Project Deliverable D: Project Plan

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1. **A list of all the tasks which need to be completed, an estimated duration for each task, as well as who is responsible for each task and any task dependencies**

Task	Estimated Time	Who	Dependencies
Order materials	2 weeks (to come in)	Heidi	Design blueprints
3D Model Design	1 week	Stephen & Carolina	List of ordered materials
Cut Hockey sticks	1 week	Jackson	Design Blueprints
Test Ice Wheels	2 days	Carolina & Heidi	Built Base/ordered materials
Build Two Front Supports	2 weeks	Heidi & Stephen	Ordered materials
Attach front supports to base	0.5 week	Stephen & Jackson	Completed Base and front supports
Assembly Seat and keel	2 weeks	Heidi & Stephen	Attached Base and front support
Build base (with runner and Ice wheels)	1 week	Jackson & Carolina	
Finishing touches/ Tests	1 weeks	Everyone (C as test subject)	Functioning design
Test W fold	2 days	Jackson & Carolina	

2. A list of milestones:

For this project, we will be following a specific calendar that was given to us that will help ensure that we finish our project in time. We will be following this list very closely and making sure that we put out our best work at each deliverable due date.

October 14th: Prototype 1

It will be very difficult and almost not possible with the budget that we're working within to be able to make a whole separate prototype that we would end up discarding for the main project. So instead we will be making individual parts that will all come together at the end to make our final product. Parts like the base with the 4 spherical orbs will be made by this date.

October 21st - October 28th: Business

These dates have deliverables that deal with the business side of things for our project. For now, we do not know to many details about these deliverables because we have not learned the content needed for it yet. To prepare for the worst, we will be making sure that we set more than enough time aside to be able to work on these deliverables in case they turn out to need a lot of time dedicated towards them.

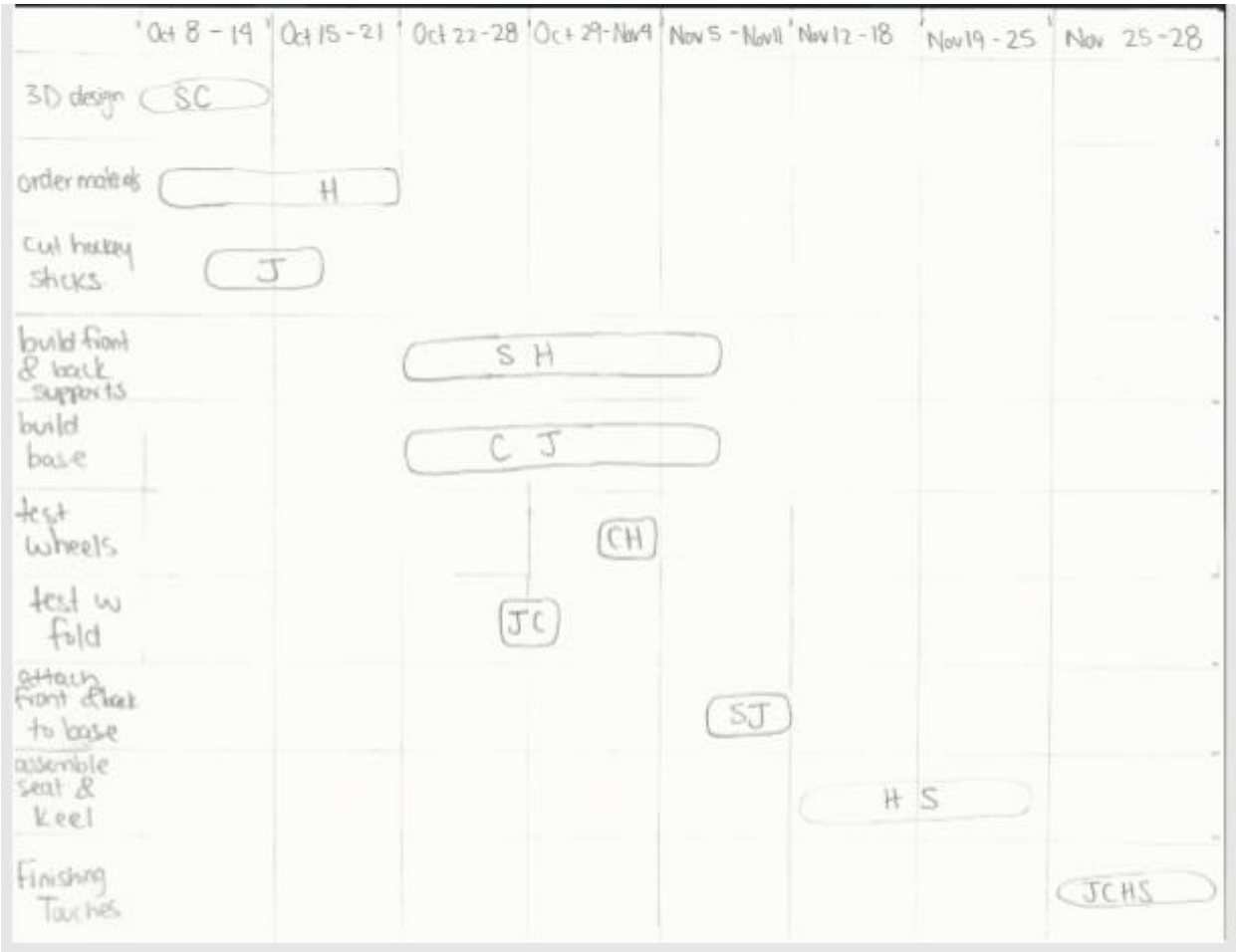
November 18th: Prototype 2

On this date, our group will be visiting David for the final time before our design day to present our final prototype. We must be finished if not very close to be finished our prototype at this time, as it is the last time David will be seeing it before design day and we need to ensure that he likes all aspects of it. David has been great about sharing his ideas and feedback whether good or bad on all the ideas we've proposed about the project.

November 28th: Design Day

On this date, all modifications and builds to our design must be finished and will be presented to our judges and clients. What we have done with our design by this day, is what we have to hand in as our final product, so we must be sure that we will finish by this time. Following our project plan and Gantt chart is crucial and will help us succeed by this date.

3. Our Gantt diagram:



4. BOM:

Item Number	Part Name	Description	Quantity	Unit Cost ($)	Extended Cost ($)
1	Hinges	Everbilt 3-inch Satin Nickel 5/8rd Door Hinge	4 (5 if we want to make it fold as a W)	2.88 (at Home Depot)	11.52-14.40
2	Hockey Sticks	Composite used hockey sticks	4	-	-
3	Plywood for front and back panels	OSB ½ 4x8	1 (split into four 2x4)	16.95 (at Home Depot)	16.95
4	Spherical Orb (for wheels) Delrin	Five ¾" delrin precision bearing balls	1 (set of 5)	12.79 (including shipping, Amazon)	12.79
5	Runner	3D printed	2	-	-
6	Telescoping pole	Wooster Brush R054 Sherlock Extension Pole, 2-4ft	1	24.99 (Amazon)	24.99
7	Seat	Soft Fabric Plywood ¼*4*8	1	5 (Fabric Land) 12.55 (RONA)	17.55
8	Wheels (For transportation on snow)	2in diameter caster wheels	2	3.25 (SES Casters)	6.50
Total					93.18

5. A justification for each cost associated with your project.

The cost of the materials have been estimated by researching the cost of the materials through various providers. We estimated using the lowest price found that provided would provide us with the materials that we need.

1.) Hinges

We will be using multiple hinges to fold our support so that it is easy to transport and fit into a car. Hinges will allow us to be able to easily switch from transport shape to the full shape that is used while skating.

2.) Hockey Sticks

To save some money and to also work towards the “cool” factor of the device, we will be using used hockey sticks as the side supports. We will be using our own sticks as well as contacting hockey clubs and stores to see if they will donate used hockey sticks.

3.) Plywood

Our plan is to use 2 sheets of plywood separated by a thick piece of Styrofoam as our front and back support panels. This will make the device very light in a section that does not need to be that strong.

4.) Spherical Orbs

We chose to use devlin spherical orbs on the bottom of the device to allow the support to propel forwards. This is a great material to use for this aspect because they have very little friction between the ice and also are relatively strong and dense.

5.) Runners

We will be experimenting and testing with 3D printed runners to see if they offer a good solution to the steering of the device. We chose to 3D print these because it does not cost anything to 3D print.

6.) Telescoping pole

Instead of making a telescoping pole for our adjustable seat ourselves, we decided it would be easier if we just bought one that we were able to use right away so there would be less complications and time wasted. This eventually will save us some money.

7.)

Our seat will need to be both sturdy but also comfortable. So we considered using tougher and more expensive materials like titanium, but because of our restricting budget, we settled to use plywood as the shell, and add comfy fabrics on top.

6. A discussion of your project’s uncertainties and risks.

We are uncertain about what materials we should use for the structure of the design. David would like a light product that will last. Aluminum would be ideal to make the product light, but we are worried that the product deform easier if it is made of aluminum. Steel would be very strong, but it is very heavy. We are leaning towards using polyurethane foam compressed between two quarter inch thick pieces of wood. We are uncertain if this will make the product light enough because wood can be heavy if enough is used.

We are also unsure of how we are going to build the seat. We have thought about using a wide seat that is attached to a telescopic pole so that if the user falls it should catch them, but that could interfere with the user’s stride. We could also use a padded bar that goes from the back to the front, but it would be hard to incorporate that into the design that we think is ideal. We are leaning towards using the seat attached to the telescopic pole and we are going to try to find a location on the product where it will not be in the way.

We have many different ideas for a design for the product, but we are leaning towards a design that folds the product into a W for easy storage. The only problem with this is that there will be a lot of loose parts. We will have to find a way to store these parts within the product when it is being stored.

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D.2 Feasibility study. TELOS factors:

1. **Technical: Does your team have enough expertise and technical resources?**

Our team definitely has enough expertise. We all know how to use a drill press, mill, and lathe, and members in the group have experience in welding and the use of power tools. We also have the skills to make necessary calculations such as calculating the angle the hinge needs to be placed at in order for the part to fit on the product.

We have plenty of resources available to us. We have the Brunsfield Centre that has drill presses, mills, lathes, and power tools. We are able to surface faces of small parts, drill and bore holes, face small parts, and screw parts together/make necessary cuts to the materials. We also have a spot in the maker lab where we can weld some of our parts together. There are many suppliers we can use to get materials such as Amazon, Carr, Spaenaur, and McMaster.

For anything that we're not familiar with, we have many people that can help us along the way. First of all, David helps us to understand the lives of children with disabilities which helps us with the planning of our project. At our second meet, we showed him many of our ideas, some of which he loved and some of which he helped us understand how they might not be the best solution for people with disabilities for various reasons. Our TA, Jay, has been very helpful in coming up with ideas and checking on if they're feasible. We don't have as much expertise with different kinds of materials, but he helps us to understand what materials are available to us and what pros and cons they all have.

2. **Economic: Can the cost of your project be reasonable?**

The cost of the product can be reasonable. Our bill of materials is currently sitting under $100 with only an estimate of some costs. Some materials may be able to be found as free scrap (leftovers from other projects) around the Makerspace, and we might be able to find a sale on other products to bring down cost. A problem that arises with ordering materials online is that it may cost extra for shipping and we may potentially have to pay extra for fast shipping since our project has a deadline and a tight schedule.

Although we have a $100 budget, another reason to try to keep expenses low is for David's patent. He has spoken to us about the possibility of selling the product (or a later version) and he wants the aid to be affordable for any family who may have a child with disabilities. He doesn't want to deprive children in need of the product of the ability to skate just because of financial issues, so we will keep the production cost as low as possible.

3. **Legal: Are there any legal issues with releasing your solution to the public?**

While David was building his prototypes, he researched many patents for skating aids. He analysed their strengths and weaknesses if used by his son and built his prototypes from there.

We have viewed the patents and one of our challenges while coming up with designs for the skating aid was not making our design too similar to any of those patents. We discussed the advantages and disadvantages of many aspects of the designs and tried to incorporate some of the general ideas into our own design. Overall, we had to be aware of the patents so that we didn't copy them and to learn from them, but they have not caused legal problems for us. David has a pending patent for his own design, so we wanted to try to incorporate his previous prototypes to our design so that he could still use it for his patent.

4. Operational: Are there any organizational constraints that will prevent your success?

A main factor that could prevent our success is time. Three of our team members are taking six courses this semester and our last team member is also taking GNG1103 which has a big time commitment for a project as well. Trying to set aside time to work on this project (especially is we want to all get together) and to work on other courses is sometimes difficult to do. We have split tasks up to complete deliverables separately and on time but for decision making that needs to be done, we want the whole group together and present, which isn't always possible.

5.Scheduling: Deadlines

Deliverable	**Deadline**
Prototype 1	October 14th
Project Progress Presentation	October 17th
Business Models	October 21st
Economics Report	October 28th
Client Meeting 3	October 31th
Prototype 2	November 18th
Presentation/Poster	November 25th
Design Day	November 28th
Intellectual Property Search	December 2nd
Final Project Presentation	December 3rd
Final Project Report	December 10th

The deadlines were provided by our professor and teacher assistant, and they are reasonable because they consider the duration of the course. They will help keep us on track in order to be able to complete the project and give a product of quality to David.