

MULTIFUNCTION BROOM

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A report submitted in partial fulfillment of the requirements for the award of the
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SUPERVISOR DECLARATION

I hereby declare that I had read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the purpose of the granting of Diploma of Mechanical Engineering.

Signature :

Name of Supervisor : EN. IDRIS BIN MAT SAHAT

Date :

STUDENT DECLARATION

I declare that this thesis entitled “**Multifunction broom**” is the result of my own research except as cited in references. The thesis has not been accepted for any diploma and is not concurrently submitted in candidature of any other diploma.

Signature : _____

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Date : _____

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ABSTRACT

There are many brooms in the market. Broom or sweeper is more synonymous with collecting and cleaning duties. Today, broom was readily adopted into the sweeper with a variety of shapes and patterns. It is the origin of the stick has been modernized with the use of plastic as the main ingredient. However, there is the design and creation of a multifunction wiper market. By creating a multifunction broom is expected not only to attract the attention of consumers because of patterns and designs are more effective cured but can help users perform work such as sweeping, cleaning floors and mirrors using only one tool only, and indirect cost savings in consumer spending. The results indicate the project objective to produce a variety of functions and can be used for a variety of situations is achieved.

ABSTRAK

Terdapat banyak penyapu dipasaran hari ini. Penyapu yang lebih sinonim dengan tugasnya mengumpul dan membersihkan kotoran. Hari ini bahan ini telah di adaptasikan menjadi penyapu yang mempunyai pelbagai corak dan bentuk. Ia yang asalnya diperbuat daripada lidi telah pun dipermodenkan dengan menggunakan plastik sebagai bahan utama. Namun, belum terdapat rekaan dan ciptaan penyapu yang mempunyai pelbagai fungsi dipasaran. Dengan terciptanya penyapu pelbagai fungsi ini, diharapkan bukan sahaja dapat menarik perhatian pengguna disebabkan corak dan rekaannya yang lebih efektif malah dapat membantu pengguna melakukan kerja-kerja seperti menyapu, mencuci lantai dan cermin hanya dengan menggunakan satu alatan sahaja dan secara tidak langsung menjimatkan kos perbelanjaan pengguna. Keputusan kajian menunjukkan objectif asal projek untuk menghasilkan penyapu pelbagai fungsi dan boleh digunakan untuk pelbagai situasi ini tercapai.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

For this chapter, it is discuss about the problem statement, objective of the project, scope of the project, and lastly project background.

1.2 PROJECT BACKGROUND

Cleanliness is one of a good value which people had looking at since human come to this world. This value had continued from a generation to another generation. People always want to see a clean place. In order to reach it, manufacturer had come out with ideas to produce some good stuff which may help people to keep the area clean like broom, mop and others.

Today, manufacturer had come with innovative ideas to achieve high productive for the competition with other manufacturers. As example, a broom today had come out with so many designs depending on their function and working place.

This also special broom which use to clean rubbish. Innovative productivity means improving efficiency in order to do the job well. So the clearance is more easily and suitable at any area.

1.3 PROBLEM STATEMENT

At the market, most of brooms is produce for one function only for example to clean the rubbish and user must buy another equipment for another work for example to clean floor and window. User previously had to clean the mop using hand. The problem now is how to make a multifunction broom. With multifunction broom, user can only use one product to perform multiple tasks.

1.4 OBJECTIVE

The objective of this project is:

- i. To design an efficient multi function broom.
- ii. To fabricate the structure this can be used anywhere.

1.5 SCOPE

The project scope consists of three scope which are:

- i. This study is focused on making a multifunction broom.
- ii. It has three function in one broom.
- iii. May sweep the trash, clean floors, wash and dry the mirror.

1.6 FLOW CHART

A flow chart, or flow diagram, is a graphical representation of a process or system that details the sequencing of steps required to create output.

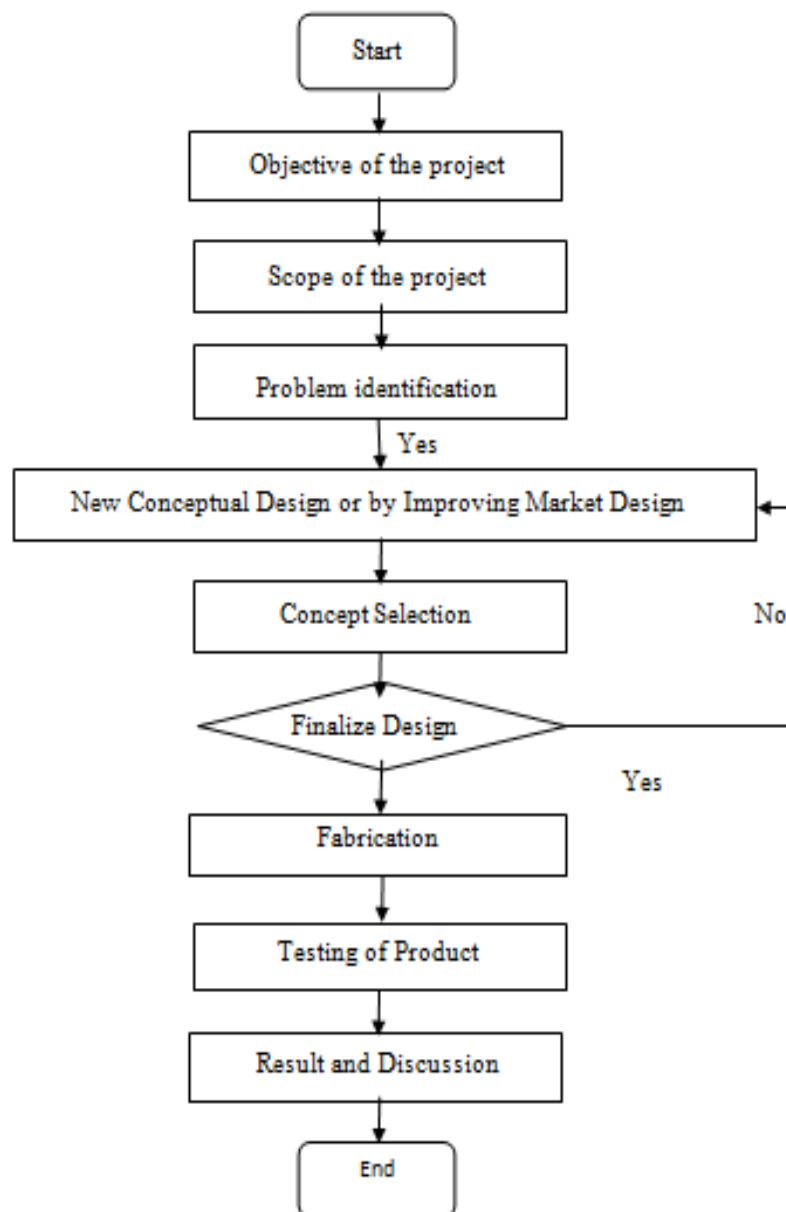


Figure 1.1 Flow Chart

1.7 GANTT CHART

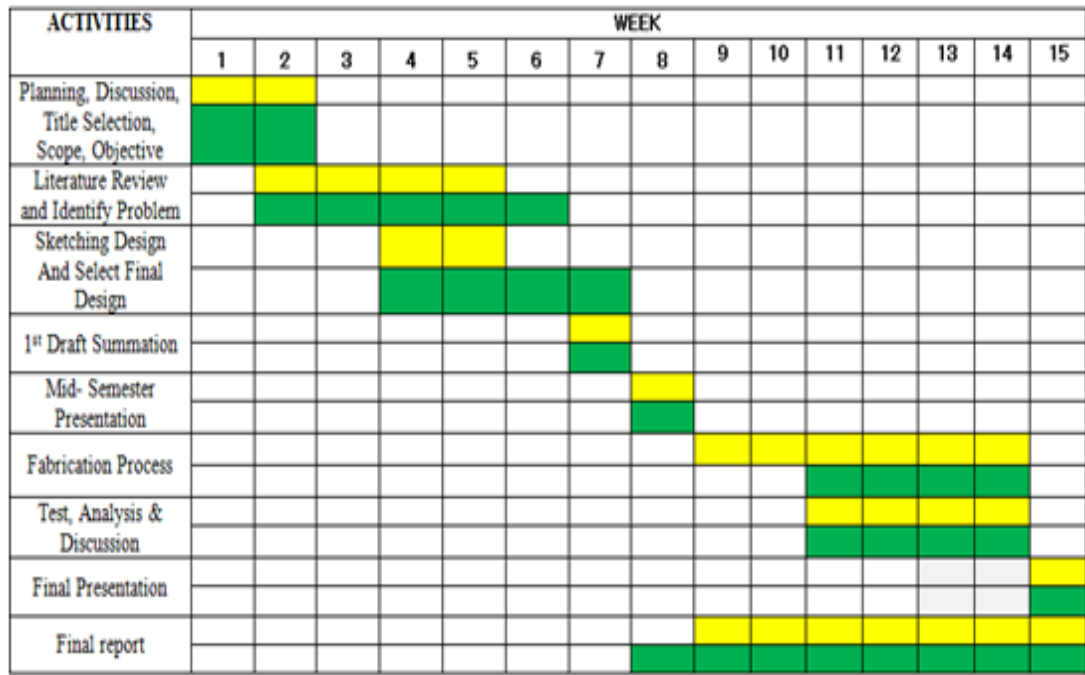


Figure 1.2 Gantt Chart

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter is the literature review of the project. In this chapter, there is a history and type of broom. Besides that, it consists of designs which are available at the market.

2.2 HISTORY AND SHARING

A broom is a cleaning tool consisting of stiff fibers attached to, and roughly parallel to, a cylindrical handle, the broomstick. It is commonly used in one function only. If it have over one function such as two or three, it call multifunction of broom.

Commonly broom used in combination with a dustpan. The dustpan may appear to be a type of flat scoop. It is often hand held for home use, but industrial and commercial enterprises often use a hinged variety on the end of a stick to prevent the user from constantly stooping to use it.

To this project just fabricate multifunction broom is going to be fabricated without the dustpan.

2.3 TYPES OF BROOMS AND BRUSHES

A broom like a brush is a collection of stiff fibers or bristles fastened into a handle so that they are roughly parallel to each other. Often, but not always, a broom has a long handle (whisk brooms, for example, are an exception). There is some crossover in terminology – identical-looking items may be called a brush in one locale and a broom in another. But it seems that all brooms are used to sweep things into dustpans or piles or off of surfaces, whereas brushes may have other functions. In addition, note that several items called brooms do not meet this definition.

2.3.1 Snow brooms

Made to sweep, push, or drag snow off of vehicles, snow brooms usually have telescoping handles, but not all have brushes: some are made of a synthetic material that effectively scrapes as well as brushes snow off, while being gentle on the car's finish.



Figure 2.1 Snow broom

2.3.2 Angled broom

Designed to fit in most corners and nooks, the angled broom, with its synthetic bristles, is frequently chosen for the bulk of indoor work not covered by a vacuum cleaner.



Figure 2.2 Angle broom

2.3.3 Whisk broom

Made by wrapping the end of the bristles or adding a small handle, a whisk broom is usually a small, somewhat triangular corn broom with two rows of stitching across it, made to whisk dirt off of upholstery, carpets, and floors. Very small models made for transporting (in a car for example), may have a case that doubles as a dustpan.



Figure 2.3 Whisk broom

2.3.4 Push Brooms

Most indoor brooms are operated by sweeping across or towards oneself, and are made accordingly, but outdoor brooms are often called push broom because when working across rough surfaces or with large amounts of dirt or debris, a pushing motion is more successful in collecting it.



Figure 2.4: Push broom

2.3.5 Corn broom

A simple corn broom cut straight across the bottom can handle rough surfaces, but is used by many all over the house.



Figure 2.5 Corn broom

2.4 Basic Parts

2.4.1 Broom handle: Made from stainless and the holder made from plastic.

2.4.2 Brush: The broom material is plastic.

2.4.3 Mop: Made from plastic and sponge

2.4.4 Mirror cleaner: Made from plastic and sponge

However, the scope for this project is to make the prototype only. So the material that will be used is different from the original plan. The different will show at a table below.

Part	Original Part	Prototype Part
Broom Handle	Plastic	Stainless
Holder	Plastic	Stainless

Figure 2.1 Multifunction broom parts

2.5 LIST OF MATERIAL



Figure 2.6 Stainless for handle and clip

2.5.1 Component and Three main functions for Multifunction Broom



Name : Mop

Function: To clean the Floor

Material: Plastic and sponge

Figure 2.7



Name : Broom

Function: To collect and sweep garbage

Material: Plastic

Figure 2.8



Name : Car mirror cleaner

Function: To clean and dry window

Material: Plastic, Rubber and sponge

Figure 2.9

2.6 FABRICATION PLANNING PROCESS.

2.6.1 Metal Inert Gas (MIG) Welding.

MIG (Metal Inert Gas) or as it even is called GMAW (Gas Metal Arc Welding) uses an aluminum alloy wire as a combined electrode and filler material. The filler metal is added continuously and welding without filler-material is therefore not possible. Since all welding parameters are controlled by the welding machine, the process is also called semi-automatic welding. Joining of some parts will use welding in this project.



Figure 2.10 Metal Inert Gas (MIG) Welding

There are two different MIG-welding processes, conventional MIG and pulsed MIG:

- i. Conventional MIG uses a constant voltage DC power source. Since the spray transfer is limited to a certain range of arc current, the conventional MIG process has a lower limit of arc current (or heat input). This also limits the application of conventional MIG to weld material thicknesses above 4 mm. Below 6 mm it is recommended that backing is used to control the weld bead.
- ii. Pulsed MIG uses a DC power source with superimposed periodic pulses of high current. During the high current pulses the metal is transferred in the spray mode. In this way pulsed MIG is possible to operate with lower current and heat input compared to conventional MIG. This makes it possible to weld thinner sections and weld much easily in difficult welding positions.

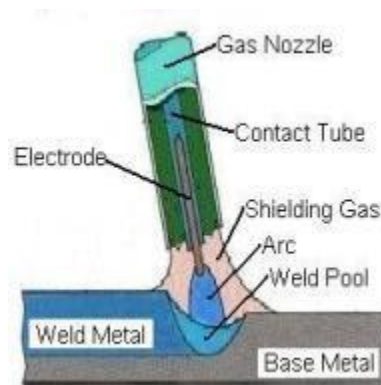


Figure 2.11 Schematic of Metal Inert Gas (MIG) Welding

Gas Metal Arc Welding (GMAW) is frequently referred to as MIG welding. MIG welding is a commonly used high deposition rate welding process. Wire is continuously fed from a spool. MIG welding is therefore referred to as a semiautomatic welding process.

There are some advantages and disadvantages in using MIG welding:

- a) The advantages of MIG welding
 - i. All position capability
 - ii. Higher deposition rates than SMAW
 - iii. Less operator skill required
 - iv. Long welds can be made without starts and stops
 - v. Minimal post weld cleaning is required

- b) The disadvantages of MIG welding
 - i. Costs money of consumable, such as tips and nozzles
 - ii. Is not worth a dang on paint, rust, or dirty surfaces
 - iii. No good for thick steel because it does not get the proper penetration

2.6.2 Hand grinder

A hand grinder as is a tool which rotates a grindstone but in this case the grinding medium is a thin disc that can be used for either grinding or cutting metal. It is usually used for cutting off material after a welding process or cutting off burrs. Although it is a convenient tool, it is a dangerous tool like the bench grinder. Again, eye protection should be worn when using a hand grinder.



Figure 2.12 Grinding machine

2.6.3 Rivet

A rivet is a permanent mechanical fastener. Before it is installed it consists of a smooth cylindrical shaft with a head on one end. The end opposite the head is called the buck-tail. On installation the rivet is placed in a punched or pre-drilled hole. Then the tail is "upset" (i.e. deformed) so that it expands to about 1.5 times the original shaft diameter and holds the rivet in place. To distinguish between the two ends of the rivet, the original head is called the factory head and the deformed end is called the shop head or buck-tail.

For this project, type of blind rivet will use to join the plastic and the aluminum. Blind rivets are tubular and are supplied with a mandrel through the center. The rivet assembly is inserted into a hole drilled through the parts to be joined and a specially designed tool is used to draw the mandrel into the rivet. This expands the blind end of the rivet and then the mandrel snaps off. These types of blind rivets have non-locking mandrels and are avoided for critical structural joints because the mandrels may fall out, due to vibration or other reasons, leaving a

hollow rivet that will have a significantly lower load carrying capability than solid rivets.

Furthermore, because of the mandrel they are more prone to failure from corrosion and vibration. Unlike solid rivets, blind rivets can be inserted and fully installed in a joint from only one side of a part or structure, "blind" to the opposite side.



Figure 2.13 Rivet

2.6.4 Drill

A drill or drill motor is a tool fitted with a rotating cutting implement used for drilling holes in various materials. The drill bit is gripped by a chuck at one end of the drill and rotated while pressed against the target material. The tip of the drill bit does the work of cutting into the target material, either slicing off thin shavings (twist drills or auger bits), grinding off small particles (oil drilling), or crushing and removing pieces of the work piece (SDS masonry drill).

Drills are commonly used in woodworking, metalworking and construction. Specially designed drills are also used in medicine, space missions and other applications.



Figure 2.14 Drill

2.7 IDEAS OF IMPROVEMENT.

To improve the project design, a new idea and design had been drawn. Those ideas must relate with the objective. For this project, it should look more efficient and creative multifunction broom. There are several ideas:

- i. For broom design, It same with a market broom but for the length and size it different because it have a adjustable handle. So user cannot remove the handle to be short and it easy to store.
- ii. For mop design, it is different compare the mop at the market because user cannot use their hand to flash the mop. It just pull the holder to make the sponge squeeze the dirty water as it have an adjustable handle.
- iii. For Car mirror cleaner, function of this component is to clean and wiping window. So, user can clean the house window and it have adjustable handle. User can clean the glasses or window in the distance and high altitude.
- iv. For the final Design, combine the three parts to make a multifunction broom.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

CHAPTER 3 is the methodology has been used to modify the small sweep. In this chapter, a project flow chart is defined. The information that included is investigation of the objective of the project, establish target specification, design concept, select final design concept, searching material for the product and fabrication of the product. It also allows others to replicate our study and run new and different studies that are based on our methodology

3.2 PROCESS FLOW

That shows below the process flow of modify a multifunction broom. The manufacturing process consists of 7 phases.

- a. Phase 1 - Establish target specification.
- b. Phase 2 - Design concept.
- c. Phase 3 - Select final design.
- d. Phase 4 - Searching material for the product.
- e. Phase 5 - Fabrication of the product.

3.3 PHASE 1 – ESTABLISH TARGET SPECIFICATION

After the investigation of the objective, criteria selection will be developed. Criteria selection here means the criteria that what people will look on the product. It is focus on the existing product on the market. Then, when the new product is done, compare it with the existing product on the market. The new design should have better criteria than the product on the market.

This is the criteria that I had to use to the new design for the small sweep.

- a. Easy to use
- b. Safe
- c. Durable / long life time
- d. Lightweight
- e. Nice design
- f. High resistance to corrosion
- g. Low cost
- h. Strong

3.4 PHASE 2 – DESIGN CONCEPT

The purpose of this project is to design multifunction broom which functions on everywhere. It is also should look more efficient than existing product on market. The motivation for this project is to improve the design of the multifunction broom with a mop and window cleaning. So the new design should have a mechanism which available to use it with hand. It will look more efficient and if people who use it, they could be interested in product because of the design include the style movement of the broom. Those are the concept planning and new design of multifunction broom.

3.5 PHASE 3 - CONCEPT A

This is a concept 1 which has a nice shape. It also a simple design as a cat roller. It uses the steel material and sponge only. That is the advantage and their Disadvantages:

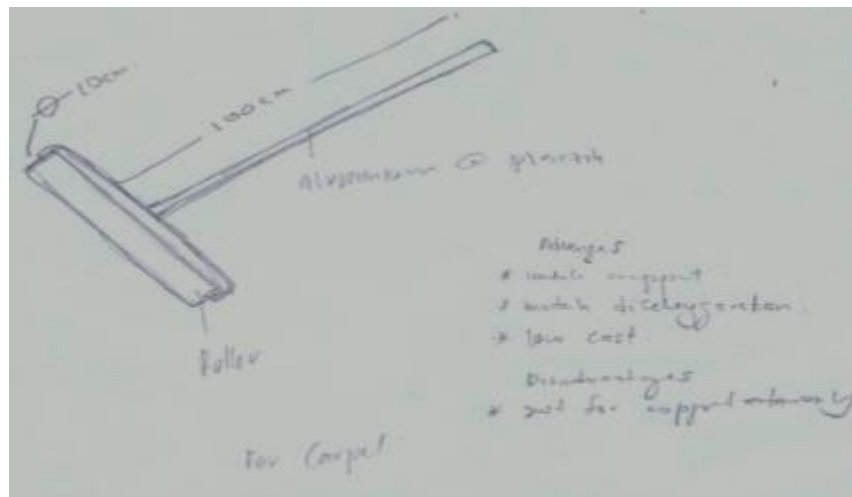


Figure 3.1 Concept A

Advantage:

- Easy to use
- light
- Low Maintenance

Disadvantages:

- Just for carpet
- Not for lab

3.6 CONCEPT B

This is second concept like a trolley design but it can collect the steel only. It has quick big size to fabricate this concept. It makes take a long time to finish this concept. This concept only for lab. That is the advantage and their disadvantages:

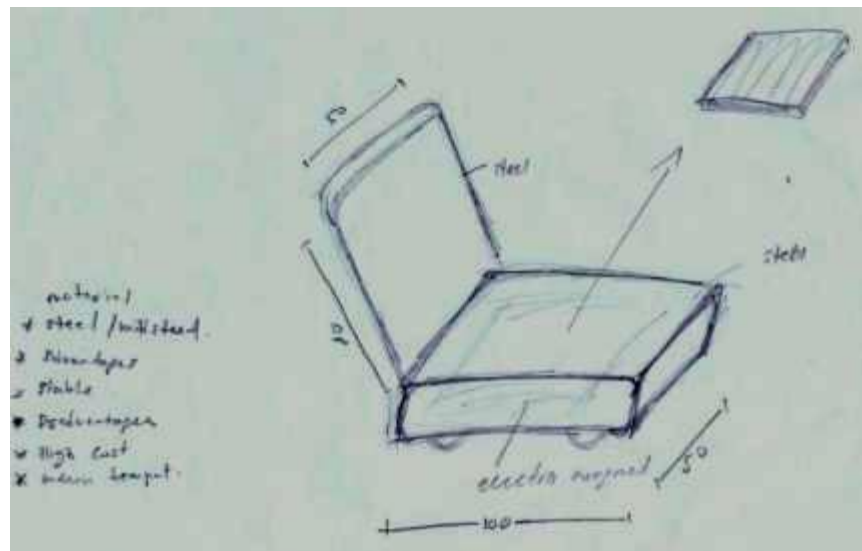


Figure 3.2 Concept B

Advantage:

- Easy to use
- Low Maintenance

Disadvantages:

- High cost
- Just for lab or workshop
- Not easy to store

3.7 CONCEPT C

This is the third concept which sketched before going to concept selection. For the concept 3, it has the wheel to easy moving to clean the floor. It also has the handle and magnetic system to collect simple steel such as screw and bolt. That is the advantage and their disadvantages.

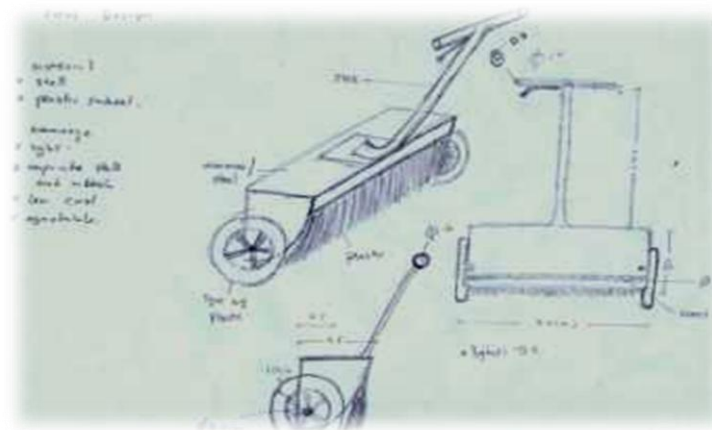


Figure 3.3 Concept C

Advantage:

- Easy to use
- Have two function
- Lightweight

Disadvantages:

- Just for lab or workshop
- Not easy to store
- High Maintenance

3.8 CONCEPT D

This is the last concept which was sketched. This is also is my final concept which is chosen to start the fabrication. It is because for this concept has many good criteria such as have mop and car mirror cleaner. That is the advantage and their disadvantages

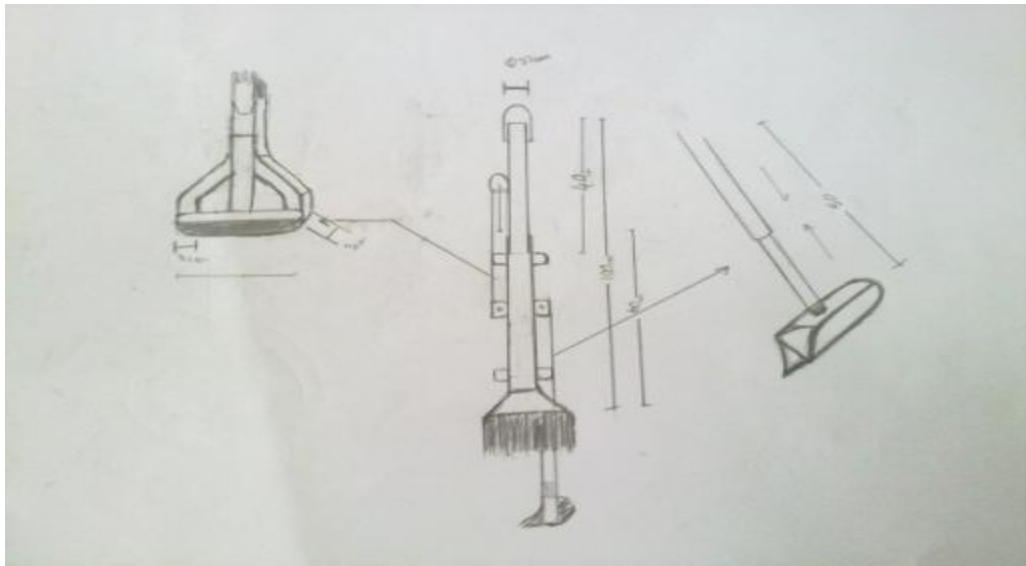


Figure 3.4 Concept D

Advantage:

- Easy to use
- Have four function
- Lightweight
- Simple design
- Low cost

Disadvantages:

- It complicated

3.9 PHASE 3 – SELECT FINAL DESIGN AND IMPROVEMENT OF THE DESIGN

After design concept, study the best design and relate it with criteria selection. Then make decision which design is the best. For this project, concept A design is the best after consider the criteria selection.

This is tables which use to select which criteria is the best.

Selection Criteria	Concepts			
	A	B	C	D
				(Datum)
Easy to use	+	+	-	0
Safe	0	0	0	0
Durable / long life time	-	0	0	0
Lightweight	+	-	+	0
Nice design	0	+	-	0
High resistance to corrosion	+	+	0	0
Low cost	+	-	0	0
Strong	0	0	+	0
$\Sigma+$	4	3	2	0
$\Sigma 0$	3	4	4	0
$\Sigma-$	1	1	2	0
Net Score	3	2	0	0
Rank	1	2	3	4

Notes:

+ = Better than

- = Worse than

0 = Same as

Figure 3.1 Concept Table

3.10 FINALIZE DESIGN

Concept A had the higher net score than the other concept. So this concept is been chosen to be the final concept and will be fabricate. For the proper function, the design had been improved by changing the sweep style from rotating the brush to forward and backward movement. This shows the final design using solid work:

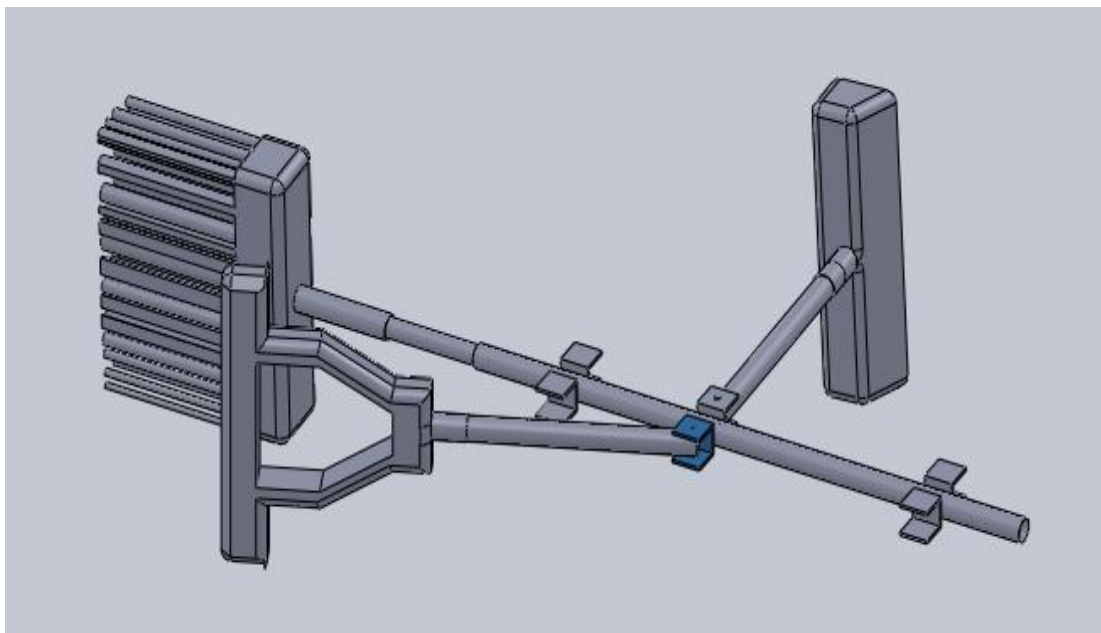


Figure 3.5 Multifunction broom Assembly by Solid Work

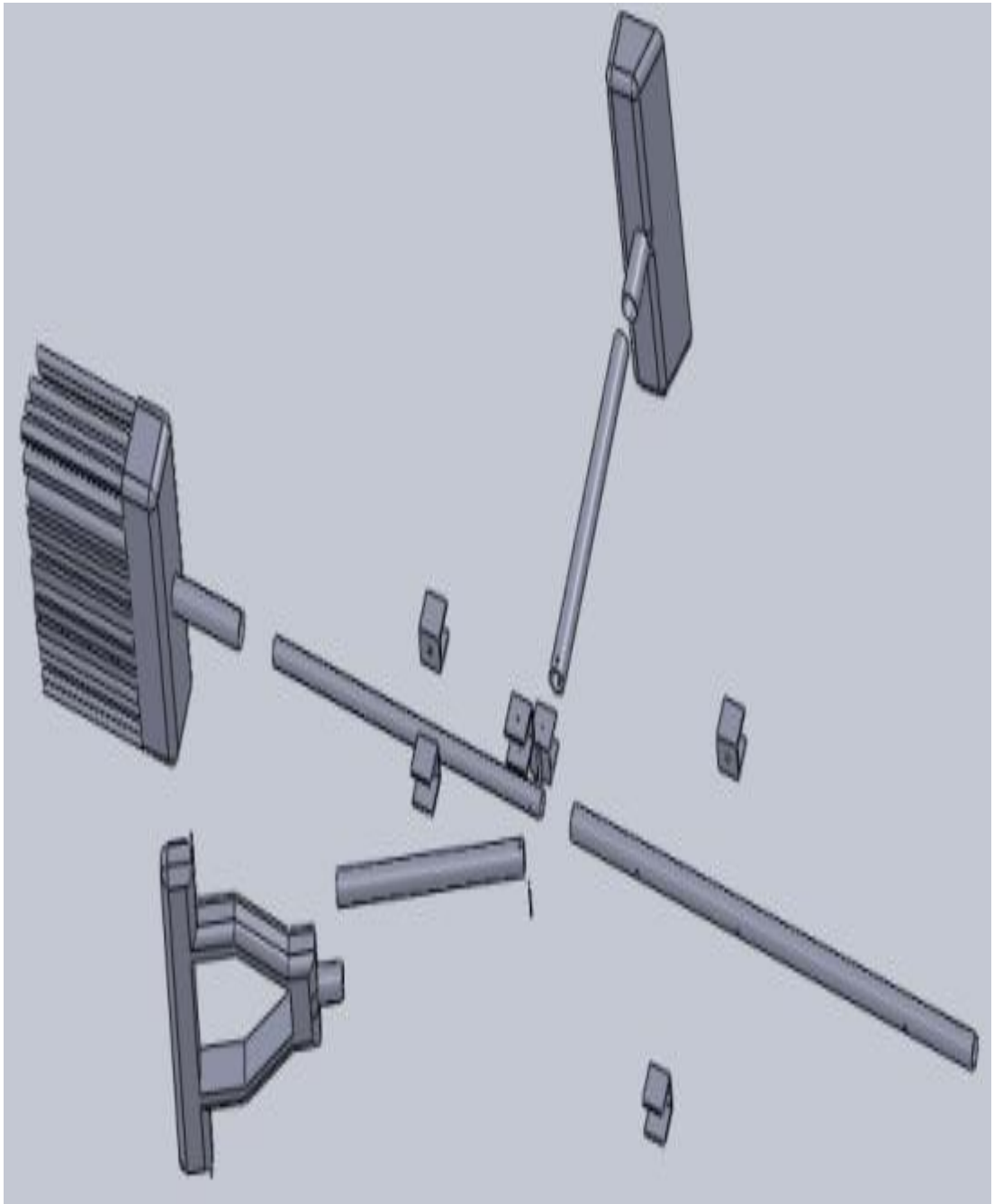


Figure 3.6 Exploded view by Solid Work

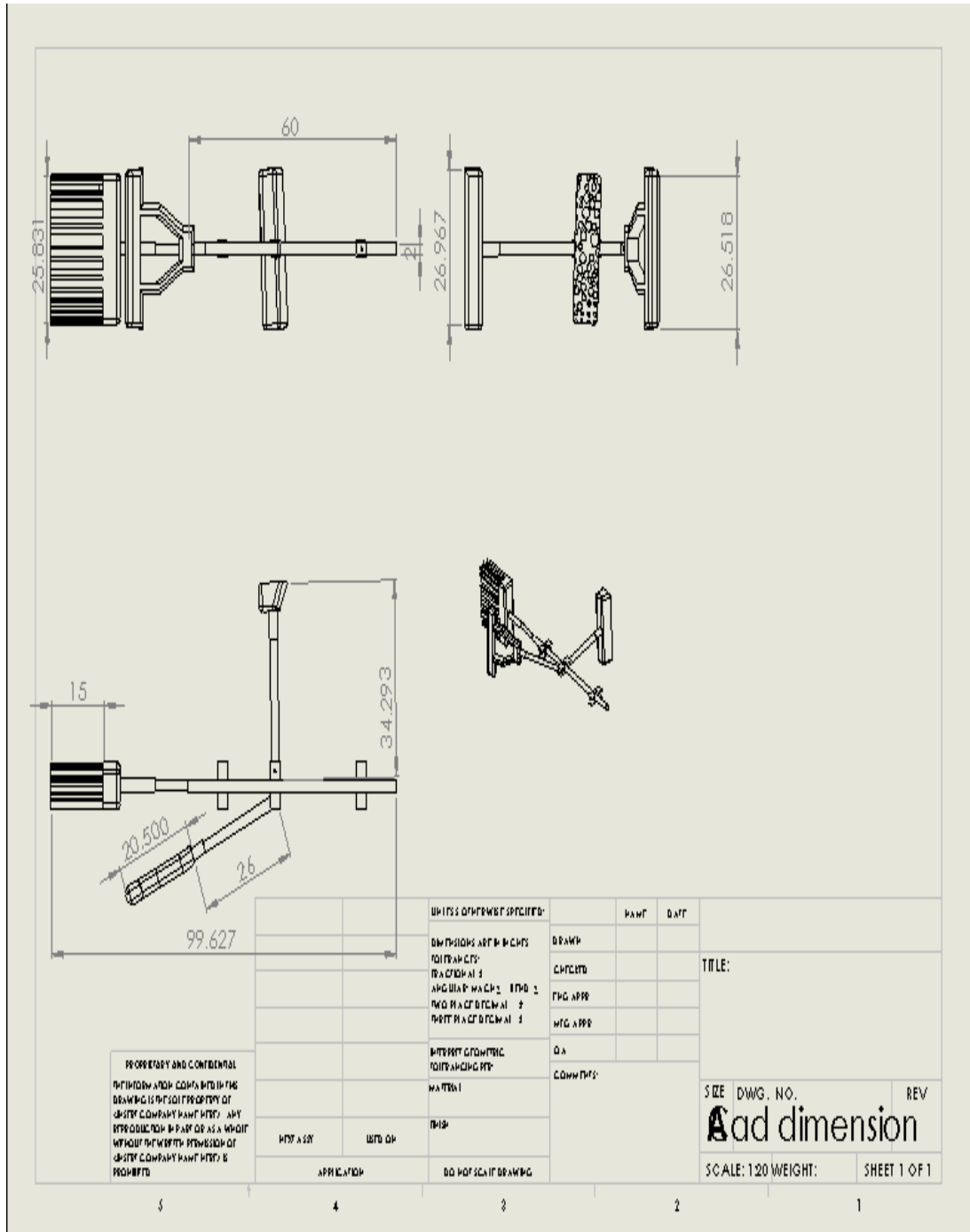


Figure 3.7 Orthographic Projection

3.11 PHASE 4 – Searching material for the product

For this project, to make a prototype. It is because for the real product, I plan to make it by mold. However, for the prototype, the material is stainless for the handle and body. All of the material is available at the market.

3.12 PRODUCT DESIGN SPECIFICATION

(a) Product title

Multifunction broom

(b) Purpose

To convenient garbage sweep, wash floors and clean the window

(c) New or special features

- Easy to use
- Simple design
- Have many functions in one concept.
- Have three function
- Lightweight
- Low cost

(d) Functional performance

- Long life
- Anti rust
- Can be recycle
- Save the cost

(i) Human factors

- Multifunction broom must be simple
- Easy to use

3.13 PHASE 5 – FABRICATION OF PRODUCT

Fabrication, when used as an industrial term, applies to the building of machines, structures and other equipment, by cutting, shaping and assembling components made from raw materials. Steel fabrication shops and machine shops have overlapping capabilities, but fabrication shops generally concentrate on the metal preparation, welding and assembly aspect while the machine shop is more concerned with the machining of parts.

After select the material, fabrication this project will be start. First of all, measuring is very important step to make the product like a true specific size. Measurement made on the broom and the clip to join at the broom handle. The area is 60cm for handle and 3cm for clip



Figure 3.8 Sample of tape for measurement

After finish the measurement step, cutting process using the saw will be done for clip. Feed the aluminum plat at clamp and cutting the plat for 9cm X 3cm. Make sure the steel blade in the right direction. This is picture for cutting process.



Figure 3.9 Cutting

After finish the clip cutting, process using the grinder will be done for handle. Feed the bar at clamp and cutting the bar using the grinder. Cut for 4 pieces short bar. Make sure the tool is tied to the strength and using the security protection such as safety boot and goggle when using the grinder. This is picture for grinder cutting process.



Figure 3.10 Grinder for Cutting Process.

The third process is making a hole in the main bar. Process of making this hole using a drill with 3mm tool. A total of 6 holes need to be made on the main iron. Function of the hole is to connect the bar with the other part. This is picture for drilling.



Figure 3.11 Drilling Process

The last process of this project is joining. Combination process using welding and rivet. Make sure the rivet is closely tied to the material. The rivet size is 3mm. The function of this process is to join the major steel mop holder and window cleaner holder with the broom handle. This is picture for rivet process.



Figure 3.12 Rivet Process

3.14 BILL OF MATERIALS

No	Part	Dimension(cm)	Function	Quantity(pcs)
1	Hollow Steel	60 x 2.2	handle	5
2	Aluminum plat	3 x 9	Clip	4
3	Screw	2.5	handle joining	4
4	Brush	26 x 13	Brush Broom	1
5	Mop	26 x 24	Mop	1
6	Car screen cleaning	7 x 10 x 20	Widow cleaning	1

Figure 3.2 Bill of Materials

CHAPTER 4

RESULTS AND DISCUSSION

4.1 INTRODUCTION

CHAPTER 4 is the discussion on the results for modification of this project and several problems occur to the project. This chapter also will discuss mainly about the problems encountered during the whole project was been carried out.

4.2 PROJECT ANALYSIS

4.2.1 Literature Review

The concept and ideas review for this project are not very wide because it is not widely modified by the manufacturer. Students should come with their ideas on the project.

4.2.2 Designing & Sketching

Because of the idea were from the student directly, so there are no references that can be referred. All the drawing and dimension need to generate by student itself.

4.2.3 Fabrication Process

Students need to be given more time to finish fabricating their product because of slackness of skill and training, the joining finishing was not so good but yet can still reliable.

4.2.4 Material Preparation

Some of the needed material needs to buy at the city. University should prepare the material or either provides the place where the material can be obtained from.

4.2.5 Budget Preparation

It is not so effective to use student's money to get the materials. University should provide budget at first place so the student's expenses are not interfere.

4.3 PROBLEM DURING FABRICATION DESIGN

During preparing this project, which passed without much problem. However, this project is quite complex in terms of design as the broom should have a lighter weight. The problem is to finding a suitable material such as aluminum and steel. Manufacturing process takes about a week to complete. Due to schedule lab use only during the day, this causes project in a long time to prepare.

4.4 FRIENDLY MULTIFUNCTION BROOM

The problem statement for this project is most of multifunction broom are not have many function. To solve the problem, idea to produce multifunction broom with efficient look had come make it available to use for many function.

A several new concept designs were come out to solve the problem. Those new concept designs are create by depending on the objective. Then, they were comparing to look, which of them could be the final design and will be fabricate. To increase the efficiency, the design had been improved by changing the broom style.

People who can use all the function will feel this product is very friendly to them. That mean the objective of the product had been achieve by increasing the function efficiency.

4.5 THE FUNCTION OF BROOM

- i. User can use the sweeper to clean the rubbish. For this time, hole up the mop and window cleaning. Clip the handle of mop and window cleaning at the handle clip. So, user can use the broom.
- ii. User can use mop to clean and wash floor. When using the mop, just hole down the mop only and adjust the handle to be a long handle. Clip the handle because to make it stable.
- iii. User can use the window cleaning to clean and dry the window. When using the window cleaning, just hole down the window cleaning only and adjust the handle to be a long handle. Clip the handle because to make it stab.

4.6 RESULT

Finally this is the output which I had achieved after doing fabrication process.



Figure 4.1: Multifunction Broom



Figure 4.2 Sweep garbage



Figure 4.3 Washing floors using the mop



Figure 4.4 Cleaning the window



Figure 4.5 Dry the window

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

As conclusion, both factor is achieved which one design and fabricate the multifunction broom with the qualities of accessible, movement, stability and strong enough to withstand the load. According to the design I have fabricate the final product.

5.2 RECOMMENDATION

5.2.1 Finding material

The problem is to finding a suitable material such as aluminum and steel.

5.2.2 Schedule lab

Manufacturing process takes about a week to complete. Due to schedule lab use only during the day, this causes project in a long time to prepare.

5.2.3 Budget Preparation

It is not so effective to use student's money to get the materials. University should provide budget at first place so the student's expenses are not interfere.

5.3. REFERENCE

- 5.3.1 <http://www.google.com.my/imglanding?q=snow+broom&um>
- 5.3.2 http://www.thebokeegroup.com/catalog/index.php?cPath=3_96_97
- 5.3.3 <http://www.greenlightoffice.com/office/stationery/72971-wilen-professional-clean-sweep-whisk-broom.html>
- 5.3.4 <http://www.google.com>
- 5.3.5 <http://www.webstaurantstore.com/heavy-duty-amish-corn-broom/7961.html>

APPENDIX A

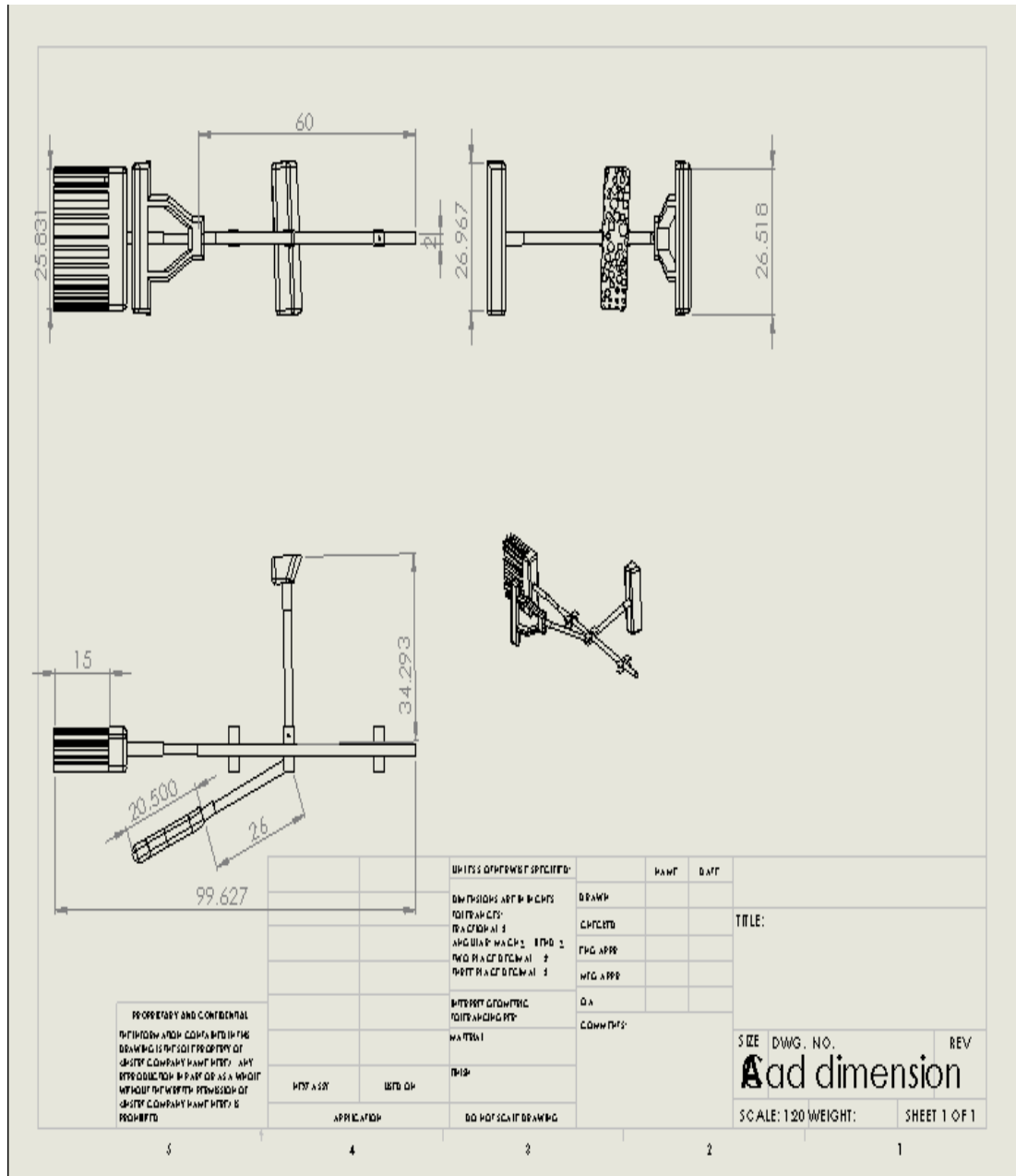


Figure 4.6: AutoCAD Design with dimension

