

**DESIGN AND MANUFACTURE OF A WHEELCHAIR TRICYCLE ATTACHMENT FOR PEOPLES IN
DEVELOPING COUNTRIES**

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INTRODUCTION

Most of the wheelchairs being used in Tanzania are imported, which are not fitting to pathological and environmental (i.e. interior and external) conditions. The present designs available in the market do not provide optimal qualities required for internal and external wheelchair use. Developing a wheelchair tricycle attachment will provide an effective means of a common wheelchair which is appropriate to the given environmental conditions for a person with lower limb problems which will be simple enough to be performed by an average person which is also cost effective. The main objective of this project was to develop a wheelchair tricycle attachment for easier accessibility and increased performance to the wheelchair users in Dar es Salaam and Kilimanjaro regions (Tanzania). Mobility aids currently used do not suit user needs, wheelchair are exhausting to push on rough grounds, while hand powered tricycles, which are more efficient to propel, are to large to use in the house, (Winter, 2005). A tricycle drive, together with wheelchair, is easy to carry in most forms of transport, (Cornick 2011).

METHODS

This was done by investigating the existing driving systems for both wheelchairs and tricycles. Literature review, survey, information analysis, observations, manufacturing, design testing, evaluation and interviews was carried out.

Conceptual design as described by (Pugh S, 1991) as generation of different concepts and selection of the best concept(Figure.1) followed by embodiment design and detail design of a cost effective wheelchair tricycle attachment for easier accessibility and increased performance to the wheelchair users was done. The evaluation and ranking of the concepts using Rating and Weighting Matrix Method was through the following criteria; i.e. easy to manufacture, low production cost, reasonable product price, easy to operate, simple design, efficiency, ergonomics, aesthetics and weight. The bill of material was formulated depending on detail and assembly drawing (Table.1).

Detail and assembly drawings of various components and manufacturing were carried out at Tanzania Training Centre for Orthopaedic Technologist (TATCOT). Thirty disabled people were interviewed. Finally testing (3 wheelchair users tested as shown in (Figure.2) with the consideration of minimum coverage of 5km and moderate speed of 5km/hr, as a primary testing.

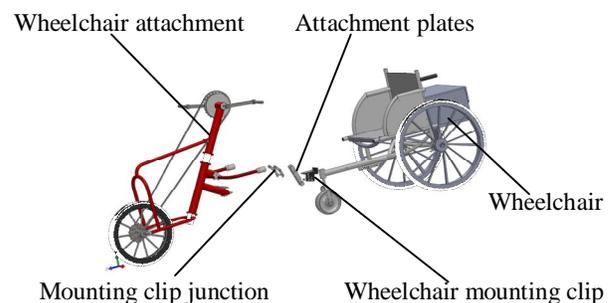


Figure 1: Wheelchair tricycle attachment



Figure 2: Final wheelchair tricycle attachment and testing by the user

RESULTS AND DISCUSSION

The results of the majority interviewed became disabled early in life with a birth defect or polio, of which most had to resort to crawling (66%) as a means of mobility before obtaining a wheelchair or tricycle, (Figure.3).

Most of the interviewed needed to travel multiple kilometers per day, with (50%) travelling more than 5km/day. For long distance a tricycle required less much power than a wheelchair (Figure.4).

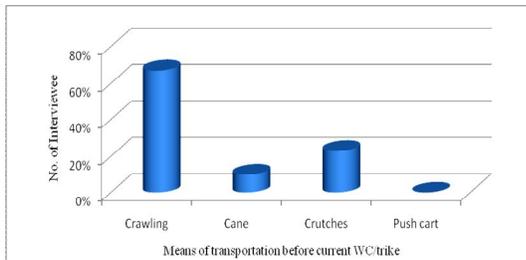


Figure 3: Travel before current mobility aid

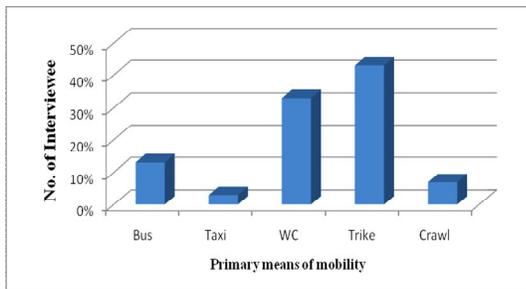


Figure 4: Means of transportation used

Bicycle shops were the most common location of wheelchair and tricycle repair reported during the assessment. One major problem observed during the assessment was the inability of many people to purchase their own mobility aid. Only 17% of those interviewed were able to purchase their own

mobility aid. For long distances, a tricycle requires much less power than a wheelchair. As a result, tricycles were observed to be more popular than wheelchairs users.

The average interviewed age of obtaining a first wheelchair or tricycle was 15-20 years old. As a result, most people who went to school or had a job before the age of 22 were forced to crawl as a means of travel, while others were simply unable to attend school or obtain a job because of distance.

CONCLUSIONS

The project was designed, manufactured and tested. The physical capabilities of the user will be very helpful in designing the way that the user is able to manipulate the attachment during attaching/detaching as well as how the device will be moving

REFERENCES

1. Pugh, S. 1991. Integrated Methods for Successful Product Engineering, Addison-Wesley Publishing Company. pg 32-50.
2. Winter, G. 2005. Assessment of Wheelchair Technology in Tanzania, Cambridge. pg 10-30
3. Cornick, P. 2002. Wheelchair Technology Manual, UK, Motivation. pg 10-15

Table.1. Bill of Quantities (BOQ)

S/N	Name	Specification/Size	Quantity
1	Used bike frame	Gear front frame assembly	2 pc
2	Pedal hub bearing assembly	∅50mm	1 pc
3	Pedal	1Pair (L= 170mm)	2 pc
4	Bike chain	Length (1820 mm)	1 pc
5	Bike sprocket	30 teeth	1 pc
6	Bike sprocket changer	28,20,12 and 10 teeth	1 pc
7	Bolts and nuts	M 12x25mm	3 Kg
8	Bolts and nuts	M8x58.1mm	3 Kg
9	Tyre	∅ 50-400 mm	1 pc
10	Round rod	∅ 10x10ft	2 pc
11	Flat bar	10x2x50 mm	2 pc
12	Wheelchair	3 wheeler	1
13	Shaft	∅ 60x100mm	2 pc