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MULTI TROLLEY TOOL BOX

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ACKNOWLEDGEMENT

Penulis ingin merakamkan penghargaan ikhlas kepada penyelia projek, diatas bimbingan dan perbincangan yang diberikan sepanjang tempoh projek ini dilaksanakan.

Penghargaan ini juga diberikan kepada sesiapa sahaja yang samaada secara langsung atau tidak langsung membantu dalam penghasilan projek ini.

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Abstrak

Projek ini terhasil daripada pemerhatian di pelbagai tempat seperti kedai , bengkel mahupun rumah sendiri dan pengalaman yang kami lalui ketika melakukan kerja - kerja di bengkel seperti bengkel kimpalan , gegas dan mesin .Antara permasalahan yang sering terjadi seperti kehilangan alatan - alatan tangan di bengkel , peralatan bengkel yang tidak teratur , ketidaksesuain tempat penyimpanan peralatan ,masalah punca tenaga elektrik jauh dan kawasan yang tiada sumber kuasa elektrik , menggunakan tenaga lebih untuk mencari peralatan bengkel ketika melakukan tugas , dan juga masalah mengalihkan dan memindahkan mesin welding atau perlatan yang berat .Melalui permasalahan ini , kumpulan kami telah menganalisis model yang sedia ada di pasaran dan melakukan beberapa modifikasi melalui kekurangan dan masalah model tersebut .Hasil daripada modifikasi itu kami telah melakukan penambahbaikan dari pelbagai aspek . Selepas itu ,hasil daripada model sedia ada di pasaran , kami melakukan beberapa memodifikasi bersesuaian masalah . Projek ini di namakan multi trolley tool box kerana mempunyai pelbagai fungsi dan hasil gabungan di antara kotak penyimpanan peralatan , platform troli , kotak pembekal kuasa elektrik dan juga meja kerja . Modifikasi yang pertama adalah , pelbagai penyimpanan peralatan , kedua , trolley platform boleh lipat yang boleh membawa dan mengalihkan barang berat seperti mesin welding dan sebagainya . Ketiga , mempunyai bekalan kuasa arus ac elektrik yang mampu membekal arus pada peralatan elektronik seperti kipas , mesin grinder , mesin drill , lampu dan sebagainya . Kelima , multi trolley tool box juga mempunyai meja kerja lipat bertujuan memberi ruang kerja extra untuk melakukan kerja . Kesimpulannya , hasil daripada modifikasi projek ini, kami dapat mengatasi permasalahan penyimpanan peralatan yang terdapat di bengkel dan pada model di pasaran dan menawarkan pelbagai fungsi dan keefisyenan dalam melakukan kerja -kerja di bengkel .

Abstrack

This project resulted from observations in various places such as shops, workshops or even our own homes and the experience we went through while doing work in the workshop Politeknik Sultan Salahuddin Abdul Aziz Shah when has been doing task at workshop such as welding , foundry ,and machining .Among the problems that often occur such as loss of hand tools in the workshop, unorganized workshop equipment, unsuitable equipment storage, hard to find electrical sources and areas without electrical power sources, using more energy to find workshop equipment when performing tasks and problem of moving and relocating welding machines or heavy equipment and limited workspace .Through these problems, our group has analyzed the existing models in the market and made some modifications through the shortcomings and problems of the model. As a result of the existing models in the market, we made some modifications to suit the problem, scope and limitations of our study. This project is called Multi trolley tool box because it has various functions and a combination of tool boxes , trolley platform , power supply box and work bench . The first modification is, a variety of equipment storage, the second, a foldable platform trolley that can carry and move heavy goods such as welding machines and the like. Third, have an electric AC current power supply that is able to supply current to electronic equipment such as fans, grinders, drill machines, lights and so on. Fifth, this project also has a foldable work bench to provide extra work space to do work . In conclusion, as a result of the modification of this project, we were able to overcome the problems of storage of equipment available in the workshop and on the models on the market and offer a variety of functions and efficiencies in doing the work in the workshop.

Appreciation

Grateful to the Divine presence and blessings on our great patron Prophet Muhammad SAW, we were able to complete the project with excellence in the allotted time without any problems that are difficult to solve as a condition for the awarding of the Diploma in Mechanical Engineering. We would like to express our appreciation to all parties directly and indirectly involved in the path of our final year Project lecturer, En. Mohamad Khirudin Bin Amdan who has given us a lot of guidance, advice, encouragement and criticism until we successfully completed this project report. Not forgetting the friends and family members who helped a lot in terms of views and finances in completing this project.

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TABLE OF CONTENT

CHAPTER	CONTENT	PAGE
	DECLARATION OF ORIGINAL WORK AND INTELLECTUAL PROPETIES	ii
	ACKNOWLEDGMENT	iii
	ABSTRAK	iv&v
	APPECIATION	VI
	TABLE OF CONTENT	VII-XII
	BLANK PAGE	XIII
1	INTRODUCTION	
1.1	INTRODUCTION	14
1.2	BACKGROUND	14-15
1.3	PROBLEM OF STATEMENT	15
1.1	RESEARCH OBJECTIVE	16
1.2	RESEARCH OF QUESTION	16
1.3	SCOPE AND LIMITATION	17
2	LITARATURE VIEW	18
2.1	INTRODUCTION	18
2.3	2.3 HISTORY OF TROLLEY TOOL BOX	18
2.4	CONCEPT OF TOOL BOX	18-19
	FIGURE 2.4.1	18
	FIGURE 2.4.2	19
	FIGURE 2.4.3	20
	FIGURE 2.4.4	20
2.5	TYPES OF TOOL BOXES IN THE MARKET	21
	FIGURE 2.5.1	21

	FIGURE 2.5.2	22
	FIGURE 2.5.3	22
2.6	MULTI TROLLEY TOOL BOX DESIGN SELECTION	23
	FIGURE 2.6.1	23
	FIGURE 2.6.2	24
2.7	INTRODUCTION OF MULTI TROLLEY TOOL BOX	25-26
	FIGURE 2.7	25
2.7.1	TROLLEY PLATFORM	26-27
	FIGURE 2.7.1	26
2.7.2	INVERTER	28
	FIGURE 2.7.2	28
2.7.2	BENEFITS OF USING INVERTER	29
2.7.3	FOLDABLE WORK BENCH	30-31
	FIGURE 2.7.3	30
2.7.3.1	THE BENEFITS OF USING FOLDABLE WORK BENCH	31
2.7.4	PRODUCT SAFETY ACT	32
2.7.5	SELECTION OF PROJECT SPECIFICATIONS AND MANUFACTURING MATERIALS	32
2.7.5.1	WOODEN PALLETS AND PLYWOOD	32
2.7.5.2	BATTERY AND INVERTER	32
2.7.6	MULTI TROLLEY TOOL BOX SPECIFICATIONS AND FUNCTION	33
2.8	PREVIOUS RESEARCHER'S STUDY (IN THE COUNTRY)	34
	FIGURE 2.8	34
2.9	COMPARISON BETWEEN MULTI TROLLEY TOOL BOX AND TOOL	35

	BOX WITH FLIPPABLE WORKBENCH	
	FIGURE 2.9	35
2.9.1	WHAT MAKE US DISAGREE ON THE DESIGN OF THE RESEARCHER'S PROJECT BEFORE	36
2.30	SUMMARY	36
3	METHODOLOGY	37
1.1	INTRODUCTION	37
3.2	FLOW CHART	38
3.2.1	IDENTIFIYING PROBLEMS	38
3.2.2	ANALYSIS	39
3.2.3	DESIGN	39
3.2.4	IMPLEMENTATION	39
3.2.5	SYSTEM	39
3.3	DATA COLLECTION METHODS	39-40
3.4	PRODUCT DESIGN SELECTION	40-41
	FIGURE 3.4.1	40
	FIGURE 3.4.2	41
3.5	LIST OF MATERIALS AND COSTS	42
3.6	LIST EQUIPMENT OF TOOLS	42-43
3.7	MULTI TROLLEY TOOL BOX	43
3.7.1	FIGURE COMPLETED MULTI TROLLEY TOOL BOX	43-44
3.7.2	THE PROCESS OF PURCHASING AND	44

	COLLECTING MATERIALS	
	FIGURE 3.7.2.1	45
3.7.3	THE PROCESS OF MARKING,CUTTING,PUNCHING AND MEASURING	45-46
	DIAGRAM 3.7.3.1	45
	FIGURE3.7.3.2	45
3.7.4	CONNECTION PROCESS	47
	FIGURE 3.7.4.1	47
3.7.5	POWER SUPPLY BOX	47
	DIAGRAM 3.7.5.1	48
3.7.6	FINISHING PROCESS	48
	DIAGRAM 3.7.6.1	48
3.7	SAFETY DESIGN PRODUCT	49
	FIGURE 3.7.1	49
	FIGURE 3.7.2	50
3.8	PROTOTYPE AND REAL MULTI TROLLEY TOOL BOX	50
3.8.1	LIST OF MATERIAL DIFFERENT (MULTI TROLLEY TOOL BOX) MULTI TROLLEY TOOL BOX FRAME	50
3.9	SUMMARY	51

4	PRELIMINARY INVESTIGATION	52
4.0	INTRODUCTION	52
4.1.1	DEMOGRAPHIC PROFILE OF RESPONDENTS	53
	FIGURE 4.1.1 GENDER RESPONDEN	53
4.1.2	AGE OF RESPONDENTS	54
	FIGURE 4.1.2	54
4.1.3	COST OF COMPONENTS	55-56
	TABLE 4.1.3	55-56
4.2	STUDY DATA	56
4.2.2	ANALYSIS OF STUDY DATA	56-57
4.2.3	QUESTIONNAIRE REVIEW	57
	FIGURE 4.2.3 STUDENTS AND EMPLOYEES	58
	FIGURE 4.2.4 FREQUENCY RATE OF LOST HAND TOOLS	59
	FIGURE 4.2.5 STUDY OF UNORGANIZED HAND TOOL	60
	FIGURE 4.2.6 RESPONDENT'S REPOSE TO THE QUESTION	61
	FIGURE 4.2.7 DIFFICULTY IN OBTAINING POWER SUPPLY	62
	FIGURE 4.2.8 STUDY OF RESPONDENTS	63
4.3	MULTI TROLLEY TOOL BOX TEST	64
4.3.1	TEST OF SMOOTHNESS OF MOVEMENT	64
4.3.2	TEST OF DURABILITY, TIME AND CAPABILITY (SUPPLY POWER BOX)	64
4.3.3	MATERIAL AND LOAD TESTING	65
4.4	SUMMARY	65

5	CONCLUSIONS AND RECOMMENDATIONS (1203)	66
5.1	INTRODUCTION	66
5.2	DISCUSSION	66
5.3	CONCLUSION	66&67
5.3	RECOMMENDATIONS	67
5.3.1	FUTUR PROPOSALS	67
5.4	REFERENCES	68-69
5.5	ATTACHMENT	69
5.5.1	ATTACHMENT OF GANNT CHART	70
5.5.2	FLOW CHART	71
5.5.3	List of equipments and costs	72

CHAPTER 1

INTRODUCTION (1203)

1.1 Introduction

A tool storage box (also known as a tool box) is a box that serves as an equipment storage place that has several levels of storage. usually used to store workshop tools that are commonly used to do maintenance work, manufacturing and even repair work. After that, the way a tool storage box works is to store and carry it anywhere by lifting and pushing. In addition, in the Shah Alam Polytechnic workshop there are several storage places and tool trolleys, but the existing workshop equipment storage is less satisfactory and less efficient.

Tool boxes are typically used as trade, hobby, or DIY and their contents vary according to the craft. Modifying the tool box becomes a hobby for people who customize the tool box depending on what and the needs and functions of the tool box are used. Therefore, we both have planned to build and modify a tool box with various functions .Each function we modify based on the needs of use and problem solving available in the Shah Alam Polytechnic workshop,

1.2 Background

In this era of globalization, the invention of equipment and technology, day by day, is growing rapidly with one main purpose which is to provide convenience to users. The use of versatile equipment makes it a major attraction for users to use it. Synonyms of the word versatile are fickle, changeable and unstable. Therefore, as much as possible is that each person or thing has the ability to change depending on the situation and the use of the thing.

This multi trolley tool box is related to the principle of versatility that depends on the suitability of the use situation.

In addition, health issues on the ergonomics of equipment and products for use such as pain in the limbs, fatigue transporting to take equipment to move from one point to another, become a weight point that must be considered before and after the project is carried out. along doing this multi trolley tool box.

By modifying the design and adding useful functions to the existing market products to make it versatile and able to solve problems for consumers is our priority to produce this project.

The mutli trolley tool box project also emphasizes on the safety of consumer good “Akta Perlindungan Pengguna 1999 ” to prevent any injuries caused by our project design to users

1.3 Problem of statement

Some of the problems 'tool box' and 'trolley tool box' that are often faced by users are the first is the durability of the material 'tool box' is not resistant to bending and load that causes the material to break easily and detach such as in the handle and cover clip that endanger the consumer. second, (trolley tool box and tool box) whose equipment storage space such as driver screws, pliers, grating file, electric soldering iron and so on is too limited and small. thirdly the suitability of inefficient storage space that can damage the equipment stored and usually the points and blades of the equipment that are easily damaged, due to the various dimensions and shapes of the equipment. Fourth, the supply of electrical power is difficult to obtain, such as when doing work - work outside that equipment requires a source of electrical energy such as lights, drills and so on. Fifth, limited work space, makes users feel less comfortable when doing work - work that causes the quality of work and work results to be reduced.

1.1 Research objective

The objective of this study is to produce a portable and multi - function tool storage and it is named multi trolley tool box. Among the objectives of this study are:

1. Able to have a place of electricity supply that can charging equipment that requires electrical energy
2. Able to store a variety of hand tools of various shapes in an organized and correct manner.
3. provide comfort to users from the aspect of workspace.
4. Facilitate tool search and reduce manpower.

1.2 Research of question

1. Is your tool storage trolley able to handle the problem statement in (1.3) above?
2. Will this project be able to increase the productivity of individuals, communities and countries?
3. Can this project increase one's thinking and creativity in creating, improving, and modifying something?

1.3 Scope and limitation

1. These products and modifications are suitable and user friendly

2. This product is more effective to students and workers in the field towards vehicle workshop, welding, maintenance and so on.

3. The suitability of the product place, more suitable in places such as homes, workshops and factories.

4. For ideas our team want make by using more heavy duty materials such as mild steel and hollow mild but we don't have enough budget and complete equipment and tool , so we replace a materials with use plywood and used material such wooden pallets .

CHAPTER 2

LITARATURE REVIEW (1203)& (1184)

2.1 Introduction (1203)

Litarature review is a study conducted based on theories - theories that are true and used in fields related to research such as articles, journals, blogspots, and so on. Therefore, in this chapter there are several theories applied to this study such as the use of our study materials, tool box system, trolley platform, power supply and work bench.

2.3 History of trolley tool box

Tool boxes were invented about 107 years ago by brothers Charles and Howard. From year to year the tool box has been upgraded for example, if before the tool box was made of wood but now the material used to make the tool box is more durable that is made of iron. The tool box nowadays also has wheels to make human work easier .

2.4 Concept of tool box



Figure 2.4.1

A toolbox could refer to several types of storage to hold tools. It could mean a small portable box that can carry a few tools to a project location or a large storage system set on

casters. Modern toolboxes are predominantly [metal](#) or [plastic](#). Wood was the material of choice for toolboxes built beginning in the early 19th century.

Toolboxes can be mainly divided as 5 types. They are:

- Plastic
- Steel
- Aluminium
- Waterproof
- Cantilever



Figure 2.4.2:Cantilever tool box

Small portable toolboxes are sometimes called hand boxes or portable tool storage. Most portable toolboxes have one handle on top and a lid that opens on a hinge. Many have a removable tote tray that sits on a [flange](#) inside the lip of the box, with a single larger compartment below. The tote tray helps organize smaller parts and accessories. Portable toolboxes sometimes use slide-out trays or [cantilever trays](#) in lieu of the removable tote tray. Metal toolboxes (typically [steel](#)) weigh more than plastic ones. A plastic toolbox laden with tools can weigh the same as a comparable steel box does when empty. Metal boxes are also subject to [rusting](#) and their sharp edges can mark the surfaces of things they are banged against. Metal is, however, known for being stronger than plastic, so one should balance its disadvantages against the need to withstand abuse and support the weight of many tools.



Figure 2.4.3: Portable chest

Portable chests are a type of tool storage that is small enough to carry, but has drawers to organize contents. Portable chests have a handle on top for portability and a top lid that opens on hinges. Portable chests typically have 3 -4 drawers. Most are made from metal, but some have a plastic shell with metal drawers in order to help lighten the piece.

A toolbox can also refer to a large tool storage system, or tool chest combos, that includes multiple pieces. These systems are almost always made from metal. Most tool storage systems are painted steel, but some are stainless steel and aluminum. They include a top chest that has drawers and a top lid that opens on a hinge. The top chest is designed to sit on a cabinet, also called a rolling cabinet (rollcab) or rollaway. The cabinet sits on four or more casters and has drawers to organize tools. Other pieces can be added to the system or combo. A middle chest, also called an intermediate chest, can be placed between the top chest and cabinet .



Figure 2.4.4 Tool carts

Toolcarts (also known as rollcabs) are commonly used in the transportation industry for maintenance and repair of vehicles on location. Used as portable work stations, some of the larger types are self powered and propelled, for example, pit carts in automobile racing.

After several decades of decline in popularity, today a resurgence in use is underway. Viewed by many as intended primarily for specialized craftsmanship, such as machinists, tool and die makers, jewelers and other specialized craftsmen, they are also sought after by average tradesman and collectors as working heirloom. Many toolboxes and chests from a variety of trades can be seen at the Smithsonian Museum of American History.

2.5 Types of tool boxes available in the market

At this point, we can see the various types of tool boxes that are available in the market and are usually widely used and generally. We can buy this tool box in markets such as hardware stores and applications buying and selling at Shopee, Lazada and so on .



Figure 2.5.1

Figure 2.5.1 is a basic tool box that only works to store hand tools in the workshop so that they are not littered and easy to find if you want to use the equipment because it has been stored in the tool box. The capacity to store equipment in this tool box is also limited due to its relatively small size the shape of a tool box like this is very basic because this type of design has not yet gone through the process of innovation.



Figure 2.5.2 : Trolley tool

From figure 2.5.2 is a trolley tool. The usual tool trolley has 3 levels of equipment storage, has 4 wheels, relatively open storage. After that, its advantage, there are 3 floors that can separate the type of storage use, portable, and also easy for users to pick up and return equipment. After that, the disadvantage is that the equipment storage looks unmanaged and does not look neat, and also easily dirty due to using the concept of open storage.



Figure 2.5.3 : trolley tool box

Trolley tool box works to store workshop equipment. However, the trolley tool box has a few advantages when compared to the tool box rajah1 earlier. This is because, not only can store equipment. This trolley tool box also has wheels to make it easier for us to move it without having to use a lot of energy to lifting. Furthermore, the capacity to store equipment in this tool box trolley is quite wide allowing users to store a lot of workshop equipment. Over time tool box trolley already has wheels and large capacity tool box trolley already has wheels and large capacity .

2.6 Multi trolley tool box design selection

1.first design

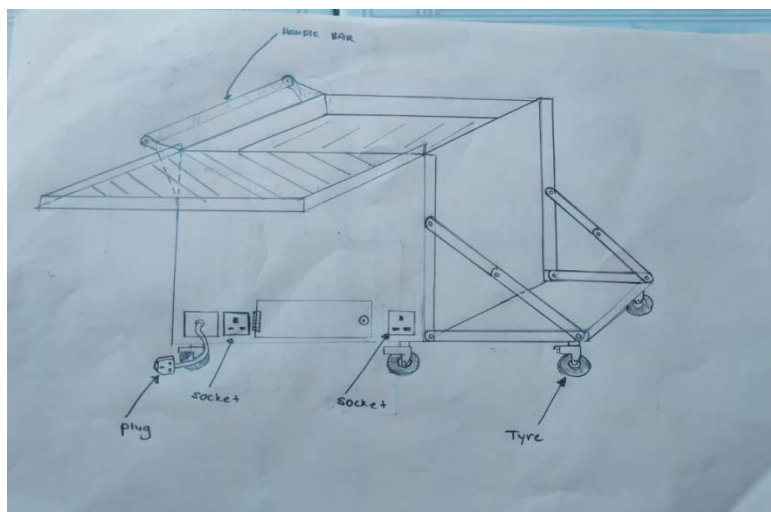
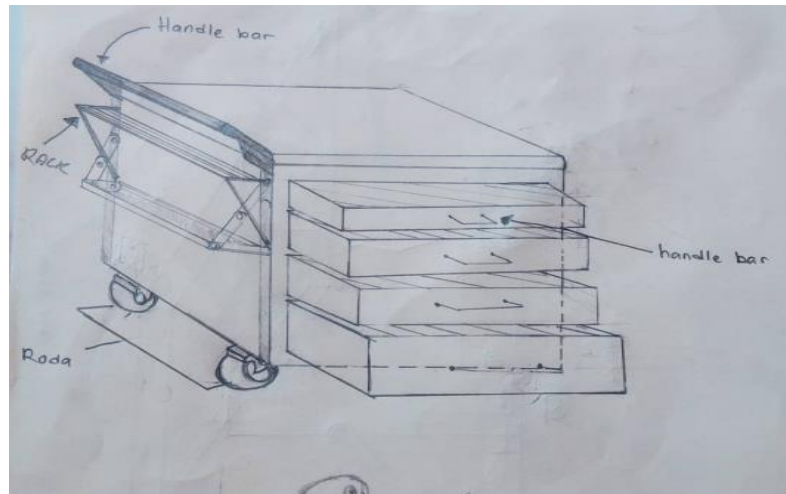


Figure 2.6.1: First sketch

In figure 2.6.1 shows the first sketch of our project, in which there are 4 wheels, 4 drawers of various sizes, 1 handle, 2 shelves, hidden equipment storage and electrical power supply.

However, there are some shortcomings in this design. after making further study of this design, it compacted some shortcomings in this design are practicality in terms of maintenance on

the electrical power supply , quite hard to develop and built this design and also shortcomings in terms of functionality to overcome our problems and achieve our objectives.

2. Second design

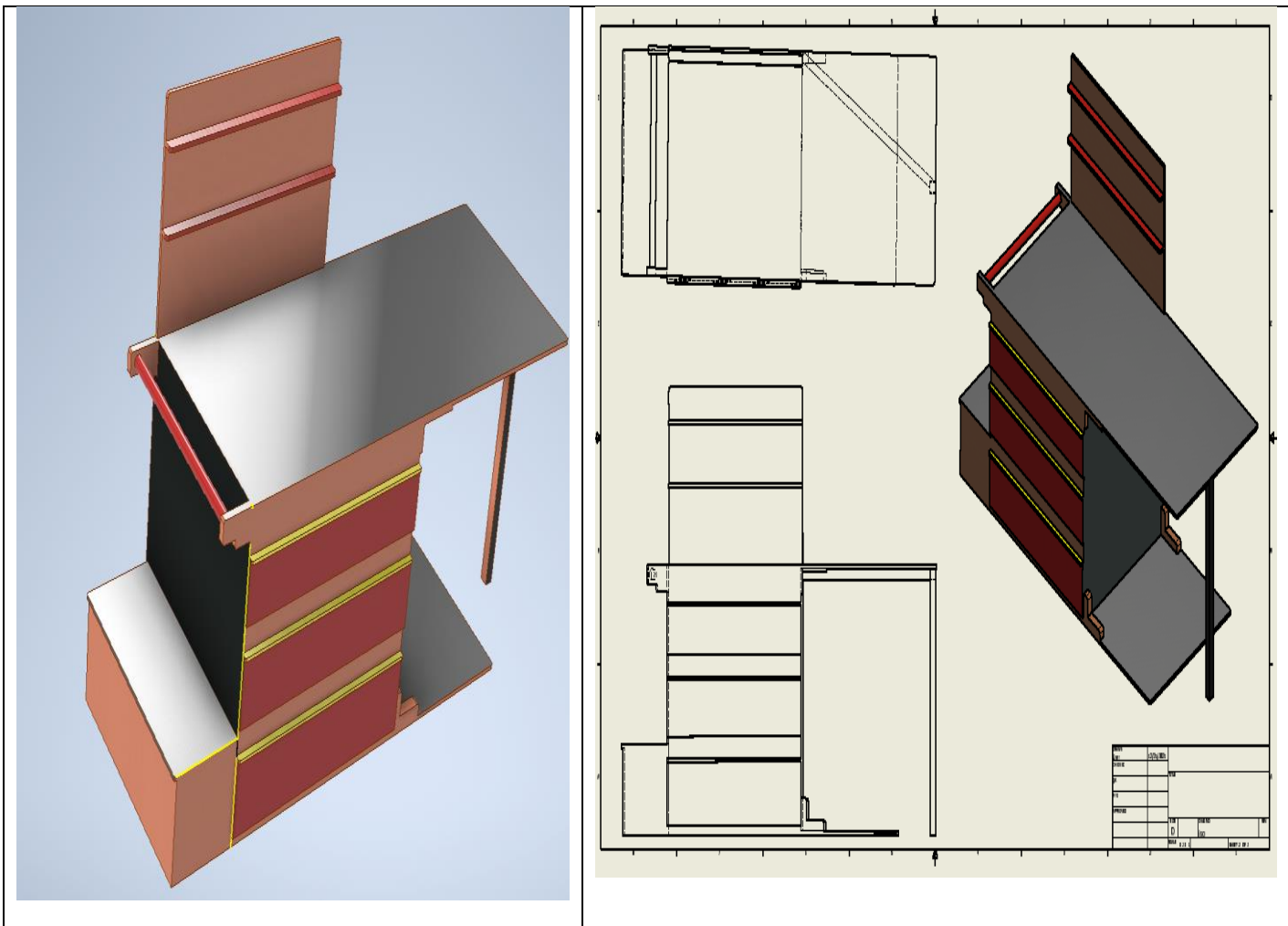


Figure 2.6.2

Figure 2.6.2 is our second design that we has been doing at inventor software . Our second design is the result of improvements from our first design to overcome problems and

achieve our objectives. Among the improvements made is to add some functions, the design is easy to build, more practical and easy to perform maintenance.

2.7 Introduction of multi trolley tool box



Figure 2.7

A trolley tool box is generally a portable storage of workshop equipment. After that, there are various types, designs and functions of trolley tool boxes available in the market and also previous researchers who designed and made trolley tool boxes. After conducting extensive and detailed observations, studies, and surveys, our group has decided and agreed to to modify the tool box trolley.

The implementation of modifying and redesigning this trolley tool box, we named as Multi trolley tool box. In accordance with the name of this Multi trolley tool box, it because there are various functions and base combined results of trolley platform, work bench, power supply box and trolley tool box.

In addition, in the Multi trolley tool box study process, we have also planned the multi trolley tool box manufacturing process based on this design. In the process of making our project we have been influenced by the materials used by the project, existing equipment and limitations in terms of our capital and finance and also we attach importance to the design of our project based on consumer safety such as the consumer protection act 1999.

2.7.1 Trolley platform



Figures 2.7.1

This goods maneuvering equipment is designed for easy transportation of heavy and bulky items. They come in great use for where carrying heavy items manually over longer distances would be unsafe or strenuous on your body. The main purpose of using one is to move items from one place to another with ease while allowing you to carry more loads than you would manually. You will notice that the item has a simple design so you and your team can use it straight away with minimal training. You can expect most versions to follow the design of a flat platform with four casters (wheels) and a fixed handle which is used to either push or pull the platform and the load it's carrying . There are a number of advantages you can get from using one of these robust and heavy goods

moving solutions. We're going to look at a number of them below to give you a better idea of it's the right moving solution for your current, or any future, challenge. Transporting heavy or uneven material manually can be a challenging task which is where having one of these can help as they are there to make the transportation process easy and safer for you, your team, and anyone else moving items on your site. Most trolleys have a grip where the load sits to ensure the load stays in place and does not become unbalanced. For anyone operating this equipment, it means they will not have to worry about the load accidentally slipping or becoming unstable. The wheels on it allow for a smooth transportations process as long as there are not any obstructions in the surrounding area so you can move items around your floor space withease.

Safety measure of platform trolley

When lifting any heavy items there is always a potential risk and that's where this item can help significantly reduce the risk of damage and personal injury. Platform trolleys are designed to take the heavy lifting out of moving objects, small and heavy, so it is less strain for the operator and person moving the item to ensure a safe and easy transportation method. You need to remember to not try to exceed the capacity of the variation you have as this can potentially damage the goods its carrying, making it less efficient when transporting. If you are carrying heavy goods, please always ensure you are wearing the correct safety equipment such as suitable safety clothing, gloves, and footwear to avoid any personal injury to the operator.

2.7.2 Inverter



Figure 2.7.2

Inverters are also called AC Drives, or VFD (variable frequency drive). They are electronic devices that can turn DC (Direct Current) to AC (Alternating Current). It is also responsible for controlling speed and torque for electric motors. Electric motors are found in most devices we use to do work such as small electronics, transportation, and office appliances. These motors need electricity to run. Matching the motor's speed to the required process is essential to avoid wasting energy. In factories, wasted energy and materials could put the business at risk, and so inverters are used to control electric motors, boosting productivity and saving energy. An AC drive consists of a rectifier unit, a DC intermediate circuit, and an inverse conversion circuit. The rectifier unit inside an AC drive can be unidirectional or bidirectional. The former can accelerate and run the motor by taking energy from the electrical network. A bidirectional rectifier can take the mechanical rotation energy from the motor and send it back to the electrical system. A DC circuit will store the electrical power for the inverse conversion unit to use. Before the regulated power is received by the motor, it undergoes a process inside the AC drive. The input power runs into a rectifier unit and the AC voltage is converted to DC voltage. The DC intermediate circuit smoothens the DC voltage. It then flows through the inverse conversion circuit to convert the DC voltage back into AC voltage. This process allows the AC drive to adjust the frequency and voltage supplied to the motor depending on the demands of process. The speed of the motor increases when the output voltage is at a higher frequency. This means that the speed of the motor can be controlled via the operator interface.

2.7.2 .1 Benefits of using inverter

1. Energy-saving

Fan and pump applications benefit significantly from AC drives. Superior to dampers and on/off controls, using AC drives can reduce energy consumption by 20 to 50 percent by controlling motor rotation. It is similar to reducing the speed of a car. Instead of using breaks, the speed of the car can be reduced by lightly pressing on the accelerator.

2. Soft Starters

An AC Drive starts the motor by delivering power at a low frequency. It gradually increases the frequency and motor speed until the desired speed is met. Operators can set the acceleration and deceleration at any time, which is ideal for escalators and conveyor belts to avoid dropouts of loads.

3. Reduced Power Line Disturbances

Starting an AC motor across the line can place an enormous drain in the power distribution system, causing a voltage sag. Sensitive equipment such as computers and sensors will trip when a large motor starts. The AC drive eliminates this voltage sag by removing the power from the motor instead of tripping.

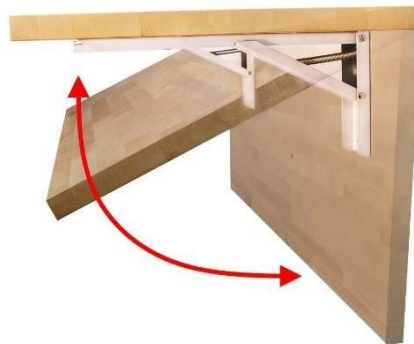
4. Simple Installation

AC drives are pre-programmed. Control power of auxiliaries, communication lines, and motor leads are already factory wired. The contractor only needs to connect the line to the power source that will supply the AC drive.

5. Elimination of Mechanical Drive Components

An AC drive can deliver low or high-speed required by the load without speed-increasing or reduction devices and gearboxes. This saves maintenance costs and floor-space requirements.

2.7.3 Foldable work bench



Figures 2.7.3

Being **compact and easy to transport**, a portable workbench is ideal for mobile workshops, allowing you to work anywhere, at any time. The material used to build portable workbenches is durable, dent-resistant and hardwearing. In addition, they often have clamps and are suitable for use with various clamps and tools

The typical woodworking workbenches come in huge sizes and substantial weight. This allows them to maintain their stance while the worker is working on a piece of wood using other tools, be it hand tools or power tools.

Moreover, workbenches are equipped with features and devices that hold the wood piece for you. Some of them include built-in face [vices](#), leg vices, end vices, and dog holes where you can put pegs, holdfast, and other accessories or tools. Most of the said features are commonly present in massive sizes of workbenches.

2.7.3.1 The benefits of using fold able work bench

A **portable workbench** truly is a game changer. If you have concerns about the sturdiness and effective weight-bearing of a **portable workbench**, you'll be surprised to discover what the latest workhorses have to offer.

Often, the height and size of **portable workbenches** can be easily adjusted. As a result, they are versatile and can fit into almost any space. Being compact and easy to transport, a **portable workbench** is ideal for mobile workshops, allowing you to work anywhere, at anytime.

The material used to build **portable workbenches** is durable, dent-resistant and hard wearing. In addition, they often have clamps and are suitable for use with various clamps and tools. As a result, you can easily take care of jobs like cutting, drilling, and sawing without breaking a sweat.

2.7.4 Product safety act

Generally consumer products include goods and services. Pursuant to the Consumer Protection Act 1999, “goods” means any thing primarily purchased or used for personal, household or household purposes: includes goods installed on, or incorporated into, any immovable or movable property; One of the rights of consumers is the right to security. This means consumers need to be protected from goods, production processes and services that could cause physical injury or harm to the health of consumers or cause damage to property.

2.7.5 Selection of project specifications and manufacturing materials

Selection of project specifications and manufacturing materials is influenced by our capital limits, our equipment.

2.7.5.1 wooden pallets and plywood

Plywood is a popular choice in construction because of its strength and low cost. It is usually used in areas that are hidden from view in a post-construction capacity. The most common plywood uses include support for floors, walls, roofs and garages in residential construction.

The main material selection we used was plywood and wood pallets as prototypes of our project to replace mild steel plate and mild steel hollow. We choose these materials due to several factors namely cheap and affordable price, strong and stable nature of the material, and also easy to work and shape.

2.7.5.2 Battery and inverter

The selection of the type and specifications of the battery and inverter to make the power box supply is an important thing that will affect the ability and performance of our power box supply when using it.

For battery selection, we plan to use car batteries. After that, for the car battery specifications are 12 Voltage and 45 AH. In addition, for the inverter, we chose the inverter that has pure sine wave DC - AC and 1500 Watts.

The reason we choose a 12V car battery is because it has a large capacity while the inverter is because pure sine wave is safe to use for electronic equipment and 1500 Watts because most electronic equipment does not exceed 1500 Watts.

2.7.6 Multi trolley tool box specifications and function

The multi trolley tool box that we designed is basically a place to store hand tools. However, we modified and redesigned in accordance with the problems, research and data collection that we have done to overcome the problem and to achieve our objectives. Our multi trolley tool box was modified with a combination of trolley tool box, work bench and power supply box. Multi trolley tool box consists of 6 wheels for portability, 1 work bench to expand work space, 3 drawers for equipment storage, 1 trolley plate to lift equipment and heavy items such as welding machines, work pieces and the like with an estimated maximum load that can at a capacity of 150 kg, a power supply box that can supply AC current electricity to electronic equipment up to 1500 Watts and is capable of supplying electrical energy up to 2,333 hours of maximum continuous use at 15 A. After that, the multi trolley tool box also has a hand tool hanger. This is a modification we have made to achieve our objectives.

2.8 Previous researcher's study (in the country)



Figure 2.8: Previous researcher's study final year project (Politeknik Banting)

In this figure 2.8, is a study in the country that has previously conducted a study on Trolley tool box. Researchers have been uploading videos on social sites on the Youtube app in the last 4 years. The project was implemented by 5 students who are students from Banting Polytechnic. After that, the final year project they did was called Toolbox With Flippable Workbench.

Through observation and research that we have conducted, this tool box with flippable work bench consists of 3, drawers where the bottom drawer for heavy for heavy material, second drawer for mid weight tools and first drawer for a small, light tool, and consumables. After that, it has a fairly large and comfortable work bench to do work in the workshop and 4 wheels to support their mobile projects.

2.9 Comparison between Multi Trolley Tool Box and Tool box With Flippable Workbench

Multi Trolley Tool Box	Tool box With Flippable Workbench
<ul style="list-style-type: none"> ● Has 3 drawers ● <input type="checkbox"/> Have a work bench ● <input type="checkbox"/> The main material used is plywood (prototype only) ● <input type="checkbox"/> Has an equipment hanger ● <input type="checkbox"/> Has a platform trolley ● <input type="checkbox"/> Has a power supply box ● <input type="checkbox"/> has 6 wheels 	<ul style="list-style-type: none"> ● Has 3 drawers ● Have a work bench ● Has 4 wheels ● Has 1 hidden storage tool space at bottom flippable work bench .

Figure 2.9

From figure 2.9, we can see some differences between Multi trolley tool box and toll box with flippable in terms of functions and additions that we do on our project based on the problems and objectives of each.

2.9.1 What makes us disagree on the design of the researcher's project before.

What makes us disagree on the design and practicality when in the situation of doing work in the previous researcher's project workshop are:

- Work bench : - The table legs are designed to be placed on top of the tool box, it will be inconvenient and heavy when trying to open a flippable work bench.
 - The legs of the table that have wheels are intended to be portable, it will be difficult where every time to move from one point to another have to fold the work bench first.
 - The position of hidden storage tool space at the bottom of the flippable work bench will be inconvenient when you want to pick up equipment without opening the filppable work bench.

2.30 Summery

Overall, what is obtained from this chapter is an experiment made with reference to previous research sources to complete the work done. In addition, some information from materials, material selection, and comparison. This implementation was able to achieve the objectives of our study.

BAB 3

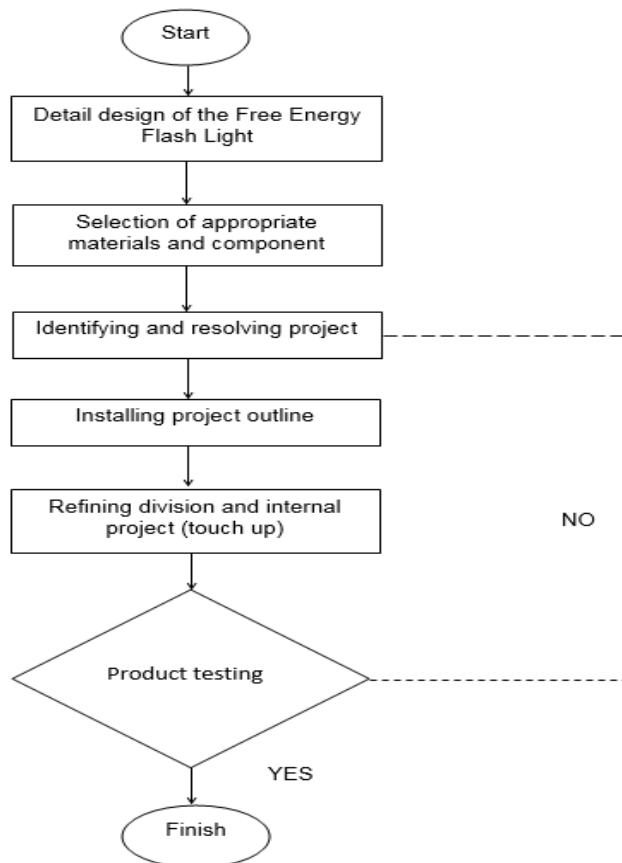
METADOLOGI KAJIAN (1203)

1.1 Introduction

In this chapter, we describe the methodological flow chart throughout the implementation of our project based on the problems we are trying to solve, the objectives of the project in progress, the steps and process of project production and data analysis.

Project selection, we chose this "multi trolley tool box" because based on the experience and problems faced by students while carrying out assignments, while in a workshop at Shah Alam Polytechnic.

3.2 FLOW CHART METHODOLOGY



3.2.1 Identifying problems

At the beginning of this study is to identify problems in PSA workshops. Therefore, careful plans are implemented for such problems. This is due to the lack of tools, damage, loss of tools, tidiness of the workshop, limited work space and the problem of distance between objects with distant electrical power sources that cause the tasks given by the lecturer to students to be slow to complete and require energy. more to complete the task.

3.2.2 Analysis

The data obtained are collected, processed and analyzed for the next steps to be taken and the determination of the study is done in the way requested in this objective.

3.2.3 Design

Before the project is implemented, the design has been designed to find out the stable features to accommodate the load and function of the tools and multi trolley tool box to be stored and used. In fact, this design is so that before the implementation is done, we can identify problems and detailed information to produce the project.

3.2.4 Implementation

When the project is completed, the multi trolley tool box will be tested with different loads and dimensions of equipment to be stored such as storing screwdrivers, saws, drills, spanners, t-shaped spanners, welding machines and so on according to the storage space that has been reserved. Also, test the power supply point to see if it can function to supply power to electrical equipment such as drills, lights, and grinders.

3.2.5 System

When the multi trolley tool box has successfully achieved the objectives demanded, such products will be placed in PSA workshops and used to address the problem statement already listed.

3.3 Data collection methods

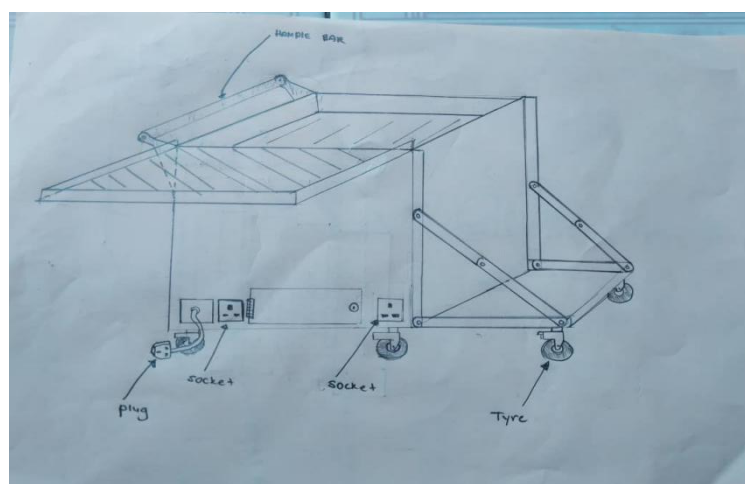
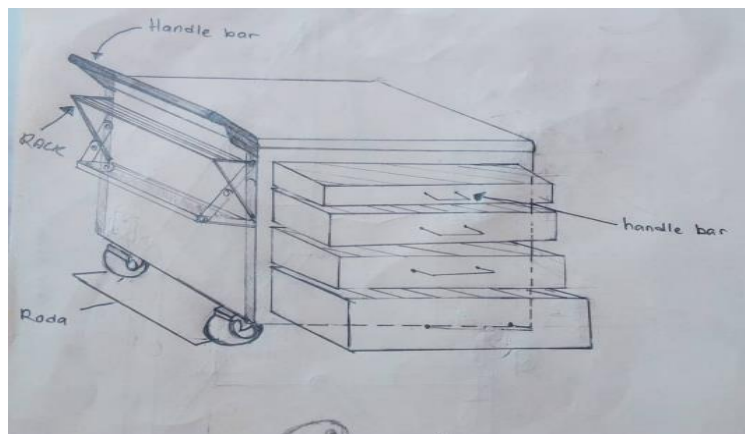
For this study, the method of data collection is to do a search on how to manufacture products through google and youtube websites. The next method of data collection is to conduct a questionnaire on the problems found in the workshops - PSA workshops and the way to distribute the questionnaire is to make a questionnaire online.

3.4 Product Design Selection

The selection of this product design is based on stability, strength, manufacturing cost, product quality, user -friendliness and ease of producing the product.

Design 1

Figures 3.4.1



Design 1 is the first sketch obtained from us. The product has various functions as in Figure 3.4.1. However, this product is difficult to build which requires additional tools and accurate measurements to be built. After that, consumer friendliness. Design 1 has battery and inverter storage that is inside the main body and looks neat, but it will be a difficulty when making the drawer part that will collide with the drawer. Next, when the battery is damage or run out, we need to remove and replace or charge the battery but need to remove the drawer first.

RAJAH 3.4.2

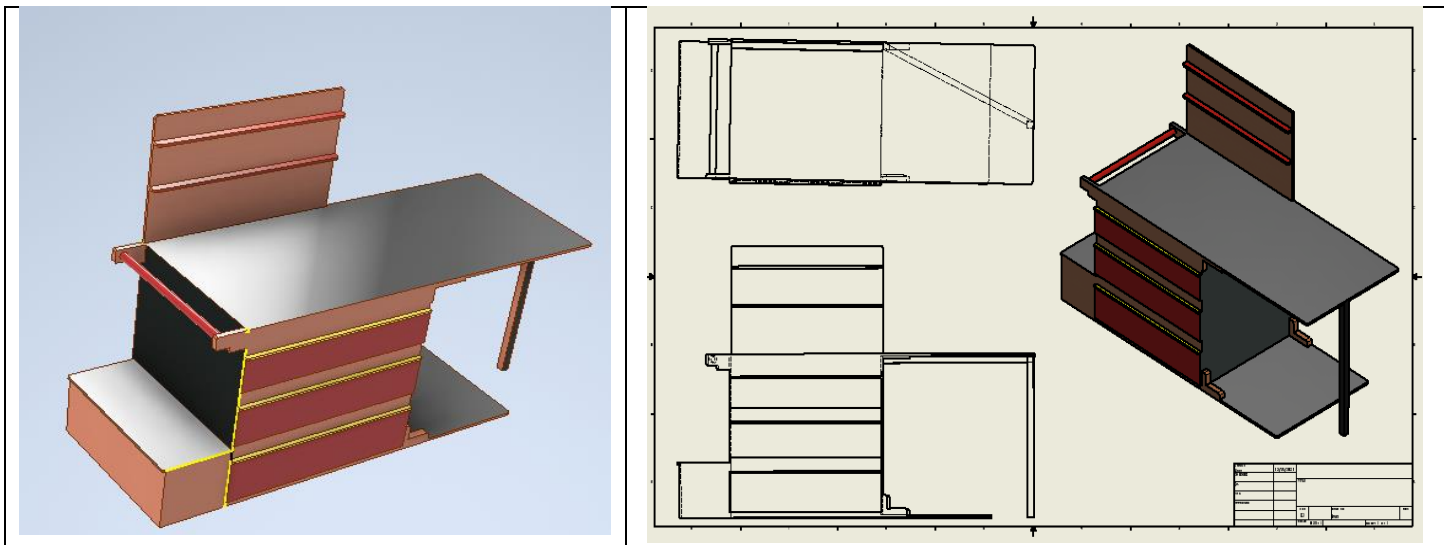


Figure 3.4.2

Design 2 is our second sketch. This design has been improved from design 1 which is easier to build, neat and user friendly. after that compared to design 1, design 2 has a hanging place and a temporary work place. after that having the supply place is outside the main body and it is easier to perform the maintenance process of the battery, inveter, switch and the like.

3.5 LIST OF MATERIALS AND COSTS

Material	Dimension	Quantity	Price (RM)
Battery	27mm, h-129mm	1	115 -121
T- Bar cabinet door handle	(3,4,6,8)inch	4	2.10,2.60,3.80,4.80
Handle Bar	10inch	1	10.00
Roller		6	3.70
Extension		1	11.70
Ball bearing drawer slide		6	24.00
90 degree self locking folding hinge		2	2(7.00)
Zinc plated cup hook		7	7(0.6)
Henge engsel	W- 48 mm , l - 80 mm	2	2(0.70)
Plywood BB/CC gred	4ft x 8ft	1	78.00
Skrew	8 x 50 mm	1 set	5.00
Inverter 1500 W		1	75.00
Nut and bolt	(m8 x 16 mm)	24	24 (1.50)

Total	RM 391.00
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3.6 List equiment of tool

1. Drill machine
2. Measuring tape
- 3.Hammer

4. Screwdriver

5.Jig saw machine

7.Grinder machine

3.7 “MULTI TROLLEY TOOL BOX ”

This "multi trolley tool box" project is based on a versatile concept and a combination concept between trolley tool box, power supply, foldable platform from hand truck trolley, foldable work table, various storage places and 6 rollers.

3.7.1 Completed multi trolley tool box





3.7.2 The process of purchasing and collecting materials

The purchase process is done after conducting a survey in hardware stores. After conducting the survey, we did the purchasing process according to the list of materials needed to continue the process of making multi trolley tool boxes.

The process of collecting materials is the process of taking used materials. The collection of used materials is done through a process of inquiry and request to individuals, and survey in several places such as in houses and development areas. Among the wear materials taken by us are as in figure 3.7.2 .1



figure 3.7.2 .1

3.7.3 the process of marking, cutting, punching and measuring

After the process of purchasing and collecting materials is completed, we perform the process of marking and measurement that has been set, as shown in Figure 3.7.3.1



Diagram 3.7.3.1

Next, we perform the process of cutting and punching holes using hand tools such as drill machine and circular saw machine, as in figure 3.7.3.1 and figure 3.7.3.2



Figure 3.7.3.1



Figure 3.7.3.2

3.7.4 Connection process

The process of joining the material with several techniques, such as nailing and fastening screws, nuts and bolts. The selection of screws, nails, nuts and bolts in the joining process plays an important role depending on the suitability of the size and type of material for strength in designing Multi trolley tool box. diagram 3.7.4.1



Diagram 3.7.4.1

3.7.5 Power supply box

The installation of the power supply box is done with several materials that have been purchased such as 12 V car battery, 500W inverter (DC to AC current conveter), 15 A 3 pin switch and also 3 phases wire, as in figure 3.7.5.1.



Diagram 3.7.5.1

3.7.6 Finishing Process

Finishing the process is the final touch in the process of making a multi trolley tool box. Among the processes we do is the sanding process, aimed at smoothing the wood surface to make it look more attractive.

After the finishing process, we performed the surface coloring process of our multi trolley tool box by using a special wood paint and glazing process on the wood surface as in diagram 3.7.6.1



Diagram 3.7.6.1

3.7 Safety design product

Keselamatan design suatu produk amat penting dalam penghasilan sesuatu produk .Berdasarkan “Akta Perlindungan Pengguna 1999 ” kami telah ,mengaplikasi design project kami dengan beberapa ciri keselamatan iaitu pada figure 3.7.1 and 3.7.2 .



Figure 3.7.1

Figure 3.7.1 shows the fillet process at the corner of the multi trolley tool box section. The fillet process works to make the lord between the line and the arc become convex or concave this is intended to reduce the risk of injury to the user.



Figures 3.7.2

Figure 3.7.2 shows a closed container for placing an AC current power supply. The purpose of this closed container is to reduce the risk of electric current shock to the user.

3.8 Prototype and real (Multi trolley tool box)

Projek multi trolley tool box yang telah kami lakukan adalah merupakan prototype daripada projek sebenar . Akan tetapi perbezaan diantara real dan prototype multi trolley tool box adalah dari segi penggunaan material , rangka multi trolley tool box .

3.8.1 senarai perbezaan bahan sebenar (multi trolley tool box)

- Hollow mild steel
- Plate mild steel
- Heavy duty pvc platform

3.8.2 Multi trolley tool box frame

On the multi trolley tool frame, we plan to use the outer frame while the material used is hollow mild steel to get higher strength and stability.

3.9 Summary

The summary in chapter 3 (Methodology) describes important topics about the production of this multi trolley tool box project. Among the contents of this chapter are introduction, flow chart methodology, problem identification, analysis, design, system, data collection methods, project design selection, cost and material list, equipment list, diagram description, manufacturing and connection methods, plan , safety features and project spreadsheet and electrical power supply installation.

CHAPTER 4

PRELIMINARY INVESTIGATION (1203)

4.0 Introduction

Once all the data and information are obtained, analysis is done to see the reaction of users to this product (multi trolley tool box).

The results obtained in this chapter are the results obtained from the online questionnaire and tests conducted directly on our project multi trolley tool box. The manufacture of this multi trolley tool box is analyzed in more detail to draw conclusions based on the stated objectives of the study.

The study was conducted by using respondents who have filled in the online questionnaire. There are several aspects that are the main focus, namely:

- 1) Demographics of respondents (gender and age)
- 2) General view of the study
- 3) Respondents' perspective on the product
 - Design
 - Function
 - Materials used
 - Advantage

4.1.1 Demographic profile of respondents

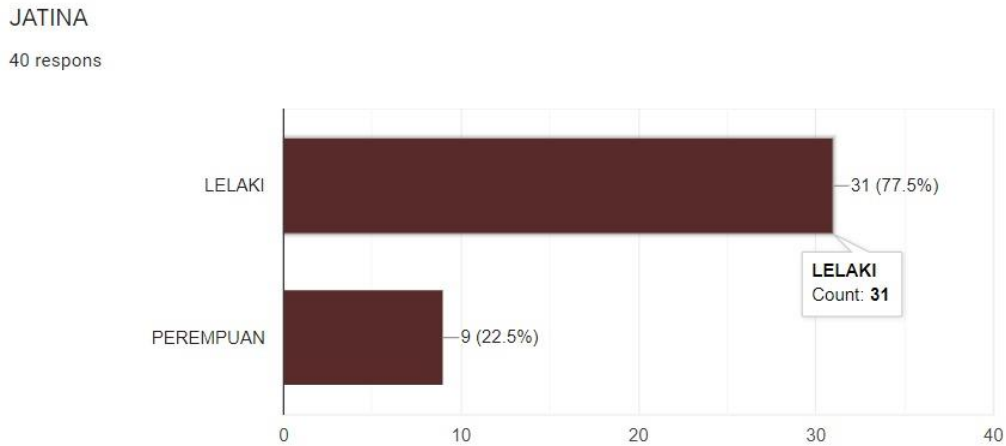


Figure 4.1.1 Gender Responden

Figure 4.1.1 shows the number of respondents who responded to the study conducted. A total of 77.5% of respondents are 31 men while 22.5% of respondents are 9 people are women. The number of male respondents is high because most of the respondents spend more time in the workshop and do workshop work that uses a lot of hand tools in the workshop compared to women who are rarely involved with work in the workshop.

4.1.2 Age of respondents

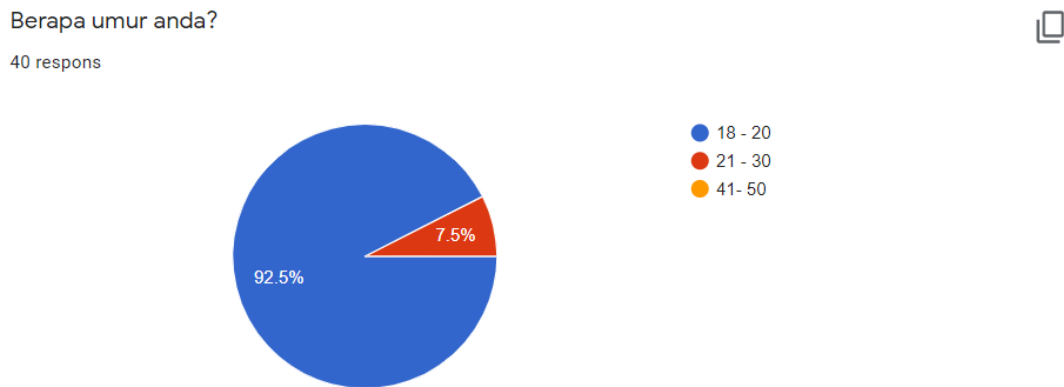


Figure 4.1.2: Age of respondents

Furthermore, the results of the study have found that a total of 36 respondents that is 92.5% aged 18-20 years more answered this questionnaire. This is because, they consist of first year and final year students, namely semesters 1,2,3,4 and 5. Most of them are students in the field of mechanical engineering and civil engineering who spend a lot of time in workshops to do practical work. many are involved in the use of hand tools provided in the workshop. In addition, a total of 4 respondents, which is 7.5% aged 21-23 years. Most of them are practical students (LI) which is semester 6. They also often spend time in the workshop because they are involved with workshop work that requires them to use hand tools and tool boxes to store it.

4.1.3 COST OF COMPONENTS

BAHAN	DIMENSI	KUANTITI	HARGA (RM)
Bateri	127mm, h-129mm	1	115 -121
U- Bar cabinet door handle	(3,4,6,8)inch	4	2.10,2.60,3.80,4.80
Handle Bar	10inch	1	10.00
Roller		6	3.70
Extension		1	11.70
Ball bearing drawer slide		6	24.00
90 degree self locking folding hinge		2	2(7.00)
Zinc plated cup hook		7	7(0.6)
Henge engsel	X- 48 mm , 1 - 80 mm	2	2(0.70)
Plywood BB/CC gred	4ft x 8ft	1	78.00
Skrew	8 x 50 mm	1 set	5.00
Inverter 1500 W		1	90.00
Nut and bolt	(m8 x 16 mm)	24	24 (1.50)

Total	RM 391.00
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Table 4.1.3: List of components

Table 4.1.3 shows the cost of materials allocated to implement the multi trolley tool box project. Plywood measuring 4ft X 8ft was used to produce this project. This multi trolley tool box has 6 wheels. In addition, an inverter with a power of 500w and a battery w-127mm is used to supply electric current to a multi trolley tool box that will be connected to the extension wire. 8 inches and a 10 inch handle bar. For the drawer, you need 6 ball bearings to make it easier to open and close the drawer. In addition, zinc plated cup hook of 7 pieces. The door hinges are 48mm, 80mm as many as 2 units for this multi trolley tool box door. Finally, screws measuring 80 X 50mm 1 set of nuts and bolts m8 X 16mm are needed to connect the components to make this multi trolley tool box.

4.2 FINDINGS OF THE STUDY

4.2.1 Study data

The data obtained during the study activities used a questionnaire based on gender and age. These data will eventually be displayed in the form of tables and graphs by percentage. Questions related to workshop equipment, tool boxes and how users store the tools will be asked by us and will be displayed on the pie chart by percentage.

4.2.2 Analysis of study data

The process of analyzing the study data will be shown in the form of graphs, tables and charts. The analysis of this multi trolley tool box includes a questionnaire to users of hand tools how often their hand tools are lost or littered. The results of the data analysis that we obtained, will be presented in the form of a pie chart.

4.2.3 Questionnaire review

To further strengthen this study, a questionnaire method using online questionnaires was conducted. The data obtained will be made in the form of pie charts according to percentage to facilitate the information studied and analyzed. The following is information related to the questionnaire that was conducted.

A) General view of the study

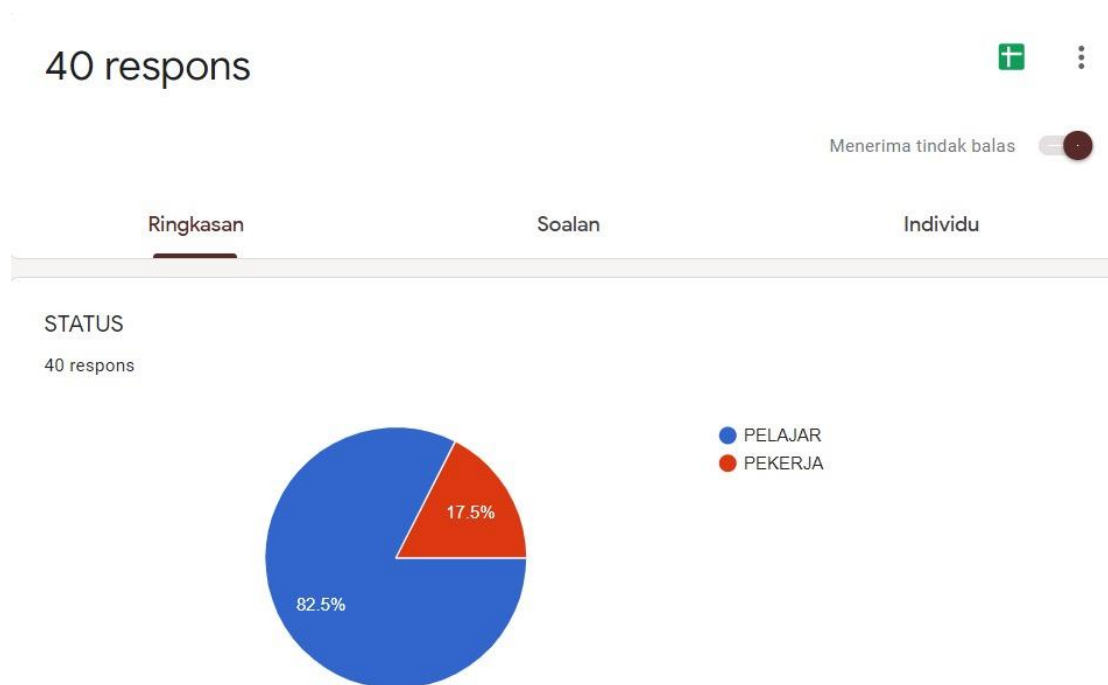


Figure 4.2.3 Students and employees

Figure 4.2.3 shows the analysis of the activities of using hand tools that respondents have done in the workshop. From the analysis, a total of 82.5% which is a total of 33 students. Meanwhile, a total of 17.5% which is a total of 7 employees. The percentage in this pie chart is obtained from an online questionnaire that has been conducted and has been filled by the respondents to these two groups.

b) STUDY OF HAND TOOL LOSS

Adakah anda selalu mengalami alatan tangan anda?

40 respons

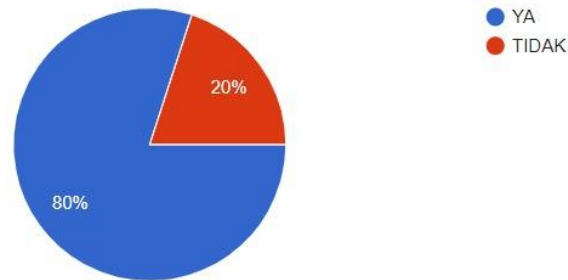


Figure 4.2.4: frequency rate of lost hand tools

For the analysis of the frequency rate of missing hand tools, figure 4.2.4 shows the results of the online questionnaire that has been done and has received responses from respondents. As many as 80% of the 32 people have problems with hand tools that are often lost and because there is no suitable storage place for hand tools to store the equipment. Meanwhile, as many as 20%, that is, 8 people who did not face the problem of equipment were lost. This is because, maybe they already have a tool box to store the equipment so that it does not get lost.

(C) Study of unorganized hand tool

Adakah peralatan tangan dan selalu bersepah?

40 respons

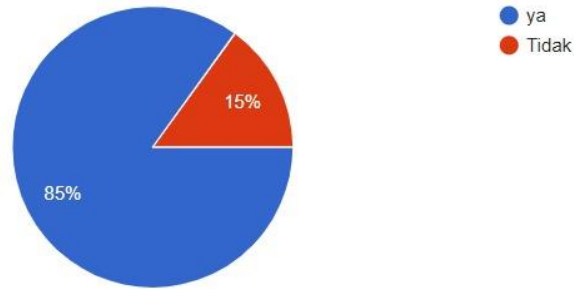


Figure 4.2.5: study of unorganized hand tool

The results of the analysis above, figure 4.2.5 shows that 85% of the 34 respondents who have problems with littered hand tools because, in their workshop they may not provide a place to store equipment (tool box) for them to store equipment after use. Meanwhile, as many as 15%, that is, only 6 people did not have problems with rubbish workshop equipment. This is because, in the workshop, they have provided a place to store hand tools (tool box) that is suitable to store hand tools so that they are not littered and easy to find if you want to use them again.

D) Is your tool box difficult to move

Adakah (kotak alat) dan berat dan susah untuk dialihkan
40 respons

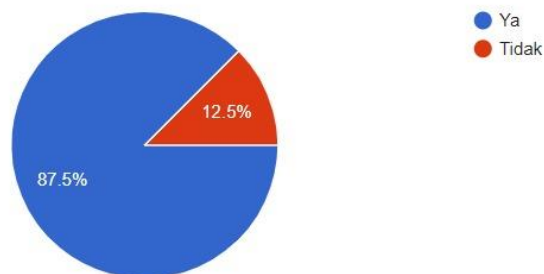


Figure 4.2.6: respondents' response to the question

In Figure 4.2.6, some of the respondents had problems with their tool boxes, ie their tool boxes were difficult to move. This is because their tool box does not have wheels, therefore, it is very difficult to be moved by the user because if they want to be moved, the user has to use a lot of energy by lifting the tool box. This will also slow down the workshop work as it takes time to remove the tool box.

D) Difficulty in obtaining power supply

ketika melakukan kerja pernah susah untuk mendapatkan bekalan kuasa elektrik untuk peralatan elektrik ?

40 responses

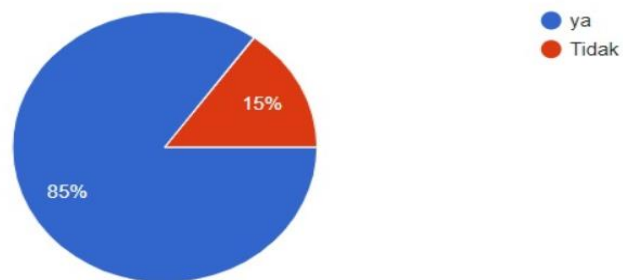


FIGURE 4.2.7: difficulty in obtaining power supply

Figure 4.2.7 shows that 85% of the 34 respondents who faced the compilation did workshop work which was difficult to get electrical power supply when they wanted to do work related to equipment that requires electric current such as drill machines. Meanwhile, as many as 15%, that is, 6 respondents who did not experience compilation while doing workshop work. This is because, maybe in the workshop they have many sources and electrical switches therefore they have no problem when wanting to get the source of electricity supply during the workshop work.

D) Study of respondents

Sekiranya kami menyediakan alat penyimpan peralatan tangan yang mudahlih, boleh bekal kuasa elektrik, praktikal dan harga berpatutan. Adakah anda berminat untuk membelinya

40 respons

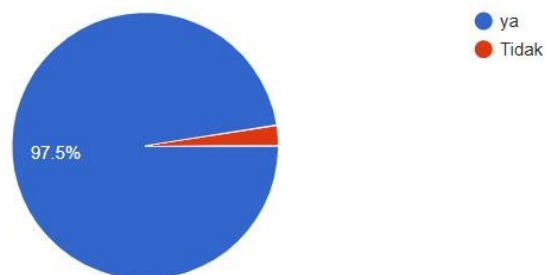


Figure 4.2.8: Study of respondents

Figure 4.2.8 shows the study of the respondents. This study was conducted using an online questionnaire that was completed by a total of 40 respondents. A total of 97.5% or 38 majority of our respondents have agreed with our product which is multi trolley tool box. As much as 2.5%, which is only 2 people who did not. Respondents have agreed with our product because our multi trolley tool box is versatile. Not only can store hand tools, it can also supply electricity thus making it easier for those who work in the workshop to get electricity to use workshop equipment that requires electric current such as drills. In addition, our trolley tool box has wheels to facilitate multi trolley tool box it is moved from one place to another

4.3 Multi trolley tool box test

Once our multi trolley tool box project was completed, we also tested our project. Among the tests we do are:

- Test of smoothness of movement and function.
- Test of durability, time and ability of power box supply.
- Material and load testing

4.3.1 Test of smoothness of movement

The smoothness of movement test is done by moving from one point to another on the six wheel multi trolley tool box. Movement tests are performed when the multi trolley tool has no load (equipment and other items stored in the multi trolley tool box) and also when there is a load.

As a result of both tests, the multi trolley tool box was successfully moved from one point to another.

4.3.2 Test of durability, time and capability (supply power box)

Supply power box we have done a test. As a result of the test performed, the power supply box can be used 2.33 - 4 hours continuously depending on the type of watts per hour of an electronic equipment that needs to be supplied. Among the successful electronic equipment tests are grinder machines, drill machines, fan stands, smart phones and lamps.

4.3.3 material and load testing

Testing of materials and loads used when doing the work of multi trolley tool box manufacturers. The main material used to produce the prototype multi trolley tool box is plywood. The use of plywood is easy to work with and strong, able to withstand heavy loads. In addition, on the trolley of the platform, it is able to accommodate a heavy load of 100 - 150 kg that can be accommodated.

4.4 Summery

Based on chapter 4, this chapter discusses the results of the studies and tests we have conducted throughout the processing of the multi trolley tool box prototype. As a result of this chapter 4, we conclude that our project has been able to achieve the objectives we have stated.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS (1203)

5.1 Introduction

For this chapter, the decision is made based on all the results obtained from the experiments conducted and the discussion is about the objectives of the study and also recommendations for the study conducted. In addition, conclusions have been drawn for this experiment.

5.2 Discussion

During the implementation of the project, various corrections and tests are implemented to meet the objectives, scope and limitations that have been stated. Among the tests performed are the load imposed on the platform trolley, as much as 100 - 150 kg of load imposed. functions on storage. Furthermore, the ability of the power supply box to supply electrical power to electronic equipment as well as the duration of electrical power users. In addition, the load test on the work bench can be accommodated. Once all the tests have been successfully run on the multi tool trolley and met our expectations, it means we have successfully achieved our objectives.

5.3 conclusion

The main objective of this study is to increase efficiency in doing work in the Shah Alam Polytechnic workshop in terms of equipment storage and various functions and facilities available on this Multi trolley tool box. Data collection is through google form (online) which is distributed to social media to Shah Alam

Polytechnic students who are experienced while carrying out assignments in workshops at Shah Alam Polytechnic.

In this study, this Multi trolley tool box focuses more on the various functions available on the workshop equipment storage tool. Among the functions available on the Multi trolley tool box is portable, various equipment storage, able to supply AC current to electronic equipment, has a work table and has functions such as trolley platform that can lift loads up to 150 kg mobile.

Overall, with this Multi trolley tool box, it can increase the efficiency and comfort for PSA students to carry out tasks in the workshop.

5.3 Recommendations

The research proposal is a listing of several further research recommendations to further strengthen the research findings in the field studied. In other words, new proposals should be put forward as a result of the findings of the study.

5.3.1 Future proposals

- Install the automatic light movement sensor on the multi trolley tool box.
- Diversify more practical equipment storage.
- Create a smart user detection system using a key that is able to record and detect lost equipment and items or equipment that have been removed and entered.
- Install automatic lock system using RFID or fingerprint.

5.4 References

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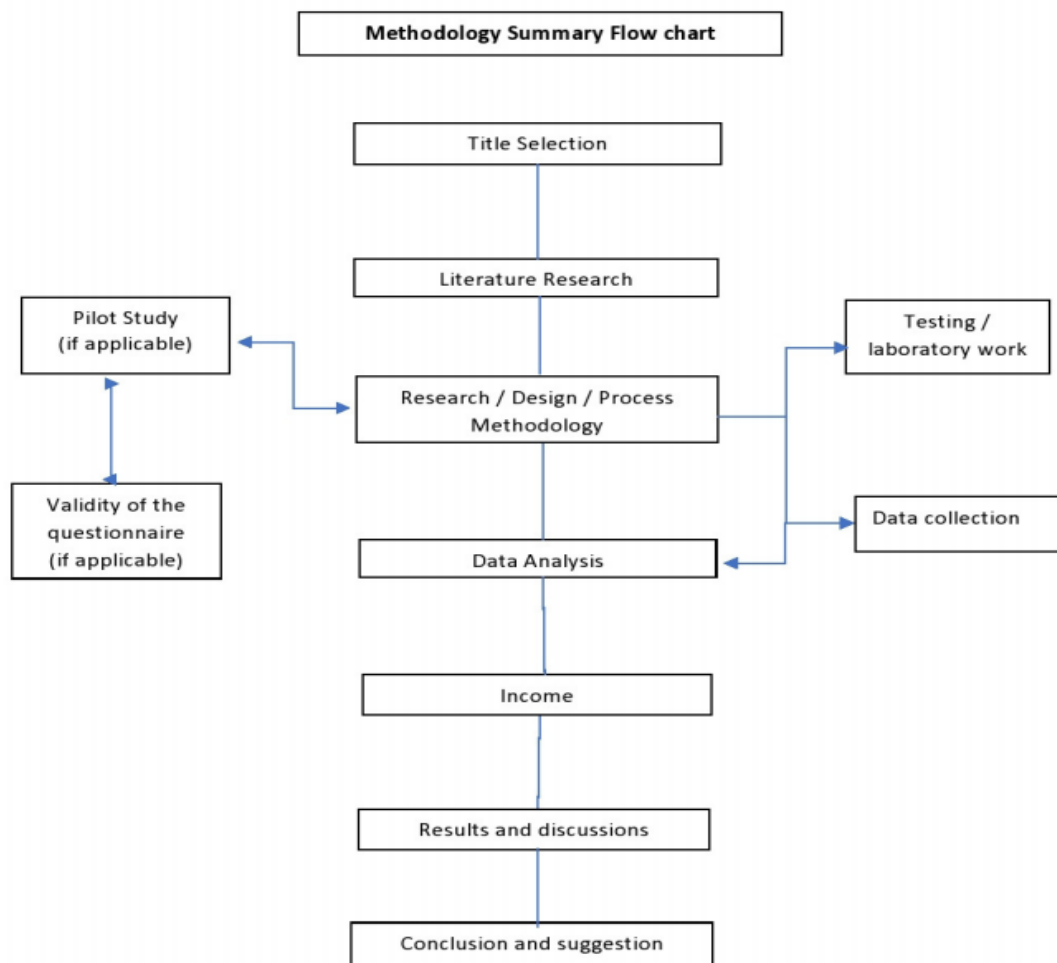
5.5 Attachment

- Attachment of gantt chart
- Attachment of flow chart
- List of equipments and costs

5.5.1 Attachment of gantt chart

Perancangan / Aktiviti	Mac				April				May				Jun	
	MK1	MK2	MK3	MK4	MK5	MK6	MK7	MK8	MK9	MK10	MK11	MK12	MK13	MK14
taklimat project 2														
membuat carian barang dan komponen														
Penyediaan Buku Log & Carta Gantt														
membeli barang dan komponen														
Carta Alir Projek														
menulis proposal(literature review)														
menulis proposal(methodology)														
Menulis Proposal (primilinary)														
Menulis Proposal (conclusion)														
membuat project														
menghantar log book														
membuat poster														
membuat penambahbaikan														
Membuat video														
Penghantaran video														
Penghantaran Proposal														

5.5.2 Flow chart



5.5.3 List of equipments and costs

BAHAN	DIMENSI	KUANTITI	HARGA (RM)
Bateri	127mm, h-129mm	1	115 -121
V- Bar cabinet door handle	(3,4,6,8)inch	4	2.10,2.60,3.80,4.80
Handle Bar	10inch	1	10.00
Roller		6	3.70
Extension		1	11.70
Ball bearing drawer slide		6	24.00
90 degree self locking folding hinge		2	2(7.00)
Zinc plated cup hook		7	7(0.6)
Henge engsel	Y- 48 mm , l - 80 mm	2	2(0.70)
Plywood BB/CC gred	4ft x 8ft	1	78.00
Skrew	8 x 50 mm	1 set	5.00
Inverter 1500 W		1	90.00
Nut and bolt	(m8 x 16 mm)	24	24 (1.50)

Total	RM 391.00
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