



**PROJECT 2 FINAL REPORT**

**HYDRAULIC WHEELCHAIR**

**FOR BEDRIDDEN PATIENT**

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**SESI 1: 2021/2022**

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**This report is submitted to the Department of Mechanical Engineering as part of the conditions for the award of the Diploma in Mechanical Engineering**

**JABATAN KEJURUTERAAN MEKANIKAL**

**SESI 1: 2021/2022**

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## **ABSTRACT**

Being bedridden is a form of immobility, manifested as being unable to move or even sitting upright. It is different from bed rest, which is a non-invasive treatment that is usually part of rehabilitation or restricted mobility. Early dementia, Alzheimer's disease, Parkinson's disease and multiple sclerosis are just few diseases that may make our loved ones bedridden. With these concerns, wheelchairs are still the best form of mobility for many bedridden peoples. However, wheelchair for bedridden people are always sell at very high price, usually around RM1900 to RM2300. Apart from that, they're also not innovative enough. We decide to design, and build cheaper, yet feature rich wheelchair for bedridden. We make sure this product is useful, safe to use, ergonomic, and cheaper than the current one in the market. A new concept of having hydraulic system to adjust the height of the wheelchair is to address the issue of ergonomic current design. This has significant potential benefits for the lives of bedridden people. Based on the official website of Department of Health of Malaysia, the number of elderly will be double from 7% to 14 % within 28 years in our country as opposed to Sweden who has been for 112 years with the same change (United Nations, 2007). Senior citizens defined as individual who aged 60 and above (United Nations, 1982). The senior citizens issues are discussed through a variety of ways, especially through health aspects. Health problems of the elderly will occur when if the need for healthy life cannot be met or achieved. Bedridden elderly patients not only suffer physical changes, but even changed from the social, economic and emotional. For family members, they also felt the challenge in terms of patient care and management of these bedridden patients. At Hospital Kuala Lumpur, the number of bedridden elderly patient cases that has been refereed Medical Social Work Department is 83 ca son 2014. The number has been increased 19% compared on 2013. The factor that affect the elderly bedridden cases are stroke, cancer, fall incident and ageing. The medical field related to disease of the elderly is Geriatric.

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## CHAPTER 1: INTRODUCTION

### 1.1 RESEARCH BACKGROUND

prepared by: Muhammad Hafizudin Bin Azmi

The word "bedridden" is derived from the Middle English term *bedridden*, which is the past tense of the *bed*, dating back to the 14th century. *Bedridden* is a fixed form of sitting that cannot move or even stand upright. Unlike *bed rest*, *bed rest* is a non-invasive treatment that is usually part of rehabilitation or restricted mobility. Some of the more serious consequences of being *bedridden* were the high risk of thrombosis and muscle wasting. A wheelchair is a chair with wheels, used when walking is difficult or impossible due to illness, injury, old age related problems, or disability. These could include spinal cord injuries (paraplegia, Hemiplegia, and quadriplegia), broken leg(s), cerebral palsy, brain injury.

Osteogenesis if needs of imperfect a.k.a. brittle bones, motor neurone diseases (MND), multiple the specific sclerosis (MS), muscular dystrophy (MD), Spine bifida, and many more. Wheelchairs come in a wide variety of formats meet their users. They included with specialized seating adaptations, individualized controls, and may be specific to particular activities, as seen with sports wheelchairs and beach wheelchairs. The most widely recognized distinction was between powered wheelchairs, where propulsion is provided by batteries and electric motors, and manually propelled wheelchairs, where the propulsive force is provided either by the wheelchair user/occupant pushing the wheelchair by hand ("self- propelled"), by an attendant pushing from the rear using handle(s), or by an attendant pushing from the side use a handle attachment.

There are many forms of wheelchairs to meet the specific needs of users. They included special seat adjustments, personalized controls, and may be specified to specific activities, such as sports wheelchairs and beach wheelchairs. The most widely recognized difference is the difference between an electric wheelchair and a manual wheelchair. Electric wheelchairs are powered by batteries and electric motors, while manual wheelchairs provide propulsion by the wheelchair user/occupant pushing the wheelchair by hand. As for *bedridden* people, there are also a specific type of wheelchair for them, it usually a

manual type wheelchair. This wheelchair usually expensive and lack of innovation. This transfer patient device price can be up to RM10000 if we look for a very good one.

We had built a wheelchair specific for bedridden. One with ability to elevate the seat height using hydraulic system. This would ease the pain of transferring the bedridden from bed to wheelchair. As for current bedridden wheelchair in market, transferring the patient take lot of work. We also make sure it was safe to use and work properly.

## **1.2 PROBLEM STATEMENT**

Prepared by: Hairul Azwar Bin Md Nizam

When mobility challenges make independently moving between chairs, beds, wheelchairs or toilets difficult or even impossible to complete safely, this hydraulic wheelchair make patients and caregivers safer and more comfortable from one place to another.

Moving bedridden patients is a common task for nursing staff and one of the most demanded responsibilities for the body. Nursing assistants lose work days due to musculoskeletal injuries, and the rate is five times that of other industries. Auxiliary patient transportation equipment can protect caregivers from excessive force injury caused by improper or excessive weight lifting, and ensure patient safety during the transfer process.

## **1.3 RESEARCH OBJECTIVES**

Prepared by: Meor Mohammed Fikry Bin Zainal Abidin

The objectives to this research are:

- i. To design a new generation of wheelchair which it will be able to disintegrate and split specifically to ease the movement of bed ridden patients?
- ii. To create the safe to use adjustable wheelchair.
- iii. To fabricate the useful wheelchair with the affordable price.

#### **1.4 RESEARCH QUESTIONS**

Prepared by: Muhammad Hafizudin Bin Azmi

Due to the fact that we need to gather opinions from the public about wheelchair for bedridden patients, these questions have been asked in the form of Google Forms as a survey so that we would be able to collect the data required.

- i. Have you ever experienced sitting on a wheelchair due to any forms of sicknesses or injuries?
- ii. Do you have any relatives who are paralyzed and have to sit on a wheelchair?
- iii. Is it difficult to transfer a bedridden individual from the bed to the wheelchair?
- iv. Do you agree that changes should be made to the current design of wheelchair to ease the mobilization of the occupants of wheelchairs?
- v. Give a suggestion for modifications that can be applied to the design of current wheelchair.

#### **1.5 SCOPE OF RESEARCH**

Prepared by: Hairul Azwar Bin Md Nizam

Hydraulic wheelchair is specifically fabricated to help patients and caregivers to be safer and more comfortable from one place to another. The scopes and limits to this research are:

- i. Hydraulic wheelchair can reduce the pain experienced by patients while moving.
- ii. Hydraulic wheelchair facilitates the caregiver from using a lot of energy when helping the patient.

## **1.6 SIGNIFICANCE OF RESEARCH**

Prepared by: Meor Mohammed Fikry Bin Zainal Abidin

In this chapter, the studies were explained about the wheelchair in general and its relation with bedridden patients and nurses. All the objectives were conceived out of all the problem statements. The main objective that was focus more on this project is wheelchair with hydraulic system to solve problem of ergonomics and we make sure this wheelchair would help as a transfer patient device for bedridden patients. This has been an issue for long time for nurse because transferring bedridden patients is not an easy task. Issues and the scope of this project was only be focusing more on the design of the wheelchair how it help nurses and patients itself during session. Thus, this new prosthetic could be beneficiary to not just nurses, but also peoples with bedridden family member as we make it cheaper than the average market price which is now very high.

## **1.7 CHAPTER'S SUMMARY**

prepared by: Meor Mohammed Fikry Bin Zainal Abidin

As for the conclusion for the first chapter, the ability and functions of the newly designed wheelchair was highly anticipated. The design was focused mainly to improve the mobilization of disabled individuals, save the time of theirs, and make the world a better place for them to live in.

## **CHAPTER 2: LITERATURE REVIEW**

### **2.1 INTRODUCTION TO WHEELCHAIR**

Prepared by: Muhammad Hafizudin Bin Azmi

The World Health Organization defines a wheelchair as "a device provide wheeled mobility and seat support for the disabled it's difficult to walk or move around." Therefore, the wheelchair is to improve personal mobility. The purpose of the wheelchair the design is to produce good performance and can provide proper seat and posture support without compromise strength, durability and safety. The government can do this authorities, manufacturers, engineers, designers, service provider and users perform their respective design responsibilities.

The design of wheelchairs is very different, and diversity should be considered user requirements with design functions, such as total length, weight, frame type and width, seat configuration, wheel and caster type, arm and footrest, axle position and propulsion mechanism, all have affect the function. To ensure that the wheelchair is suitable, Designer & provider must thoroughly understand the expected demand Users and their environment.

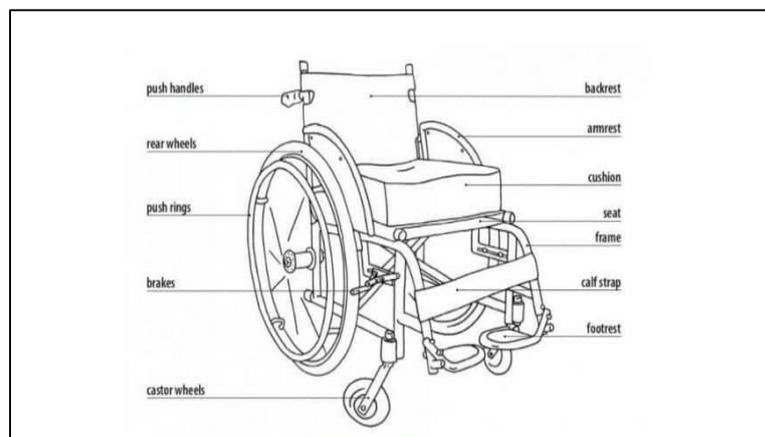
According to the design of Visagie et al. (2015). The function must match the user's functional ability and posture support needs, as well as requirements for the environment and durability claim. Realize the ideal match between the user and the wheelchair design and environment can be both difficult and important.

When there are multiple models to choose from, it can best meet the needs of users which one to choose. The design of the wheelchair should enable its users to use it participate in as many activities as possible. At least, a wheelchairs should enable users to lead a more active life without have a negative impact on their health or safety. Comfort and safety, these are two important factors that affect the quality of life of long-term users.

## 2.2 GENERAL CONSIDERATIONS

Prepared by: Meor Mohammed Fikry Bin Zainal Abidin

The design of the wheelchair should enable the user to participate in as many activities as possible. At least, the wheelchairs should enable users to lead a more active life have a negative impact on their health or safety. Comfort and safety these are two important factors affecting the quality of life of long-term users. Common wheelchair parts were shown in Figure 1. Is considered to be an integral part of the wheelchair and therefore should be included in all wheelchairs, especially for wheelchair user's sensory issues to prevent the development of life-threatening stress sore.



*Figure 2.2: Wheelchair Schematic Diagram*

## 2.3 SUITABLE FOR USES

Prepared by: Hairul Azwar Bin Md Nizam

The wheelchair should be suitable for the following environment they would be used and for the specific people who will use them. One design of a wheelchair is not suitable for everyone. When designing or choosing a wheelchair, it is necessary to consider the environment and the way the wheelchair will be used and place where wheelchairs can be used. Consider the following;

- Moving long distances on rough and uneven roads.
- Many curbs up and down every day.
- Entering the built environment: narrow doorways, small turning areas, Steep ramps, tables and tables, bathroom facilities (e.g. Squatting in the toilet).
- Exposure to humid environments such as rain, high humidity, snow, ice, hail and body fluids, such as urine and sweat.
- The user sits in a wheelchair and takes a shower.
- Exposure to extreme temperatures.
- Users are pushing handles, upholstery, footrests or other parts of the wheelchair.
- Passengers riding on footstools and handrails.
- People who lift the wheelchair with an armrest, footstool or push handle when the wheelchair is occupied.
- Transport wheelchairs in confined spaces or crowded conditions.

## 2.4. HEALTH AND SAFETY FOR THE USER

prepared by: Muhammad Hafizudin Bin Azmi

Although it seems that any wheelchair is better than nothing Wheelchair, when the wheelchair causes or contributes to this condition, this is not true Injury or other health risks. User's health and safety never compromise to reduce costs. Wheelchair should be designed to ensure the safety and health of users. There are many ways as shown in the picture, which users may be injured by their wheelchair the following example: Insufficient cushions or wheelchairs without cushions can cause pressure sores;

- An unstable wheelchair may tilt forward or backward, causing the user falls and may hurt himself;
- Overuse or increased load may cause shoulder injuries due to the result of a wheelchair that is too wide, too heavy, or sitting position incorrectly designed to wheelchair.
- Sharp edges on surfaces can cause skin rupture, which in turn can cause skin rupture, then cause infection.
- Improper design can lead to wheelchair users it can pinch finger or skin.
- Wheelchairs that cannot be used daily in the user environment it may fail prematurely and may harm the user.
- 



*Figure 2.3: Standard Wheelchair*

## **2.5. FUNCTIONAL PERFORMANCE**

prepared by: Meor Mohammed Fikry Bin Zainal Abidin

Functional performance is how a wheelchair works with different people or users in different environments. Functional performance the wheelchair is determined by its unique design and features. There are lots of trade-offs to consider when designing or selecting different uses, but in general a manual wheelchair should be configured to optimize stability and manoeuvrability in daily work.

Stability is essential to keep the customer safe when using the chairs. Manoeuvrability affects access to tight spaces and ease drive. Manoeuvrability and stability in a wheelchair can be changed by adjusting the rear axle and front wheels in position relation to the centre of gravity of the wheelchair and the customer. In practice appropriate wheelchair configuration for a given customer balance their need for stability and manoeuvrability. As there is fine balance between stability and manoeuvrability. The wheel chair configuration should be assessed for indoor activities and outdoor use in various environments, and should also be reviewed over time

According the changes in the client's wheelchair skills, experience and health status (e.g. adjusting axle position to compensate for weight gain or loss).

This section provides information on the key features of a wheelchair that affects the main categories of performance and how to evaluate them. It also outlines compromises that need to be considered when choosing different design features. To meet the functional performance needs of individual users, a range of wheelchair designs and sizes are needed.

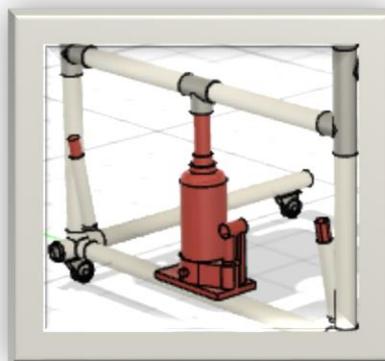
## 2.6. HYDRAULIC SYSTEM

prepared by: Hairul Azwar Bin Md Nizam

Hydraulic wheelchair pump's use hydraulic fluid as the force to move the hoist mechanism. A simple crank was attached to pump the fluid to provide lifting force. Manual Patient Lifts require less physical energy to raise the patient. The person cranked the lever uses minimal effort since the hard work was accomplished by the hydraulic fluid. These lifts offer a safe way to lift mobility patients who are unable to physically get out of bed or a chair on their own. These lifts help protect patients from injuring themselves while moving around. At the same time, they also protect caregivers from physical injuries or strains due to having to physically lift the patient. Since the discovery of patient hydraulic lifts, injuries to mobility patients and caregivers have significantly been reduced.



*Figure 2.6: Hydraulic System*



*Figure 2.6.1: Hydraulic Location*

## **CHAPTER 3: METHODOLOGY**

### **3.1. INTRODUCTION OF METHODOLOGY**

prepared by: Muhammad Hafizudin Bin Azmi

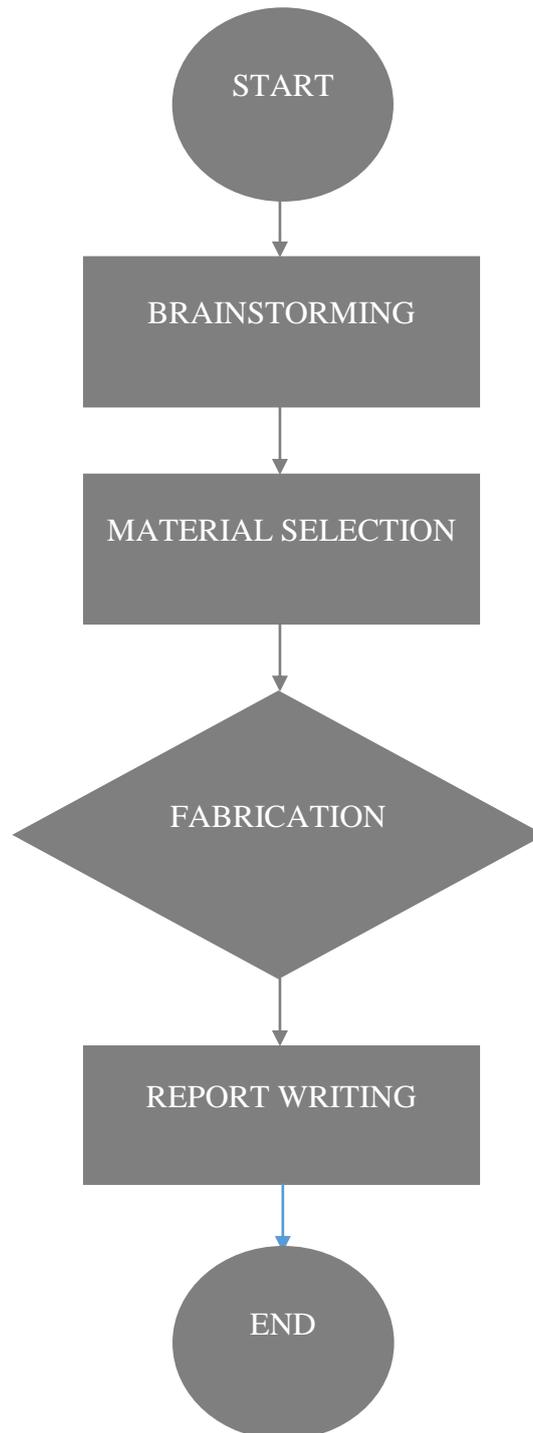
What is the methodology? Methodology is the study of the methods that are employed. It is concerned with uncovering the practices and assumptions of those who use methods of different kinds. In fact, a methodology is a system of methods followed consistently. Scientists, for example, use various methodologies as they perform experiments. It might seem like the world was nothing but chaos and disorder. But actually, sometimes there is a method to this madness. And sometimes there's a methodology.

As the main part of this chapter, we will be showing the processes, methods, details and information throughout the journey of ours in the making of the Hydraulic Wheelchair as our Final Year Project. Throughout this chapter, there will be a flow chart, the sketching of the design of the product, and a Gantt chart showing our weekly progress.

Besides that, materials selection, fabrication, cost of materials and operation methodology would be shown as well in this chapter to provide in depth information about the product.

### 3.2. FLOW CHART

prepared by: Meor Mohammed Fikry Bin Zainal Abidin



*Figure 3.2: Flow Chart Diagram*

### **3.3. FLOW CHART EXPLANATION**

prepared by: Meor Mohammed Fikry Bin Zainal Abidin

#### **3.3.1. BRAINSTORMING**

We have briefing by the supervisor for the final project. We come up with some ideas for our final project. We share some opinion about things to use to make this wheelchair can be adjustable the height level. Make a discussion how to design the better of the final project.

#### **3.3.2. MATERIAL SELECTION**

Material selection was a step in the process of designing any physical object. The selection of materials must be appropriate to the project to be carried out to avoid losses.

##### **- Stainless Steel**

Stainless steel is a group of iron-based alloys that contain a minimum of approximately 11% chromium, a composition that prevents the iron from rusting and also provides heat-resistant properties. Different types of stainless steel include the elements carbon (from 0.03% to greater than 1.00%), nitrogen, aluminium, silicon, sulphur, titanium, nickel, copper, selenium, niobium, and molybdenum. The corrosion resistance and other useful properties of the steel are enhanced by increased chromium content and the addition of other elements such as molybdenum, nickel and nitrogen. There are more than 60 grades of stainless steel.

One of the main reasons stainless steel is most sought after is its strength, which it retains at both very high and very low temperatures. In addition, Stainless steel is very tough, and even lightweight stainless steel won't buckle under great weight, making it one of the most durable metals on the market. It can endure weight, hot and cold temperatures as well as weather extremes.

## - Aluminium

Aluminium is a silvery-white metal, the 13 elements in the periodic table. One surprising fact about aluminium is that it's the most widespread metal on Earth, making up more than 8% of the Earth's core mass. It's also the third most common chemical element on our planet after oxygen and silicon. In addition, Aluminium is about one-third the weight of steel, meaning parts can be made thicker and stronger while still reducing weight in vehicles and other applications. Depending on the alloy and processing technique used, pound for pound aluminium can be forged to be just as strong if not stronger than some steel. A known lightweight metal, it has a specific weight of approximately 2.71 g/cm<sup>3</sup>. It's about a third of the weight of steel, which makes it easier and cheaper to transport than most other metals. Besides, Aluminium is a corrosion resistant metal that naturally generates a protective coating. The coating formed is extremely thin and is generated when aluminium comes into contact with an oxidising environment.



*Figure 3.3.2: Stainless Steel and Aluminium*

### 3.3.3. MATERIAL PURCHASE

The process of purchasing materials was very important to ensure that the project to be implemented according to the budget and reduce waste of money. The purchased items should be of specified quality in desired quantity available at the prescribed time at a competitive price. We also use the online purchase method to buy project item. Shopping online is convenient because we can do it any time from any place and have purchases delivered without getting up and going anywhere.

### **3.3.4 FABRICATION**

During fabrication, Asian body size was used as a guide in the design of the wheelchair. Although people living with disabilities usually have distorted frames, this work considers average adult structure in order to accommodate various forms of deformation, and create room for future improvements in body frames as their health conditions improve. The fabrication of the components and parts of the wheelchair would be connected via welding techniques. Gas metal arc welding (MIG) and Gas Tungsten Arc Welding (TIG) would be used to connect either steel or aluminium rods as the frame and backbone of the product. Some of the small components might be installed by using screws, bolt and nut. Rubber would be installed to the handle and caster wheel in order to increase frictional force against the ground so that it will be able to catch firmly even on a slippery floor.



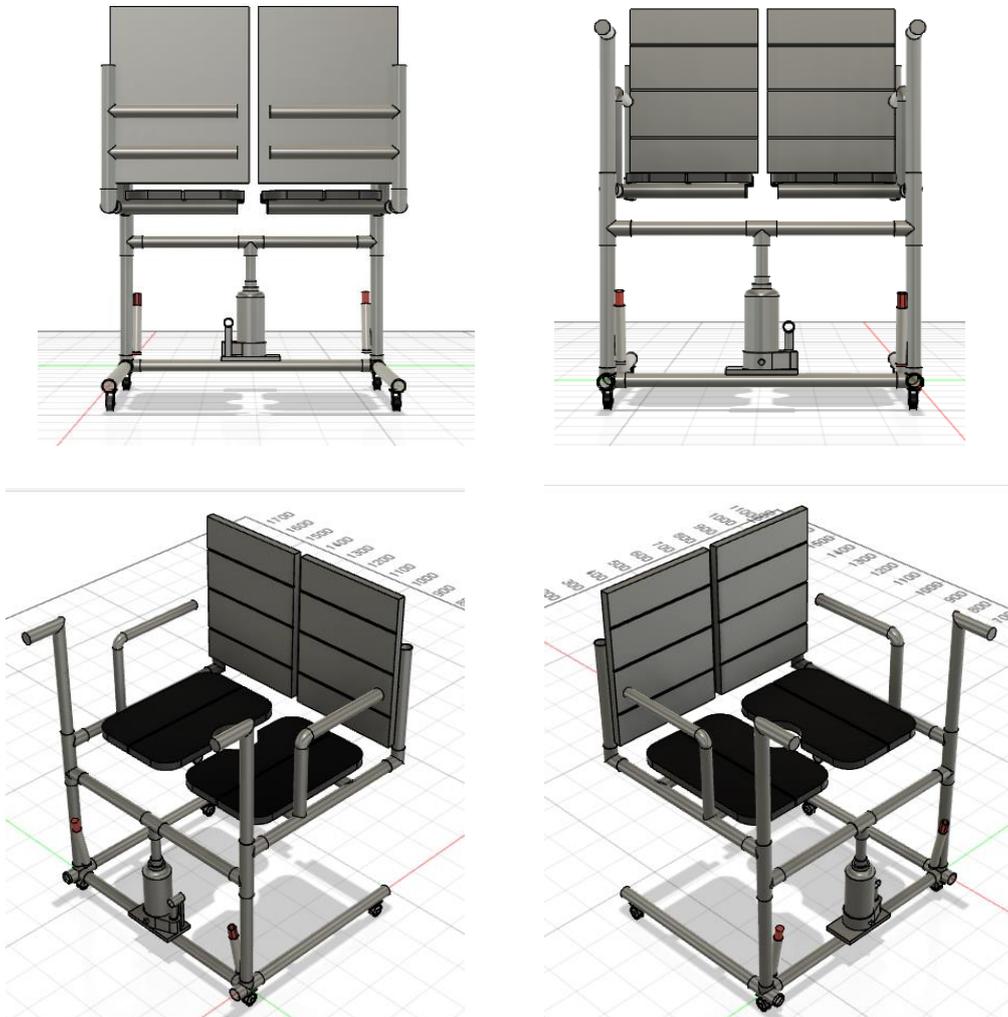
*Figure 3.3.4: Fabrication Process*

### **3.3.5. REPORT**

Report writing was one of the most important step in every project invented. It was important to make a report based on the project, test run and analysis so that future improvements nor expansion of knowledge could be done. Our report writing was based on the analysis and findings that we collected throughout this whole process of completing this project.

### 3.4. DESIGN OF EZM WHEELCHAIR

prepared by: Hairul Azwar Bin Md Nizam



*Figure 3.4: Design Wheelchair for Bedridden Patient*

### **3.5. DESIGN DESCRIPTION**

prepared by: Hairul Azwar Bin Md Nizam

The purpose of wheelchair design was to produce a wheelchair that performs well and was able to provide a height -adjustable seat and appropriate postural support without compromising strength, durability and safety.

The health and safety of users should never be compromised in order to reduce costs. A wheelchair should be designed to ensure the user's safety and health. There are many ways in which users can be injured by their own wheelchairs, as illustrated by the following examples:

- A wheelchair without a cushion or with an inadequate cushion can cause pressure sores. This in turn may require the user to spend many months in bed; without appropriate care and treatment this often leads to bedsores, secondary complications and even premature death.
- Unstable wheelchairs can tip and lead to users falling and injuring themselves.
- Wheelchairs that are too wide or are unduly heavy can cause shoulder injuries.
- Sharp edges on surfaces can cause cuts that in turn can lead to infection.
- Poor design can result in places on the wheelchair where the user or others can get their fingers or skin pinched.
- Wheelchairs that cannot endure daily use in the user's environment may fail prematurely and can injure the user.
- Strength and durability

Wheelchairs used outdoors are subjected to greater wear and tear than those designed for indoor use or use on smooth roads and paths. A wheelchair must be strong enough not to suffer a sudden failure while being used. The wheelchair should be built to have the longest possible useful life and require the fewest repairs. A wheelchair should be designed so it can be repaired near the user's home if it fails, and replacement parts should be easily available.

- Suitability for use

Wheelchairs should be appropriate for the environment in which they will be used and for the specific people who will use them. One wheelchair design will not suit

everyone. When designing or selecting wheelchairs, it was necessary to think about the environment and the way in which the wheelchair may be used.

### 3.6. COST AND MATERIALS

prepared by: Muhammad Hafizudin Bin Azmi

*Table 3.1: Cost and Materials*

<b>No.</b>	<b>Material &amp; Equipment</b>	<b>Amount</b>	<b>Price (RM)</b>
1.	Galvanised Iron Pipe	2057.4mm	54.10
2.	Connecting Joints	'L' big (2) 'L' small(4) 'T' big (4)	36.00
3.	Hydraulic bottle jack (2 Tons)	1	39.30
4.	GI Pipe 20mm '36'	2	37.80
5.	Seat Clamp	2	30.00
6.	Sandpaper	7	5.40
7.	Mounted Stone	2	9.00
8.	Spray Paint	2	14.00
9.	Welding	1	70.00
<b>TOTAL</b>			<b>295.6</b>

## **CHAPTER 4: RESULTS**

### **4.1 INTRODUCTION**

prepared by: Meor Mohammed Fikry Bin Zainal Abidin

In this chapter, we will exhibit the data and analysis that have been obtained from product testing of the wheelchair. This is to ensure all the objectives and scope of research are achieved. We analyse every single data that we obtained to ensure that this project is successful.

### **4.2 ADVANTAGES & DISADVANTAGES**

prepared by: Muhammad Hafizudin Bin Azmi

Every project has its own advantages and disadvantages. We believe that each advantages can bring benefits and assistance to those who's using it. Hence for the disadvantages, this is where improvements must be made so that the product will be more reliable and accountable for its user in the future.

#### **4.2.1. ADVANTAGES**

This wheelchair is able to disintegrate or split on the mainframe which made mobilization of occupant would be much easier & this wheelchair can lift up & down smoothly.

#### **4.2.2. DISADVATAGES**

The disadvantages of this wheelchair is that it is too heavy due to the material used to build the wheelchair. Hence, improvements must be made on the material selection in the future so that the product can be lighter and portable.

### **4.3. RESULTS AND ANALYSIS**

prepared by: Hairul Azwar Bin Md Nizam

The project of Hydraulic Wheelchair is designed to improvise the design of current bedridden wheelchair. This project aims to develop a wheelchair with new capabilities and designs specifically for bed ridden patients. The innovations of this wheelchair is focus on the adjustable height of the wheelchair and disintegrate or split function on the seat and mainframe which ease the mobilization of occupant by employing movable double cylinder support structure. The ingenious idea of implementing the hydraulic system enables the wheelchair to lift up and down freely. While doing so, the design of the wheelchair will be able to maintain the rigid structure of the wheelchair while being versatile at the same time in order to achieve safety standard.



*Figure 4.3: Wheelchair For Bedridden Patient*

### **4.4. PRODUCT TESTING**

prepared by: Hairul Azwar Bin Md Nizam

This design is expected to be able to support load up to 150 kg. Test and analysis on Hydraulic Wheelchair is carried out based on analysis of structure deflection. The project mainframe is made of metal. (Galvanised Iron) Pipes is used as the mainframe where GI Pipe has minimum yield strength of 50,000 psi and a minimum tensile strength of 55,000 psi which can support to heavy loads. Plus, GI Pipes come in cheaper price compares to other metal. This project can hold load of at least 100kg after test and analysis based on structure deflection conducted on it. Finally, it can be concluded that the stated objectives were achieved and implemented effectively.

#### **4.5. PRODUCT ANALYSIS**

prepared by: Muhammad Hafizudin Bin Azmi

The Hydraulic Wheelchair price is expected to be around RM 400 ,which is reasonable for the purpose it offer, and it also way more cheaper than competition. Our market potential for this product is health industry. From Global Wheelchair Market analysis, Wheelchair market growth rate is expected to be around 7.1% in the next 5 years (2021-2025).It 2020 market size is 5386 million USD, expected growth is 7818.5 million USD by the end of 2025.Following this trend, good sales number can be accomplish.

The wheelchair have a good overall design and it also a strong structure because it is made from a galvanized iron,which can withstand long term use due to its high quality. It also highly ergonomic and safe for bedridden patients and their guardian.

#### **4.6. CONCLUSION**

prepared by: Meor Mohammed Fikry Bin Zainal Abidin

The conclusion for this chapter is that there are advantages and disadvantages of this project. All hopes that the advantages of this product can bring benefits and convenience to the community. While for the disadvantages, we will encourage the younger generations to take this as rooms for improvements for this product and conduct more research on this project. This project will be a beneficial in the future. More test and analysis should be conducted so that the product will be more accountable in the future.

## CHAPTER 5: DISCUSSION

### 5.1. INTRODUCTION

prepared by: Muhammad Hafizudin Bin Azmi

In this chapter, we will explain about the results and findings from the product testing. Based on the data and analysis obtained, we will discuss about the improvements and changes that can be made to this product in order for it to be more reliable, user-friendly and last longer.

### 5.2. DISCUSSION

prepared by: Hairul Azwar Bin Md Nizam

With references and observations made on the data obtained, the first improvements that should be made to this product is the material of the mainframe. Though the mainframe we selected is strong which can support heavy load, it cannot be deny that it made the structure of the wheelchair is too heavy. This cause the wheelchair to be not portable and it is difficult for the occupants to bring this wheelchair whenever they are travelling. So, other material such as stainless steel which is lighter and stronger can be considered as alternatives to the current material. This can ensure the future wheelchair is more portable and user-friendly. The next improvement that should be made on this wheelchair is the lifting mechanism. Bearings should be added to the cylinder so that it can last longer, lift smoother and more durable. The current features on the wheelchair have the probability to go wear as there are frictional force between the cylinder and the mainframe. The next improvement is that we can install electric motor on the wheelchair. With that, the power will be generated by the motor and the occupants will no need to use their own force to move the wheelchair. This can of course bring convenient to the occupants.



*Figure 5.2: Mainframe of Bedridden Wheelchair*

### **5.3. CONCLUSION**

prepared by: Meor Mohammed Fikry Bin Zainal Abidin

Through this project, it helps develop creativity and critical thinking among us in figuring out solutions to any problems. Problems related to existing projects can be solved through some modifications and fabrications applied to the current design. Innovations made on Hydraulic Wheelchair is not just convenient to the bed ridden patient to move, but also to the guardian. The 'split' feature on the wheelchair will ease the guardian to assist the bed-ridden patient to sit on the wheelchair. The lifting feature also will make it easier for the guardian. The process would save a lot of time and energy compared to last time. There is still room for improvement which can be added to this project to make it more effective, durable and user-friendly. This project has a big potential in market and should be commercialized for advanced research and development.

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## **APPENDIX**

APPENDIX A

Gantt Chart (Project 1)

APPENDIX B

Gantt Chart (Project 2)

## APPENDIX A

Project Activity	Weeks													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Briefing and Project Planning														
Material Selection														
Materials Purchase														
Project Design														
Fabrication														
Proposal Writing														
Slide														

	Planning
	Actual

**APPENDIX B**

**GANTT CHART (PROJECT 2)**

Weeks / Activity	W 1	W 2	W 3	W 4	W 5	W 6	W 7	W 8	W 9	W 10	W 11	W 12	W 13	W 14
Course Registration	█													
Write a Final Report	█	█	█	█	█	█	█	█	█	█				
Assemble project materials and components		█	█	█	█	█	█	█						
Product testing							█	█	█	█				
Finish the entire part of the project							█	█	█	█				
Data Analysis									█	█				
Project Progress Presentation									█	█				
Presentation Preparation										█	█			
Abstract, Technical Paper & Report review by supervisor										█	█			
PITEX PSA												█		
Submission of Final Report													█	
Logbook Submission														█