

JABATAN KEJURUTERAAN MEKANIKAL

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POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

TRI- WHEEL TROLLEY

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JUN 2019

TAJUK : TRI-WHEEL TROLLEY

SESI : JUNE 2019

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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

In this era of modernization, there have been various revolutions in the field of engineering. However, there are still changes in the process of moving an item or load to a higher place compilation using stairs. The creation of elevators is one of solution for the process of load transfer process, however the facilities of elevators is not available everywhere. For example, schools, construction areas, colleges and so on. This project aims to create an appropriate mechanism for the transfer loads thru stairs either going up or down. This shows that human needs are increasing over time. Hand trolley is one of the devices that can be used to decrease pressure from loads on flat ground. However, usually this device fails to carry the load thru stairs. So this project aims to create a trolley that can lift heavy load and be used thru stairs or uneven terrain with low energy needed to operate. In addition, the main objective of this project is to find an effective and user-friendly method for user to carry load thru stairs with as minimum force as possible thus providing smooth movement compilation of the load transfer process. Therefore, we have innovated a trolley that can climb stairs. The trolley has three wheels on both sides, and three wheels are used in the tri-winding frame. In addition, the folding chair is also combined with a trolley for users to relax after using it. An adjustable handle bar feature is added to match users' comfort by adding ergonomic factor to ensure user can feel more comfortable when using this product. The study begins with the collection of information through questionnaires, analysis of information obtained as well as comparisons made with previous studies. The results of the questionnaire found that 75% of respondents agreed that users need a lot of force, especially when climbing stairs. In addition, 63% of respondents stated that it is difficult to move on uneven and bumpy surfaces. At the same time, 50% of respondents found existing trolleys are not suitable for heavy lifting.

ABSTRAK

Pada era modenisasi ini, telah berlakunya pelbagai revolusi dalam bidang kejuruteraan. Walau bagaimanapun, masih terdapat kesukaran dalam proses memindahkan sesuatu barang atau beban ke tempat yang lebih tinggi ketika menggunakan tangga. Meskipun penciptaan lif adalah

salah satu cara untuk memudahkan proses pemindahan beban, namun kemudahan lif tidak semestinya disediakan di semua tempat. Misalnya, sekolah, kawasan pembinaan, kolej dan sebagainya. Projek ini bermatlamat untuk mewujudkan mekanisme yang sesuai bagi membolehkan beban dialih ketika menggunakan tangga. Hal ini menunjukkan bahawa keperluan manusia semakin meningkat dari semasa ke semasa. Troli tangan merupakan salah satu produk yang boleh mengurangkan tekanan daripada beban apabila mengangkat barang. Dengan adanya produk ini, proses mengangkat barang akan menjadi lebih mudah. Hasil daripada inovasi produk sedia ada dengan tambahan elemen ergonomik, pengguna akan berasa lebih selesa tanpa mengalami sakit pinggang semasa mengangkat barang. Produk sedia ada dipasaran gagal untuk membawa beban menggunakan tangga. Satu produk telah diinovasikan bertujuan untuk membina sebuah troli yang boleh memudahkan pengguna untuk membawa objek berat menggunakan tangga sekaligus mengurangkan penggunaan tenaga. Selain itu, objektif utama projek ini adalah untuk mencari kaedah yang berkesan dan mesra pengguna yang membolehkan pengguna mengangkat beban melalui tangga dengan penggunaan tenaga secara minimum seterusnya menyediakan pergerakan yang lancar ketika proses pengalihan beban. Produk yang telah diinovasikan ialah sebuah troli yang boleh mendaki tangga. Troli tersebut mempunyai tiga roda di kedua – dua sisi, dan tiga roda tersebut digunakan dalam bingkai berlaku tri. Di samping itu, kerusi lipat juga digabungkan bersama troli untuk pengguna berehat setelah menggunakannya. Batang pemegang ditambah baik dengan ciri boleh laras mengikut kesesuaian pengguna dengan menitikberatkan ciri-ciri ergonomik untuk menambahkan keselesaan kepada pengguna. Kajian bermula dengan pengumpulan maklumat melalui soal selidik, analisis maklumat yang diperolehi serta perbandingan yang dibuat dengan kajian lepas. Hasil daripada soal selidik mendapati 75% responden bersetuju bahawa pengguna memerlukan daya yang banyak terutama ketika menaiki tangga. Selain itu, 63% responden pula menyatakan, ia sukar digerakkan di atas permukaan yang tidak rata dan berbonggol. Dalam masa yang sama, 50% responden mendapati troli yang sedia ada tidak sesuai untuk mengangkat muatan berat.

CHAPTER 1

INTRODUCTION

1.1 RESEARCH BACKGROUND

In everyday life, there will be many instances where heavy loads will have to be carried between two locations, such as travel suitcase, books, etc. In most of these situations, these items can be easily carried in hand. But, over the recent years, the rise of escalators over

elevators have made things difficult for people to carry heavy items in their hands, for example while shopping in malls, carrying heavy research equipments between multiple floors of a university, etc.

In such cases, the usage of conventional trolleys (Figure.1) will be heavily reduced and will stick to baskets and other hand-carriable methods. While this method might work for light objects, it will prove to be a tedious one when heavy objects are considered.

Hence, in these circumstances, there is a need for a much simpler and comparatively effortless method to move the objects between two different floors. In this proposed design, we have designed a trolley that can be used to move things on flat surfaces as well as stairs and other irregular surfaces without the need for the user to apply extreme forces, with better stress distribution on the trolley overall; which would reduce the chances of failure; and a lighter construction that would allow the load capacity of the trolley to be increased.

1.2 PROBLEM STATEMENT

Trolley is equipment used to move heavy loads from one place to another. It can reduce the human burden in their daily lives. This device is commonly used by a large number of industries to transport physical products. trolleys are often used by those who organize and stock merchandise in retail stores restock. when used properly, trolley can protect people from having back injuries and other health problems that can result from lifting and carrying heavy loads. In a normal trolley models, some problems were identified. Such as :

- Lot a effort are required to adjust the inclination of the hand truck for provide stable transportation of the loads.
- As a result of operator gets out of control when climbing the stairs, the incident will occur due to the load roll back.
- These truck have a pair of ground engaging wheels which wear quickly because of the heavy load bearing downwardly directly on the wheels.

1.3 RESEARCH OBJECTIVES

- This project aims in developing a mechanism for easy transportation of heavy load over stair.
- It also ease the movement of trolley in irregular surface like holes and bumps.
- Help the person to move the items by using hydraulic jack system on trolley.

1.3 SCOPE

- Use solid tyre
- Can be used on any type of surface
- Use hydraulic jack to move up and down

1.4 PROJECT DEFINITION

A tri-wheel trolley is a type of **trolley** fitted with rotating **wheels** or tracks so that it can be pushed or pulled up or down steps or a stairway. Tri-wheel trolley also can be manual or use hydraulic jack to move up and down easily, and commonly found in **wheel**, track, push arm or walker variants.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter, will be shown materials used in making tri-wheel trolley in the current markets. These materials have its own advantages and disadvantages. Hence, all the characteristics of those materials will be compared to our own product which has its own specialties and benefits. The trolley is a patented invention that is part of social history as well as the evolution of house wares.

Advance material handling trolley using tri-wheel mechanism. International Journal Of Recent Research in Civil And Mechanical Engineering (IJRRCME) Vol. 2, Issue 2, Pp: (160165), Month: October 2015 – March 2016:-This article aims is developing a mechanism for easy transportation of heavy loads over uneven terrain. The need for such a system arises from day-to-day requirements in our society.

Devices such as hand trolleys are used to relieve the stress of lifting while on flat ground; however, these devices usually fail when it comes to carrying the load over short height. Several designs were conceived that would allow a non-industrial hand trolley to travel over stairs, curbs, or uneven terrain while reducing the strain on the user. In our project the trolley is consisting the triwheel or tri- star mechanism eases the movement of trolley in irregular surfaces like holes, bumps, etc.

2.2 TRI-WEEL TROLLEY



2.2.1 INTRODUCTION

In everyday life we may have to carry so many goods of various quantities through stairs specially in offices, schools, colleges, hotels, industries, apartments etc. where the lifts may not be available, may be full with the people or under repair. It is very tiresome to carry the various objects through stairs manually for higher floor for so many times. In most of building lifts are not installed so there only human labor is solution for carrying material. Labor is becomes costly as well as time consuming, where growth rate is getting negative. This problem can be solved if a trolley can lift loads while traveling through stairs.

2.2.2 Characteristic TRI-WHEEL TROLLEY

2.2.2.1 Advantages

They makes it easier for you to move heavy loads upstairs and downstairs. It easily levers your load on the stair case and takes the pressure off as you don't have to entirely lift the trolley from one step to the next. It helps reduce the strain on your body that you would otherwise experience if you were to lift the heavy luggage upstairs or downstairs. Often people experience lower back injury as well as other discomforts from lifting heavy loads upstairs stair climber trolleys relieves you from such discomforts and injuries.

- Reduce human effort(pulling trolley than carryings object)
- time for carrying things is minimized
- Easy to use (it can be easily climbs up steps or kerbs

Material selection is a step in the process of designing any physical object. In the context of product design, the main goal of material selection is to minimize cost while meeting product performance goals. Systematic selection of the best material for a given application begins with properties and costs of candidate materials.

2.3.1 Trolley body

Material Used- Mild Steel

Mild Steel

Mild steel, also called as plain-carbon steel, is the most common form of steel because its price is relatively low while it provides material properties that are acceptable for many applications, more so than iron. Low-carbon steel contains approximately 0.05–0.3% carbon making it malleable and ductile. Mild steel has a relatively low tensile strength, but it is cheap and malleable; surface hardness can be increased through carburizing. It is often used when large quantities of steel are needed, for example as structural steel. The density of mild steel is approximately 7850 kg/cm³ and the Young's modulus is 210 GPa (30,000,000 psi).

2.3.2 Tri-Star wheel web

Material Used- Stainless Steel Grade 304 Stainless

Steel Grade 304:

Steel Type 304 is a variation of the basic 18-8 grade, Type 302, with a higher chromium and lower carbon content. Lower carbon minimizes chromium carbide precipitation due to welding and its susceptibility to inter-granular corrosion. In many instances, it can be used in the “as-welded” condition, while Type 302 must be annealed in order to retain adequate corrosion resistance.

Type 304L is an extra low-carbon variation of Type 304 with a 0.03% maximum carbon content that eliminates carbide precipitation due to welding.

As a result, this alloy can be used in the “as-welded” condition, even in severe corrosive conditions. It often eliminates the necessity of annealing weldments except for applications specifying stress relief. It has slightly lower mechanical properties than Type 304.

2.3.3 BEARING SELECTION

Ball bearing

A ball bearing is a type of rolling-element bearing that uses balls to maintain the separation between the bearing races. The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. It achieves this

by using at least two races to contain the balls and transmit the loads through the balls. In most applications, one race is stationary and the other is attached to the rotating assembly. As one of the bearing races rotates it causes the balls to rotate as well. Because the balls are rolling they have a much lower coefficient of friction than if two flat surfaces were sliding against each other. Selecting a ball bearing with minimum inner diameter of 30mm, minimum load carrying capacity of 50kg radially and speed greater than

100rpm

Bearing Selected - SKF 6006 Open Deep Groove Ball Bearing

30x55x13mm

Inside Diameter: 30mm

Outside Diameter: 55mm

Width: 13mm

This 6006-2RS 30x55x13-millimeter sealed ball bearing has deep groove geometry for high speeds and supporting both radial and axial loads. This bearing has rubber seals on both sides of the bearing to keep lubricant in and contaminants out, and comes pre-lubricated from the manufacturer so that no additional lubrication is required. This deep groove sealed ball bearing is for use in applications that involve combined radial and axial loads, and a need for high running accuracy at high rotational speeds. Such applications include clutches, drives, gearboxes, compressors, pumps, turbines, and printing and textile machines, among others.

WHEEL SELECTION

Wheel material selected – Filled rubber

Types of Wheel Material

Filled rubbers

In tyres rubbers are usually filled with particles like carbon black or silica. They consist of a tread and a body. The tread is the part of the tire that comes in contact with the road surface. The portion that is in contact with the road at a given instant in time is the contact. Treads are often designed to meet specific product marketing positions.

Polyurethane

Polyurethane (PUR and PU) is a polymer composed of a chain of organic units joined by carbamate (urethane) links. While most polyurethanes are thermosetting polymers that do not melt when heated, thermoplastic polyurethanes are also available. The main ingredients to make a polyurethane are isocyanates and polyols. Other materials are added to help processing the polymer or to change the properties of the polymer.

- 10 -

Steel

Steel is an alloy of iron, with carbon being the primary alloying element, up to 2.1% by weight. Carbon, other elements, and inclusions within iron act as hardening agents that prevent the movement of dislocations that naturally exist in the iron atom crystal lattices.

The surface of the wheel and what it is rolling on are not perfectly smooth. They have irregularities shown in figure 4.1.

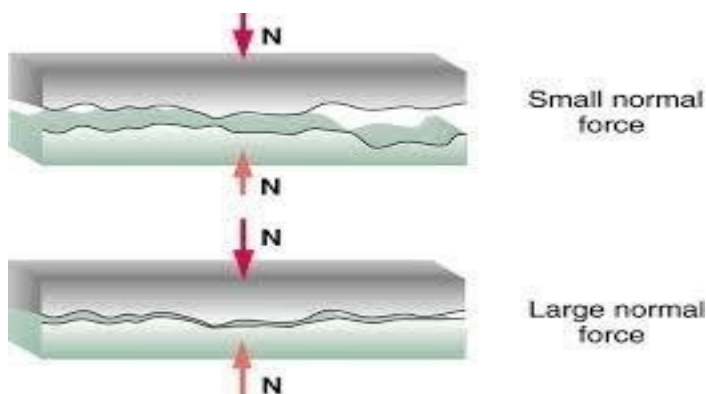


Fig4.1 Close-up showing surface roughness In

sliding friction, this surface roughness is the reason for the static and kinetic resistance to motion. Although the wheel is not sliding, the surface roughness causes a "jiggle" when the wheel is rolling.

2.4 Chapter's Summary

Though this project had some limitations regarding the strength and built of the structure, it can be considered to be a small step forward, as far as Stair Climbing Vehicles are concerned. During the test run of this project, it was realized that it wouldn't be a bad idea to consider this design for carrying heavy loads up the stairs. This product will be well acclaimed if it can be commercialized to suit the needs. Though the initial cost of the project seemed to be higher but more accurate manufacturing would shorten this. As far the commercial aspects of this product are concerned, if this product can be fully automated and produced at a lower cost the acceptance will be unimaginable. Presently, there are no competitors for such a kind of product in our market.

CHAPTER 3

METHODOLOGY

3.1 PENGENALAN

Dalam kehidupan seharian, akan ada banyak keadaan di mana beban berat harus dibawa di antara dua lokasi, seperti beg pakaian, buku, dll. Dalam kebanyakan situasi ini, barang-barang ini dapat dibawa dengan mudah. Tetapi, sejak beberapa tahun kebelakangan ini, kenaikan eskalator di atas lif telah menyulitkan orang untuk membawa barang berat di tangan mereka, misalnya ketika berbelanja di pusat membeli-belah, membawa peralatan penyelidikan berat di antara beberapa tingkat universiti, dll.

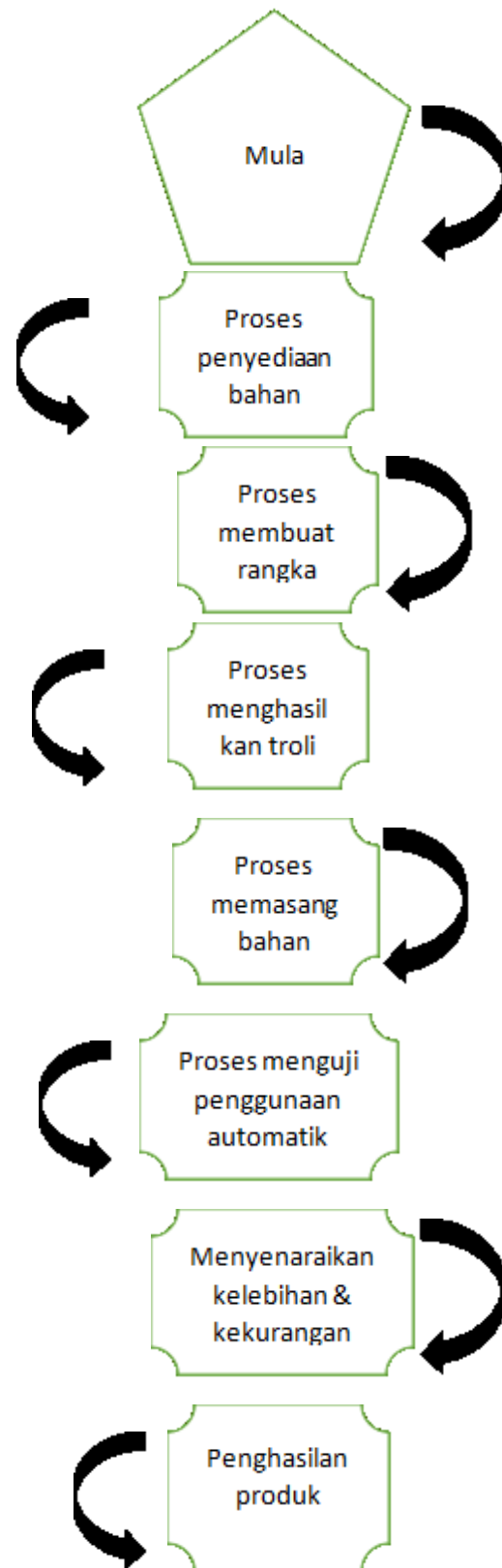
Dalam kes sedemikian, penggunaan troli konvensional (Gambar 1) akan sangat berkurang dan akan berpegang pada bakul dan kaedah lain yang boleh dibawa dengan tangan. Walaupun kaedah ini mungkin berfungsi untuk objek ringan, ia akan menjadi membosankan ketika objek berat dipertimbangkan.

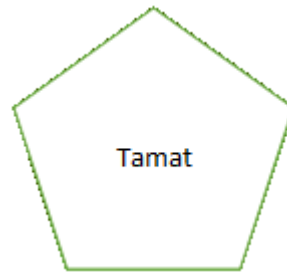
Oleh itu, dalam keadaan seperti ini, ada keperluan untuk kaedah yang lebih mudah dan relatif mudah untuk memindahkan objek di antara dua tingkat yang berbeza. Dalam reka bentuk yang dicadangkan ini, kami telah merancang sebuah troli yang dapat digunakan untuk menggerakkan barang-barang di permukaan rata serta tangga dan permukaan tidak teratur yang lain tanpa perlu pengguna menggunakan daya yang melampau, dengan pengedaran tekanan yang lebih baik pada troli secara keseluruhan; yang akan mengurangkan kemungkinan kegagalan; dan pembinaan yang lebih ringan yang membolehkan kapasiti muatan troli dinaikkan.

Secara umumnya, kaedah atau langkah kerja yang akan dijalankan untuk menyempurnakan kajian ini dibahagikan kepada beberapa peringkat utama. Antara peringkat – peringkat tersebut adalah seperti berikut :-

1. Kajian literature.
2. Penghasilan projek Smart Brush.
3. Melaksanakan kajian yang lebih teliti keatas masalah-masalah yang timbul untuk mendapatkan data bagi menyempurnakan alat tersebut.

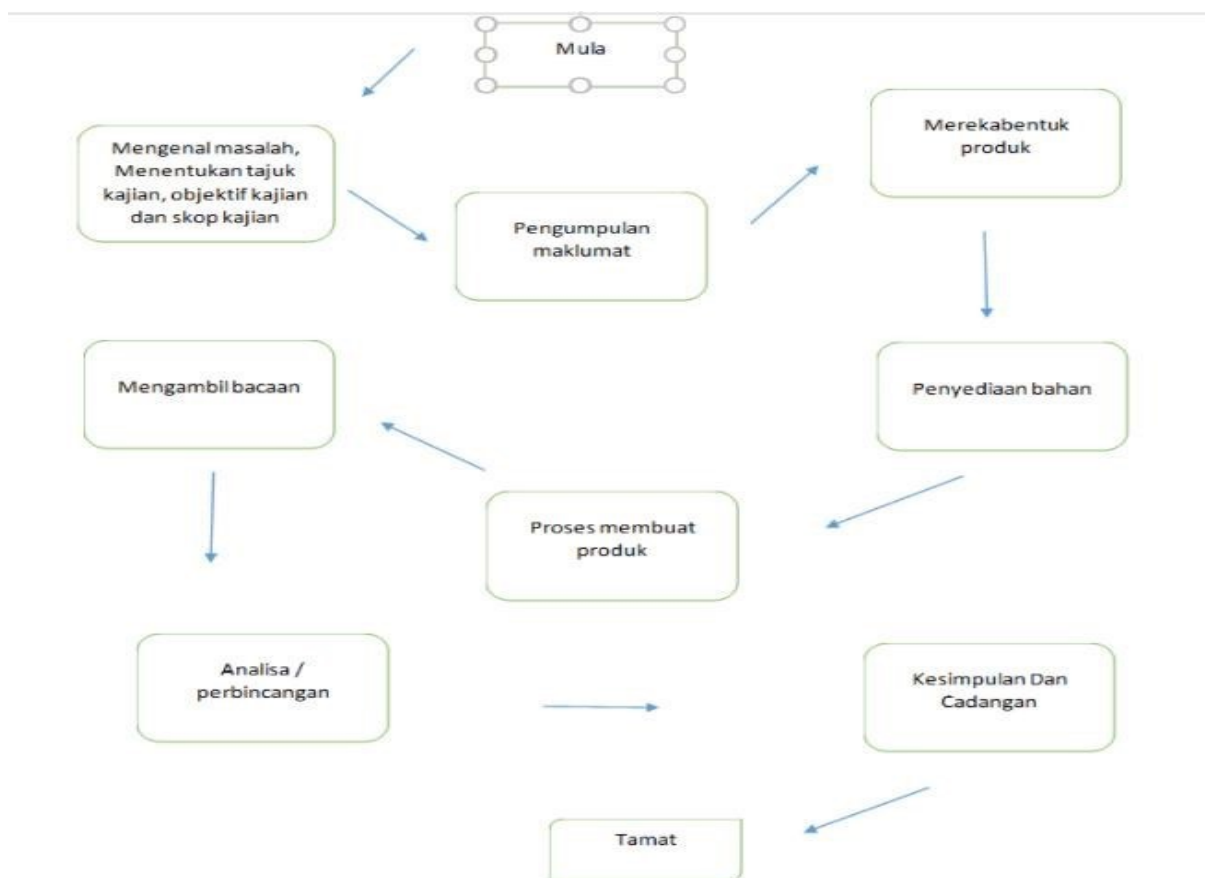
3.2. Carta Alir Penghasilan Produk





3.3 Kaedah-kaedah untuk menghasilkan Tri-Wheel Trolley

Proses merekacipta merupakan sebahagian daripada kerja-kerja yang perlu dilakukan bagi menghasilkan sesuatu projek baru atau pengubahsuaian ke atas sesuatu projek atau lebih dikenali sebagai proses penambahbaikan. Antara Langkah-langkah yang perlu dilakukan dalam proses merekacipta ialah:



3.4 Peralatan & Bahan

3.4.1 Peralatan

Peralatan yang diperlukan untuk melaksanakan projek untuk membina projek yang dilakukan. Tanpa peralatan kerja ini,projek tidak dapat dilaksanakan. Antara peralatan yang digunakan ialah:





Mesin ini digunakan untuk memotong pipe pvc mengikut size yang telah ditetapkan.



Alat ini digunakan untuk mencantumkan bahagian-bahagian pipe yang telah dipotong mengikut size yang telah diukur.



Cecair pelekat yang cepat kering ini digunakan untuk menyapu pada kedua-dua bahagian paip PVC semasa membuat penyambungan supaya sambungan kukuh dan tidak bocor.

 <p data-bbox="323 562 671 591">Cermin Mata Keselamatan</p>	<p data-bbox="810 203 1358 315">Alat ini digunakan untuk melindungi mata daripada terkena serpihan yang terpecik semasa melakukan kerja</p>
 <p data-bbox="445 1003 624 1032">Pemutar skru</p>	<p data-bbox="810 622 1321 651">Alat ini digunakan untuk memutar skru</p>

3.4.2 Bahan

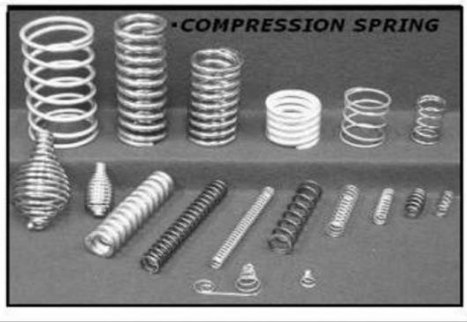
Bahan yang diperlukan untuk melaksanakan projek bagi menyempurnakan produk. Antara bahan yang digunakan ialah:

 <p data-bbox="411 1935 531 1964">Pipe PVC</p>	<p data-bbox="746 1469 1241 1547">Bahan ini digunakan sebagai bahan utama untuk mendirikan projek</p>
---	---



Roda Tiga Tayar

Bahan ini digunakan untuk membantu pergerakan troli ketika menaiki tangga.



Compression Spring

Bahan ini digunakan sebagai



Sarung Pemegang

Bahan ini digunakan dibahagian pemegang



Motor Gear DC 240v

Bahan ini digunakan untuk menggerakkan bahagian lifting turun naik ketika mengangkat barangan



Front Tyre

Bahan ini digunakan untuk menstabilkan troli pada bahagian depan



Bateri

Bahan ini digunakan sebagai sumber kuasa

3.5 Kos

Bahan	Kuantiti	Harga(RM)
DC motor 240V	1	RM200
Roda Tiga Tayar	2	RM90
Pipe PVC	5	RM150
Compression Spring	4	RM28
Sarung Pemegang	2	RM15
Rivet	50	RM30
Bateri	3	RM60
	Jumlah	RM573

3.6 Kesimpulan

Metodologi merupakan kaedah yang digunakan di dalam penyelesaian projek ini. Kajian metodologi menunjukkan pendekatan yang digunakan seperti kaedah pengumpulan data, model, carta alir, membuat pemilihan idea, pemilihan bahan yang terbaik dan membuat pengujian pada bahan projek. Seterusnya, kajian metodologi projek ini juga menunjukkan faktor-faktor yang perlu dipertimbangkan dalam pemilihan sesuatu kaedah atau pendekatan tertentu bagi menghasilkan projek yang sempurna.

4. Cadangan Penyelesaian

Disebabkan bakteria pada lantai tidak mudah dibunuh dengan hanya menggunakan air sabun jadi kami membuat kajian dan mendapati cara yang mudah untuk membunuh bakteria yang tidak dapat dilihat dengan mata kasar iaitu menggunakan cahaya UV, mengikut kajian cahaya UV ini mampu membunuh banyak jenis kuman. Dengan mengambil kira radiasi yang spesifik dan pendedahan bakteria tersebut pada cahaya UV pada jangka masa tertentu. Jadi kami menambah cahaya UV pada bahagian bawah supaya cahaya UV tersebut dapat memancarkan cahayanya terus pada permukaan lantai ketika proses mencuci sedang dilakukan. Selain itu, bagi memudahkan lagi proses mencuci, produk kami mempunyai ciri semiautomatik iaitu kami menggunakan motor untuk memutar berus 360 darjah. Jadi, pengguna tidak perlu menggunakan tenaga yang banyak sebaliknya hanya perlu menghalakan produk pada permukaan yang hendak dicuci sahaja.

Disebabkan kerja-kerja harian sukar dilakukan dengan hanya menggunakan troli biasa jadi kami membuat kajian dan mendapati cara mudah untuk mengangkat barang ketika menaikitangga secara mudah

5.Faedah/Kebaikan

Dengan adanya produk ini dan jika dapat dikembangkan,tandas-tandas awam yang berada di negara kita akan menjadi lebih bersih dan tidak berbau,ini akan memberi pandangan yang baik kepada orang luar.Selain itu,kita juga dapat menghindari segala penyakit daripada kuman yang terdapat di dalam tandas.

6.Cara Mengimplementasi/Kaedah Penggunaan

Pertama,untuk menghidupkan motor pengguna perlu menekan butang "ON" lalu berus akan terus berpusing dan lampu UV akan menyala.Ketika proses mencuci dilakukan,pengguna hanya perlu menggerakkan produk tersebut ke arah yang hendak dicuci dan berus akan menyental kotoran pada lantai dengan sendirinya.Setelah selesai,pengguna perlu menekan semula butang "OFF" untuk menghentikannya daripada berpusing.Kaedah penggunaanya adalah sangat ringkas dan mesra pengguna di mana,tidak kira usia malah sesiapa sahaja boleh menggunakannya

7.Kesimpulan/Rumusan

Walaupun projek ini memiliki beberapa batasan mengenai kekuatan dan binaan strukturnya, projek ini dapat dianggap sebagai langkah kecil ke depan, sehubungan dengan Stair Climbing Vehicles. Semasa menjalankan ujian projek ini, disedari bahawa bukan idea buruk untuk mempertimbangkan reka bentuk ini untuk membawa beban berat ke tangga.

Produk ini akan mendapat sambutan baik jika dapat dikomersialkan untuk memenuhi keperluan. Walaupun kos awal projek nampaknya lebih tinggi tetapi pembuatan yang lebih tepat akan memendekkan ini. Sejauh aspek komersial produk ini, jika produk ini dapat sepenuhnya automatik dan dihasilkan dengan kos yang lebih rendah penerimaannya tidak dapat dibayangkan. Pada masa ini, tidak ada pesaing untuk jenis produk seperti ini di pasaran kami.

CHAPTER 4

FINDINGS AND ANALYSIS

4.1 INTRODUCTION

This chapter combines data and analysis of the water tank cut off. This data and analysis are especially important for this project because it is containing the discussion to achieve the objectives and scope of this project. This chapter analyses the advantages, disadvantages and comparisons between normal water tank and water tank cut off. We used this data to, analyses every single possible to make it perfect and we did it.

4.2 ADVANTAGES AND DISADVANTAGES

Every project has its own pros and cons, the pros will help the people and the environment. However, the cons or the disadvantages must be improved or change for the future so that we could enhance the good and very efficient product that hardly to find disadvantage of the project. Besides of the advantages, this project also disadvantages that we must overcome it in the future for the better good.

ADVANTAGES OF TRI-WHEEL TROLLEY

They makes it easier for you to move heavy loads upstairs and downstairs. It easily levers your load on the stair case and takes the pressure off as you don't have to entirely lift the trolley from one step to the next. It helps reduce the strain on your body that you would otherwise experience if you were to lift the heavy luggage upstairs or downstairs. Often people experience lower back injury as well as other discomforts from lifting heavy loads upstairs stair climber trolleys relieves you from such discomforts and injuries.

- Reduce human effort(pulling trolley than carryings object)
- time for carrying things is minimized
- Easy to use (it can be easily climbs up steps or kerbs

Material selection is a step in the process of designing any physical object. In the context of product design, the main goal of material selection is to minimize cost while meeting product performance goals. Systematic selection of the best material for a given application begins with properties and costs of candidate materials.

DISADVANTAGE OF NORMAL TROLLEY

Due to normal single-wheel design, it's harder to pass uneven terrain or climb stairs. You need to put much effort to lift it up the stairs and cause your body sore. Lifting normal trolley up or down the stairs also time-consuming. Material of normal trolley often to be steel, this may cause the product heavy and not very portable. Short people will go through hard time handling normal trolley due to unadjustable handle. Last but not least, back injuries often happen when user lifting stuff from the trolley to table high.

CHAPTER'S SUMMARY

As a conclusion for this chapter, the analysis and findings have been made. This Tri-Wheel Trolley has a lot of advantages however there are every cons to pros. Hence, the challenges are taken as a room for improvements and more developments for future generation and well as to

enhance their knowledge on the project we carried out. Test run is carried out to determine the fullest potential of this device.

CHAPTER 5

DISCUSSION , CONCLUSION AND UPGRADE PLAN

INTRODUCTION

This chapter explains about discussion , conclusion and upgrade plan all together for the project . From the data from the test run of the project, the analysis have been done. In everyday life we may have to carry so many goods of various quantities through stairs especially in offices, schools, colleges, hotels, industries, apartments etc. where the lifts may not be available, may be full with the people or under repair. It is very tiresome to carry the various objects through stairs manually for higher floor for so many times. In most of building lifts are not installed so there only human labor is solution for caring material. Hence, the discussion from all the results of test run and analysis will be explain in this chapter. Then , the conclusion will be made based on the discussion and upgrade plan that have been made.

DISCUSSION

Based on data we collected, which we tested ourselves, we agree that we need to use dc motor that at least 240v to achieve 50kg lifting with minimum speed. The 12V DC motor makes a loud noise when in use. This is because higher DC motor volt makes louder noise.

Other than that, we decided to change the body material from stainless steel to furniture pvc. Stainless steel is a strong and reliable structure but it will a make the product heavier and exceed targeted weight. Furniture PVC on the other hand is a lightweight and strong material. It is the right material for the body of this product.

In additional, we have change the lifting mechanism for our product from inside the frame to outside of the frame. Our first design was using two separated motor lifting through right and left frame. This was designed to achive more power. However, based on our observation, there was a few flaw in this method which is both motor does not lifting in the same rate or time. It also require more power input and will exceed our budget. We have improve the lifting mechanism design by using only one motor and a track for the base to slide up. Both cost and weight were reduce while achieve the balance of lifting rate on both side of trolley.

CONCLUSION

Though this chapter, project had some limitations regarding the strength and built of the structure, it can be considered to be a small step forward, as far as Stair Climbing Vehicles are concerned. During the test run of this project, it was realized that it wouldn't be a bad idea to consider this design for carrying heavy loads up the stairs. This product will be well acclaimed if it can be commercialized to suit the needs. Though the initial cost of the project seemed to be higher but more accurate manufacturing would shorten this. As far the commercial aspects of this product are concerned, if this product can be fully automated and produced at a lower cost the acceptance will be unimaginable. Presently, there are no competitors for such a kind of product in our market.

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