



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF RUBBER TRACK WHEELCHAIR USING
ARDUINO CONTROLLER**

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

by

NURUL WAHIDA BINTI HALIM

B071410034

910811085654

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TAJUK: **Development of Rubber Track Wheelchair Using Arduino Controller**

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DECLARATION

I hereby, declared this report entitled “Development of Rubber Track Wheelchair Using Arduino Controller” is the results of my own research except as cited in references.

Signature :
Author’s Name : Nurul Wahida binti Halim
Date :

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Electronic) with Honours.. The member of the supervisory is as follow:

.....
(Ir Mohd Syahrin Amri bin Mohd Noh)

ABSTRAK

Kelemahan pada kerusi roda telah menghadkan kebebasan pengguna kerusi roda untuk pergi ke tempat kawasan yang tidak rata seperti kawasan berpasir dan berbatu. Adalah mustahil bagi pengguna kerusi roda yang kurang upaya untuk menikmati suasana walaupun mereka penggemar pantai. Oleh itu, penghasilan kerusi roda bersistem trek getah akan membantu pengguna kerusi roda untuk mengatasi had supaya mereka dapat bergerak ke mana sahaja seperti orang biasa. Perubahan pada kerusi roda yang menggunakan sistem trek getah (beraksi seperti kereta kebal) ini boleh digunakan oleh pengguna kerusi roda pada kawasan yang tidak rata kerana ia mempunyai cengkaman yang lebih baik dan lebih stabil. Kerusi roda ini menggunakan dua motor DC untuk bergerak dan ia dikawal oleh pemandu motor bagi membolehkan kedua-dua motor untuk bergerak pada masa yang sama. Seterusnya, ia disambung pada Arduino UNO untuk arahan. Sistem ini dikawal melalui aplikasi pada telefon pintar atau 'tablet' menggunakan sambungan Bluetooth. Bluetooth Module akan bertindak sebagai penghantar dan penerima data antara gadget Android dan Arduino UNO.

ABSTRACT

The drawback of a wheelchair is the limitation of the user to go freely to places such as non-flat surfaces or sandy area. For handicapped person which using wheelchair who loves beach and trail will be an impossible places for them to enjoy. The development of wheelchair with the rubber track system will help the wheelchair user to overcross the limit so they can go everywhere like normal people. The wheelchair modification by implementing rubber track system(which act like a military tank), can be used by the users for non-flat surfaces or sandy area since it have better gripping and more stable condition. The wheelchair use two DC motor to move controlled by motor driver for both motor to run simultaneously and connected to Arduino UNO for the instructions. The system is controlled by bluetooth application at the android smartphone or tablet. Bluetooth Module act as transmitter and receiver between the android appliance and the Arduino UNO.

DEDICATION

My most honour and appreciation to my mother who always supporting me and give encouragement for not to give up no matter how hard I have been through. My thanks and appreciation to my supervisor Mr Ir Mohd Syahrin Amri Bin Mohd Noh for conducting me through out the time to complete this project. I am grateful to all my friends who shared their memories and experiences that gives me ideas and creativity.

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TABLE OF CONTENT

Declaration	iv
Approval	v
Abstrak	vi
Abstract	vii
Dedication	viii
Acknowledgement	ix
Table of Content	x
List of Tables	xiii
List of Figures	xiv
List Abbreviations, Symbols and Nomenclatures	xv
CHAPTER 1: INTRODUCTION	1
1.0 Chapter Introduction	1
1.1 Introduction	1
1.2 Project Background	4
1.3 Problem Statement	4
1.4 Project Objectives	5
1.5 Project Scope	5
1.6 Organization of Thesis	6
1.6.1 Chapter 1	6
1.6.2 Chapter 2	7
1.6.3 Chapter 3	7
1.6.4 Chapter 4	7
1.6.5 Chapter 5	8
CHAPTER 2: LITERATURE REVIEW	9
2.0 Introduction	9
2.1 Previous Projects	9

2.1.1	Smartphone for smart wheelchairs by A. Milenkovich, M.Milosevic and E. Jovanov	9
2.1.2	Track tension optimization for stairs-climbing of a wheelchair robot with Variable Geometry Single Tracked Mechanism by S. Yu, T.Wang, Z. Wang, Y. Wang and X. Li	11
2.1.3	Smart electronic wheelchair using Arduino and Bluetooth Module by Lodhi, D. K., Vats, P., Varun, A., Solanki, P., Gupta, R., Pandey, M. K. and Butola, R.	13
2.1.4	Mobile controlled wheelchair by R. Achkar, G. A. Haidar, H. Dourgham, D. Semaan and H.Araji	14
CHAPTER 3: METHODOLOGY		17
3.0	Introduction	17
3.1	Flow Chart	17
3.1.1	Identify the circuit and the components	18
3.1.2	Simulate the circuit	20
3.1.3	Build the hardware	21
3.1.4	Apply circuit on hardware	22
3.1.5	Test	23
3.2	Gantt Chart	23
CHAPTER 4: RESULTS & DISCUSSION		25
4.0	Introduction	25
4.1	Results	25
4.1.1	MIT Inventor 2	25
4.1.2	Arduino coding	27
4.1.3	Circuit Connection	29
4.1.4	Design of The Project	30
4.1.5	Analysis	30
4.1.5.1	Data Collection	30
4.2	Discussion	31
CHAPTER 5: CONCLUSION & RECOMMENDATION		33

5.0	Introduction	33
5.1	Conclusion	33
5.2	Recommendation	34
REFERENCES		35
APPENDICES		36
MD13S User Manual of 13A DC Motor Driver		

LIST OF TABLES

1.1	Malaysia Standard Code of Practice on Access for Disabled Persons.	3
2.1	The command words and operations	14
4.1	Condition of the wheelchair through the speed of motor.	31

LIST OF FIGURES

1.1	Motorized Wheelchair And Parts	2
1.2	Manual Wheelchair And Parts	2
2.1	The system view	10
2.2	mWheelness Android Applications Screen	10
2.3	The original wheelchair robot (a) The back flipper rotates to the initial position. (b) The back flipper rotates to the terminal position	11
2.4	Stair climbing procedure of the wheelchair robot. (a) transforming at the lower floor. (b) ~ (d) Climbing the first stair. (e) Moving on the corner of the stairs. (f) Adapting the peak of the stairs. (g) ~ (h) loading on the upper floor	11
2.5	Block diagram of the project	13
2.6	The wheelchair paths	14
2.7	Manual wheelchair equipped with two DC motor	15
2.8	Block Diagram of Mobile Controlled Wheelchair	16
2.9	Main application screen	16
3.1	Flow chart of the project	17
3.2	Flow chart of the system	19
3.3	Block diagram of the system	20
3.4	Draft drawing of initial design	22
3.5	Motor driver polarity connection	23
4.1	MIT Inventor 2 program coding.	26
4.2	MIT Inventor 2 main application screen	27
4.3	Arduino coding	27
4.4	Circuit connection	30
4.5	Design of Rubber Track Wheelchair Using Arduino Controller.	30

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

PWDA	-	Person With Disabilities Act 2008
PWD	-	Person With Disabilities
MS	-	Malaysia Standard
UBBL	-	Uniform Building By Law
DO	-	Development Order
MDD13S	-	Dual Channel 13A DC Motor Driver
VGSTM	-	Variable Geometry Single Tracked Mechanism
DC	-	Direct Current
V	-	Voltage
W	-	Watt
A	-	Ampere
MIC	-	Microphone
PWM	-	Pulse Width Modulation
DIR	-	Direction
+	-	Positive
-	-	Negative
AH	-	Ampere Hour

CHAPTER 1

INTRODUCTION

1.0 Chapter Introduction

This chapter purposes to expose the project's introduction, background, problem statement, objectives and scope this project. The view of this project can be seen at this chapter including the reason of development and the result expected.

1.1 Introduction

In Malaysia, person with disabilities Act 2008 (PWDA) defined persons with disabilities as those as who have long term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society. [5]

There are several types of disabilities such as learning, mental, physical, multiple disabilities, visual impairment, hearing impairment, and speech impairment. Some of the physical require the handicap to use the wheelchair. For a wheelchair user, there are some activities or places such as night market with rocky road, family time at the beach or grassy area, and hilly road or inclined road that cannot be achieved not only because of their incapability but also the condition of the wheelchair. The condition of the wheelchair played important roles that will determine what the handicap can do or go with the wheelchair. There are also lots

type of wheelchair either it is motorized or manually pushed by person such as the Figure 1.1 and Figure 1.2.



Figure 1.1 : Motorized Wheelchair And Parts



Figure 1.2 : Manual Wheelchair And Parts

It is agreeable that motorized wheelchair can move on rocky road, grassy area and hilly or incline road due to diameter of the wheel and the motor power that push the user. However, the problem arise when it is come to the sandy area like the beach where the wheelchair may stuck in the sand and damage the motor. As the manual wheelchair, non-flat area are the most challenging for the user and also the person who push the wheelchair. More force is need to push the wheelchair on he grassy

area and hilly or incline road. It can caused the person who push the wheelchair exhausted and also injury. For the type such as figure 1.1(b), it is impossible to push the wheelchair on the sandy area and rocky road with the type and diameter of the wheel. It is because the design is meant to use for indoor or facilities provided that exclusive for wheelchair user at the certain places. It is certainly that the outdoor environment is limited to the wheelchair user especially in Malaysia because the design of the wheelchair also limited and it is costly. As an author agreed about lacking of consideration of equal accessibility to outdoor environment as normal person in Malaysia. [5]

Malaysian Standards	Description
Malaysia Standard 1184:2002, Code of Practice on Access for Disabled Persons to Public Buildings (First Revision)	It focus on the basic requirements of buildings and related facilities as a permit for PWDs to access.
Malaysia Standard 1183:1990 Code of Practice for Means of Escape for Disabled Persons	The practices use as guidance for a new building construction work and modification. It is to provide the planning, action and requirement that should be applied in building in aspect of fire safety for PWD which including of fire escape, staircase and others.
Malaysia Standard 1331:2003, Code of Practice for Access of Disabled Person Outside Buildings (First Revision)	It specifies the basic requirements for the provision and design of outdoor facilities so that they are accessible and usable by PWDs. This standard supersedes MS 1331:1993. This MS is not included in the Uniform Building (Amendment) By-Laws (UBBL) 1991. However the requirement of conform to this code is included for getting planning permission which is stated in

	the Development Order (DO) requirement.
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Table 1.1 : Malaysia Standard Code of Practice on Access for Disabled Persons.

1.2 Project Background

The design of the wheelchair has create a limitation for the wheelchair user to freely go anywhere they desire especially the place with non-flat surfaces and sandy area such as beach and rocky road night market. It is impossible for the wheelchair user to enjoy their time at beach with the their daily used wheelchair because usually this type of wheelchair is designed to be used for indoor purposes not the outdoor environmental. To enjoy the beach, the user need to use the special design for the sandy structure. Same goes with the rocky road as the design of the wheel of the wheelchair will give hardship to the pusher because it is impossible for the user to push it by themselves and it is very uncomfortable for the motorized wheelchair user to move on the rocky road which also can damage the motor. For this type of road, the track system will be the most suitable wheel for the wheelchair because of the design as the army tank which is the purpose to move on any type of surfaces . However the track system will not be suitable for the indoor purposes because the material for the track is metal which is it will caused damage to the road surfaces and also hurt people if it run onto them. Therefore, the wheelchair user need to have many types of wheelchair to allow them to access any place without limit which is it very unreasonable to have all those types for one person and it is costly. All they need is the design of wheelchair that allow them to over-cross the limit which is this project purposes.

1.3 Problem Statement

The design of the standard wheelchair whether it is motorized wheelchair or manual wheelchair cannot be use freely at outdoor environmental. The places with non-flat surfaces road are the most problematic for the wheelchair user to enjoy their day. Non-flat surfaces road are sandy area and rocky road With the diameter of the wheel can caused problem to them, not only the user but the pusher to push the wheelchair for the manual wheelchair. By forcing push the wheelchair may damage the wheel and also injure the pusher. For the motorized wheelchair, the user can move by themselves on the rocky road because the wheel diameter is bigger than manual wheelchair. However, the rocky road may damage the motor and even if the diameter of the motorized wheelchair's wheel is bigger than manual wheelchair, the motorized wheelchair also cannot move freely on the sandy area. Even if the user force the wheelchair to move on the sandy area, the sand may damage the motor.

1.4 Project Objective

The development of the rubber track wheelchair is to improve the weakness of the standard design. The objectives of this project are :

- i. To upgrade the conventional wheelchair by improving the capability to move on the non-flat surfaces road.
- ii. To control the movement of the wheelchair using mobile application.

1.5 Project Scope

This project focus on the developing a wheelchair with the rubber track system using Arduino Controller which only cover :

- i. Wheelchair
- ii. Arduino Software.
- iii. Arduino UNO.
- iv. Cytron 13A DC Motor Driver (MD13S).
- v. 24V 300W Brush DC Motor (11 Teeth Sprocket).

- vi. HC-06 Bluetooth Module.
- vii. MIT Apps Inventor 2.
- viii. 9V Battery.
- ix. 12V 7AH Lead Acid Batteries.
- x. LM7805 Voltage Regulator.
- xi. 49 Teeth Motorcycle Sprockets.
- xii. 55 Teeth Mini Bike Sprockets.
- xiii. Motorcycle Chains.
- xiv. Motorcycle Timing Chains.

1.6 Organization of Thesis

Organization of thesis is divided into five chapter that is explain about all procedure and method for complete these project. Each of the chapter separately because of the different tittle for completed this project. This thesis covered on the introduction, literature review, research methodology, discussion, conclusion and recommendation.

1.6.1 Chapter One

The first chapter is about the overview of this project which consists of introduction of the project, problem statement, project objective, project scope. The view of this project can be known in this chapter without following the progress of this project. This project objectives are obtain from the problem statement which is to solve the problems that are highlighted from the last product. However, the project need to have a limit so the project scope is given. This project scope describe the description of this project.

1.6.2 Chapter Two

The literature review is in this chapter where it is the information of past project that can be used as a references. The information can be obtain from the research in journal, books, internet or etc. Only the related information can be used as reference because the idea, knowledge, facts, methodology and etc from other author research is useful to improved the idea of this project. The information can be obtained from more than one source.

1.6.3 Chapter Three

This chapter focus on the methodology that used to complete this project. This is crucial part for elaboration and details about the usage of hardware and software. It means the flow of this project including what to use, how to do and follow requirement. To achieve the project, this part need to be organized properly.

1.6.4 Chapter Four

Chapter four consists of the result and discussion that are obtained from the testing and modification process. This part including simulation and hardware testing. The simulation is important to determine the circuit can be test on hardware or not and determine the right components to be used so there will be no wastage. By the result of the simulation, the process for hardware can be continued. The result of hardware can obtained after testing the hardware. The discussion is about the result whether it is according the objectives of this project or not. The problem happened while doing this project will be put inside the discussion such as the unsuitable motor driver for the DC motor.

1.6.4 Chapter Five

The last chapter is about the conclusion where the project will be conclude after all the processes are done. This part will determine the objectives of this project are achieved or not. By the result of the main project, the future recommendation also included in this chapter. This recommendation is to improve the main project by using the latest technology or can add some more features to make it more better product.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter is focus on the research of the previous projects that are related to this project. By referring to the previous project, the knowledge, skills, information and idea can be obtained to assist the developing of this rubber track wheelchair's project. The sources are from journal, books, articles and etc. Their analysis may improved this project to achieved the objective of this project.

2.1 Previous Projects

The previous project is the project that is done by other researcher which can be found in the journal, thesis, article or etc. The weakness of their project also can be used to improved this project where the theoretical and construction hardware already elaborated from the past researches. The references need to be more than one to obtain more precise result for this project.

2.1.1 Smartphone for smart wheelchairs by A. Milenkovich, M. Milosevic and E. Jovanov