

Electricity For Noobs

Electronics Survival Guide for Fab Academy: How to Not Just Survive, But Maybe Even Thrive (Or at Least Avoid a Spectacular Crash and Burn)"

Tom Dubick Charlotte Latin Fab Lab

Safety

You are not going to light up like a torch

- We are generally working with electronics that are low voltage and low current so don't be afraid of electrocuting yourself.



Safety

Do listen to your instructor

- We are generally working with electronics that are low voltage and low current so don't be afraid of electrocuting yourself.
- However, if you develop a project that has higher power requirements, speak to your instructor and make sure you follow whatever safety procedures your instructor prescribes. If you are **not sure, ask!**

 <p>WARNING dual supply</p>		<p>Do not work on this equipment until it is isolated from <u>both</u> mains and <u>on-site</u> generation supplies</p> <p>Isolate on-site generator at _____ Isolate mains supply at _____</p>
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"Any sufficiently advanced technology is indistinguishable from magic."

Arthur C. Clarke

Preparation

- **yea, you have homework**

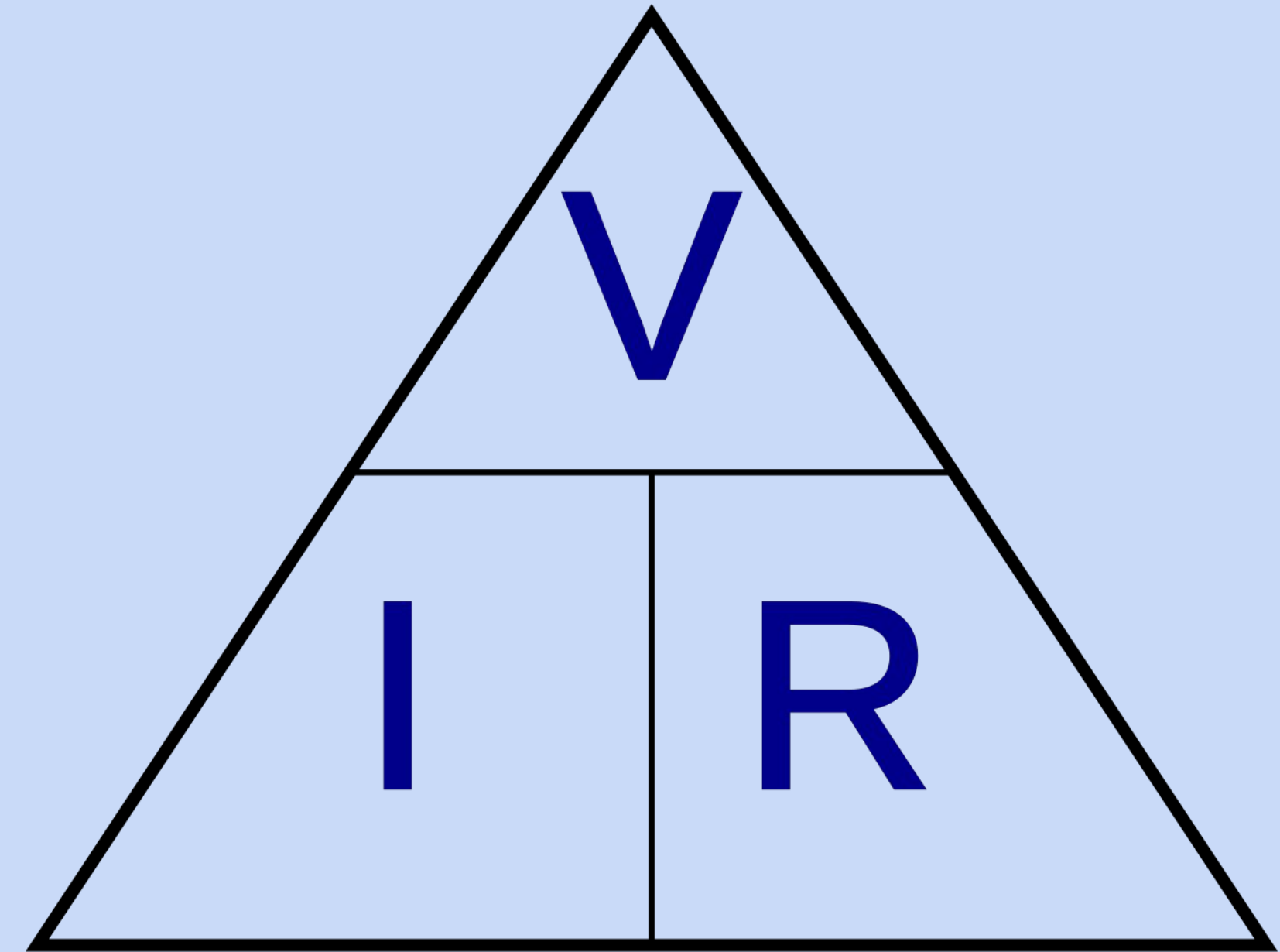
- Investigate resources that work for you
 - You need to understand these basic principles:
 - Ohm's Law
 - Power = voltage * amperage
 - Kirchhoff's circuit laws

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Kirchhoff's laws, comprising the Current Law (KCL) and the Voltage Law (KVL), state that the total current entering a junction equals the total current leaving, and the total voltage around a closed circuit loop is zero, respectively.

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- Fab Academy Resource Page



The Fab Academy.
2023

Schedule

Labs

Students

Presentations

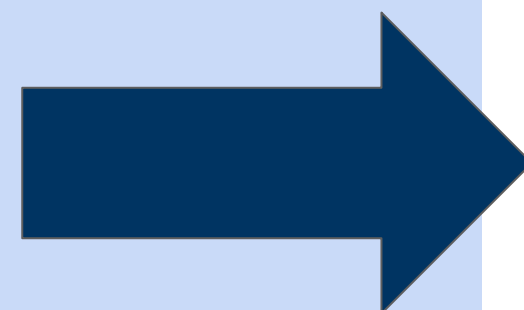
Documents

Projects

Highlights

Prior Years

Search:



Preparation

Expert Network Map

Six generations of Fab Academy students intertwined

Seek Out *Topic Experts*

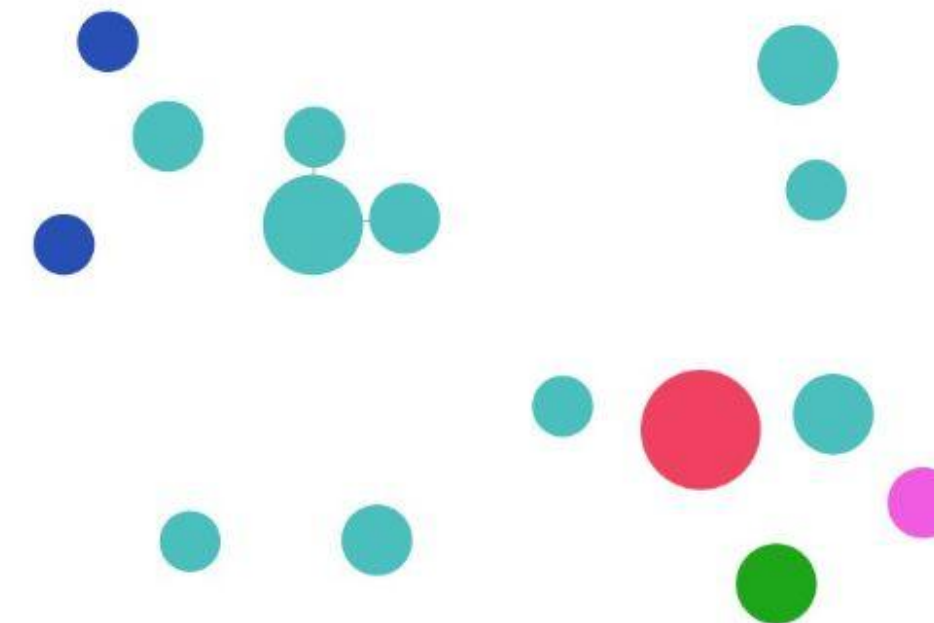
The *Expert Network Map* allows users to visually identify *Topic Experts* in the Fab community. *Topic Experts* are Fab Academy students who are frequently referenced by peers. Fab Academy students often link each other's websites in their documentation, and mapping these connections creates a network intertwined across labs, years, and countries. The more times a student is referenced correlates with expertise level in specific subject areas. For current Fab Academy students, it can be extremely helpful to quickly identify *Topic Experts* to access their documentation for reference. Interacting with the Map can determine *Topic Experts* by year and specific labs. Once *Topic Experts* are found, clicking on their circle redirects the user to their Fab Academy Documentation Website.

The *Expert Network Map* allows users to navigate the massive web of interconnected students and highlights *Topic Experts* dating back to 2018. Each Fab Academy student is represented by a circle. Drag around different students to play with the data and gain insight into the interconnectedness of the Fab community.

The larger a student's circle, the more times they have been referenced. Hover over a circle to see the student's name, year, lab, and region, and click on it to open their documentation website. Click the tabs on the left to filter by topic area; click different years on the bottom left circle to highlight students from that year; use the dropdown on the top right to highlight students from certain Fab Labs; and use the dial on the bottom right to set a minimum number of references that a student must have, changing the *Expertise Threshold*.

- All
- Computer-Aided Design
- Computer-Controlled Cutting
- Embedded Programing
- 3D Scanning and Printing
- Electronics Design
- Computer-Controlled Machining
- Electronics Production
- Mechanical Design, Machine Design
- Input Devices
- Moulding and Casting
- Output Devices
- Embedded Networking and Communications
- Interface and Application Programming
- Wildcard Week
- Applications and Implications
- Invention, Intellectual Property and Business Models
- Final Project

Filter Labs



Preparation

Expert Network Map

Here is the link to the Expert Network Map:

<https://pub.fabcloud.io/project/expert-network-map/>

tinyurl link: <https://tinyurl.com/expertmap>

Here is a link to the documentation:

<https://adamnstone.com/stem/expert-network-map/>

Link to the GitLab repo:

<https://gitlab.fabcloud.org/pub/project/expert-network-map/-/tree/main>

Preparation

- yea, you have homework

- **Investigate resources that work for you**
 - Introductory Resources:
 - Adafruit
 - Ohmify
 - Raspberry Pi.org
 - Sparkfun
 - Starting Electronics

Preparation

- yea, you have homework

- **Investigate resources that work for you**
 - Introductory and Advance Resources:
 - Circuit Bread
 - Circuit Digest

Preparation

- yea, you have homework

- **You Tube resources:**
 - Element 14 (learning circuit)
 - Great Scott
 - learnelectronics

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- Don't just watch video. When possible, work along with the video

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- Don't just watch video. When possible, work along with the video
- Wait, I don't have access to the lab yet!

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Don't just watch video. When possible, work along with the video

Wait, I don't have access to the lab yet!

Try these simple online simulators:

- Wokwi
- CircuitJS (also known as Falstad Circuit Simulator)
- Fritzing
- TinkerCad: Circuits

Workflow at Charlotte Latin

Remember, we are teachers so we are in the newbie business

This is how we have students creates circuits:

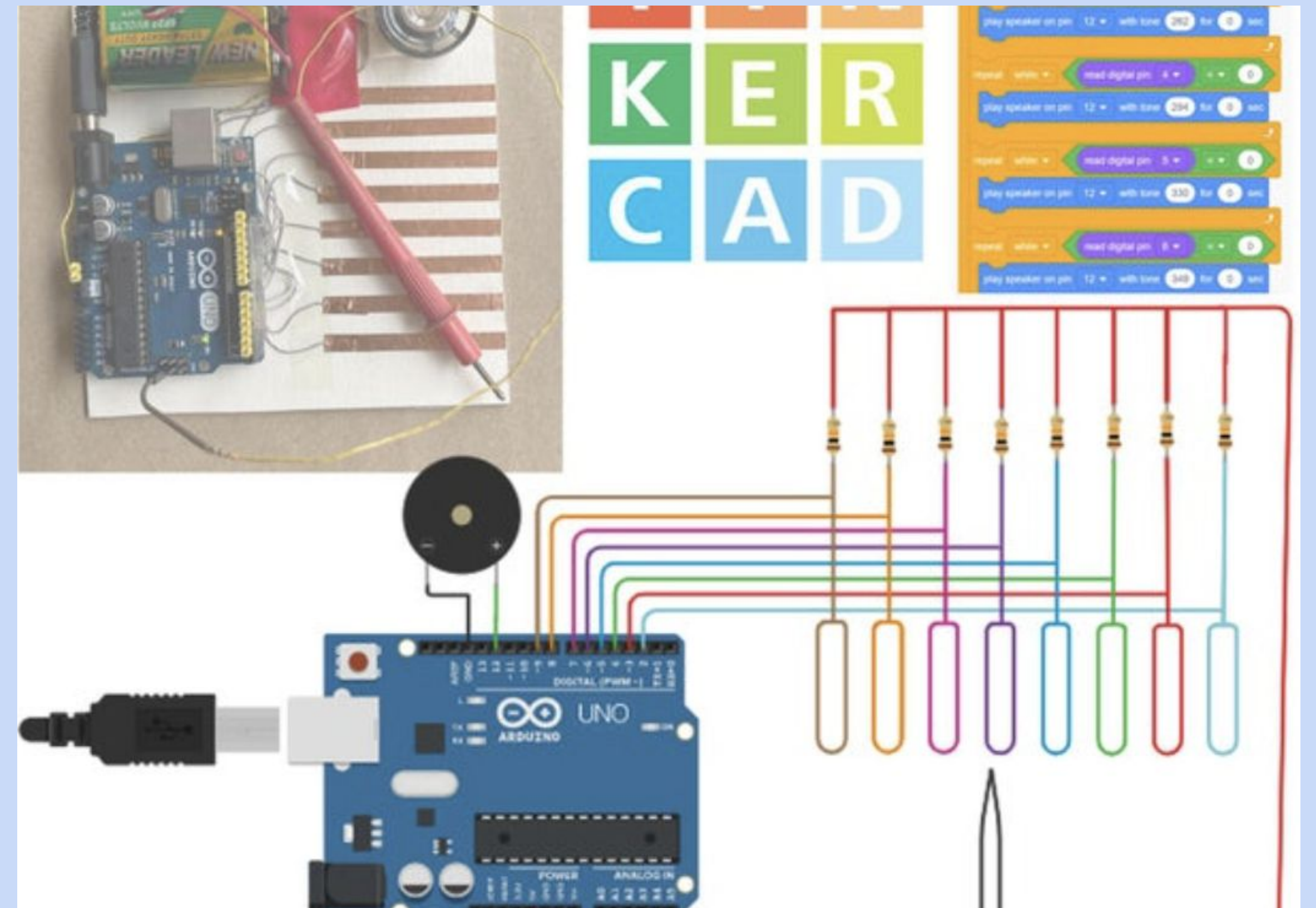
1. Wowki: Circuits - Simulate
2. Use a breadboard to make the circuit
3. Program if necessary
4. Make the circuit on a protoboard
5. Make the PCB
6. Surface Mount Solder
7. Upload the program
8. Show it to off to others

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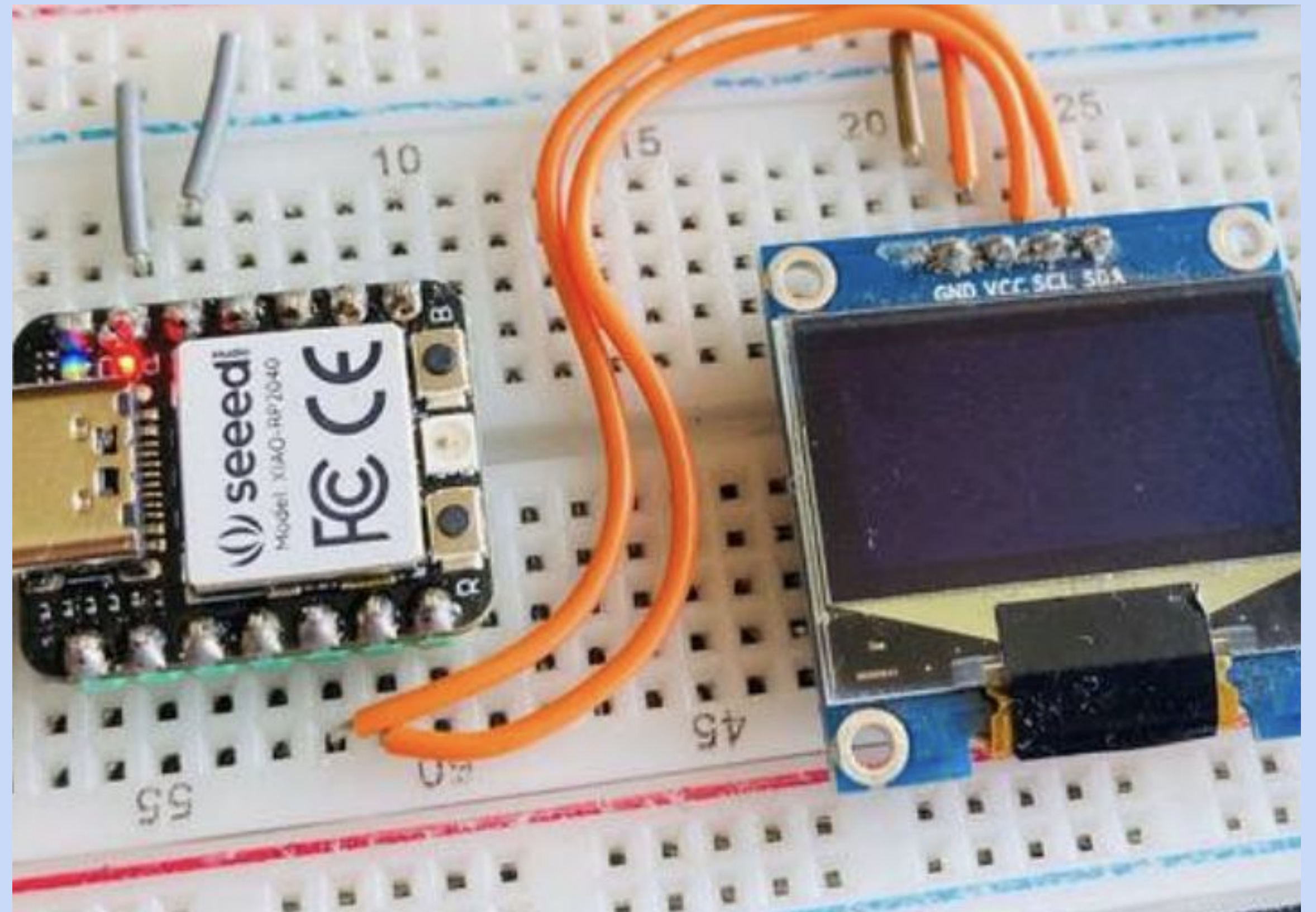
Created by Taifur on Instructables

Workflow at Charlotte Latin

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1. TinkerCAD: Circuits - Simulate
2. Use a breadboard to make the circuit
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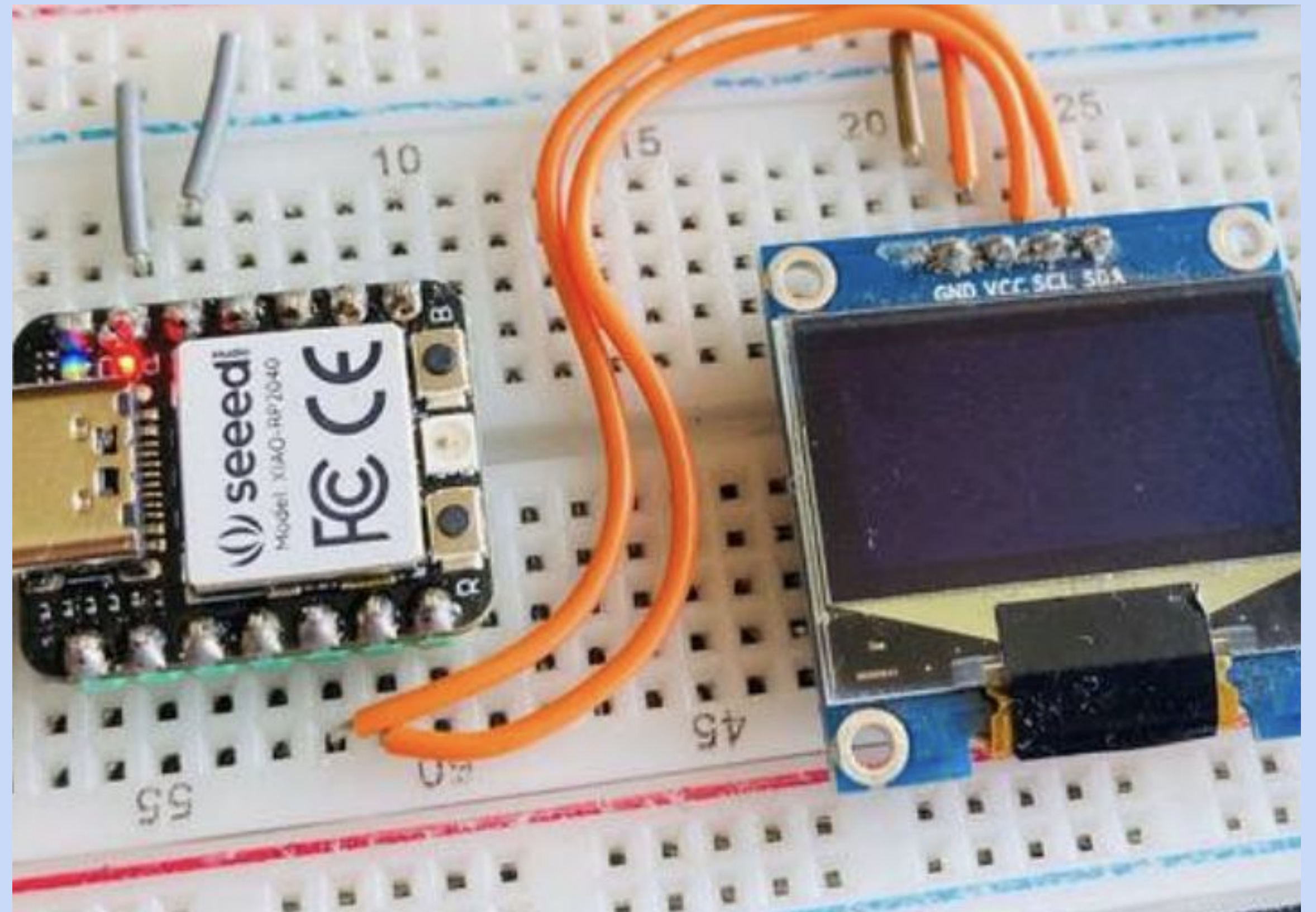


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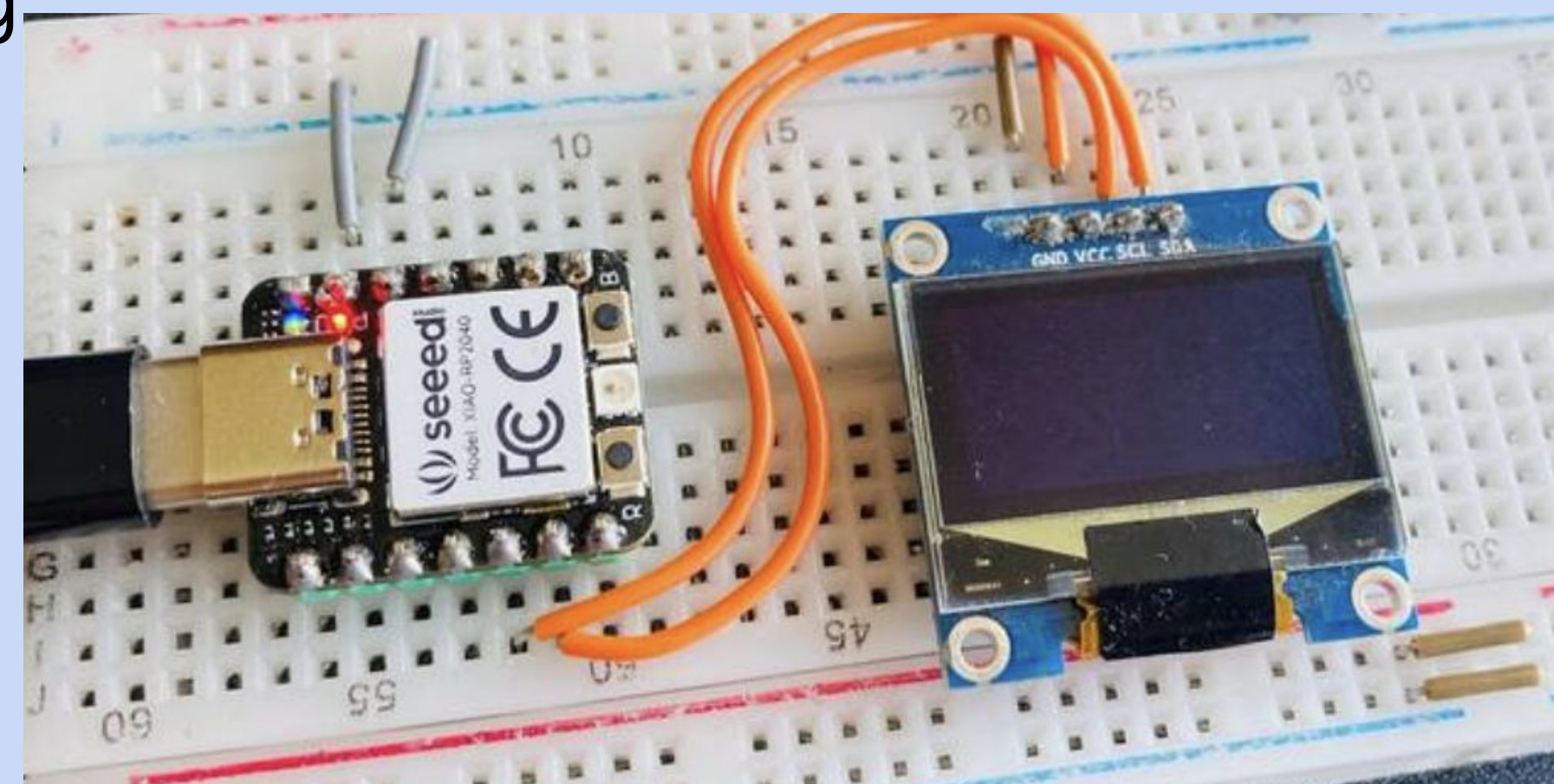
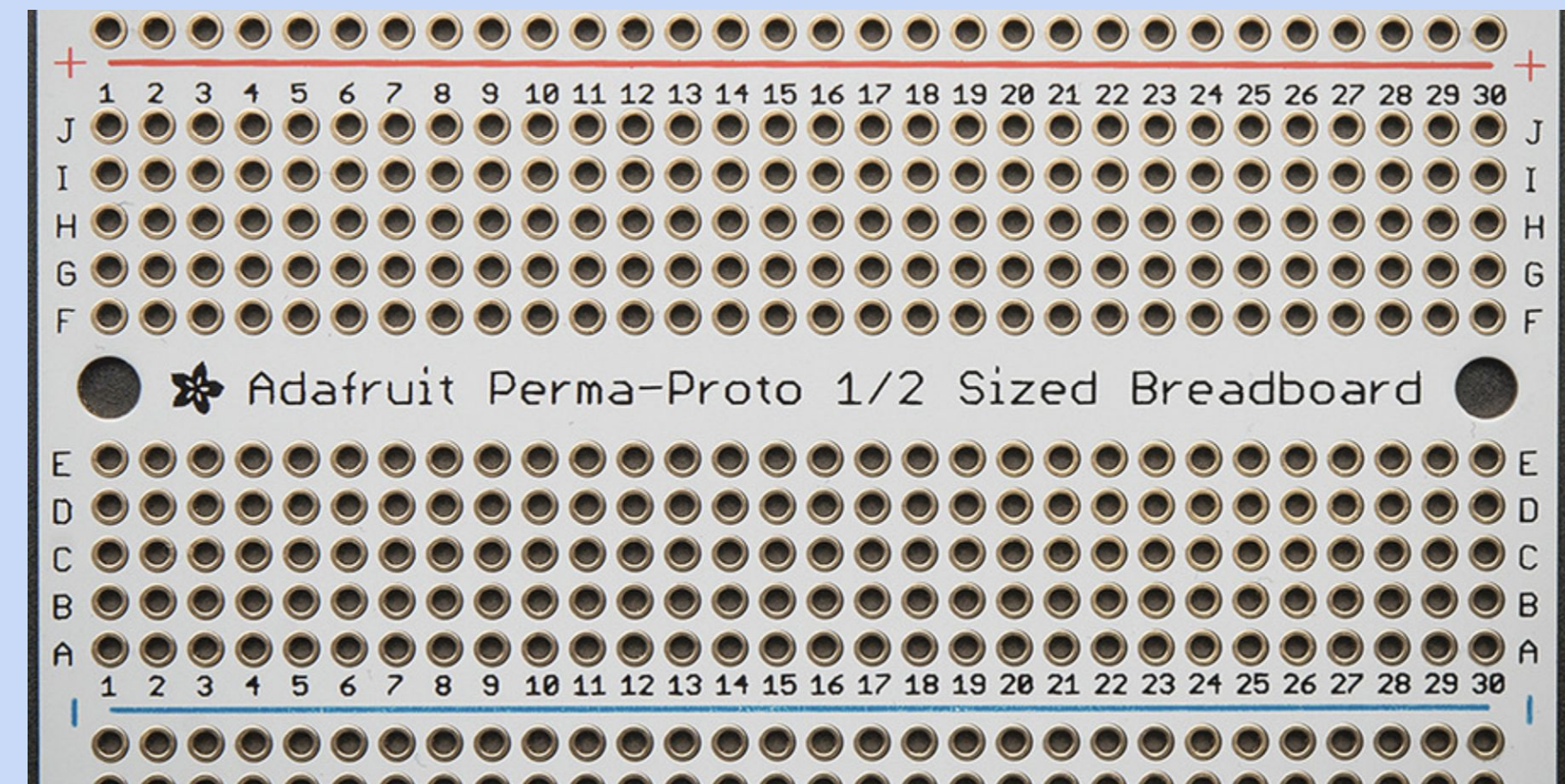


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1. Wowki: Circuits - Simulate
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4. Make the circuit on a protoboard - through hole soldering
5. Make the PCB
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Protoboard vs Breadboard

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5. **Make the PCB**
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PCB - made by Amany - Fab Academy 2022

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PCB with components - made by Amany - Fab Academy 2022

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Programming the board Amany - Fab Academy 2022

ChatGPT and Electronics

"Give me a place to stand, and a lever long enough, and I will move the world." - Archimedes

"The tools, exactly; the tools are the subtlest of traps."
- Neil Gaiman's "The Sandman"

ChatGPT and Electronics

If Google is a question, then ChatGPT is a conversation.

You will get better results if you ask it a series of questions or you make additional suggestions (prompts).

Be sure to check the accuracy - quick wikipedia or google
second opinion never hurts

ChatGPT and Electronics

Ask ChatGPT to explain a concept to a 12 year old

Then ask ChatGPT to explain the same concept to a 18 year old

Finally, if needed, we ask ChatGPT explain it to an electrical engineer

ChatGPT and Electronics

Avoid asking ChatGPT to write all your code or it may become a crutch which is quite easy to do.

Rather, look at code that someone has written and ask ChatGPT to explain the code to you.

The juice is worth the squeeze

Learning electronics initially can be difficult, but once you grasp the fundamentals, it becomes quite straightforward, especially in the way most people apply electronics in a fab lab.



You are going to learn how to make amazing things.