The 10 C's of Product Design

Why Learn Printed Circuit Board Design?

To Learn a Product Design Cycle!!

You can make your living doing the **WORK YOU ENJOY on the PROJECTS YOU LOVE and believe in!**

A PCB layout is part of just about any project you may want to make these days. Consequently, it can be the **basis** of an entire **engineering/design career**!! Even though it can take a while to learn, capturing your own circuit designs into schematic form and then creating your own PCB layouts, will give you **one of the basic skills sets** needed to be a product designer. For me this has been fun (most of the time). The **Hippie-I/O** channel is presenting projects and ideas and methods so that you can start with basic **WORKING** circuits. This approach comes from over 50 years of computer and electronic experience. (I wrote my first computer program in 1967, designed, built and programmed my first single board computer in 1986. This included writing a *cross assembler program* (JAsm)to do the programming and a downloader Jterm) You can download the report of this project on my website https://www.hippie-io.com/Useful-Info/

Many of the circuits presented will be in the form of modules. You can learn how to order the PCB's and components and successfully solder them. You will learn how to test your circuit boards for proper operation. You will ultimately be able to **combine** these modules into other useful designs **of your own!** Your first couple of years might be doing nothing more than scouring the internet for circuits donated by others. Ideally, you will be looking for ways to enhance living by **solving problems,** or helping people be more productive or in having a more enjoyable life! You will get practice choosing the right components for these circuits and ordering these components from electronic part distributors. You will layout and order your own printed circuit boards. You will solder the components you ordered onto your circuit boards. You will test your circuit. You may need to make changes to your design. "Spin" another 'rev' (revision).

Go through this design cycle enough times to get the **rhythm of project and product design**. All the ideas presented for you by **Hippie-I/O** do nothing more than give you a starting point. You will eventually find **your own way** through the design and manufacturing process, adding processes and ideas that make your product designs safer, faster, better, stronger, easier to use, etc. You just might be able to sell some of your designs to neighbors and friends to help finance your projects along the way!

(This list is just to help get you started, there are plenty more good ideas out there once you get plugged in. [*pun intended*])
If you think this is a path you would like to tryout, your goal will be to learn and use some basic "C's" of the **Creation of** a product design: (yep, here are 10 of 'em)

My Ten C's of Product Development

(yeah I know, it's actually 11, but I was trying to capitalize on a paradigm)

- Concepts
- Components
- Circuits
- CAD
- CAM
- CNC
- Construction
- Coding
- Commerce
- Collaboration/Community

YOUR NOTES:

[**CONCEPT**]
    Conceive an idea, write it down (you might even use the famous NAPKIN)
[**COMPONENTS**]
    Choose electronic components that you can use to implement your idea
[**CIRCUITS**]
    Form those components into a circuit design
[**CAD**]
    Capture your schematic and layout your circuit board (PCB) design using programs such as Diptrace, Altium Designer,etc.
    Design an enclosure using a program like Fusion360 if needed.
    Design a front panel for your enclosure if needed.
[**CAM**]
    Create the data for your project, in the form of gerber, dxf, g-code, etc. files
[**CNC**]
    Use your CAM data to make your prototype enclosure or cut your front panel using a Computer Numerically Controlled device if needed.
[**CONSTRUCTION**]
    Solder the components onto the PCB's and test your circuit. Install it into your enclosure.
[**CODING**]
    If your project has a microcontroller, write and test the code for it. Ideally, you will take *the road less travelled* by coding in such a way that other people can read and understand your code. *And change it if needs be*. My degree in Computer Science taught me how to write poor code. One class in technical writing taught me how to improve that code. No CS degree? Good for you!! Most of the code that comes out of college teaching is PURE GARBAGE!! The code might "work", but it will be full of potential failure points, un-readable, un-changeable without 'breaking' it and will take more memory than is needed. The best programs come from good communicators, such as those from literature and writing backgrounds! Once I experienced the GREAT code coming from these types of programmers, I sunk my head in shame and made it a point to **UNLEARN** the crap style that I had been taught in school. I'm still working on this goal. Still working toward writing code more clearly, with empathy toward the poor sap that has to try to read this code and change it! (Apologies in advance to all of you using my code samples in the future, but know that it is a work in progress and still open to suggestion)
[**COMMERCE**]
    Send the gerber data to a PCB manufacturer of your choice (example:Seeed Studio, JLCPCB, PCBWay, https://oshpark.com/ , etc.) .
    Create a bill of materials (BOM) from your circuit design .
    Order the parts on your BOM from a electronic parts distributor (For example DigiKey).
    Receive the PCB's .
    Receive the electronics parts from the distributor you chose (Example:DigiKey, Mouser, Newark, Allied, etc.) .
    Send your design out for fabrication.
    Market your product.
[**COLLABORATION**] /[**COMMUNITY**]
 Share your designs with like-minded people that enjoy your interests and goals.

Just an anecdote:

What I've presented to you comes to you from over **50 years** of experience. In that 50 yrs I have filled out 2 job applications. Most of my life I have been hired on the spot, with a very short interview. Only once was I ever asked about my degrees (2 of 'em)! And that was *AFTER* I was hired! As one person on YouTube said: "Skills pay the bills". In year 2021, it is pretty clear to me that you **do not** need a degree!! In fact, my last employer tried not to hold my degrees against me!

"There's no need even to have a college degree at all, or even high school...." Elon Musk

LEARNING HOW TO LEARN

I agree. I think formal education can now be considered a form of brain washing, debt-enslavement and a rip off. You get far more value **learning how to learn. Also, by having and creating experiences**. Learn how to get the knowledge and skills you want on YOUR OWN! Put the resources you would have invested in college, into your own business or project idea. You can watch all of my boring soldering videos in less time than it took to go to **one class** in a day at college. If you pay attention, to these soldering videos, you can save countless hours of time troubleshooting your projects, due to poor soldering.

Design that circuit!
Design that machine!
Build that circuit!
Build that machine!

Watch it go up in smoke! Listen to it sizzle. You'll learn!! (*Please don't breath the smoke!*) You'll find out what went wrong and you'll fix it. You'll find the missing parts or information you need. The process will make you tougher, smarter, wiser. You'll learn that it is OK to fail. Because an attempt is **never** failure. It's a step toward your goal. The only failure is NOT TRYING. If you attempt nothing, failure is 100% guaranteed.

I'd like to think of myself as a member of a community of people who want to live in a FREE society. My freedom has come from a learned ability, and acquired Ninja skills. Contribute a part of who you really are, to your fellow humans. We are all in this together!

(Whew! Thanks for listening to this rant)
Disclaimer:

No college graduates or attendees were harmed in the making of this rant. If you have a degree('s), congratulations, that is an accomplishment. Some departments, in some colleges, are doing some marvelous research and development. There are some awesomely bright people engaged as such. (e.g. John Bannister Goodenough, professor of mechanical engineering and materials science at the University of Texas at Austin.)

Just highlighting the tattered mess and extremely low value that formal education has made of itself for many of us, and that, others (i.e. my homies) can be successful taking other educational approaches.