SMALL SWEEP

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

I hereby declare that I have checked this project report and in my opinion this project is satisfactory in terms of scope and quality for the award of Diploma in Mechanical Engineering.

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Position: FKM TUTOR
Date:

STUDENT'S DECLARATION

I hereby declare that the work in this report is my own except for quotations and summaries which have been duly acknowledged. The report has not been accepted for any degree and is not concurrently submitted for award of other degree.

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ABSTRACT

This report presents about the small sweep that had been fabricated with a new design, more efficiency and suitable to use in a mosque. Today, most of the small sweep is function by two hands. For a single hand user, it is not really friendly to them. The idea of the fabricating of this small sweep is based on student's creativity. The materials selection in the fabricating process of this small sweep is a material with suitable weight, long life-span and can detain force depending on the function. Materials are proposed for the fabrication of the small sweep is aluminium, stainless steel and plastic. This report also focuses on the fabrication process of this small sweep.

ABSTRAK

Laporan ini membentangkan tentang penyapu kecil yang dicipta khas dengan bentuk yang lebih menarik dan efisien dan sesuai digunakan di masjid. Penyapu kecil yang terdapat pada hari ini majoritinya boleh digunakan dengan mengunakan kedua-dua belah tangan. Penyapu jenis ini bersifat tidak mesra pengguna bagi mereka yang boleh menggunakan sebelah tangan. Idea pembentukan penyapu kecil ini adalah berdasarkan kreativiti pelajar sendiri. Pemilihan bahan yang sesuai untuk digunakan bagi pembentukkan penyapu kecil ini merupakan bahan yang mempunyai berat yang sesuai, jangka hayat yang tahan lama dan boleh menahan daya yang sesuai dengan fungsinya. Bahan yang dicadangkan untuk pembentukkan penyapu kecil ini merupakan bahan jenis aluminium, stainless steel dan plastik. Dalam laporan ini juga akan lebih memfokuskan kepada pembentukkan penyapu kecil tersebut.

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Ø	Diameter

LIST OF ABBREVIATIONS

MIG	Metal Inert Gas Welding
GMAW	Gas Metal Arc Welding
UMP	Universiti Malaysia Pahang
mm	Millimetre

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

CHAPTER 1 is the introduction chapter of this project. Generally, it discuss about the project background, problem statement, the objective, scope of project, project flow and project Gantt chart. Besides that, it also consists with the process of the project.

1.2 BACKGROUND OF THE PROJECT

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.

In mosque, there are also special brooms which use to clean dirt. It size is small than other standard sizes. Innovative productivity means improving efficiency in order to do the job well. So the clearance is more easily and suitable at any area without disturbing people whose pray there.

1.3 PROBLEM STATEMENT

At the market, most of small sweep are produce to use by two hands. From handicap people's point of view that only can use single hand because of physical disability, current design of small sweep is not very friendly to them. It is because, at the market, a lot of small sweep need one hand to hold the brush, and another hand use to hold the dustpan.

1.4 OBJECTIVE

Objective is a plan do to achieve them. Each project has its own objective. Diploma final year project objective is to practice the knowledge and skill of the student that have been gathered before in solving problem using academic research. This project also important to train and increase the student capability to get know, research, data gathering, analysis making and then solve a problem by research or scientific research.

The project also will educate the student in communication like in a presentation and educate them to defend their research in the presentation. The project also will generate students that have capability to make a good research report in thesis form or technical writing. This project also can produce and train student to capable of doing work with minimal supervisory and more independent in searching, detailing and expanding the experiences and knowledge.

The objective of this project is:

1.4.1 To design an efficient small sweep.

1.4.2 To fabricate the structure which can be use in mosque.

1.5 SCOPE

In project, scope performed a range in the completion of a project. The scopes usually define the boundary of the project framework.

The scopes of this project are:

1.5.1 This study is focused on making a new small sweep for mosque.

1.5.2 Function to remove small dirt for mosque.

1.6 FLOW CHART

A flow chart, is a graphical representation of a process or system that details the sequencing of steps required to create output. A typical flow chart uses a set of basic symbols to represent various functions, and shows the sequence and interconnection of functions with lines and arrows. Flow charts can be used to document virtually any type of business system, from the movement of materials through machinery in a manufacturing operation to the flow of applicant information through the hiring process in a human resources department.

Each flow chart is concerned with one particular process or system. It begins with the input of data or materials into the system and traces all the procedures needed to convert the input into its final output form. Specialized flow chart symbols show the processes that take place, the actions that are performed in each step, and the relationship between various steps. Flow charts can include different levels of detail as needed, from a high-level overview of an entire system to a detailed diagram of one component process within a larger system. In any case, the flow chart shows the overall structure of the process or system, traces the flow of information and work through it, and highlights key processing and decision points.

Flow charts are an important tool for the improvement of processes. By providing a graphical representation, they help project teams to identify the different elements of a process and understand the interrelationships among the various steps. Flow charts may also be used to gather information and data about a process as an aid to decision making or performance evaluation.

In conducting a project, well arrangement of works and task is important to keep the momentum of this study. This is flow chart for this project.

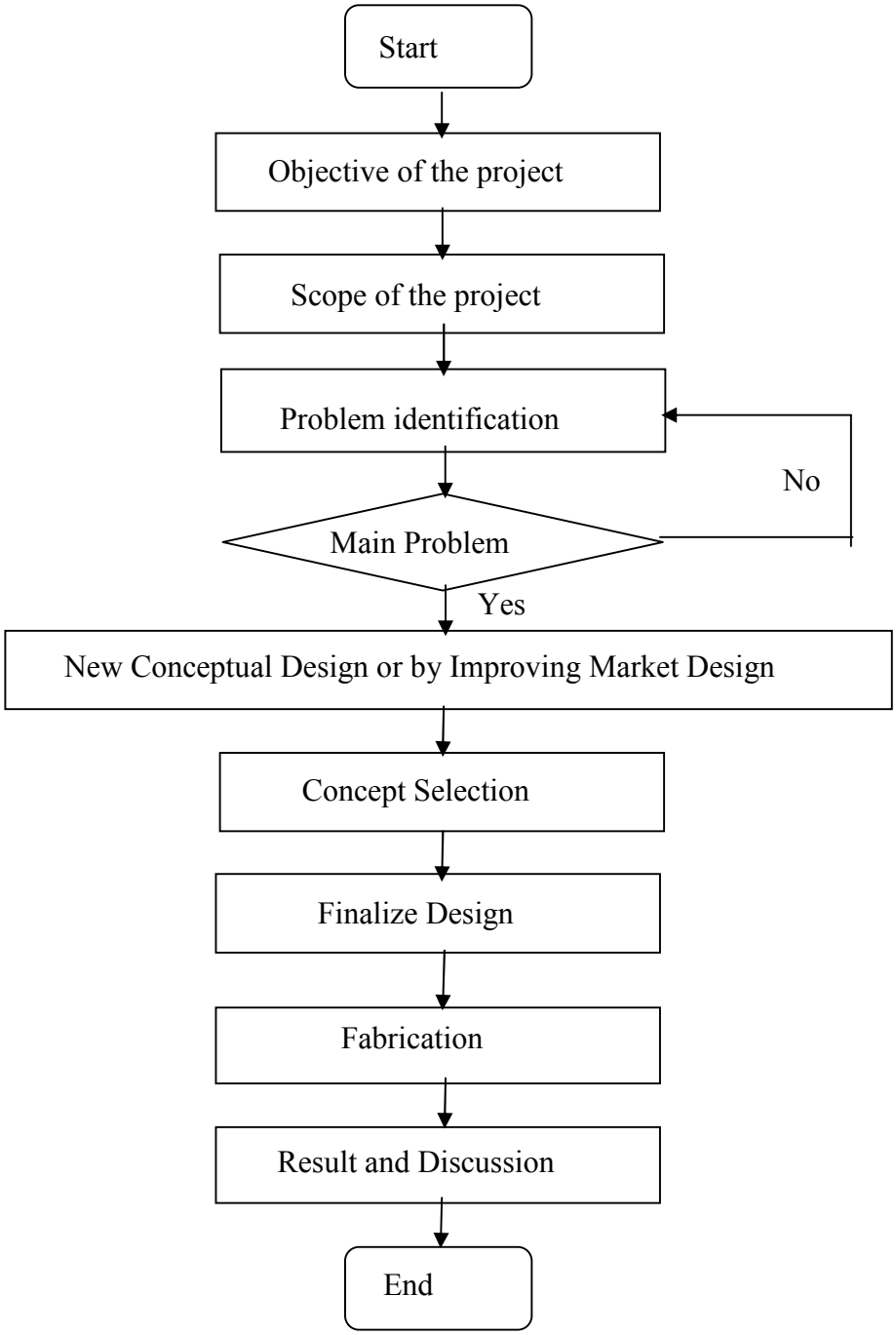

Table 1.1: Flow Chart

The project starts with identifying the problem regarding the present product of interest. It is a first step for the project flow in order to find the problem in current product. The problem detected is, most of small sweep are produce to use by two hands. This step helps to create different new ideas to improve the product.

After identify the problem for the project, project continues with identify the objective that will become the solution of the problem that been identified earlier. The objective is very important in every work because every procedure to accomplish a project will depend on it. It will help to know the main point on what to achieve and thus determine the project success or not. So, the main objective for this project is to design an efficient small sweep and fabricate the structure which can be use in mosque.

The project continues with identify the scope of the project because this scope can help the progress to create the new product design for the project and to make sure the method chose will be within the range of an achievable objective at a period of time. The first scope for this project is making a new small sweep for mosque. This scope is important to gather data about sweep in entire aspect like type, material and shape that is suitable to use in the mosque. For the next scope is, it is function to remove small dirt only. With these scopes, the new design for the product can be well determined for further analysis before it can be fabricate.

Literature study will be carry on throughout the project beginning from defining the problem statement until choosing appropriate method in achieving objective. This consist a review of the design of small sweep, and type of sweeps. These tasks have been done through research on the internet, books and others reliable sources.

From the information gathered via literature study, the design for new concept had been done. A present product set as datum as reference for few new design. Then improve the design. Try to come with several concepts. Then compare the criteria from each design which are the best. Produce the drawing together with dimension of the product and the type of materials needed to avoid major adjustment of shape to the raw product. Then, start the fabrication process. Gather the parts need for the project to proceeds the fabrication process. The fabrication process that involved is bending, welding, grinding and rivet.

Here come the testing and evaluation process. The small sweep will be tested to see if it fulfills the requirement such as safety, ability and strength. During the testing, if a problem occurs, the process of fabrication small sweep will step back to the previous process. The reason to step back is to fix the minor error.

After all the parts had been joined together and no error, here comes the phase of result and discussion. In this part, how the small sweep functions will be inform. Beside, how to achieve objective and solve problem statement of the project will be discuss in this phase.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter will discuss about the literature review that been done for this project. This will includes history, previous product development and plans to make the product. Besides that, it is consists with the design which were 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 combination with a dustpan. A smaller whisk broom or brush is sometimes called a duster.

A dustpan is a cleaning utensil, commonly used in combination with a broom. 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.

Handheld dustpans may be used with either a full-size broom or with a smaller whisk broom or brush sometimes called a duster. This second combination may be sold as one.

2.3 TYPES OF BROOMS/SWEEPS 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 brooms

Source: toyotapartsstore 2007

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

Source: greenlightoffice 2006

2.3.3 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 2.3: Corn broom

Source: homedepot 2005

2.3.4 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 2.4: Whisk broom

Source: greenlightoffice 2006

2.3.5 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 2.5: Push broom

Source: housewares 2004

2.3.6 Small Sweep

Most of this type of sweeps will come with a dustpan. It is use to clear small dirt by sweeping the dirt into dustpans at small area.

Figure 2.6: Small sweep

Source: comparestoreprice 2003

2.4 BASIC PARTS

2.4.1 **Dustpan and holder**: Made from plastic. The dustpan use to store the dirt. Make by molding process.

2.4.2 Brush: The brush material is plastic. It is use to sweep the dirt.

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

Part	Original Part	Prototype Part
Dustpan	Plastic	Aluminum
Holder	Plastic	Plastic

Table 2.1: material for object parts

2.5 TYPE OF MATERIALS

2.5.1 Aluminum

Physically, chemically and mechanically aluminum is a metal like steel, brass, copper, zinc, lead or titanium. It can be melted, cast, formed and machined much like these metals and it conducts electric current (azom 2007). In fact often the same equipment and fabrication methods are used as for steel. It advantages are:

2.5.1.1 Light weight

Aluminum is a very light metal with a specific weight of 2.7 g/cm^3, about a third that of steel. For example, the use of aluminum in vehicles reduces dead-weight and energy consumption while increasing load capacity. Its strength can be adapted to the application required by modifying the composition of its alloys.

2.5.1.2 Corrosion resistance

Aluminum naturally generates a protective oxide coating and is highly corrosion resistant. Different types of surface treatment such as painting or lacquering can further improve this property. It is particularly useful for applications where protection and conservation are required.

2.5.1.3 Electrical and Thermal Conductivity

Aluminum is an excellent heat and electricity conductor and in relation to its weight is almost twice as good a conductor as copper. This has made aluminum the most commonly used material in major power transmission lines.

2.5.1.4 Ductility

Aluminum is ductile and has a low melting point and density. In a molten condition it can be processed in a number of ways. Its ductility allows products of aluminum to be basically formed close to the end of the product's design.

2.5.1 Plastic

Plastic is the general common term for a wide range of synthetic or semisynthetic organic amorphous solid materials used in the manufacture of industrial products (Robert Scoot, Adrian 2006). Plastics are typically polymers of high molecular mass and may contain other substances to improve performance and/or reduce costs.

2.5.2 Stainless steel

Stainless steel, also known as inox steel or inox, is defined as a steel alloy with a minimum of 10.5 or 11% chromium content by mass (Rodney P. Carlisle, John Wiley and Sons, 2004). Stainless steel does not stain, corrode, or rust as easily as ordinary steel (it *stains less*, but it is not stain-proof). It is also called corrosion-

resistant steel or CRES when the alloy type and grade are not detailed, particularly in the aviation industry.

2.5.3.1 Durability

Stainless steel can withstand very hot and very cold temperatures. This makes the material ideal for appliances. Unlike plastic or ceramic, stainless steel does not break easily, even if dropped. Stainless steel may dent, but it will not shatter or chip the way other materials will.

2.5.3.2 Rust Resistance

Stainless steel is resistant to rust. If rust does form on stainless steel, it is because small particles of iron-containing metal have become imbedded in the steel. This can occur, for instance, if you use steel wool to clean stainless steels.

2.5.3.3 Cleaning

Cleaning stainless steel appliances is very easy. Wiping the surface down with liquid soap and water is usually all that is required. Do not use abrasive cleaners or scrubbers (such as steel wool). For fingerprints or similar smudges, use glass cleaner and a polishing cloth.

2.6 FABRICATION PLANNING PROCESS

2.6.1 Bending

Bending (also known as flexure) characterizes the behavior of a slender structural element subjected to an external load applied perpendicularly to an axis of the element. The structural element is assumed to be such that at least one of its dimensions is a small fraction, typically 1/10 or less, of the other two. When the length is considerably larger than the width and the thickness, the element is called a beam (Boresi, A. P. and Schmidt, R. J. and Sidebottom, O. M., 1993).

A closet rod sagging under the weight of clothes on clothes hangers is an example of a beam experiencing bending. On the other hand, a shell is a structure where the length and the width are of the same order of magnitude but the thickness of the element is considerably smaller. A big but thin short tube supported at its ends and loaded laterally is an example of a shell experiencing bending. In this project, bending process is use to make the dust. The item to be bending is a sheet of aluminum.

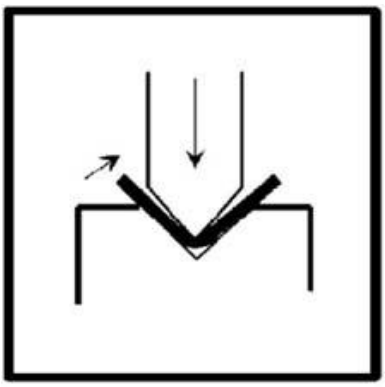

Figure 2.7: Bending

Source: sheetmetalguy 2005

2.6.2 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 (ajeepthing, 1999). 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 2.8: Metal Inert Gas (MIG) Welding

Source: weldingengineer 2003

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.

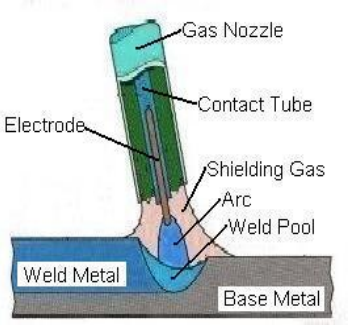

Figure 2.9: Schematic of Metal Inert Gas (MIG) Welding

Source: weldingengineer 2007

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) <u>The advantages of MIG welding</u>

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) <u>The disadvantages of MIG welding</u>

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

2.6.3 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

(Koichi Hirata, 2003). 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 2.10: Grinding machine

Source: alibaba 2007

2.6.4 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 (Smith, Carroll, 1990). 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 2.11: Rivet

Source: dotchrock 2006

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 use with single hand. There are several ideas:

1. Add a trigger at the holder and a round brush fixed at lips of the dustpan. Then add a belt to connect the trigger and the round brush. How the small sweep is function is, by pull the trigger, then the round brush will rotate and sweep the dirt into the dustpan.

2. Make a hold at the dustpan wall start from the dustpan lips with 55 mm length and 3 mm wide. To hold the sweeper at the dustpan wall, enter a nail both side. Then put rod on the brush. Use push and pull mechanism to move the sweeper forward and backward.

3. Combine two rollers and at the end of round brush side by side. Then add them at the dustpan lips. To sweep, push the small sweep, so the roller will rotate and sweep dirt into the dustpan.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

In this chapter, a methodology project 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

Below the process flow of modify a small sweep. The manufacturing process consists of 7 phases.

i. Phase 1 - Establish target specification.
ii. Phase 2 - Design concept.
iii. Phase 3 - Select final design.
iv. Phase 4 - Searching material for the product.
v. 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 good 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 efficient small sweeps which function on small dirt at the mosque. It is also should look more efficient than existing product on market. The motivation for this project is to improve the design of the small sweep with a single hand. So the new design should have a mechanism which available to use it with a single 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 sweeper. Those are the datum and new design of small sweeps.

3.4.1 Datum

At the market, this product is available. Use two hands to conduct it.

Figure 3.1: Datum

3.4.2 Concept A

This concept has push and pull switch to move the sweep.

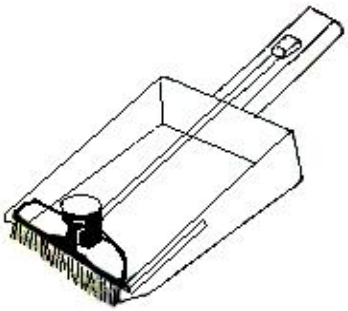

Figure 3.2: Concept A

3.4.3 Concept B

For this concept, push the trigger so the brush will rotate and drive the dirt into the dustpan.

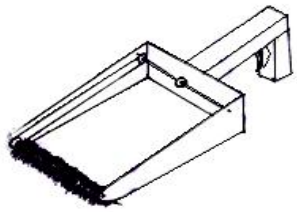

Figure 3.3: Concept B

3.4.4 Concept C

To sweep, push the small sweep, so the roller will rotate and sweep dirt into the dustpan.

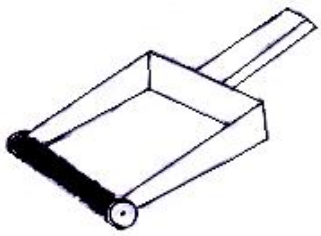

Figure 3.4: Concept C

3.5 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 a table which uses 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
∑+	4	3	2	0
∑0	3	4	4	0
∑-	1	1	2	0
Net Score	3	2	0	0
Rank	1	2	3	4

Notes:
+ = Better than
- = Worse than
0 = Same as

Table 3.1: Concept Criteria Selection

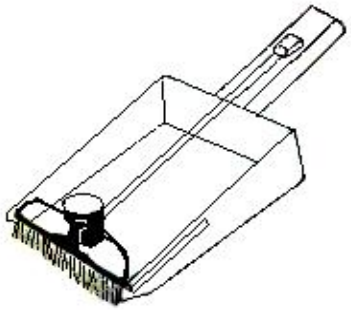

Figure 3.5: Final Concept

Concept A had the higher net score than the other concept. So this concept had 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. Technical drawing and bill of material for the final design will show at the appendix.

3.6 PHASE 4 - SEARCHING MATERIAL FOR THE PRODUCT

For this project, I plan to make a prototype. It is because for the real product, I plan to make it by mold. That mean the material is plastic for the whole body. However, for the prototype, the material is aluminum for the dustpan and plastic for the brush and holder. Use sheet of steel to connect the switch and the brush and hollow steel with diameter 18 mm to maintain the brush angle. All of the material is available at the market.

3.7 PHASE 5 - FABRICATION OF THE PRODUCT

After gather the items for the material, start to cut the sheet of aluminum. The area is 180 mm length and 140 mm wide. At 30 mm at the end of both lengths, bend it to shape the dustpan. For the back cover of the dustpan, take 30 mm from 140 mm.

Figure 3.6: Bending

Put a nails side by side of the brush as the holder. The function is to rotate the brush after put nails into the hole.

Figure 3.7: Nails location

Cut hollow steel with 18 mm of diameter until 53 mm of length. Grind the hollow steel depend on the shape of the brush. Make sure the hollow steel is able to hold the brush with 30 degree of angle.

Figure 3.8: Hollow Steel Shape after Grinding

Take thick steel (2mm) with 120 mm length and 15 mm wide. Then weld it the hollow steel. The distance between them is 25 mm start from the end thick steel at the brush to the center of the hollow steel.

Figure 3.9: After weld the thick steel and the hollow steel

Make hole (2.6 mm x 16 mm) a little up from the brush. The function is to put the thick steel into the hole so the brush will not slip when sweeper is using.

Figure 3.10: Hole at the brush

To make the brush work proper, expand both holes until 55 mm start from fix holes. For the new design, the brush is able to move forward and backward. It is still depend on connector as the switch for the mechanism.

Figure 3.11: Hole to hold the nail

Then join a holder at the back of the dustpan cover by rivet. Add another sheet of plastic to cover the aluminum back cover so the back cover is thicker. The reason is to make sure the rivet tie it better.

Figure 3.12: Rivet

Next step is joins the hollow steel with the brush. Make sure the thick steel fit into the hole at the brush. Also make sure the hollow steel hold the brush properly.

Figure 3.13: Joining part

Join the joining part with the dustpan. Add the switch to push and pull the brush at thick steel. Put the nail into the slider so the brush will able to slide forward and backward.

Figure 3.14: Final design

CHAPTER 4

RESULTS & DISCUSSION

4.1 INTRODUCTION

This chapter will discuss mainly about the product produced in this project and how the product function. Besides, problems that was appeared had been encountered during the whole project has been carried out.

4.2 PRODUCT ACHIEVEMENT

The problem statement for this project is most of small sweep are produce to use by two hands at the market. To solve the problem, idea to produce small sweep with efficient look had come make it available to use just by single hand.

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 sweep style from rotating the brush to forward and backward movement.

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

4.3 WAY TO USE NEW SMALL SWEEP

Figure 4.1: Final product

This new small sweep remove the dirt by sweep it into the dustpan. It use push and pull mechanism at the holder as a switch to sweep the dirt. The switch is direct connected to the brush. When the switch is push, the brush will move forward. So, there is a gap between the brush and lip of the dustpan. Use this gap area to put the dirt inside the area. To remove the dirt, pull the switch so the brush will sweep the dirt into the dustpan.

4.4 PROBLEM DURING FABRICATION PROCESS

4.4.1 Design

For the brush, the first plan is to hold it at lip of dustpan then put a shaft on it as switch. To sweep, just push and pull the shaft so the brush will rotate and clear dirt into the dustpan. However this type of sweeper is not very nice because when we sweep the dirt into the dustpan, it will go out back follow the brush while getting dirt.

Another idea is fix the left side of the brush at the lips of the dustpan. Then add a rod on the right brush. To sweep, use push and pull mechanism to move it. So the left side is fixed and the right side is moveable.

4.4.2 Welding Process

There are so many things happen in fabrication the product during welding process such as defect like dimensional defect deformation because the material is small. There is many type of defect occur during the fabrication such as gap, and bead. Besides that, the heat also makes the brush leaky.

4.4.3 Material selection for the prototype

Material is very important because it will affect the product. In fabrication process, if material selection is wrong, the project may put on hold or cannot be done. Maybe it is because the material cannot join together or not suitable for the product.

If the wrong materials are still using in the fabrication process to produce a product, then the product criteria will not fulfill the customer want, such as the product is heavy than it should be or it is more expensive because of wrong material selection.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

For the final chapter it represent about conclusion and recommendation for the project. In this chapter will discuss mainly about the conclusion of the project, concluding all the process that involved. Besides that this chapter also contains recommendation about the project. So for this recommendation it can make improvement about the project in the future.

5.2 CONCLUSION

The objective of the project is to design an efficient small sweep and suitable to use at the mosque which it is comfortable to be used are successfully done and achieved. The cost to fabricate the small sweep is cheap. It is user-friendly because it is easy to handle and suitable to use by people who are physically disabled. The new design of this small sweep is giving a lot of benefits in order to make the human life easier and more efficient.

This product is not only suitable to use at the mosque only. It is also suitable to use at another place like hotel and hospital. As long as it is small dirt, the small sweep is useful.

To run this project, idea, theory and skill are needed to design and fabricate the product. Base on the flow chart, this project is start by review related product at the market, then imaging the new design with improvement and then collection data

at the internet. With a several data, several designs had been produce and the best design was chosen as the final concept. Then the fabrication process is started after gather materials for the product.

The problem during the fabrication process was encounter at the result and discussion. This part also explains about how to use this product. This project had achieved the objective because the final product had increase the efficiency from the product at the market.

5.3 RECOMMENDATION

5.3.1 Design

For the brush holder, use a screw to replace the nail. Try to use thicker sheet of aluminum so the sheet will not easy to fracture. Increase the finishing part so the product will look smooth and friendly to user.

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APPENDIX A

GANTT CHART PROJECT

Project Gantt Chart

This is the Gantt chart for the project. It also show the duration needed for each task that carried out during the study.

ID	TASK		WEEK													
			1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Title selection, scope and objective	Plan														
		Actual														
2	Literature review	Plan														
		Actual														
3	Identify problem	Plan														
		Actual														
4	Design concept	Plan														
		Actual														
5	Selection concept	Plan														
		Actual														
6	Collecting data and information	Plan														
		Actual														
7	Preparing mid presentation	Plan														
		Actual														
8	Mid presentation	Plan														
		Actual														
9	Fabrication	Plan														
		Actual														
11	Preparing final presentation	Plan														
		Actual														
12	Making report	Plan														
		Actual														
13	Final presentation	Plan														
		Actual														
14	Correction and submit final report	Plan														
		Actual														

APPENDIX B

PROJECT TECHNICAL DRAWING

APPENDIX C

PROJECT BILL OF MATERIAL

Bill of material

This project use a many material with a different shape and size. Beside that, BOM also explain a quantity and type ogf material. Table below show a bill of material the product.

Bill	Type	Size(mm)	Quantity	Price (RM)
1	Plastic	82.8 X 25 X 10	1	1.00
2	Aluminum Sheet	180 X 140 X 1	1	1.50
3	Steel Sheet	120 X 15 X 1	1	0.50
4	Stainless Steel Rod (hollow)	55 (Ø 18)	1	1.00
5	Brush	120 X 80 X 10	1	1.00