

Accessibility and Universal Design Project

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Abstract—In recent decades, the quality of life of many disabled people has improved. There are more and more devices for making handicapped people's lives better. This accessibility has the aim of giving more independence to certain people with motor disabilities. Specifically, it focuses on two paraplegic children who have difficulties both in standing up from their wheelchairs as well as standing for short periods of time due to their condition. Therefore, they need a device that can help them to stand up from their wheelchair.

This project was carried out in conjunction with a social organization called Accessibility Chair with the objective to improve the quality of life of these two children and to make them less dependent on the help of other people. If successful, there are potentially many other children and adults that could benefit from the research that has been carried out and the prototype that has been designed and built by the team.

Keywords—Bipedestador, seat, winch, harness

I. INTRODUCTION

EACH year, the Polytechnic University of Catalonia proposes a more or less similar accessibility project allowing the engineering students to make their best to help people by creating devices. In this one, the accessibility team must find how to build a device for two clients, who are two boys using wheelchairs. The best solutions must be found because the clients will live with them during a long time, even all their childhood.

Client 1 has not got any strength in upper and lower limbs and is affected by tetraplegia with severe spasticity. He needs more help than the Client 2 who has his strength affected in his body lower parts but can still use them to get up alone with a Zimmer frame help.

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II. DESCRIPTION OF THE PROJECT

A. Scope

The objective of the project is to create a usable prototype adapted to each of the two clients' wants and needs, in order to improve the quality of their everyday life. It is not the responsibility of the team to find financiers for the materials and such, also the scope of the project does not allow project members to focus on anything different than to create a usable prototype within the time set.

B. Goals

The main project goal is to add a mechanism to a wheelchair in order to help two paraplegic boys to stand up with the least assistance possible from helpers which are the physiotherapists. Secondary goals are to make a system the most cost effective as possible, portable, ergonomic and easily adaptable to wheelchairs.

III. RESEARCHES

The researches were focused first on existing systems, and most of the time prototypes made by universities around the world. It was decided after a while that the two clients need a lifting seat but this solution looked very easy and maybe not the best one. Indeed, because of different diseases, it looks logical to have different devices. All the decisions taken by the team are explained in details in the next part.

IV. TAKEN ON SOLUTIONS

A. Client 1

A belt with a harness that holds the upper part and legs is decided. A hand crank or a system of pulleys must be adapted in the bipedestador to allow the physiotherapists helping the client gradually up from the chair and approach the bipedestador.



Figure 1 : Harness

The work of physiotherapists becomes much easier and they

should not load the whole weight of the client, sometimes hard for them.

Different kind of small winches are available on the market, the most interesting for the project being an electrical and a manual one. The manual one is the best option in terms of cost and usability.

Different options are proposed for the harness, buying an existing harness made for climbing or making it by our own. First option's cons are the cost and the problem of adaptability. Second option's con is mostly the feasibility without sewing skills. A third solution is found regarding the physiotherapists who know how to sew. A harness is made with their help and tested with the client.

Both devices are finally combined and tested with the client.

B. Client 2

The choice of a booster cushion is chosen. This makes the standing up of the client much easier in combination of his Zimmer frame. This provides him extra help and reduces the strain on his body if he does this several times a day.

The different options the team has are first choosing between an electrical, hydraulic and pneumatic seat. It is revealed that the pneumatic one is enough for the project, also the cheapest. Then, a selection is made between buying an existing one or making one. The first option is quickly kicked out because of its over-dimensions. The second option is realized by buying the components separately: a pneumatic piston, a cushion, a hinge, a wood base and screws.



Figure 2 : Seat under construction

The final prototype is tested by the team first to make it the most convenient as possible and then adapted to the client's wheelchair for testing and validation.

V. CONCLUSION

The clients having a different disease, two different solutions are found duplicating the work needed. Most feasible options are chosen according to the budget of the organization the team is working for. Each device is tested individually by the team first and then by the clients themselves. Validation is done after with the physiotherapists as the clients are supposed to live with these devices during most of their childhood.

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