
Project Management & OneNote

ECE 401 Senior Design I

Week #2

Please visit Bison Academy for corresponding lecture notes,
homework sets, and videos
www.BisonAcademy.com

Introduction

Project Management looks at how to manage projects.

A project is an activity that has

- A start date
- An end date, and
- A specific outcome or deliverable

Some things are *not* projects:

- Reading your emails is not a project. It has no start date, no end date, and no specific deliverable
 - Your ECE 401 term project *is* a project: it has all three of these.
-

When is Project Management Needed?

Sometimes, project management isn't necessary

- If a project is small enough or
- If you have enough experience,

You can simply start the design process right away.

However, when dealing with a project which is

- Complex.
- Large in scope,
- With a large number of people, and
- Which has a hard deadline for completion,

a little organization up front helps to increase the odds of the project being successful. That's the goal of project management.

Project management isn't easy.

- People make careers out of being good at project management.
- You can get a degree in project management (MBA)
- Have respect for MBA's - they're really useful.

Examples where project management was vital:

- The James Webb Space Telescope
*1200+ scientists, engineers, and technicians
from 14 countries and 27 states working on it.,*
- The F35 Fighter
*125,000+ people
46 states working on it*
- TerraPower
*600+ employees
designing the next generation Thorium fueled
nuclear reactors.*

Projects of this size take considerable organization to complete successfully.



Project Management in Senior Design

Senior Design isn't as complicated as these

However, you will be given

- A fairly complex project,
- With a team of three people,
- With a hard deadline: the end of the second semester.

It really pays off to spend some time at the start to get the project organized.

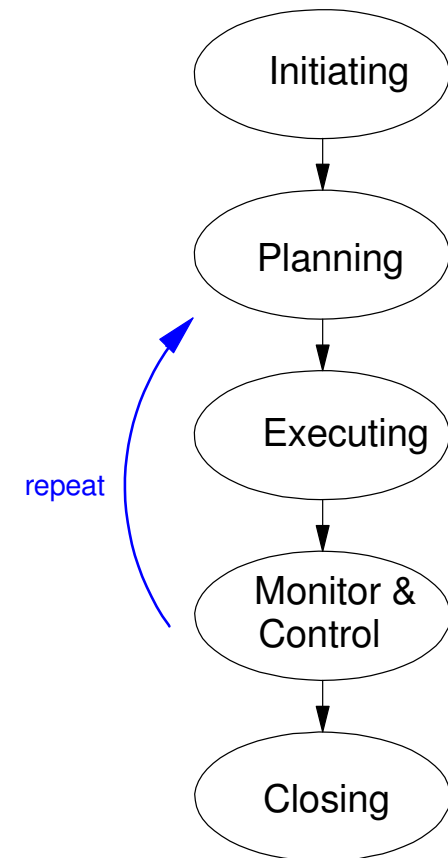
- We'll be doing this in Senior Design I with a smaller, simpler project.
 - Hopefully the ideas behind project management make more sense and can be applied in ECE 403
-

Project Life Cycle

Any given project usually goes through:

- **Initiation:** Where you start the project. In companies, this is usually at the start of the fiscal year when money is allocated to the project.
- **Planning:** When the project manager defines the scope of the project, the time allocated to it, and the budget to complete the project. This also includes the organization of the project.
- **Executing:** Doing the work
- **Monitor and Control:** Feedback during execution to make sure the project remains on track.
- **Closing:** Finishing the paperwork and documentation, closing the accounts, releasing personnel.

This doesn't have to be sequential: the middle three (planning / executing / monitoring) can be repeated over and over as often as needed to get the project right.

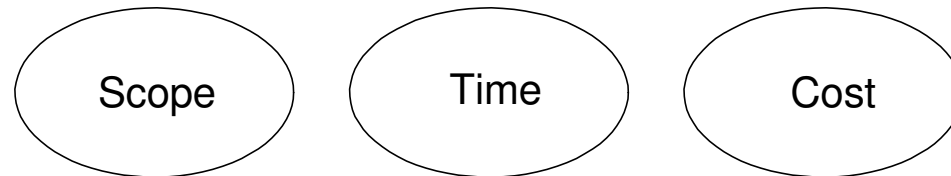


Project Manager

The project manager (or project management) seeks to complete these tasks within the constraints of

- Scope: What the project is and what it isn't,
- Time: The time allocated to the project (start and end date), and
- Cost: How much money and resources are allocated to the project

Constraints



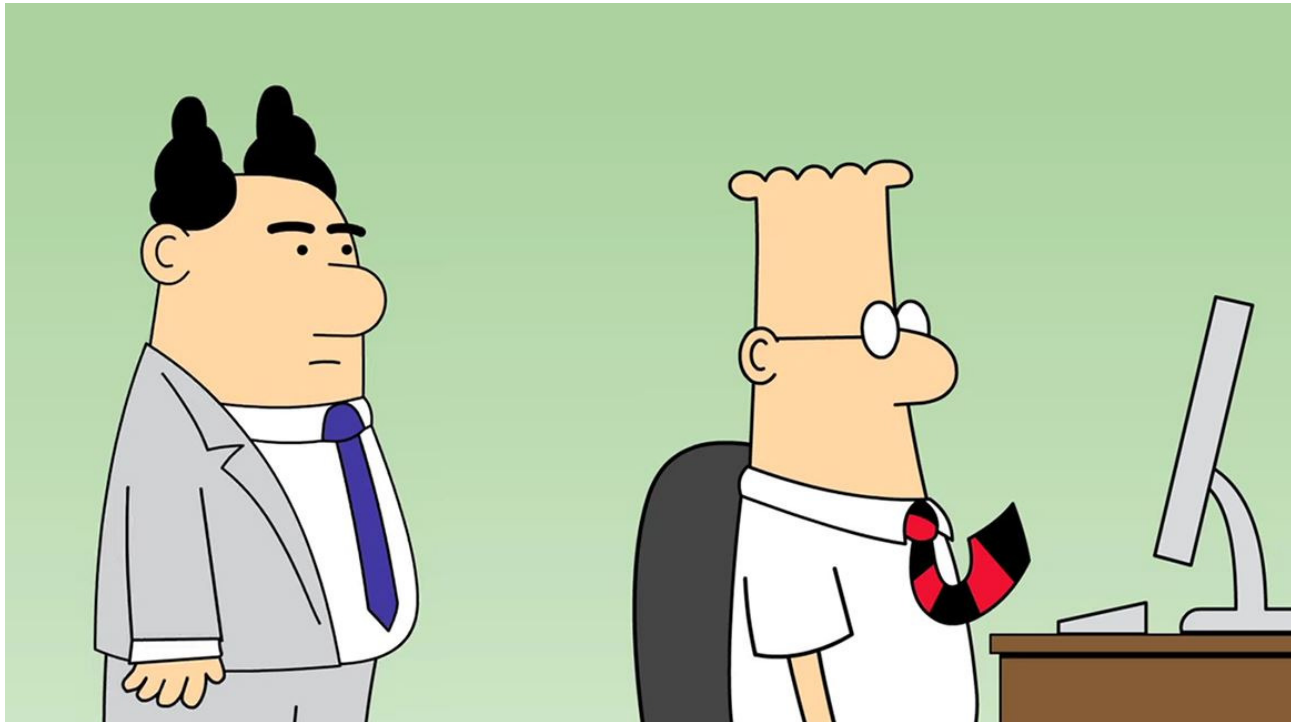
Project Manager's Job:

- Make sure the time and budget allocated are sufficient for the scope of the project.
- Protects the project against project creep

Others trying to increase the scope of the project

Others trying to change the scope of the project

Without allocating any more time or budget.



Project Charter

One way to prevent project creep is to start with the *project charter*.

This is a document which specifies

- What are the deliverables for the project
 - What are the key elements for the project
 - How much time is allocated for the project, and
 - What's the budget
-

Project Charter (cont'd)

The *project charter* is the most important document in the project.

- When someone joins the team, the *project charter* helps him/her know what the project is all about.
- When a manager tries to change the scope of the project (project creep), the *project charter* defines what the project is, what it isn't, and whether this new mission is or isn't within the scope of this project.

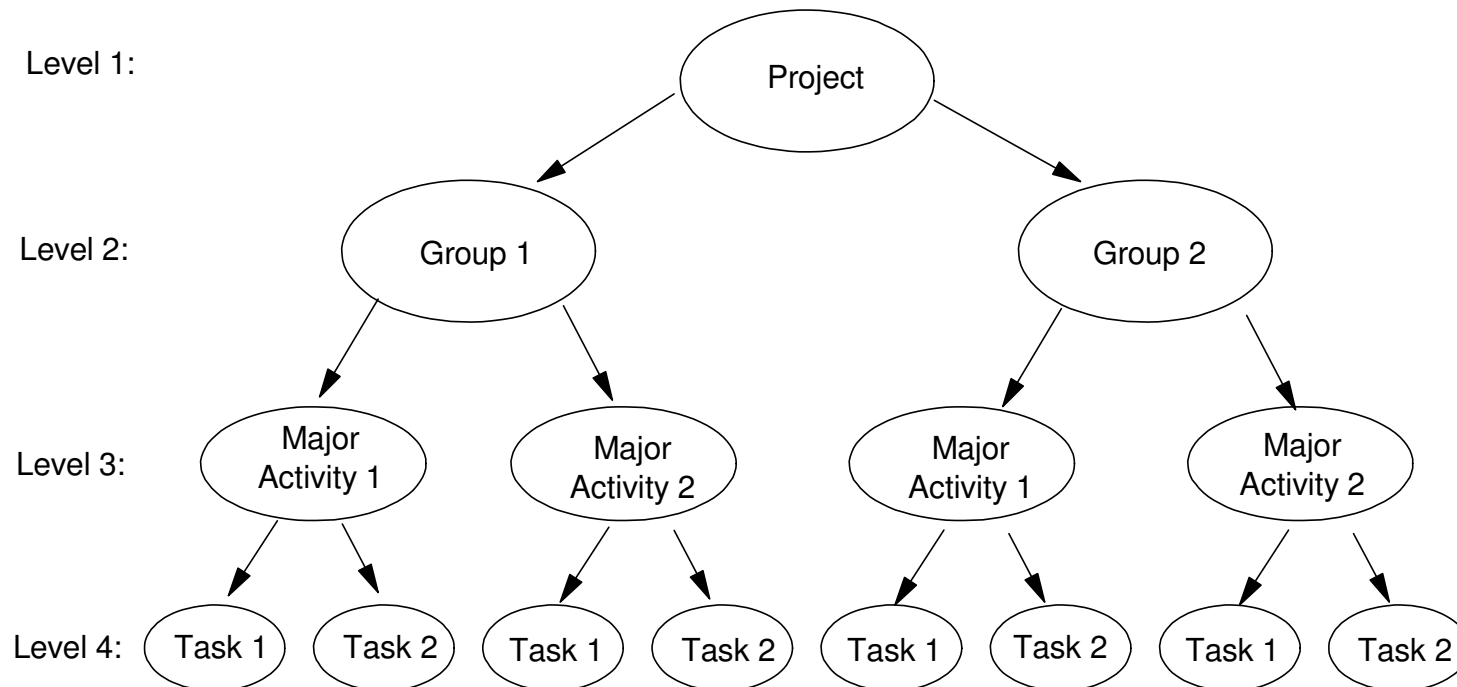
As a note - everyone at your company is part of the same team. If something important comes up and it needs to be added to a project, you'd like to say yes, we can do that. However, given a limited time and budget, there's only so much you can do.

If the new task is really that important and it significantly changes the project, you might need more time, people, and resources. The project charter helps the project manager make that argument.

Work Breakdown Structure

Once the project is defined, the next task is to split the project into smaller tasks

- Sort of a divide and conquer technique.
- Once the tasks are small enough, you can start knocking them off one by one.



Work Breakdown Structure (cont'd)

Level 1: Define by the *project charter*.

Level 2: Split the project

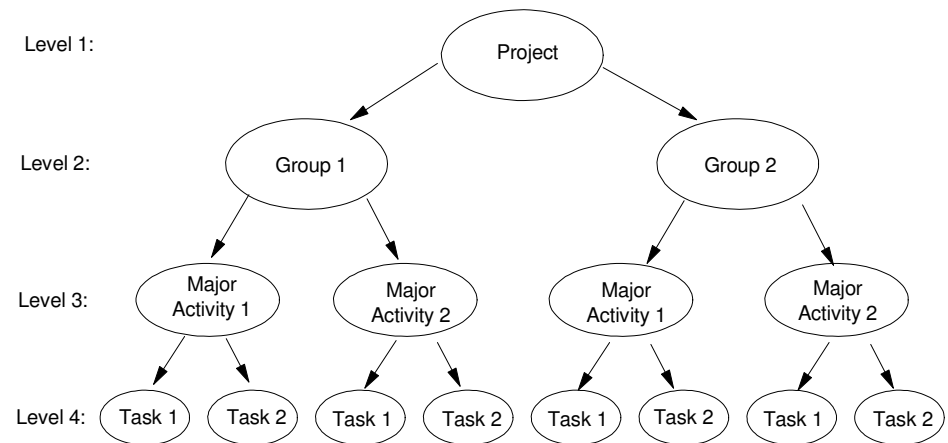
- by department
- by functionality

Level 3: Specify the major parts

- Major technical challenges for Sr Design

Level 4: Tasks.

- What are the tasks that need to be completed

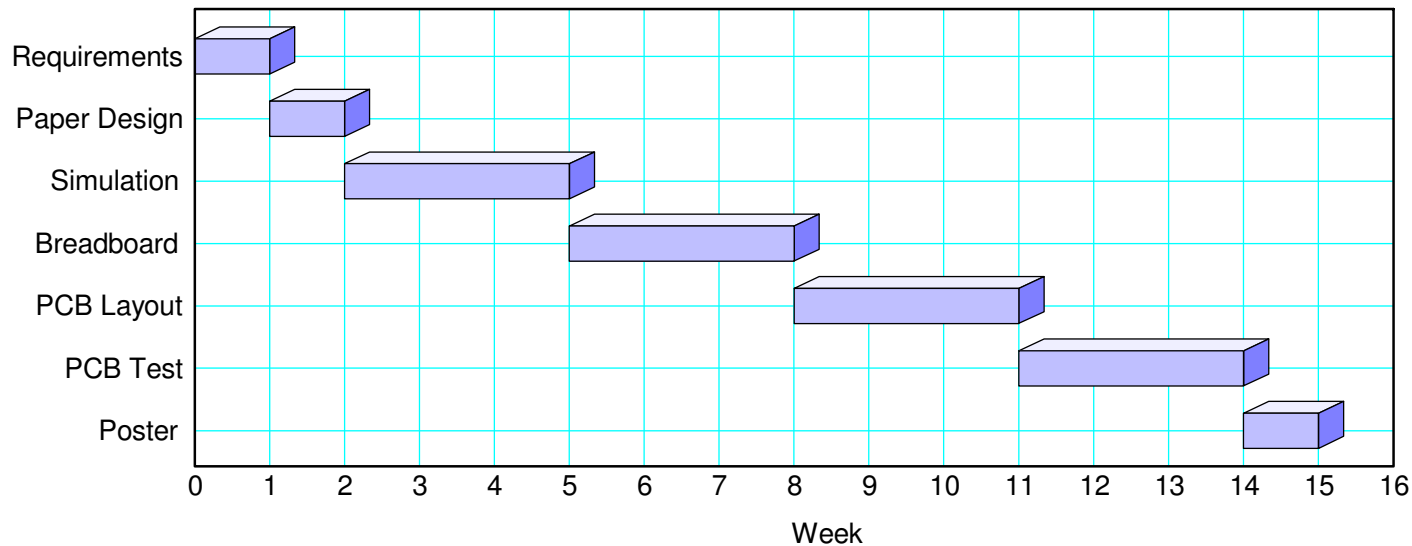


Gantt Chart

Once the major tasks to complete a project are defined, you can start defining

- how much time is allocated to each task,
- what the start date of each task is to be, and
- when the end date of each task is.

A Gantt Chart is a graphical way of displaying that information. We'll talk more about Gantt charts in week #3.



Project Management Techniques

Many styles exist

- Coursera offers over 2700 different courses on project management.
- They all seek to improve the odds of a project being successful

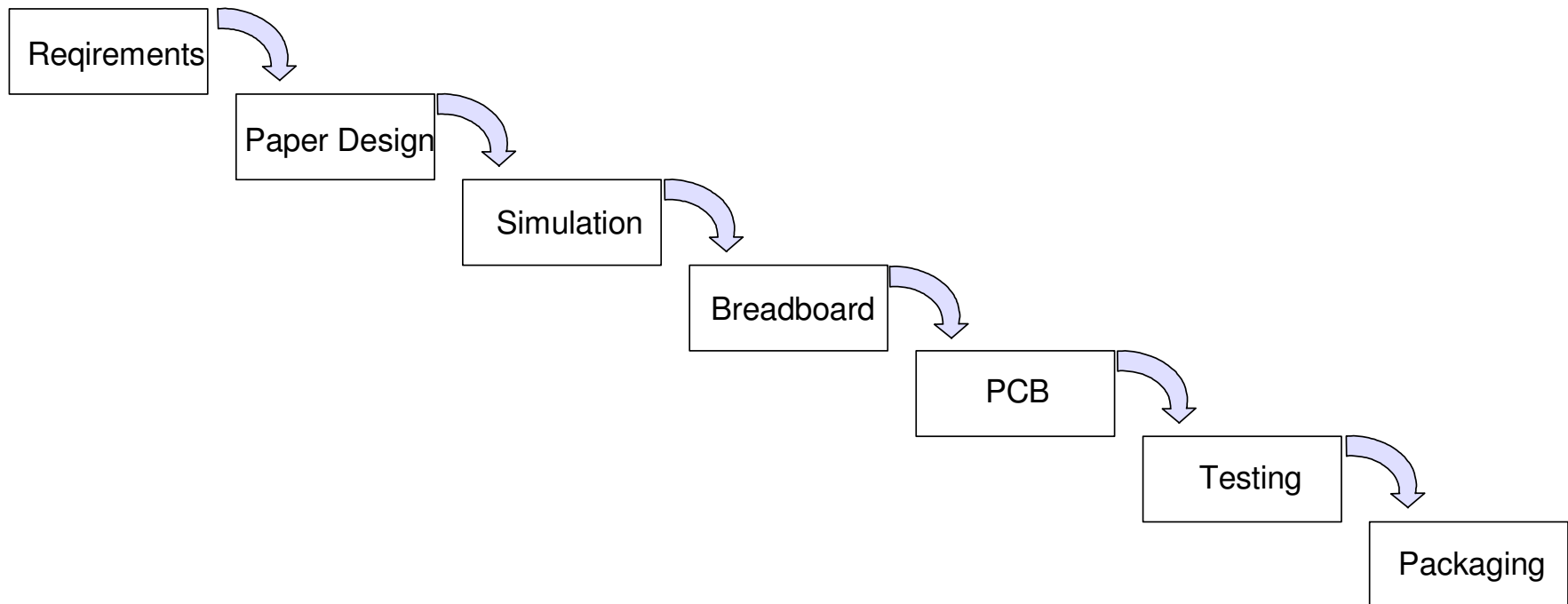
We'll look at four versions of Project Management:

- Waterfall
 - Critical Path
 - Agile
 - Total Quality Management
-

Waterfall

The idea behind *Waterfall* is

- A given project can usually be split into a set of tasks that need to be completed.
- One way to complete the overall project is to complete these tasks one at a time.
- The *waterfall* shows you the order in which these tasks will be completed.

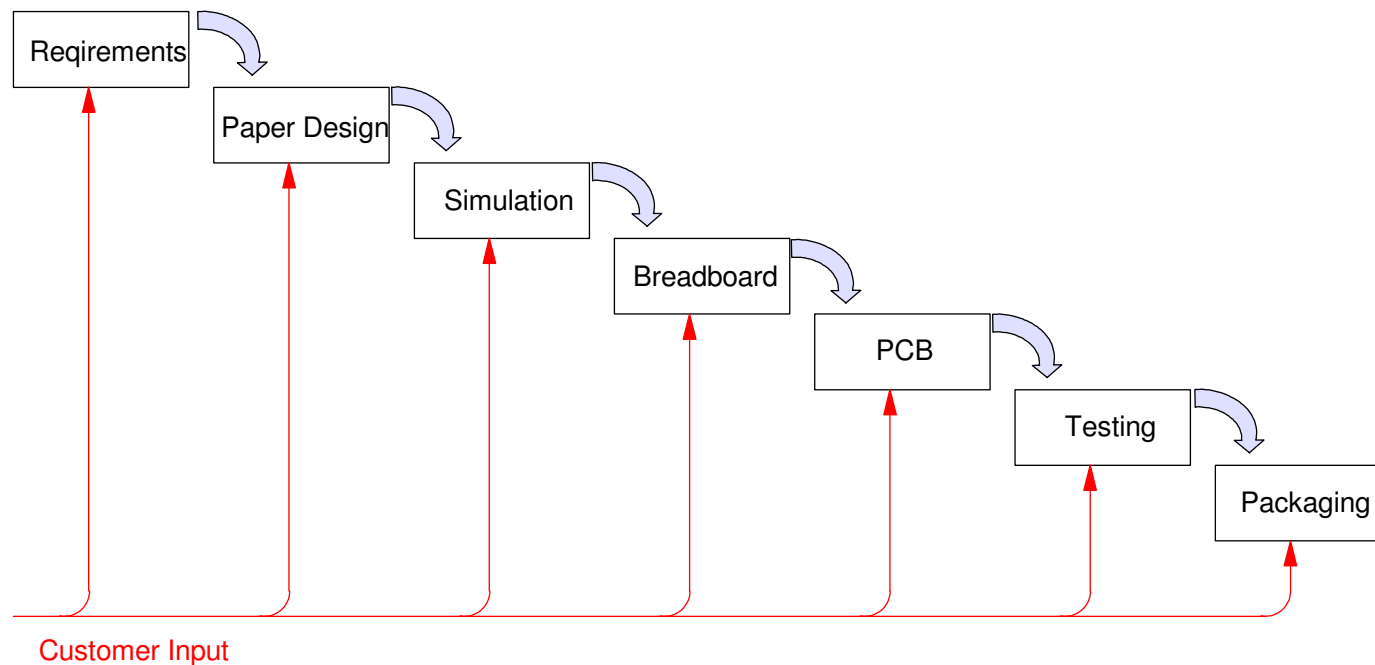


Waterfall for Senior Design

- Requirements Capture: Define the inputs, outputs, and how they relate.
 - Paper Design: Analysis and calculations for circuits and/or programs which meet these requirements.
 - Simulation: Test your hardware design in simulation or test your software with test programs.
 - Breadboard: If your design works in simulation, build it on a breadboard to get the schematics correct.
 - PCB: Transfer your breadboard design to a printed circuit board.
 - Testing: Check that final design meets the system requirements.
 - Packaging: Place your final design in a package for delivery to your customer (ECE 405 only).
-

Waterfall projects can be very agile and responsive to customer input.

- There is nothing stopping you from having customer input and alterations to the design along the way.
- Often times, this is necessary: customers often times don't know what they want until they see it.
- As the customer sees your project progress, he/she may get a better understanding of what they really need and what can be delivered.



Critical Path

The idea behind Critical Path is that

- Most projects can be broken down into smaller parts.

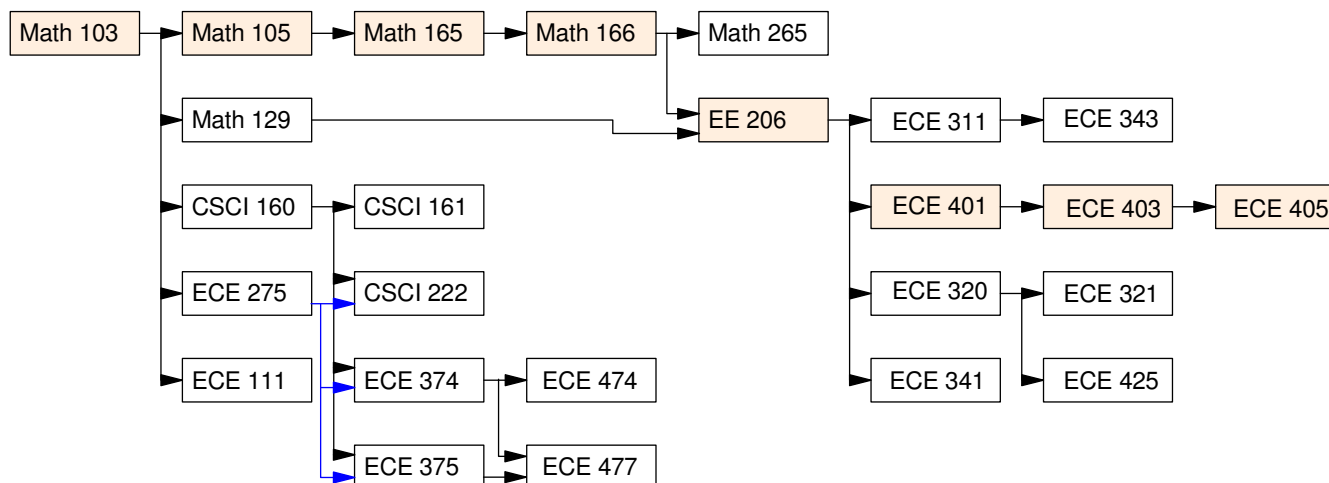
To graduate from NDSU in Computer Engineering, for example, you need to take and complete forty courses.

- Some things have to be done sequentially.

You can't shingle a roof until you have a roof.

You can't take Calculus II until you complete Calculus I.

- If you lay out all of the tasks in the order of when they can be completed, you'll see the longest path from start to finish, This is the critical path.



What the critical path tells you is

- If you want to graduate in the minimum time possible, you *need* to be taking the next course in this sequence each semester. If you skip a semester, you postpone graduating.
- The other courses can be moved around to even out the workload each semester - providing you are abiding by the prerequisites.

The same holds in Senior Design.

- If you break your project down into smaller chunks then arrange these by the order they need to be completed, you'll see which activities form the critical path.
 - At any given time, you need to be working on the next item in this path.
 - If you don't, your end date will slip.
-

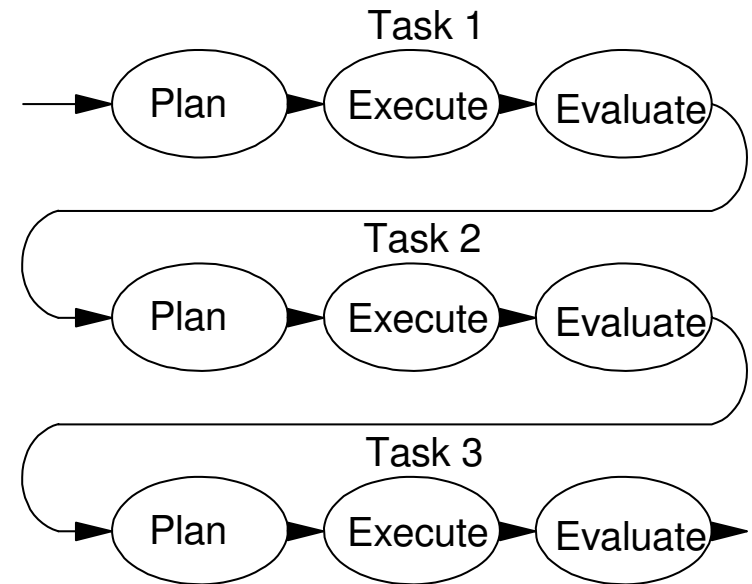
Agile

An iterative design

The idea is to

- Split the project into smaller tasks, then
- Go through the entire design sequence for each task, one by one (requirements, paper design, breadboard, PCB design, validation)

Essentially, the goal is to slap out a prototype quickly, then iterate on improving this prototype over and over.



Agile Example

- Build a stoplight

One way to split up the tasks are

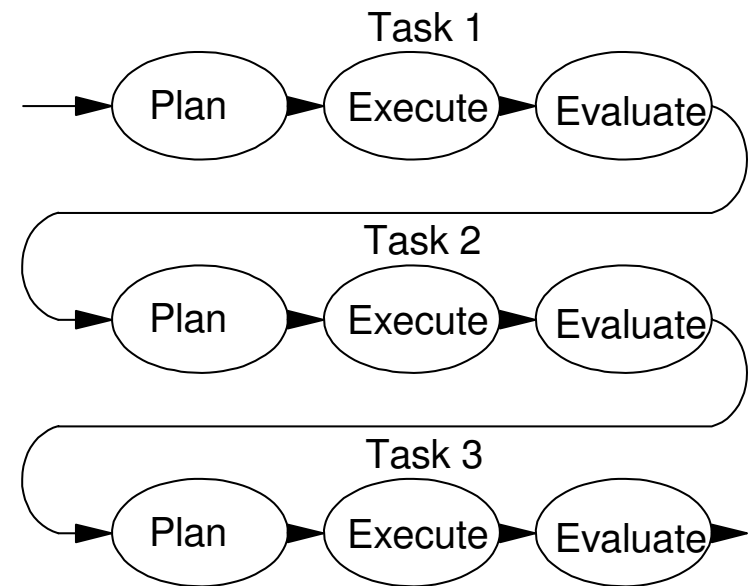
- Physical Design
- User Interface
- Traffic Sensors

1st Iteration: user interface

- Cell phone app
 - shows you what the stoplight is doing*
- Go through the design cycle
 - plan - execute - evaluate*

2nd Iteration: physical stoplight

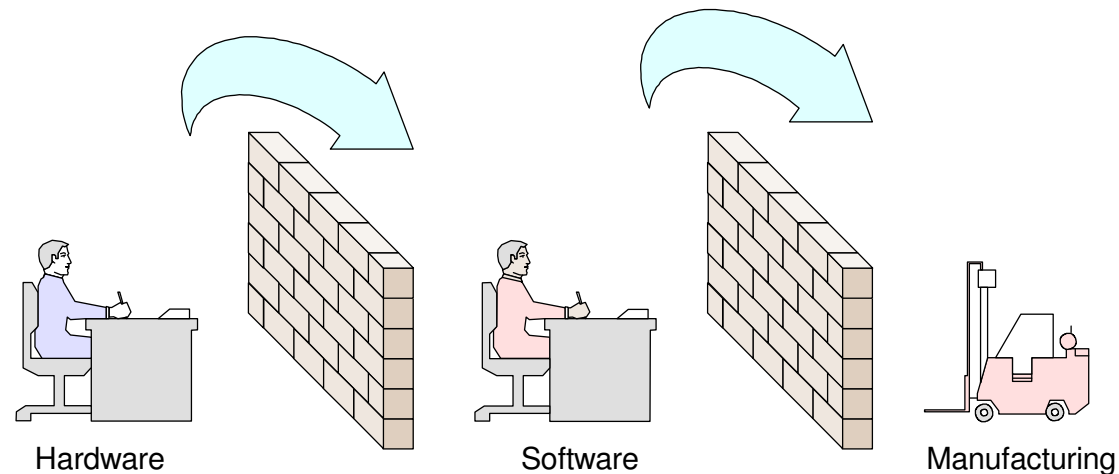
- Hardware controlled by cell phone app
 - controlled by the cell phone app*
- Go through the design cycle
 - plan - execute - evaluate*



Total Quality Management (TQM)

Problem: Company A is trying to design and build a widget.

- The hardware group starts with the design.
When done, it passes their final design over the wall to the software group.
- Software looks at the hardware design and it doesn't really work for them.
*Software redesigns the hardware and then
Writes the corresponding software.*
When done, they pass the final design over the wall to manufacturing.
- Manufacturing looks at the design and it really doesn't work for them either.
Manufacturing redesigns the hardware and software so that the product can be built.



Total Quality Management

The idea behind TQM is to get the design right, right from the start.

To do that,

- You need to have an initial design meeting with everyone right from the start.
- Once you hash out a framework that hardware, software, and manufacturing can live with, *then* you start the design process.

The hope is that you won't have to redesign the widget each step of the way, saving both time and money.

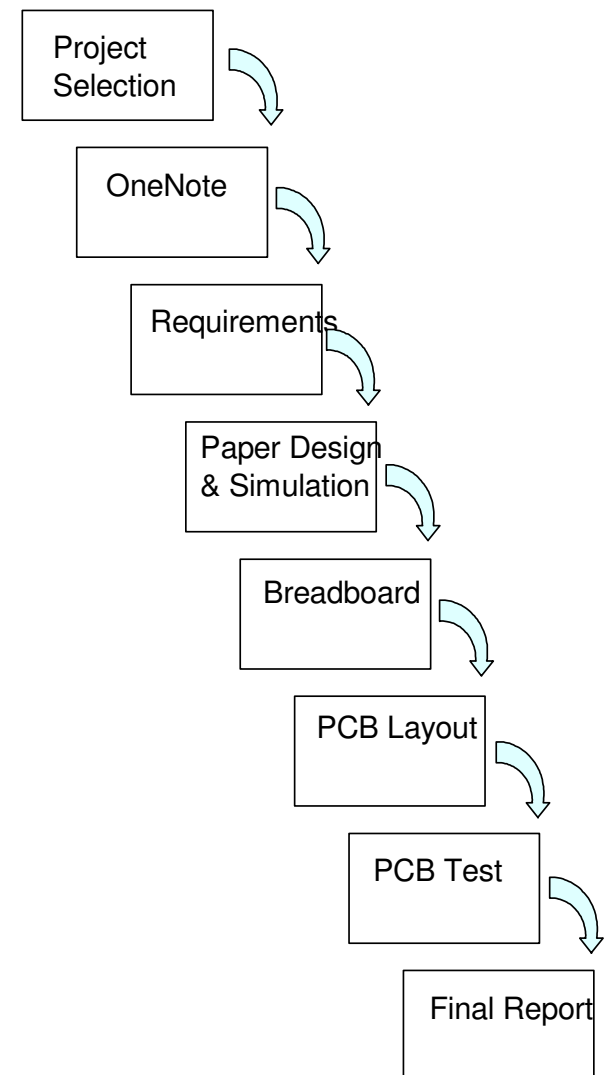
Project Management in ECE 401

Usually Waterfall:

- Follows the homework sets

In ECE 403, you can change this

As long as you complete the project under the constraints of time, budget, and scope, you meet the expectations for Senior Design.



Design Notebooks & OneNote

What is a Design Notebook?

Essentially your diary

- Where you keep all of your records
- What your ideas were,
- How you tested them, and
- What the results were.

Design notebooks are also very common and very old: Leonardo Da-Vinci, for example, kept extensive notes on his work

(Page from one of Leonardo Da-Vinci's design notebooks¹)



¹ <https://www.openculture.com/2018/08/leonardo-da-vincis-earliest-notebooks-now-digitized-and-made-free-online.html>

Purpose of Design Notebooks:

Help you organize your thoughts.

- "If you're stuck, write up what you have."

They serve as a reminder.

- If you ever want to go back and refresh your memory on what you were thinking, what you tried, and what the results were, all of that information is in your design notebook.

They help your successor

- Design Notebooks help the engineers who pick up where you left off when you get promoted.
- Often times, the design notebook is all that's available to help get your replacement up to speed in terms of what you did, what worked, and what didn't.

They can also be used in the patent process

Patent Law - What is a Patent?

From Wikipedia:

A patent is a type of intellectual property that gives the owner the legal right to exclude others from making, using, or selling an invention for a limited period of time in exchange for publishing and enabling disclosure of the invention.

Issued by the United States Patent and Trademark office (USPTO).

Used in industry to prevent competitors from stealing their ideas and designs.

Note:

- Patents do not allow you to making, using, or selling an invention
- They only block others from doing so.
- If identical patents are issued to two different parties, there is no conflict

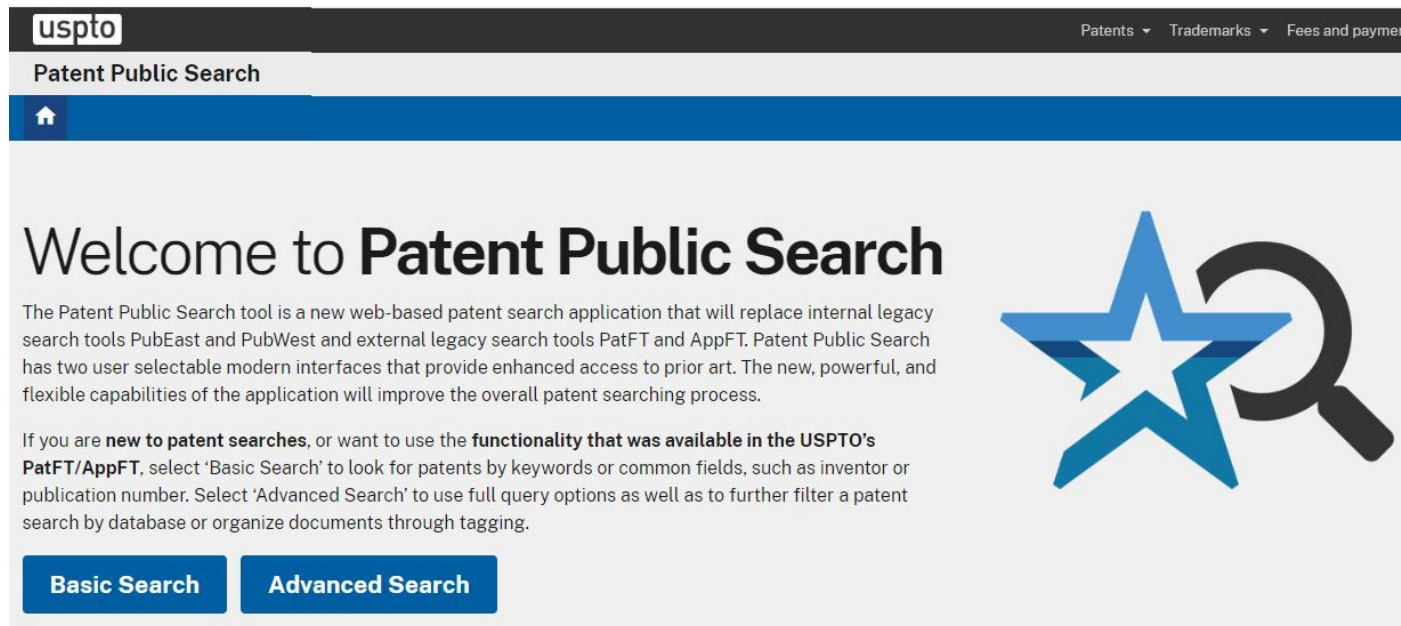
The two patents simply block each party from making use of the patent.

It's up to them to negotiate

USPTO Web Site

<https://ppubs.uspto.gov/pubwebapp/static/pages/landing.html>

The USPTO actually has a very friendly, easy to use web site. On that site, you can search for patents fairly easily, free of charge.



<https://ppubs.uspto.gov/pubwebapp/static/pages/landing.html>

Sample Patent Search:

Example: Search for "Talking Football"

Results in 3624 patents

Search results

Results for query "talking AND football"

Showing 1 to 50 of 3624 records50 of 3624 records

Result #	Document/Patent number		Title	Inventor name	Publication date	Pages
1	US-11775052-B1	Preview PDF	Smart room system	Douglas; Robert Edwin et al.	2023-10-03	62
2	US-11771366-B2	Preview PDF	Method, apparatus, and system for radio based sleep tracking	Wu; Chenshu et al.	2023-10-03	52
3	US-11778138-B2	Preview PDF	System and methods providing supplemental content to internet-enabled devices synchronized with rendering of first content	Verna; Anthony F. et al.	2023-10-03	17
4	US-20230306218-A1	Preview PDF	METHOD FOR TRACEABILITY OF RAW MATERIALS, COMPONENTS, OBJECTS, AND PRODUCTS EXPOSED TO HARSH OPERATIONAL CONDITIONS IN INDUSTRY	Kayalar; Mete et al.	2023-09-28	38
5	US-20230308303-A1	Preview PDF	SYSTEMS, METHODS, AND APPARATUS FOR MEETING MANAGEMENT	Jorasch; James et al.	2023-09-28	407

3624 patents contain the words "talking" and "football"

Viewing Patents

- Click on "Preview" or "pdf"
- Gives you the entire patent

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2023/0283110 A1**
BINDER (43) **Pub. Date: Sep. 7, 2023**

(54) **DEVICE FOR DISPLAYING IN RESPONSE TO A SENSED MOTION**

(71) Applicant: **May Patents Ltd.**, Hod Hasharon (IL)

(72) Inventor: **Yehuda BINDER**, Ramat Gan (IL)

(21) Appl. No.: **18/196,109**

(22) Filed: **May 11, 2023**

G01P 15/18 (2006.01)

A01K 15/02 (2006.01)

H02J 50/20 (2006.01)

H02J 50/90 (2006.01)

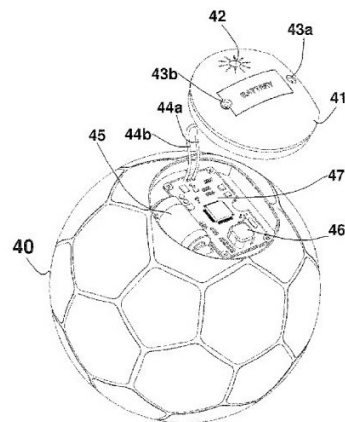
G01P 1/07 (2006.01)

H02J 7/00 (2006.01)

(52) **U.S. Cl.**

CPC *H02J 50/10* (2016.02); *G10H 1/26*

(2013.01); *A63B 21/0055* (2015.10); *A63H*



(57)

ABSTRACT

A device includes a signaling means and a motion sensor, and logic for activating or controlling the signaling means in response to a sensed motion according to an embedded logic. The device may be used as a toy, and may be shaped like a play ball or as a handheld unit. It may be powered from a battery, either chargeable from an AC power source directly or contactless by using induction or by converting electrical energy from harvested kinetic energy. The embedded logic may activate or control the signaling means, predictably or randomly, in response to sensed acceleration magnitude or direction, such as sensing the crossing of a preset threshold or sensing the peak value. The visual means may be a numeric display for displaying a value associated with the count of the number of times the threshold has been exceeded or the peak magnitude of the acceleration sensed.

Cost to Patent

The USPTO is very egalitarian: anyone can file for a patent or a trademark for not a lot of money.

- Trademark: one-time filing fee of \$250
- If granted, this trademark lasts for six years and can be renewed
- Hiring lawyers for a bulletproof patent costs more
- Individuals are more than welcome to submit a patent on their own



Revolking a Patent

Patents can be ruled null and void.

This is usually done if

- It can be shown that the invention was used prior to the patent, or
- The invention is obvious to an expert in the field.

Example: The Wheel

- Sort of a fad to try and sneak a patent for the wheel through the patent office.
- Granted in 2001 in Australia as a "circular transportation fascillation device."²

But...

- If the owner tried to enforce the patent, it would be revoked (wheels were being used prior to 2001)



² <https://www.newscientist.com/article/dn965-wheel-patented-in-australia/>

Who owns a patent?

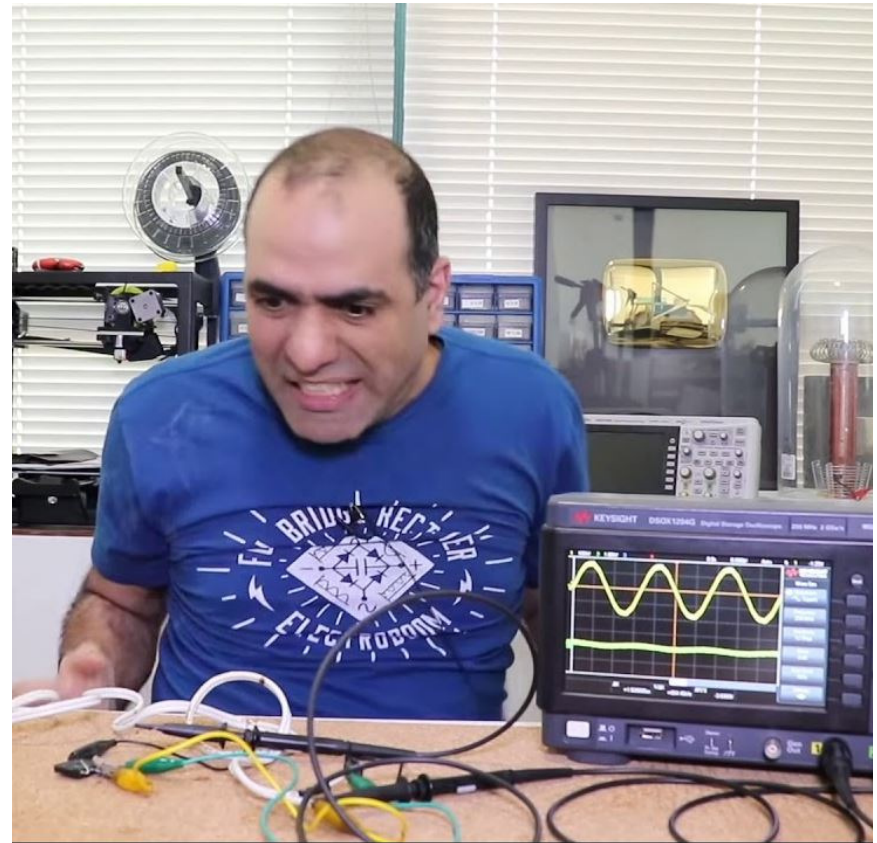
Depends...

Pre-2019: First to bring to practice

- Very friendly to engineers

Doesn't matter who pays for and who files the patent

- The patent goes to whoever was the first one to bring that invention to practice.



Design Notebooks: Pre 2019

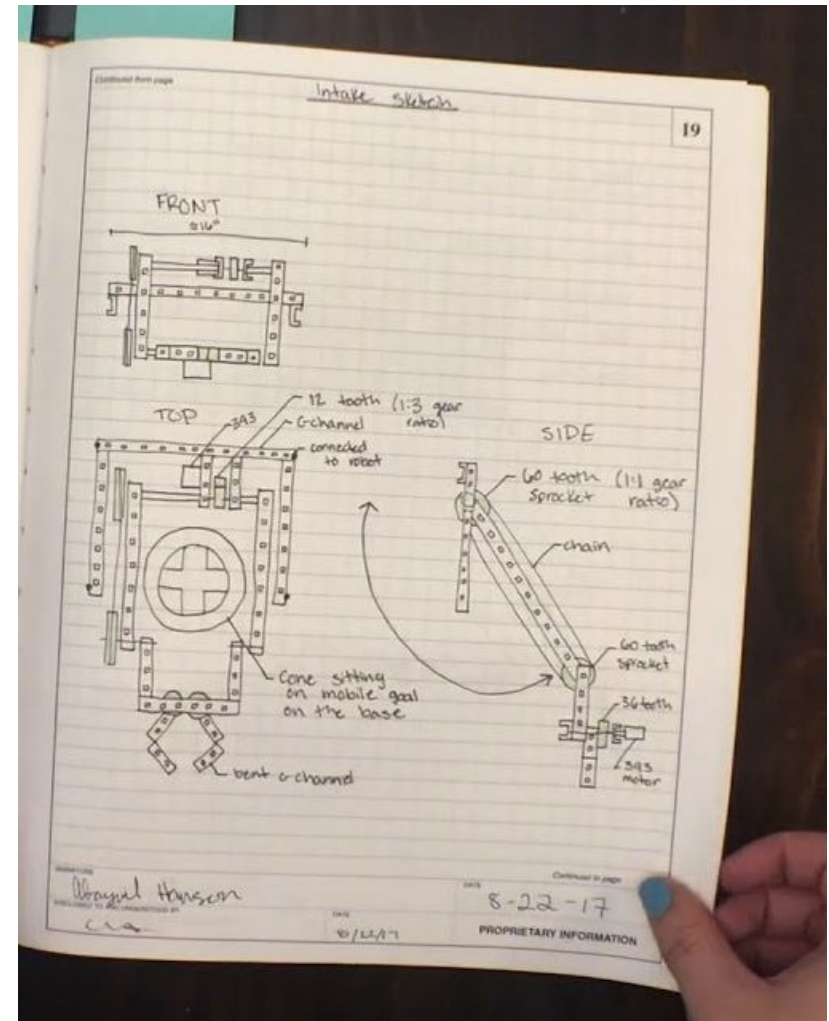
Engineering design notebooks were legal documents:

- Who first brought an invention to practice.

Rules for design notebooks:

- Must be hardbound
- Pages must be numbered consecutively
- Entries must be on consecutive pages
- Each page had to be dated, signed, and cosigned.
- All entries must be in non-erasable pen.

Necessary so you can determine who was the first one to bring an invention to practice.



Example: Patent for the Laser

USPTO awarded to Townes in 1959.

- For 18 years, Townes (or the company he worked for) owned the patent on the laser
- Anyone wanting to use a laser had to get permission (i.e. pay royalties) from Townes (or his company)

In October 1977 the patent for the laser was reassigned to Gould

- Gould had design notebooks from 1957 showing he was the first to bring the laser to practice
- Made no difference who filed for the patent and who paid for the patent.³



³ <https://www.electronicdesign.com/technologies/components/article/21795623/gordon-gould-the-long-battle-for-the-laser-patent>

Who Owns a Patent: Post 2019

Law changed in 2019

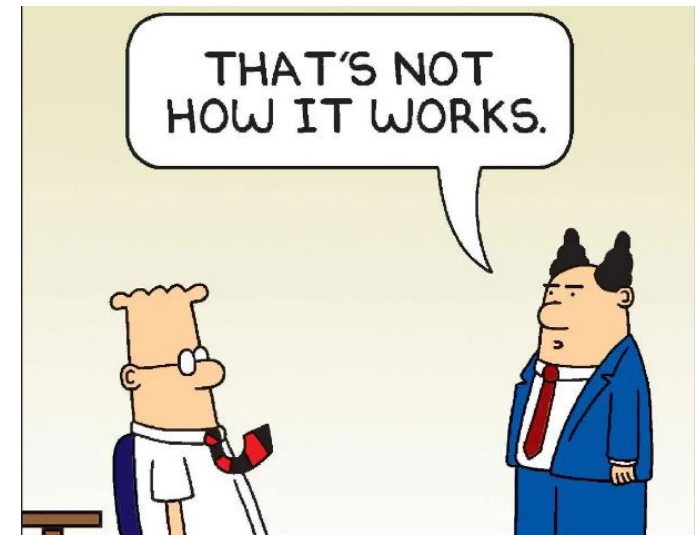
- Industry did not like "first to derive to practice"
- Meant uncertainty in who owns a patent

In 2019, patent law was changed to "first to file"

- Provides certainty (good for industry)
- Means your invention can be taken from you

Also means engineering design notebooks are no longer legal documents

- Electronic design notebooks are now OK
- Power-Point, MS Word, OneNote, etc.

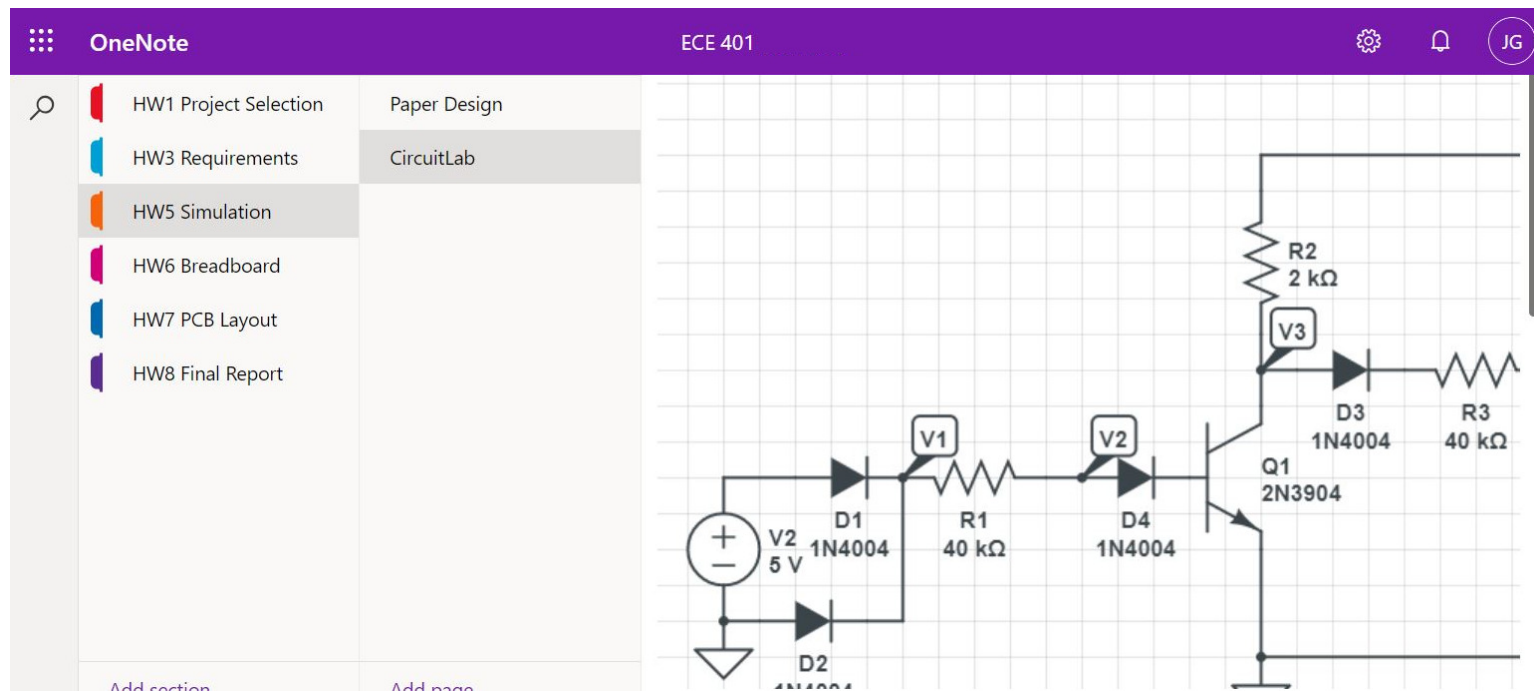


MicroSoft OneNote

Just another option for an electronic notebook

Advantages of OneNote:

- Easy to use, easy to read
- Versatile: you can include text, photos, excel files, videos
- Collaborative: several people can be adding to a single OneNote file



OneNote in Senior Design

Good for groups

- Each student has access to the same OneNote document
- Each student can add material
- Each student can see what their partners have done

Easy to see previous work

- All homework sets are in the same document
- Easy to refer back to HW3 when working on HW5
- Helps with grading (can see all work up to this point)

Basically, OneNote works really well for senior design.

Suggested OneNote Organization for ECE 401

Split into sections	Section major activities	Page tasks	Content
<ul style="list-style-type: none"> Each homework set 	HW1: Project Selection	Project Description	
		Contact Information	names, email, phone of students in your group
Add pages to each section	HW2: Work Breakdown Structure	Project Charter	Short Description
		Engineering Requirements	Time Frame (16 weeks)
		Gantt Chart	Budget (\$50)
<ul style="list-style-type: none"> Parts of homework sets Add content to each page as the semester moves along. 			
		Schematics	Schematics
		Calculations	Calculations for R's and C's
		Schematic	Circuitlab schematic
		Results	Simulation results
notes:	HW3: Paper Design		
<ul style="list-style-type: none"> It's OK to go back and revise previous work in this class. 		Schematics	Schematics
		Calculations	Calculations for R's and C's Voltages and Currents
<ul style="list-style-type: none"> Grading of sections will be revised throughout the semester 	HW4: Simulation	Schematic	Circuitlab schematic
		Results	Simulation results
		Compare vs. Calculations	Compare to calculations

ECE 401: Homework for Week #2

- Create a OneNote document (one document per group)
- Call your OneNote document ECE401_XX_YY
 - XX is the term (Fa24, etc)*
 - YY is your group number*
- Add sections for each major activity (homework sets)
- Share your OneNote document with each member of your group and your instructors