

TOOLKIT SECTION 4.

Digital /Visual Tools for **PREPARATION OF SCHEMATICS + DIAGRAMS**



Co-funded by the
Erasmus+ Programme
of the European Union

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2019-1-SE01-KA204-060535

4. Digital/Visual Tools for Preparation of Schematics & Diagrams

Schematics and Diagrams form a large component of some engineering and vocational education curriculum.

Traditionally these would have been taught and practiced offline but now thanks to digital tools, more life like and animated schematics and diagrams can be created. In the section, we present the VLEE's project's carefully curated list of Digital/Visual Tools for Preparation of Schematics & Diagrams.

- 1 MATLAB
- 2 Mockflow
- 3 Autocad
- 4 Draw.io
- 5 Circuit lab
- 6 UML Diagramming Tool



MATLAB “In a Nutshell”

MATLAB (*MATrix LABoratory*) is an interactive system whose basic data type is a matrix. This makes it possible to solve many technical problems, in particular those formulated with matrices and vectors. Thanks to MATLAB, problems can be solved faster than using programming languages such as C, C ++ or Fortran. Moreover, the software can have many uses.

MATLAB - examples of application areas are signal processing, image processing, telecommunication, designing control systems and financial mathematics.

A characteristic feature for MATLAB is a set of additional libraries (m-files) called toolbox for solving specialized problems in specific fields (automation, electronics, telecommunications, mathematics, etc.). These libraries extend the capabilities of MATLAB.





MATLAB Advantage

- Easy to use command line interface and file-oriented structure. An engineer or scientist can quickly create a working program.
- There is an inexpensive Student Edition of MATLAB
- Platform independent - can be installed on different Operating Systems such as Windows, Vista, Linux and Macintosh
- MATLAB contains a tool that allows programmers to interactively design a Graphical User Interfaces (GUI)



MATLAB Disadvantage

- The first disadvantage is that it is an interpreted language and, therefore, may execute more slowly than compiled language.
- Price - A full copy of MATLAB is five to ten times more costly than a conventional compiler.
- The program itself is not very intuitive for first-time users. Once you get used to the software, it is much more straightforward, but it is hard to just pick it up and begin to use MATLAB.

MATLAB Feedback/Insights

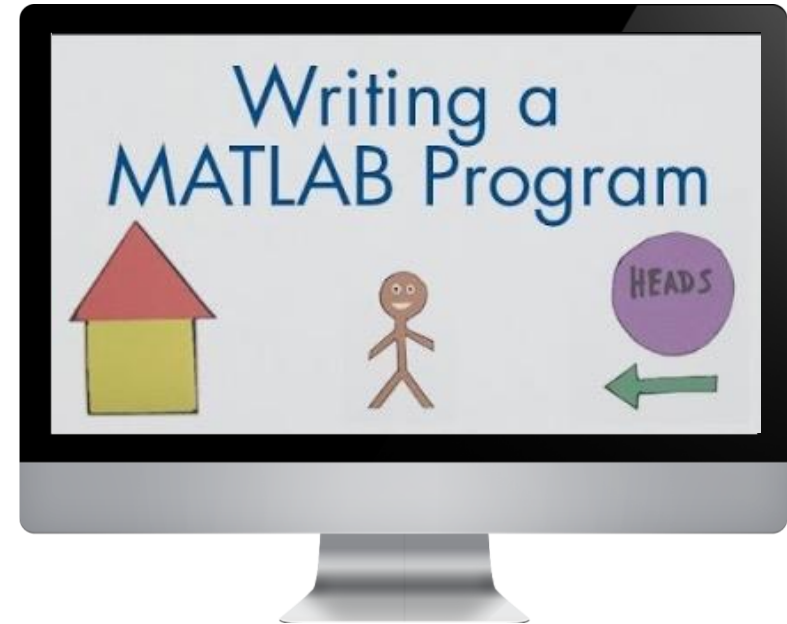
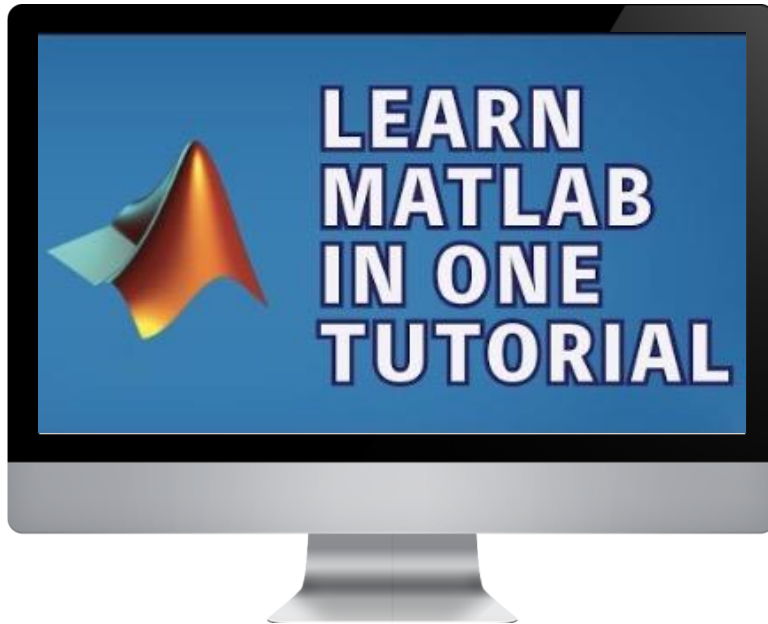
“ *The most powerful software for Science and Engineering. There's a vast range of functions and the ability of plotting graphs is amazing. I use it pretty much daily for my research, my teaching, and even in some personal day-to-day life.* ”



Nicolas L., Assistant Professor



MATLAB - In Action



MATLAB is a computer program that is an interactive environment for performing scientific and engineering calculations, and for creating computer simulations. Here are some examples how MATLAB works.

<https://www.mccormick.northwestern.edu/documents/students/undergraduate/introduction-to-matlab.pdf>



MockFlow “In a Nutshell”

Mockflow is a visual discovery engine for finding ideas like recipes, home and style inspiration, and more. Is a tool that engineering educators as well as students can use to create share user interface flows and information architecture mapping projects.

Mockflow features collaboration Tools, drag & drop Editor, feedback management, Presentation Tools and Wireframe Creation. Also, Mockflow can be used by engineering educators for rapid draw and iterate layouts of websites and apps, user journeys and data flows teaching, as well as discuss, conduct learning activities. Mockflow can be used to visual ideation, serving for exploring creative potential on the specific tasks of UI design, being an interesting tool for enhancing visual literacy creation competences.





MockFlow Advantage

- Easy to learn and to use.
- Rapidly and easily sketch ideas.
- Allow collaborative creative activities.
- Offers Thousands of pre-built components and layouts to draw any UI
- Templates lets an easy use of custom features.
- Mockflow can be used to iterate ideas.



MockFlow Disadvantage

- Limited scope of use
- Requires a adobe flash plugin to run.
- There could be more pre-built options that are standard to websites such as more drop-down menu options or navigation bars.

MockFlow Feedback/Insights

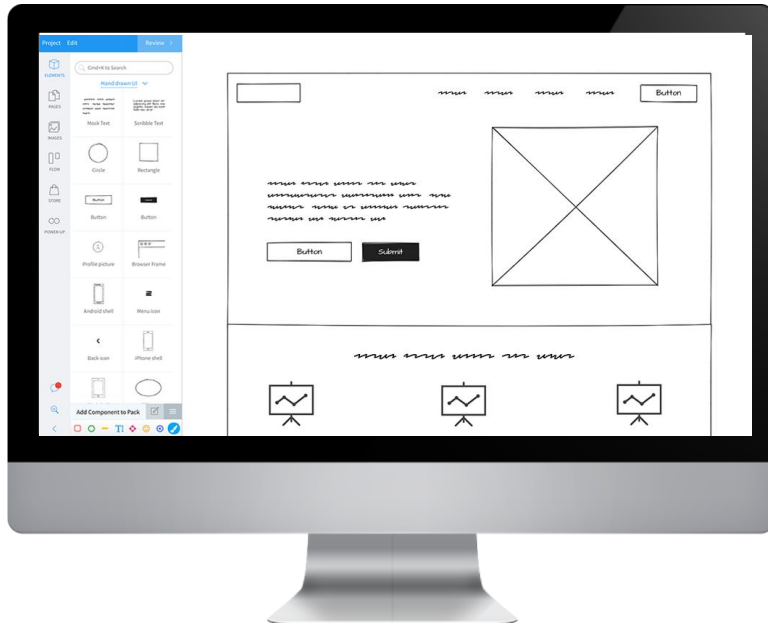
“ One of the best tools I've ever tried online for sketching ideas, website wireframes, apps. ”



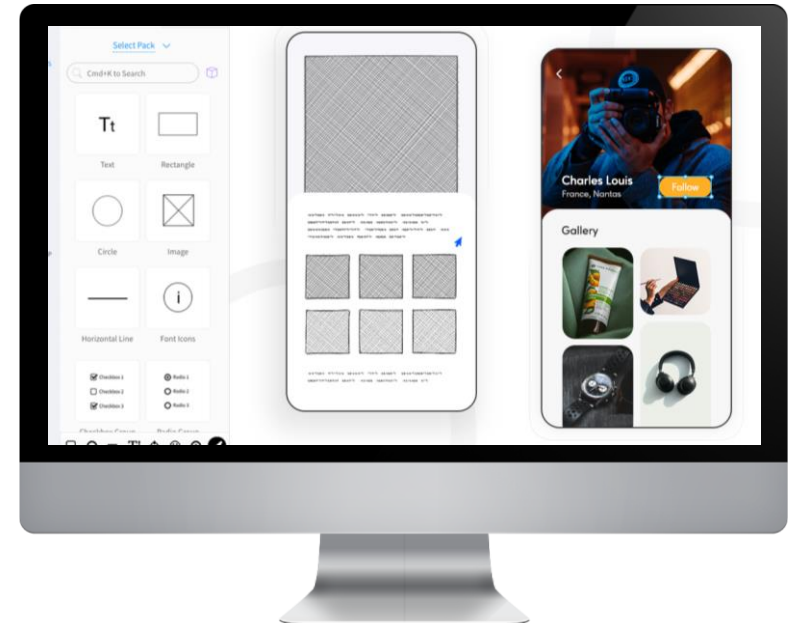
Engineering software educator



MockFlow - In Action



Here we show an example of using Mockflow for visual learning on the designing of user interface



Another interesting feature of Mockflow is the creation of sitemaps



Autocad “In a Nutshell”

Autocad is the most popular CAD tool in the world. It can be used for many engineering branches, like: construction, energy, geodesy, geology, telecommunications and many others. Author of this solution is american company Autodesk. It’s a leader in 3D design, engineering and entertainment software. More information about software and firm is on the web site: <https://www.autodesk.com/>.

Autodesk solutions span countless industries, empowering innovators everywhere to combine technologies in new ways, unleash talent, and unlock insights to make the new possible.

This program offers free educational versions and trials. In Autocad implemented a few toolsets adapted to engineering industries.





Autocad Advantage

- No compatibility problems in the CAD environment
- Applicable to almost all fields of engineering
- Flexibility (access anytime, anywhere with the Autocad Web and Mobile Apps)
- Free educational versions
- Easy installation



Autocad Disadvantage

- Non – intuitive
- Hardware requirements
- Still too high price

Autocad Feedback/Insights

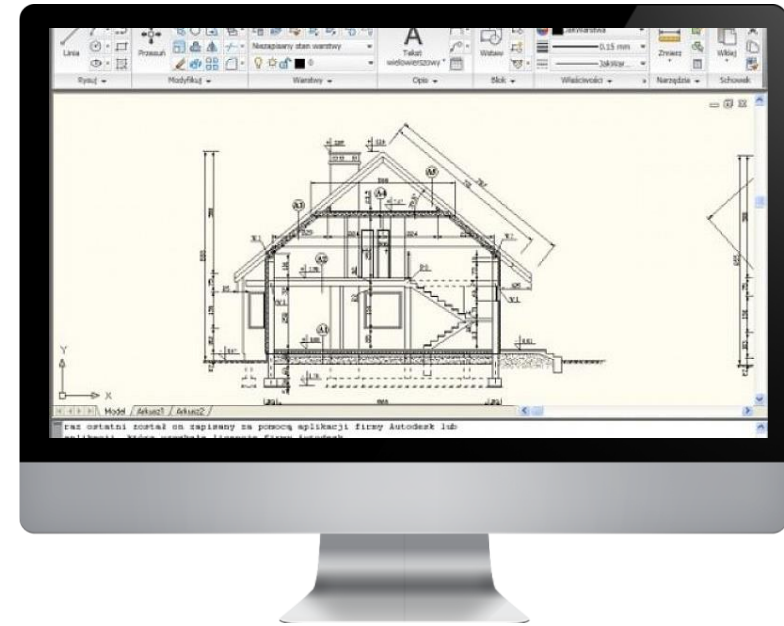
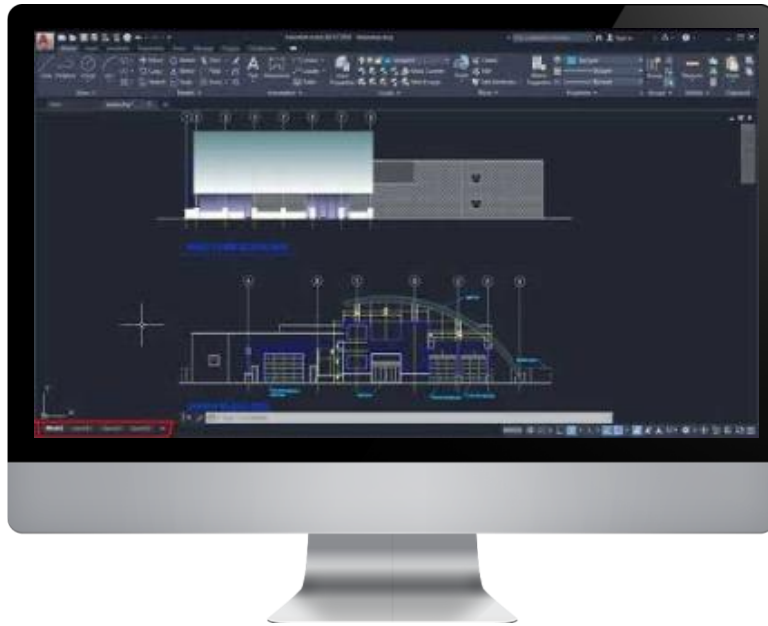
“ I've been working with Autocad for over six years and never thought about changing. It meets all my needs and, when I can't find a solution for a project, I have the answers by searching the Internet. I have experience in 2D projects, but I have already tried 3D tools and found it easy to learn. I have no problems with slowness and crashes, unlike other software I've tested ”



Daniele from AW Construction



Autocad - In Action



Autocad can support all engineering industries in residential 2D design and drawing.



Draw.io “In a Nutshell”

Draw.io is a tool that engineering educators and students can use to create and share diagrams and flowcharts as well as mind maps to help us visualize ideas, understand complex concepts and workflows as well as well as for engineering analysis, such as understanding and visualizing algorithms. Draw.io is a free diagramming application that allows users to create and share diagrams within a web browser. The online tool works with G Suite/Google Drive and Dropbox, and is deeply integrated and audit-friendly in Atlassian's Confluence and Jira products. Draw.io can be used in engineering classes to practice map out engineering processes, systems as well as algorithms.

As a visual literacy tool, Draw.io can be used to foster visualization abilities, as well to develop visual expression skills.





Draw.io Advantage

- Completely free software. No registration needed
- Easy creation of diagrams including flowcharts and all UML models.
- Very flexible, diagrams can be built using the web or the desktop app
- Facilitates collaborative work, diagrams links are easy to share
- Creates different models and save it in different formats like png, jpeg, pdf etc.



Draw.io Disadvantage

- On the online version some editing and drawing functions are a little awkward.
- Hard to maintain from an organizational perspective at educational institution level
- Hard to Audit and update versions
- Sometimes it is hard to move around the different types of shapes in the diagram. Apart from them the saved file metadata also gets corrupted which makes us work again on the same diagram

Draw.io Feedback/Insights

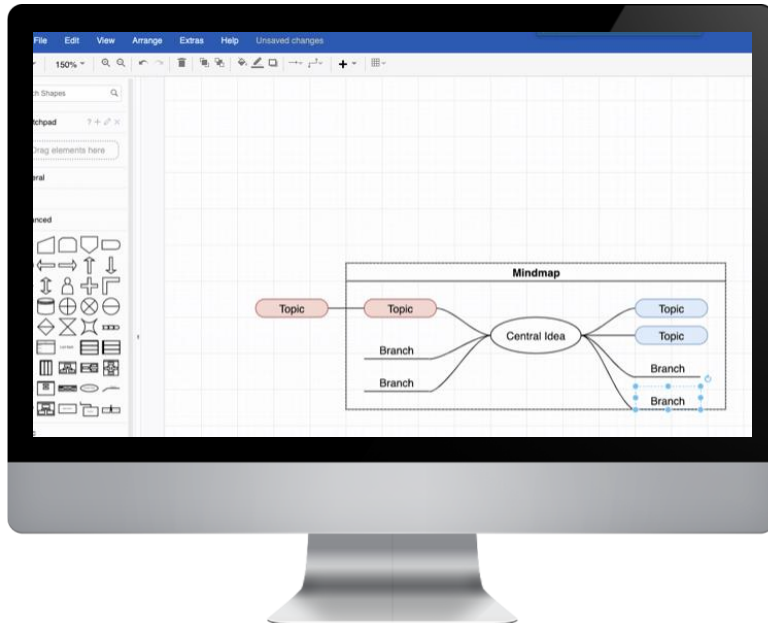
*“ I'm impressed and still diving into all it's features. I really like the amount of templates available to start any kind of project. There are tons of predesigned symbols to use also for free!
Also, you have a bunch of export options from image files to svg for vector editing that other apps don't have ”*



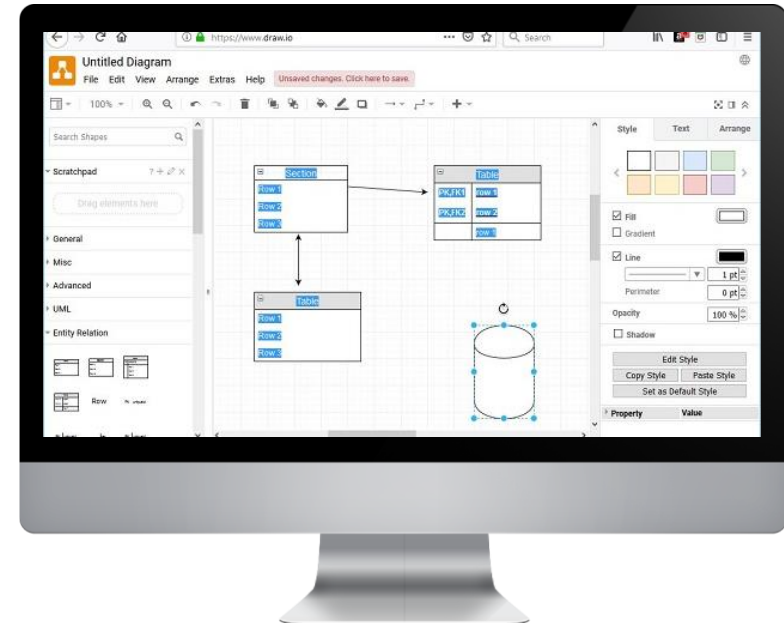
Engineering Educator



Draw.io - In Action



Mindmaps



Entity Relationship Diagrams

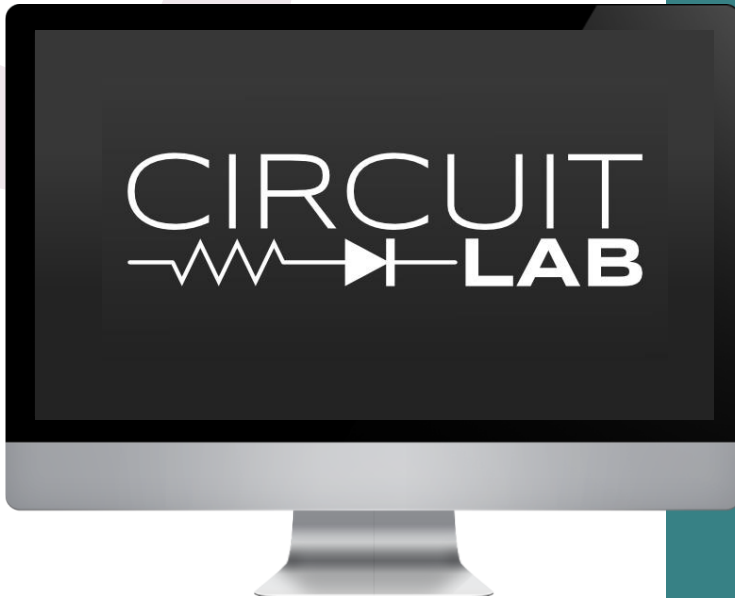
All kinds of diagrams using in engineering can be created and shared in draw.io
Here we present some examples of mind maps for project-based learning and clarifying complex concepts, Entity relationship and UML diagrams for software engineering learning.



Circuit Lab “In a Nutshell”

CircuitLab is a tool that engineering educators and students can use for Circuit simulation. CircuitLab has been made to develop Spice style simulators that run on the web, using cloud storage to save and share circuit schematics with ease. In the CircuitLab students can create their own electrical circuits and do measurements on it. In the circuits the students can use resistors, light bulbs, switches, capacitors and coils. The circuits can be powered by a AC/DC power supply or batteries. There is an ammeter, voltmeter, wattmeter and an ohmmeter. There is also a version of the Electrical Circuit Lab in which data can be collected. Students can analyze the collected data by creating graphs of the data and use the graphs in the conclusion tool.

CircuitLab is online and works as a web browser application.





Circuit Lab Advantage

- Simple and easy to use
- The CircuitLab provides a free, interactive electronics book (<https://ultimateelectronicsbook.com/>) that combines the math, the physics, and the engineering intuition.
- Circuitlab take significant advantage of hardware acceleration by utilization Chrome hardware acceleration.



Circuit Lab Disadvantage

- The CircuitLab uses only schematic symbols not realistic to displays circuit components.
- The CircuitLab cannot switch between pictorial and schematic view.
- Other similar applications have more attractive virtual instrumentation features that more accurately convey the sense of working on a real electronics bench.

Circuit Lab Feedback/Insights

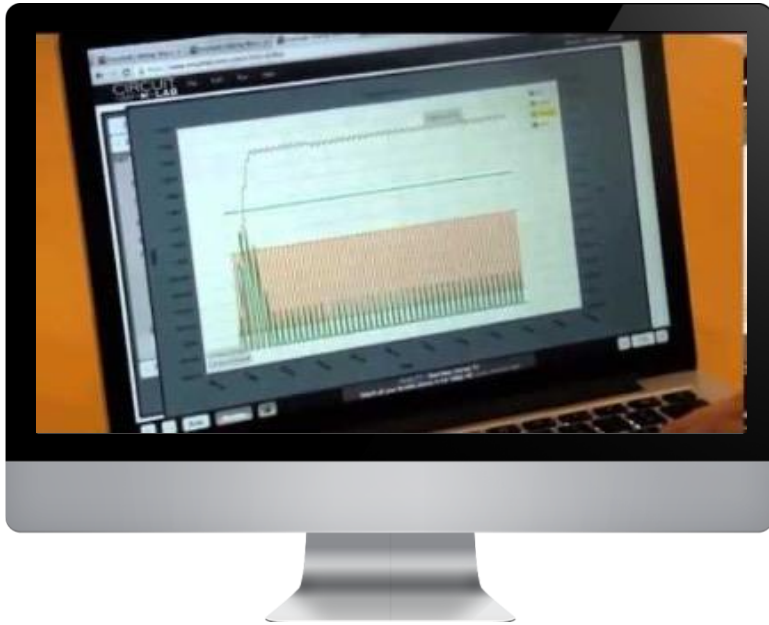
“ In our product development cycle, we’ve used CircuitLab in more places than you might expect: optimizing our analog front-end, RF matching network analysis, improving our power supply robustness, and designing and documenting test and production fixtures ”



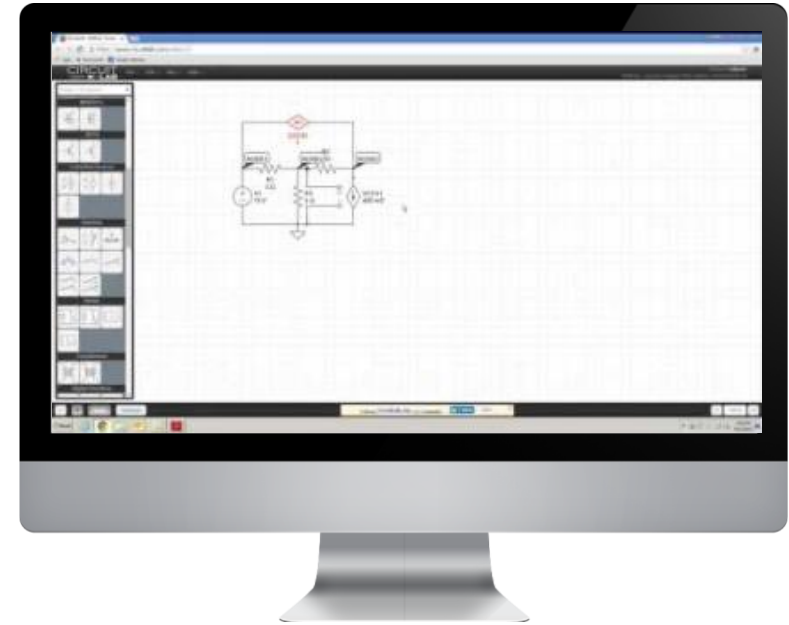
Pantelligent Hardware Engineering Team



Circuit lab - In Action



A look at the Circuitlab cloud-based schematic capture and design tool on powersystemsdesign TV (PSDTV)



ENGR 313 - Circuits and Instrumentation Youtube channel discussed the Dependent Supplies used CircuitLab



UML Lucidchart “In a Nutshell”

Block diagrams are one of the basic components of system design. For software engineering or IT systems, Lucidchart offers network diagram and block design tools. Lucidchart is customizable for technical flowcharting, with thousands of shapes and icons, instant organization charts, business diagrams, project maps, sales processes and customer service flows. It has a drag-and-drop editor which is compatible with various operating systems (Mac, Windows and Linux).

An extensive graphics palette, a fully customizable editor, keyboard shortcuts and master pages help in creating product management diagrams. With the ability to modify grid settings, HEX codes, page layout, font size, and even line curve radii, Lucidchart is a very flexible flowchart creator.





UML Lucidchart Advantages

- It's easy to learn with drag and drop functionality. Even if you're new to creating diagrams, you'll pick it up quick. This tool have great tutorials and tips to help get started.
- It's intuitive and easy to use.
- It's pretty flexible. It guides a good way to do things but doesn't force it.
- Being web-based eliminates install hassles and makes sharing the output and collaboration easier.



UML Lucidchart Disadvantages

- It is dependent on internet speed to drag and drop items to add them to your schematic. It can be slow and sometimes not even work at all.
- Finding things that interest us can be quite difficult, nothing is given directly. To achieve a master level in working with the tool, a lot of trials and experiments are needed.
- The tool, although efficient in a basic package, requires huge investments in professional, team and corporate packages.

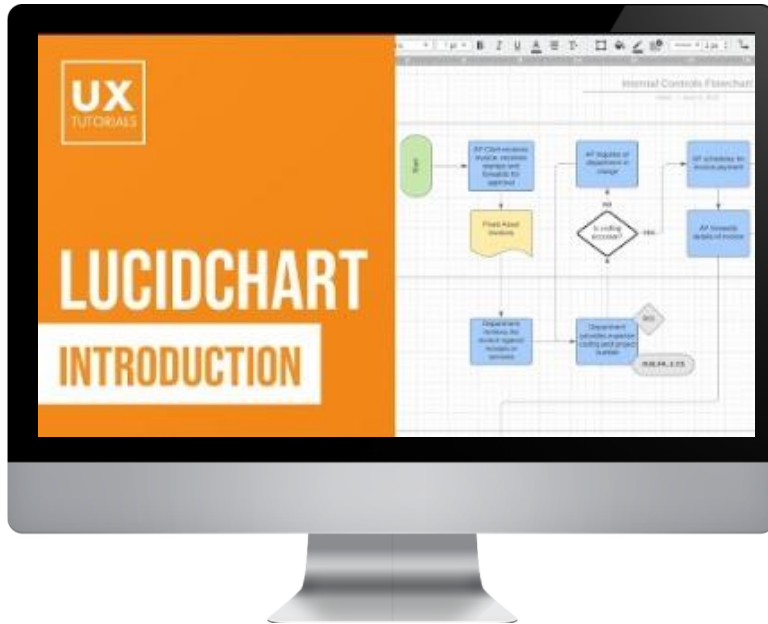
UML Feedback/Insights

“*Lucidchart accommodates students of all ages—it’s intuitive enough for elementary school students and powerful enough for advanced engineering courses.*”





UML Lucidchart - In Action



Watch this tutorial video which gives an Introduction to using Lucid chart to create everything from Sitemaps to User Journeys and Flows.

[Lucidchart tutorial for beginners - YouTube](#)



This tutorial video is for those who want to learn how to work faster in Lucidchart and build better designed, fully interactive, easily shareable documents and diagrams. [Lucidchart Tutorial: Top Tips and Tricks for Lucidchart - YouTube](#)

Next up...

Section 5 - Digital/Visual Tools for
Communication, Presentation and Reporting

