UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF NEURO-CONTROL POWERED WHEELCHAIR SYSTEM

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronics Engineering Technology (Telecommunications) with Honors.

by

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FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING TECHNOLOGY

2019

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: DEVELOPMENT OF NEURO-CONTROL POWERED WHEELCHAIR

Sesi Pengajian: 2019

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This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electronics Engineering Technology (Telecommunications) with Honors. The member of the supervisory is as follow:

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ABSTRAK

Tesis ini membentangkan perkembangan sistem kerusi roda yang dikendalikan kuasa kawalan neuro untuk menyokong orang yang kurang upaya dan lebih tua untuk melakukan aktiviti harian mereka. Perlaksanaan sistem kerusi roda yang menggunakan isyarat minda ini adalah suatu usaha meningkatkan kualiti hidup individu kurang upaya dan juga sebagai satu komunikasi antara mereka dan orang awam. Ia disokong oleh alat bedik sebagai alat kawalan yang sesuai bagi pengguna yang tidak dapat mengawal kerusi roda biasa. Projek ini menggunakan sistem pengendalian motor DC yang disepadukan dengan sistem media komunikasi Bluetooth dan menggunakan sistem EEG (electroensefalogram) di pakai sebagai pengikat di kepala serta disepadukan dengan Mikrokontroller Arduino yang boleh digunakan pada hasil penyelidikan teknologi sistem kawalan kerusi roda automatik. Ia didorong dengan menggunakan sasaran pengguna dalam minda dan alat bedik sebagai pengawal gantian. Pergerakan motor DC akan dikawal oleh EEG dan alat bedik yang telah diprogramkan dalam Arduino Mikrokontroller. Dari kawalan itu, ia akan menghubungkan ke sensor ultrasonik untuk mengesan halangan dan alat bedik disambungkan oleh kabel penyambung.

ABSTRACT

This thesis presents the Development of Neuro-control Powered Wheelchair Control Systems to support disabled and older people to do their daily activities. The implementation of a wheelchair system is an effort in improving impaired individual life quality as well as communication from disable person is encouraging in connection to public activity with others. It supported by joystick as control device reasonable for users who are unable control a standard wheelchair. This project used DC motor to operating system integrated with Bluetooth communication media system. Then it uses an (EEG) electroencephalogram system as a binder in the head and integrated with Arduino Microcontroller that can be used on the results of automated wheelchair control system technology research. It is driven by target users in mind and the joystick as a replacement controller. The movement of the DC motor will be controlled by the EEG and the programmed detector in the Arduino Microcontroller. From that control, it will connect to Ultrasonic sensors to detect the obstacles and the joystick connected by the connecting cables.

DEDICATION

To my beloved parents, thank you for all the sacrifices given. All the sacrifice both of done cannot be repay by me, only god can. This also be dedicated to my friends and supervisor of Universiti Teknikal Malaysia Melaka who involved directly or indirectly in finishing this project report and assisting me at this final year project to complete this project.

ACKNOWLEDGEMENTS

Alhamdulillah, thank you Allah because of his blessing, I finally complete and finish my PSM 2 successfully. With great pleasure, I want to take this opportunity to express my heartfelt gratitude to all people who helped in making this major project work a grand success.

I was grateful to En. Khairul Azha Bin A. Aziz, lecturer of Fakulti Teknologi Kejuruteraan (FTK) UTeM for his valuable suggestions and guidance during the execution of this project and also for giving me moral support throughout the period of our study in UTeM. I believe that, without his knowledge and assistance, I will be lost into my wrong turn.

My sincere appreciation also extends to all my friends and colleagues who shared their knowledge, ideas, opinions and tips regarding my project especially to Nur Ezzati Bt Julaihi, Hamizatul Hafsah Bt Ismail and Pavithara. I would also like to thank all my family members, especially my parents. Lastly, I offer my regards and blessings to all those who supported me directly and indirectly in any respect during the completion of the project.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

AIN	-	Artificial Intelligence Network
EEG	-	Electroencephalogram
VIP	-	Vertical Image Projection
MIT	-	Massachusetts Institute of Technology
SPAM	-	Spamming
PC	-	Personal Computer
RAM	-	Random Access Memory
EPROM	-	Erasable Programmable Read-only Memory
EEPROM	-	Electrically Erasable Programmable Read-only Memory
SIL	-	Single Connector
ECG	-	Electrocardiograph Machine
LCD	-	Liquid Crystal Display
MM	-	millimetre
CM	-	Centimetre
KG	-	Kilogram
IDE	-	Integrated Development Environment
%	-	Percent

LIST OF APPENDIX

CHAPTER 1

INTRODUCTION

In this chapter, it will briefly discuss about the Neuro-controlled power wheelchairs system. This chapter also will briefly explain about the project background, problem statement, objective, scope, and methodology of the project. To Understand more details about the project can be obtained from this chapter.

1.1 Project Background

Disabled people in developing countries do not have sufficient access to education, employment, or medical treatment. Their physical or mental state as well as the lack of financial and technological resources, have burdened their families and themselves. The effect is that the negative perception of society also contributed to discrimination against the disabled from numerous aspects including education, employment and quality of life. Wheelchairs with additional technology such as Neuro controller are facility support and also can reduce the burden of the public.

But this issue become serious because they have not got the right facilities. This project aims to find an effective method of people with disabilities in terms of their quality of life, health and medical care, especially those who experience paralysis of the entire body and fail to communicate or interact with people around them. With

this method, they also have the right to live as a normal person which include protection when in risky situations and emergencies.

As an overview of this project, the major components of this project such as EEG (electroencephalogram) handset to transmit information from the brain human, an HC-06 Bluetooth module for wireless transmission of data, fuzzy logic system to collect data information user and transmit to Arduino for the next implementation, an Arduino microcontroller to process received data into wheelchair movements, and a motor driver module to operate the miniature wheelchair's motors. The devices will work together to give a person control over his wheelchair using only his mind and joystick controls.

1.2 Problem Statement

According by research had been done by Government Statistician New Zealand, the correlations among disable and non-disable individuals on key social and economic outcomes. In 2013 an expected 24% of individuals living in New Zealand were distinguished as disabled. An aggregate of 1,062,000 individuals were limited in their carry out everyday activities by at least one impairment type. The population is growing at an older age group, and this group is more likely to be disabled than adults or young people. In that year (Table 1.1), 11% of kids were handicapped, contrasted and 59% of individuals matured 65 or over. Boys are almost certain than girls to be disabled (13% and 8%, separately). However, there was little distinction in handicap rates for people (matured 15 years and over) which is 15 to 44 years is 16% and 45 to 64 year is 28%.

Table 1.1: Number rate of disabled people by age and sex

Number rate of disabled people by age and sex						
Age group	**Male**		**Female**		**Total population**	
	Number	Rate (%)	Number	Rate (%)	Number	Rate (%)
< 15 years	60,000	13	35,000	8	95,000	11
15 to 44 years	138,000	16	145,000	16	283,000	16
45 to 64 years	149,000	28	165,000	28	314,000	28
65 years and over	169,000	58	201,000	60	370,000	59
All ages	516,000	24	545,000	24	1,062,000	24
Source: Statistics NZ						

Disability Survey got some data about their ability to out a range of everyday activities. In Figure 1.1, shows every activity are related with a particular weakness type. Males, females, adults and children demonstrated contrasts in the extent to which they encountered diverse weakness type (Liz MacPherson, 2014).

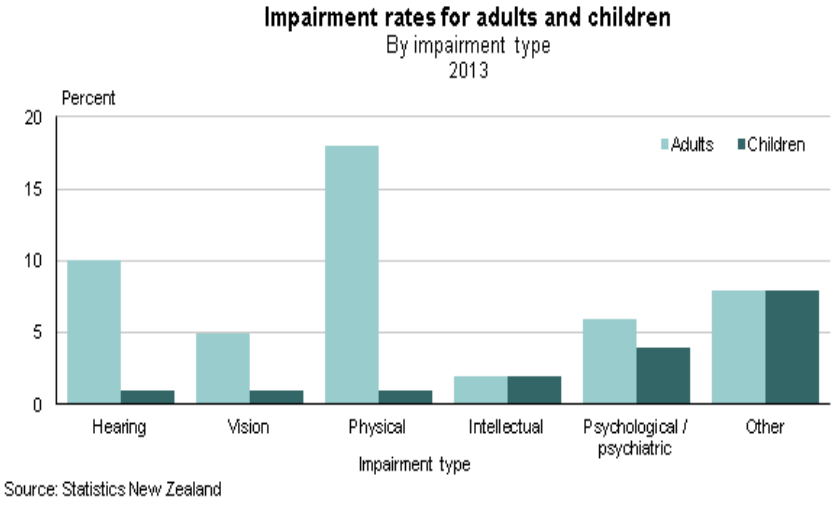

Figure 1.1: The rates impairment for adults and children

For adults, an estimated 18% a physical impairment limited their everyday activities. Then, 10% a sensory impairment (hearing and vision loss) limited in their

everyday activities, 8% for other impairment types were covered by the survey such as speaking, learning, memory, and developmental delay. But share the same amount (%) as children. Next, 6% were living with long-term limitations causes by psychological and/or psychiatric impairments, 5% vision problem and 2% same adults and children of intellectual disability were low compared with other types of impairment. This was the most widely impairment (15 years or over). For children, an estimated 2% a hearing, vision and physical were limited their everyday activities.

Therefore, with innovation on this project it be able to overcome the problem that causes the barrier to the disabled individuals by upgrading the technology of wheelchair functions to make the system more practical and tactical for the disabled.

1.3 Objective

The objective of this development project implement to achieve the following which are:

i. To develop the wheelchair system of Neuro power control.
ii. To identify the performance signal wave of EEG.
iii. To simulate in analyzing and performance wheelchair that user needs in terms of durability of goods and safety use factors in their own environment.

1.4 Project Methodology

To perform a successful project, a correct method and procedure of this project is needed. This project provides neuro-controlled power wheelchair systems using Artificial Intelligence Network (AIN) for people with disabilities. In addition, this project also makes everyone feel easy to learn to control the wheelchair. The methodology steps of this project is as below:

i. Make a research on other journal that has same pattern of Neuro control network and will be put in literature review.
ii. Follow by knowing characteristic of project, build design of project, step of project development.
iii. Testing software and hardware
iv. Make experiment and figure out expected outcome for this project.

At the end of this project, the development of the system is expected to be a successful in software and hardware. The prediction of results is the system from Artificial intelligence network (AIN) can transmitted the data to DC motor and it can control the directions of the wheel's rotation and the Neuro control system can communicate well with the device to display the accurate data output.

1.5 Project Scope and Limitation

Neuro-controlled powered network is project that introduce the development of wheelchairs system. While this project is aimed towards disabled people in general,

it does have some limitations, especially for those who can or cannot use this project. The limitations as follows above:

i. Due to the nature of brainwaves, complete and absolute control over them is impossible.
ii. For quadriplegics or people with no limbs, assistance is still required in the operation of this project, particularly in the turning on and off of the component.
iii. Wheelchairs can only go in one direction at one time only as forward, upside down, left, or right.
iv. Transmission range between this project's components is limited to their respective Bluetooth device.

CHAPTER 2

LITERATURE REVIEW

This chapter present literature review on the development of Neuro-control powered wheelchair system. This chapter will clarify some venture that identified with Neuro control of wheelchair particularly for impaired individuals. The advantages and disadvantages of development for each wheelchair discussed. Literature review done by referring from several sources such as journals, thesis report and valid website. This chapter additionally introduces the improvement of Neuro-control powered framework that will be used in this task.

2.1 Wheelchairs

Wheelchair is the primary transportation used by the disabled to move from one place to another place since long ago. The advancement of wheelchair and the design have been changed inside ongoing decade. The capabilities of standard power wheelchair by introducing control and navigation intelligence. By using the smart wheelchairs, it can help millions of people with paralysis, broken legs, fatigue and more around the world. A few factors to be considered in choosing the right wheelchair which is the size, comfort, weight and technologies.

People with disabilities are forced to face problems with their daily activities. The effects of the problems it brings towards education, housing, transportation and more The ability of wheelchairs is to help the user in different ways, such as avoid accident-free travel, helping the user transportation between locations and for performance in definite tasks. (Sumit Desai, Dr. S. S. Mantha and Dr. V.M. Phalle, 2017)

The mobility design and performance improves the functionality and user participation. It seen in terms of physical and emotional health, as well as in lifestyle and integration into the society. There is an increase in mood disorders in people with chronic illnesses that have been shown to have adverse effects on their journeys. Improving mood may be associated with their health expectations and their function or control over their environment. Mood changes may have a positive impact on their physical inability. The issue problems of health may reflect decreased disease, bleeding pressure decreased, and increased mood in life. (Amiel Hartman and Vidya K. Nandikolla, 2019)

Smart wheelchair is popular used because capability for easy control without requiring assistance from the manual wheelchair. It also no minimum strength required to moving the wheelchair and go great distances without getting tired. The common type of smart wheelchair mostly been used is folding power wheelchair with footrest and batteries (Figure 2.1). It safe, control using the joystick, lightweight and easy to fold. It also equipped with seat belts, seat cushions and pockets for convenience and storage.