Contents

1 Arduino Intermediate Class

In this class each week will go over a specific circuit from the vilros book, going over some electronics and programming before building and testing the circuits. Students are welcome to try other circuits from the book if they have already completed this exercises, and we will try and provide tips as time allows.

1.1 This weeks class: circuits.io web based Arduino simulation

This week we give a tutorial on the circuits.io tool offered by autodesk. This tool allows you to create and simulate your own breadboard

1.1.1 Note on licenses - everything you create in circuits.io (at least the free version) is covered by an open source license of some sort, but there are choices.

2 A brief diversion on simulators

Simulators make up an important part of electronics design. There are many different types of simulators depending upon the task at hand. Some simulation tools are targeted for integrated circuit design, and other Target for printed circuit board design. The circuits.io simulator simulates both the CPU as well as some analog behavior.

3 Logging into circuits.io simulation tool

If you already created an account just browse to circuits.io and log in. Otherwise you can login with Facebook, Google+, or create a free login with you email address

4 Home Page

Your circuits.io homepage has several features=

4.1 Overview tab

Main menus as well as your designs

4.2 Create

Menu for creating different project types. We will focus on electronics lab, but other tools are available

4.3 Explore

Browse popular projects created by others.

4.4 Learn

Tutorials

4.5 Menu Page

Clicking on the menu lets you switch tools, as well as change your profile setting. You can also use the new button on the right and well as the profile button on the right.

5 Creating your first circuits.io circuit

Pressing the "new" button and selecting electronics lab will create a blank electronics circuit for you to start with. Note you will start with an empty breadboard.

5.1 Overview of electronics lab tool

5.1.1 PROJECT NAME - defaults to "The Unnamed Circuit"

click on this to change the circuit settings. This is where you can change the license

5.1.2 + Components

use to add parts

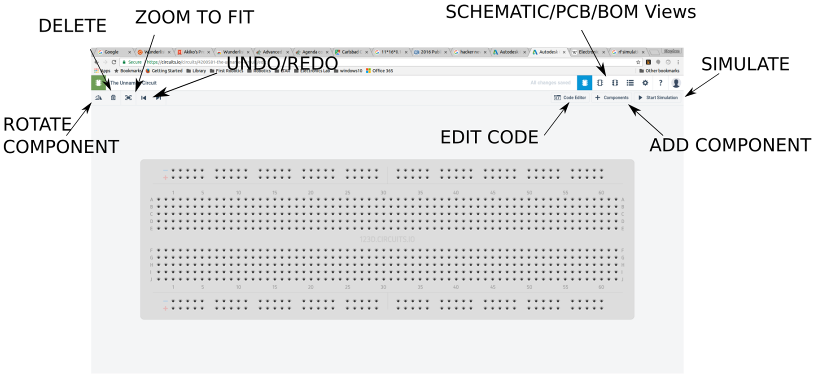
5.1.3 CODE EDITOR

use to add/edit code

5.1.4 START SIMULATION

Used to start simulation

6 Electronics Lab Controls



7 Adding wires

Mouse over the breadboard and you will see that you can "click" to create wires. This is how you make a wire

7.1 Bending Wires

Click while dragging wires to create joints in them. This is handy to make your drawing tidy.

7.2 Wire colors

Note when you select the wire you get a dialog on the right to change the color from the default green. Usually I do red for power and black for ground.

8 Adding components

Click on the "+Component" button to add a component. Click in the search box and type "resistor" to find the resistor component. Drag it onto the screen and place it on the breadboard.

9 Changing component position, orientation and values

9.1 Position

By selecting the component with the mouse you can drag it around

9.2 Orientation

Sometimes you want to rotate a component 90 or 180 degrees. Use the rotation button in the upper left hand corner to incrementally rotate it. Note it only works in one direction so if you go to far you have to circle around.

9.3 Value

Some components (like resistors) have values associated with them. Click on the component to bring up a dialog box on the right hand side.

10 Make the DC Motor Circuit

Find the DC Motor Circuit breadboard and parts list in the pdf file in the folder. Find the parts and add them one at a time. The arrange them the way you want, and finally add your wires. Note there is a "halfsize" breadboard in the component list and I like to delete the bigger breadboard since the halfsize matches what we have in the hub.

11 Adding Code

Once you have created your circuit you select "code editor" to start the coding. A new window will appear at the bottom of your screen, splitting the window

11.1 Default Code

There will be some default code in there. We can delete this

11.2 Libraries.

There is a button where you can add some of the Arduino libraries.

11.3 Upload and run

After you have entered your code you can use upload and run to start your project. If there is a compile error in your code you will get an error.

12 Running the project

When you upload the code the simulation starts automatically. Note you cannot change the code or the circuit when its running. Press "stop simulation" on the right to end it and make changes.

13 Debugging the project

13.1 Debugging electronics

13.1.1 Test Instruments

The Electronics Lab has several test tools, like meter, power supply, oscilloscope which you can add in your circuit to see what is going on.

13.2 Debugging code

The code editor has the serial monitor, just like the Arduino IDE. But it also has a debugger where you can enter a breakpoint to stop the code and you can inspect variables. This is something you cannot do with the Arduino IDE.

14 Sharing Circuits

The easiest way I found to share the circuits is to just have someone search for my user name. But they can also search for the title, without logging in `https://www.tinkercad.com/things/1onQ02knksS`

15 Extras

As mentioned before, you can also do a PCB design and get a parts list from circuits.io. You can also create your own components for a PCB design, but I don't think you can simulate them

16 Questions?