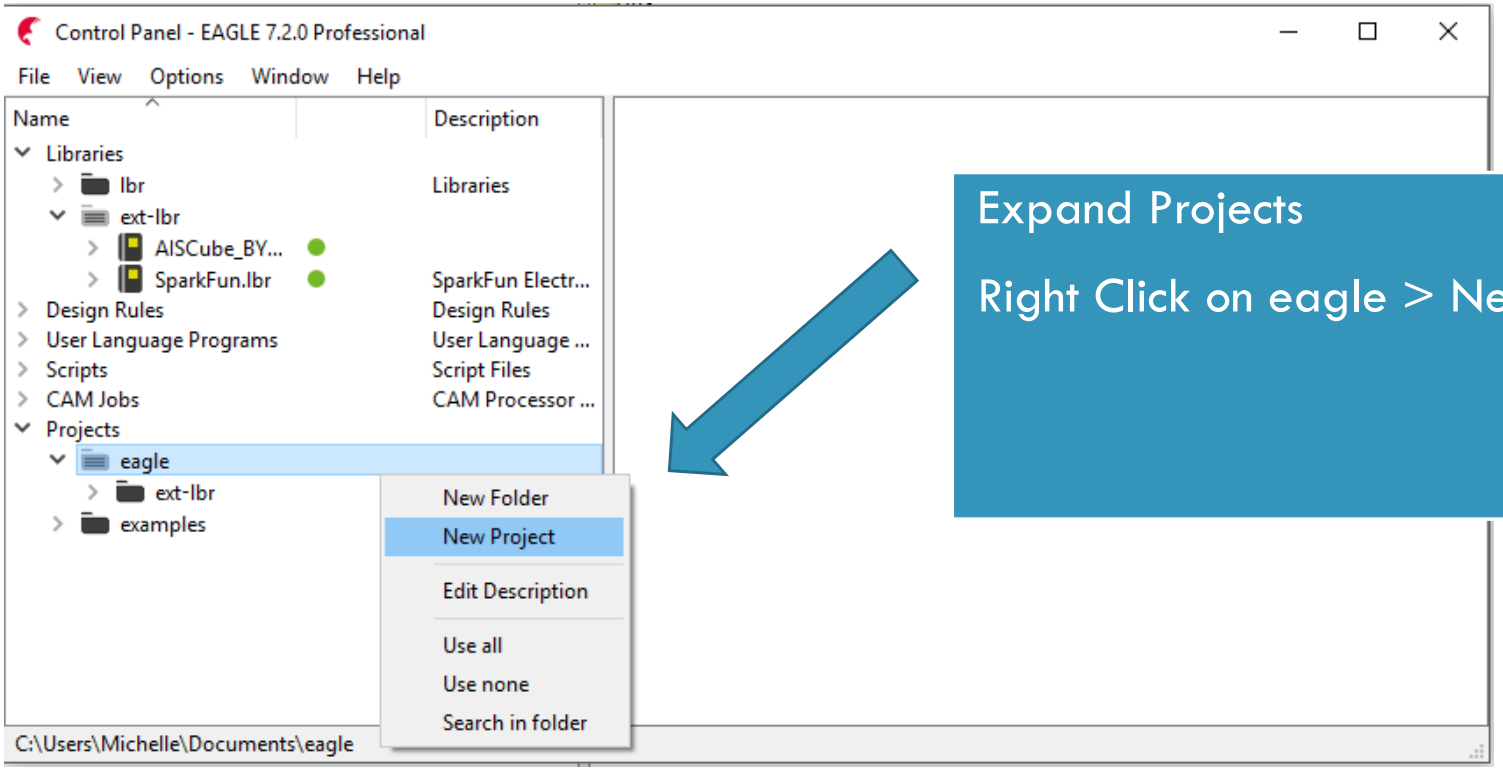
GO TO EAGLE'S CONTROL PANEL

Expand ext-lbr

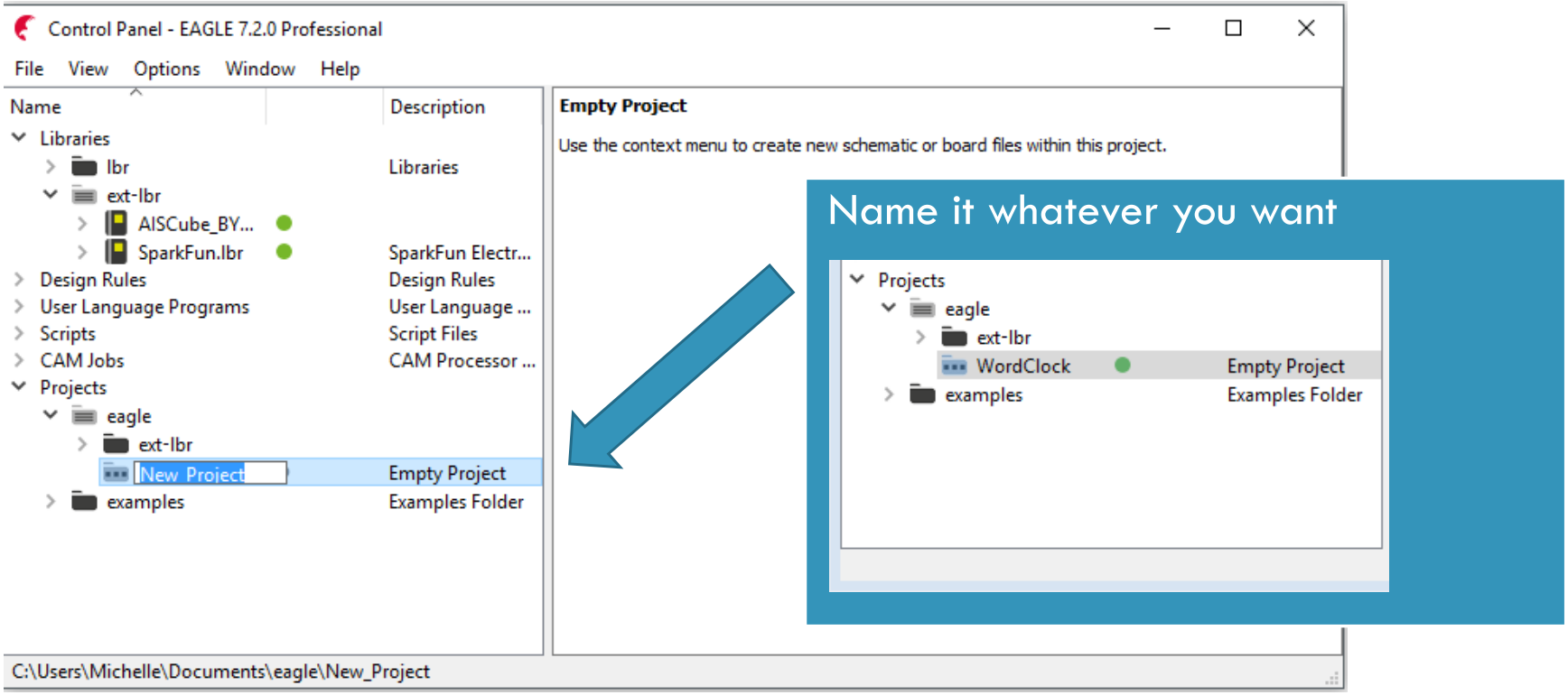


Click on the grey dot to enable use of the libraries

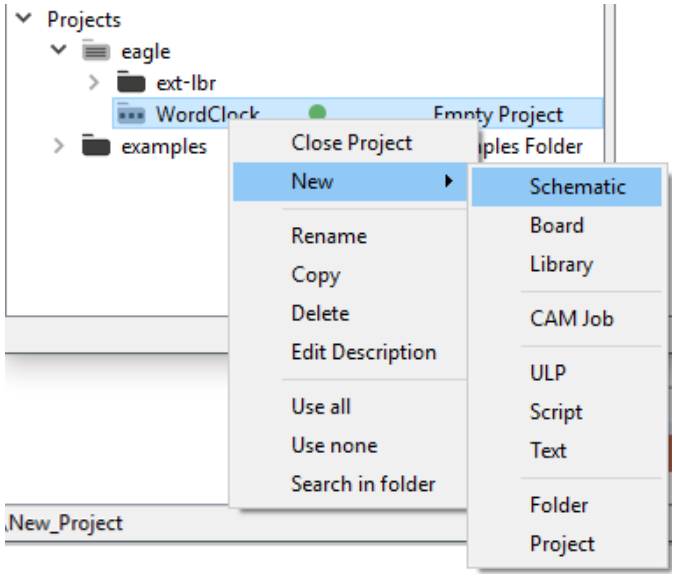
LET'S CREATE A NEW PROJECT



NAME IT WHAT EVER YOU WANT.



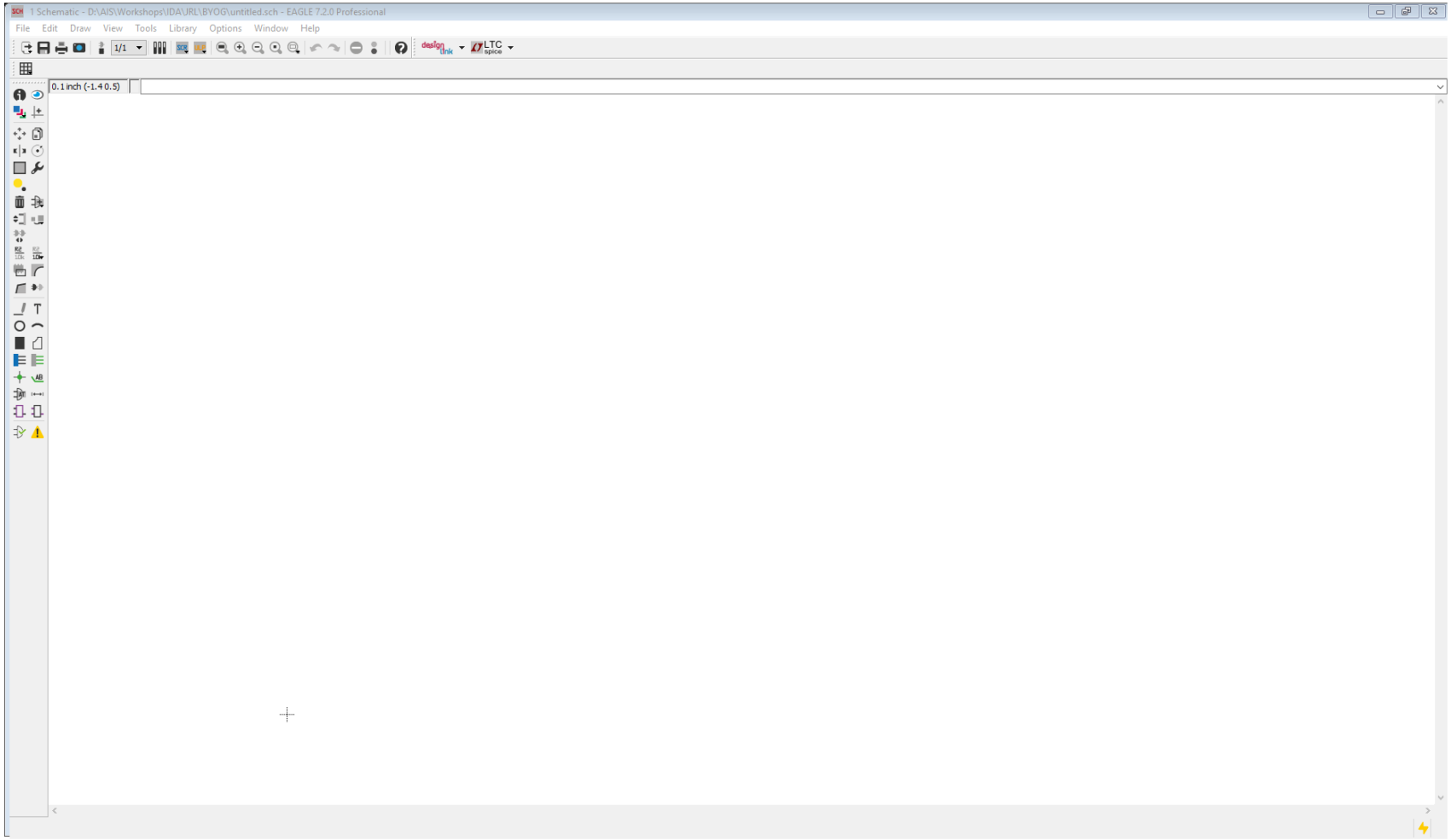
CREATE NEW SCHEMATIC



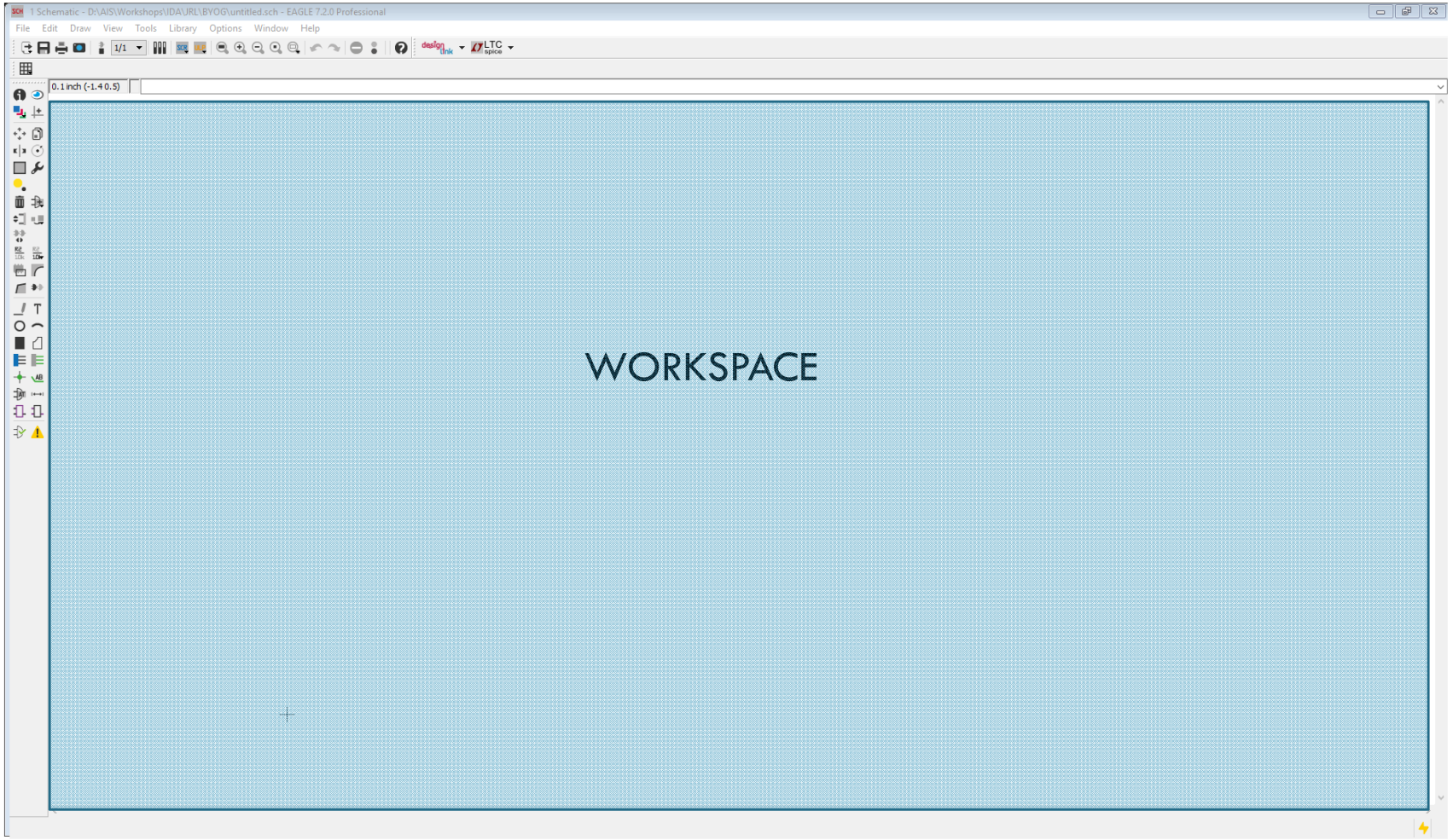
Right Click on your project

New > Schematic

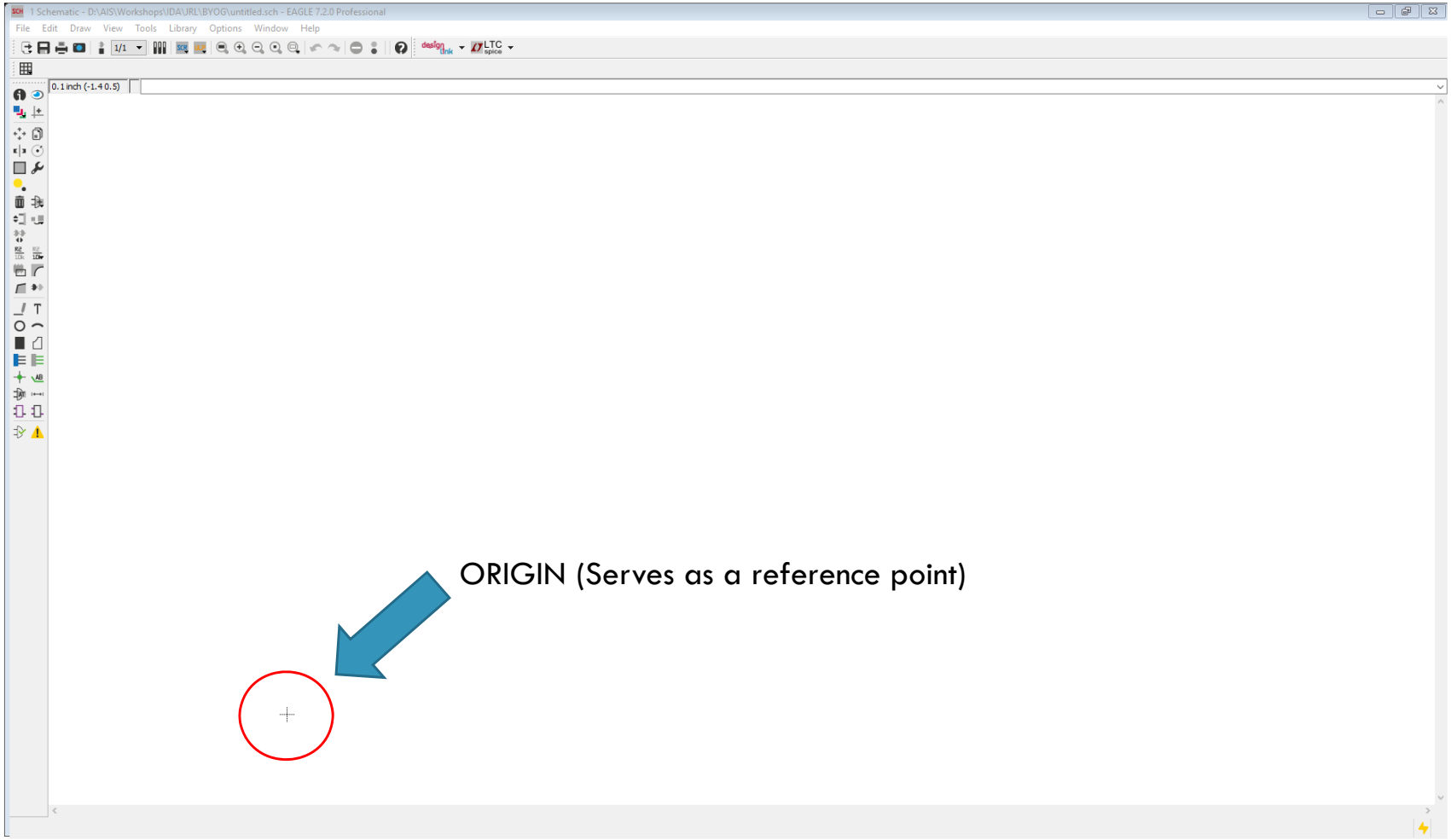
WELCOME TO EAGLE ☺



WELCOME TO EAGLE ☺



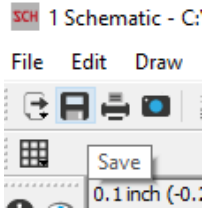
WELCOME TO EAGLE ☺



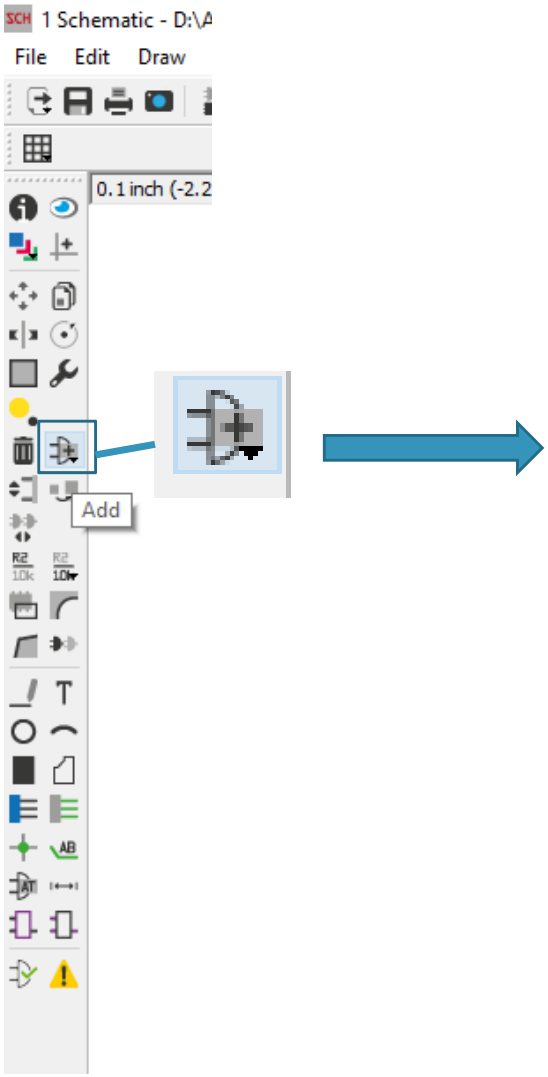
LET'S SAVE THE SCHEMATIC

Any of these methods

- FILE > SAVE
- Save icon
- Ctrl + S

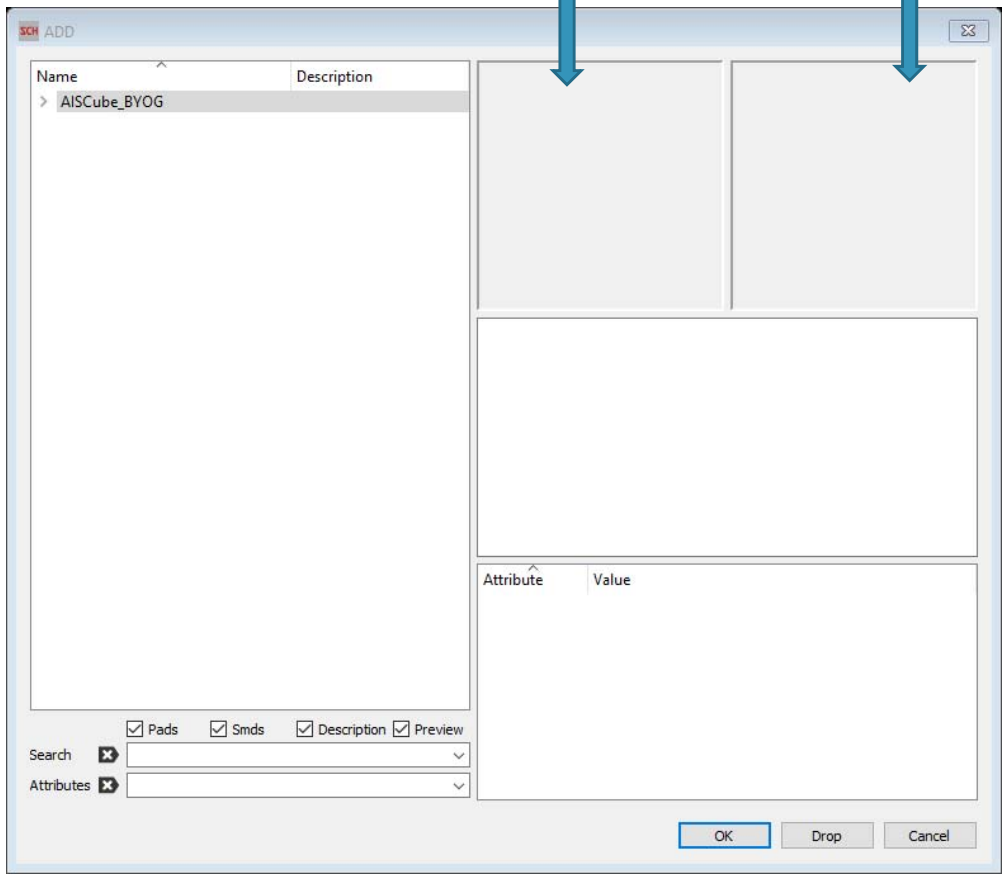


ADDING COMPONENTS



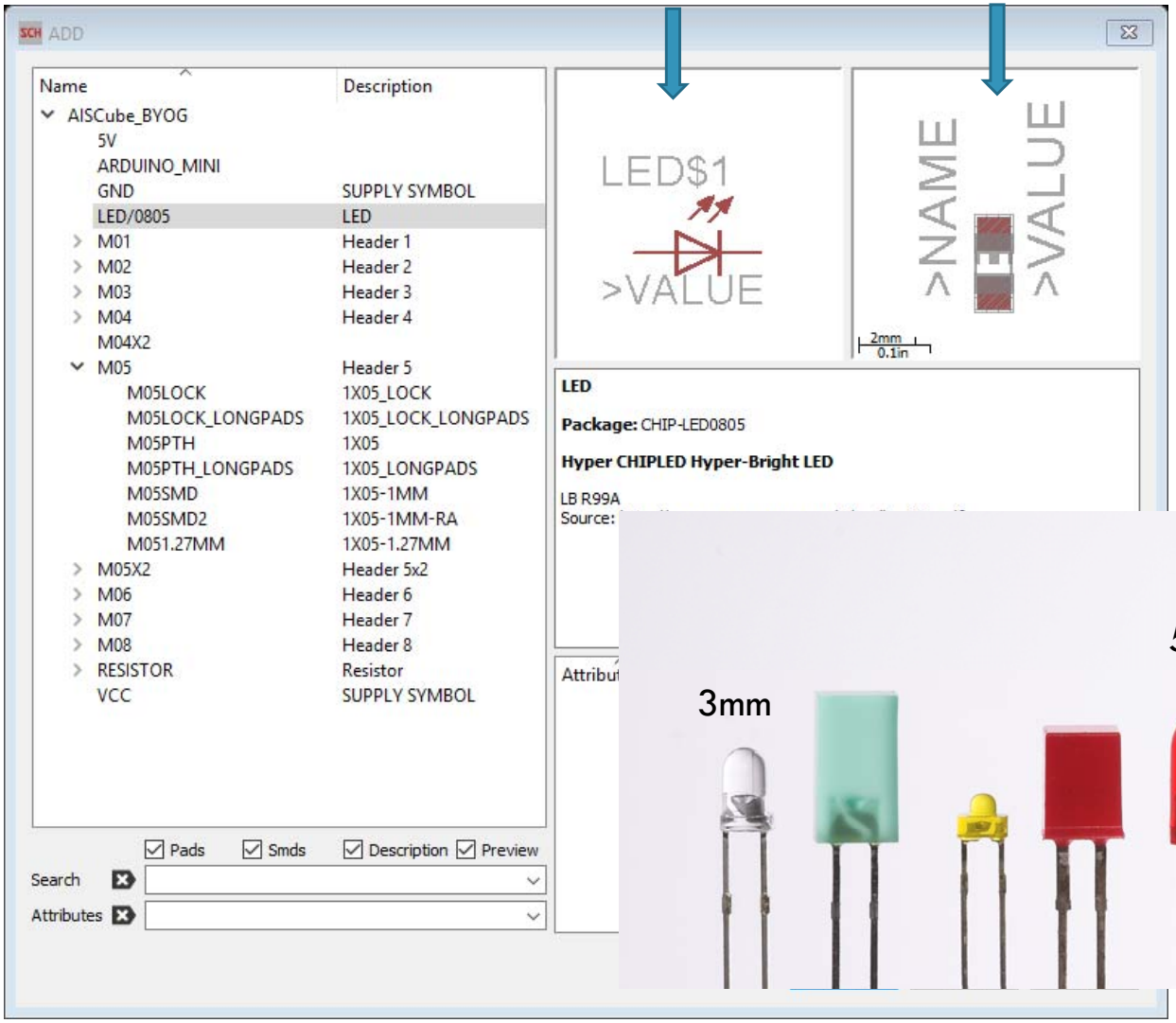
Symbol Preview

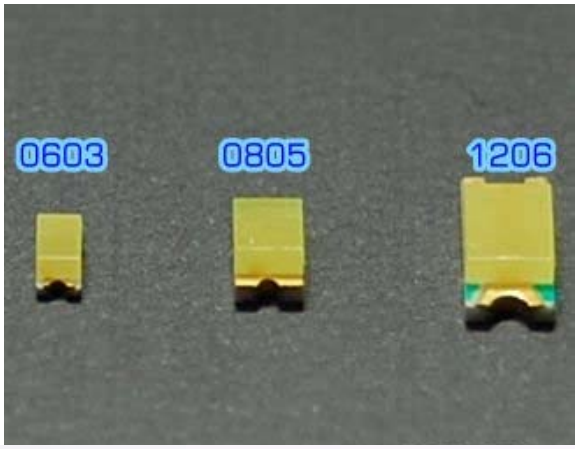
Footprint Preview

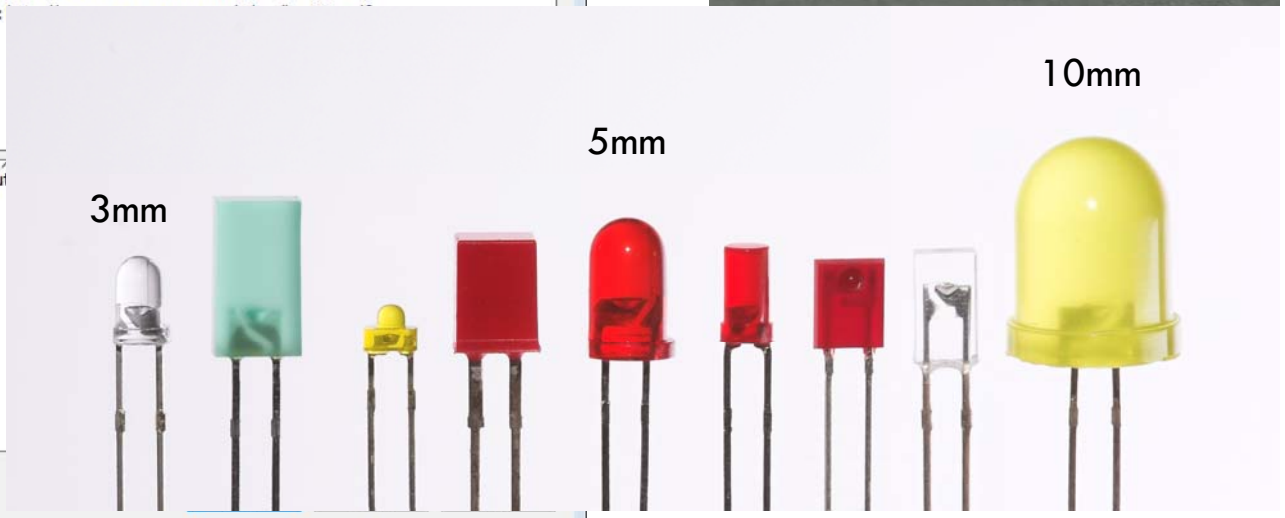


Symbol Preview
(DOES NOT CHANGE)

Footprint Preview
(CHANGES)

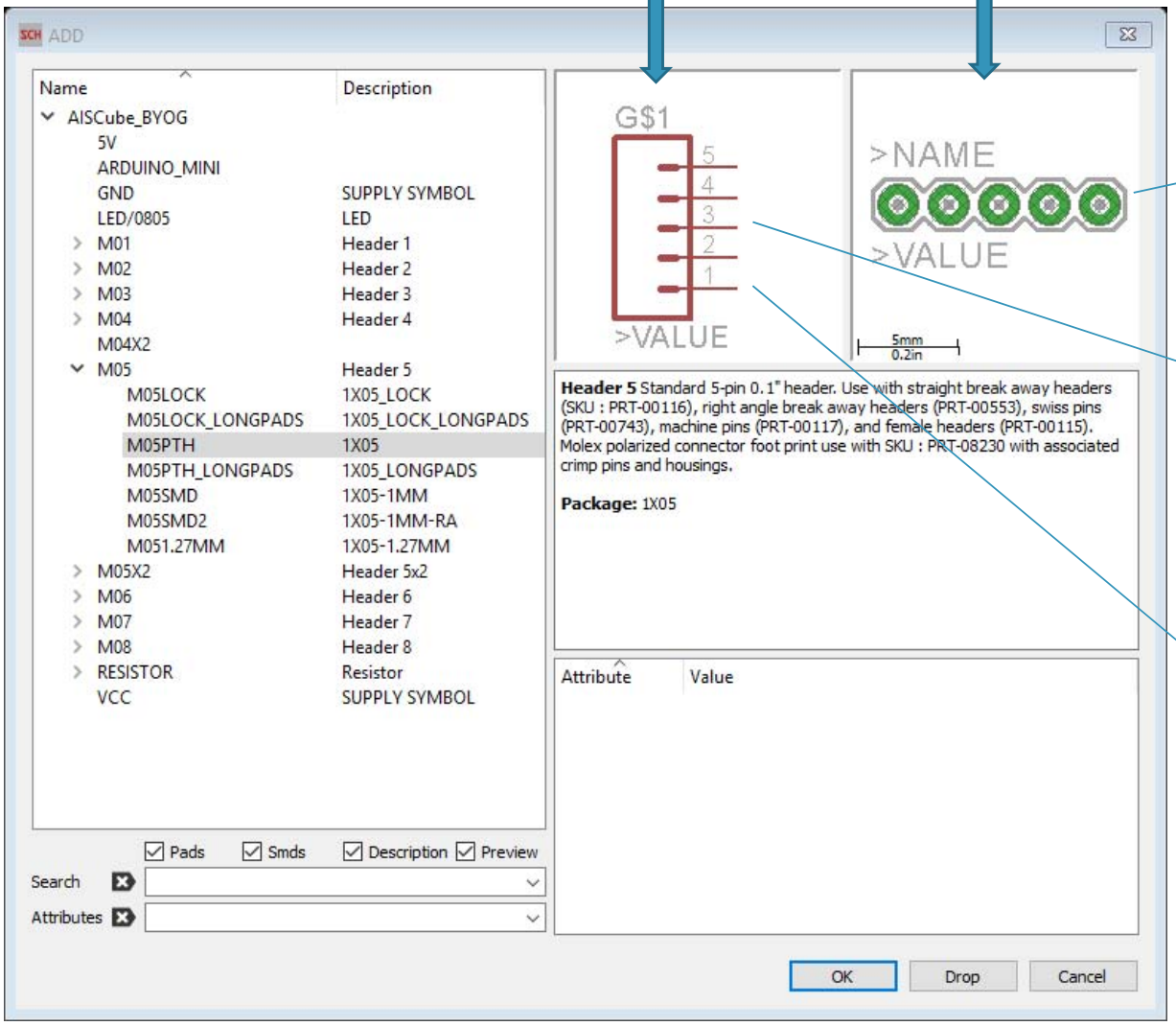


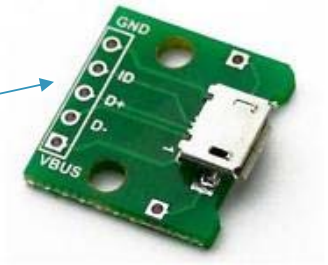


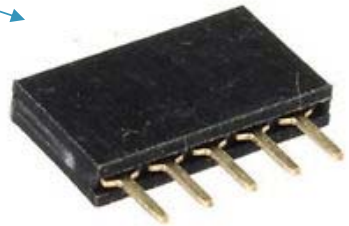


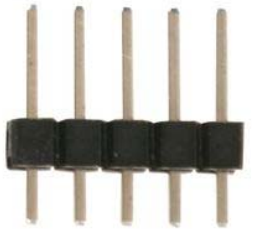
Symbol Preview

Footprint Preview



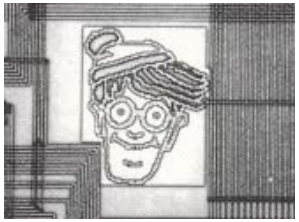


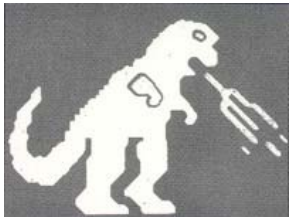




HOMEWORK

Logo/Image for Silkscreen





Remember!

Bring your mouse! And your laptop charger / a fully charged laptop!