

Transformer Crutch

[Team T.C]

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Design Brief Report

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1. Background & Introduction

Crutches are tools for people who injured and their leg. There are many types of crutches; underarm or axilla, forearm, platform, leg support, one crutch. The traditional crutch, which is a long stick with a crosspiece at the top, used as a support under the armpit. The knee scooter is a two, three or four-wheeled alternative to crutches or a traditional walker as an ambulation aid. When people injure their legs, they often buy both the crutches and the scooter. However, it is hard to carry both at the same time. Outside, it is easy to use knee scooter, but hard to use inside. On the other hand, the crutch is hard to use outside. To solve this problem, Team T.C made an idea that is called the transformer crutch.

2 Problem Statement

There are three problems that regular crutches and the knee scooter have

- 1) Need to buy the crutches and the knee scooter separately at an expensive price.
- 2) Need to carry crutches when using the knee scooter.
- 3) There are limitations on where to put the scooter, which means there are few places to park scooters.

2.1 Research Question

- 1) Is it simple(easy) to transform from crutch to the knee scooter (or vice versa)?
- 2) How convenient are revamped crutches and scooters?
- 3) Does the balance fit well when transformed from a crutch to a scooter?

2.2 Methods & Approach

We used SolidWorks for drawing. And for manufacturing, we used ARC welding to stick each steel piece. The base of the crutch frames is aluminum. So, we used aluminum grinding, and Casting. Now there are three kinds of approaches for a solution.

- Conduct a survey about the product from people who have injured their legs.
- Work with SolidWorks for designing the product.
- To make the product, use several machines in a laboratory factory at Chico State University.

2.3 Solutions Considered

Researching, brainstorming and prototyping led to a primary and contingency design. The process and designs are covered below.

- The solutions should be able to change 2 types. That are crutches and a knee scooter.
- In the crutches, it should be able to endure human's weight. And it should be light.
- In the knee scooter, it should be able to endure human's weight. It should be able to change direction.
- The process of transformation should be as concise as possible.

3. Design Solution

Folding system parts

Figure 1: It easily transforms from crutches to scooter. These are key parts of our project. The origin of this idea came from the scooter folding system.

Figure 2: This part is connected with third wheels and make it easy to handle and fold to carry.



Figure 1: Bending support



Figure 2: Chair Part

<Welding parts>

- There are two welding parts of our crutches. One attached upper crutch with the scooter leg part. Additionally, it has strong hardness and can endure any forces up to at least 154 lb. that is the average of an American man's weight. Likewise easily can see below figure, the other welding part is scooter handle axis attached with little cylindrical steel parts in order to holding with upper crutches.



Figure 3: Bending support Welding

<Holding parts>

Figure 4: This will help to connect with upper crutches and the scooter handle part. A little spring the method is used for little cylinder. In part, tiny spring is put inside and if that button is pushed. Those parts will be easily divided into two respectively. If you put them together, it is possible to do it the opposite way.

Figure 5: To attach with side wheels and the scooter leg, we selected the bolt and nut method. To make this part, we used the drilling machine, which is located in our lab factory and 1/2 bolts and nuts. It blocks vibration of ground if the scooter goes through.



Figure 4: Holding Part 1



Figure 5: Holding Part 2

3.1 Alternative Concept

We preferred it to be fitted with crutches and a saddle because of the inconvenience of carrying the seat parts. The plan was to attach the saddle on the arm of crutches and fold it at 90 degrees. However, considering the length problem, durability, and weight increase, we chose a removable seat. If we can get another chance and if we have appropriate equipment for manufacturing, we want to try this method.

4. Result

The use of revamped crutches the same as can be used ordinary crutches. The extra wheels and joints are added over the original crutches to increase the weight slightly, but the increased weight is NEGLIGIBLE. In the state of the scooter, the angle between the upper part and the lower part of the crutches is 90 degrees. Anyone can easily turn to 90 degrees using the clip at the joint of the crutches halfway through. The additional combination of the seat and handle completes the scooter. The handle part, combine the bars on both sides of the handle into the joint of the 90 degrees bent crutches. In addition, hanging the seat hook on the arm handle of crutches completes the scooter.



Figure 6: Final Design

4.1 Testing

Tensile Test

Objective: The objective of this test is to check that the transform crutches can endure the weight of general people. Also, through this test we could observe in the aluminum's failure if enough exertion forces into the upper handle part of crutches as it transforms to a scooter.

4.2 User feedback

“The slight angle of crutches is rather more comfortable.”

“The big wheel under the seat can bear a lot of weight, and the two wheels located in lower part of crutches support it.”

“It's a convenient tool to go a long way”

5. Cost

The main purpose of our crutches are to transform the original crutch and scooter. We bought one set of crutches (\$24) and two scooters (\$60). In addition, we bought separate hardware nuts and steel to create the folding mechanism that sets the TC a part. At making cost this totaled around \$200.

6. Significance

The purpose of our transformer crutch was to focus on transforming original crutches and scooters. we considered the price of just one set of crutch and scooter, and the price would be burden to customers if they bought both it. In addition, this machine suitable for people who have leg injuries. Overall, Transformer Crutch merits on privacy and mobility with portable function.

Appendices

- Budget..... 1

Detailed Budget

Table 1 - Budget

Expenses		
MATERIALS	Steel	\$24.00
PARTS	Crutch (1 set)	\$24.00
	Scooter (x2)	\$60.00
	Bolts and Nuts	\$24.00
	Screw	\$8.00
	Hooks	\$12.00
	Wheels (x2)	\$16.00
LABOR	50 Hr @ 15/Hr.*	\$750.00
	Welding*	\$30.00
		<u>\$948.00</u>