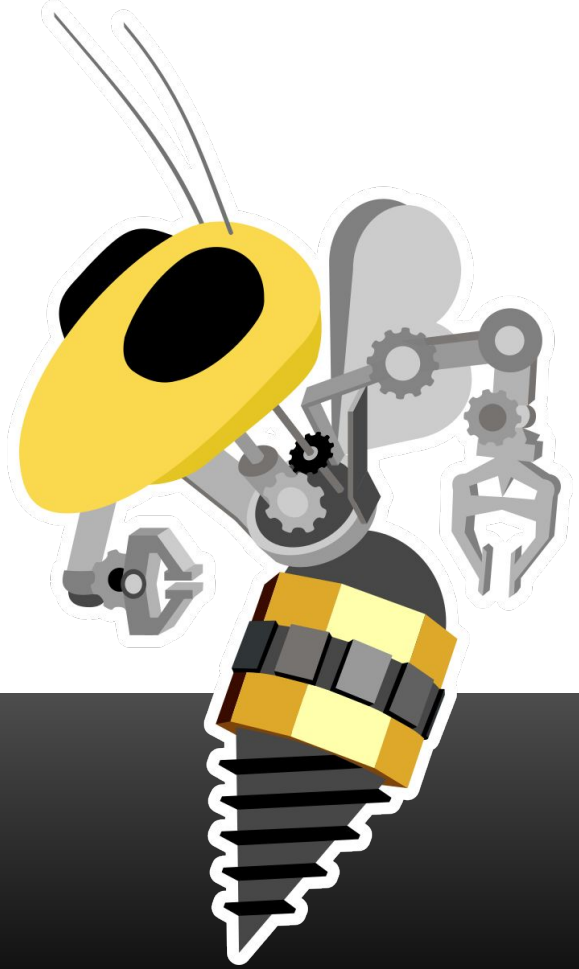
# Welcome!

## Electrical Training Week 4



RoboJackets

Competitive Robotics at Georgia Tech

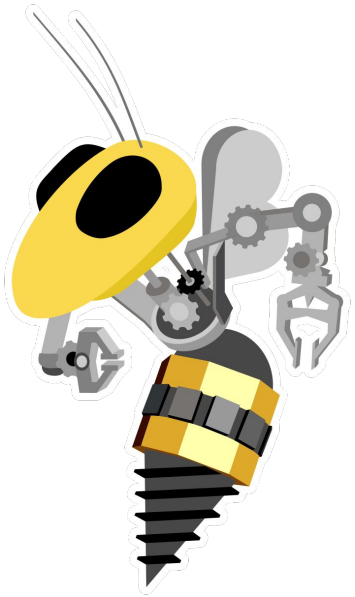
www.robojackets.org

# Agenda

- Announcements
- Git
- EAGLE
  - Introduction
  - Parts and Libraries (brief)
  - Schematics
  - Guidelines

# Announcements

- We have started publishing videos on YouTube!
  - Please make sure you are on the mailing list
- If you're bored, take a chance to watch the videos on the "Good YouTubers List"
  - GitHub -> Miscellaneous folder



# What is EAGLE?

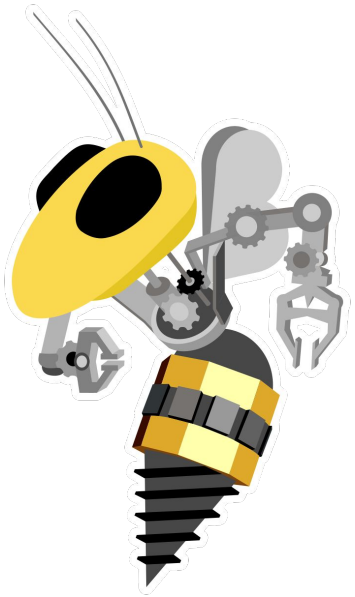
# EAGLE

- Software used to make Printed Circuit Boards
- 3 Components
  - Library + Parts
    - Virtual representations of components you put in your circuit
  - Schematic
    - Defines connections between functional units in circuit
  - Board Layout
    - Defines physical locations and sizes of parts

# Installation

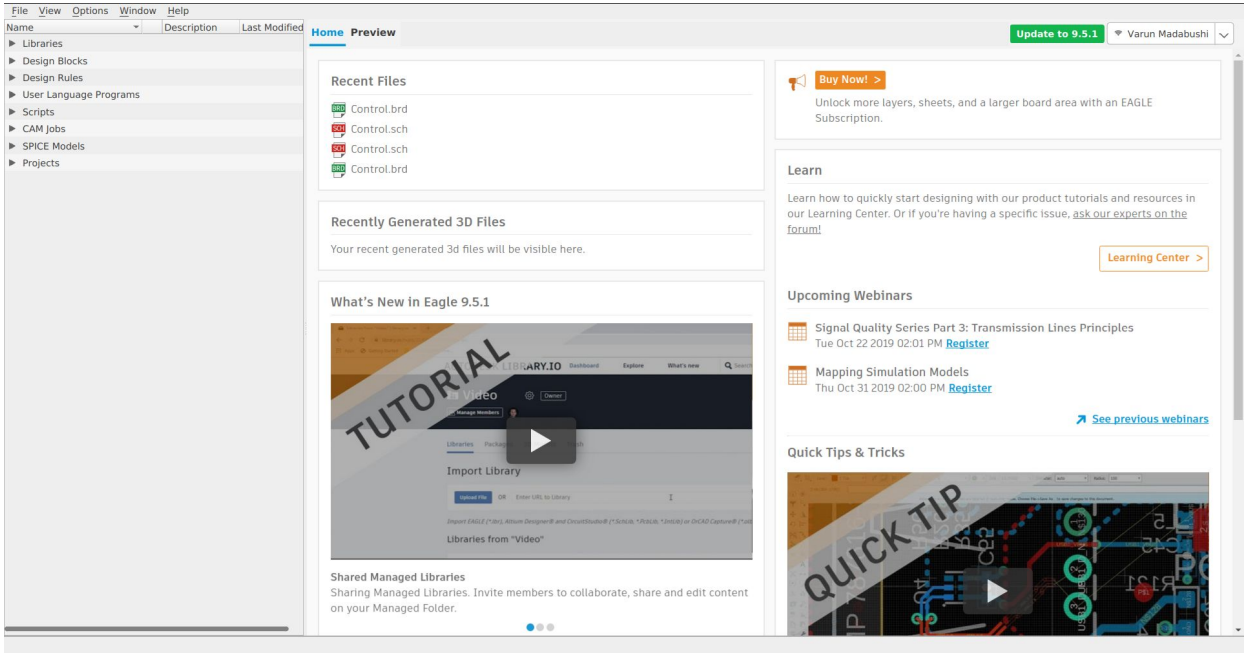
- Free for students
  - Requires an Autodesk account and GT Email

- http://www.autodesk.com/education/free-software/eagle



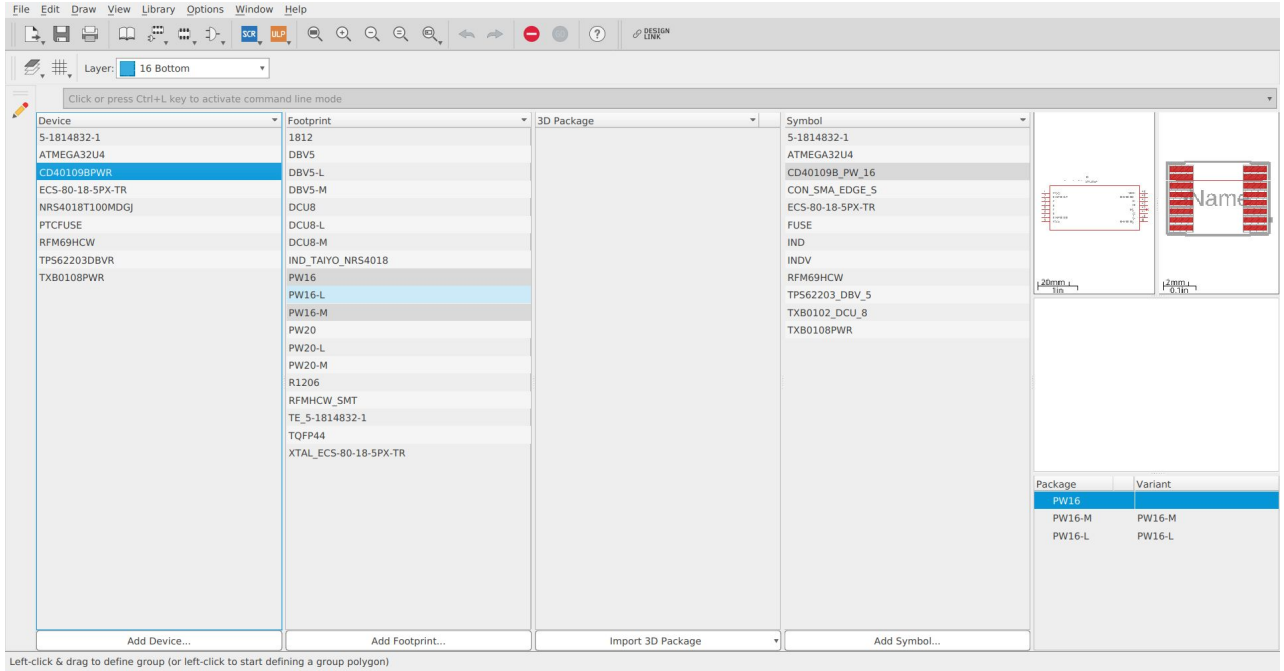
# EAGLE Parts and Libraries

# Control Panel



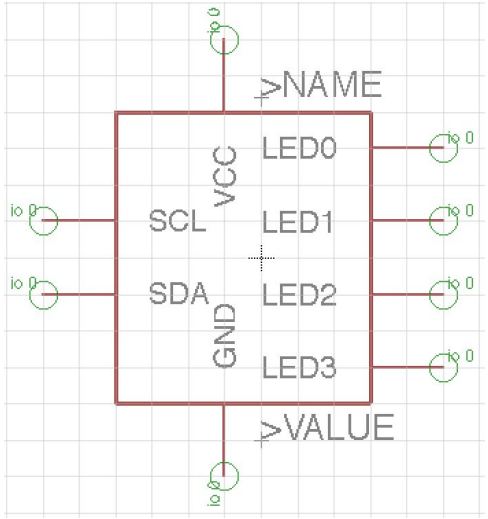
ROBOJACKETS
COMPETITIVE ROBOTICS AT GEORGIA TECH

# Library (.lbr)

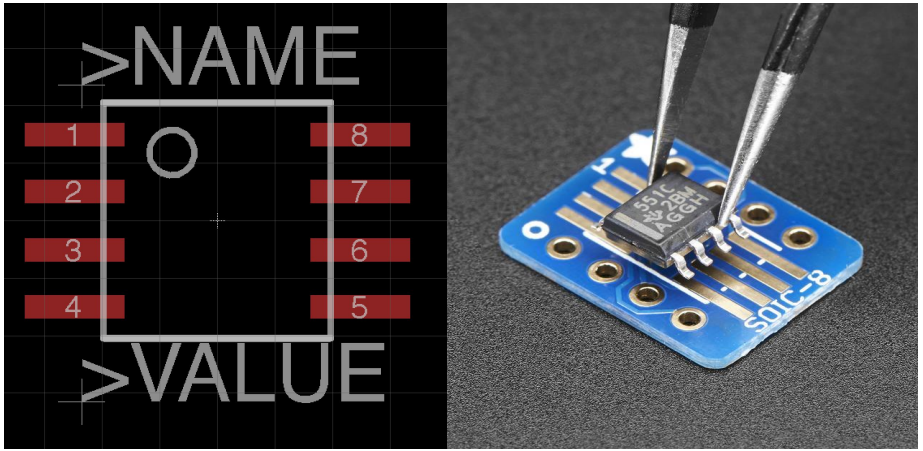


# Parts

## Symbol




## Package



# Making Libraries

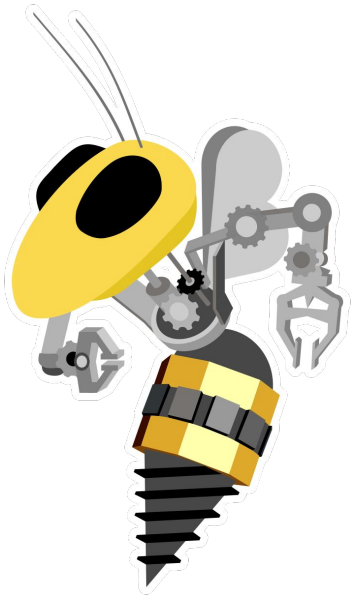
- Generally want to make one for each project
  - Keeps unique parts together without having to worry about merging
- Can import parts from other libraries through Add Device -> Import

# Commonly Used Libraries

- rcl - Resistors, Capacitors, and Inductors of various sizes
- supply, supply2 - Symbols for voltage sources, grounds, and others
- led - assortment of LEDs
- testpad - Test Points and pins

# RJ Libraries

- Created a set of libraries to hold some various commonly used parts
- github.com/robojackets/eagle-libraries
- Can pull these files using git to keep a copy on your computer that automatically matches the latest



# Git Basics

Source Control Software

# Source Control?

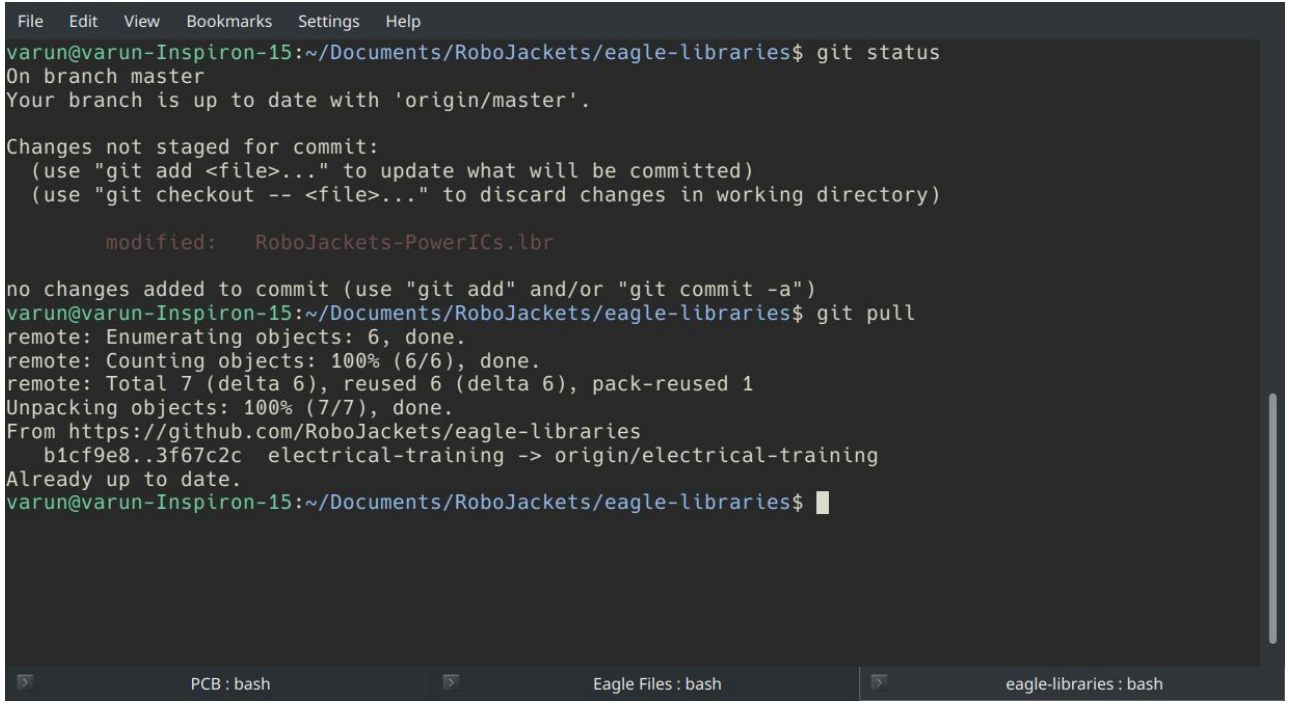
- Allows the user to keep track of changes on any code project
  - EAGLE isn't "code" but can be tracked in the same way as it comprises of text
- Once a user makes changes, they can "commit" them
- Changes can be shared among users by "pushing"

# Git Terminology

- **Remote**:  Internet location where files are stored
- **Local**:  The developer's computer
- **Clone**:  Put a copy of the remote on the local
- **Pull**:  Update the local with the latest version of the remote
- **Push**: Update the remote with your copy of the local (requires special permission)

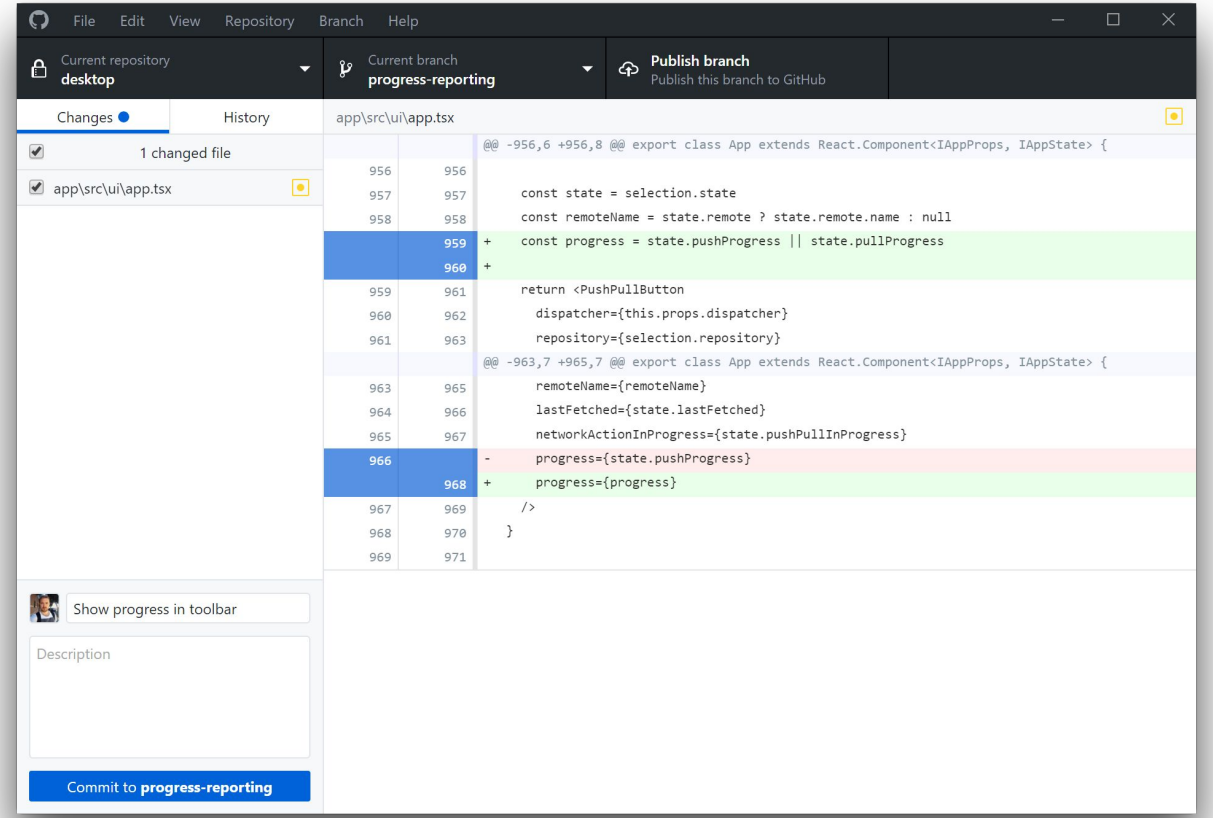
RoboJackets
Competitive Robotics at Georgia Tech

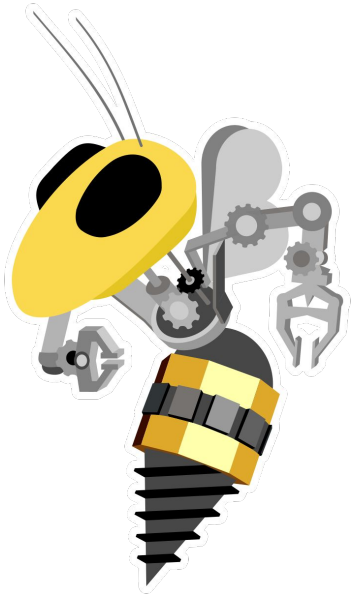
# Git CLI



RoboJackets
Competitive Robotics at Georgia Tech

# GitHub Desktop app





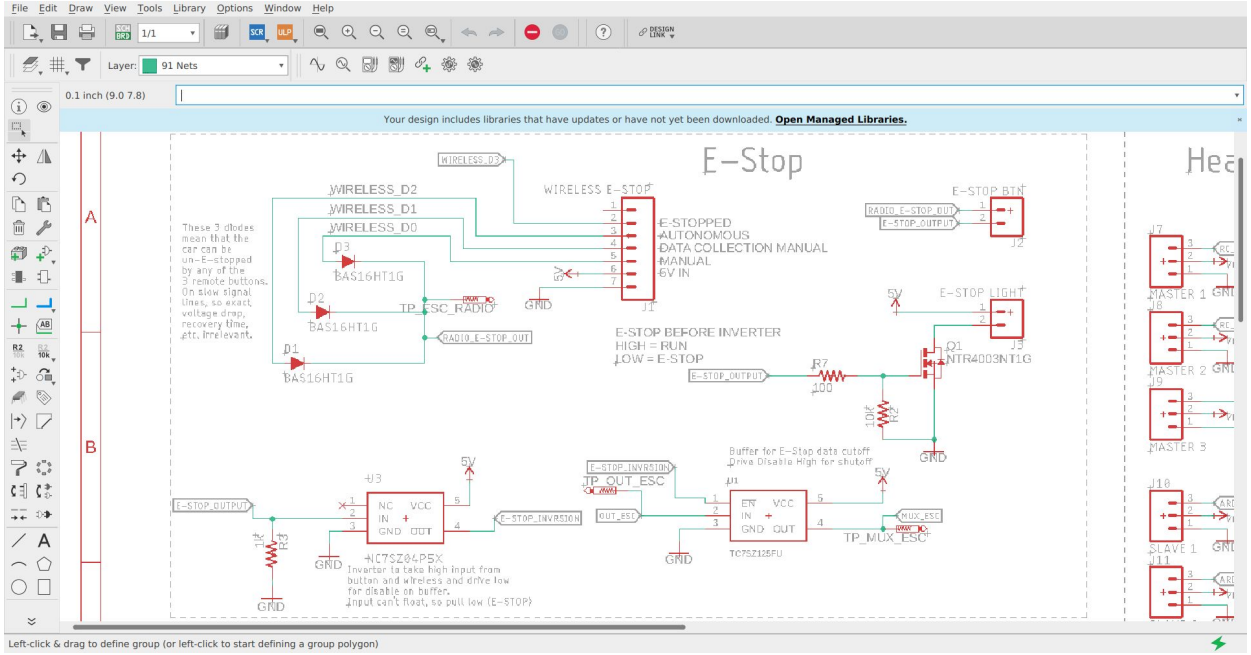
# EAGLE Schematics

# Creating a Schematic

- From Control Panel, create new schematic (File -> New -> Schematic)
- Place parts on paper using `add` command
- Connect pins on parts together using `net`
- Name nets and implicitly connect them with `name`

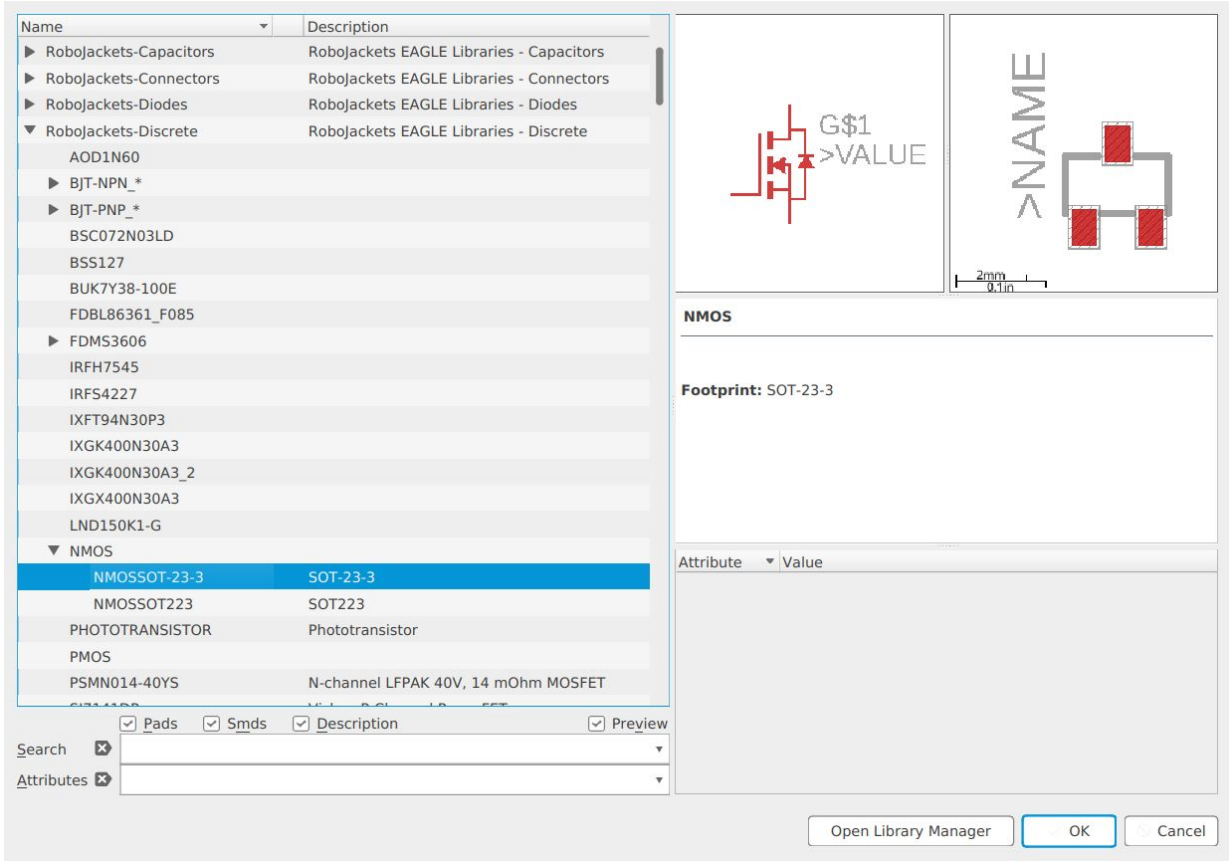
ROBOJACKETS
COMPETITIVE ROBOTICS AT GEORGIA TECH

# Schematic Window



ROBOJACKETS
COMPETITIVE ROBOTICS AT GEORGIA TECH

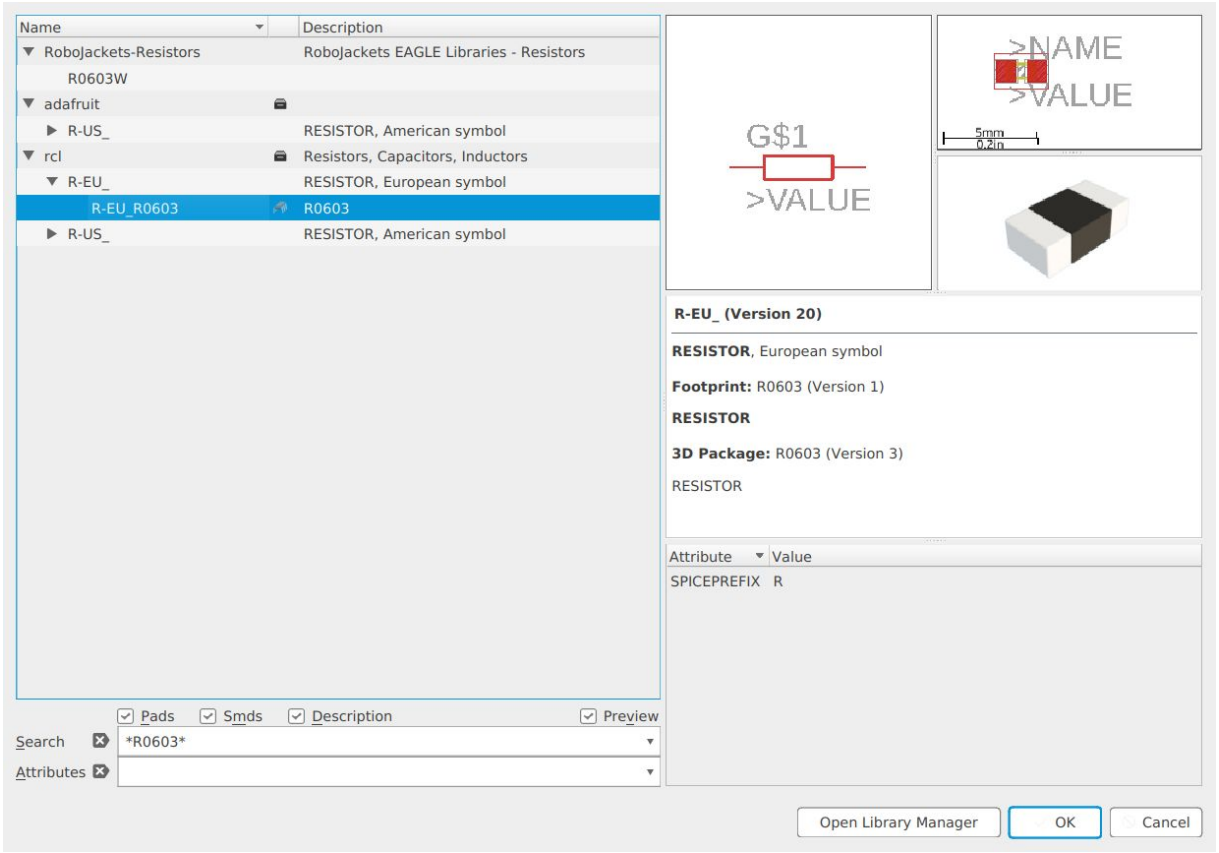
# Adding Parts



ROBOJACKETS
COMPETITIVE ROBOTICS AT GEORGIA TECH

# Searching for Parts

*Use wildcard character if you don't have a perfect match*

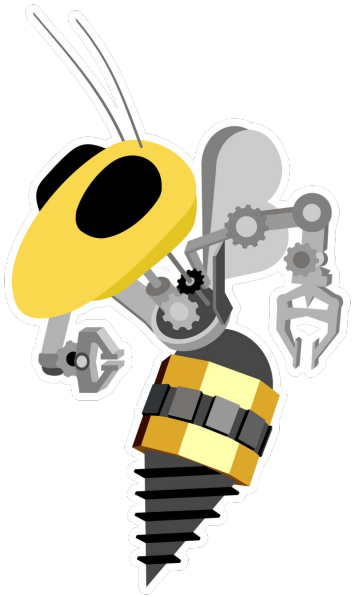


# EAGLE Resources

- Detailed walkthrough of all EAGLE features
  - /references/eagle_training_guide/eagle_guide.pdf
- Quick “cheat sheet” to look at for command names
  - /references/eagle_training_guide/eagle_cheat_sheet.pdf
- Videos
  - YouTube -> RoboJackets Training -> Playlists -> EAGLE Training

# Style Guide

- Defines conventions and best practices for using EAGLE
- Ensures compatibility when transferring EAGLE files across users or teams
- eagle-libraries/resources/EAGLE Style Guide.pdf



# Let’s do some EAGLE together!

Please follow along on your own computer or a partner’s

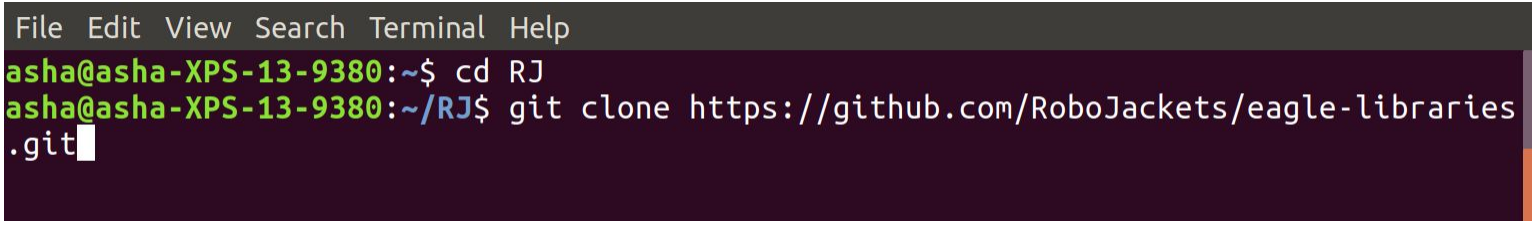
# Cloning our libraries

1. Find our library on GitHub
   a. github.com/robojackets/eagle-libraries
2. Copy the URL from the 

button

# If using Terminal

- Change directory to where you want the folder to exist
  - Ex: `cd ~/Documents/RoboJackets`
- Clone repository
  - `git clone url-of-repo`

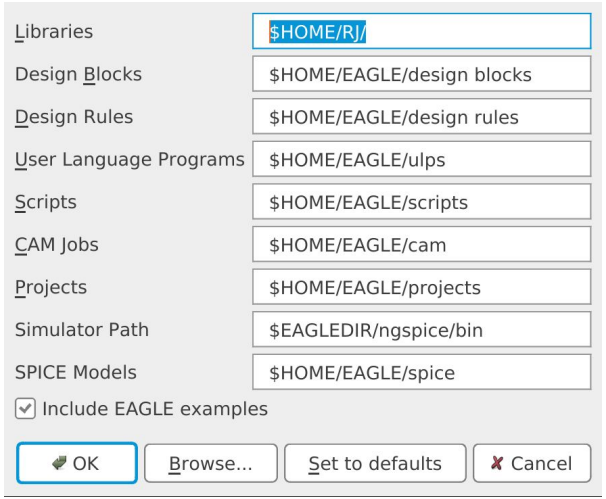


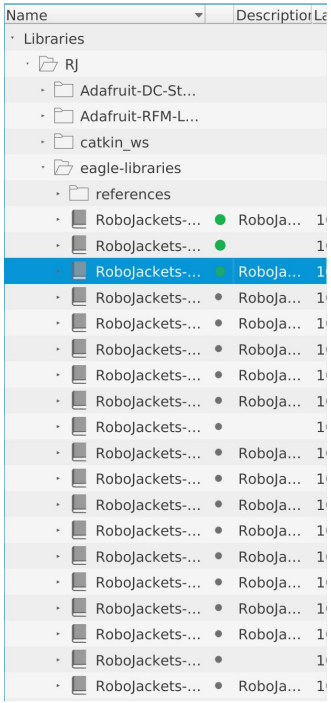
# If using GitHub Desktop

1. File > Clone Repository
2. Click URL
3. Paste URL copied from GitHub Website
4. Click “Clone”

# Adding Libraries in EAGLE

- In the Control Panel: Options>Directories
- Change the file path to where your libraries are located
  - You can add multiple directory paths, separated by colon ( : )
- Click on dot (changes to green) so the library can be used in designs

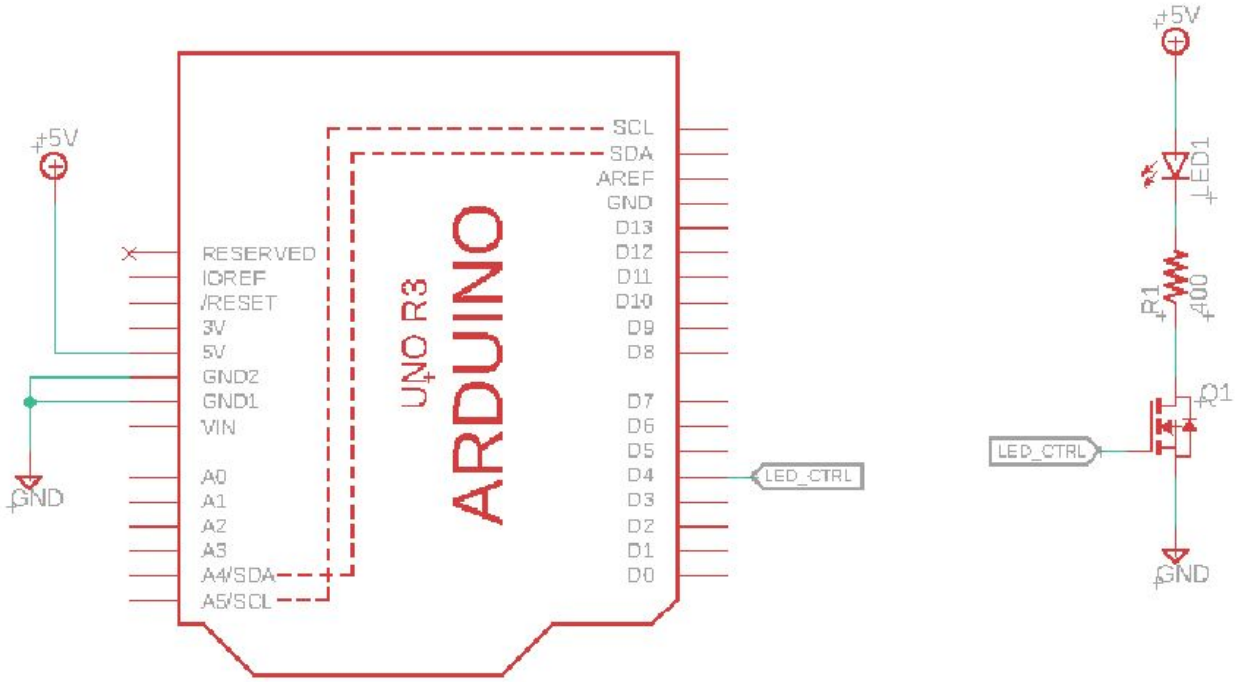


# Creating a Schematic

- In the Control Panel: File>New>Schematic
- Fun fact: While using EAGLE you must keep the Control Panel Window open (closing it closes your open EAGLE files)
  - Yeah it's stupid
- Check your grid by clicking the  button in the top-left
  - Make sure you are in inches!

# Low-Side Switch



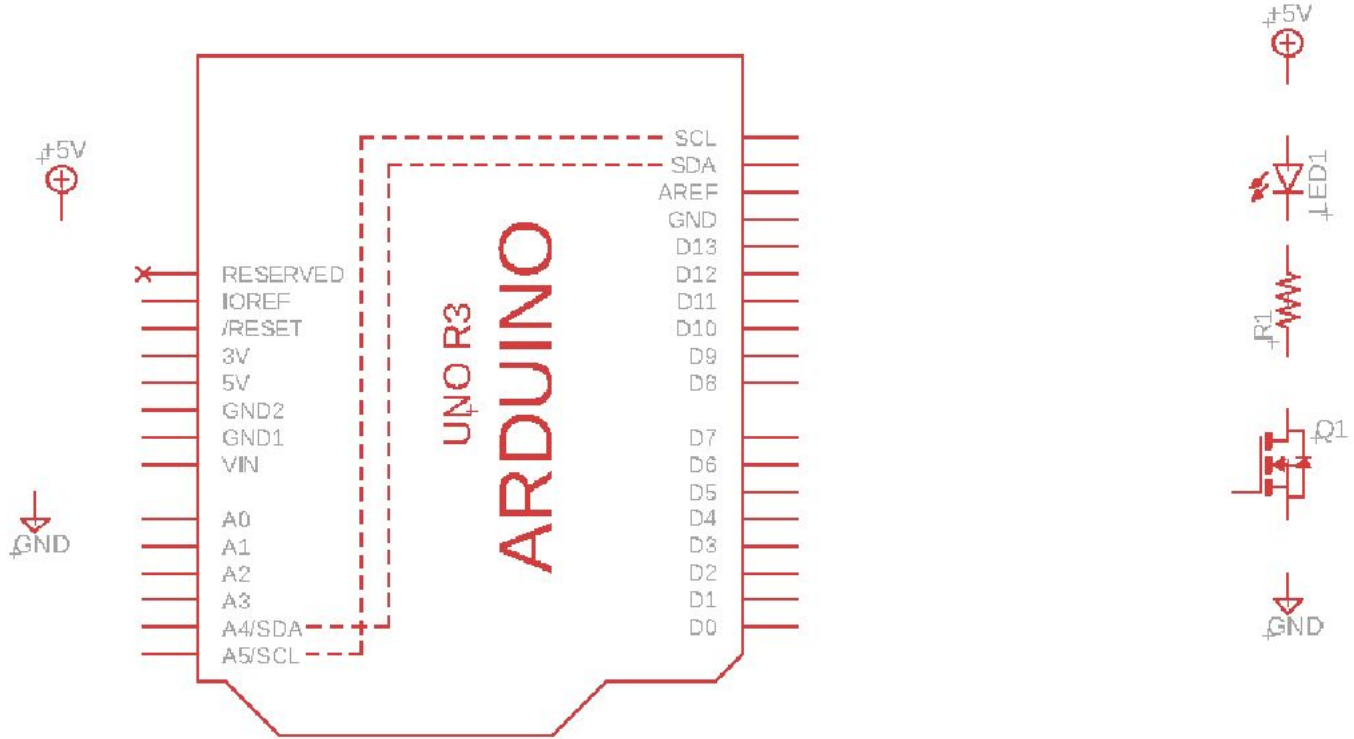
# Parts List

- Arduino Uno R3
  - adafruit Library
- LED (0603 package)
  - led library
- Resistor (0603 package)
  - rcl
- N-type Transistor (NFET, SOT2-23 package)
  - RoboJackets-discrete

# Step 1: Add Components

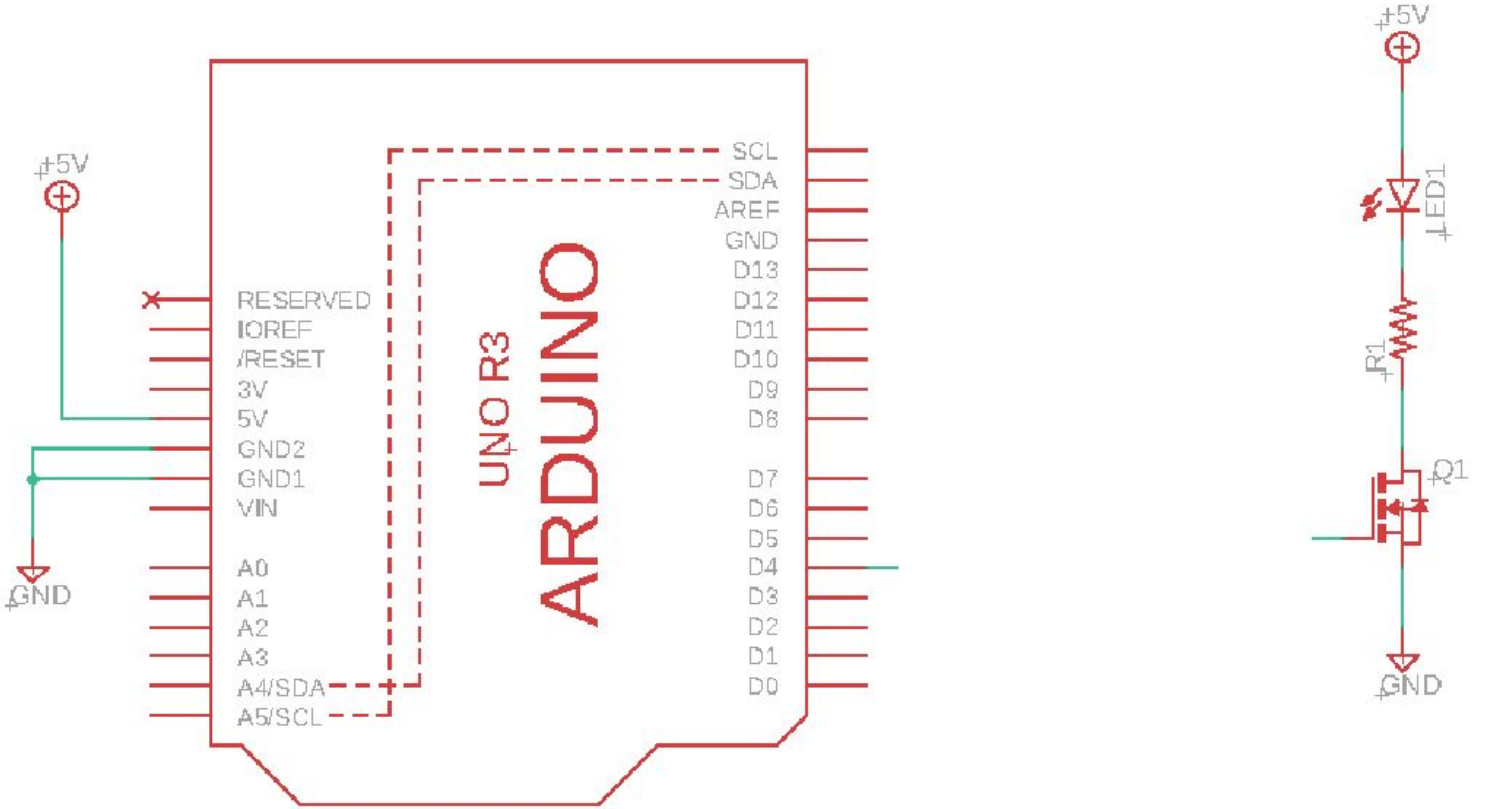
- Type `add` or press the Add button
- Find all of the following parts and add them to your schematic
- Connect Arduino power to 5V Source

- Arduino Uno R3
  - adafruit library
- LED (0603 package)
  - led library
- Resistor (0603 package)
  - rcl
- N-type Transistor (NFET, SOT2-23 package)
  - RoboJackets-discrete


+5V
GND
RESERVED
IOREF
/RESET
3V
5V
GND2
GND1
VIN
A0
A1
A2
A3
A4/SDA
A5/SCL
UNO R3
ARDUINO
SCL
SDA
AREF
GND
D13
D12
D11
D10
D9
D8
D7
D6
D5
D4
D3
D2
D1
D0
+5V
LED1
R1
Q1
GND

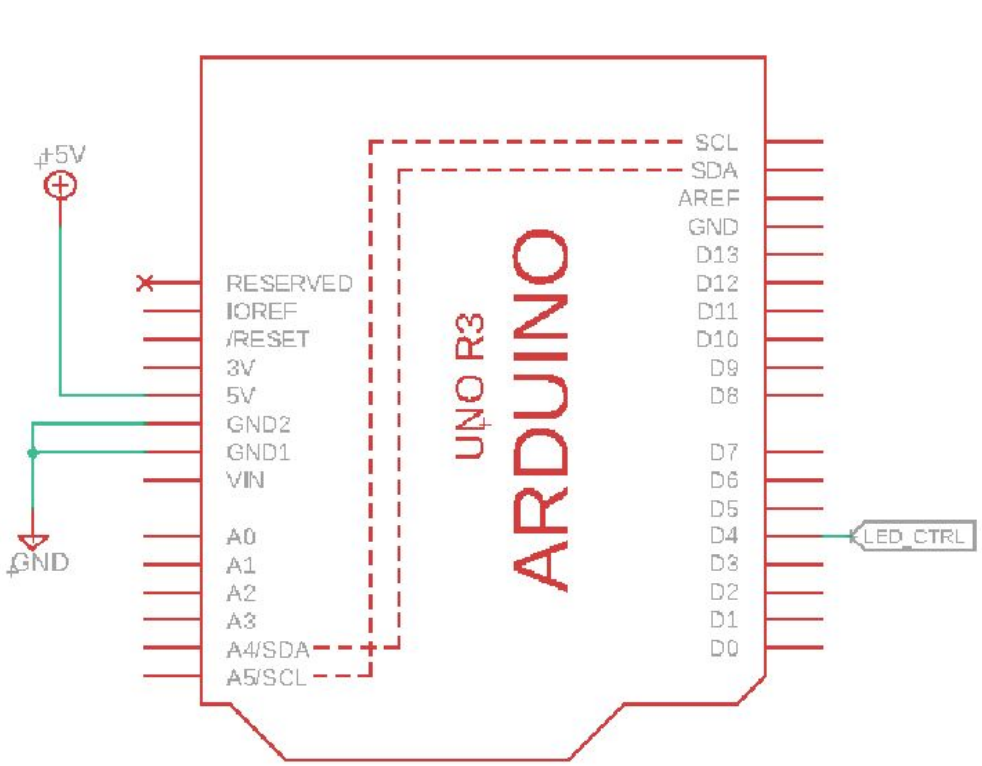
# Step 2: Draw nets

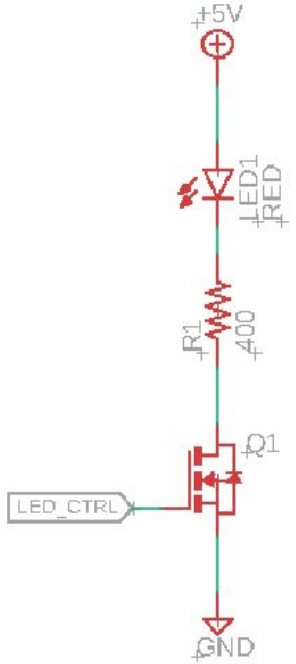
- For LED + Resistor + Transistor series circuit:
  - Draw nets by typing `net` or clicking the Net button
  - Click on pins you want to connect
- Connect a 5V supply net and Ground net to the 5V (not VIN) and GND pins on Arduino
- Create short nets sticking out from an Arduino DIO pin and the FET Gate


+5V
GND
RESERVED
IOREF
/RESET
3V
5V
GND2
GND1
VIN
A0
A1
A2
A3
A4/SDA
A5/SCL
UNO R3
ARDUINO
SCL
SDA
AREF
GND
D13
D12
D11
D10
D9
D8
D7
D6
D5
D4
D3
D2
D1
D0
+5V
LED1
R1
Q1
GND

# Step 3: Names and Values

- Implicitly connect the DIO pin on the Arduino to the Transistor's gate
  - Use `name` to give both nets the name `LED_CTRL`
- The resistor needs a value
  - Use `value` to give the resistor a value of 400
- The LED needs a color
  - Use `value` to give the LED a value of RED


+5V
GND
RESERVED
IOREF
/RESET
3V
5V
GND2
GND1
VIN
A0
A1
A2
A3
A4/SDA
A5/SCL
UNO R3
ARDUINO
SCL
SDA
AREF
GND
D13
D12
D11
D10
D9
D8
D7
D6
D5
D4
D3
D2
D1
D0
LED_CTRL


+5V
LED1
RED
R1
400
Q1
LED_CTRL
GND

# Just for fun!

- Click SCH/BRD on top left
- Let’s look at the board layout
- We will talk about layouts in a future EAGLE training session