Welcome!

Electrical Training Week 5

RoboJackets

Competitive Robotics at Georgia Tech

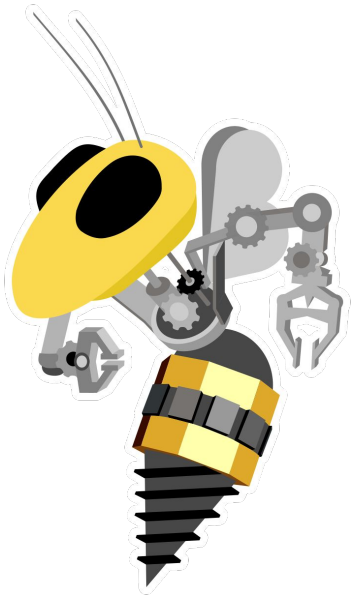
www.robojackets.org

Announcements

- Electrical Training cancelled next week
- RoboJackets social event - Nov 6
- Soldering Training at The Hive
  - Nov 12-13
  - Signup: http://bit.ly/349ypBV

Agenda

- More Git!
  - Branches, Checkouts
- Board Layouts
  - Placing Components
  - Routing Traces



Git Branching

Git Basics

- Git is a **collaboration tool**
- Used to keep records of file changes and share changes among teams
  - Commit and Push

- How do two people work on one project simultaneously?

Branches

- Split the history of a project at a certain point (commit)
- Creates two different copies of the project history that can then be edited separately
- Changing branches - `checkout`

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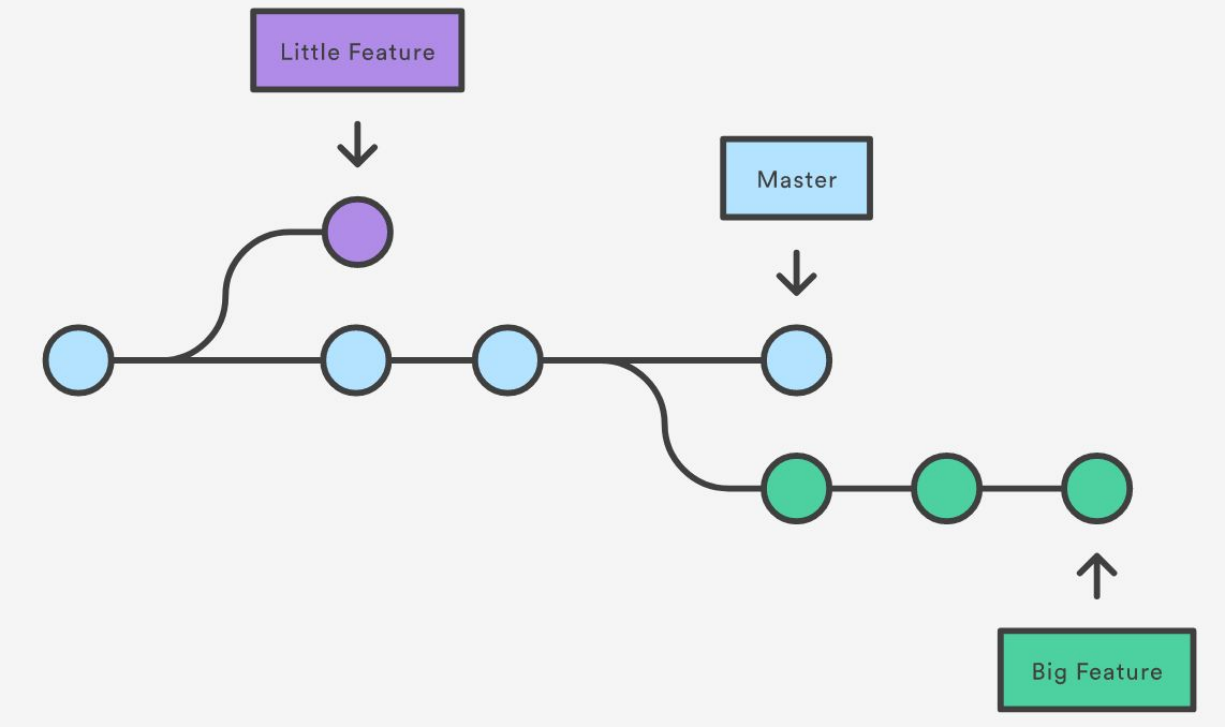
Git Branches



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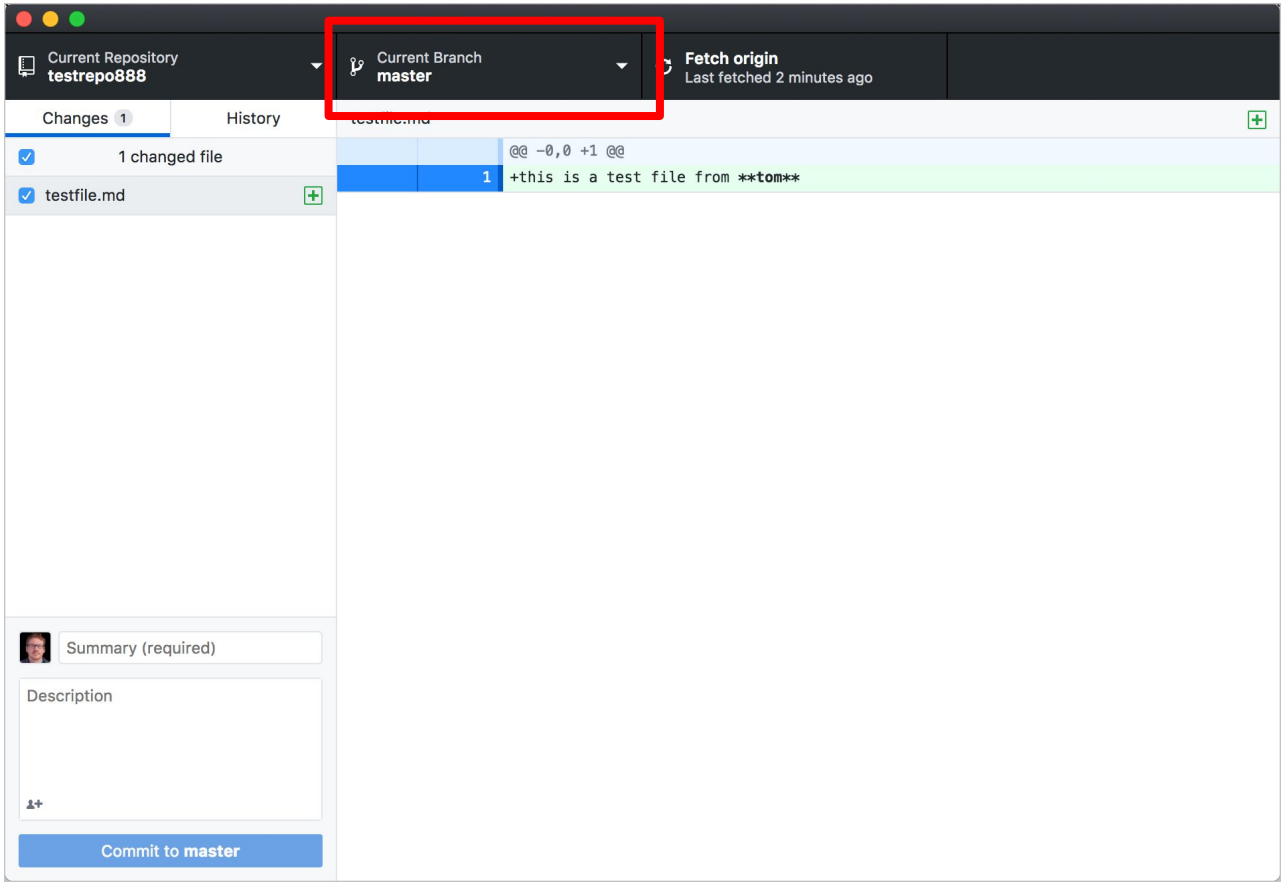
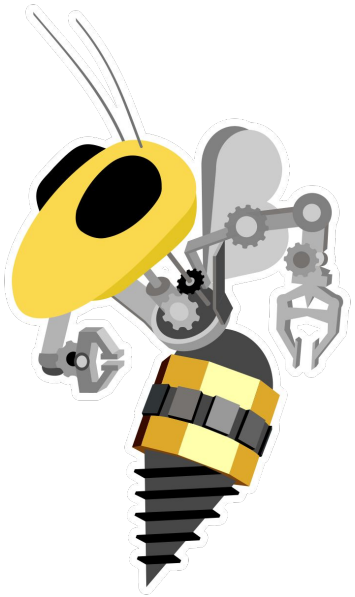
GitHub Desktop

Click on the highlighted menu to change branches



Task

- Checkout branch `routing_practice`
- Verify that this is successful - try opening training_board.brd



Board Layouts

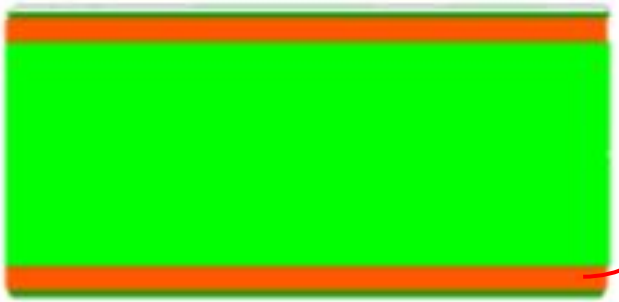
Recap

- Previously studied Parts/Libraries and Schematics
- Libraries contain a **device** which has a **symbol** and **footprint**
- In schematics, we use **nets** link **pins** on a **symbol** together to represent device function

Board Layouts

- Physical placement of components on the PCB
- Replace the abstract **nets** from schematic with physical **traces**
- Access this feature by pressing the SCH/BRD button

PCB Structure



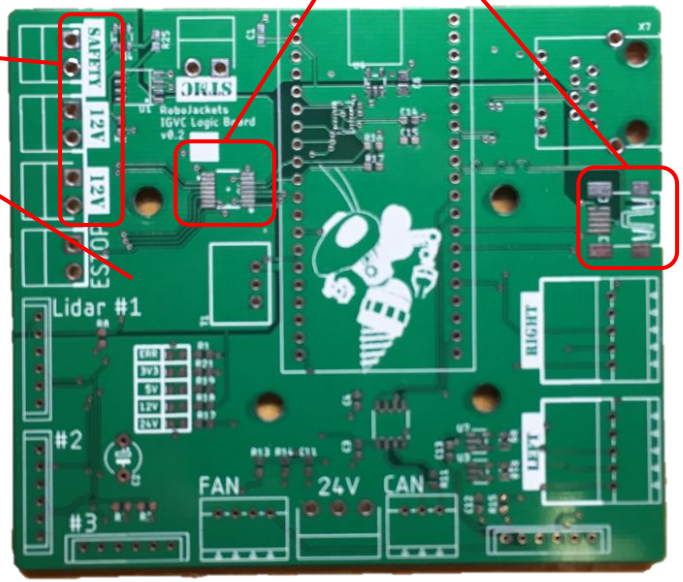
Silkscreen

Soldermask

Copper

FR-4

Pads



Color	Layer Name	Layer Num	Layer Purpose
	Top	1	Top layer of copper
	Bottom	16	Bottom layer of copper
	Pads	17	Through-hole pads (copper on top and bottom)
	Vias	18	Vias to route signal between layers (copper on top and bottom)
	Dimension	20	Outline of the board
	tPlace	21	Silkscreen for top
	bPlace	22	Silkscreen for bottom
	tDocu	51	Top documentation layer (just for reference)

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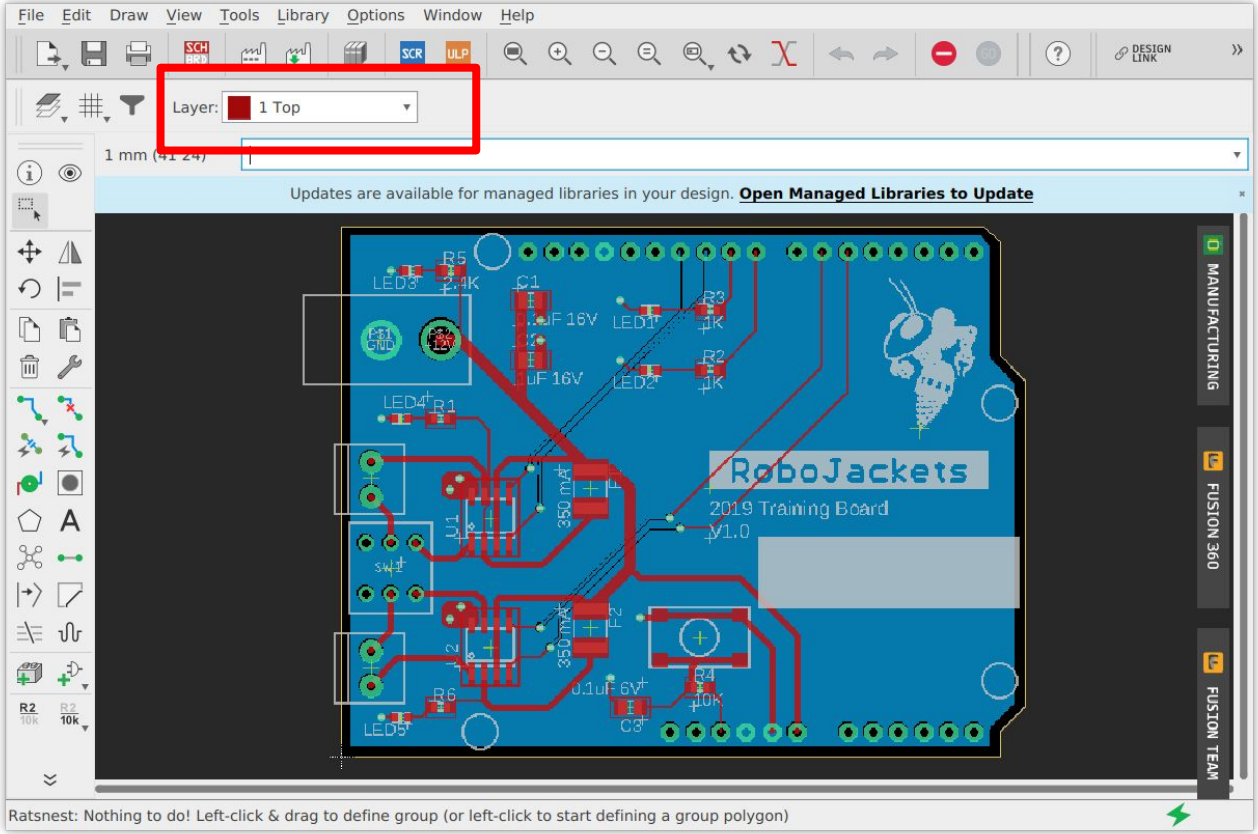
Changing Layers



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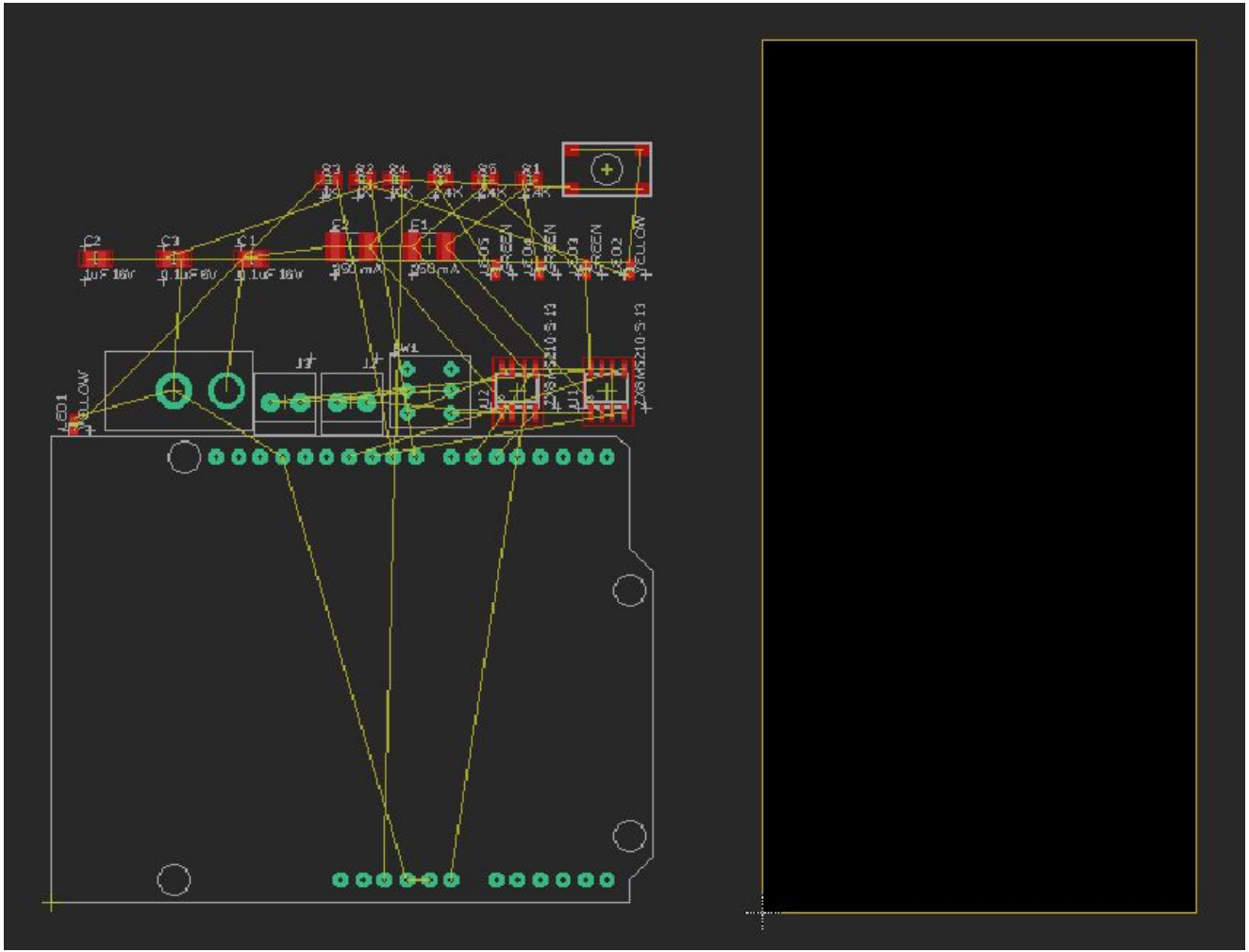
Blank Board Generation



Arrange Components

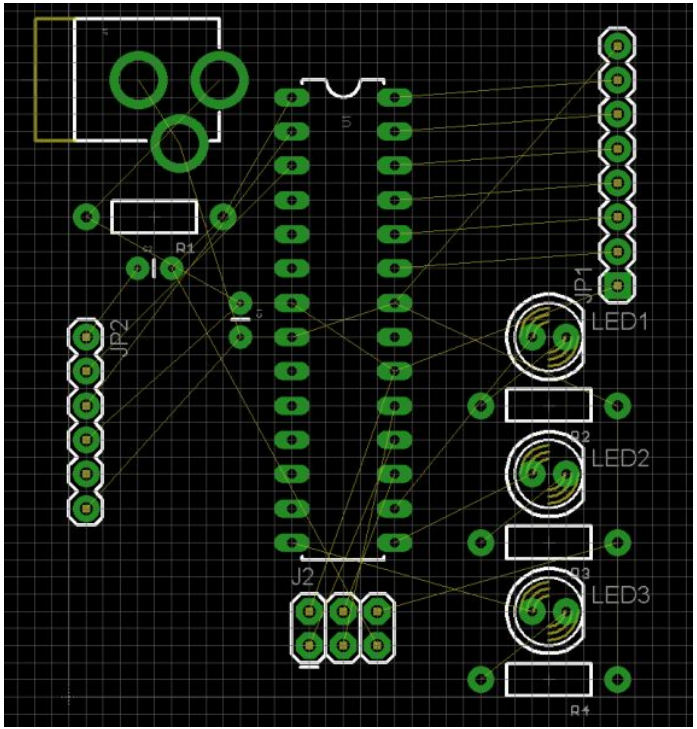
- Click on crosshair and drag to move parts around (or use command `move`)
- Right click to rotate
- Position components on the board area
- Since this is an Arduino Uno Shield, all components will be positioned within the size constraint of the Uno footprint

Arrangement Considerations

- Maximum size of board
- Clearance between mounting holes and components
- Location of specific components
  - Connectors on board edge
  - Decoupling capacitors near ICs
  - Communicating/related components near one another

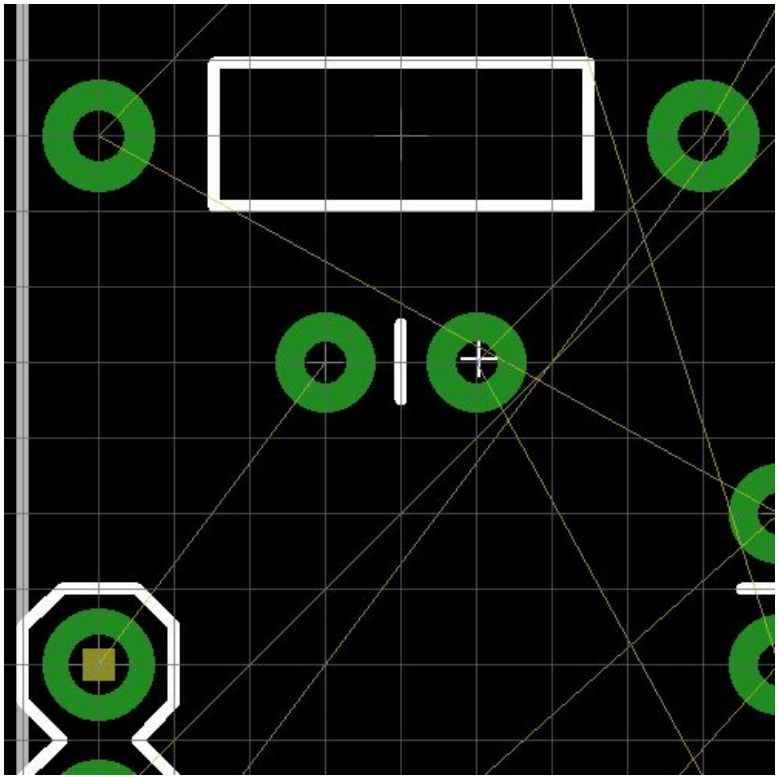
Good Practices

- Leave space between components
  - Room for traces
  - Room to solder
- Minimize intersecting airwires
  - Easier to route traces



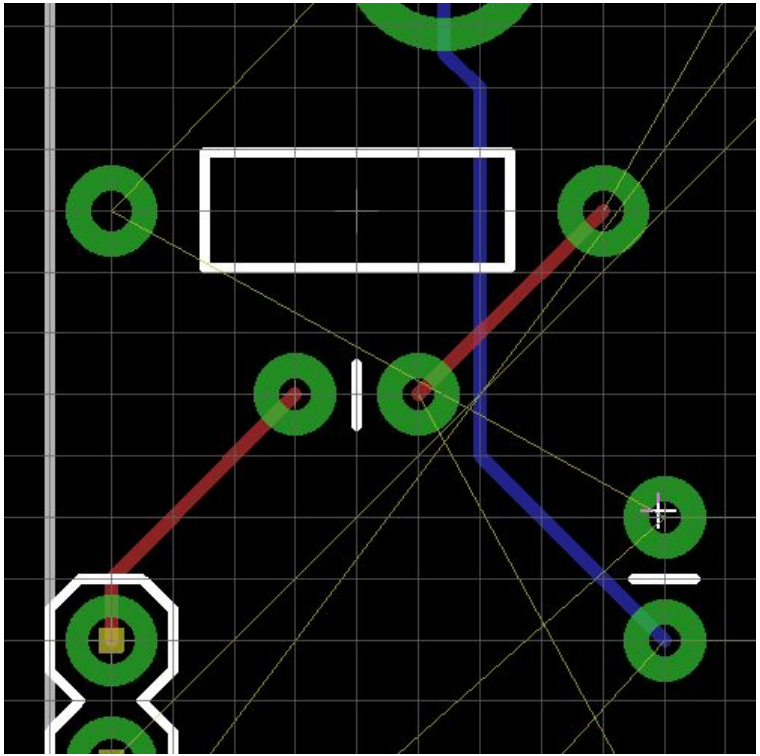
Drawing Traces

- Use the `route` command
- Left click on starting point and left click around board to place segments
- Follow start and end of airwire



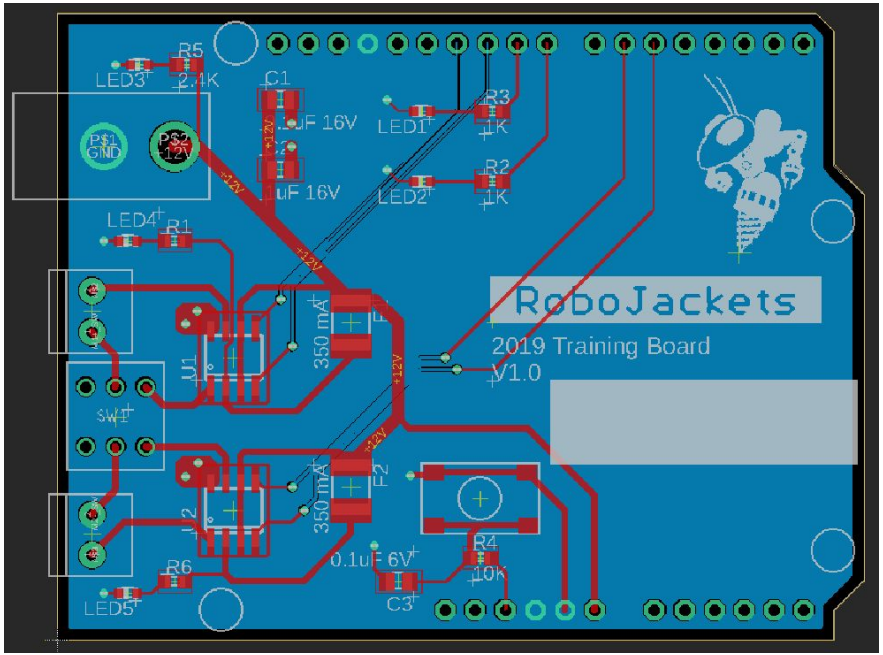
Layers

- Inevitably, a portion of your circuit will get blocked off
- You can route on the bottom layer of the board as well
- Middle click to place a **via** (hole connecting top and bottom layer) and continue routing on the opposite layer



Polygons

- Allows you to fill a drawn area with copper connected to a specific net
- Useful to make “ground planes”
- Draw polygon around area with `polygon` command and name with desired net
- Running `ratsnest` will fill it



Other Commands

- `ratsnest`: rechecks airwires and traces after routing
- `ripup`: deletes selected trace
- `text`: lets you place text on the board
  - Right-click on text and change its layer to tPlace so it gets printed on the silkscreen!

Task

- Practice routing by routing the Arduino Uno motor driver schematic
- Resize board to match size of the Arduino Uno footprint (don’t worry about the angled edges)
- Draw ground plane on bottom layer
- Position and route components

Resources

- Make sure to read the eagle guide as you work - it provides very detailed instructions
  - references/eagle_training_guide/eagle_guide.pdf