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ECONOMIC VIABILITY IN THE AUTOMATION OF WHEEL CHAIR CONVENTIONAL: ENGINEERING APPLIED TO SOCIAL DEVELOPMENT

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Abstract. *In order to promote the ergonomic comfort for wheelchair users, this research project aims to facilitate the transformation of a wheelchair conventional in a eletric wheelchair, making it totally autonomous to the user, having facilities in the handle for access to small places. The device will facilitate locomotion in irregular lands by reducing individual effort or the need for an escort. As a result it is expected at the end of the research a validation of the prototype with its economic viability for the production in large scale. This project will be used for wheelchair users who do not have movement of under limbs and have physical capacity in the upper limbs.*

Keywords: *Wheelchair, Economic viability, Automation, Ergonomy.*

1. INTRODUCTION

Over the decades, the wheelchairs were being adapts with technology allowing the users a better facility day a day. These technology allow the wheelchair users a less effort and better control and comfort, once the technologies are implemented, they have the meaning to reduce the physical and psychological limitations for users.

Despite the laws indicate good perspect about the inclusion of accessibility to disabled people, not always these legislation is practiced. Many examples are the challenges that a wheelchair user stare and many times have to turn third-parties help, reducing your limited freedom of locomotion. Still according to the author, the access to appropriate wheelchairs, equipped and framed, it is not just help the mobility but also improve in education, work and social live of those who need this kind of support. According last search realized by IBGE (Brazilian Institute of Geography and Statistics), Brazil have a quota about 13 millions of motor deficiency, this means that people with difficulty to move represents 7% of Brazilian population (IBGE, 2010). Promote equality in society is a duty of all. This aspect, the use of engineering contributes in development and improvement of products that allow decrease until eliminate these differences between peoples, mainly about the third-parties dependence, mutual compartment between wheelchair users. The general objective of this research of project is submit a economically viable prototype in the development of an electric coupling kit for automating a conventional wheelchair.

Having the specific objective differentiate of market mechanization kits, making the developed kit in this research, a easily kit to couple in any other wheelchair being the wheelchair user mount and dismount the mechanization kits at least 20 seconds, bringing a giant mobility to wheelchair user.

2. EXPERIMENTAL PROCEDURE

The procedure and developed of the project have the following objectives:

- Evaluate the required materials to automation of a wheelchair relating the weight and cost.
- It was changed comercial materials for the execution of the project, 1020 steel and aluminum, facilitating the access and decreasing the building cost of the kit in relation to another on the market.

Making a study of soil type and ramps, the roof quality and the way the pavements are made in the country, do not reach the minimum necessary for the great majority of electric chairs in the market circulate without mobility problems. Irregularities on the roofs and access ramps cause them to break in most cases. The kit besides targeting the low cost,

still carries in DNA a robustness capable of surpassing these urban barriers and having strength to overcome obstacles. Featuring a 350w front-wheel drive and 36V 10A lithium battery with 60km range and 150kg load capacity.

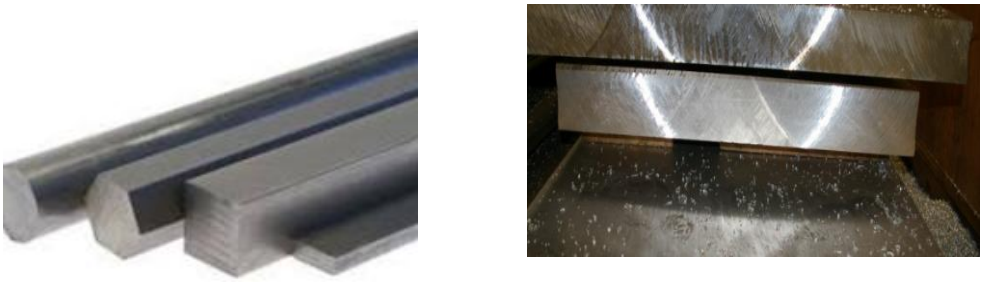

Figure 1 – Material (1020 steel and Aluminium respectively)

Font: Gonçalves Dias GGD

All materials to be used have already been searched and the business plan for a future project in the sector is being developed based on market research and accessible prices.

Tabela 1 - Materials and Prices Chart

Quantity	Description	Price	Quantity	Description	Price
1	M16x150 bar	USS 5,00	1	conduit	USS 0,31
1	4x300x300 plate	USS 4,07	1	Brake lever	USS 3,13
1	30x30 1020 square	USS 1,25	1	Grip	USS 3,13
1	14x300 billet	USS 3,76	1	fork with suspension	USS 47,02
1	30x20x750 metalon	USS 4,07	4	m8x20 Screw	USS 5,02
1	20x15x30 flat bar	USS 31,74	10	m6x25 Screw	USS 9,40
1	20x250 pipe	USS 14,10	2	m10x30 Screw	USS 2,51
1	32x2500 pipe	USS 2,19	1	350w eletric bike kit	USS 689,66
1	15x100 pipe	USS 1,25	1	10 spring	USS 1,88
1	20x4x200 flat bar	USS 6,90	1	nuts	USS 7,52
1	Stem bike	USS 31,35	1		USS 10,97
1	Handlebar	USS 12,54	1	automobile ink	USS 14,11
1	bike gloves	USS 1,25	1	varnish	USS 9,40
1	inner brake	USS 0,63	1	sandpapers	USS 4,08
1	thinner	USS 12,54			

Font: Author

2.1 Economic Market Research

The economic feasibility of producing the electric kit to automate the wheelchair in relation to the market cost founded was satisfactory, as shown in the following chart:

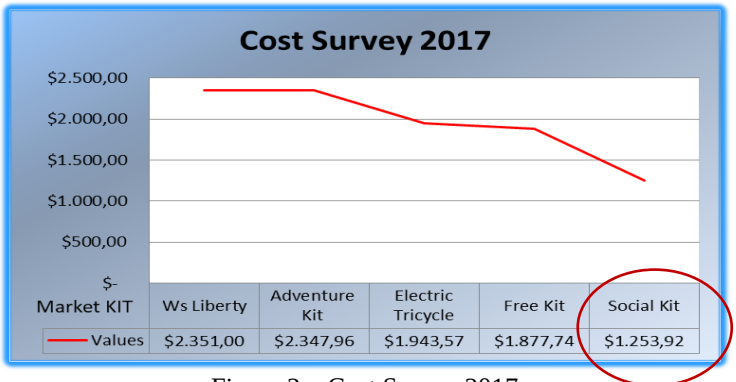

Figure 2 – Cost Survey 2017
(Font: author)

As the project has no profit, all materials plus labour totaling a cost of no more than R$4000. According to each patient and their disability, the cost could be reduced, taking into account the updating of values founded in the pieces based on national market.

2.2 Methods

The research method is model the prototype through the disability and relation ease and cost aiming comprehensiveness mobility and social inclusion.

It will be necessary identify character that have influence in the form of the coupling kit to be developed.

How already seen in kits offered by the market, the coupling of the motor to the wheelchair has a difficult operation to the patient. But the kit in question has quick coupling and without taking your hands off the handlebars, minimizing the time and helping in the ease of coupling and mobility of the wheelchair user.

2.3 Field Research

User Profile: routine, travelled distance, ergonomy, among other features.

The wheelchair user Fernanda uses her kit daily in on asphalt roads and urban stretches with sidewalk.

The kit was tested and submitted to curves at maximum speed and tested for two months by the chairwoman Fernanda, who worked in the UNISAL - LORENA.

Figure 3 - Kit adapts to any wheelchair
(Font: Fernanda Zanin Facebook)

The kit adapts to any wheelchair, thus providing comfort to the most diverse wheelchairs, since urban wheelchairs to off-Road.

2.4 Results and Discussion

The project aims to economically make possible the kit for automation of a wheelchair. The development at the lowest cost possible aims to make the kit accessible to many users as possible, generating comfort, convenience and greater independence. The material tests will be fundamental in the costing process of the kit, mainly in quantity that was used.

The kit was studied and had a positive replication from the public. We have many wheelchairs users searching for this kit, but for being a project of social inclusion project, we are looking for more funding and sponsors, so that we can increase the number of participants.

The engine that will be used will be defined through the identification of users profile characterizing the weight and measures establishing the minimum required performance. We expect define a business plan for production on a larger scale enabling operational cost reducing for manufacturing and mounting kits.

The ergonomic comfort of wheelchair in daily activities could be facilitated through improvements developed in the chairs. Besides that, you can realize better proportion of users if develop an economically viable improvement, through research of materials and components.

3. CONCLUSIONS

This project provides an opportunity for hands-on learning for engineering students besides develop a product that can benefit a part of society. Besides providing better conditions of comfort and mobility for these people, it makes this project with scientific and social characteristics.

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5. RESPONSIBILITY NOTICE

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