

**DEVELOPMENT OF A MACHINE TO ASSIST WHEELCHAIR USERS TO
BOARD A BUS**

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF A MACHINE TO ASSIST WHEELCHAIR USERS TO
BOARD A BUS**

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**This report is submitted
in fulfillment of the requirements for the degree of
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**PEMBANGUNAN MESIN BAGI MEMBANTU PENGGUNA KERUSI RODA
UNTUK MENAIKI BAS**

MUHAMMAD ASIF ASYRAF BIN ABDUL NASIR

**Laporan ini dikemukakan sebagai
memenuhi sebahagian daripada syarat penganugerahan
Ijazah Sarjana Muda Kejuruteraan Mekanikal**

Fakulti Kejuruteraan Mekanikal

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2020

DECLARATION

I declare that this project report entitled “Development of a Machine to Assist Wheelchair Users to Board a Bus” is a result of my own work except as cited in the reference.

Signature :

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Date :

PENAKUAN

Saya akui laporan ini yang bertajuk “Pembangunan Mesin bagi Membantu Pengguna Kerusi Roda untuk Menaiki Bas” adalah hasil kerja saya sendiri kecuali yang dipetik daripada sumber rujukan.

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PENGESAHAN PENYELIA

Saya akui bahawa telah membaca laporan ini dan pada pandangan saya laporan ini adalah memadai dari segi skop dan kualiti untuk tujuan penganugerahan Ijazah Sarjana

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DEDICATION

I dedicate this project to my beloved parents and family members, lecturers and friends.

DEDIKASI

Saya mendedikasikan projek ini kepada ibu bapa dan ahli keluarga, para pensyarah dan rakan-rakan.

ABSTRACT

People with physical movement disabilities will likely to have some difficulties in moving from one place to another. A wheelchair has been invented for them in order to make their daily life become easier. Although the use of wheelchair can help people with disabilities to move, they still have a problem in getting onto the bus. Therefore, a few mechanisms such as hydraulic wheelchair lift, ramp and bridge plate has been invented to solve this problem. The purpose of this project is to introduce a new mechanism and improve the existing wheelchair mechanism to help wheelchair users to get into the bus. This new mechanism was designed to enable a lifting process occur at the standard bus that has a high stairs. The design process of this mechanism is started with a survey among civilians which includes some person with disabilities and some students. Through the data obtained from the survey, a House of Quality has been produced to convert the customer requirements into the engineering characteristics. Then, a Product Design Specification is produced in order to be used as a project target specification that must be met. Furthermore, a Morphological Chart is used to obtain some conceptual design whereas the final designs is selected through the Weighted Decision Matrix. After the 3D final design is produced using SolidWorks 2016, some analyses and simulation has been carried out in order to obtain the workability and functionality of the design. A motion study was conducted to observe whether the product design is able to lift the required load or not. Using motion study, the trace path, velocity, acceleration and amount of force use to lift the required load can be determined. Next, a simulation on stress analysis is conducted to obtain the stress data so that the factor of safety of the product design can be classified. Conclusion and recommendation about the project are discussed further.

ABSTRAK

Orang kurang upaya dari segi pergerakan fizikal akan menghadapi beberapa kesukaran untuk bergerak dari satu tempat ke tempat lain. Kerusi roda telah diciptakan untuk mereka agar kehidupan seharian mereka menjadi lebih mudah. Walaupun penggunaan kerusi roda dapat membantu orang kurang upaya untuk bergerak, mereka masih menghadapi masalah untuk menaiki bas. Oleh itu, beberapa mekanisma seperti lif kerusi roda hidraulik, tanjakan dan plat jambatan telah diciptakan untuk menyelesaikan masalah ini. Tujuan projek ini adalah untuk memperkenalkan mekanisma baru dan menambahbaik mekanisma kerusi roda yang sedia ada untuk membantu pengguna kerusi roda menaiki bas. Mekanisma baru ini direka bagi membolehkan proses mengangkat berlaku di bas standard yang mempunyai tangga yang tinggi. Proses reka bentuk mekanisma ini dimulakan dengan tinjauan di kalangan orang awam yang merangkumi beberapa orang kurang upaya dan beberapa pelajar. Melalui data yang diperolehi daripada tinjauan tersebut, sebuah 'House of Quality' telah dihasilkan untuk mengubah keperluan pelanggan menjadi ciri-ciri dalam kejuruteraan. Kemudian, "Product Design Specification" dihasilkan agar dapat digunakan sebagai spesifikasi sasaran projek yang mesti dipenuhi. Selanjutnya, "Morphological Chart" digunakan bagi mendapatkan beberapa reka bentuk konseptual yang mana reka bentuk akhir dipilih melalui "Weighted Decision Matrix". Setelah reka bentuk akhir 3D dihasilkan menggunakan SolidWorks 2016, beberapa analisis dan simulasi telah dilakukan untuk mendapatkan keboleherjaan dan fungsi reka bentuk. Kajian gerakan dilakukan untuk melihat sama ada reka bentuk produk mampu mengangkat beban yang diperlukan atau tidak. Dengan menggunakan kajian gerak, jalan jejak, halaju, pecutan dan jumlah penggunaan daya untuk mengangkat beban yang diperlukan dapat ditentukan. Seterusnya, simulasi analisis tekanan dilakukan bagi mendapatkan data tekanan supaya faktor keselamatan reka bentuk produk dapat ditentukan. Kesimpulan dan cadangan mengenai projek dibincangkan lebih lanjut.

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LIST OF ABBREVIATION

| | | |
|------|---|--|
| APTA | - | American Public Transportation Association |
| CAD | - | Computer Aided Design |
| DOSM | - | Department of Statistics Malaysia |
| DSW | - | Department of Social Welfare Malaysia |
| FBD | - | free-body diagram |
| FKM | - | Fakulti Kejuruteraan Mekanikal |
| HOQ | - | House of Quality |
| MITC | - | Melaka International Trade Centre |
| MA | - | Mechanical Advantage |
| MBS | - | Minimum Breaking Strength |
| MBL | - | Minimum Breaking Load |
| PSM | - | Projek Sarjana Muda |
| PDS | - | product design specification |
| PWD | - | Person with Disabilities |
| QFD | - | quality function deployment |

| | | |
|------|---|-------------------------------------|
| RPM | - | Revolution per minute |
| SWL | - | Safe Working Load |
| FS | - | Factor of Safety |
| UVL | - | Under Vehicle Lift |
| UTeM | - | Universiti Teknikal Malaysia Melaka |
| WLL | - | Working Load Limit |
| FEA | - | Finite Element Analysis |

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

People who have some disabilities especially in their physical movement are often having difficulty to live like a normal person in a daily life routine. Disability is an illness or injury that makes someone to face hardship and makes it difficult for them to do what others can do (Disability, n.d.).

According to the Department of Statistics Malaysia (DOSM), there were 453,258 persons registered as Person with Disabilities (PWD) at the Department of Social Welfare Malaysia (DSW) in 2017 (DOSM, 2018). Figure 1.1 below shows the percentages of registered PWD by the type of disabilities.

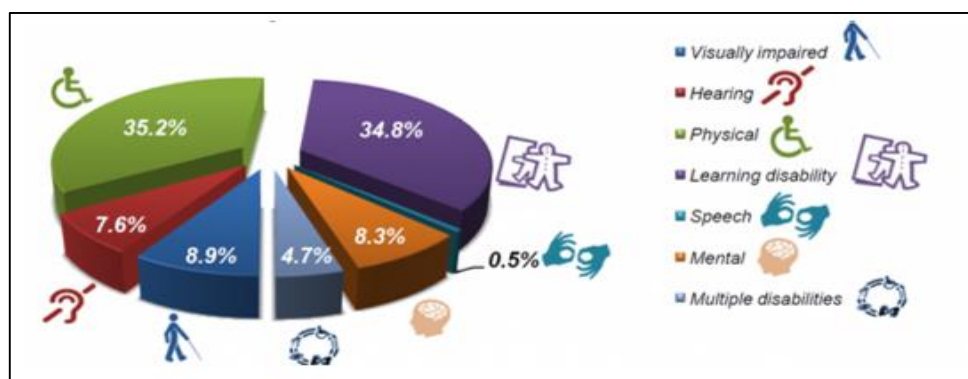




Figure 1.1: Percentages of registered PWD by the type of disabilities.

From Figure 1.1, people with physical disabilities have the highest percentages compared to the others followed by learning disability, visually impaired, mental, hearing, multiple disabilities and speech problems. In order for physical disabilities persons to move around, there are some equipment that have been invented to help them. One of the invention is the wheelchair.

A wheelchair is typically a chair that has some wheels used to transport a disabled person especially for physical disabilities by his or her own push or by being pushed by someone else (Collin, n.d.). There are variety of wheelchairs in the current market from old school to sophisticated one. For wheelchair users, they have the difficulties to get into the vehicles specifically the bus.

Nowadays, there are a few mechanisms developed to solve the problem face by PWD in order to get into the bus. Table 1.1 below shows the mechanisms for wheelchair users to access into the bus.

Table 1.1: The mechanisms for wheelchair users to access into the bus.

| Mechanism | Name |
|---|---|
|  | <ul style="list-style-type: none"> • Wheelchair Lift |
|  | <ul style="list-style-type: none"> • Ramp |