BUSITEMA UNIVERSITY

FACULTY OF ENGINEERING

DEPARTMENT OF COMPUTER ENGINEERING

FINAL YEAR PROJECT REPORT

AN AUTO-NAVIGATING WHEELCHAIR SYSTEM USING VOICE COMMANDS

BY

TWEHAMYE CRISPUS

REG. NO: BU/UG/2013/1589

EMAIL: 765cris@gmail.com

TEL: +256-705-920-371 / 0784-834-365

SUPERVISOR: Ms. ASINGWIRE BARBARA

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DECLARATION

I, TWEHAMYE CRISPUS, BU/UG/2013/1589, do hereby declare that this Project is my original work and has never been published and/or submitted for any other award to any other University or institution of higher learning.

Signed ……..... Date…….....

APPROVAL

This is to certify that the project under title "**Auto – navigating wheelchair system using voice commands**" has been done under my supervision and is now ready for examination.

Sign ……. Date ……..

Ms. ASINGWIRE BARBARA

Department of computer Engineering

Faculty of Engineering

DEDICATION

I dedicate this project report to my beloved mother Mrs. Joy Tumwine for the love and support she has provided to me throughout this project period and my family for the advice and financial support they rendered to me during the research period.

I also dedicate it to my project supervisor Ms. Asingwire Barbara for her tremendous effort and guidance in relation to my project report , the courage, and the moral & support she offered to me during my research period may the Almighty God bless her.

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My supervisor, Ms. Asingwire Barbara, has been a vital requirement in helping me to accomplish this project report. Thank you so much for the aid offered to me.

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Special thanks my family for their never ending financial and advisory support. May God reward them abundantly.

Above all, I acknowledge the Almighty God for the gift of life, wisdom and guidance for without Him, I would not have been able to accomplish this project report.

LIST OF ACRONMY

AC: Alternating Current

ADC: Analogue Digital Conversion

DC: Direct Current

LCD: Liquid Crystal Display

PWD: People with Disability

RAM: Random Access Memory

ROM: Read Only Memory

VRM: Voice Recognition Module

WHO: World Health Organisation

ABSTRACT

Normally physically disabled people and those who have lost their legs by any accidents or due to malnutrition have a special innovation, wheel chair to give them the pleasure of moving with ease. The idea of wheel chairs that the innovators have come up with mostly involves the handling of the equipment physically with their hands. But this is difficult or impossible for the patients who have lost their hands or aged. With the aim of providing these people an enhanced pleasure of handling the equipment with comfort, the idea of voice controlled wheel chair has been chosen and studied upon. This model uses Arduino and voice recognition module which recognizes the word from the user and matches with the predefined instruction in the system and the sensor attached to the design checks for any obstacles including pits and then directs the wheel chair to act accordingly.

A voice controlled wheelchair can provide easy access for physical disabled person who cannot control their movements especially the hands.

Once the voice recognition system recognizes the voice commands in comparison to the pre-stored memory, the respective coded digital signals would be sent to Processor which then controls the wheelchair accordingly.

The system is divided into two main components: speech recognition module with voice Recognition module sensor and wheelchair control unit. Handicapped people do not have soft motion of hands and legs, it is therefore not easy to control different turns of the wheelchair manually. To remove this problem moment of wheelchair is controlled by voice. So by giving simple voice command turns wheelchair to different directions depending on the voice command given to it.

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CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND

Disability may be defined as the consequence of an impairment that may be physical, cognitive, mental, sensory, emotional, developmental, or some combination of these that result in restrictions on an individual's ability to participate in what is considered "normal" in their everyday society [1].

The number of people with disabilities is growing and globally, persons with disability constitute 15% of the world's population [1]. This is because populations are ageing, older people have a higher risk of disability and because of the global increase in chronic health conditions associated with disability, such as diabetes, cardiovascular diseases, and mental illness [2]. Professor Stephen W Hawking [3], chronic diseases are estimated to account for 66.5% of all years lived with disability in low-income and middle-income countries. Patterns of disability in a particular country are influenced by trends in health conditions and trends in environmental. The other factors include road traffic crashes, natural disasters, conflict, diet, and substance abuse.

The global burden of disease is shifting away from infectious diseases towards chronic ones, which brings increased limitations of functional abilities or 'disability' resulting in increased dependency. The World Health Organization (WHO) predicts massive increases in the number of people dependent on daily care from 2000-2050 [4].

Country	**Predicted % increase is number of people dependent on daily care 2000-2050**
India	120%
China	70%
Sub-Saharan Africa	257%
Burkina Faso, Congo, Liberia, Niger, Somalia, Palestine, Uganda	Increases over 400%

Table 1.1 The predicted %ge increase in number of people dependent on daily care 2000 - 2050

The child disability prevalence is about 13% i.e. approximately 2.5 million children live with some form of disability in Uganda [5] and they are prone to challenges faced by disabled people.

The National Household Survey 2005/2006 estimated that 7% of Uganda's population had a disability. Physical impairments account for the highest form of disability (34%), followed by visual impairments (22%) and hearing difficulties (15%). Other impairments include mental, speech and learning disabilities [6].

The research shows that carers undergo pain and devastation when they realize that their future dreams and expectations would not be met because of the child with disability [7]. Most families bank on their children for future prosperity and well-being. Parents have to clothe them, feed them and meet all their daily needs with less prospects of maximum output from the child. The expectation that the child would marry is reduced. One of the main outcomes of a child's disability is carer's stress. The data reveal stress in the form of insufficient time for other chores and responsibilities and isolation from community activities because of time spent attending to the child at home [8].

The disabling barriers contribute to the disadvantages experienced by people with disabilities and include.

- **Poorer health outcomes**. People with disabilities experience poorer levels of health than the general population.
- **Lower educational achievements**. Children with disabilities are less likely to start school than their colleagues' with-out disabilities, and have lower rates of staying and being promoted in schools.
- **Less economic participation**. People with disabilities are more likely to be unemployed and generally earn less even when employed.
- **Higher rates of poverty**. People with disabilities may have extra costs for personal support or for medical care or assistive devices. Because of these higher costs, people with disabilities and their households are likely to be poorer than non-disabled people with similar income [2].

The findings suggest that people with disabilities are not necessarily denied access to microfinance if they meet the desired requirements [9]. These relate to adequate savings or collateral and perceived trustworthiness. These are seen to be key determinants of success and can be linked to impaired functioning relating to limited mobility, distance, poorer access to information and disabled people's own negative attitudes. Increasing access and utilization of microfinance services by people with disabilities requires formulation of financial policies that accord them special consideration. At the same time, improvement is needed in the knowledge, attitudes and skills of the people with disabilities themselves and also microfinance providers [10].

Due to the challenges faced by the People with Disability, the need for aids like use of walking sticks, wheelchair that are manually pushed by caretakers, some are remotely controlled and hand-crank bicycle by people with mobility impairments that are available in Uganda increase as time goes by to improve their lives and do work that need them to move around [11].

Mary F M [12], People in Uganda who need support of wheelchairs fall under three categories

- The first category People with Disability (PWDs) who have obvious movement challenges. Some PWDs are solely dependent on wheelchairs for any movement and there are others who require them in combination with other appliances. In Uganda, wheelchair users are increasing in numbers because of the increasing Road Traffic Accident (RTA) burden, which is fast becoming one of the top ten causes of morbidity.
- The second category of wheelchair users is the elderly. Persons above 60years are estimated at 800,000, and to reach 1,900,000 by 2030.
- The third category that needs wheelchairs are the temporally users, who use them because they require faster movement beyond their normal ability, as a result of injury, surgery or sudden immobilization of some sort.

There are nine different types of wheelchairs in use in Uganda according to the survey findings and are shown in the table below [12].

No.	Wheelchair Type	Prevalence in %
1	Tricycles and Non-Foldable wheelchairs	53%
2	Hucksteps (Kampala Wheelchair)	31%
3	3-wheeler Rigids	6%
4	4-wheeler Foldables	6%
5	Whirlwind	1%
6	Other Foldables	2%
7	Self Propelled Type	1%
8	Motorized wheelchairs	1%

Table 1.2 Showing the prevalence of each type of wheelchair used in Uganda

The existing types of wheelchairs currently being used in Uganda mostly use manual mechanism of propulsion and even the 1% of motorized wheelchairs are not appropriate for every category of

disability most especially for people with severe impairments who have limited flexibility of body parts like arm and legs thus end up being tiresome and challenging for people with weak upper limbs and/or without arms and this calls for extra aid from caretakers indicating high level of dependency on others.

All these gaps in existing aids call for Auto-navigating wheelchair using voice commands that enable users to achieve mobility at ease and without depending on others.

1.2 PROBLEM STATEMENT

Currently in Uganda, people with disabilities and mostly with mobility impartment find it hard and/or impossible to move around on their own and perform or exercise their duties as they require to make several moves. This therefore limits their presence and performance as they may be expected. Although there are some mechanisms available to aid their movements such as use of walking sticks, manual wheelchairs or remote controlled, hand-crank bicycle and sometimes carrying them from point to point, they are not sufficient and neither do they support all categories with such impairment. The operation of all the aids available requires engagement and flexibility of the body parts such as arms and legs. In an event that the victim cannot ably engage their body parts due to weak upper limbs and/or absence of arms, it is almost impossible and rather frustrating for one to do it on their own. This therefore calls for a third party to come to their rescue, hence making the victims totally dependent on the caretakers.

There is a need to come with a mechanism that favors the victims by making them able be independent as they move around from place to place.

This project therefore focuses on designing a wheelchair system that is voice controlled and can easily be operated by the victim without the need of a third party.

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