



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF LOW COST MULTIFUNCTIONAL MODULAR
WHEELCHAIR CONTROL SYSTEM**

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

by

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APPROVAL

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ABSTRAK

Tesis ini membentangkan pembangunan sistem kawalan kerusi roda pelbagai modul kos rendah yang membantu orang kurang upaya untuk membuat kerusi roda manual menjadi kerusi roda kuasa elektrik tanpa mengganggu struktur asal kerusi roda asal. Projek ini adalah sengaja orang untuk mengatasi masalah bagi orang kurang upaya agar lebih terlibat dalam masyarakat dan memiliki kerusi roda kuasa elektrik sendiri untuk menjadikan kehidupan mereka lebih mudah. Isu ini menjadi serius kerana memberi kesan sampingan kepada pengguna kerusi roda manual seperti bahu nyeri. Projek ini melibatkan penggunaan motor DC untuk menggerakkan kerusi roda pelbagai fungsi yang akan mengawal perisian dan perkakasan Arduino. Perisian dan perkakasan bersambung antara satu sama lain yang akan dilaksanakan dalam projek ini. Gerak motor dikawal oleh kayu bedik yang telah diprogramkan dengan ATMEGA Arduino, motor, DHT 22 sensor kelembapan suhu untuk menunjukkan kelembapan dan suhu di dalam kotak kawalan, sensor ultrasonik untuk mengesan halangan dan joystick disambung dengan menggunakan kabel penyambung. Hasilnya menyimpulkan bahawa untuk membangunkan sistem kawalan kerusi roda pelbagai fungsi berbilang kos rendah dengan menggunakan motor DC bersama dengan visualisasi data IoT.

ABSTRACT

This thesis presents the development of low cost multifunctional modular wheelchair control system that help disability people to make manual wheelchair into electrical powered wheelchair without disturb original structure of original wheelchair. This project are purposely people to overcome the problem for disability people to be more involved in the society and own electrical powered wheelchair to make their life easier. This issue become serious as it give side effect to manual wheelchair user such as pain shoulder. This project is involved the usage of DC motor to move the multifunctional wheelchair which will be controlling by Arduino software and hardware. The software and hardware connect with each other that will be implemented in this project. The motor motion is controlled by the joystick which been programmed with Arduino ATMEGA, motor ,DHT 22 temperature humidity sensor to show the humidity and temperature inside the control box, Ultrasonic sensor to detect obstacle and joystick is connected by using a connector cable. The results conclude that to develop a low cost multifunctional modular wheelchair control system using DC motor along with IoT data visualization.

DEDICATION

To my beloved parents, thanks for everything. 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.

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LIST OF SYMBOLS

%	-	Percent
mm	-	Millimeter
cm	-	Centimeter
V	-	Volts
Ω	-	Ohm
kg	-	Kilogram
s	-	Second
g	-	Gravity = 9.81 m/s
I	-	Moment of inertia
l	-	Length

LIST OF ABBREVIATIONS

IoT	Internet of Thing
DC	Direct Current
Wi-Fi	Wireless Fidelity
I/O	Input/Output
GPS	Global Positioning Satellite
LCD	Liquid Crystal Display
PWM	Pulse Width Modulation
Tx	Transmit
Rx	receive

CHAPTER 1

INTRODUCTION

This chapter gives a brief on the project background, problem statement, objective, scope, and methodology of the project. Understanding on the project can be gain from this chapter.

1.1 Project Background

Low cost multifunctional modular wheelchair control system is a project that help disability people to make manual wheelchair into electrical powered wheelchair without disturb original structure of original wheelchair. In market, electrical powered wheelchair is expensive. So, low cost multifunctional modular wheelchair control system can help disability people to use this features to help them in daily life.

This project are purposely people to overcome the problem for disability people to be more involved in the society and own electrical powered wheelchair to make their life easier. This project also can help disability people more happy to go work, study and event have a social life to the fullest.

As an overview of this project, there will be a device which is the low cost multifunctional modular wheelchair control system that can be attach to manual wheelchair. The microcontroller will control all the operation which is receive data from joystick and transmit data to the motor for the movement also LCD display to show the status of the operation such as speed of motor, DHT 22 temperature humidity sensor to show the humidity and temperature inside the control box, Ultrasonic sensor to detect

obstacle. The microcontroller also allowed device to send data information via IoT system. That can be read at the ThingSpeak for analyse the data.

1.2 Problem Statement

Electrical powered wheelchair and manual power assist for wheelchair user is low. According to research that had been done by (Jerome, 2010) at United States participant in the research only 27% user electrical powered wheelchair while only 6% of the user use manual power assist wheelchair. For the manual wheelchair is 63% of user as state in the pie chart at Figure 1.1. High amount of user for the manual wheelchair that been worried because there a side effect such as pain shoulder 86% for the person with a spinal cord injury as state by (Koesters & DiGiovine, 2015).

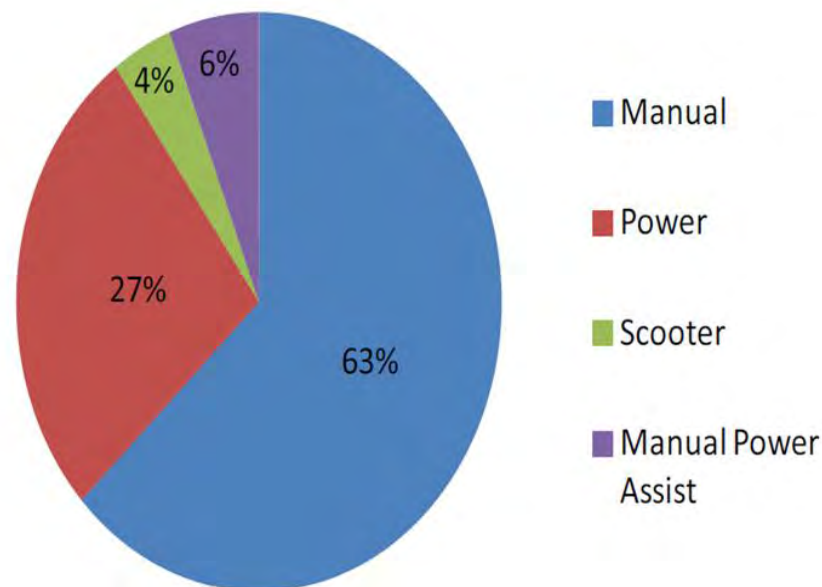


Figure 1.1: Number of percentage mobility device use research by (Jerome, 2010)

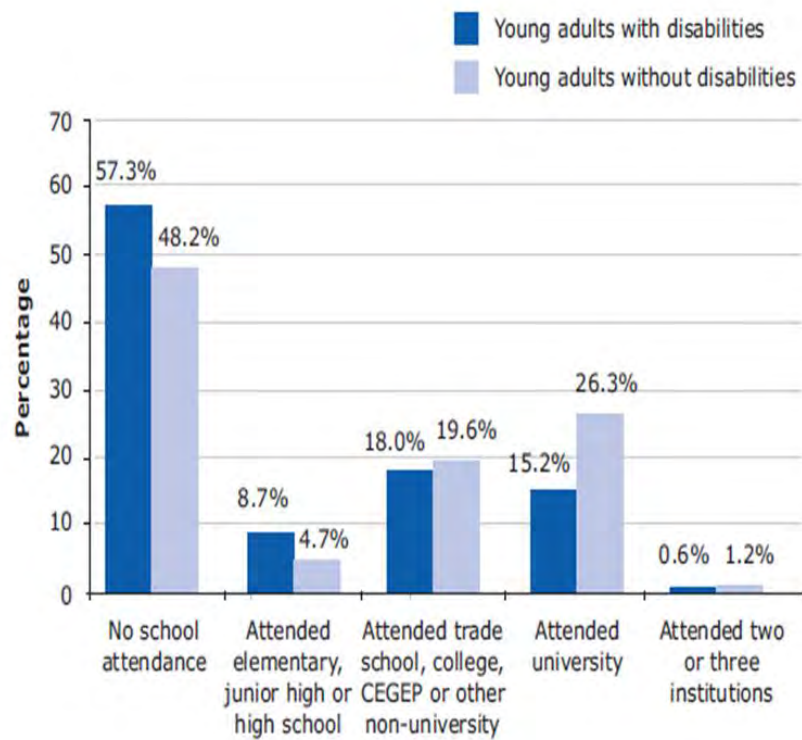


Figure 1.2: School attend by disability status from aged 20 to 24, by (Human Resources and Skills Development Canada, 2006)

As state by (Human Resources and Skills Development Canada, 2006) as shown in Figure 1.2 people that have a disability aged between 20 – 24 years are not continue their study comparing people that have not have disability. This finding was worried because disability people don't want to continue their study and stop study. Physical disability while using a wheelchair had been affect them to attend to the studies.

Hence, the invention of this project hopefully can overcome the problem by developing low cost multifunctional modular wheelchair control system that can give benefit to all disability people and make their live easier and enjoy for them feel like normal people so that there are no boundaries for what are they capable to do.

1.3 Objective

The objective of this development project are:

- i. To develop a low cost multifunctional modular wheelchair control system using DC motor along with IoT data visualization.
- ii. To analyze the performance of low cost multifunctional modular wheelchair control system.

1.4 Project Methodology

To make this project can be done, a right strategy and method need to make this task achievable. This technique deliberately to guarantee the task can be done in the period of time and less problem that will occur. To guarantee this project achievable then few technique must be done and considered. The step below are summarize from flowchart.

- i. Make a research on manual power assist from previous journal, books, pattern project and trusted internet resources.
- ii. Design and measure the project on actual manual wheelchair to get the accurate project design that can fit on manual wheelchair.
- iii. The project was install and the data can be sent using IoT that can the data visualization can be seen at ThingSpeak

- iv. The project was assemble after all the hardware and software function properly.
- v. The project design will be test software and hardware then if it was success next step can be proceed.
- vi. Report and result can be made from the data collection.

At the end of this project, all the objective that had been state can be achieved, solved all the problem that will be faced while do this project the most important this project help all the community that was need this type of project. Then, the project can perform move according to the coding that that been set on the controller when received an input from joystick, DHT 22 temperature humidity sensor to show the humidity and temperature inside the control box, Ultrasonic sensor to detect obstacle motor will move the project as an output. This low cost multifunctional modular wheelchair control system should be well known so that many new design even more low cost project can be made to help to give benefit in human civilization.

1.5 Project Scope

Manual powered assist is project that introduce the development of low cost multifunctional modular wheelchair by using DC motor and microcontroller.

This project is involved the usage of DC motor to move the multifunctional wheelchair which will be controlling by Arduino software and hardware. The software and hardware connect with each other that will be implemented in this project. The input of this project will be given by the joystick when the user move it. The joystick connection with Arduino by using a cable. Arduino will process the data that was received from the