

## Individual Micro Project: Creative Engineering Design course 2024

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**Project brief:** *Entangling of multiple wires and keeping track of which wire is connected to which electrical point (e.g. on a computer) are common problems. Design and develop a proof of concept for a means of keeping wires un-entangled and easily trackable (with a functional prototype if possible).*

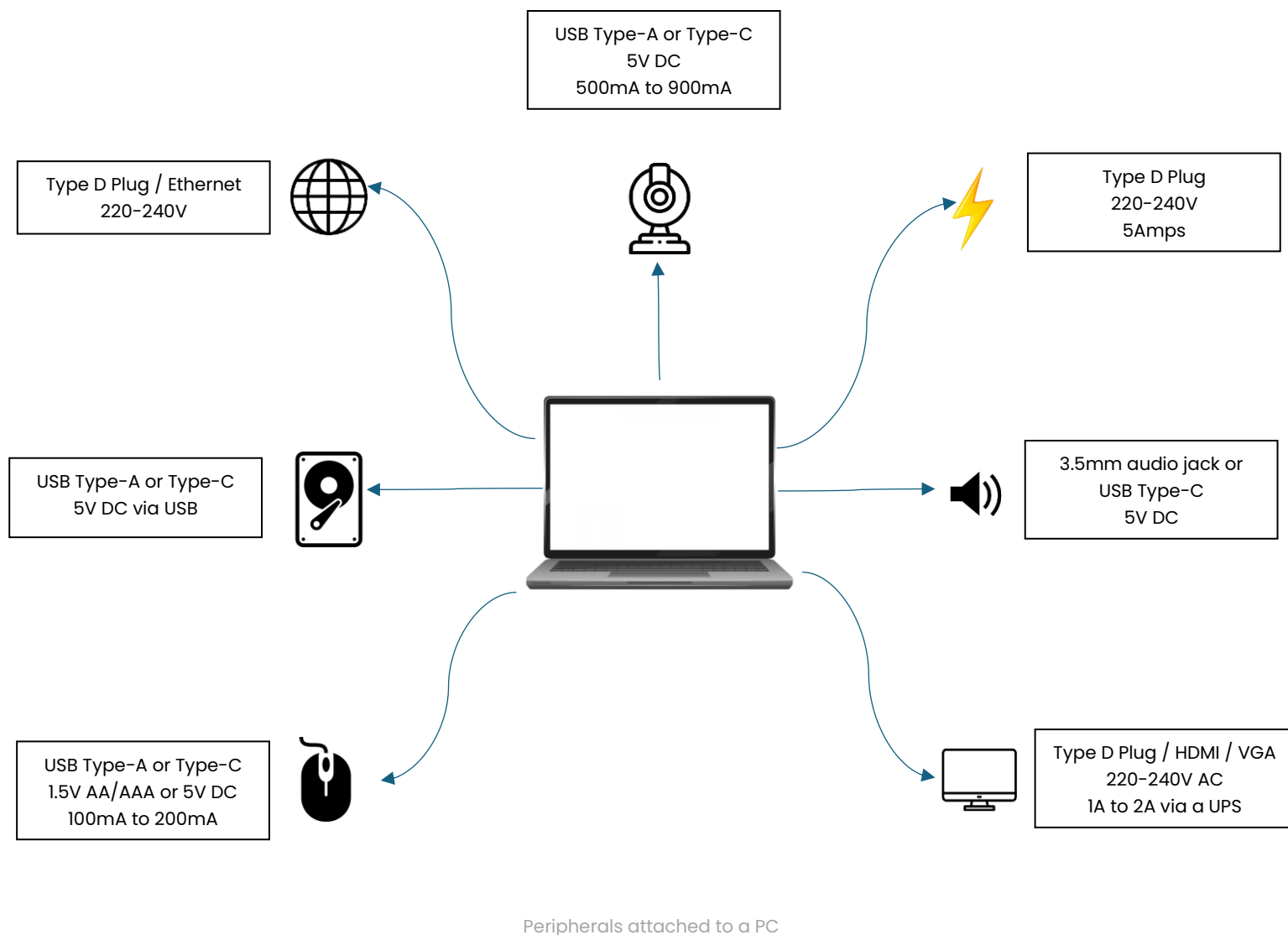
- **Design Process Plan;** reasons for choice, and how understanding.

**Considerations:** There are multiple ways a person may use a computer. There are multiple types of people who use a computer. The way a gamer might use a computer is vastly different than how a businessman would do, and after some thought, I settled down onto designing the product for a gamer. The reasons for going for a gamer as the customer were as follow:

1. **Gaming setup:** A person who games usually does so at a setup. A quaint location where movement is less likely and the problem regarding wiring is much more probable. A businessman on the run would rather take a laptop and a charger and get done with his job.
2. **Gaming habits:** Gamers tend to have peculiar habits, the eye for aesthetics is one of them. The worriless nature of the hobby also invites issue of laziness, and in such case an aid would greatly help.
3. **Data availability:** On online forums like reddit, gamers are usually the most active people seeking help with cable management issues. This data would prove helpful in developing the ISQ later on.

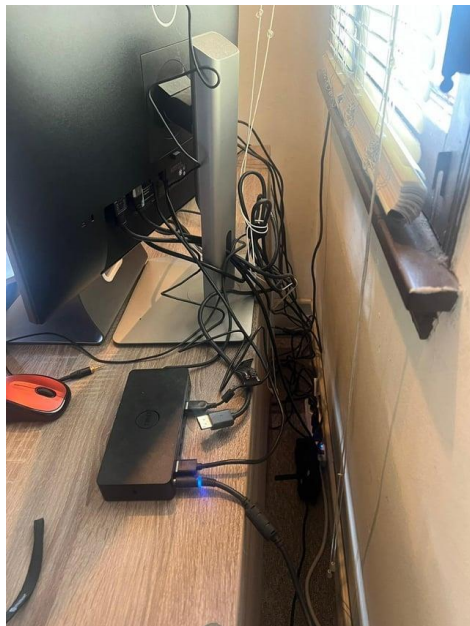
### Problem Brief:

The current computer systems, due to different data transfer standards, use multiple wires for input and output. This causes a visual and arrangement clutter which is aesthetically unpleasing and difficult to moderate.



### **A normal gaming setup, the good, the bad and the ugly:**

I game myself, and as I also have a wired mouse (better), but to obtain a proper understanding of the problems faced I could not solely depend on my own experience. Thankfully, internet comes in handy in such a scenario, and cable management is a problem faced often enough that it wasn't very hard to obtain firsthand images, anecdotes and frustrations for it all.



A great setup I found on reddit, a bad one I found here, and of course, the workstation I wrote this report on

The most frequently raised queries and comments I found are presented below concisely:

Username	Comment	Inference
<a href="#">Angrvmic2002</a> • 6y ago •	Having cables that are the correct length goes a long way. When you have a six foot cable that only needs to go 12 inches it creates a mess. I use cable sleeves and a shit ton of zip ties. Also, all of my cables are run in wall. No exceptions.	<b>Adjustable Length</b>
[deleted] • 10mo ago •	<ol style="list-style-type: none"> <li>1. Pick a wire and make it not visible. And then after awhile do it again.</li> <li>2. Rinse and repeat until 6 months goes by and you need to change something.</li> <li>3. Get frustrated because everything's tangled.</li> <li>4. Proceed to undo your work.</li> <li>5. Repeat steps for the rest of your life.</li> </ol>	<b>Adjustability</b>
<a href="#">FichwaFellow</a> • 2y ago •	<p>Step one - deal with the things that aren't even plugged in. if you don't use them, take them out. Why do you have multi outlet adapters plugged into the surge protector when there are plenty of open spots?</p> <p>I would start over from scratch, but you want to wind all the extra slack out of the cords, then secure them with velcro or something.</p>	<b>Clarity</b>
[deleted] • 4y ago •	I struggled with where to attach the nodes and commander pro and also the ssd if anyone has any ideas of where to put them rather than just bundling them to each other and hanging the ssd up lol	<b>: Ease of Use</b>
<a href="#">chronicpcbuilder</a> • 5mo ago •  (I trust him with my heart)	Beautiful work. Wouldn't change it.	<b>Aesthetically pleasing</b>

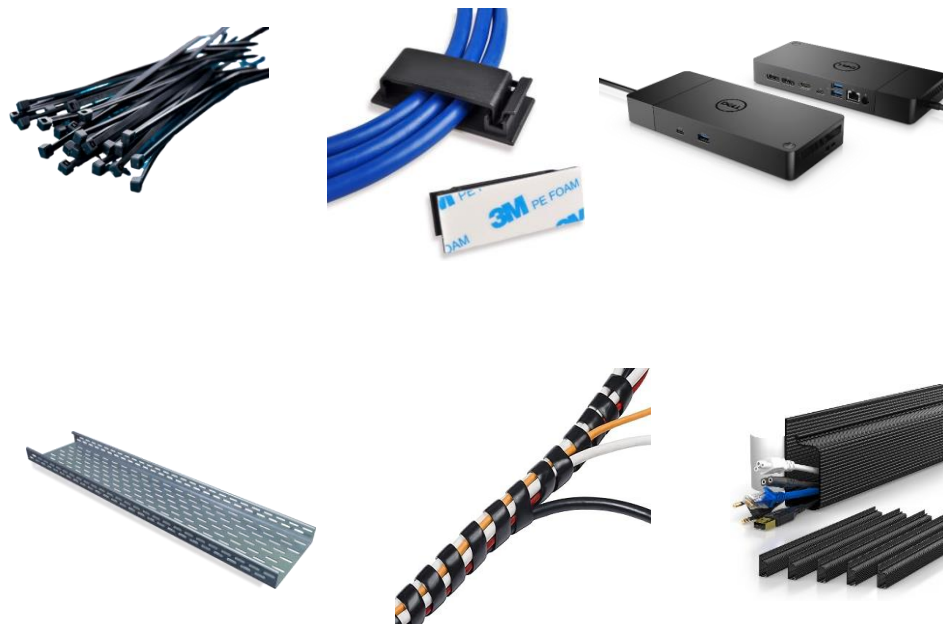
"Interviews"

### Observations Made by self:

- The sockets align on different angles which might produce clutter.
- The computing device has inlets on either side, which makes it harder for cable management.
- There are multiple standards for different kinds of inputs, which doesn't allow a singular solution.

- People don't mind wires, but wires in open is where the problem lies.
- Short wires reduce the clutter but also pose connectivity and movement issues.
- There is always a danger of a Power Strip Surge. (The light went off in the VDS lab at 4AM)

**Competing Products:** A need for studying the competitive product arises so we can know what products exist in the void already and what can be developed further. I would also be listing out the faults in each of those designs found usually so we can avoid that and create a unique space in the market for our product.



From clockwise: zip ties, wire clips, docking stations, wire mounting boards, spring cable coil, J channels

Problems with each Competing Product:

Product	Design Flaws
Zip ties	Non reusable, plastic wastage, non-adjustable
Wire clips	Surface Damage, Non-Reusable, Adhesive
Docking stations	Port-Type limitations, Power Usage, Heating
Cable Management trays	Manual installing work, heavy, non-aesthetic
Spiral cable wrap	Difficult to use, length, non-adjustable
Channel Raceways	Heavy, manual Installing work, less flexible

From the above comments and self-made-observations, it wasn't that difficult to extract the user requirements and the technical requirements out. The user values the aesthetic pleasure, less clutter and more comfortable workplace. The frustrations are often the tangled web of wires, as stated in the problem statement, or rather the mess it creates, visually or physically.

#### User requirements:

Parameter	Weight
Modularity	4
Ease of use	4
Aesthetic appeal	5
Durability	3
Compartmentalization	4
Adjustability	3

#### Technical requirements:

Parameter	Weight
Material Strength	3
Cable Capacity	5
Flexibility	4
Installation method	4
Space Efficiency	3
Maintenance effort	4

#### Function Behaviour Structure:

Wire	Details
Behaviour	Bendable, usually long wires
Structure	Plastic coated wires with a connected at either end
Interaction	Connection by insertion in ports
Allowable Changes	Clustering, hiding, sticking, alignment, colour of wires,
Limitations	Length, standard port, Rigidity,

**QFD:**

The change in the submission deadline and ongoing exams did not allow me to perform the Quality Function Deployment to its fullest, but to understand the user needs against the technical parameters was an important job, to design and develop concepts according to both the user and the technical feasibility. Hence, the relationship matrix is presented below:

Customer Requirement	K1	K2	K3	K4	K5	K6	Rank	% Sum
Modularity (4)		1	1	1	1	1	1	22.727273
Ease of Use (4)	1		0	0	1	1	4	13.636364
Aesthetic Appeal (5)	1	0		1	1	1	2	18.181818
Durability (3)	1	0	1		0.5	0	5	11.363636
Compartmentalization (4)	1	1	1	0.5		0.5	2	18.181818
Adjustability (3)	1	1	1	0	0.5		3	15.909091

Customer Requirement	Material Strength	Cable Capacity	Flexibility	Installation Method	Space Efficiency	Maintenance Effort	Weight
Modularity (4)	3	9	9	3	3	1	10
Ease of Use (4)	1	3	9	9	3	9	6.
Aesthetic Appeal (5)	3	3	1	1	9	9	8
Durability (3)	9	3	1	1	3	3	5
Compartmentalization (4)	1	9	3	3	9	3	8
Adjustability (3)	1	3	3	3	1	9	7
SUM	120.0384	240.0768	202.0647	142.0455	214.0685	238.0762	

Modularity, Aesthetic appeal and compartmentalization come out to be the most important user demands. The technical parameters one needs to work on the most are cable capacity and maintenance efforts, loosely followed by space efficiency.

## SNPS:

An average computer user often experiences the problem of entangled mess of a lot of jumbled wires. The need of a solution that can compartmentalize the wires with required adjustments with relative ease over time while keeping the aesthetic appeal of the workbench is required.

The **desired function structure** of the process is thus followed:

- Separate the cables according to their general groups. (Compartmentalization)
- Prevent cable entanglement. (Accessibility)
- Optimize the usage of space. (Aesthetic Appeal)
- Make the cables easily trackable. (Accessibility)

Separate the cables according to their general groups.				
Problem as given	Goals as understood	Example	Examination	Force Fit
It is difficult to recognize from a jumble of wires which one belongs where.	Clear distinction between two different sort of wires.	Aadhar card	Asymmetrical	Weighting the proportions
Due to different connection standards different wires are needed.	Make them easily trackable.	Fingerprint	Different	Proposing a different identity
A lot of peripherals are wire based still.	Keep the wires straight for as long as possible.	Snowflake	Unique	Creating a unique tag
Organizing such wires is a hassle.		Birth mark	Blemished	Design for flaws
All wires are usually black so there is no distinct separating factor.		Face	Proportions	Adjust the size and weight
Wires may start off together but get intertangled later.		Departments	Side Profile	Observations from a different angle
Tracking a wire throughout its length is a challenge.		Sensations		
Due to their bendable nature the wires can twist and become harder to follow.				



Prevent cable entanglement.				
Problem as given	Goals as understood	Example	Examination	Force Fit
The wires curl onto themselves and get tangled.	Separation of wires.	Hair curling	Braid	Loop wires over each other to increase their size.
The wires overlap each other and get tangled.	Removal of bends.	Stretching	Heat	Provide energy to entangle.
The wires are too long		Filling	Stretch	Elastic Material
On the ground there are random kicks and pushes that push the wires against each other.		Thick	Restricted Movement	Low space available
A lot of wires are very close to each other.		Hard	Rollers	Allow rolling movement against one other.
		Restrict		

Optimize the usage of space.				
Problem as given	Goals as understood	Example	Examination	Force Fit
The wires make the space look small	Use the space efficiently	Home	Rooms	Personal dedicated space
More wires means less space for other things	Recognizing what belongs where	Moulds	Furniture	Usage of specialized tools
A lot of current solutions like docking stations are small but stick out	Declutter	Soul	Parents	Connecting child activities to their parents
Workplace for gamers are desk based so the space already is less		Distribute	Sleep	Allowance of rest in the wires
				Allow rolling movement against one other.

Make the cables easily trackable				
Problem as given	Goals as understood	Example	Examination	Force Fit
Long Cables usually are hard to track	Make each wire distinct	Arrow	Tail feathers	Failsafe
All the wires are the same colour often	Define where the wire ends up clearly	Map	Sharp	Use of contrast in differentiating

A lot of wires usually end up close together	Keep two wires away from one other as long as possible	Airplane	Directional	Guiding of eye
Overlap of wires		Location tracking	Time	Less time is spent on finding where
		GPS	Vector	Defining something with colour and shape.

**Conceptualization:**



