Deliverable C: Conceptual Design, Project Plan, and Feasibility Study

Group 25

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Abstract

This report details group b25's work on coming up with a generated concept to move forward on. In the report a functional decomposition chart is used to identify key functions and subfunctions of the device. This information is then taken and each group member generated three possible design concepts, either for the main system or the subsystem. Each of those concepts was thoughtful analyzed, and then a finalized design was chosen from them. Finally the group decided on what was next moving forward and developed a plan for the upcoming client meet.

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C.1 Conceptual Design

C.1.1Core Functionality

To establish core functionality of a device, first a list of needs from the client need to be taken. This was done in Deliverable B, shown below is the tabulated results of the needs.

Table 1 List of interpreted needs.

Interpreted Needs
Desired cost, under \$100
Looking for a foldable and easy to carry table with similar features to a camp or patio lounge chair
Approximately 5 lbs to 7 lbs and no more than 10 pounds. Easy to carry with one hand. Compact.
Dimensions of device (full size open) approximately 2' by 5',
Something to block off the person being changed from sight
Needs to support more than 100 lbs
Device needs to be approximately 24" to 30" high, height adjustability would be preferred
The device should work in an accessible bathroom or outside
Smooth/glossy fabric either attached or attachable to the top of the device
Adjustable height for caregivers' comfort
Some kind of thing that is able to secure the user
Comfort is a priority
Quick to set up

While a table is nice to look at, unfortunately it does not do a very good job of telling what are the core subsystems that need to be made for device functionality. To address that issue, and in order to understand the problem better. A functional decomposition chart was made (Figure 1).

Functional Decomposition.





This chart shows the key subsystems that need to be made, as well as their boundaries; determined by interpreted user needs. After this chart was made, concept generation was done to gain a list of possible solutions for each subsystem and device.

C.1.2 Concepts

Concept Design 1(Ersan)

The general idea behind this system is that it is a curtain which is able to be hung above the table to provide privacy for the user. While the picture is not completely representative of the final product there could be two long bars attached to the table that are able to hold up the curtain, which would satisfy the user need for privacy whilst changing

Figure 2: Representation of curtain idea



Concept Design 2(Ersan)

This is Ersans generated concept for the possible actual changing table. It is based on the idea of a camping cot with a few modifications to make sure that it meets the height specifications listed. This idea would be great, because it would be able to meet the specifications of weight as well as collapsibility.

Figure 3: Camping cot concept



Concept Design 3(Ersan)

A modified version of this popup tent could be great to use to provide privacy to the user. Taking this popup tent and scaling it up to be bigger. The user would be able to have personal privacy wherever they were, and it would be compact enough to be able to be easily carried.

Figure 4: Pop-up tent concept



Concept Design 1 (Devin)

The client requested that if possible we make the table height adjustable so that the caretaker would be able to comfortably change the user.

To accomplish this, we could use the button locking mechanism that crutches use to adjust height and put them on the legs of the table.



Figure 5: Drawing of bubble locking mechanism

Concept Design 2 (Devin)

The general idea for the design will be based on that of the camping cot, however slight changes will be made. My idea is instead of having the crosses across at the bottom for every point, the middle is 2 flat beams across so that the table is able to be raised or lowered for the person.





Concept Design 3(Devin)

For comfortability while the person is being changed I would add a popup pillow extension that could just be put onto the end of the device. This would just be something that would be attached to one end that would be able to to be "flipped-up" and the user would be able to rest their head. Which would help to maximize user comfort.





Concept design 1 (Jerry)

The main idea behind this concept is based off of that of a hammock. The "table" would sit on a collapsible stand, which would then have a piece of fabric attached to it which the user would sit on to be able to be changed. This satisfies the user requirements of this being able to be collapsed and therefore portable as well as comfort for the person being changed.

Figure 8: Hammock representation



Concept design 2 (Jerry)

Polyester material is very common in use for bed sheeting, as such it provides sufficient comfort to someone laying down. Therefore this material would be perfect for use in a changing table. As it would help to meet the needs of comfort for the person being changed

Figure 9: Potential material



Concept design 3 (Jerry)

Despite the height adjustable provided by the hammock-like design, the hammock is originally designed to lie and rest. The height can be too low for a "standing" caregiver to comfortably support the patient. The chair is foldable and has a conveniently folded size (able to be put in a backpack) to give conveniences to the caregiver.

Figure 10: Stool concept



Concept design 1 (Frank)

Figure 11: Fold-up representation



The top of the table would fold in half lengthwise with hinges. There would be velcro that would wrap around the two ends of the table to hold them together. A handle would be permanently attached on one of the outer ends of the table. When in use the hinges would be on the underside to increase strength A locking mechanism would be attached to where the hinges are to prevent any accidents from happening

Concept design 2 (Frank)

Figure 12: Extend legs representation



This design is based on how crutches work, where you are able to extend or shrink the height based on the user using it. Instead of having a "bubble" like crutches this design would use a screw that a person could screw or unscrew to adjust the height.

Concept design 3 (Frank)

Figure 13: Pop-up privacy tent



There would only be three walls (two lengthwise and one at the end) and no roof, this is to cut down on materials and so the caretaker can see the user

The material of the walls would be dark and opaque

There would be holes on each corner of the top of the table for the tents legs to slide into and be held

Would be detachable (so they don't have to bring it if they don't need it for the outing) and have a separate carrying bag that could be put in with the table

When pulled out of the bag the tent would expand by itself (similar to how a umbrella expands)

C.1.3 Analysis of Concepts

There are three concepts generated per individual working on the project. However there can only be one true design for the final product. So an analysis of each needs to be done. This analysis is going to be based on two key metrics: feasibility of the device, that is how possible it is for the device to be built, and how well the generated concept meets the clients need, based on the target specifications found in Deliverable B (Table 2).

#	Customer's Needs	Importance
1	The change table is compact	5
2	The change table is portable	5
3	The change table is Durable	5
4	The change table is made of Non-stick material	3
5	The change table is made of Comfortable material	3
6	The change table supports a 16 year old boy (support a weight of 100 pounds)	5
7	The change table is big enough to support person (minimum of 5ft long and 2ft wide)	5
8	The change table is lightweight (a maximum of 10 pounds)	5
9	The change table is cheap (a maximum of \$100)	1
10	The change table can provide privacy	1
11	The change table can be set up quickly (1 minute is the max)	2
12	The change table can be cleaned/sanitized easily	3
13	The change table is ergonomic for user	3
14	The change table is usable multiple environments	4

Table 2: List of customer needs.

Concept Design 1(Ersan)

This concept is feasible, as explained in the design, you would simply attach two bars on either side with a circular metal bar on top and then have curtains attached to that. This device meets the target specifications of privacy(1), and is able to be used in multiple environments(4). However this device fails to meet compact(5) as the extra metal could reduce the amount that the device could "shrink" to, lightweight(5), as the extra metal or even plastic would certainly take it above the amount of 10-15 pounds. Overall, this device can be rated no higher than a 1/5 as it sacrifices meeting the needs of a lot of important target specifications to meet the need of a lower rated target specification.

Concept Design 2(Ersan)

This concept is feasible, as camping cots exist and have existed for a while. Now moving on to target specifications. This design meets: compactability(5), portability(5), Support a weight of more than 100 pounds(5). However, it fails to meet the need of comfort(3) as the table would be made of just a polyester sheet, and ergonomic(3), as the table is unable to be height adjustable. Accounting for all of these metrics, this design concept is rated as a 4/5, as it is able to meet all major target specifications comfortably.

Concept Design 3(Ersan)

This is another totally feasible idea. This device meets the target specifications of: portability(5), compactibility(5), lightweight(5), and quick set up(2). However it fails to meet the specifications of: durability(5), as these types of tents are easily able to be torn and can be whipped around in hard weather. Overall this is a very good design that meets the majority of important target specifications, while failing to meet one very important target specification. As such, a rating of no more than 3/5 can be given.

Concept Design 1(Devin)

This is a feasible idea that would be simple to implement. This subsystem meets the target specifications of: portable(5), Quick set up(2), ergonomic(3). While failing to meet the target specifications of: lightweight(5). Therefore this concept cannot be given more than a 4/5.

Concept Design 2(Devin)

This is a feasible idea, as a cot would be very simple to implement and would successfully change a person. This would meet the target specifications of: compac(5)t, portable(5), supports weight of person(5), and the table is long enough to support an adult person(5). However this concept would fail to meet the target specifications of being cheap(1), providing privacy(1). As the target specifications that this concept fails to meet are relatively low rated this concept can be given a 4/5.

Concept Design 3(Devin)

This concept idea is feasible to add. This would meet the target specifications of being ergonomic(3). However if implemented it could possibly take away from the compactness of the device(5), and make it weigh more(5). As such this idea cannot be given more than a 2/5

Concept Design 1(Jerry)

This idea is feasible to build. However it is not feasible in the sense that a hammock design would be impossible to work as a changing table. As such the concept cannot be given more than 0/5.

Concept Design 2(Jerry)

This idea is very feasible. The concept would help to meet the target specifications of: comfortable material(3), lightweight(5), and cheap(1). While not failing to meet the target specifications of anything else. Therefore this concept can be given a 5/5.

Concept Design 3(Jerry)

This idea is feasible to build and would meet the target specifications of: ergonomic (3), durable(5). However this design would fail to meet the target specifications of compact(5), and lightweight(5) as it could add extra weight. Therefore this device cannot be given more than a 3/5.

Concept Design 1(Francois)

The concept design is feasible. It would help to meet the target specifications of: compact(5) and portable(5). Whilst not failing to meet any other target specifications. Therefore this concept can be given a 5/5.

Concept Design 2(Francois)

A very feasible concept. This subsystem meets the target specifications of: portable(5), ergonomic(3). While failing to meet the target specifications of: lightweight(5). Therefore this concept can be given a 4/5.

Concept Design 3(Francois)

This is another totally feasible idea. This device meets the target specifications of: portability(5), compactibility(5), lightweight(5), and quick set up(2). However it fails to meet the specifications of being durable(5) as a tent could be very easily torn or blown away. Therefore this device cannot be given more than a 4/5.

C.1.4 Solution

We have decided to move further with a few of the generated concepts. For the privacy subsystem we have gone with a pop-up tent system as suggested by ersan, and frank. For the main table system we decided to go with a cot based system as suggested by Ersan, Devin, and Frank. Then we have decided to go with a bubble locking mechanism for the height adjustability subsystem as suggested by Devin and Frank.

C.1.5 Finalized Conceptual Design

Bubble locking mechanism

Figure 14: Representation of bubble lock mechanism



This was decided on as the height adjustability subsystem, as this is industry standard for most height adjustable things. As well as it is one of the only subsystems that would allow for a not excess of weight to be added to have height adjustability.

Main system

Figure 15: CAD representation of main system



This concept was decided on for the main system, as this would be the best way to meet all of the client's listed needs, as well as it is more within the abilities of group members to build this than to build possible other designs.

Pop-up tent subsystem

Figure 17: Representation of pop-up tent concept



This concept was chosen due to the fact that it's the best way to provide privacy for a person and still be lightweight and compact.

C.2 Project Plan

C.2.1 New Understanding

From deliverable C the team has gained a new understanding of the project and were able to solidify a chosen design concept. Going further the plan is to meet with the client and discuss the group's chosen design concept and get their thoughts on it. As well as to begin developing a "proof of concept" prototype.

C.3

C.3.1 Next Client Meeting

The next client meeting will be all about asking the client what they think about the proposed design. As well as asking her about what could be improved.

C.3.2 Questions for Client Meeting

- 1. Which of these concepts do you like the best?
- 2. Why do you like this specific concept?
- 3. Of the concepts not chosen, why did you not like them?
- 4. What improvements could be made on your chosen concept?
- 5. Could any improvements be made on the concepts that you didn't choose to make you like them?
- 6. Is there anything this design is missing?
- 7. Do you have any design ideas of your own?
- 8. For the privacy curtain, does it need to go all the way around, what are some examples of places you'd change in public