AN INNOVATION OF WALKING AID FOR REHABILITATION PATIENTS

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DECLARATION

I hereby declare that the work in this thesis is my own expectations for quotation and summaries which have been duly acknowledged.

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ABSTRACT

Walking aid is used for two purposes as a tool for rehabilitation when the user is recovering from an injury or operation and for long term use when the user has a permanent difficulty with walking unassisted. In this research, the Easy Walking Aid (EWA) is developed to help the lower limb disabilities patient to live an independent daily life. EWA is product to help the patient for easy rise up from sitting to standing position and vice versa by adding additional features which is dc motor at the side leg of walking frame. The DC motor mainly functions in adjusting height of the walking frame during standing and sitting activity done by the patient. The push button connected with dc motor to control the height of the walking frame. It helps the hip fracture patient to exert less force on the walking frame during standing up. In addition, two wheels was fixed at the front leg of the walking frame to help the patient move forward without lifting the walking frames during walking activity. To run the DC motor efficient, 12V battery was used in this product. In the meantime, by improving existing products to help and facilitate the lower limb disabled to do their daily activity. The product is tested for the smoothness of the DC motor in adjusting height with 12V and usability of the patient in walking with 2 wheeled walking aid. The device can help increase the confidence of the user's walking ability to do their rehabilitation and reduce the time taken for the lower extremity to recover.

Keyword- Walking Aid, Lower Limb Disabilities, Hip Fracture, Sit to Stand and Bone Fracture

ABSTRAK

Alat bantuan berjalan digunakan untuk dua tujuan sebagai alat untuk pemulihan apabila pengguna pulih dari kecederaan atau operasi dan untuk kegunaan jangka panjang apabila pengguna mengalami kesukaran yang tetap dengan berjalan tanpa bantuan. Dalam kajian ini, Easy Walking Aid (EWA) dibangunkan untuk membantu pesakit kurang upaya anggota badan menjalani kehidupan seharian yang bebas. EWA adalah produk untuk membantu pesakit mudah bangkit dari duduk ke kedudukan berdiri dan sebaliknya dengan menambah ciri tambahan yang motor dc di kaki sisi bingkai berjalan. Motor DC terutamanya berfungsi dalam menyesuaikan ketinggian bingkai berjalan semasa berdiri dan aktiviti duduk yang dilakukan oleh pesakit. Butang tolak yang disambungkan dengan motor DC untuk mengawal ketinggian bingkai berjalan. Ia membantu pesakit patah tulang pinggul untuk memberi tekanan kurang pada bingkai berjalan semasa berdiri. Di samping itu, dua roda dipasang di kaki depan bingkai berjalan untuk membantu pesakit bergerak ke hadapan tanpa mengangkat bingkai berjalan semasa aktiviti berjalan. Bateri 12V digunakan dalam produk ini untuk menjalankan motor DC yang cekap. Dalam pada itu, dengan meningkatkan produk sedia ada untuk membantu dan memudahkan anggota kurang upaya kurang upaya untuk melakukan aktiviti harian mereka. Produk ini diuji untuk kelancaran motor DC dalam melaraskan ketinggian dengan 12V dan kegunaan pesakit dalam berjalan dengan bantuan berjalan 2 roda. Peranti ini dapat membantu meningkatkan keyakinan keupayaan berjalan pengguna untuk melakukan pemulihan mereka dan mengurangkan masa yang diambil untuk ekstrem yang lebih rendah untuk pulih.

Kata Kunci- Bantuan Berjalan Kaki, Anggota Badan Kurang Upaya, Pinggang Retak, Duduk ke Bangun dan Tulang Retak

TABLE OF CONTENTS

LIST OF FIGURE

LIST OF TABLE

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Most of the people in the world whose health suffer because have limit to do normal activities. One of health suffer is hip fracture. A hip fracture is a break in the thigh bone (femur) of your hip joint[1]. The number of elder people is increasing and thus interest of welfare for the elderly and disabled are rapidly rising as well. This rapid increase of attention implies that elders require more technical aid to support their daily living.[2] The patient of hip fracture was unable to stand up from seated without support.[3]

Healing from a hip fracture takes time for patience. Most people over age 65, probably know has broken hip. Every year, a quarter of a million Americans do this, commonly after a fall. After a hospital stay and the rehabilitation therapy that follows, many people still can't do things they used to do with ease, like dressing, rising from a chair, or climbing stairs and the simple exercises done at home can make a big difference in recovering from a broken hip.[3] If the patient want to use walker from sit to stand may influence balance and function that will make fall risk[4].

The risk of mortality in hip fracture patients was 3-fold higher than that in the general population and included every major cause of death[5]. To solve the problem, need to develop or innovate walker that can support hip fracture patient to stand from seat position. The latest of the device walking aid also not suitable for patient to rise up

from sit and still need adjust the height manually that is called rollator in Figure 1 because it designs for people can stand up easily but not stable in walk.

Figure 1: Rollator

This an innovation of walking aid for rehabilitation more by using existing walker that add two wheel in fronts, dc motors by using 12v battery, break tires for safety and switch or button up and down to control the high of the product for patient who had hip fracture that they hard to stand from seated position and it also can use by for those who have injury or problem of their lower extremities.

This walking aid will move by pushing the device without folding, that will make easily for patient who had hip fracture to do rehabilitation for recovery while can move from one place to another place.

1.2 PROBLEM STATEMENT

For patient hip fracture which is hard to stand up, this patient hard to move from a sitting to standing position for using standard walking frame, because standard walking frame design to use in standing position not to rise from a chair[6]. Patient needs someone to assist to conduct daily life activities. Hip fracture had become cause the person hard to stand up without support. Physically for hip fracture person will decrease their balance to walk and most patient can't walk normally cause decrease their confidence level. The product can solve the problem for the patient in managing daily life.

1.3 OBJECTIVE

The main objective of this project is:

1. To upgrade the walking aid for patient hip fracture for rehabilitation.
2. To determine the capability of motor to make patient to standing from sitting position.
3. To analyze the voltage for support the motor to make easy walking aid.

1.4 SCOPE

This project will develop by using DC motor to adjust the height of the walker for support patient from seated to stand position with added mechanical part to a new design for the patient hard to rise up from sit that can use the device for rehabilitation such as exercise treatment or to walk from one place to another.

1.5 SIGNIFICANT

This study to analysis the problem from patient low limb disability that is hip fracture which hard to stand from seated. Patient hip fracture cannot use walking aid to stand from seated because can fall and effect pain other part of body. This project will help and reduce energy of patient to stand from seated easily then the person can move from one place to another place without need anyone help

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This project provides the description of literature review that has done according of journal that relate with this project. In the globalization era of technology developments involving devices for users with physical disabilities that is we can categorize for people who paralysis, difficulties with walking or other movement in lower limb, slow response time, difficulty controlling movement. However, the defects faced have made they need tools or support device that can help them and facilitate them in movement and from seat to stand position. There are even many devices that can help them in the market as technology progresses more rapidly and not all of the device is suitable for the patient. This project device that created has benefits and specifications for the user. Since the main of this project is to facilitate the movement that hard for them to do activity from seat to stand position and recovery of hip fracture patient. Thus, literature review related definition of design and the walking aids. Apparently, literature review related with definition walking aids and ergonomic.

Most of the people in the world whose health suffer because have limit to do normal activities. Due to the technology now can solve or simplify the problem. Poor recovery after hip fracture causes considerable suffering for the patients and imposes a financial burden on the social and health care sector. Recovery of walking ability after hip fracture is a necessity for reestablishing patients into their normal environment. The

causes of poor recovery are not fully understood. A few studies have investigated walking recovery after the hip fracture. Patient rehabilitation, on average four weeks after hip fracture, patients experienced improvement in walking ability and physical factors, independent of pain or balance. However, on average three months after discharge, they reported pain, poor balance, and fear of falling, as well as reduced outdoor mobility, walking ability, and participation in community activities.

The literature review will give an overview or a brief introduction of techniques that are suitable to be used in project.

2.2 WALKING FRAMES

A walker or walking frame is a tool for disabled or elderly people who need additional support to maintain balance or stability while walking.[7] In the United Kingdom, a common equivalent term for a walker is Zimmer frame, a genericized trademark from Zimmer Holdings, a major manufacturer of such devices and joint replacement parts. A walker for physical therapist will work as long to get strong and walk again. It also refers to a piece of equipment which provides additional support to an individual when walking or standing.[8] A walking frame is designed to be used over short to medium distances and can have accessories added to it to accommodate each individual's requirements.

Walking aids are helpful for patients who have chronic problems, including hip and knee arthritis, as well as those who have acute injuries, such as ankle sprains and leg fractures. A lot of older adults seem to struggle with their walking aids, they often drag along their walking aids like a burden with a difficult gait pattern as a result, possibly increasing the risk of falling. [14]

Older people need to be able to function independently, but gait problems can undermine that, even leading to nursing home admission. [15] Research found that a fairly large number of elderly falls are related to walking aids. Apparently, a high percentage of walking aids in use may be inappropriate, of incorrect height, or used incorrectly. [16]

Figure 2. 1: Walking Aid

Specification:

- Handle height adj: 75-92.5cm (30-36")
- Weight: 2.3kg (5lbs)
- Overall Width (open): 52cm (20.5")
- Footprint (open): 52cm x 47cm
- Folded Sizes (H 75-92.5cm X W 52cm x D 10cm
- Max user weight: 100kg (15.7 stone)

2.2.1 WALKING FRAMES AND ZIMMER FRAMES

Walking frames also commonly referred to as Zimmer frames are a walking aid/mobility aid for disabled or elderly people who require additional support to maintain balance and stability while walking. Walking frames are suitable for both indoors and out. The purpose of this guide is to offer you an overview of the types of walking frame available, their suitability for individual needs and the range of accessories that compliment walking frames and zimmer frames.

Walking frames, like all walking aids, are used for two purposes, as a tool for rehabilitation when the user is recovering from an injury or operation and for long term use when the user has a permanent difficulty with walking unassisted. For the long-term user, the walking frame is not completely practical, for instance when maneuvering in

tight spaces and moving up and down stairs. As a result, crutches and stair lifts provide the user with a more appropriate and higher level of mobility when tackling such terrain.

The rehabilitation program will eventually provide the user with the confidence and ability to put more weight through their affected legs, as such progress onto walking sticks and crutches. Ultimately the rehabilitation program looks to render walking aids obsolete. However, independent walking for some users is not possible and walking aids are a necessity. In situations like these, mobility aids, specifically walking frames and Zimmer frames, may be required for long term use. It is advised, to ensure the appropriate aid is chosen, a home/lifestyle assessment should be undertaken.

The disabled independent living centers around the country have a wide range of equipment on display, so do most mobility aids retailers. These disabled living centers house occupational therapists, who offer support and expert advice.

2.2.2 FUNCTION OF WALKING FRAME

The walking frame offers a number of functions, the following cover those, important, functions:

- Increase the confidence of the user's walking ability.
- Weight redistribution – weight is distributed through the arms and transferred away from the legs. This helps reduce fatigue.
- Provides a wider support base, thus greater stability.

2.2.3 USING A WALKING FRAME SAFELY

As mentioned earlier, independent/disabled living centers and occupational therapists offer a wealth of information about walking aids, they will also offer assistance with training users and advising about best practice. However, there are simple factors one should take into account when using a walking frame safely;

- ✓ In the home: Loose carpet, mats, rugs, a cluttered area are all potential hazards.
- ✓ Wet floors: Walking aids should not be used on wet floor environments.
- ✓ Footwear: Footwear should be functional, supportive and appropriate.

2.2.4 REDUCING THE RISK OF FALLS

There are a number of actions that you can take to minimize your risk of a fall whilst using a walking aid.

- Home environment: Remove all loose rugs, trailing flexes and clutter from the floor. Keep your access routes around the house clear at all times
- Stairs: If you have stairs in your house and use a walking aid, obtain a second one and keep one upstairs and one downstairs. Do NOT attempt to take a walking frame up and down stairs
- **Standing from a chair: <u>Do not attempt to use a walking frame or stick to rise from a chair</u>**. They are not stable enough. You should push up with your hands on the arms of the chair and only take hold of the frame or stick once standing. If necessary, ask to practice this with a healthcare professional. Further information about getting in and out of a chair is available in our factsheet on Choosing a chair and chair accessories.[17]
- Wet floors: Walking equipment should not be used in wet floor areas. If you need to access a wet room or shower area, ask the advice of an occupational therapist. You may be able to install grab rails.
- Footwear: Footwear should be well fitted, secure on your feet and supportive as you walk.
- Maintaining your walking aid: It is vital that your walking aid is kept in good condition. More on this can be read below.

2.3 TYPE OF WALKING AID

Walking aids include assistive canes commonly referred to as walking sticks, crutches, and walkers. According to individual user needs, this device helps to maintain vertical ambulation by providing any or all improved stability, reducing lower limb loading and generating movements. The better stability by providing additional touches, running help provides additional support and a wider network of gravity centers. Generate movement walking and arm support can replace spine, pelvis or leg and joint muscles in dynamic power generation while walking.

2.3.5 CANE

It is held in the hands and sends the load to the floor through the stem. Loads that can be used through rattan are delivered by the user's hands and wrists and limited by these.

2.3.6 CRUTCHES

The crutches transmit the load to the ground through the stem, but have two contact points with the arms, in the hands and either under the elbows or under the armpits. This allows a much larger load to be provided through the funnel than the stick.

2.3.7 WALKER

Walker also known as Zimmer frame is the most stable running aid and consists of a free metal framework with three or more contact points that put users in front of them and then tie during movement. The point of contact can be fixed rubber ferrules like sticks and sticks, or wheels, or a combination of both. Wheelchairs are also known as rollators. Most pedestrians are also equipped with built-in chairs so users can relax while using and with metal bags to carry personal items.

2.3.8 WALKER CANE HYBRID

A walker cane hybrid has two legs that provide lateral side to side support. It can be used with two hands in front of the user, such as a walker, and provides a higher level of support than wood. It can be adjusted for use with one or two hands, both front and side, as well as climber helper. Hybrid is not designed to replace a walker that usually has four legs and provides a 4-way support using both hands.

2.3.9 GAIT TRAINERS

This is a more supportive mobility assistance than a standard walker. It usually offers support that helps to balance and balance. The accessories or parts of the product attached to the product frame provide unbalanced support and postural alignment to enable the practice to run.

2.3.10 FORARM WALKING FRAME

This type of walking frame is basically the same as the standard walking frame but with forearm support rather than handgrips. This allows the user to transfer their weight through their forearms rather than their hands. This is particularly helpful to those who have arthritic hands and find gripping the frame challenging.

2.3.11 RECIPROCAL

A reciprocal walking frame operates with a pivot mechanism for each side. This provides the user with the option of lifting the frame up and moving around one step at a time. Many users prefer this movement as it is more intuitive to how one naturally walks. However, consideration needs to be given to how much weight is being placed on one side of the body, specifically arms. It is advisable to consult an occupational therapist or physiotherapist about the suitability of such a frame.

2.4 BONE FRACTURE

A bone fracture is a medical condition where the continuity of the bone is broken. A significant percentage of bone fractures occur because of high force impact or stress.[9] However, a fracture may also be the result of some medical conditions which weaken the bones, for example osteoporosis, some cancers, or osteogenesis imperfecta (also known as brittle bone diseases).

A fracture is the medical term for a broken bone. Fractures are common, the average person has two during a lifetime. They occur when the physical force exerted on the bone is stronger than the bone itself. Risk of fracture depends, in part, on age. Broken bones are very common in childhood, although children's fractures are generally less complicated than fractures in adults. As you age, your bones become more brittle and you are more likely to suffer fractures from falls that would not occur when you were young.[10]

There are many types of fractures, but the main categories are displaced, non-displaced, open, and closed. Displaced and non-displaced fractures refer to the alignment of the fractured bone. In a displaced fracture, the bone snaps into two or more parts and moves so that the two ends are not lined up straight. If the bone is in many pieces, it is called a comminuted fracture.

In a non-displaced fracture, the bone cracks either part or all of the way through, but does move and maintains its proper alignment. A closed fracture is when the bone breaks but there is no puncture or open wound in the skin. An open fracture is one in which the bone breaks through the skin, it may then recede back into the wound and not be visible through the skin. This is an important difference from a closed fracture because with an open fracture there is a risk of a deep bone infection.

2.5 HIP FRACTURE

A hip fracture is a break in the upper quarter of the femur (thigh) bone. The extent of the break depends on the forces that are involved. The type of surgery used to treat a hip fracture is primarily based on the bones and soft tissues affected or on the level of the fracture. In anatomy The "hip" is a ball-and-socket joint. It allows the upper leg to bend and rotate at the pelvis. An injury to the socket, or acetabulum, itself is not considered a "hip fracture." Management of fractures to the socket is a completely different consideration.

Hip fractures most commonly occur from a fall or from a direct blow to the side of the hip. Some medical conditions such as osteoporosis, cancer, or stress injuries can weaken the bone and make the hip more susceptible to breaking. In severe cases, it is possible for the hip to break with the patient merely standing on the leg and twisting. The patient with a hip fracture will have pain over the outer upper thigh or in the groin. There will be significant discomfort with any attempt to flex or rotate the hip.[11]

If the bone has been weakened by disease (such as a stress injury or cancer), the patient may notice aching in the groin or thigh area for a period of time before the break. If the bone is completely broken, the leg may appear to be shorter than the noninjured leg. The patient will often hold the injured leg in a still position with the foot and knee turned outward (external rotation).

Most people over age 65, you probably know someone who has broken a hip. Every year, a quarter of a million Americans do this, commonly after a fall. After a hospital stay and the rehabilitation therapy that follows, many people still can't do things they used to do with ease, like dressing, rising from a chair, or climbing stairs. A report in Journal of the American Medical Association shows that simple exercises done at home can make a big difference in recovering from a broken hip.

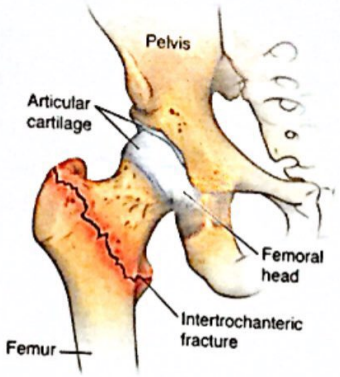

Figure 2. 2: Bone Fracture

2.5.12 TYPE OF HIP FRACTURE

In general, there are three different types of hip fractures. The type of fracture depends on what area of the upper femur is involved. Firstly Intracapsular Fracture in figure, these fractures occur at the level of the neck and the head of the femur, and are generally within the capsule. The capsule is the soft-tissue envelope that contains the lubricating and nourishing fluid of the hip joint itself. This fracture occurs at the level of the "neck" of the bone and may have loss of blood supply to the bone. With intracapsular breaks, it focus usually to break cracks with double screws or large compression hip screws. With older patients with prolonged fractures that may damage the blood supply to the femoral head, we usually recommend replacement surgery.

Intertrochanteric Fracture, This fracture occurs between the neck of the femur and a lower bony prominence called the lesser trochanter. The lesser trochanter is an attachment point for one of the major muscles of the hip. Intertrochanteric fractures generally cross in the area between the lesser trochanter and the greater trochanter. The greater trochanter is the bump you can feel under the skin on the outside of the hip. It acts as another muscle attachment point. This occurs further down the bone and tends to have better blood supply to the fracture pieces. Subtrochanteric Fracture, This fracture occurs below the lesser trochanter, in a region that is between the lesser trochanter and an area approximately 2 1/2 inches below . This occurs even further down the bone and may be broken into several pieces.[11]

2.6 SIT TO STAND

Sitting to stand motion is a person's function often used as they change from sitting position to standing position (and then often walking). The ability to go from sitting position to standing position is an important skill. To elderly people, the inability to perform these basic skills can cause functionalities, and mobility to be affected in daily life

Stand from sitting position is a very common task in everyday life, and is essential for independence in people with disabilities. Adults with disabilities can sit around 60 times a day.[12] The importance of sitting to stand is very clear when the ability diminishes and shows itself as a reduction in the quality of life associated with mobility and increased risk of falling into the elderly as well as the disabled

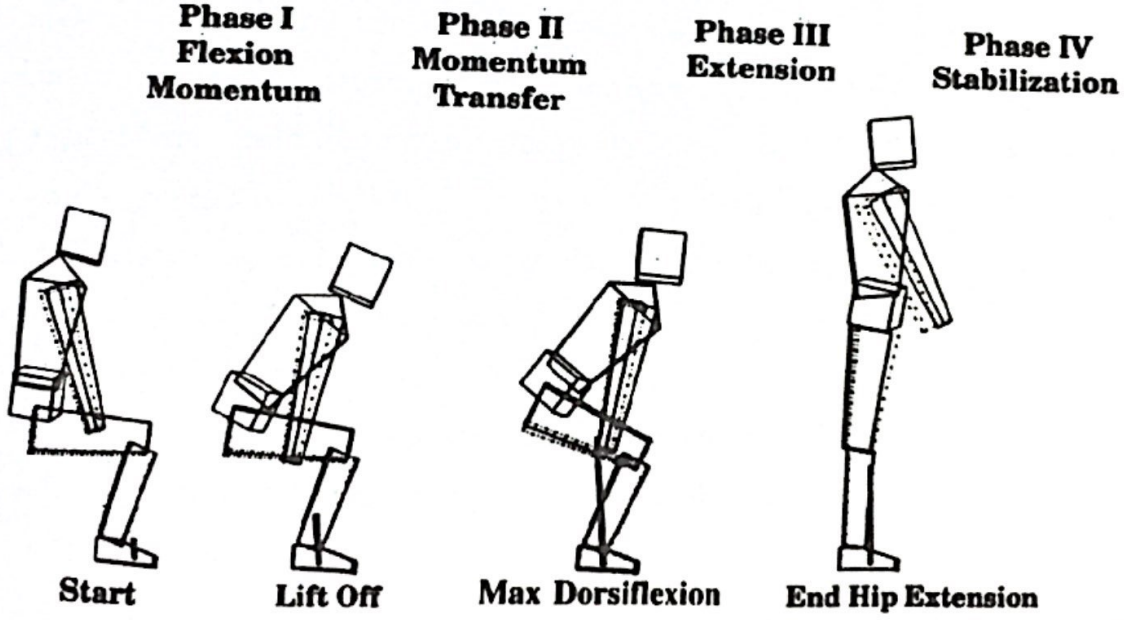

Figure 2. 3: Sit to stand[12]

2.7 ALUMINIUM MATERIAL

Aluminum is white silvery metal, 13 elements in periodic table. The surprising fact about aluminum is the widest metal on Earth, which forms more than 8% Earth's core mass. It is also the third most common chemical element in our planet after oxygen and silicon. At the same time, as it is easily bonded to other elements, pure aluminum does not occur in nature. The most common form of aluminum is aluminum sulfate. This is a mineral that combines two sulfuric acid: alkali metal based (lithium, sodium, potassium rubidium or cesium) and metal based on the third batch of periodic tables, especially aluminum.

Aluminium sulphates are used to this day to clean water, for cooking, in medicine, in cosmetology, in the chemical industry and in other that relate with project is medical device it is because the material is light. By the way, aluminium got its name from aluminium sulphates which in Latin were called alumen. Aluminum offers a unique combination of treasures. It is one of the lightest metal in the world: it is almost three times lighter than iron but it is also very strong, very flexible and corrosion resistant because its surface is constantly closed in very thin and very powerful oxide film.[13] It is not magnetise, it is a great an alloy shape with the practicality of all other metals.

Aluminum can be easily processed using pressure when it is hot and when it is cold. It can be rolled, pulled and stamped. Aluminum does not burn; it does not require special paint and unlike plastic it is non-toxic.

2.8 LINEAR ACTUATOR (DC MOTOR)

A linear actuator is an actuator that creates motion in a straight line, in contrast to the circular motion of a conventional electric motor. Linear actuators are hi-tech electric devices able to convert rotational motion in low voltage DC motors into linear push/pull movement. Electric actuators are the perfect solution when you need simple, safe and clean movement with accurate and smooth motion control. Linear actuators are

ideal for all sorts of applications where tilting, lifting, pulling, or pushing with thrusts up to 15,000 N is required.

electric actuators come with intelligence, and are easy to integrate. Compared to both hydraulic and pneumatic systems, electric actuators are much easier to install. The absence of hoses and pumps also makes maintenance obsolete in many cases. linear actuators are quiet, clean, non-toxic and energy efficient. It fulfils any user demand, and meet all international standards required to operate in any given application.

2.9 FORWARD REVERSE RELAY

A relay is an electrically controlled switch. Electromechanical relays use an electromagnet to activate mechanical contacts, solid-state relays use semiconductor switches. A latching relay stays in the current state when power is removed. A non-latching relay reverts to a known state when power is removed. Relay contacts come in several varieties. The most common are:

- A: normally open
- B: normally closed
- C: one normally-open and one normally-closed both actuated by a single coil
- X: normally open, double make
- Y: normally closed, double break
- Z: one X and one Y, both actuated by a single coil

2.10 ERGONOMIC

Ergonomics is the methodical discipline concerned to comprehend the interaction between human beings and various element of the system where person is living. Ergonomics is employed in fulfilling the goals of health and productivity. Ergonomics investigation of wheelchair is the connection to different parts of vehicles mechanics and client's physical and mental condition. Walking aids composed ergonomically lessens the strain that is caused because of longer utilization of item.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter will cover about the process and the method that used to make this project. Methodology is an important role in to make the ergonomic walking aid. In this chapters, there will be covered to section which is software and hardware.

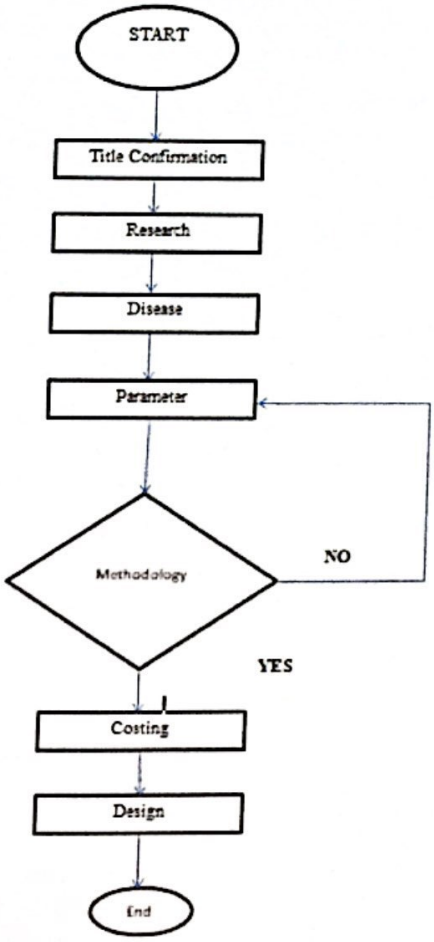

Figure 3. 1: Flowchart of the project

3.2 FLOWCHART PRODUCT

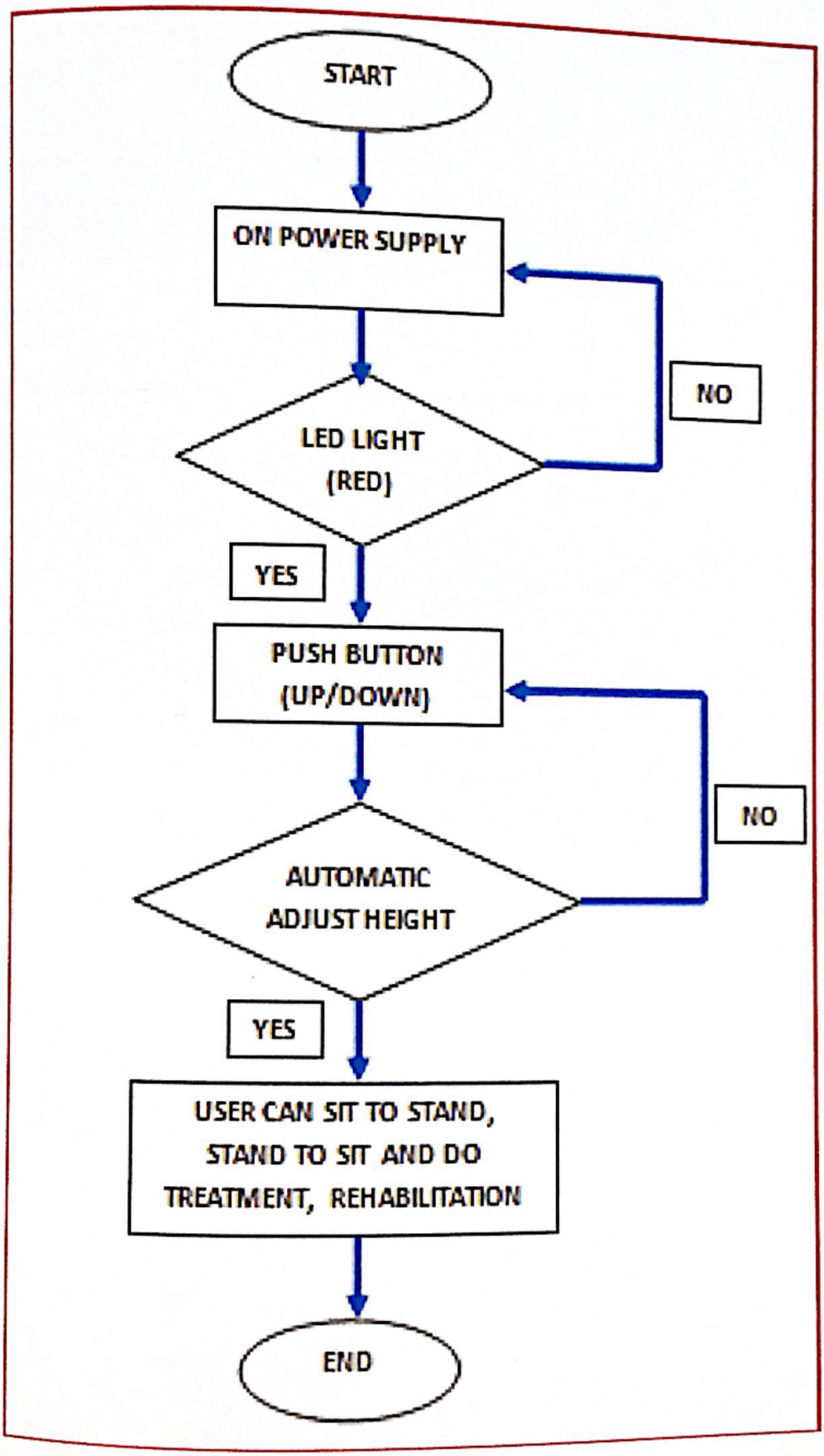

Figure 3. 2: Flowchart of Product

3.3 BLOCK DIAGRAM

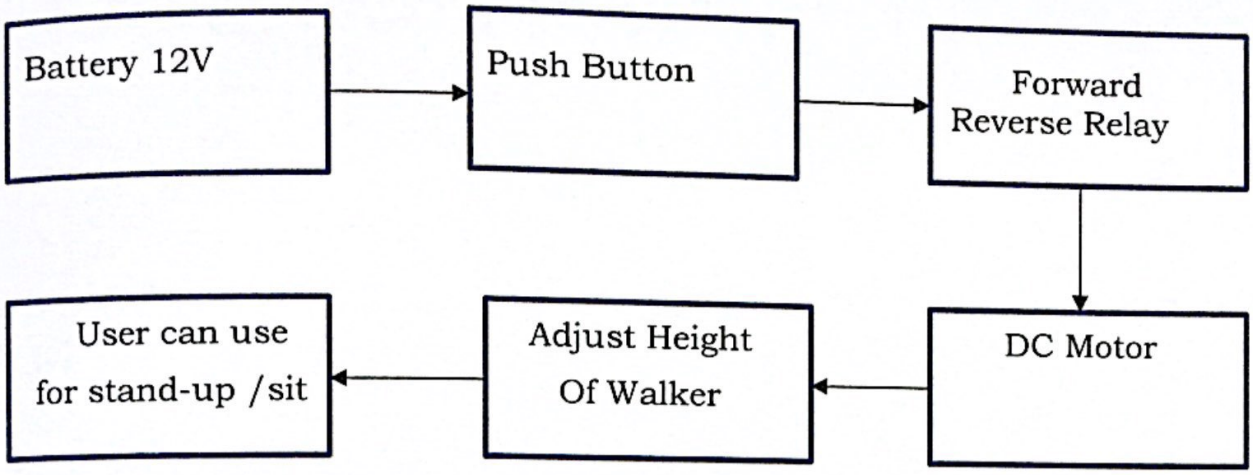

Figure 3. 3: Block Diagram

The project innovation consists of idea of the device function and the block diagram of process. From the Figure 3.1 of block diagram, first step is switch ON to open the power supply. Next step, hold the easy walking aid to rise up, stand-up with straight position and push button up or down according to user's suitability. Then, after push the button it will adjust the height of the device by follow the comfortable to the patient to use it. It makes easily to patient from seated to stand with the motor support to control the height of walker.

3.4 SOFTWARE

Figure 3.2 show the software has been used in this project that is sketchup. This software used formerly Google Sketchup, is a 3D modeling computer program for a wide range of drawing applications such as architectural, interior design, landscape architecture, civil and mechanical engineering, film and video game design.

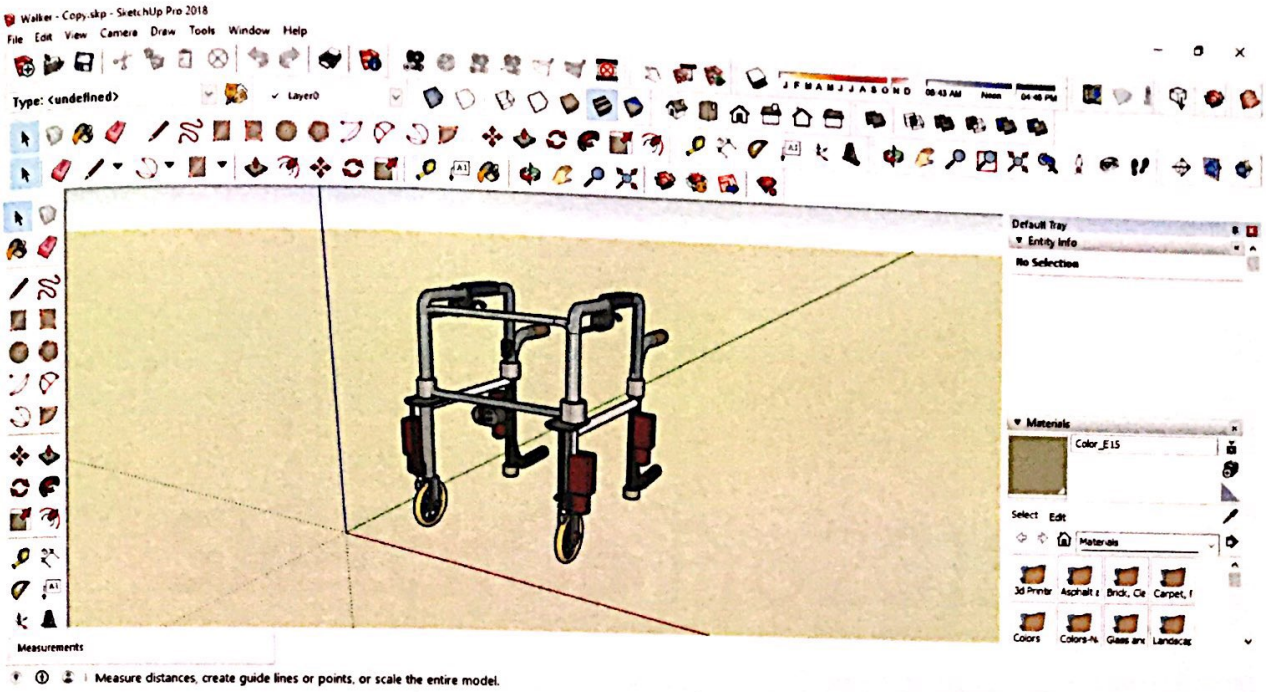

Figure 3. 4: Software Sketchup

3.4.1 SKETCHUP

Figure 3.3 show the symbol of sketchup. Sketchup, in the past Google Sketchup is a 3D demonstrating PC program for an extensive variety of drawing application, for example building, inside outline, scene engineering, common and mechanical designing, film and computer game plan. It is accessible as a freeware rendition.

SketchUp make and a paid adaption with extra usefulness, SketchUp Pro. Sketchup Pro includes the functionality of sketchUp Make plus importers and exporters to common 2D and 3D formats, acces to layout (2D documentation software) and Style Builder (create custom edge styles for SketchUp models). SketchUp Pro 2018 has native intergration with trimble Connect, treat 3D Warehouse models as reference objects as well as a new layout API. On this project, Sketchup use for design the walking aids. Figure 3.5, 3.6, 3.7, 3.8 and 3.9 show example for this project that use Sketchup to design the product.

SketchUp Pro 2018

Figure 3. 5: SketchUp

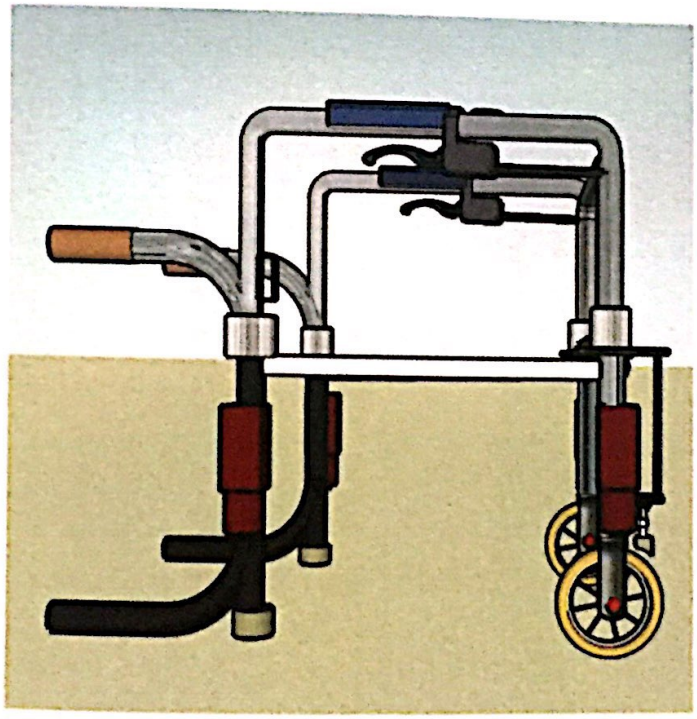

Figure 3. 6: 3D Design Use in SketchUp

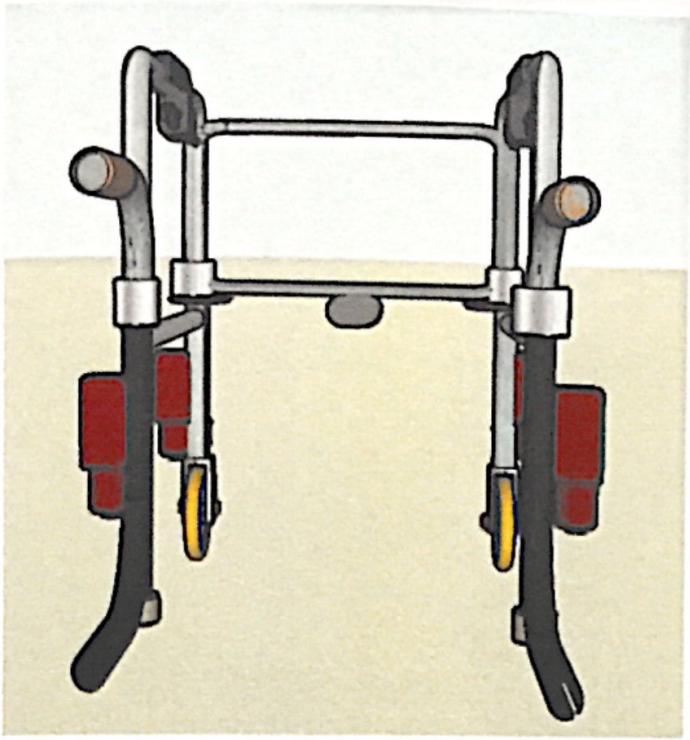

Figure 3. 7: 3D Design Use in SketchUp

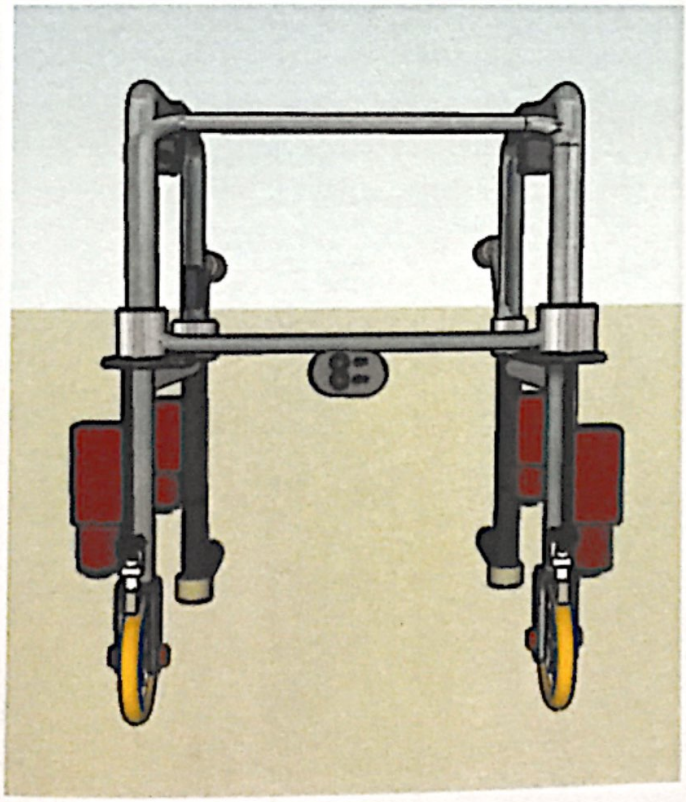

Figure 3. 8: 3D Design Use in SketchUp

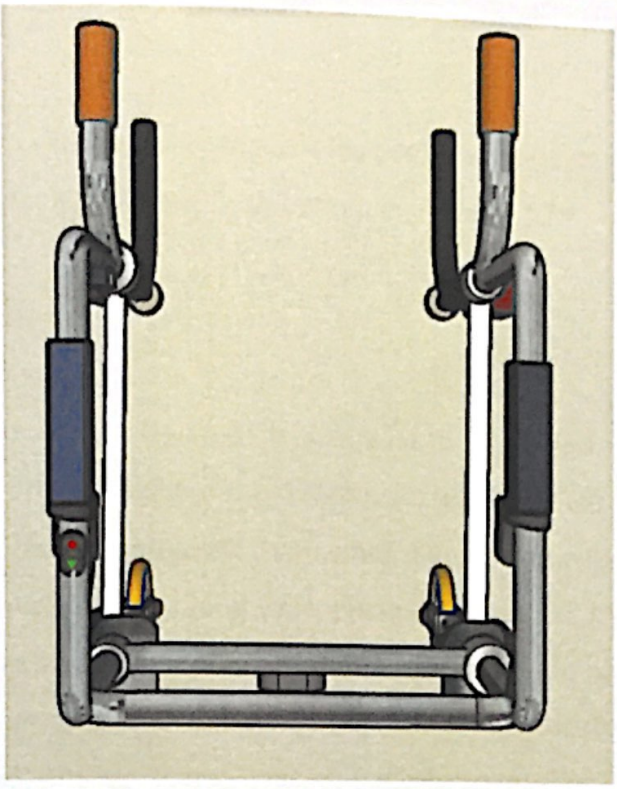

Figure 3. 9: 3D Design Use in SketchUp

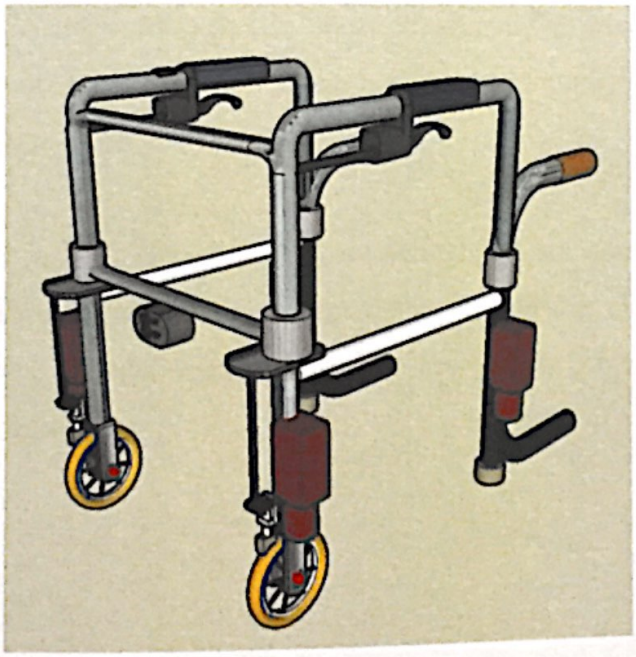

Figure 3. 10: 3D Design Use in SketchUp

3.5 HARDWARE

In this project, the hardware that has been used to create the product is dc motor, two wheels, walking frame, push button and battery 12v.

3.5.1 DC MOTOR

The linear actuator in figure 3.10 is applied in the project with their capability to automatically adjust the height of the walking aid that make the product friendly use that can adjustable height automatic with push button without manually by using existing product of walker. For a long time, pneumatic systems, hydraulic and manual systems are the default options in many motion applications. In addition, the 24volt & 12volt DC driver navigates to various applications. When there is something to be raised, pulled, pulled, pulled, rotated, placed, pulled, removed or removed, 24V linear drive & 24V linear actuators made an irrefutable case for electricity. This 12volt actuator works more easily, efficiently, clean and silent. And with less components to act or wear, the 24V linear drive & 12v linear actuator offers exceptional durability. Although seen as more expensive, 12v linear actuator are actually saving higher costs due to savings in some areas.

Figure 3.10 is XTL Series Linear Actuators that are compact, self-locking, feature an ACME screw drive, an aluminium alloy gear housing, aluminium extension and protection tubes, powder metal gears, and are ideally suited for off-highway equipment applications.

Specification:

- Voltage: 12V
- Rated Current: 2A
- Rated Power: 25W
- Max. Speed: 12mm/s
- Max. Load: 1000N
- Wire Length: 80cm
- Travel Distance: 100mm
- Type: Fixed

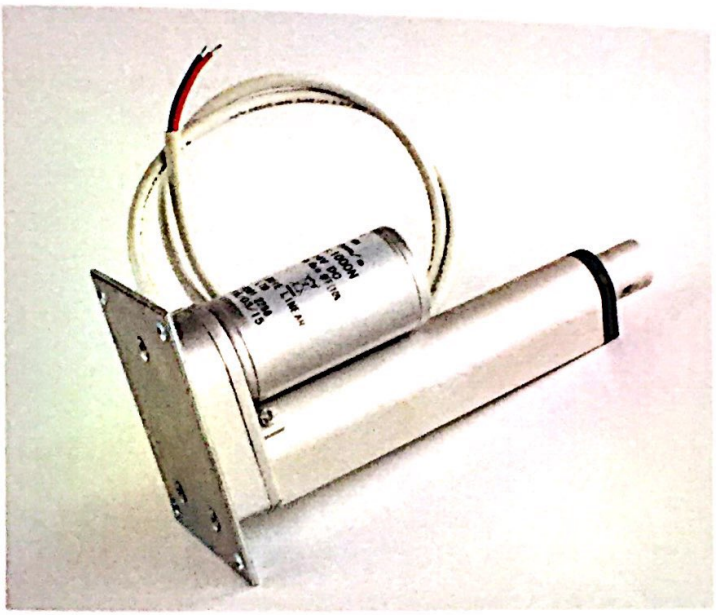

Figure 3. 11 : Dc Motor (Linear Actuator)

3.5.2 FORWARD REVERSE RELAY

The forward reverse motor control is used in a project where forward and backward or upward and downward movement in the operation are needed. Forward and Reverse Operation of motor can be obtained by interchanging any two of its three terminals. It applied in this project to make the dc motor (linear actuator) to move upward and downward. That make the product move easily to set the height for comfortable of the user. The schematic diagram in Appendix A.

Specification:

- 2 Channel Relay Motor Driver Module.
- Operating voltage: 9Vdc.
- Relay contact rating: 10A 250Vac.
- Satus LED indicator.

Pinout:

- Signal 1 = Control input 1 (motor control to left)
- Signal 2 = Control input 2 (motor control to right)
- GND = Ground
- VCC = 9V - 12V
- Green Connector to Motor

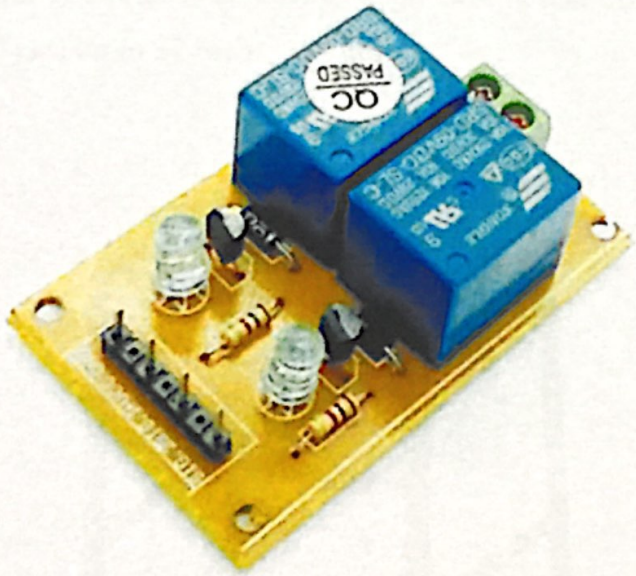

Figure 3. 12: Reverse Forward Relay

3.5.3 WALKING FRAME

Walking Frame refer to a piece of equipment that provides additional support to individuals while walking or standing. Running frames are designed for use in short distance and medium range and can add accessories to meet individual needs.

Figure 3.11 is walking frame are that usually made of aluminum or called zimmer frame so they are light enough to be picked up and moved easily. They often have grips made of foam, gel or rubber to enhance the comfort of consumers. Foot tips are usually covered with rubber hats designed to prevent slipping and improving stability. Zimmer frames have is a metal frames made from aluminium or steel. rubber ferrules on the bottom of their four legs which aim to prevent the frame from slipping. moulded plastic or foam rubber handgrips. In order to accommodate all possible heights of users, walking frames are generally available in three or four different height ranges, from 26 inches (67 cm) up to 37 inches (94 cm).

Figure 3. 13:Walking Frame

3.5.4 WHEELS

The wheels use in project is rubber wheels shown in figure 3.12 that are applied at two leg in front of the walking frame. The rubber wheels currently used in different types of equipment for indoor and outdoor applications. Rubber wheels are universally applicable, vibration-absorbing, offer very good floor preservation, and are resistant to many aggressive substances. Based on the different application purposes, it has developed a precisely calibrated product range in premium quality.

In addition to low-cost standard solid rubber wheels, the product range also includes wheels with high-quality elastic solid rubber treads. The highly resilient solid urethane tread will not go flat and is designed to minimize energy loss and absorb vibration. Arched tread design ensures the contact surface is spherical to improve pivot ability. The extra width better distributes downward pressure allowing the wheel to maintain higher flotation and does not sink into carpet and gravel. Designed for those who want the ultimate smooth ride.

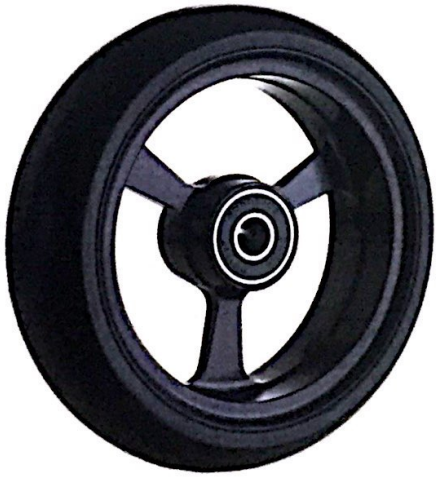

Figure 3. 14: Rubber wheel

3.5.5 PVC PIPE

It's the white plastic pipe commonly used for plumbing and drainage. PVC stands for polyvinyl chloride, and it's become a common replacement for metal piping. PVC's strength, durability, easy installation, and low cost have made it one of the most widely used plastics in the world.

Figure 3. 15: PVC Pipe

CHAPTER 4

RESULT & DISCUSSION

4.1 INTRODUCTION

This chapter shown the result for this project. It also concludes from collected data and analysis such as experiment, questionnaire and graph. However, the result that analyze is discuss in this chapter.

4.2 EASY WALKING AID FOR HIP FRACTURE

Easy walking aid for hip fracture is a walking aid that easy for patient use from sit to stand position with the design and also helpful for user adjust their height which is control by dc motor using 12V to move up and down the height of the device without manually but automatically. The dc motor analyzed that able to withstand the load until 100kg, that will prove that the device can adjust the height automatically with that load of patient or use.

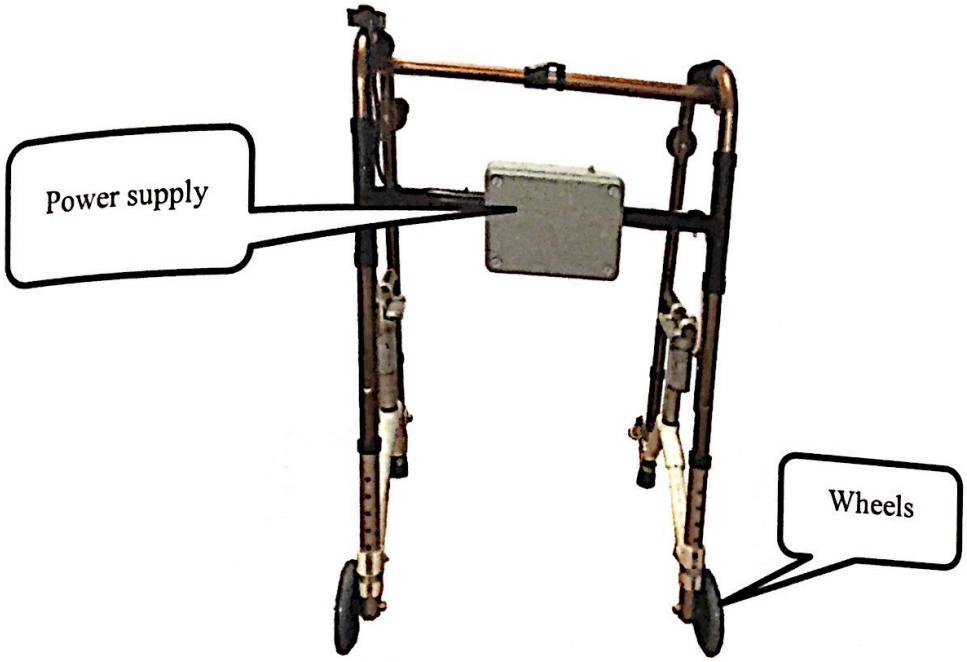

Figure 4. 1: Easy Walking Aid

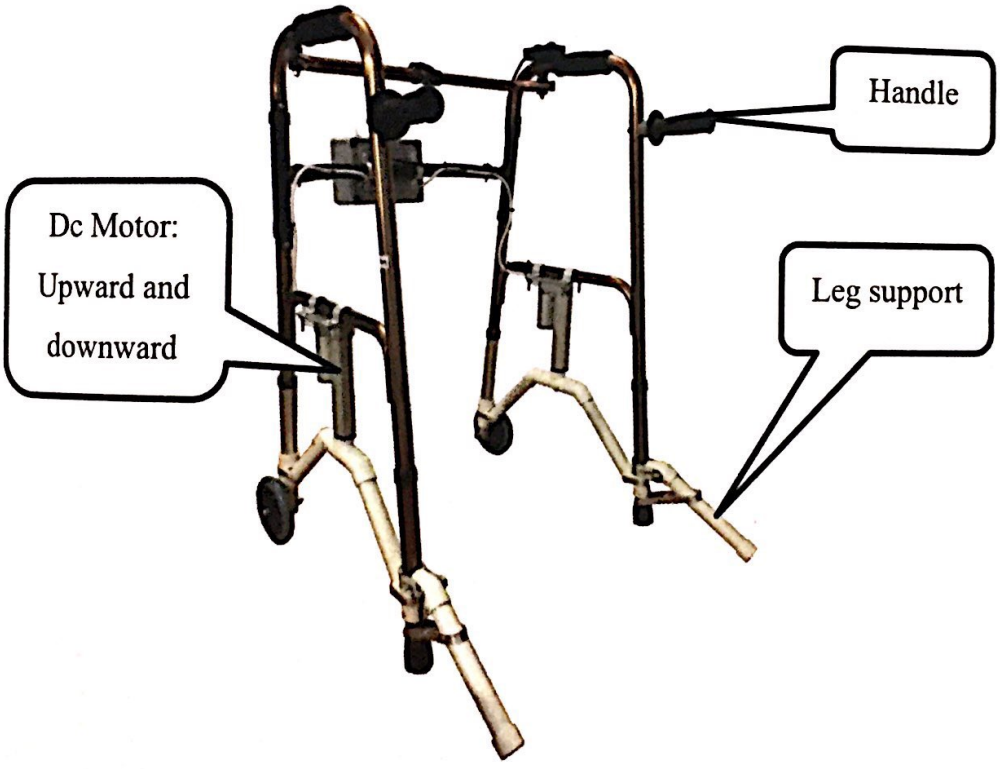

Figure 4. 2: Easy Walking Aid

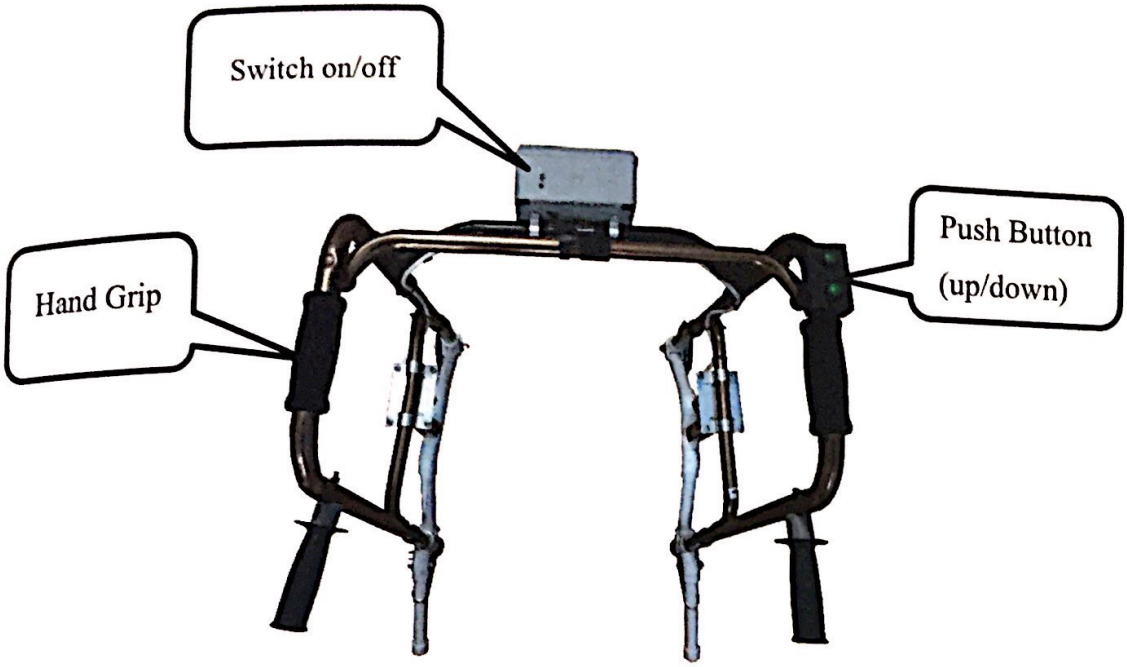

Figure 4. 3: Easy Walking Aid

4.3 USABILITY

During the usability test, five normal subjects were tested to use easy walking aid that is name of project innovation. It is designed to use in sitting to standing position then may automatic adjust the height using dc motor that control by push button for suitable to the user. Answer questionnaire were distributed to them. Table show the result from questionnaire. According to Appendix B show a questionnaire.

Table 4. 1: Result Questionnaire

Bil.	Question	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
1	1	0	0	1	1	3
2	2	0	0	0	2	3
3	3	0	0	1	1	3
4	4	0	0	0	2	3
5	5	0	0	2	2	1
6	6	0	0	1	4	0
7	7	0	0	1	2	2

Example questionnaire, refer to Appendix B:

1) The device is very useful to lower limb disabilities person especially hip fracture patient.
2) The device should be used every day to help hip fracture patient move independently.
3) The device should be a comfortable for a long time used.
4) The device can be recommend to other patient injury leg, paralyzed.
5) The device ensures the safety of the user.
6) Patient will learn to use the device product very quickly.
7) The device can be commercialized in rehabilitation unit, hospital and pharmacy.

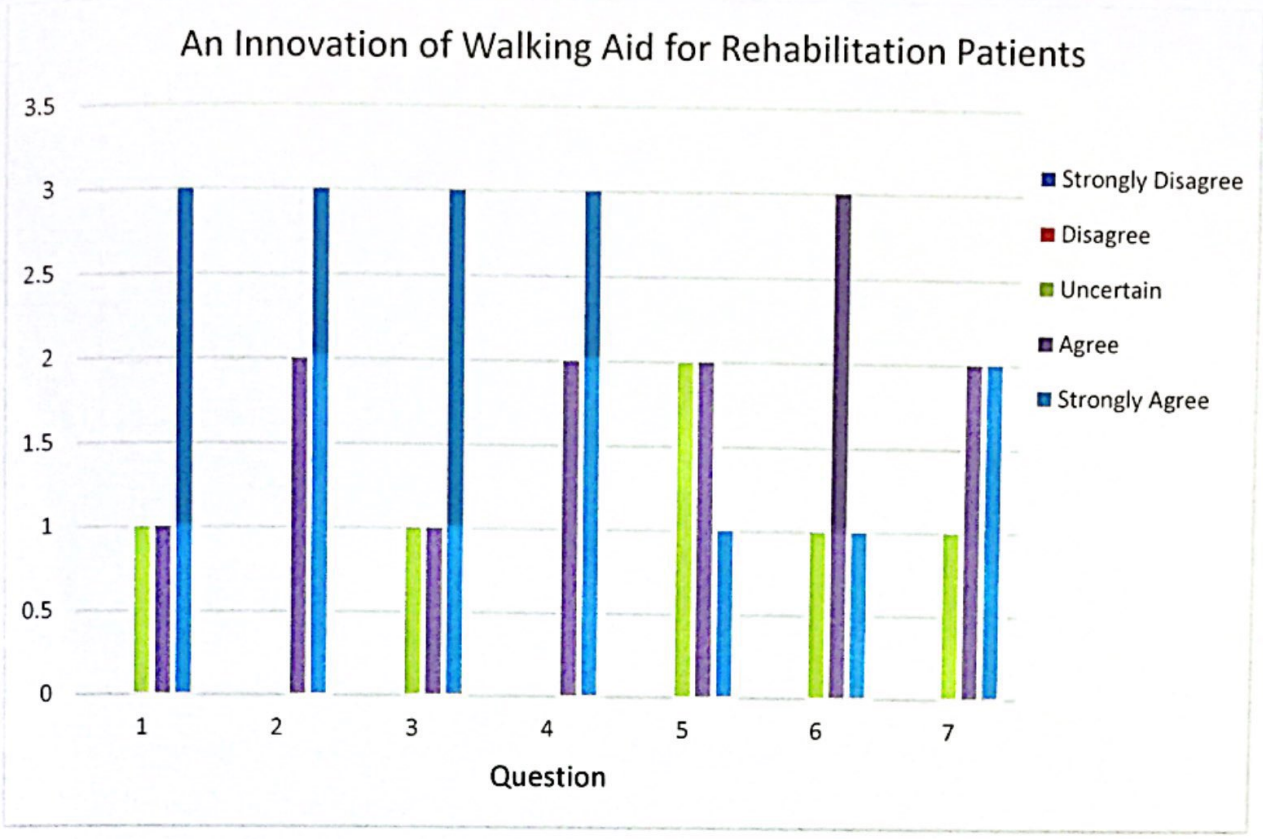

Figure 4. 4: Graph Result Questionnaire

From Figure 4.4 show the result from table in questionnaire, for question 1, we can say that 65% was strongly agree that the Easy Walking Aid (EWA) is very useful to a disable person especially hip fracture. For question 2,3 and 4, 60% strongly agree that EWA should be used every day to help hip fracture patient move independently, should be a comfortable for a long time use and can be recommend to other patient like lower limb disabilities such as injuring leg that hard to move normally.

For question 5, 40% agree that Easy Walking Aid (EWA) is safety for the user, 80% strongly agree that this walking aid is very easy to use and patient will learnt to use the product very quickly and 40% strongly agree that this walking aid can be commercialized in rehabilitation unit, hospital and pharmacy. Table 4.2 describe about result from questionnaire.

Table 4. 2: Result Questionnaire about operation of Easy Walking Aid

Bil.	Question	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
1	1	0	0	0	2	3
2	2	0	0	0	3	2
3	3	0	0	1	2	2
4	4	0	0	0	2	3
5	5	0	0	1	3	1

Example of questionnaire, refer to Appendix B:

1) I was found this product is easy to used and friendly.
2) The design walker is suitable and comfortable.
3) The push button is place on the good position.
4) The speed of adjustable height of this walker is suitable.
5) The walker is safety to use.

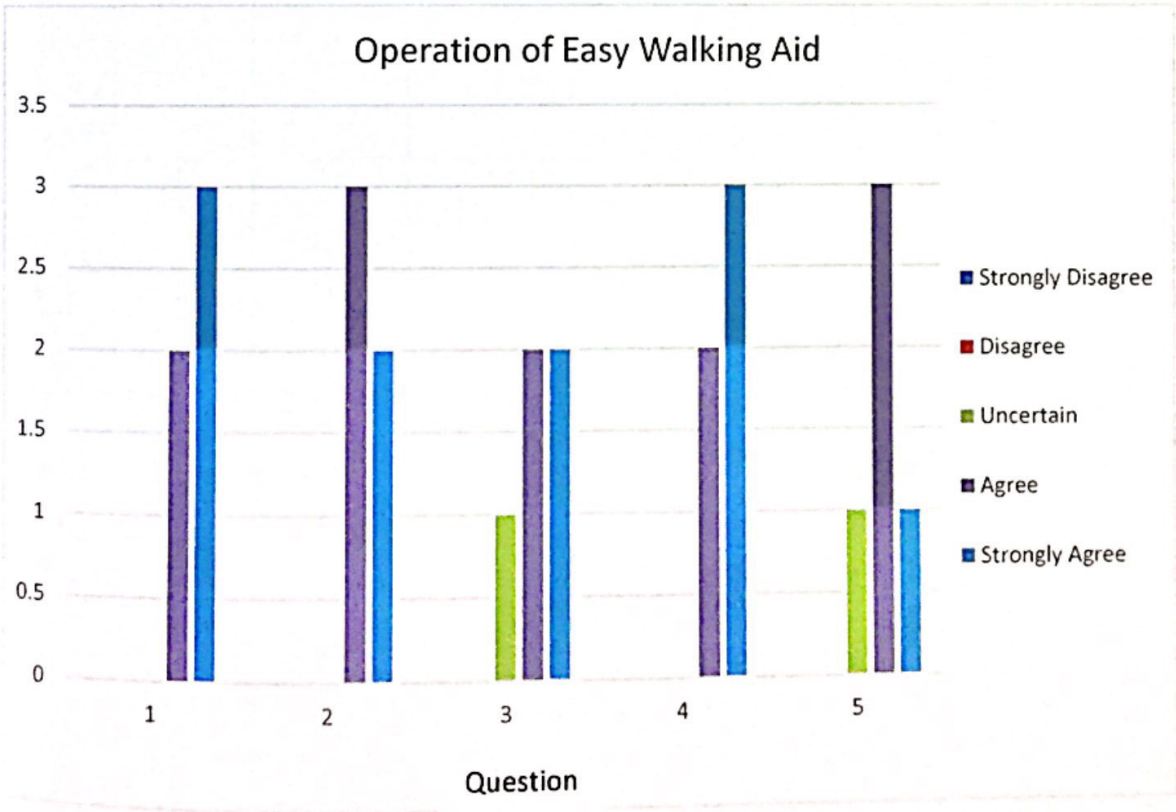

Figure 4. 5: Graph Result Questionnaire

From the Figure 4.5, we can see that 60% strongly agree that walking aid is very easy to used and friendly. For question 2, 60% agree the design of the Easy Walking Aid (EWA) is suitable and comfortable. 40% agree that all sensor is place on the good position. For question 4, 60% agree that the speed of adjustable height of this walker is suitable. 60% agree that walking aid is safety to use. Table 4.3 show the result from the normal subject that tested on the time taken maximum and minimum of the height. The experiment was made whether the walker of adjustable height able to work with load or not. During the usability test, subject with difference weight were tested to use easy walking aid for capture the data to analysis the capabilities of the dc motor to run by adjust the height of the device. According to figure show a result of the test.

Table 4. 3: Result Test

BIL.	Subject	Weight (kg)	Time taken maximum (s)	Velocity (m/s)	Acceleration	Force	Torque (J)
1	-	-	9.94	0.1006	0.0101	0	0
2	A	63.4	10	0.100	0.0100	0.634	0.634
3	B	67.3	10.4	0.0962	0.0093	0.623	0.623
4	C	73.2	11	0.091	0.0083	0.608	0.608

The table 4.3 show the result of test to subject and one of it without subject. We can see that the more weight or load, the low torque will produce.

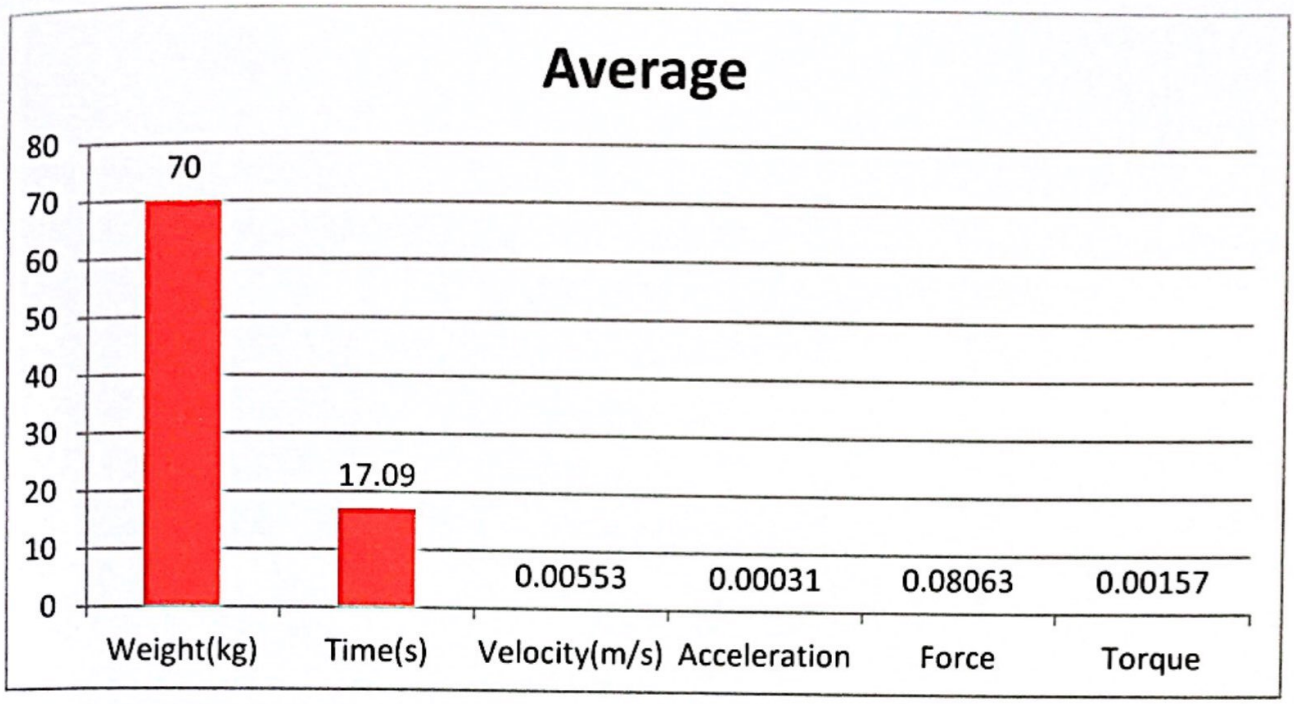

Figure 4. 6: Average of Result Experiment

From Figure 4.6, we can conclude that all average in weight, time taken, velocity, acceleration, force to the walking aid and find the torque of the DC motor. The graph show that the average for weight is 70kg, time taken is 17.09s, velocity is 0.00553m/s and acceleration is 0.00031m/s^2. By using formula. We calculate force and torque. In summary, we can say that the heavier weight the decreasing torque value will produce.

CHAPTER 5

RECOMMENDATION & CONCLUSION

5.1 CONCLUSION

As a conclusion, an innovation of walking aid for rehabilitation patients is a device that created focus to hip fracture patient which is hard to stand up from sitting because standard walking aid design to use in stand position, if use in sit to stand may cause fall. There is a lot walking aid on the market now days, different function and design that more specific for suitable of the user. But there no walking aid that suitable for hip fracture with easy to rise up and automatic adjustable height. This walking aid is very easy to use and handle. Hip fracture patient can be independent, without need anyone help they can move everywhere and do daily life activity.

From the usability test that has done, 5 normal subjects were volunteer to try use the Easy Walker Aid (EWA) with adjustable height. Each of subject have different weight. With design of the walking aid that support user from sitting to standing and then using button for automatic adjustable height accordingly to the user that the range of the height is 32 to 36.5 inches. 5 subjects have test of using the walking aid. From that, we can get difference time taken. By using all the information, we can calculate the velocity, acceleration, force and torque.

After 5 normal subjects do the test on Easy Walking Aid (EWA), they answer all the questionnaire that given to them. From the conclusion, 40% agree that this walking aid is very useful to hip fracture. 60% agree that this walking aid can

recommended to other patients for exam lower limb disabilities. 80% strongly agree that they learn very fast to control the walking aid.

Lastly, as a conclusion, this study to analysis the problem from patient low limb disability that is hip fracture which hard to stand from seated. Patient hip fracture cannot use walking aid to stand from seated because can fall and effect pain other part of body. This project will help and reduce energy of patient to stand from seated easily then the person can move from one place to another place without need anyone help or less of need someone to help and increase their level of confidence to be more in good condition and have a healthy life like a normal person. Hopefully the device can help motivate the patients to do their rehabilitation and also can reduce the time taken for the lower extremity to recover.

5.2 RECOMMENDATION

From this product that is Easy Walking Aid EWA) we can see that many functions can upgrade to be more user friendly, one of the things that not enough time to add is a brake. For future study this walking aid can install GPS to detect where the walker if it gets stolen. Besides that, we can put battery indicator so patient will know the how long battery will survive. Lastly, the walker can control the height by using smart phone.

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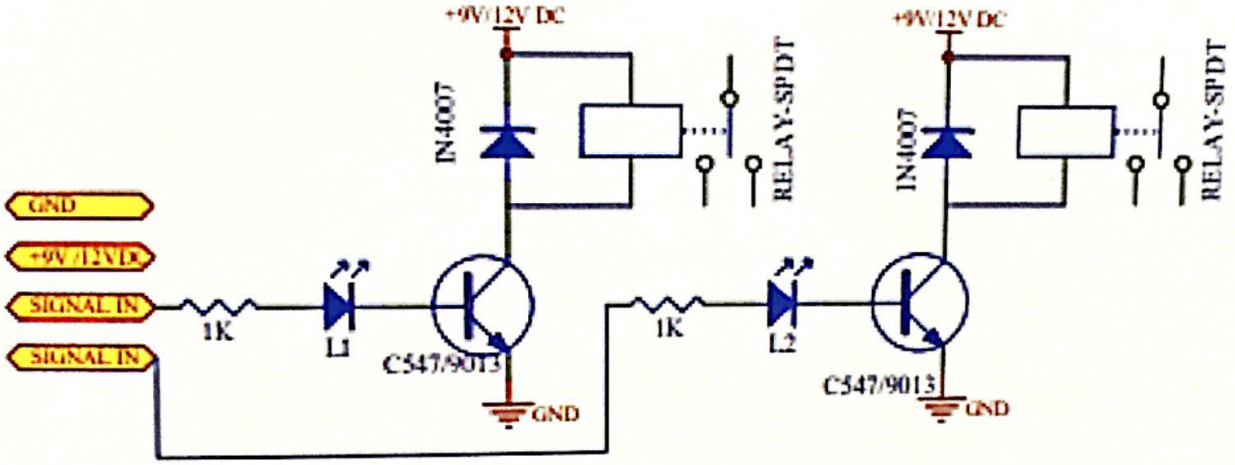
APPENDICES

APPENDIX A SCHEMATIC DIAGRAM



APPENDIX B QUESTIONNAIRE

KEMENTERIAN PENDIDIKAN MALAYSIA

POLITEKNIK MALAYSIA
SULTAN SALAHUDDIN ABDUL AZIZ SHAH

SURVEY QUESTIONNAIRE

AN INNOVATION OF WALKING AID FOR REHABILITATION PATIENTS

DISCLAIMER:

Thank you for taking time to fill in this questionnaire. You will remain anonymous. The objective of this questionnaire is to get some data through the range of agree or disagree of information about an innovation of walking aid for rehabilitation patients.

The survey based on the final year of Bachelor of Electronic Engineering (Medical Electronic) project device, an Easy Walking Aid (EWA). This will be helpful to improve and enhance the device in future. This walker focus hip fracture patient which unable to walk and move from sitting to standing position without support, but upper limb can move normally such as hand. Participant of this survey are entirely voluntary and all the data will be recorded and analyzed.

This questionnaire divided into two sections (A and B)

Section A: Demographic

1. Gender : ☐ Male
   ☐ Female

2. Age : ☐ 20-30 years
   ☐ 31-40 years
   ☐ 41-50 years
   ☐ Others: .....

Section B: An Innovation Of Walking Aid For Rehabilitation Patients

This section contains two part of question. Please read the question and tick (✓) your response in the space provided based on the scale given.

1	2	3	4	5
Strongly disagree	Disagree	Uncertain	Agree	Strongly agree

An Innovation Of Walking Aid For Rehabilitation Patients		1	2	3	4	5
1.	The device is very useful to lower limb disabilities person especially hip fracture patient.					
2.	The device should be used every day to help hip fracture patient move independently.					
3.	The device should be a comfortable for a long time used.					
4.	The device can be recommend to other patient injury leg, paralyzed					
5.	The device ensure the safety of the user					
6.	Patient will learn to use the device product very quickly.					
7.	The device can be commercialized in rehabilitation unit, hospital and pharmacy.					

An Innovation Of Walking Aid For Rehabilitation Patients		1	2	3	4	5
1.	I was found this product is easy to used and friendly.					
2.	The design walker is suitable and comfortable.					
3.	The push button is place on the good position.					
4.	The speed of adjustable height of this walker is suitable					
5.	The walker is safety to use.					

If you have comments or recommendation about this project, please write in the space below. Thank you ☺

APPENDIX C COSTING PROJECT

BIL.	ITEMS	QUANTITY	PRICE (RM)
1	BATTERY 12V	1	60.00
2	WALKING FRAME	1	90.00
3	DC MOTOR (LINEAR ACTUATOR)	2	350.00
4	FORWARD REVERSE RELAY	1	15.00
6	WHEELS	2	50.00
	TOTAL	**7**	**565.00**