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MOVING LADDER MULTITASK

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2. Kami mengakui bahawa Moving Ladder Multitask dan harta intelek yang ada di dalamnya adalah hasil karya / reka cipta asli kami tanpa mengambil atau meniru mana-mana harta intelek daripada pihak-pihak lain.

3. Kami bersetuju melepaskan pemilikan harta intelek Moving Ladder Multitask kepada Politeknik Sultan Salahuddin Abdul Aziz Shah, Shah Alam bagi memenuhi keperluan untuk penanugerahan **Diploma Kejuruteraan Perkhidmatan Bangunan** kepada kami.

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ABSTRACT

Abstract- A ladder is a piece of equipment consisting of repeated rungs or steps for climbing up and down something to do any task especially in building maintenance for high rise. Although many people use ladder without incident, when things do go wrong, the injuries are often very serious. In accident statistics, stepladder is commonly one of the most injurious products within both the domestic and industrial environment and this leads to considerable human suffering. In addition, the ordinary existing stepladders are not capable of moving horizontally and too difficult to change the place from one point to another while maintaining. As we know, existing ladders have many shortcomings for workers. Existing ladders are static in one place. This ladder cannot move smoothly if a worker wants to divert it without just staying above the ladder. Users need to move down and lift up the ladder onto the next point. It will take a long time to finish their task. From the project, we focus on developing a method to help users with the initiative to innovate a ladder that can move horizontally (left and right) at the desired distance using mechanical mechanisms and to save users time when doing work that requires a change of places. The movement of this ladder uses the mechanical mechanism, which is limited to 150 Kg maximum load and the height of the ladder is 1.84 m when opened. This ladder can only be used on flat surfaces, which is not suitable for grassy and rocky surface areas. Besides, this ladder also provides a tool's pocket to help users easily use the tools without lifting up and down from the ladder to pick. In a nutshell, the importance of the innovation on this stepladder is for having a great relationship with domestic or professional users because it will help them stay satisfied at the workplace and give them something to look forward to each day.

Keywords- Stepladder, Moving, multitask, horizontally, mechanical mechanism

Abstrak- Tangga adalah peralatan yang terdiri dari tangga atau langkah yang berulang untuk memanjat sesuatu bagi melakukan apa-apa tugas utamanya dalam kerja penyelenggaraan bangunan di tempat tinggi. Walaupun ramai orang menggunakan tangga tanpa insiden, apabila perkara itu salah, kecederaan sering menjadi serius. Dalam statistik kemalangan, tangga biasanya adalah salah satu produk yang paling buruk dalam persekitaran domestik dan perindustrian dan ini membawa penderitaan manusia yang besar. Di samping

itu, tangga-tangga yang sedia ada tidak mampu bergerak secara mendatar dan terlalu sukar untuk mengubah tempat dari satu titik ke titik yang lain sambil mengekalkan. Seperti yang kita tahu, tangga yang sedia ada mempunyai banyak kelemahan untuk pekerja. Tangga yang sedia ada adalah pegun di satu tempat. Tangga ini tidak dapat bergerak dengan lancar jika pekerja ingin mengalihkannya dengan hanya berada di atas tangga. Pengguna perlu bergerak ke bawah dan mengangkat tangga ke titik seterusnya. Ia akan mengambil masa yang lama untuk menyelesaikan tugas mereka. Dari projek ini, kami memberi tumpuan kepada membangunkan kaedah untuk membantu pengguna dengan membuat inovasi tangga yang boleh bergerak secara mendatar (kiri dan kanan) pada jarak yang dikehendaki menggunakan mekanisma mekanikal dan untuk menjimatkan masa pengguna apabila melakukan kerja yang memerlukan perubahan tempat. Pergerakan tangga ini menggunakan mekanisma mekanikal, yang terhad kepada beban maksimum 150 Kg dan ketinggian tangga ialah 1.84 m apabila dibuka. Tangga ini hanya boleh digunakan pada permukaan rata, yang tidak sesuai untuk kawasan permukaan berumput dan berbatu. Selain itu, tangga ini juga menyediakan poket alat untuk membantu para pengguna mudah menggunakan alat tanpa mengangkat dan turun dari tangga untuk memilih. Ringkasnya, pentingnya inovasi pada tangga tunjang ini adalah untuk mempunyai hubungan yang hebat dengan pengguna domestik atau profesional kerana ia akan membantu mereka berpuas hati di tempat kerja dan memberi mereka sesuatu untuk dilakukan setiap hari.

Kata kunci- Langkah-langkah, Gerakan, multitask, mendatar, mekanikal mekanikal.

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LIST OF SHORT FORM

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DIY	Do It Yourself	8
MIG	Metal Inert Gas	12
TIG	Tungsten Inert gas	12

LIST OF SYMBOLS

SYMBOLS		DEFINITION	PAGES
Kg	Kilogram		5
m	Meter		5
%	Percent		33

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

A ladder is a piece of equipment consisting of repeated bars or step use for climbing up or down something to do any task especially in building maintenance for high rise. Different type of ladder has different function for various occasions. The ladder has two types of permanent and non-permanent. Folding ladder is one non-permanent ladder used to reach the higher horizontal field and it used only at certain times so it can be moved or stored. Step ladders can be used anywhere because it does not have to be leant against any type of support to be used. Twin step ladder is more popular as it provides rungs on either side of the ladder.

Although many people use ladder without incident, when things do go wrong, the injuries are often very serious. In accident statistics, stepladders are commonly one of the most injurious products within both the domestic and industrial environments and this leads to considerable human suffering and financial cost. The fact that such patently dangerous tools and activities are responsible for lower accident rates than stepladder use suggests that there is a fundamental problem associated with both the design and application of stepladders to tasks (Lauren Clift MSc,2002)

From all above, we found that the existing ladder has a lot of disadvantage. We had done an observation about the problems faced by the organizers to maintaining the building. An organizer in a building that is maintaining an electrical wiring system is difficult to change the place from one point to another. They need to climb up and down the ladder to move to another point that need to be maintain. In this case, we know that if the user repeated climb up and down, they will lack of ergonomic in working environment. Most probably every user had to be an accident. The idea that we want to improve is to add the wheels and paddle as the movement mechanism and we provide the pockets at ladder for placing tools in order to facilitate

The initiative in this study is to innovate an existing ordinary step ladder that only static in one place into a ladder that capable of moving horizontally. This ladder moving horizontally with the help of a wheel and it is a mechanical mechanism.

SAFETY PRECAUTIONS WHEN USING A LADDER:

Ladder Riding Hazards



Figure a)



Figure b)



Figure c)

Figure 1.1.1: Safety Precautions when Using A Ladder.



Figure 1.1.2: The Technician Used Ladder to Maintenance the Ducting.

1.2 BACKGROUND OF THE PROJECT

No one really knows when the ladder was invented. However, the earliest evidences of it is located in Valencia, Spain. The Spider Caves have a Mesolithic rock painting of a ladder that's about 10,000 years old. Over the years, different kinds of ladders have been created to suit different purposes. There are two type rigid ladders that are self-supporting or that may be leaned against a vertical surface such as wall. Nowadays, aluminium ladder is widely used because the ladder is multifunction, more light and can be keep easily. Next, another one ladder is flexible ladder. These ladders are usually made of rope, cord, grass, and other such flexible materials. They're more convenient to carry and easy to use. However, they're often used in combat situations and can be great for emergencies. From the observation, the ordinary existing stepladder not capable to moving horizontally and too difficult to change the place from one point to another while maintaining the building. So, the gap that we had identified in this project is, the innovation of this moving ladder multitasks had been capable to moving horizontally by using the mechanical mechanism.

1.3 PROBLEM STATEMENT

As previously identified, the problem facing is more to

- i. Existing ladder are static in one place. This ladder cannot move smoothly if worker want to divert it with just stay above the ladder. Worker need to move down and lifting up the ladder into the next place. It will take a long time to finish their work.
- ii. The user allocates more time to complete the work due to the frequency of moving the ladder. Like above, there are static and cannot be move properly. It is also bear the risk to the user of falling from the ladder as a result of the frequent ascending and descending the ladder.
- iii. The ordinary existing stepladder is difficult to carry anywhere by using small vehicle or to keep in the small storage because of the big size. Its cannot be reduced and heavy to carry

1.4 OBJECTIVE OF THE PROJECT

In this paper, the objective to focus is:

- i. To innovate a ladder that capable in moving horizontally (left and right) at the desired distance.
- ii. To save users time when doing work that requires a place change
- iii. To facilitate the users to use the tool systematically when provided tool's pocket.

1.5 SCOPE OF THE PROJECT

- i. The movement of this ladder are using the mechanical mechanism, which limited to 150 Kg maximum load and the height of the ladder is 1.84 m when opened.
- ii. This ladder only can be use on flat surface, which is not suitable for grassy and rocky surface area.

1.6 IMPORTANCE OF THE PROJECT

The importance of the innovation on this stepladder, is for having great relationships with domestic or professional user because it will help them stay satisfied at work and give them something to look forward to each day. However, far too often, that will help them move from point A to point B while maintaining the building.it will easier to the domestic and professional user especially the technician for maintenance task of the building or the domestic user that like to do DIY.

1.7 TERM OR OPERATING DEFINITIONS

TERM	DEFINITIONS
Moving	<ul style="list-style-type: none">• The word of moving shows that its goings in a specified direction or manner; change position.• Moving shows that it capable or having movement, so the ladder that we want to create involving a motor vehicle in motion. We created the vehicle wheeled ladder to produce movement.
Ladder	<ul style="list-style-type: none">• A structure for lifting up or down that consists essentially of two long sidepieces joined at intervals by crosspieces on which on may step.
Multitask	<ul style="list-style-type: none">• Have performance of multiple tasks at one time, the ability to do several things at the same time.

Table 1.7.1: Term and Operating definitions

1.8 CONCLUSION

For the conclusion in this first chapter of the introduction of the project is to exposed and overviewed the background, problem facing by the existing ladder, the objective from our project, scope, term and operating definition and the importance of the project. It soon, continue to the next chapter that research the detail about the literature review for the source of references to collect the fact and data about this moving ladder multitask project.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The purpose of the literature review is to give the reader a solid background of the phenomena being studied. It should provide the reader with information that will lead to the statement of the problem

Moving ladder multitask is the innovation from the existing ordinary stepladders to the ladder that capable of moving horizontally to the right and to the left by using the mechanical mechanism. Regarding the stepladder task, COM and COP movement have also been investigate in previous study. (Ashton-Miller, 2015). In this chapter, we will perform the research about an existing ordinary stepladder to find the gap between the new version of our own innovation moving ladder multitask. The main context in this literature review is more to different between the existing ordinary stepladder and the innovation moving ladder, also focus on an ergonomic evaluation in using the stepladder to find out the ergonomic in safety and health of the domestic and professional user. Besides, we had finds out all the structure, material being use and the welding joint context in term of construction of the moving ladder multitask.

2.2 CONCEPT/THEORY

2.2.1 Types of ladder

The types of ladders that probably most familiar with are the rigid type with its familiar A-shape. We will find that portable that we can tote place to place as we need it. We'll also see ones fixed in place such as on the outside of a building or attached to an attic access. (Homestratosphere,2019)




Types of ladder	Figure	Descriptions
Step Ladder		<p>The step ladder is the most popular one available simply because you can use it for so many things. It is self-supporting, so you can take it where you need it. It consists of two sets of rungs or steps that are evenly spaced with a top cap that connects the two together.</p> <p>(Homestratosphere,2019)</p>
Multipurpose		<p>The multipurpose ladder combines the features of the step and extension models that increase its versatility. It can be self-supporting or require that you place it against something stable. It can even stand in as scaffolding, depending on the product. It's a smart choice for a contractor or the DIY handyman</p> <p>(Homestratosphere, 2019)</p>
Articulated		<p>Ladder that can change to fit the job. Its design makes it easy to transport. They have a series of locking hinges to keep them in place. Because of that factor, they have a limited height range. However, they are versatile too which makes them worth a look. (Homestratosphere, 2019)</p>

Table 2.2.1 : Types of ladder

2.2.2 Type of ladder material

i. Aluminum

Aluminum ladders are lightweight and resistant to moisture and corrosion. However, they can conduct heat and electricity, and therefore should never be used near energized electrical equipment. Aluminum ladders may also bend under pressure, and consequently are not well-suited for heavy-duty weighted projects. (Homestratosphere, 2019)

ii. Fiber glass

Fiber glass ladders are heavier and more resilient than their aluminum counterparts. They are both moisture and corrosion resistant and are non-conductors of heat and electricity. Under express stress, fiberglass ladders may snap, and therefore are not well-suited or heavy-duty weights. Homestratosphere, 2019)

iii. Wood

Wood ladders are not recommended for any type of commercial or industrial application. Although they are non-conductors of heat and electricity, they have variable strength, and are prone to warp and rot. (Homestratosphere, 2019)

iv. Steel

Steel ladders are resilient and well-suited to heavy-duty weighted project, however they are not moisture or corrosion resistant, and are conductors of both heat and electricity. (Homestratosphere , 2019)

2.2.3 Structural Supports

Reaction Equivalent to a force with known line of action, support and connections caring reaction of this type include roller, rockers, frictionless, surface, short links, and cable, collars on frictionless rods, and frictionless pins in slots. Each of these supports and connection can prevent motion in one direction only (Ferdinand P. Beer,2014)

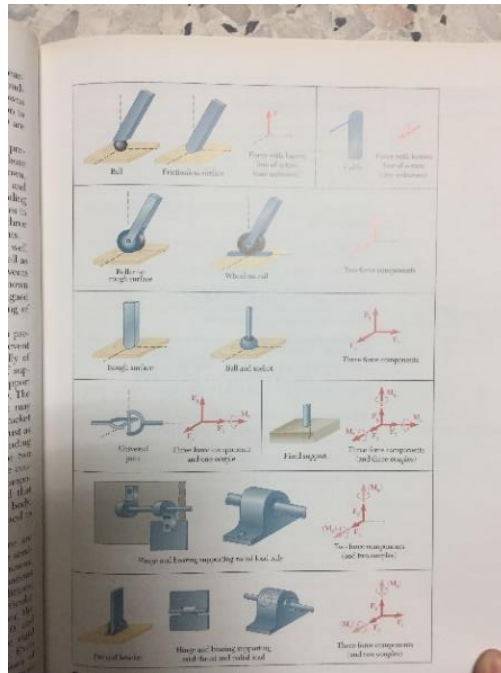


Figure 2.2.3.: Structural support

2.2.4. Selection of an appropriate factor of safety

The selection of the factor of safety to be used for various applications is one of the most importance engineering tasks. On the one hand, if a factor of safety is chosen too small, the possibility of failure becomes unacceptably large. (Ferdinand P. Beer,2014)

- i. Variation that may occur in the properties of the member under consideration. the composition, strength and dimensions of the member are all subject to small variations during manufacture. (Ferdinand P. Beer,2014)
- ii. The number of loadings that may be expected during the life of structure or machine. (Ferdinand P. Beer,2014)
- iii. The type of loading that are planned for in the design, or that may occur in the future (Ferdinand P. Beer,2014)

2.2.5 Hazardouse in using ladder

Injury statistics show that the use of ladders presents many hazards. Injuries involving ladders frequently cause permanent disability.

The hazards associated with ladders include:

- i. Falls from ladder
- ii. Struck by falling ladders
- iii. Struck by materials falling from ladders

- iv. Tripping over ladders (erect or lying on floor)
- v. Lifting heavy ladders
- vi. Striking persons or objects when carrying ladders
- vii. Contact with electrical equipment.

(Workplace Safety and Prevention Services, 2014)



Figure 2.2.5: The hazards associated with ladders include

2.2.6 Types Of Welding Joint

2.2.6.1 Corner joints

used to joint two steel at right angle to each other. It can be difficult to assemble and maintain correct alignment, particularly in thin flexible sheet. The root of a single-sided weld when loaded in tension is very weak for the highest strength the corner joints needs to be welded from both sides. The single-sided weld may also have a crease containing oxides along the center line of the penetration bead, further reducing the strength of the weld

2.2.6.2 Butt joint

Commonly used technique in welding that can either be automated or done by hand on steel pieces. Butt welding can also be done with brazing for copper pieces. It is used to attach two pieces of metal together such as pipe, framework in factories, and also flanges. A flange is something that either is internal or external that provided to strengthen a piece of material. Butt joints are best performed with MIG or TIG welding application due to their natural ability to connect two pieces of metal together. Using different types of welding electrodes for the welder will determine the properties of the weld such as its resistance against corrosion and strength.

2.3 PREVIOUS STUDY

Ladder slant, rung separation, climbing velocity, and climbing direction required further investigation. Each variable was studied at two levels except for ladder slant (the effect of which was highly significant in the pilot study) which was investigated at four levels. "Time-into-cycle" was included to determine how the dependent variables vary over the step cycle. (Donald S. Bloswick, 1990)

In accident statistics, stepladders are commonly one of the most injurious products within both the domestic and industrial environment and this leads to considerable human suffering and financial costs. The fact that such patently dangerous tools and activities are responsible for lower accident rates than stepladder use suggests that there is a fundamental problem associated with both the design and application of stepladders to tasks. (Lauren Clift MSc, 2002)

Verification of body posture stability on a stepladder is required in order to understand how to use stepladders safely and to establish the associated safety rules. (Atsushi Sugama, 2015)

A step is a tool for moving to or working at an elevated location, which is used at various situations. According to a previous survey, occupational accidents caused by the use of stepladders (stepladder accidents) in Japan led to nearly 40,000 injuries a day of absence of four or more days and to 20 fatalities (Sugama and Ohnishi, 2015)

Regarding the stepladder task, COM and COP movements have also been investigated in previous studies (Ashton-Miller, 2016)

The standing positions, the reaching directions, and the interaction were significant for all measure. The reaching distance at 1 step below was significantly shorter than that of the other standing position. There was no significant difference between platform and 2 steps below. The longest horizontal reaching distance to the forward direction was for the stepping-over condition (110cm) and the shortest was at 1 step below (90 cm). (Akihiro Ohnishi, 2016)

Under the conditions studied there does not appear to be significant slip hazard for people with reasonable strength and mobility. There may be a potential for climber grip strength to be exceeded under some field conditions and foot slip is possible during the use of vertical ladders. There is also the potential for localized fatigue in muscle acting at the elbow, hip and ankle joints during long climbs. The relatively high measured torso muscle IEMG suggests that certain ladder climbing activities may generate considerable back forces. A biomechanical model was developed which allowed the evaluation of dynamic joint moments and back forces, study results include safety and biomechanical design guidelines relating to the effect of the task, equipment, and user parameters on climbing safety. This study is about ergonomic posture of user body when using ladder. (Donald S. Blowswick, Don B. Chaffin, July 1990)

The problem of providing a strong and larger work area at the top of step ladders has faces the art for many years, and to which a number of solutions have been proposed typical of these proposed solutions are those exemplified in U.S. This patent provides an extension for the top of step ladder but such extensions are not satisfactory for a number of reasons. First, such extensions are hinged at the top of the step ladder and the hinged arm offers no support or any added weight that might be placed on the extension, Second, this patent solves only part of the problem in that it only increases the width of the step ladder top and not the length, and also leaves a crack across the work top. (Edwin I. CASADA, April 1982)

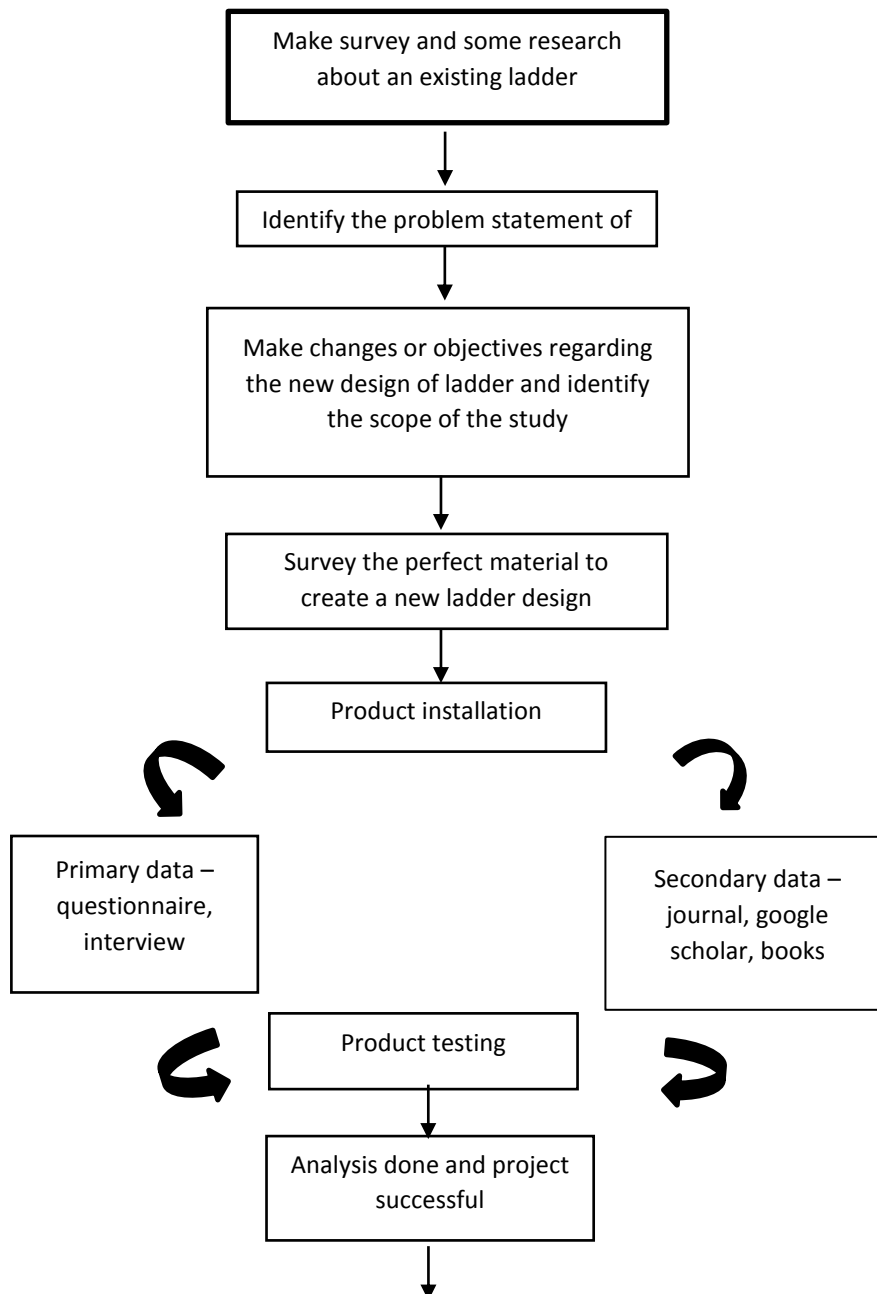
2.4 CONCLUSION

In the conclusion of this chapter, literature review helps us to find the theory, concept, and previous study to support our project which is to find the real component, type of ladders, structural support, safety requirement and hazard in using ladder. The purpose of the literature review is to give the reader a solid background of the phenomena being studied. It should provide the reader with information that will lead to the statement of the problem. By

the end of this chapter, it continues to the methodology which is to view about the method on doing research and the flow to conduct our Moving Ladder Multitask project.

CHAPTER 3 METHODOLOGY

FLOW CHART



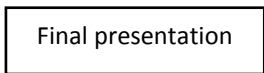


Figure 3.1.1: Project Flow Chart

3.1 INTRODUCTION

The methodology of the study refers to the most appropriate method of conducting research and determining an effective procedure to answer the research problems. This chapter covers chapter identification, study design, data collection methods, research instruments, data analysis methods and chapter formulas. Nevertheless, subheading found in this section depends largely on the type of project being implemented. Some studies may require more detailed discussion of design and research instruments than others.

The idea of this project is from an observation of group member toward the user of stepladder is hard to conduct the ladder while using to maintained the electrical wiring. In this chapter, I would overview about the method of a research to produce a Moving Ladder Multitask. The method is important to collect all data, responses and overview to make sure the existence of the production of Moving Ladder Multitask.

3.2 RESEARCH DESIGN

3.2.1 METHOD

In this project, this study will be conducted by using: -

- a. Qualitative method:
Qualitative research is a study of the individual and the individual to get the information in depth and in depth.
- b. Questionnaire (refer to appendix)
- c. Design sketch of Moving Ladder Multitask

3.2.1.1 Design Sketch of Product

a. First sketch:

In this first sketch, we decide to produce a ladder that only capable of moving horizontally in need to change the place. Paddle was made from steel plat-paddle may be hard to handle because of heavy. Many steps so it most probably risks when climbing the close step.

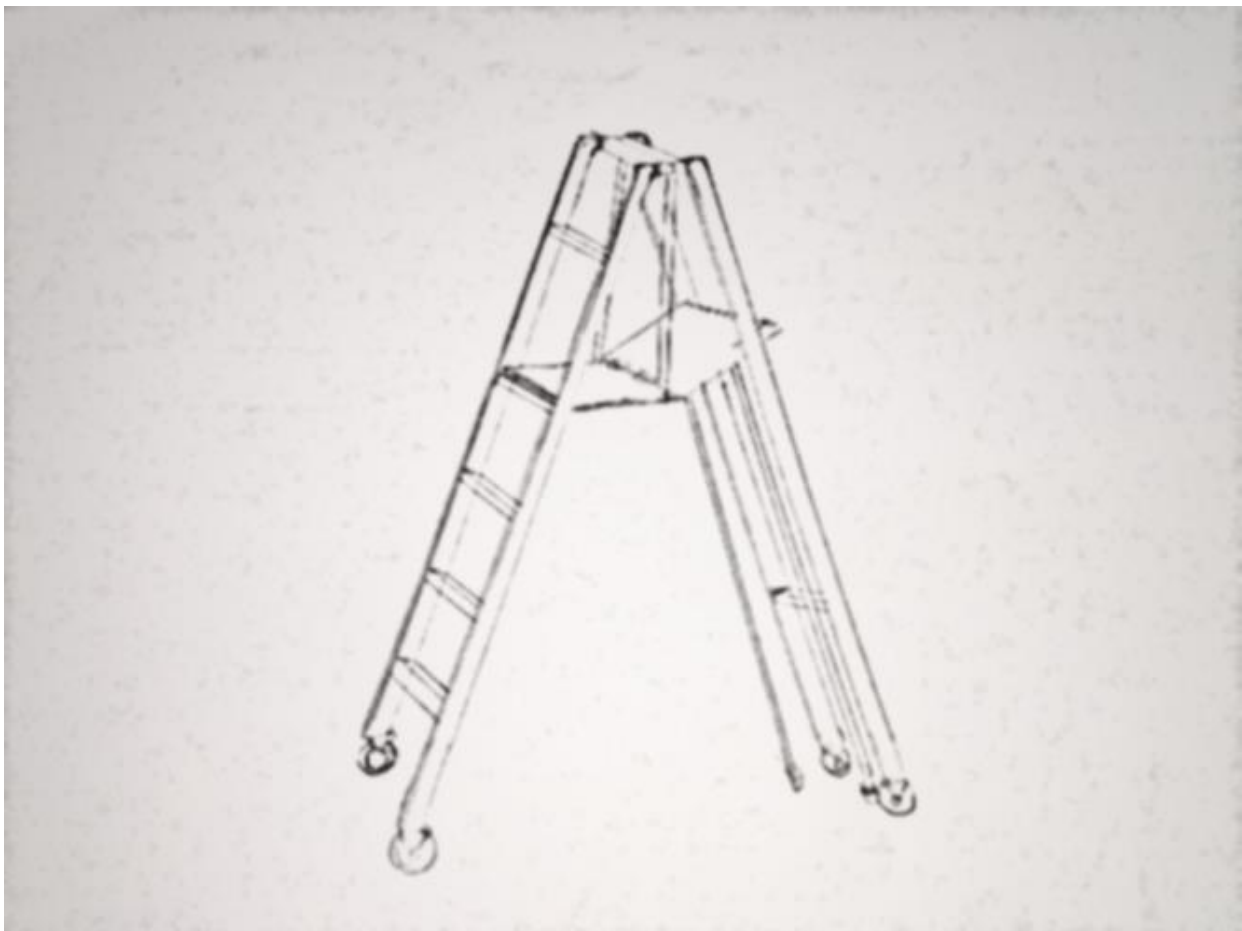


Figure 3.2.1.a.: First design sketch

b. Second sketch:

For an improvement, our ladder has a tools pocket that users will be able to put the tools for maintaining. The ladder was made from a combination of 1"x2" and 1"x1" steel. Length between steps was 15".

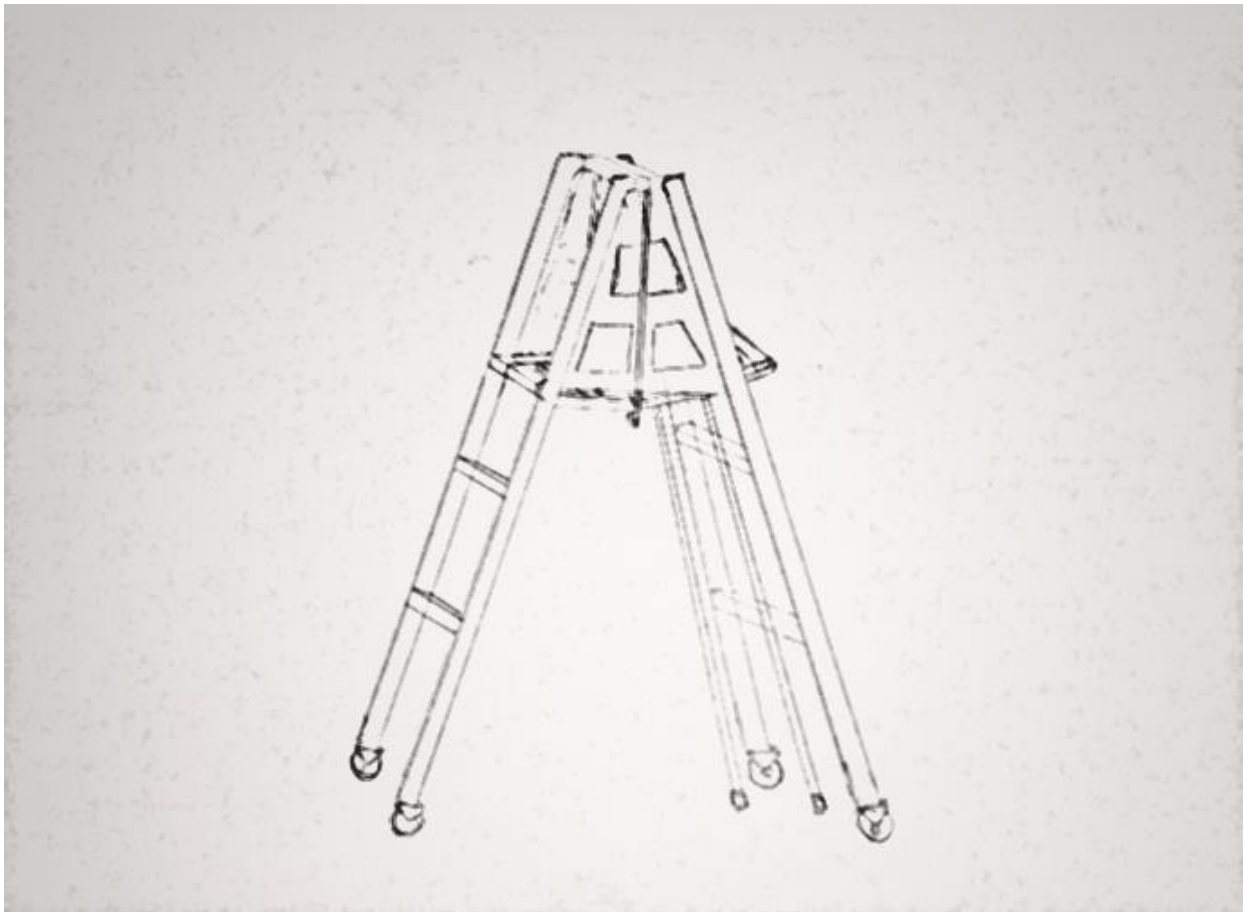


Figure 3.2.1.b: Second design sketch

3.2.2 EVALUATION CONCEPT AND SELECTION

Evaluation concept and choosing were analysed with comparison of the design concept at figure. This method was to give credit for every concept in choosing the best design to produce. This is called the Matrix Evaluation Method (Jalil MKA, 2000) as shown in table 1

Perspective	First design	Second design
Safety	2	3
Ergonomic	2	3
Easy to carry and keep	2	2
Easy to handle	2	3
Comfortable	1	3
Durability	1	3
Total	10	20

References:

1	Bad
2	Good
3	Very good

Table 3.2.2: Rating of perspective for evaluation concept and choosing in both design

3.2.3 PRODUCT DIMENSION

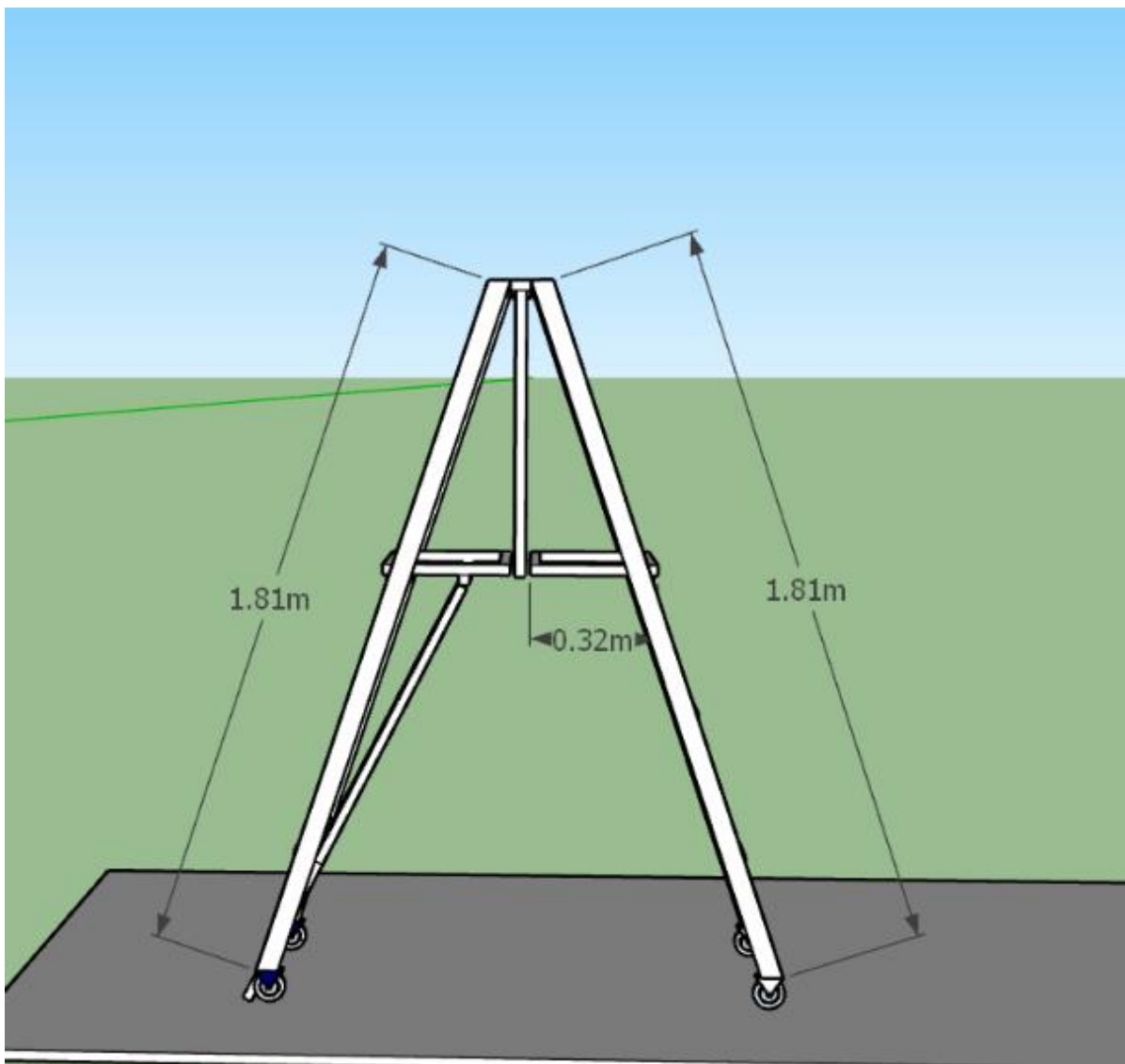


Figure 3.2.3.a.:Side view dimension

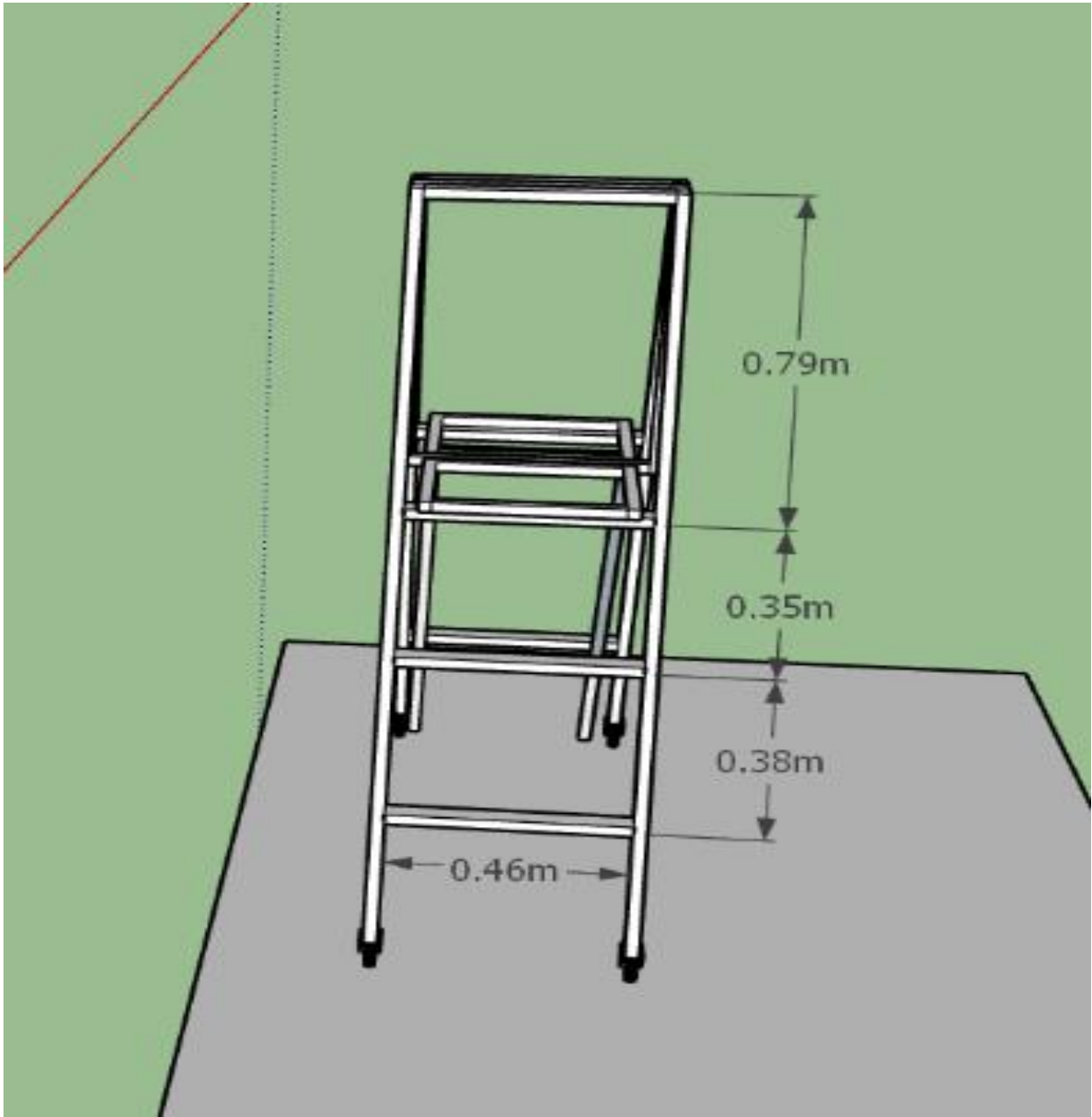


Figure 3.2.3.b.:Front view dimesion

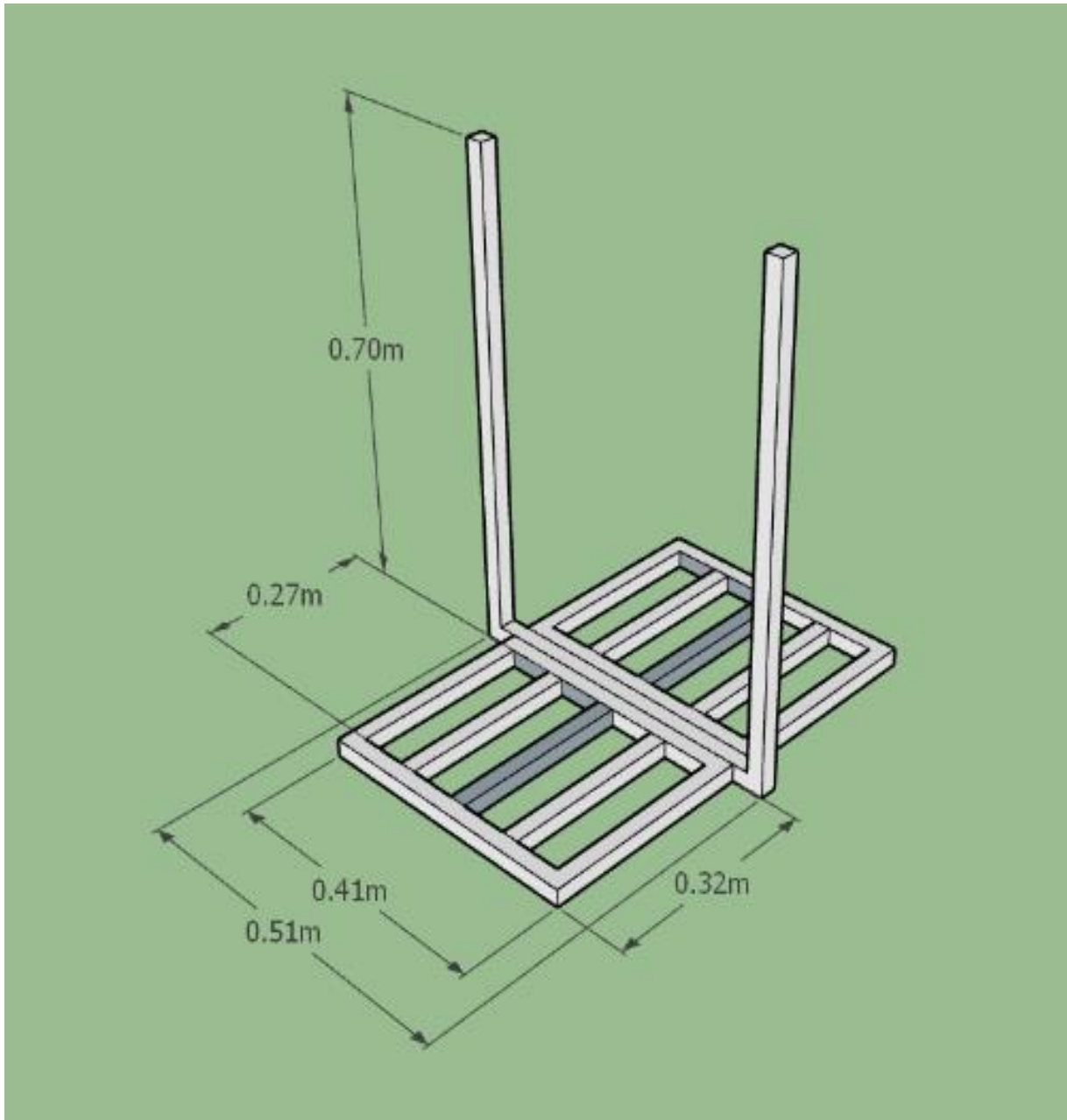


Figure 3.2.3.c: Dimension for paddle

3.3 DATA COLLECTION METHOD

3.3.1 METHOD

a. Google Form

Google form allow us to spread in social media to find more response. By this way, we will able to get response from other institutions or industries.

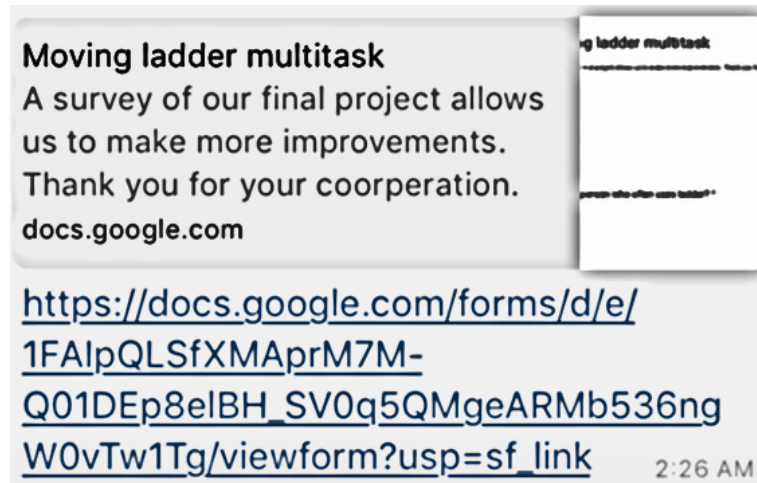


Figure :3.3.1: Google form for survey of the project.

b. Questionnaire (refer to appendix)




By using this questionnaire, we will able to get response from student and staff in PSA and also give to outside response by hand such as Store boy at supermarket, and maintenance.

c. Literature review

In this literature review I had found the concept and theory and the previous study on a ordinary existing ladder so that I can improve my project.in concept and theory, I found the types of ladders, type of ladder materials, Selection of an appropriate factor of safety, structural support, Hazardouse in using ladder

3.4 RESEARCH INSTRUMENT

The research instrument is a solid method to support a product that has been produced. In this study, this instrument refers to the equipment used to obtain and collect research data. Among the tools used in the implementation of this project are :

Instrument	Description
	<p>1”X2” and 1”x2” steel Used as a ladder framework. This steel also for making the paddle for the movement of ladder</p>
	<p>castor wheel As capable of ladder moving horizontally</p>
	<p>Stainless steel hinges Mechanical bearing that connects two solid objects, typically allowing only a limited angle of rotation between them</p>




	<p>Grinder machine Use for cutting the steel for making the ladder with good finishing. This machine also using for polishing the steel after it weld to be more seemed neater.</p>
	<p>L angles and measurement tape To measure the steel needed for sure the best dimension. It is tool used for making and measuring for drawing a straight line perpendicular, test level and accuracy.</p>
	<p>MIG welding gas Gas welding machine is a machine that can be facilitated connected works iron between one with the rest. This machine able facilitate our project work to joint steel until become a ladder. This machine use gas energy and electric.</p>

Table 3.4.1: Equipment for Research Instrument

3.5 SAMPLING TECHNIQUE

Analysis the google form and questionnaire to find out the best response for our project improvement according to user needed and safety requirement in using a our Moving Ladder Multitask

3.6 CONSTRUCTION PROCESS

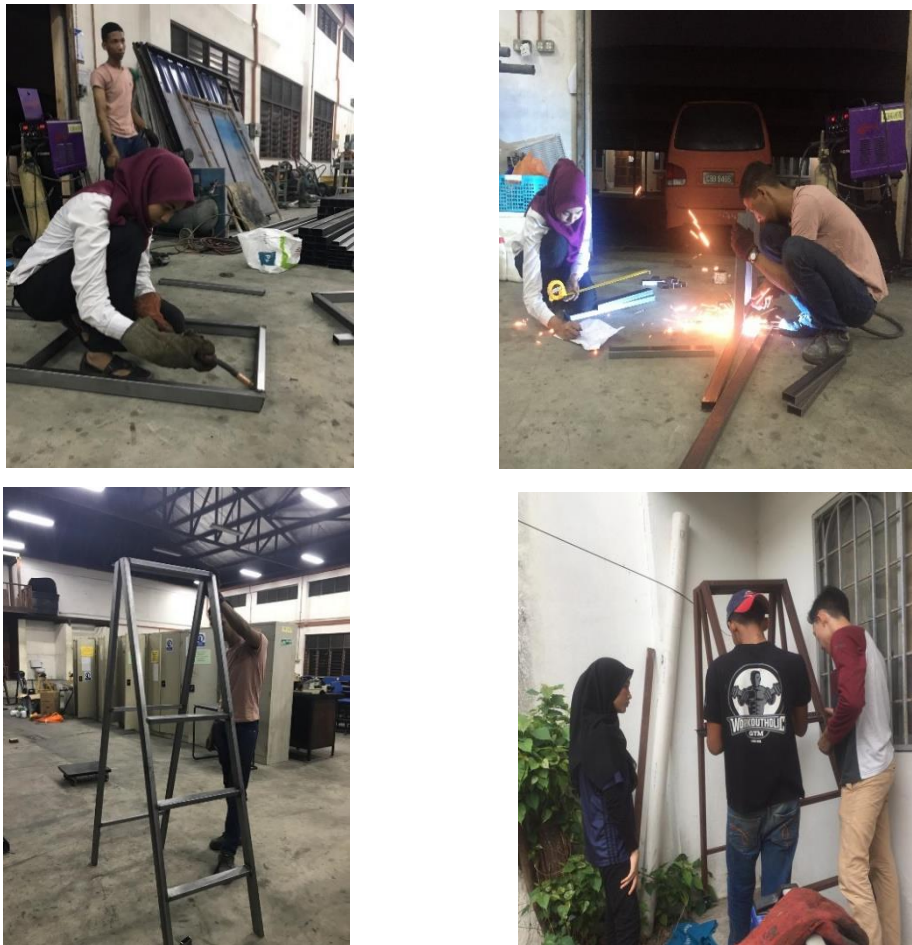


Figure 3.6.1 : Ladder construction process

3.7 PROJECT-BASED COMPONENTS

1) Steel

- The steel that we used is 1 "x 1" type of steel. Steel is a main component of this product and serves as a framework for 'multitask moving ladder' products. These features of steel are able to with stand loads of less than 150kg. This steel has a thickness of 0.8mm.



Figure 3.7.1 : Steel as main component of framework

2) Wheel

- The wheels are used to facilitate this product to move from one place to another without having to lower and lift the ladder. These wheels will be fitted once with steel using screws for easy maintenance.

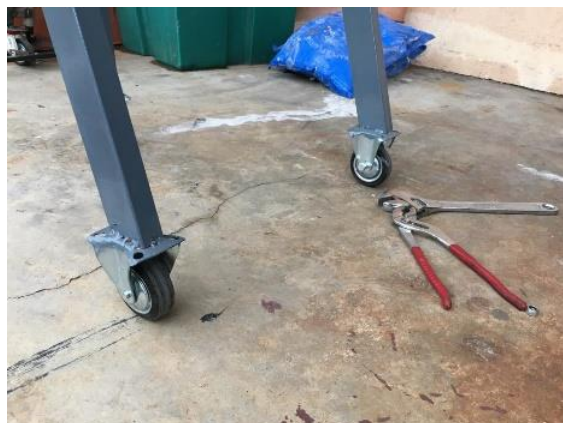


Figure 3.7.2 : Wheel as component of movement

3) Hinges

- The hinges are used to facilitate stair-stepping when finished. This hinge is placed at the top of the stairs.



Figure 3.7.3 : Hinges

4) Paddle

- The paddle is used to move the ladder forward and backward using the movement mechanism. This saves electricity. This saver can save users time for this product as users do not have to go down the stairs.



Figure 3.7.4: Paddle used to move the ladder

5) Stering

- Stering is used to control the movement of ladder to move 45° left and right. This can help the user control the movement of the ladder from the top of the ladder.

-



Figure 3.7.5: Stering to handle the placement from the top of ladder

6) Pocket

- The function of the pocket on the ladder is to keep the equipment in the pocket. This makes it easier for the user to use the ladder without having to go down to pick up other equipment while doing maintenance work.



Figure 3.7.6: Tools Pocket

3.8 WELDING PROJECT

Welding is a process of mixing one material with another using a metal-like material. This welding process involves the melting of one type of metal to form a bond between the other structures.

3.8.1 Welding structure

To do the process of welding, the creation of the structures is done in stages. The first step is to make the iron measurements according to the specified size. This welding is done using a MIG welding machine. Then, steel cutting should be done using grinder cutter. Welding process is done to attach the steel to form a steel frame for each ladder.

3.8.2 Welding of wheel

Wheel connectors with this ladder frame are designed to facilitate multitask moving ladder. This connection is done using a MIG welding machine for welding the base plate for wheel assembly.

3.8.3 Welding of paddle

1'x1 'steel is cut using a cutter grinder according to the size of the paddle. This paddle acts as a ladder moving from one place to another using the pedestal.

3.9 CONCLUSION

By the end of this chapter, I able to allocate the methodology was describe all the method on research to conduct my project which is Moving Ladder Multitask. Next it continues to the next chapter which to analyzes the research data. It aims to bring the reader's attention to the research findings.

CHAPTER 4

RESULTS

4.1 INTRODUCTION

This chapter presents and analyse the research data. This chapter aims to bring the reader's attention to the research findings based on the objectives and research questions. It also describes the overall study that we want to undertake. The items described in this section include response rates, respondents' demographic profiles, variables, parameters and study findings.

The Moving Ladder Multitask innovation requires comprehensive observation as well as the opinions and response rates of domestic and professional users to achieve the objectives that are in line with consumer needs.

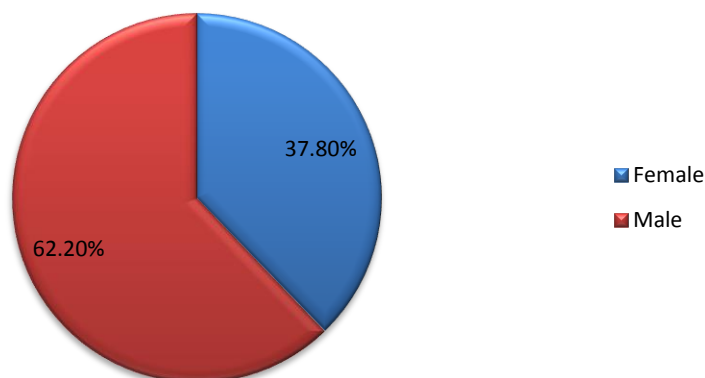
4.2 RESPONSES RATE

A total of 20 questionnaires form given to respondents,15 were returned representing 70% responses rate. In the other hand, the survey has been conducted by using google online survey forms. The survey includes 5 questions, out of which 37 responses were returned.

4.3 DEMOGRAPHIC PROFILE OF RESPONDENTS

4.3.1 Gender

Gender of respondents

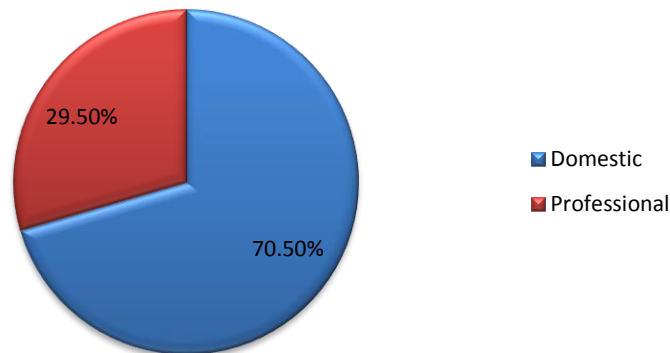


A total of 37 respondents, 23 is male representing 62.2% and 14 is female representing 37.8%

More men use stepladders than women, though this relationship is affected by the use environment. However, from accident statistics it was determined that 70% of injured users were male and 30% female. This provided the makes up of the subject panel for the trials.

4.3.2 Domestic and Professional users

Domestic and Professional users



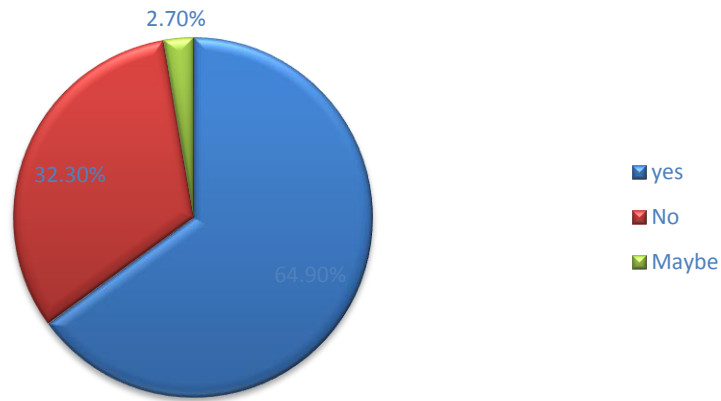
Experience of stepladder use is a diverse variable and, for the domestic user, one that can be adequately represented by a good random sampling technique. For professional users this is less easy, since the premise is that professional users will be trained and their use monitored. The level of training and monitoring may vary greatly, though in truth the current health and safety legislation makes provision for ensuring effective education and practice.

4.4 QUESTIONNAIRE CONTENTS AND RESULT

This questionnaire is used to get feedback from users especially those using our Moving Ladder Multitask project such as contractors, factory workers and so on. This questionnaires consisting a few questions to know the risk and hazard, safety, the frequent in using stepladder and necessity of stepladder at home.

Question 1 : Does stepladder use a risk to an accident

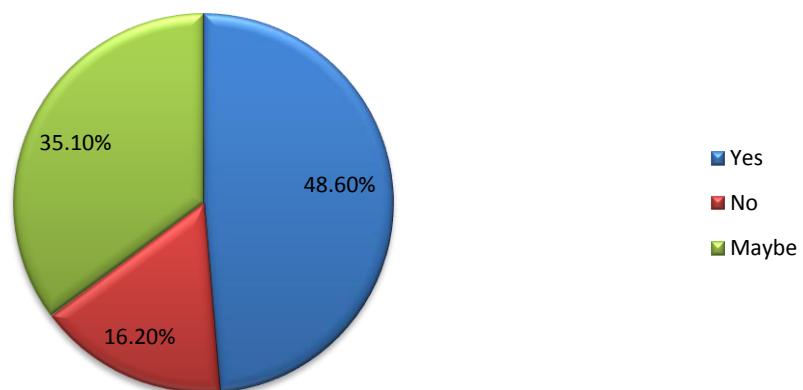
Does stepladder use a risk to an accident



As well as their approach to safety and risk management. It has been found that they can be grouped according to age, predisposition to risk and other variables, which correlate to undertaking risky behaviour with stepladders. This finding leads to the recommendation that some personality profiling tools may be used to help identify individuals who are unsuited to professional ladder use without some other safety intervention.

Question 2: Do you feel burden when using an existing ladder

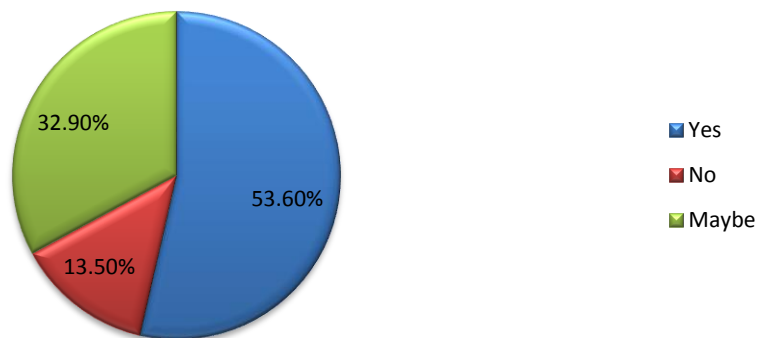
Users feel burden when using existing ladder



From this, we observed that an existing ladder was difficult to carry and be handled by one person. So the initiative is, we make a handle with a castor wheel helped in using to handle our Moving Ladder Multitask that makes it easier for users.

Question 3 : Does existing ladder required more time to complete work

Existing Ladder Required More Time To Complete Work



From this, we take the initiative to innovate existing stepladder to the ladder that is capable in moving horizontally (to the left and to the right) that does not require the users to lift up and down to move from one point to another during maintenance tasks.

Item	Rating (%)		
	Yes	No	Maybe
Risk To An Accident	64.9	32.3	2.7
People feel burden with existing ladder	29.7	29.7	40.5
Existing Ladder Required More Time to Complete Work	53.6	13.5	32.9

Table 4.4.1 : Questionnaire Contents And Result

4.5 TIME REQUIREMENT TESTING

	Lamp installation	Take the carpentry
Twin stepladder	1 : 01 : 75 min	0 : 35 : 0 min
Moving ladder multitask	0 : 39 : 98 min	0 : 13 : 0 min

Table 4.5.1 : Time required to complete lamp installation and take the carpentry

4.6 FINAL PRODUCT TESTING



Figure 4.6.1: Final Product Testing

The outcomes from this testing is, “Unit Bangunan dan Infrastruktur” feel satisfaction, but they recommended to add some more safety feature to our Moving Ladder Multitask

4.7 FINAL PRODUCT VIEW

Based on the results analysis from all respondents and product testing, the initiative to innovate an existing stepladder into Moving Ladder Multitask will be the best satisfaction to all users both domestics and professional.



Figure 4.7.1: Final Product View

4.8 CONCLUSION

For the conclusion in this chapter, a presented and analysed research data able to bring the reader's attention to the research findings based on the objectives and research questions. As overall it come to the initiative to better improvement of our Moving Ladder multitask that make it more easier to users. By the end of this chapter, it continues to the overall chapter which is the conclusion for our Final Year Project.

CHAPTER 5

CONCLUSION

5.1 INTRODUCTION

Base on the results obtained in Chapter 4, a discussion of the finding is presented in this chapter. The findings from the study are used to discuss whether the proposed hypotheses are supported. All research questions will be answered subsequently and finally the achievement of research objectives are determined. Vendors are provided with managerial implications and recommendations, to enable them to draft appropriate strategic in gaining consumers intention to get a ladder that meets an ergonomic, safety evaluation and able to facilitate their task while using a ladder. Finally, the contributions of the study are discussed based on theoretical, methodological, practical approaches and end with suggestions for future research.

5.2 DISCUSSION OF RESULTS

There are three major question been focused in this report to know the safety evaluation, constraints for the users when using the ladder and time requirement. We also do a testing of the time required to complete lamp installation work.

The first major question from questionnaire to be discuss is, (Does stepladder use a risk to an accident?). As well as their approach to safety and risk management. It has been found that they can be grouped according to age, predisposition to risk and other variables, which correlate to undertaking risky behaviour with stepladders. This finding leads to the recommendation that some personality profiling tools may be used to help identify individuals who are unsuited to professional ladder use without some other safety intervention.

Next question is, (Do you feel burden when using an existing ladder?). From this,we observed that an existing ladder was difficult to carried and be handle by one person.So the initiative is,we make a handle with castor wheel helped in using to handle our Moving Ladder Multitask that make it easier for users.

The last question is, (Does existing ladder required more time to complete work?). From this, we take the initiative to innovated existing stepladder to the ladder that capable in moving horizontally(to the left and to the right) that not required the users to lifting up and down to move from one point to another during maintenance task.

For the testing of time requirement to complete lamp installation and take the carpentry,we decided to keep the function of our Moving Ladder Multitask that capable in moving horizontally(to the left and to the right) with paddle and handle by using mechanical mechanisme. It will be a satisfaction to consumers both domestic and professional. In terms of reducing time to complete some task, it can be a key step to use an equipment that easier their task.

5.3 CONCLUSION

In fact, the use of stairs is a necessity for both domestic and professional users, and it is a trend at risk for danger. As we know, many of these existing stairs do not meet ergonomic safety and safety evaluation. Existing stairs are also not capable of facilitating the work done by the users but rather burdening them. In terms of reducing time to complete some task, it can be a key step to use an equipment that easier their task. It will be a satisfaction to consumers both domestic and professional. From all above, we found that the existing ladder has a lot of disadvantage. They need to climb up and down the ladder to move to another point that need to be maintain. In this case, we know that if the user repeated climb up and down, they will lack of ergonomic in working environment. Most probably every user had to be an accident. The idea that we want to improve is to add the wheels and paddle as the movement mechanism and we provide the pockets at ladder for placing tools in order to facilitate. The initiative in this study is to innovate an existing ordinary step ladder that only static in one place into a ladder that capable of moving horizontally. This ladder moving horizontally with the help of a wheel and it is a mechanical mechanism.

5.4 RECOMMENDATION

on the whole, the innovation of these Moving Ladder Multitask will be the benchmark of all the uses of stepladder in performing work especially for professional users in building

maintenance work. In an effort to build a ladder that capable in moving. It will be a satisfaction to consumers both domestic and professional.

As the significant and implication in this study, firstly is focused to the safety evaluation of our Moving Ladder Multitask that need to considered and put more safety. Secondly, the concept of moving horizontally also need to be consider in term of multitask defined that able to do more than one task by using these ladder. Hopefully this project will give huge impact to the users in term facilitated them to do some task using the ladder.

5.5 CONCLUSION

For the conclusion in this chapter, discussion of the finding is presented. The findings from the study are used to discuss whether the proposed hypotheses are supported. All research questions has been answered subsequently and finally the achievement of research objectives are determined. This is the last chapter for Final Year Project Report

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APPENDIX

APPENDIX A	Questionnaire 1
APPENDIX B	Testing Permission Letter
APPENDIX C	Appreciation Letter
APPENDIX D	Testing and Commission Letter
APPENDIX E	Ghantt Chart

APPENDIX A



Pengenalan

Borang soal selidik ini digunakan untuk mendapatkan maklumbalas daripada pengguna khususnya yang sering menggunakan projek kami iaitu *Moving Ladder Multitask* seperti kontraktor, pekerja kilang dan sebagainya. Kami juga dapat memperbaiki kelemahan projek yang sudah sedia ada dan dapat membuat lebih banyak penambahbaikan dari pelbagai aspek. Kerjasama anda untuk menjawab borang soal selidik ini amat kami hargai.

Tajuk kajian (produk)

Moving Ladder Multitask merupakan sebuah rekaan tangga yang mampu untuk bergerak di mana pengguna hanya berada di atas tangga sahaja tanpa perlu mengalihkannya. Selain itu, rekaan produk ini mempunyai poket untuk menyimpan alatan seperti paku, skru dan alatan yang lain.

BAHAGIAN A : LATAR BELAKANG RESPONDEN

Arahan : Bahagian ini merupakan soal selidik mengenai latar belakang anda. Sila tanda (/) pada ruang yang disediakan.

1. Jantina : Lelaki
- Perempuan
2. Umur : 18 sehingga 25 tahun
- 26 sehingga 30 tahun
- 31 sehingga 40 tahun
- 41 hingga 50 tahun

BAHAGIAN B : PEMERHATIAN DAN UJIAN TANGGA

Arahan : Bahagian ini merupakan soal selidik mengenai produk yang sudah diubahsuai untuk kegunaan pengguna domestik dan professional. Sila bulatkan skor pilihan anda berdasarkan pada skala berikut :-

1-Setuju 2- Tidak setuju 3- Mungkin

No	Soalan	Bulatkan skor pilihan anda		
		1	2	3
1.	Pergerakan horizontal pada tangga ini memudahkan pengguna	1	2	3
2.	<i>Moving Ladder Multitask</i> ini mempunyai ciri-ciri keselamatan yang baik	1	2	3
3.	<i>Moving Ladder Multitask</i> mempunyai ciri-ciri ergonomic	1	2	3
4.	<i>Moving Ladder Multitask</i> ini mengurangkan risiko untuk berlakunya kemalangan semasa pengguna menggunakan tangga.	1	2	3
5.	Konsep mekanisma mekanikal yang digunakan pada tangga yang bertujuan menggerakannya mencapai teknologi hijau.	1	2	3
6.	Poket peralatan pada sisi bukaan tangga memudahkan pengguna mengambil peralatan tanpa perlu turun dari tangga.	1	2	3
7.	Material kain yang digunakan untuk membuat poket peralatan memudahkan tangga disimpan dengan kemas dan tidak mudah terkoyak.	1	2	3

BAHAGIAN C :

Pendapat anda mengenai tangga yang diubahsuai ini dan pendapat mengenai penambahbaikan
