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POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

DHA SMART WALKING AID

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JABATAN KEJURUTERAAN MEKANIKAL

SESI 1: 2022/2023

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Laporan ini dikemukakan kepada Jabatan Kejuruteraan Mekanikal

sebagai memenuhi sebahagian syarat penganugerahan Diploma

Kejuruteraan Mekanikal

JABATAN KEJURUTERAAN MEKANIKAL

SESI 1: 2022/2023

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2. Kami mengakui bahawa "Projek tersebut di atas' dan harta intelek yang ada di dalamnya adalah hasil karya/reka cipta asli kami tanpa mengambil atau meniru mana-mana harga intelek daripada pihak-pihak lain.

3. Kami bersetuju melepaskan pemilikan harta intelek 'projek tersebut' kepada 'Politeknik tersebut' bagi memenuhi keperluan untuk peanugerahan **Diploma Kejuruteraan Mekanikal** kepada kami.

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ABSTRACT

A walking aid is one of several devices that can help patients to improve their walking patterns, balance, or safety while moving. Some patients have trouble adjusting the height of their assistive device because the patient moves in an uncomfortable poster position. This is because the body height of each patient varies. The purpose is to help patients, especially Geriatric rehabilitation and Amputee rehabilitation. The method introduced to solve this problem is the Push Button concept on the Linear Actuator which has been designed and branded as DHA Smart Walking Aid. DHA Smart Walking Aid was successfully designed and fabricated also testing has been made on the actuator and walking aid to accommodate the maximum human weight. The actuator can lift to 150 mm, taking about 13 to complete the movement. We have analyzed an elderly person to test our product, we have tested our product on walking and our walking aid sustainability, and as a result of our testing, we found the subject body posture that is bent over can become straight. In conclusion, as a result of the analysis and discussions conducted this product has achieved the objectives that have been discussed.

Keywords: walking aid, rehabilitation, help, linear actuator, body posture

ABSTRAK

Alat bantu berjalan adalah salah satu daripada beberapa peranti yang boleh membantu pesakit untuk memperbaiki corak berjalan, keseimbangan atau keselamatan mereka semasa bergerak. Sesetengah pesakit menghadapi masalah melaraskan ketinggian alat bantuan mereka kerana pesakit bergerak dalam kedudukan poster yang tidak selesa. Ini kerana ketinggian badan setiap pesakit berbeza-beza. Tujuannya adalah untuk membantu pesakit khususnya rehabilitasi Geriatrik dan rehabilitasi Amputee. Kaedah yang diperkenalkan untuk menyelesaikan masalah ini ialah konsep Push Button pada Linear Actuator yang telah direka dan dijenamakan sebagai DHA Smart Walking Aid. DHA Smart Walking Aid telah berjaya direka dan direka dan ujian telah dibuat pada penggerak dan bantuan berjalan untuk menampung berat maksimum manusia. Penggerak boleh mengangkat sehingga 150 mm dan mengambil masa kira-kira 13 untuk melengkapkan pergerakan. Kami telah melakukan analisis ke atas seorang warga emas untuk menguji produk kami, kami telah menguji produk kami pada berjalan kaki dan kemampanan bantuan berjalan kami, dan hasil ujian kami, kami mendapati postur badan subjek yang membongkok boleh menjadi lurus. Kesimpulannya, hasil daripada analisis dan perbincangan yang telah dijalankan bahawa produk ini telah mencapai objektif yang telah dibincangkan.

Kata kunci: bantuan berjalan, pemulihan, bantuan, penggerak linear, postur badan

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CHAPTER 1

INTRODUCTION

1.1 RESEARCH BACKGROUND

Nowadays, walking aids have been widely used in society, especially among the elderly. A walker is a walking aid that has four points of contact with the ground and usually has three sides with the side closest to the patient open. It provides a wider base of support than crutches and is widely used to stabilize patients with poor balance and mobility. Having a guard and not being able to walk more than one meter per second has been associated with the use of a walking frame.

Paradoxically, the use of walkers or frames has been associated with an increased risk of falls in both community residents and those living in residential care. Although there is a positive correlation between device use and falls, caregivers report that mobility aids promote independent mobility among people with disabilities, and users report that mobility aids increase opportunities for social interaction. Using a walker can also increase metabolic and musculoskeletal demands so prescription and education are key to helping users maintain their balance, minimize the risk of falls and optimize their activity level.

About the current problem, the Internet of things is a technology that allows us to add devices to inert objects (for example mailboxes, vehicles, lighting lamps, etc.) that can measure environmental parameters, generate relevant data and send them through communication and networks. Despite what it is called, the Internet of Things is not all function based solely on Internet connectivity. A Push Button Switch is a type of switch that consists of a simple electrical mechanism or an air switch mechanism to turn something on or off. Depending on the model they can operate with a momentary or latch action function. A Push Button Switch is a type of switch that consists of a simple electrical mechanism or an air switch mechanism to turn something on or off. Depending on the model they can operate with a momentary or latch action function. Therefore, **‘Smart’** has an IoT concept that is adapted to the use of a walking frame that allows each user to adjust the height of the walking frame with just a fingertip.

Therefore, the three of us decided to do a project that would facilitate and help patients or users to adjust the height of the walker to a comfortable condition. We came up with the name **'DHA Smart Walking Aid'** for our project. The result of the DHA product name consists of **'D'** which is *Disease* refers to the condition of patients suffering from chronic problems, including hip and knee arthritis, as well as those suffering from acute injuries, such as sprained ankles and broken legs. **'H'** refers to *Hospital* as this Project is specifically for use in Orthopedic Rehabilitation Centers. **'A'** is an *Actuator* that works to produce motion by converting energy and signals into the system.

1.2 PROBLEM STATEMENT

Patients sometimes have to face difficulties using most non-adjustable walkers. For example, elderly people or patients with chronic knee problems, suffer from acute injuries such as sprained ankles and broken legs. So, they had to ask for help from a nurse or people nearby to manually adjust the height to the user's comfort. However, there is still a height distance that cannot be set according to the user's height resulting in the patient being uncomfortable moving.

In addition, the most important feature of any walking aid is safety, but comfort and usability are good. Walking aids come with various features and sometimes lack some important features. For example, most walkers are not equipped with safety features for use during alertness. Can only be controlled while walking and stopping walking. The upcoming function can reduce the accident factor for patient safety.

In Malaysia, the vast majority of users using walking aids are based on self-use. So, We decided to propose this project for use in the hospital rehabilitation center. It is also open to all patients facing related problems.

1.3 RESEARCH OBJECTIVES

The objectives of this research are:

i. Design an innovative solution to help the elderly, patients with chronic knee problems, acute injuries such as sprained ankles, broken legs, and with hunched body postures.

ii. To fabricate a walking frame design that is easy to adjust without asking for help from others.

iii. To test the effectiveness of the DHA Smart Walking Aid for the elderly.

1.4 RESEARCH QUESTIONS

This study will answer the following research questions:

i. How to convince the elderly and existing users to use this DHA Smart Walking Aid?

ii. How to find the right materials to modify these walking aids?

iii. Is it necessary to change the existing fit walker?

1.5 SCOPE OF RESEARCH

The scopes and limits of this research are:

i. People who need support such as the elderly and patients who have difficulty walking.

ii. The use of the walking frame is simple and easy.

iii. Suitable for elderly people who are bent over.

1.6 SIGNIFICANCE OF RESEARCH

This study has several importance. Among them are :

i. To help balance the body when the user walks and passes on uneven ground. With this device, the disabled, the elderly, and the chronically ill can walk without having to ask for help from others.

ii. Can reduce pressure on the spine and knees. The effect is to provide additional energy and balance, reducing stress on the knee when walking. The pressure load on the body and back can be reduced.

iii. Can minimize limb activity.

iv. This aid is innovated to facilitate the correct height for the user automatically.

1.7 DEFINITION OF OPERATIONAL TERMS

i. Walking Frame

- A frame on which a person pushes to move, which allows the maintenance of stability and balance and the support of body weight while walking or standing; with hand grip, without forearm support, and with either four ends or two ends.

ii. Linear Actuator

- Linear actuators work on the walker by adjusting the height or equipment in a straight line and repeating if necessary.

iii. Push Button Switch

- A Push Button Switch is a type of switch that consists of a simple electrical mechanism or an air switch mechanism to raise or lower something.

iv. Protection Cap Crutch Rubber End Tips Skid

- End caps for crutches provide significant additional safety in the mobility of people who need load-bearing points to move. All this makes them individuals who not only need physical but also emotional support to walk. And the end cap in bad condition, unable to perform its function properly, can lead to a situation that has bad consequences.

1.8 CHAPTER'S SUMMARY

In conclusion, DHA Smart Walking Aid is based on the original walking frame device. We improve the existing walking frame into something else by placing a Linear Actuator that is controlled using a push button switch. Thus this tool will be an important help in time of need and a perfect choice for any kind of situation. In this paper, we have introduced the draft and implementation of a cost-effective, flexible and easy-to-use solution for our product.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In the context of aging, According to Chung & Mansur (2018), Malaysia is now preparing to become older when 7% of the total population in the country reaches the age of 65 and above in 2030[1]. According to Chew Mei Fun (2017) (Deputy Minister of Development Women, Family and Society), the population of young people and those aged 60 and over can share the same share, where each group will occupy up to 20% of the country's total population by the year 2045 (Old People Outnumbered, 2017).[2]

Thus, the Department of Statistics Malaysia (2017) stated, the elderly in Malaysia will reach up to 6.0 million residents by 2040. There is a change in the scenario compared to now and back in the 1970s. In 1970, only 3.3% of the country's total population was over 65 years old, and the majority of the population was younger than 14 at that time. However, the proportion of the elderly is increasing nowadays. There are 2.10 million (6.5%) of the total population aged 65+ in 2018 compared to 2.00 million (6.3%) in 2017 which shows almost double the size of the elderly in 1970 (Mahidin, 2018).[3]

The increase in the elderly population is a result of longer life expectancy and a lower birth rate compared to the birth rate in 1970. As the number of elderly people increases, injuries such as the risk of falls among the elderly will be one of the correlated issues that will be raised as well. Therefore, there should be attention to putting more effort into reducing the risk of falls among the elderly. To overcome this problem, action needs to be taken as an initial preparation to take care of them.[4]

2.2 The History Of Walking Frame

prepared by Muhammad Haziq Luqman Bin Musanief (08DKM20F1078)

2.2.1 Introduction

Walking Frame is mentioned in British English while Walker is mentioned in North American English. A device that provides support to maintain balance or stability while walking, often due to age-related mobility disabilities, including frailty. Another common equivalent term for walkers is the frame, a generic trademark from Zimmer Biomet, a leading manufacturer of such devices and joint replacements. A walker has two front wheels, and there are also wheeled walkers that have three or four wheels, also known as rollers.[5]

Walking Frame began to appear in the early 1950s. The first US patent was awarded in 1953 to William Cribbes Robb of Stretford, UK for a device called a "walking aid" which was filed with the British patent office in August 1949. Two variants with wheels were both awarded US patents in May 1957, and the first non-wheeled design called a "walker" was patented in 1965 by Elmer F. Ries of Cincinnati, Ohio. The first walker resembling the modern walker was patented in 1970 by Alfred A. Smith of Van Nuys, California.

The basic design consists of a lightweight frame that is about waist height, about 12 inches (30 cm) deep, and slightly wider than the user. Walkers are also available in other sizes such as children (for children) or bariatric (for obese people). Modern walkers are height adjustable and should be set at a comfortable height for the user, but will allow the user to maintain a slight bend in their arm. This bend is necessary to allow proper blood circulation through the arm when the walker is in use. The two front legs of the walker have wheels attached or not, depending on the strength and abilities of the person using them. It is also common to see castor wheels or skids on the back legs of pedestrians with wheels in front.[6]

2.2.2 Advantages of Walking Frame

When a person is unsteady on their feet and is at risk of falling, naturally they need to use a walking frame to help with stability and safety. A walking frame is also required if the user has limited lower body strength. A walking frame can act as a support during walking, reducing the load on the lower limbs and hips.

Many advantages can be gained from using a walking frame. Firstly, can improve physical security. Using a walking frame can help individuals avoid tripping and falling. This is especially important for older users as falls can have dire consequences with increasing age and frailty.

Secondly, Greater Freedom for users. For both the elderly and the physically challenged, the use of a walking frame can dramatically increase their level of independence. Being able to walk without the help of others means they are much more likely to be able to do small tasks for themselves.[7]

Additionally, it can increase the probability that users can engage in some form of exercise by giving individuals the opportunity to walk on their own. This can be anything from walking around the house to going out and about and taking the walking skeleton with them outside.

Further, Being able to encourage more standing without the use of a walking frame, those with mobility issues may be far less likely to stand regularly, instead choosing to remain seated throughout the day. Many health experts will tell you that sitting for long periods is not entirely good for one's posture and internal organs. Having a walking frame that allows the user to stand freely, is the best way to combat this health concern.

Finally, can reduce stress on the body. By distributing the weight and allowing the upper body to take some of the strain of walking, walkers can minimize stress on their bodies.

There are some additional benefits, such as the ability to walk longer, and the use of a walking frame when recovering from surgery. Overall, some major improvements can be gained by individuals who choose to try out a walking frame.

2.3 MATERIAL SELECTION

1) Walking Frame

prepared by Alif Danial Bin Mohamad Rais (08DKM20F1055)

The main material we use is Walking Frame. we bought this device on Shopee. This device is very easy to use. Walking Frame is designed as a mobility aid for people who only need stability. This device can also save space when carried in the car. By simply folding both sides that will become one surface only. In addition, this Walking Frame Material is made of Sturdy Aluminum. This Walking Frame is also equipped with 2 sets of additional wheels. Can support a load of 100 kg. It is also ergonomically designed to handle with soft a vinyl contoured grip that provides comfort. Suitable for Elderly Seniors, pregnant women, Sick Patients, and Mentally or Disabled persons. And finally, Can reach a maximum height of 74 cm - 84 cm.

Figure 2.3.1 – Walking Frame

2) Lead Acid Battery

prepared by Muhammad Aliff Bin Mohd Sapri (08DKM20F1075)

Lead acid batteries are the most used type of battery in photovoltaic systems. Although lead acid batteries have a low energy density, only moderate efficiency, and high maintenance requirements, they also have a long lifetime and low costs compared to other battery types. One of the singular advantages of lead acid batteries is that they are the most used form of battery for most rechargeable battery applications (for example, in starting car engines), and therefore have a well-established established mature technology base.

Figure 2.3.2 - Lead Acid Battery

3) Linear Actuator

prepared by Muhammad Haziq Luqman Bin Musanief (08DKM20F1078)

Defined simply, an actuator is a device that converts energy, which may be electric, hydraulic, pneumatic, etc., to mechanical in such a way that it can be controlled. The quantity and the nature of input depend on the kind of energy to be converted and the function of the actuator. Electric and piezoelectric actuators, for instance, work on the input of electric current or voltage, for hydraulic actuators, it's incompressible liquid, and for pneumatic actuators, the input is air. The output is always mechanical energy.

The definition, A linear actuator transforms the rotational movement of the motor into a straight line. A conventional electric motor moves in a circle, while a linear actuator moves forward and backward. Push and pull actions allow the device to slide, type and lift items with the push of a button.

Actuators are not something you would read about every day in media, unlike artificial intelligence and machine learning. But the reality is that it plays a critical role in the modern world almost like no other device ever invented. In short, their use is endless because any mechanical movement requires them, and most devices require some form of mechanical movement.

Figure 2.3.3 – Linear Actuator

The following are the usual components that are part of the functioning of an actuator:

- Power source: This provides the energy input that is necessary to drive the actuator. These are often electric or fluid in nature in the industrial sectors.
- Power converter: The role of the power converter is to supply power from the source to the actuator by the measurements set by the controller. Hydraulic proportional valves and electrical inverters are examples of power converters in industrial systems.
- Actuator: The actual device that converts the supplied energy to mechanical force.
- Mechanical load: The energy converted by the actuator is usually used to make a mechanical device function. The mechanical load refers to this mechanical system that is driven by the actuator.
- Controller: A controller ensures that the system functions seamlessly with the appropriate input quantities and other setpoints decided by an operator.

4) Arduino Uno

Prepared by Muhammad Haziq Luqman Bin Musanief (08DKM20F1078)

Arduino Uno is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

The Arduino platform has become quite popular with people just starting with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) to load new code onto the board -- you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.

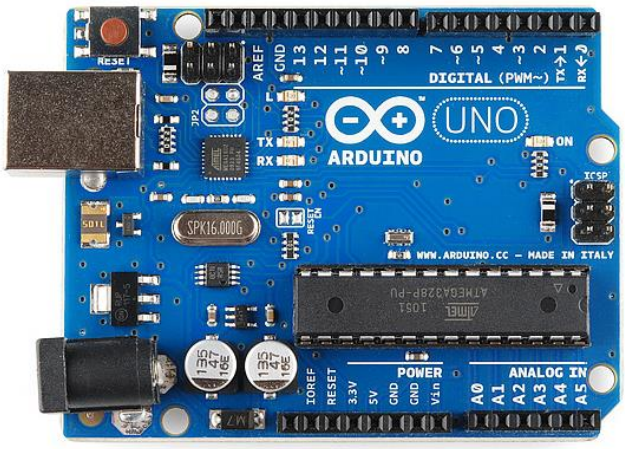


Figure 2.3.4 – Arduino Uno

Advantages

- Arduino is very cheap compared to others
- Very beginner friendly
- The most used Arduino board
- It has easy and more documentation
- It's easy to prototype using this board
- It has many existing open-source projects
- Small size

Disadvantages

- It has very limited processing power so it cannot be used for projects that require high processing such as computer vision, speech recognition, deep learning etc.
- It has limited storage, ram, flash memory etc.
- It is not in the industry standard.

5) Push Button Switch

Prepared by Muhammad Aliff Bin Mohd Sapri (08DKM20F1075)

A push-button (also spelled push button) or simply button is a simple switch mechanism to control some aspect of a machine or a process. Buttons are typically made out of hard material, usually plastic or metal. The surface is usually flat or shaped to accommodate the human finger or hand, to be easily depressed or pushed. Buttons are most often biased switches, although many unbiased buttons (due to their physical nature) still require a spring to return to their un-pushed state. Terms for the "pushing" of a button include pressing, depressing, mashing, slapping, hitting, and punching.

In Arduino, push buttons or switches connect two points in a circuit when you press them. It is used for simple power controlling switches of a machine or appliance.

Figure 2.3.5 – Push Button Switch

6) Relay Module Channel

Prepared by Muhammad Haziq Luqman Bin Musanief (08DKM20F1078)

A power relay module is an electrical switch operated by an electromagnet. The electromagnet is activated by a separate low-power signal from the microcontroller. When activated, the electromagnet attracts to either open or close an electrical circuit.

A simple relay consists of a coil of wire wound on a soft iron core, or solenoid, an iron yoke that provides a low reluctance path for the magnetic flux, a movable iron armature and one or more sets of contacts. A movable armature is fastened to a yoke and connected to one or more sets of movable contacts. Held in place by a spring, the armature leaves a gap in the magnetic circuit when the relay is de-energized. While in this position, one of the two sets of contacts is closed while the other set remains open.

When an electric current is passed through the coil, it creates a magnetic field which in turn activates the armature. This movement of the movable contact makes or breaks the connection with the fixed contact. When the relay is de-energized, the set of closed contacts opens and disconnects and vice versa if the contacts are open. When turning off the current to the coil, the armature is returned, forcibly, to its relaxed position. This force is usually provided by a spring, but gravity can also be used in certain applications. Most power relays are manufactured to operate quickly.

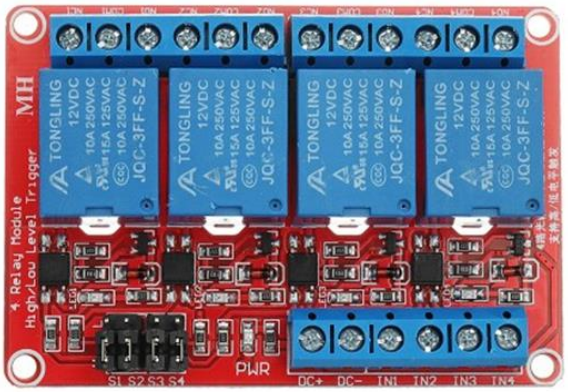


Figure 2.3.6 – Relay Module Channel

7) Protection Cap Crutch Rubber End Tips Skid

Prepared by Alif Danial Bin Mohamad Rais (08DKM20F1055)

End caps for crutches are an indispensable item for ensuring the safety of those obliged to walk with the help of these aids. However, the use of crutches may be necessary for a variety of reasons. It may be for a short period, due to a specific accident or injury. Or for a prolonged period, because of mobility problems and the need for support in movement. Either way, achieving stable, safe and effective support is essential; and this can be achieved by placing caps on the end of the crutch or walking stick.

When we talk about the tips or end caps for crutches and walking sticks we are referring to safety components that must fulfill certain characteristics. Thus, they must have good adhesion to the floor. Ensuring stability is paramount to avoid the possibility of slipping or falling. To this end, they must also possess enough flexibility to adapt correctly to various terrains and their irregularities.

Moreover, they must also provide a significant amount of strength and cushioning, so that the upper body does not suffer from using the crutches. In particular the upper extremities, elbows, shoulders and hands can be over-exerted by absorbing the impact of every step and load imparted by the crutches.

Figure 2.3.7 –Crutch Rubber End

2.4 CHAPTER'S SUMMARY

As a conclusion of this chapter, the literature review is very important to showcase all the studies of materials and methods to increase knowledge about this project. Every thesis and other projects related to Walking Frame, Arduino Uno, and Linear Actuator are very helpful, especially for us to understand them fully.

After many materials and methods were discussed and research was done, the most suitable materials for our project were as mentioned above. Therefore, because of its character and advantages, the method we decided to run is the Push Button coding method. This is because the method is simple and easy to understand.

Finally, this product is very convenient and affordable. As we can see products that exist out there but are expensive so we create the same device with low cost and the same purpose.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

According to ("methodology - definition of methodology in English from the Cambridge English Dictionary," n.d.), the methodology is defined as a system of ways of doing, teaching, or studying something. The purpose is to describe the research methodology used for this project, explain how to design the proposed product, elaborate on the process used in creating the product, data collection, and analyze the collected data.[8]

Several tools and requirements need to be used to run the research. Personal laptop computer with Windows 10 platform to store all files, documents, and browse research papers. Moreover, Microsoft office is a graphical word processing program to process, manipulate, save, and share a text-based document made by Microsoft computer company also being used. Google Chrome helps the author to browse files, photos and provide resources or information for product research.

This chapter will cover a details explanation of methodology throughout the making of the final project. There will be a flow chart showing the operation of the whole project and the approaches we took. Meanwhile, the Gantt chart shows the project timeline chart with the lists of project activities. Next, the project activity will display the actual and planning throughout all 14 weeks of final year project development. Moreover, in this chapter, we also will show two methods of research to carry out the final year project. Yet, these two methods have their pros and cons.

Among the two methods is a TIG Welding connection using a Stainless Steel stick or Bolt and nut connection. The head of the bolt and the screw (external cylindrical length) are connected to form a class of Nuts, and the need for a nut in the assembly of the lid is in two parts with a hole. According to the research on the size of the diameter between the Walking Frame and the Linear Actuator, it is suggested to use Bolt and Nut Connection. Therefore, in this chapter, we will discuss these two methods and which one we choose.

3.2 FLOW CHART

prepared by Muhammad Aliff Bin Mohd Sapri (08DKM20F1075)

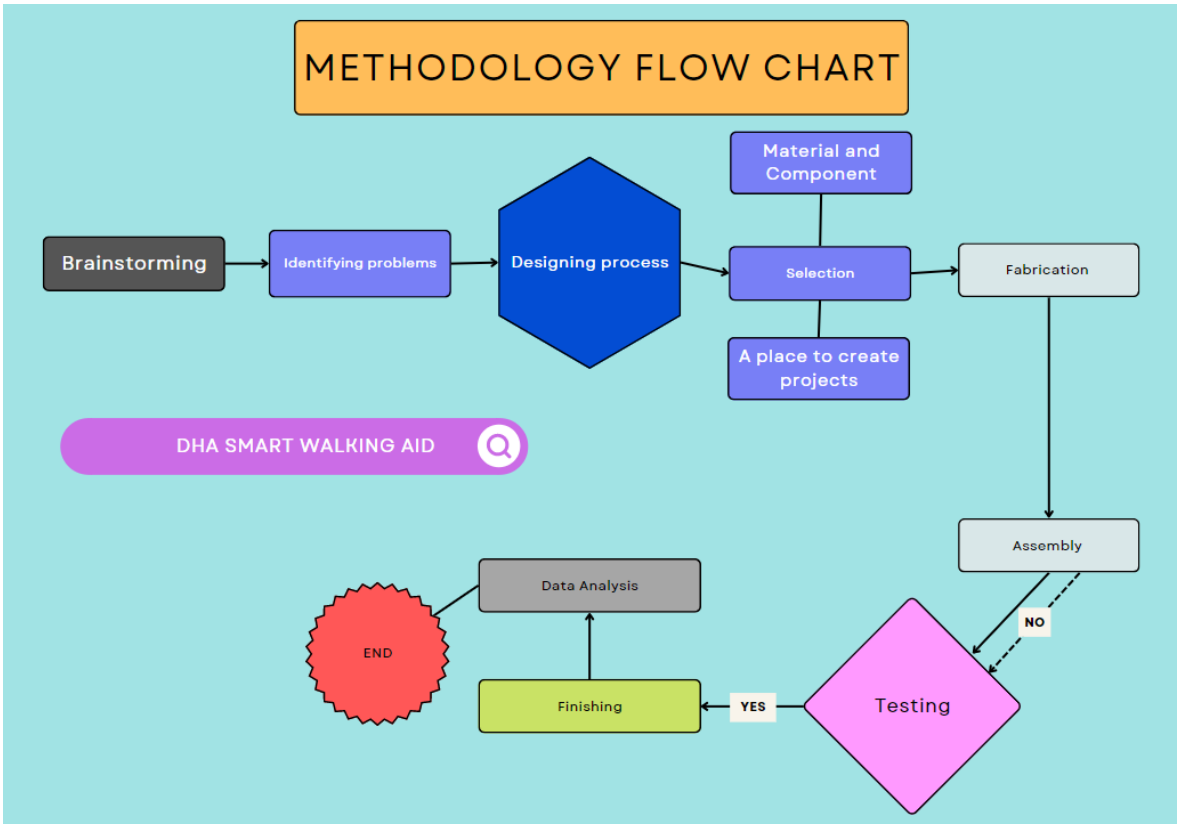


Figure 3.2.1 – Flow Chart

A flowchart is a visual representation of steps and decisions needed to perform a process. Each step in the series is noted within a diagram shape. Connecting lines and directional arrows link the steps in the process. This chart allows anyone to view the chart workflow and logically follow the process from beginning to end.

3.3 FLOW CHART EXPLANATION

1) START

prepared by Alif Danial Bin Mohamad Rais (08DKM20F1055)

The main thing is to get started, yet it is the first step for anything. A good start makes the rest more manageable, and it lays a foundation to build upon in completing the project. Somewhere down the line when anything ends its outcome is partly dependent on how it began. Define and identify the project's main meaningful goal that will ultimately lead to project success. The goals will save time in the long run by accelerating the overall project strategy. Identify specific Achievements, actions, and obstacles associated with each goal along with a step-by-step action plan for accomplishing goals and overcoming obstacles.

2) PRODUCT DESIGN

prepared by Muhammad Haziq Luqman Bin Musanief (08DKM20F1078)

Every product produced by any organization should have distinguishing physical characteristics that will make it attractive to customers, also known as design. A well-designed product makes a significant difference to the customer's perception of the product, and individual factors influence the customer's decision about the creation of a particular product, these factors are attributes of value perceived by the customer. This project comes with a new design of a Walking Frame along with Linear Actuator with solutions to redesign currently available products. The redesign means changing some aspects of the design so that it can be produced at a lower cost than an external product.

Autodesk Fusion 360 – 2022

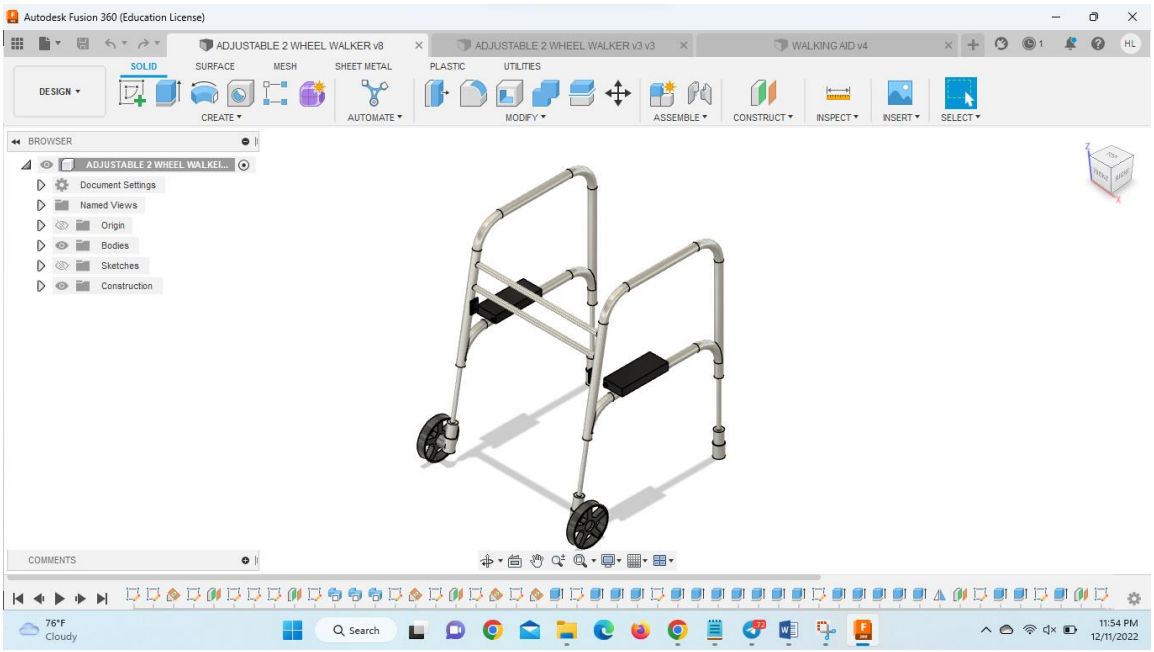


Figure 3.3.1 – Design trial 1

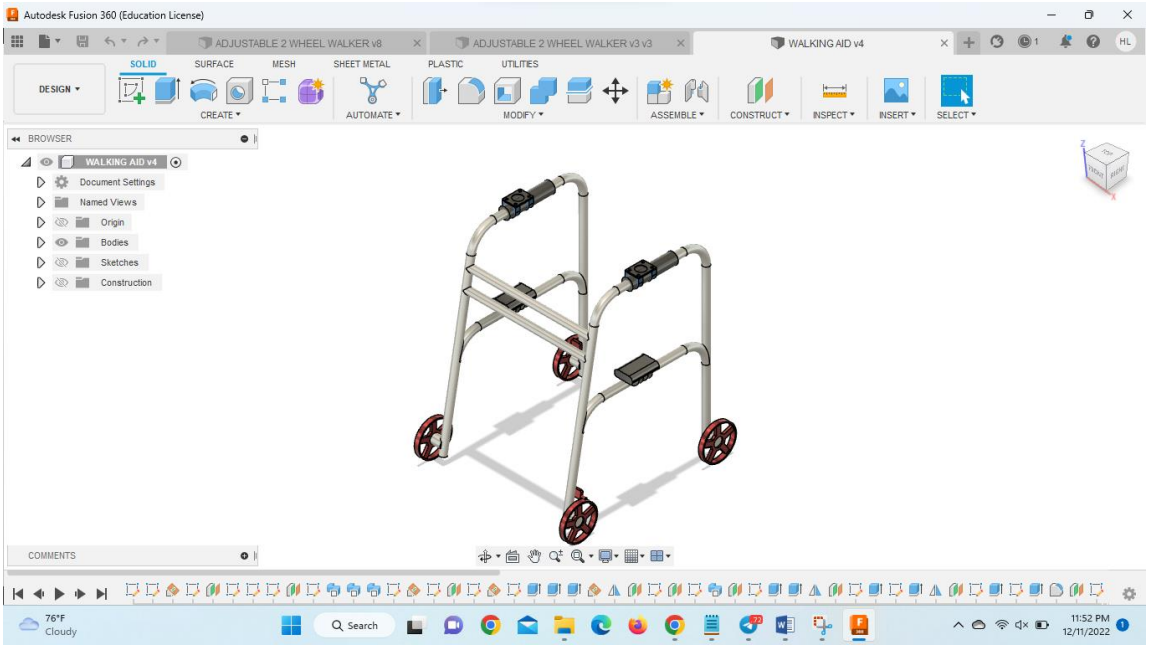


Figure 3.3.2 – Design trial 2

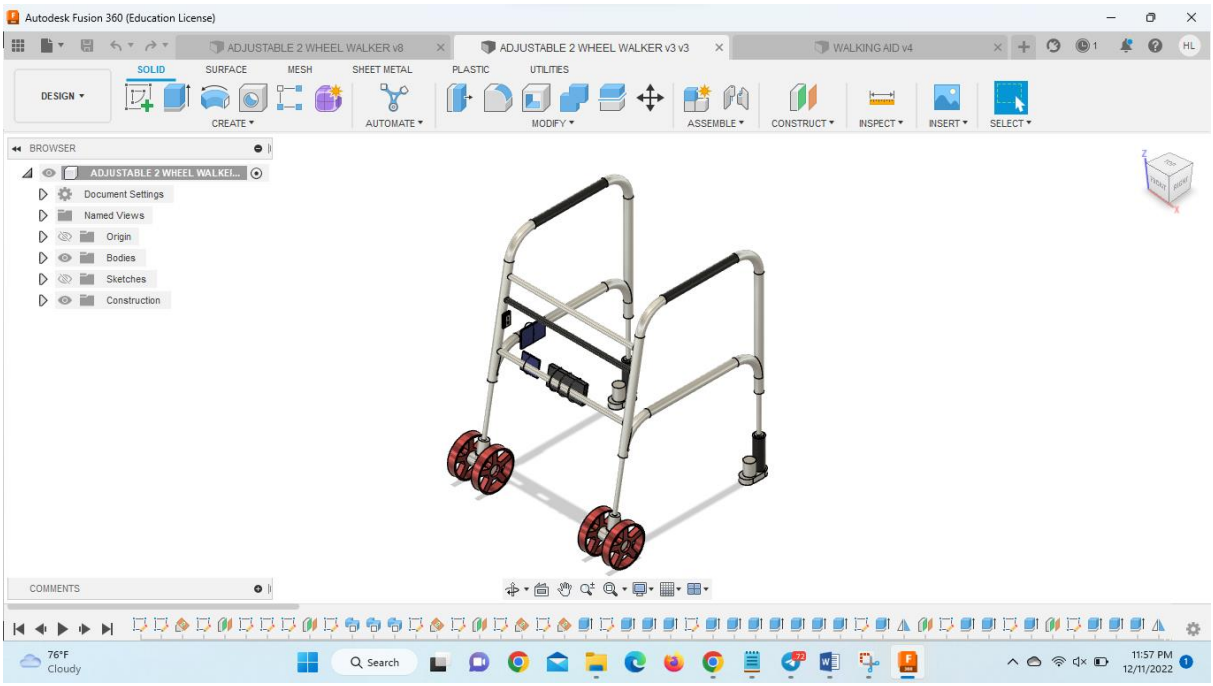


Figure 3.3.3 - Final design of the project

3) MATERIAL PURCHASE

Prepared by: Alif Danial Bin Mohamad Rais (08DKM20F1055)

Material selection begins with the identification and prioritization of critical design criteria. Material selection is the act of choosing the material best suited to achieve the requirements of a given product. Many different factors determine the selection requirements, such as mechanical properties, physical properties, and cost.

The main functions of material purchase are to obtain the required amount of materials at a reasonable price. Investment in the raw material is 50% to 60% of the total cost of the product. So, it is vital to buy raw materials at a low price. The first step of material purchasing, classify all the materials according to the nature of the material. Studies the purchase requisition which it gets from product design and makes the list of necessary material requirements. Awareof the market conditions and must know the sources of supply. Purchased materials should be entered in the note, and receipt of the materials is kept for budget calculation.

Walking Frame

Prepared by: Alif Danial Bin Mohamad Rais (0DKM20F1055)

The person walks with the frame surrounding their front and sides and their hands provide additional support by holding on to the top of the sides of the frame. Traditionally, a walker is picked up and placed a short distance ahead of the user. The user then walks to it and repeats the process. With the use of wheels and glides, the user may push the walker ahead as opposed to picking it up. This makes for easier use of the walker, as it does not require the user to use their arms to lift the walker. This is beneficial for those with little arm strength.

A walker is often used by those who are recuperating from leg or back injuries. It is also commonly used by persons having problems with walking or with mild balance problems.

Specifications

Height	74 – 84 cm
High Strength Material	Stainless Steel and Aluminium Alloy
Ergonomically	The designed handle with soft Vinyl Contoured Grip provides comfort and security.
Made from	Sturdy aluminium construction.
Net Wight	2.5 kg
Load Bearing	100 kg
Suitable for	Elderly Seniors, pregnant women, Sick Patients, Mentally or Disabled persons, and others need this product.

Figure 3.3.4 – Walking Frame

Lead Acid Battery

Prepared by: Muhammad Aliff Bin Mohd Sapri (08DKM20F1075)

Lead acid batteries are the most used type of battery in photovoltaic systems. Although lead acid batteries have a low energy density, only moderate efficiency, and high maintenance requirements, they also have a long lifetime and low costs compared to other battery types. One of the singular advantages of lead acid batteries is that they are the most used form of battery for most rechargeable battery applications (for example, in starting car engines), and therefore have a well-established established mature technology base.

Specifications :

Voltage	12 V
Nominal capacity	1.2 Ah
Size	95mm X 42mm X 52mm
Weight	0.7 Kg
Self-discharging factor	5% per month
Min charging	10 Hours
Lifetime of battery inverter	10 Years

Figure 2.3.5 - Lead Acid Battery

Linear Actuator

Prepared by: Muhammad Haziq Luqman Bin Musanief (08DKM20F1078)

An actuator is a device that uses a form of power to convert a control signal into mechanical motion. From electric door locks in automobiles, to ailerons on aircraft, actuators are all around us. Industrial plants use actuators to operate valves, dampers, fluid couplings, and other devices used in industrial process control. The industrial actuator can use air, hydraulic fluid, or electricity for motive power. These are referred to as pneumatic, electro-hydraulic, or electric actuators.

Specifications :

voltage	12 DC
Rated current	2 A
Rated power	20W
Max. Speed	70mm/s(for 150N)
Max. Load	150N
Wire Length	75cm

Figure 3.3.6- Linear Actuator

Arduino Uno

Prepared by: Muhammad Haziq Luqman Bin Musanief (08DKM20F1078)

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller developed by Arduino and initially released in 2010. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced with various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), and 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.

Specifications :

Microcontroller	12 V
Operating Voltage	5 V
Input Voltage	7-12 V
Output Voltage (limit)	6-20 V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
DC Current per I/O Pin	20 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by the bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
LED_BUILTIN	13
Length	68.6 mm
Width	58.4 mm
Weight	25 g

Push Button Switch

Prepared by: Muhammad Aliff Bin Mohd Sapri (08DKM20F1075)

In Arduino, push buttons or switches connect two points in a circuit when you press them. It is used for simple power controlling switches of a machine or appliance.

Figure 3.3.7 – Push Button Switch

Relay Module

Prepared by: Muhammad Haziq Luqman Bin Musanief (08DKM20F1078)

A power relay module is an electrical switch operated by an electromagnet. The electromagnet is activated by a separate low-power signal from the microcontroller

Rated through-current	10A (NO) 5A (NC)
Max. switching voltage	250VAC/30VDC
Max. switching current	10A
Size	76mm x 56mm x 17mm

Figure 3.3.8 – Relay Module Channel

Protection Cap Crutch Rubber End Tips Skid

Prepared by: Alif Danial Bin Mohamad Rais (08DKM20F1055)

End caps for crutches are an indispensable item for ensuring the safety of those obliged to walk with the help of these aids. However, the use of crutches may be necessary for a variety of reasons. It may be for a short period, due to a specific accident or injury. Or for a prolonged period, because of mobility problems and the need for support in movement. Either way, achieving stable, safe and effective support is essential; and this can be achieved by placing caps on the end of the crutch or walking stick.

Figure 3.3.9 –Crutch Rubber End

4) METHOD SELECTION

prepared by Alif Danial Bin Mohamad Rais (08DKM20F1055)

Method Selection plays an important part in the overall design of production and operations to satisfy the needs of the product. Method selection involves strategically choosing which types of work processes to include in the production of a product. Each step in the production process can be completed in a variety of ways. Choosing the right processes most efficiently can increase production output, decrease operational costs and enhance product quality

The goal of method Selection is to realize the form of a method that fulfills the needs of the product and contributes many potentially beneficial ways explored, hence the developmentof better products for users.

TIG Welding Process

In the TIG welding process, an arc is formed between a pointed tungsten electrode and the surface layer of a Walking Frame with a Linear Actuator in an inert atmosphere of argon or helium. The small intense arc provided by the pointed electrode is ideal for high-quality and precision welding. Since the electrode is not used during welding, the TIG welder does not have to compensate for the heat input from the arc as the metal is deposited from the molten electrode. When filler metal is required, it must be added separately to the weld pool.

Bolts and Nuts installation

Bolts and nuts are also used as materials for fastening wooden or metal parts. These bolts will expand when tightened and are ideal for mounting parts that require strong hold. While a Nut is a pair of bolts. The nut works to lock and strengthen the bolt's grip on the workpiece. For the selection of Bolts and Nuts will use the Hexagon shape.

5) FABRICATION

prepared by Muhammad Haziq Luqman Bin Musanief (08DKM20F1078)

Fabrication is the process of making something from semi-finished or raw materials rather than from ready-made components. In other words, it is the process of making something from scratch rather than assembling it. Fabrication term referring to any process that cuts, shapes, or molds metal material into a final product. Fabrication depends on both the beginning material and the desired end product.

Cutting Parts of the Walking Frame

1. Open the walking frame that is tightened using an adjustable spannerdetach the speakers from the headband for parts
2. Open all the wheels to cut the stainless steel part
3. Cut off all the legs to be replaced using the Actuator
4. Cut off the excess metal legs on the wheels
5. Every cut smooths the surface so that it is neat and safe.
6. Mark the location of the bolt and nut holes
7. Punch at the marker using a grinding machine

Figure 3.3.10 – Cutting Parts of the Walking Frame

Connection of Walking Frame Parts

1. Try to insert the bolt and nut in the hole
2. Install the bolt and nut on the base of the walking frame
3. Put the wheel back in its original place.
4. Install the actuator on the walking frame
5. Arduino Uno which has been programmed with Actuator installation is ready. And finally, the DHA Smart Walking Aid can adjust automatically just by using a push button.

Figure 3.3.11 – Connection of Walking Frame Parts

Coding

For Arduino Uno, we use the Coding Push-button. And we display the results below.

TestPushButton1

```
const int relay1 = 2;
const int relay2 = 3;
const int pushButton1=8;
const int pushButton2=9;


void actuatorPull();
void actuatorPush();
void turnOFF();

void setup() {

    pinMode(relay1, OUTPUT);// set pin as output for relay 1
    pinMode(relay2, OUTPUT);// set pin as output for relay 2
    pinMode(pushButton1, INPUT_PULLUP);
    pinMode(pushButton2, INPUT_PULLUP);

    // keep the motor off by keeping both HIGH
    digitalWrite(relay1, HIGH);
    digitalWrite(relay2, HIGH);


  Serial.begin(9600);// initialize serial monitor with 9600 baud
  Serial.println("Robojax Actuator Control");
  Serial.println("Using 2 Relays");
  delay(2000);
}

void loop() {

  while(digitalRead(pushButton1) ==LOW)
  {
   actuatorPull();
  }

  while(digitalRead(pushButton2) ==LOW)
  {
    actuatorPush();
  }

   turnOFF();

}// loop end

void actuatorPush()
{

    digitalWrite(relay1, LOW);// turn relay 1 ON
    digitalWrite(relay2, HIGH);// turn relay 2 OFF

}//actuatorPush()

void actuatorPull()
{
```

Figure 3.3.12 – Coding Push Button

6) PRODUCT TESTING

prepared by Muhammad Aliff Bin Mohd Sapri (08DKM20F1075)

During the testing phase, several tests will be used to ensure that the product operates as expected and also aim to determine the limitations and weaknesses of the product. It is not difficult to test against real-world scenarios because the results are predictable by design for the DHA Smart Walking Aid. Tests are performed to ensure product quality and reliability and that all parts work together. Through product testing, we can develop technical standards for products to produce functional products that are safe for customers to use.

Figure 3.3.13 – Product Testing

i. Effectiveness Testing

Test Effectiveness can be defined as how effectively the test is performed or the goal achieved that meets the user's needs. In figure 3.6.2 several tests such as standing, walking and getting up using DHA Smart Walking Aid have been shown.

Product testing has been used on 2 elderly women aged 60 - 90 years.

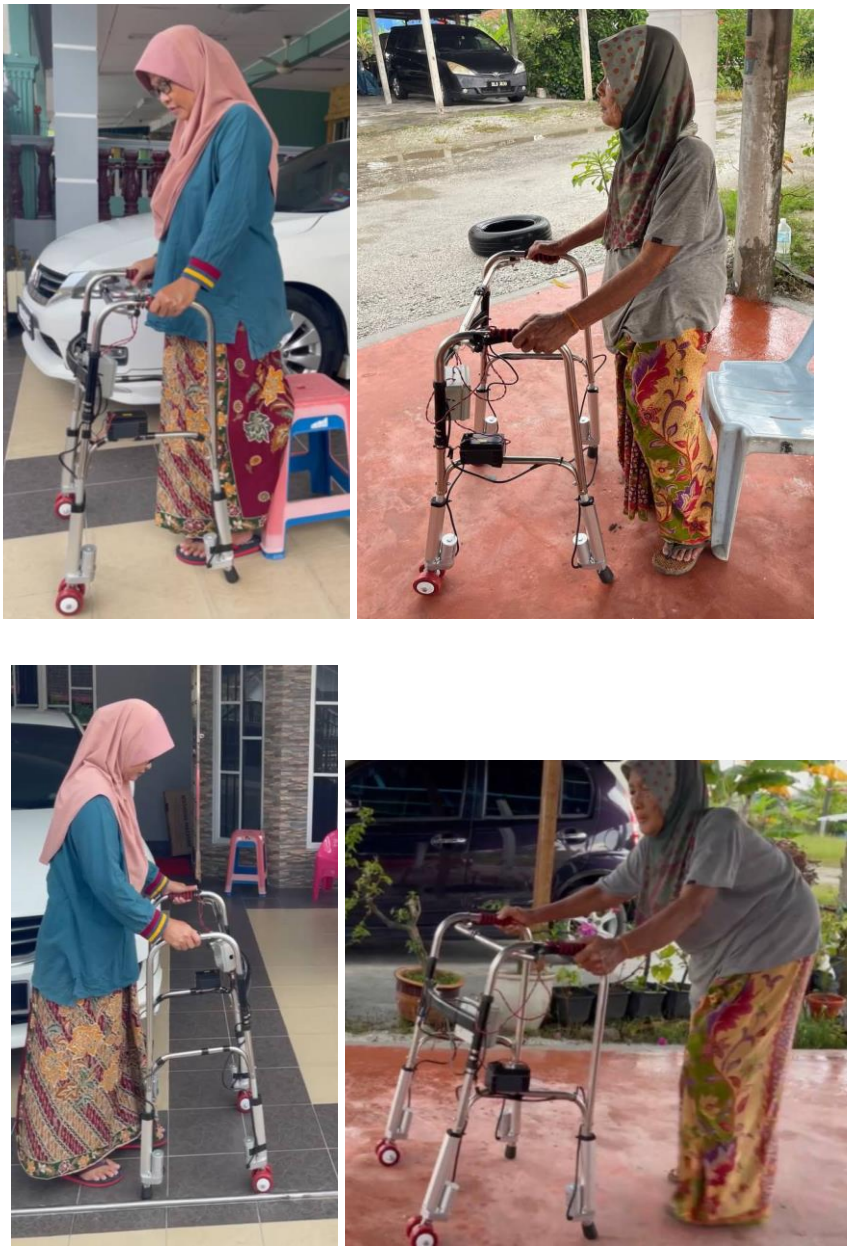
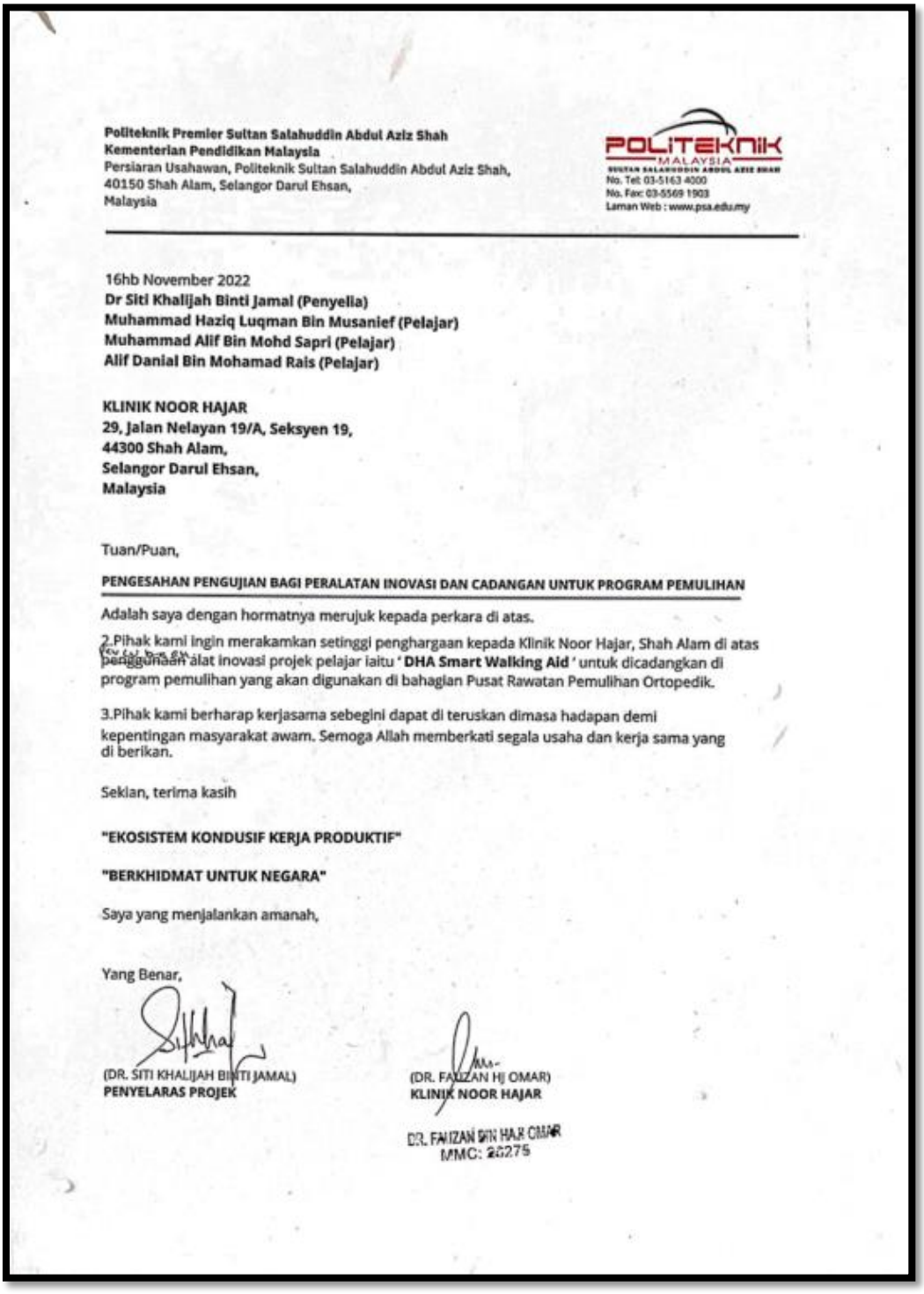


Figure 3.3.14 – Effectiveness Testing

Certificate

prepared by Muhammad Haziq Luqman Bin Musanief (08DKM20F1078)

We have obtained confirmation of testing for innovative equipment and suggested going to the rehabilitation center. From Noor Hajar Clinic, Section 19, Shah Alam.



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16hb November 2022
Dr Siti Khalijah Binti Jamal (Penyelia)
Muhammad Haziq Luqman Bin Musanief (Pelajar)
Muhammad Alif Bin Mohd Sapri (Pelajar)
Alif Danial Bin Mohamad Rais (Pelajar)

KLINIK NOOR HAJAR
29, Jalan Nelayan 19/A, Seksyen 19,
44300 Shah Alam,
Selangor Darul Ehsan,
Malaysia

Tuan/Puan,

PENGESAHAN PENGUJIAN BAGI PERALATAN INOVASI DAN CADANGAN UNTUK PROGRAM PEMULIHAN

Adalah saya dengan hormatnya merujuk kepada perkara di atas.

2.Pihak kami ingin merakamkan setinggi penghargaan kepada Klinik Noor Hajar, Shah Alam di atas penggunaan alat inovasi projek pelajar iaitu ' **DHA Smart Walking Aid** ' untuk dicadangkan di program pemulihan yang akan digunakan di bahagian Pusat Rawatan Pemulihan Ortopedik.

3.Pihak kami berharap kerjasama sebegini dapat di teruskan dimasa hadapan demi kepentingan masyarakat awam. Semoga Allah memberkati segala usaha dan kerja sama yang di berikan.

Sekian, terima kasih

"EKOSISTEM KONDUSIF KERJA PRODUKTIF"

"BERKHIDMAT UNTUK NEGARA"

Saya yang menjalankan amanah,

Yang Benar,

(DR. SITI KHALIJAH BINTI JAMAL)
PENYELARAS PROJEK

(DR. FAUZAN Hj OMAR)
KLINIK NOOR HAJAR

DR. FAUZAN BIN HAJI OMAR
MMC: 25275

Figure 3.3.15 – Certificate

Result

Based on the results that have been studied, we found that our DHA smart walking aid project achieved the expectations we expected when we first brainstormed, we succeeded in following the objectives we had set, The main problem stated is that rigid walking aids on the market require different sizes and types to accommodate different patient heights in the hospital. Based on our observations, the Hospital is the ideal place to place this smart walker in the rehabilitation department.[9] Next, the problem faced by existing walkers is the difficulty for patients or users to use them because most walkers are not adjustable which causes elderly patients especially to be uncomfortable using them. After all, it is not suitable according to their height level causing them to walk in a bent position.[10]

In addition, the products produced can also be sold commercially and are beneficial. The products produced can also meet the needs and wants of users and help solve problems faced by the community, especially patients. In addition, this project is also important to ensure that the objective of creating new products is achieved in line with the development of Industrial Revolution 4.0 which is currently being worked on. Finally, commercial marketers also benefit from research where products created after research can be sold and commercialized for profit and at the same time have a positive impact on consumers.

7) ANALYSIS DATA

Data analysis is defined as a process of cleaning, transforming, data to discover useful information for project decision-making. Analysis data is the process of preparing data for analysis by removing or modifying data that is incorrect, incomplete, irrelevant, duplicated, or improperly formatted. The purpose of data analysis is to extract useful information, taking a decision based on the data analysis and lastly derive conclusions based on the data.

8) REPORT WRITING

Reports cover a varied range of topics but usually focus on transmitting information with a clear purpose, to a specific reader. A report is a result of research and analysis of data. Requirements for the precise content of a report should refer to specific guidelines. Reports may contain some of the following elements, introduction, literature review, methodology, findings and conclusion. Students are required to write short reports and also in engaging video format for Pitex Innovation 2022. Good final reports are documents that are accurate, objective and complete. Essentially, it must be well-written, clearly structured to meet examiner expectations.

9) FINISH

Completing and delivering a project invites learning something meaningful that helps the project move forward. The greatest obstacle known to finish what has started is anxiety, doubts and hesitation. Achieving an end product and something excellent comes withexpected issues to arise and the need to deal with it empathetically. Doing so helps learn what to improve, and it gives the project a fighting chance to make a difference.

3.4 BUDGET CALCULATION

prepared by Muhammad Haziq Luqman Bin Musanief (08DKM20F1078)

No	Materials/Equipment	Quantity	Price 1 item
1	Walking Frame	1	RM 76.50
2	Lead Acid Battery	1	RM 40.00
3	Linear Actuator	4	RM 125.00
4	Arduino Uno	1	RM 72.00
5	Relay Module	1	RM 10.00
6	Push Button Switch	2	RM 2.80
7	Pvc Enclosure Box	1	RM 4.90
		Total	RM 709

Table 3.4 – Budget calculation

3.5 PROJECT ACTIVITY

Project Activity	Weeks													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Briefing and Project Planning														
Material Selection The selection of materials that meet the requirements in the production of this product.														
Materials Purchase The purchase of goods refers to the selection made so that no waste occurs.														
Project Design The production of design walking aids can help in the event of any misunderstanding during the construction of the project.														
Method Selection The method used is very important so that no problems occur.														
Report Writing Production of a report that includes 5 chapters produced by each group in the allotted time.														
Video and Slide making A video is provided that matches the marketing of the product that will be contested in the 14th week														

Table 3.5 – Project activity

	Planning
	Actual

CHAPTER 4

RESULT

4.1 INTRODUCTION

For this chapter, we combined data from a questionnaire about community views on the DHA Smart Walking Aid. This data is very important for this project to know that our project is suitable for all communities. After getting all this data, we analyze everything that can make it perfect.

4.2 ADVANTAGE & DISADVANTAGE

prepared by Alif Danial Bin Mohamad Rais (08DKM20F1055)

Every project has its pros and cons, the pros of this project are that it will help our patients to wear walking aids more safely when In addition, this product will make it easier for users to adjust the height without needing the help of others.

However, the cons or disadvantages must be improved or changed for the future so thatwe could enhance the good and very efficient products that hardly find a disadvantage of the project. Each new product must have certain aspects that are needed improvement that needs to be done to raise the value of its product. As in our products, we need tidiness in terms of wires that are scattered for users to use this product. We will find the best solution to solve this problem.

4.3 ANALYSIS

prepared by Muhammad Aliff Bin Mohd Sapri (08DKM20F1075)

From the Questionnaire of 60 people (Google Form)

No.	Subject	YES	NO
1	Do you have any difficulty walking outdoors?	34	26
2	Are you one of those who use a walking aid?	21	39
3	Are there people around you who use walking aids?	32	28
4	Do you have a problem with the walking tool that causes you not to use it?	27	33
5	Do you need someone to help you walk?	18	42
6	Do you think this walking aid is safe to use?	31	29
7	Do you think walking aid can be used as one of the exercises for the rehabilitation center?	51	9
8	Have you had positive changes in your range of motion?	45	15
9	Have you had positive changes in your psychological state?	42	18
10	Have you had positive changes in your ability to walk?	49	11
11	Was it easy to adjust to using the walking aid?	55	5
12	Does the existing walking aid need to be improved?	47	13
13	Are you satisfied with the device overall?	52	8
Total		60	60

Table 4.3.1 – Questionnaire

This is one of the results of the questionnaire:

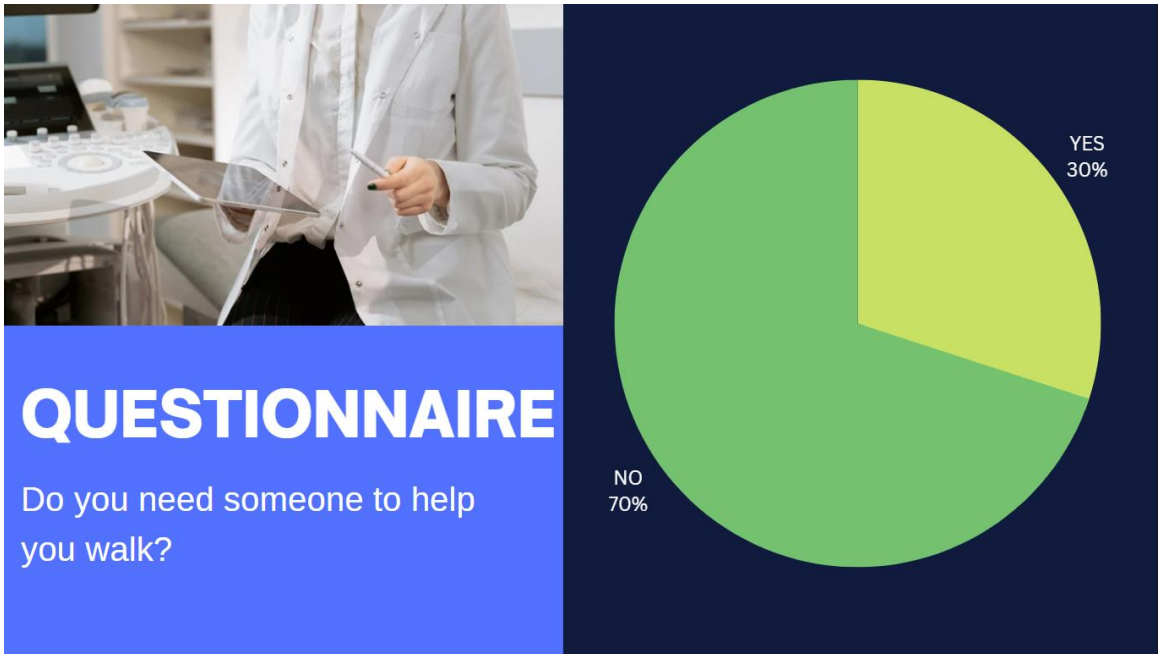

Figure 4.3.2 – Results from the questionnaire

For the results, we combined data from the DHA Smart Walking Aid questionnaire. This data is very important for this project to tell us that our project is suitable for all communities. After receiving all this data, we analyze everything that can make it perfect. Every project has advantages and disadvantages, the advantage of this project is that it will help our patients to be safer when handling the walking aid and also to minimize the accident factor. However, the disadvantages must be fixed or changed for the future so that we can improve a good and highly efficient product that almost does not find the weaknesses of the project.

From the data, we analyzed that 87% agree that our product can make it easy for users to wear and 13% disagree that our product can make it easy for users.

4.4 BODY POSTURE ASSESSMENT

prepared by Muhammad Haziq Luqman Bin Musanief (08DKM20F1078)

Before	After
	

Table 4.4.1 – Body Posture Assessment

4.5 TIME TABLE

prepared by Alif Danial Bin Mohamad Rais (08DKM20F1055)

Before	Time Taken To Walk 10 Meters
Elders	25 Seconds
Adult	17 Seconds

Table 4.5.1 – Time Table Before

After	Time Taken To Walk 10 Meters
Elders	20 Seconds
Adult	9 Seconds

Table 4.5.2 – Time Table After

4.6 CHAPTER'S SUMMARY

As a conclusion to this chapter, analysis and findings have been made. This DHA Smart Walking Aid has many advantages but there are disadvantages to the advantages. Therefore, challenges are taken as room for improvement and more development for the next generation and also to increase their knowledge about the projects we are running. Product testing was conducted to determine the full potential of the DHA Smart Walking Aid and proved to be robust. The relationship is well shown in the graft.

CHAPTER 5
DISCUSSION

5.1 INTRODUCTION

The conclusion allows presenting the last word on the issues and innovation raised in the report paper which is to demonstrate the importance of the project and the opportunity to make a good final impression on a positive note. The conclusion also is intended to help the reader understand the project should matter after finishing reading the paper.

This chapter covers the conclusion of the overall of this project. The conclusion will be concluded the future recommendation and improvement for future innovation with a better result for the Bluetooth system. In promoting a good explanation, the following sections also present the discussion of the project and recommendations to improve quality.

5.2 DISCUSSION

prepared by Alif Danial Bin Mohamad Rais (08DKM20F1055)

Throughout the project, the product progressed from a rough draft to a polished product. It encourages creativity in creating projects and improving existing projects to be more affordable and user-friendly with new fabrication methods. The innovation of the DHA Smart Walking Aid is an ergonomic design that makes it flexible and comfortable to wear but is important for the safety factor.

The DHA Smart Walking Aid is positively tested and easily adjustable in height but importantly, fits any user's comfort. It is the effectiveness of the project that is used when the user operates it that allows others to believe that this product is commercially viable. This project has the potential to be added to other IoT in line with the important needs of users. Advertising and commercialization are recommended to help inform customers about the availability of DHA Smart Walking Aid in the market.

5.3 PROBLEM

prepared by Muhammad Aliff Bin Mohd Sapri (08DKM20F1075)

In the life cycle of any project, there are almost always unexpected problems and questions that arise because every project is different and unique. Most importantly, solve problems quickly and effectively.

- The switch opener from the battery caught fire due to long-term use of the operation causing the switch opener to melt and be damaged.
- During the product test, a technical problem occurred which was on the control part of the Arduino Uno caused by a Dupont wire not connecting to one of the components on the relay module.
- During the product test also, the wire connection on the Linear Actuator part is connected from positive to negative. This causes electricity to affect the Arduino Uno resulting in the Arduino Uno being damaged.
- For the neatness of the Linear Actuator wires, there is still no initiative to hide the wires behind the walking frame.

5.4 RECOMMENDATION

prepared by Muhammad Haziq Luqman Bin Musanief (08DKM20F1078)

Based on the observations and explanations offered after completing the DHA Smart Walking Aid Project, some suggestions to meet the product's needs and better satisfy users. However, improving product quality and features is not an easy task. Talking to users and prospects is a way that has helped projects and staying inspired to take a more strategic approach towards product development. The best way to make product improvements is to add new product features or improve existing features.

- Wiring is an important component of any electrical system and can cause potential hazards. When it comes to electrical wiring and cables, make sure you get the right materials built on a solid foundation of quality, reliability and safety to improve the product.

- The addition of a safety factor system is the main key for any product, especially aimed at the elderly and patients. So, For improvement by creating a panic button alarm. The purpose is that we can recognize one of the patients who use the DHA Smart Walking Aid in an emergency.

- With a panic button alarm, we can find out the patient's location by using GPS Location Finder. This device can identify the patient outside the hospital, in the elevator or in the toilet.

- There is always room for improvement by building a strong and waterproof Lead acid Battery holder. In addition, build an official push button switch case so that the scattered wires can be hidden from the user who carries it.

CONCLUSION

A plan will not happen by itself. The process of preparing a carefully designed project is quite complicated due to various obstacles and problems. Also, improve students' existing skills while spending quality time learning new things. A supervisor is someone responsible for monitoring progress and catching up on outstanding project activities.

This report has documented the development, features, methods and use of the DHA Smart Walking Aid as an innovative assistive device that can be used and benefits everyone. The challenge of designing a new learning framework based on The Fourth Industrial Revolution as production by integrating the Internet of Things is summarized in the paper.

Specifically, the DHA Smart Walking Aid introduces the development of a new aid consisting of a Push Button Switch to control the height of the Linear Actuator more easily. The product uses a well-developed modular design that is ready to work with external companies. Finally, create new opportunities to market and sell products to interested customers.

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APPENDIX