

POLYTECHNIC SULTAN SALAHUDDIN ABDUL AZIZ

SHAH

SOLAR WASHING MACHINE

NAME

NO. REGISTRATION

IZZAT AIMAN BIN ABDUL RAHMAN

08DMP18F1131

AMIRUDIN ARIF BIN AHMAD MUKHTAR

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NUR SYAFAWANI BINTI SAMSUL

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DEPARTMENT OF MECHANICAL ENGINEERING

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This report is submitted to the Department of Mechanical Engineering as fulfilling part of the requirements of the Diploma in Mechanical Engineering (Packaging)

DEPARTMENT OF MECHANICAL ENGINEERING

JUNE 2020

APPRECIATION

Grateful to Allah and peace be upon our great determination, the Prophet Muhammad SAW, we can commulify the final project with excellence in the prescribed period of 6 months without facing any difficult problems being resolved as a condition of the Conferment of Diploma in Mechanical Engineering in the June 2020 session. We extend our gratitude to all parties involved directly or indirectly, especially our supervisor Ani Binti Yaakub, who has given us all the guidance, advice, encouragement and constructive criticism that we have successfully completed this final project report. Not forgetting to friends and family members who helped a lot in terms of views and finance in comparing this final project assignment.

With this we are grateful to Allah SWT then the completion of this final project. We hope that this report will be an example and guidance to the relevant parties in the future.

ABSTRACT

The project is applied from observation based on how to wash clothes using electric washing machines. The objective of this project is to build a prototype device capable of washing clothing without the use of electricity. Furthermore, there are several scope of study that have been set in this project that is, those prototype tools that are protected using solar energy and those tools that are capable of competing existing washing techniques. These are set to resolve some of the problems arising from the use of existing methods, including the difficulty of washing shirts with no electricity supply and the higher electricity price definition nowadays. The materials for this project also need to have special characteristics of using quality solar panels to channel energy to washing machines, based on literature studies conducted by 50W Monocrystalline type solar panels are the most suitable for this project. Meanwhile, for the process of forming components, methodological studies were used to plan the project production process using flow charts as a guide for planning, production and testing of projects. As a result, the project was successfully produced with an average electricity savings rate of 32.76%. Based on these results, the results of the analysis and discussions carried out can be formulated that the Solar Washing Machine has achieved the objectives discussed. Besides that, this prototype tool is also proven to be able to save electricity than ever before.

ABSTRAK

Projek ini diaplikasikan daripada pemerhatian berdasarkan cara mencuci pakaian menggunakan mesin basuh elektrik. Objektif projek ini adalah untuk membina sebuah alat prototaip yang berupaya mencuci pakaian tanpa menggunakan tenaga elektrik. Tambahan lagi, terdapat beberapa skop kajian yang telah ditetapkan dalam projek ini iaitu, mereka alat prototaip yang berfungsi menggunakan tenaga solar dan mereka alat yang mampu menyaingi teknik membasuh sedia ada. Kesemua ini ditetapkan bagi menyelesaikan beberapa masalah yang timbul dengan penggunaan kaedah sedia ada antaranya, kesukaran untuk membasuh baju dikawasan yang tiada bekalan elektrik dan takrif harga elektrik yang semakin tinggi pada masa kini. Bahan bagi projek ini juga perlu mempunyai ciri-ciri khas iaitu menggunakan panel solar yang berkualiti untuk menyalurkan tenaga kepada mesin basuh, berdasarkan kajian literatur yang dijalankan panel solar jenis Monocrystalline 50W adalah yang paling sesuai untuk projek ini. Manakala bagi proses pembentukan komponen, kajian metodologi digunakan bagi merancang proses penghasilan projek dengan menggunakan carta alir sebagai panduan untuk perancangan, penghasilan dan pengujian projek. Hasilnya keseluruhan projek ini berjaya dihasilkan dengan kadar purata penjimatan elektrik sebanyak 32.76%. Berdasarkan keputusan ini, hasil analisa dan perbincangan yang telah dijalankan dapat dirumuskan bahawa Mesin Basuh Solar ini telah mencapai objektif yang telah dibincangkan. Selain itu, alat prototaip ini juga terbukti mampu menjimatkan tenaga elektrik berbanding sebelum ini.

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CHAPTER 1

INTRODUCTION

1.0 INTRODUCTION

Before entering Semester 6 for the diploma program, we are required and obliged to do a paper for the DJJ6143 module. Every member of our group has been given a 2-month period to find design ideas understanding the concept and making any research. As a result of the paperwork done from each member of our group we will collect and discuss to choose the best ideas.

As a result of discussions from members of our group and supervisors, we have finally chosen the idea of *creating a Solar WashingMachine*. The design of this machine is simple, not difficult to maintain and very easy to operate.

Solar Washing Machine design is safe to use and easily find spare parts in the event of any damage. This machine can start operations quickly. The installation used on this machine is very easy for spare parts conversion. Consumers today have done a lot of waste on monthly budgeting by paying excessive electricity bills when using regular washing machines. Therefore, we have innovated existing washing machines to reduce wastage on monthly expenses. The products we have innowed are ideal for families with large households and limited electricity supply.

1.1 STUDY BACKGROUND

Nowadays there are still a few places that are still difficult to find electricity supply. This make it difficult for the community to do everyday work like washing clothes. In addition, they need to wash their shirts nearby and definitely add to their load.

Solar Washing Machine is designed to make it easier for the community to be inland-controlled and allow the washing to be done at any time despite the absence of electricity supply. With the availability of this machine, the time to wash clothes will be saved in the absence of electricity supply. The cost of this maintenance is also low and easily maintained. The machine is adapted from the existing washing machine but it is improved efficiency by thinking about the ideas and innovations to add to the new design of the machine. This machine has solar panels to supply energy for clothing washing.

With the problems faced by consumers and the lack of efficiency of existing machines from survey results, we have agreed to produce a more efficient washing machine with the ability to do washing despite the absence of electricity supply. It is much better than existing because the existing washing machine can only wash when there is electricity supply only.

1.2 PROBLEM STATEMENTS

We are in the spite of a difficult place to find electricity as in the interior. There are most of them spending hours washing clothes by hand. A number of them soaked up their clothes and then hit them on a rock to remove the dirt. *Solar Washing Machine is an innovation* from an existing washing machine. This is due to the fact that existing washing machines cannot be used without electricity supply. Moreover, in the absence of a washing machine most of them have wasted time washing shirts using hands. Therefore, the idea of developing this innovation project.

1.3 OBJECTIVES OF THE STUDY

Among the objectives in this study are:

- a) Build a prototype capable of washing clothing without using electricity
- b) Saves washing time rather than using hands.

1.4 SCOPE OF STUDY

This project is carried out in a area with limited electricity supply. The scope of the study will involve data collection processes and information related to washing machines and solar panels. Information such as time taken to wash clothes using hands is also taken into account in order to ensure the effectiveness of Solar Washing Machine.

Moreover, to determine the strength and stability of the platform, this study will test the maximum weight of clothing that can be washed using Solar Washing Machine.

Next, the project uses solar panels that are easy to understand. In addition, the Solar Washing Machine designed is also capable of washing without electricity.

1.5 LIMITATIONS OF STUDY

The limitations for this study made for this project can be divided into:

i. Cost

Based on the research done by our group, the gross capital allocated is RM 1000. This includes the cost of raw materials to produce structures, essential components and installation costs. Affordable costs affect consumer attractions.

ii. Time

The time required to complete the product's carturous string design results is 6-8 weeks covering by doing various studies to solar washing machines. Moreover, studies are made to solar panels about how long can accommodate to wash the shirt with the source of sunlight.

iii. Consumer Needs

The production of this product should meet the required features of the user such as the size of the product that is suitable for use. In addition, machines must have attractions in terms of use, design, advantages etc.

iv. Energy

The product uses sun sources as energy or fuel to operate. The complete washing of the shirt was done by the source of the sun. This machine can be used by one user.

v. Design

- Easy to operate

This product created does not require high skill to operate it to carry out operations.

- Strong structure

The sturdy structure here means that the building material used is the whole iron for the Solar Washing Machine cross

1.6 DEFINITION OF CONCEPT

The washing machine refers to the machine used to wash and clean the dirty shirt. The existing washing machine is now unable to wash the shirt in no electricity supply conditions, with this problem users find it difficult to wash clothes at all times they are suspected. The concept to be used in this project is the concept of the Solar Panels. Where the Solar Panels are used to make this machine a success.

1.7 GROUP ORGANIZATION CHART

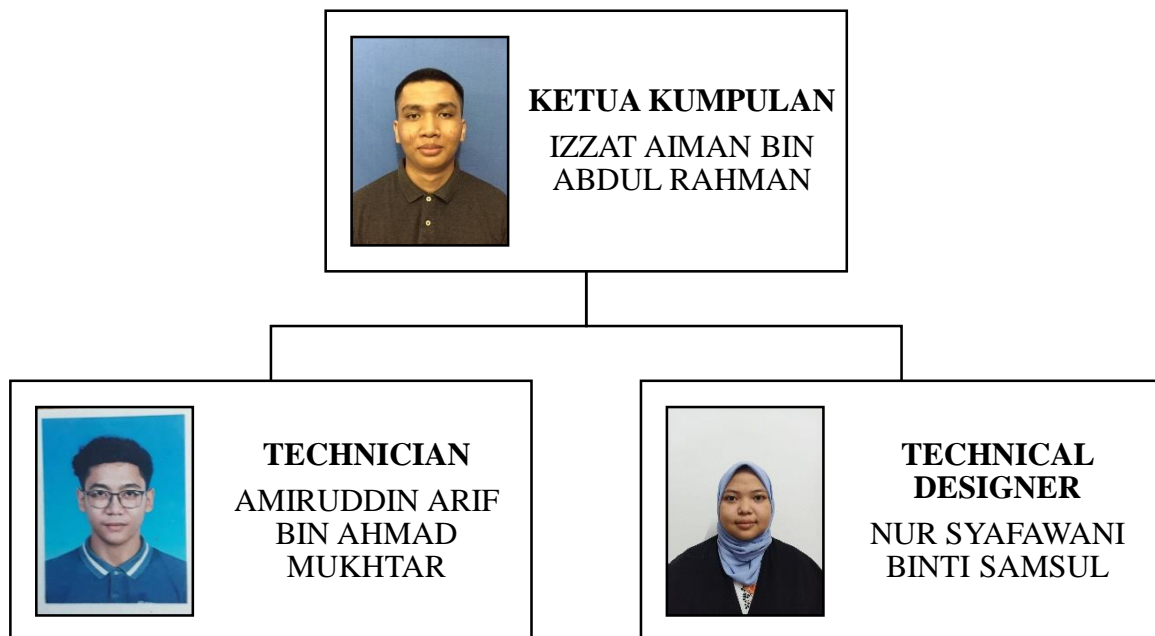


Figure 1.7 Group Organization Chart

1.8 PROJECT CATEGORY

The Solar Washing Machine project involves several categories of projects:

- Malacca, measuring
- Iron cuts
- Wire connection
- Formation of work materials

1.9 TASK DIVISION SCHEDULE

TASKS PERFORMED	GROUP MEMBER NAME
Cutting iron	Amirudin Arif & Izzat Aiman
Wire connection	Amirudin Arif & Izzat Aiman
Sketch	Nur Syafawani & Amirudin Arif
Records on log books	Nur Syafawani, Amirudin Arif, Izzat Aiman
Reports and presentation materials	Nur Syafawani, Amirudin Arif & Izzat Aiman

Table 1.9 Division of Duties

1.10 SUMMARY

Nowadays, there is still an issue of absence of inland-stiff electricity supply being the cause of hard to do clothing. Overall in this chapter such as background studies, problem statements, study objectives, scope of study and the importance of the study discussed to overcome the issue of absence of electricity supply in the interior through *the construction of Solar Washing Machine and becoming a useful product to the local residents.*

CHAPTER 2

LITERATURE STUDY

2.1 INTRODUCTION

Literacy studies are a very important aspect. Necessarily need to be done in the production of a project. With careful research and all the necessary information will be obtained easily. A project can be done easily and systematically according to a predetermined and planned schedule.

2.2 HISTORY OF WASHING MACHINES

Cleaning clothes basically requires someone to scrub as well as rub clothes with soap to break down solid stains as well as help the soap solution penetrate it. Originally it was done by scratching or crashing clothes on a rock in the river, until the pile of the touchboards lingered. During the Roman times, humans whitened the dress by scratching it on a rock while letting the soap be informed of it. At that time, soap was made of animal fat.

Washing machine technology is developed as a way to reduce manpower consumption as a result of the process of scrubbing by providing an open tub or covered container with a radius to wash the dress automatically. The earliest washing machines were mostly still using human power. Since the electricity supply was yet to be widely available until the earliest of the 1930s, some of these washing machine models used low-speed single-speed cylinder gasoline engines.

Since water should be heated to wash, hot soapy water is valuable and will be used repeatedly; first to wash clothes that aren't how dirty, followed by more dirty clothes. While the earliest models were made of wood, the newer ones were made of metal to allow the fire loops to be installed under the washing tub to heat water during the day's washing.

The process of removing soap from clothing after washing is originally a separate process. The wet clothes were originally wrung with hands to remove soap. To reduce this workforce, roller machines are created using two tension rollers to remove soap from clothing. Nevertheless, only a

piece of clothing can be swalked at any one time. The earliest rollers used hands before using electric motors.

Modern methods for urination through rotation only begin to be used after an electric motor was created. The dry rotation process requires high-powered and high-speed electric motors. Originally this process is done separately on a dry spin tab. Upon completion of washing, users need to transfer their own clothes from the washing tab to the dry spin tab before the clothes are rotated to defecate. ^[1] Such washing machines are known as semi-automatic washing machines and they are still being removed until now due to their cheaper price than automatic washing machines.

The earliest dry spin tabs are often quite dangerous to use given that a disballated load of clothing will cause the machine to shake up loud. Many efforts have been made to reduce tremors due to unbalanced loads, such as installing an absorbent system as well as a machine-turning switch automatically as it roars out loud to allow users to rearrange clothing in a dry spin tab. Most modern machines come with a liquid-covered bracelet to deal with a stretch of imbalance.

2.2.1 Types of Modern Washing Machines

2.2.1.1 Upper Load Washer

The top load washer places the clothes loaded through the cover at the top into a vertical stacked tub as well as *having a rotator (pulsator)* on the essential part. Such machines are popular in Asia, Australia, AustraliaUSA, Amerika SyarikatLatin America, NewZealand, Canada Kanada and Malaysia. During the washing cycle, the clothing-filled tub is filled with plenty of water to support clothing and rotational movements pulling clothing into the central base section towards the rotate. Then the dress moves towards the side of the tub and the recurring process for the opposite direction of the rotation until the washing time ends. After the washing process ends, some water is discarded and the rotates the clothes in a very short period of time to crowd the clothes to balance the clothes payload before the intermediary dry rotation process. The next process is repeated for the first and last rinse, and after the last rinse cycle ends, the last dry rotation cycle lasts about 6 minutes to dry the dress completely.



22.2.1.1 Washing Machine Top Load Load

2.2.1.2 Front Load Washer

Machine Washing Load front Require User To Enter Clothing To in the tab Through Door front the Silly Water. Effects touch Produced Through Movement tab And Action Gravity, As Method Year Age Formerly With Crashing Clothing To On Batu. Movement tab Lifting Clothing To Part On tab Before Clothing Fall Re To Policy tab.



Figure 2.2.1.2 Front Load Washing Machine

2.3 EXISTING WASHING MACHINE PROBLEMS

Refers to existing products in the market. Undoubtedly this existing product benefits consumers. However, the product is still unsatisfactory. This is because in the absence of electricity, the product cannot work because there is no power supply. In fact, because of the matter, the washing becomes too long as a result the product does not work. This is based on the studies we have conducted through questionnaires towards consumers.

2.4 MARKET RESEARCH

Market research is a study of a request or purchase of a particular item.

i. Product market location

Our market focus is on machine traders marketing these kinds of goods and our consumer targets are to every household user and laundry operator to be able to own these solar washing machines either small or large.

ii. Market potential

We found the average purchase of washing machines per month within 250 units. Through the research we did, it was found that increasing sales of washing machines each year were seen to be constantly increasing as it was among the obligatory things at home. So it is not a problem for us to produce and market this product marketed.

iii. Price promotion

The sale of new products requires an attraction to attract buyers. In the early stages of marketing, price promotions are offered to consumers in order to further introduce this product to consumers. Consumers can also have quality products at an affordable price. Price promotions are not carried out on an ongoing daily. It is as a product identification and will be increased to the original price but still at an affordable price.

iv. Promotion on the internet.

The internet is also one of the great platforms for promoting products because it is a wide network where in just a few minutes it can spread throughout the world.

The step we use is to make a video on how to implement and effectively implement solar washing machine users. In addition, we will also advertise on the internet via the website. This is intended to introduce our latest product results to all users on the internet

v. Online Marketing

Besides providing promotions on the internet, we also create online sales processes. Among the sites used are E-Bay, Amazon, and BigPay. It aims to facilitate the sale and purchase arrangement between the seller and the buyer. We also accept bookings of shoppers from outside who are interested in obtaining our products.

2.5 DESIGN STUDIES

Design studies are important to produce a new product. It covers various aspects that should be taken into account physically, science, as well as the environment. This is important because the production of new products must meet the characteristics that suit the needs of the consumer.

Research should also be done in terms of safety, attractions, etc. According to the studies we have conducted, several types of additional components and tools will be used to complement this design so that it can easily operate. These additional tools have been selected according to the appropriate characteristics and specifications in line with the construction of this design.

Aesthetic values are inducted into this project according to consumer demand such as designing simpler and smaller products. Moreover, we emphasize on the weight of tools that have a lifespan such as solar panels.

Consumers are often more likely to choose products that have affordable prices, have privilege features, and are easy to use. So design studies done cover the following aspects:

i. Cost

Selection of materials used to obtain low product manufacturing capital costs. Apart from conscious capital used, the quantity of materials should also be emphasized in order to avoid any future difficulties.

Simple use of design colors can also save on capital production producing products. With the replacement of the product division when they think about savings in keeping the maintenance of the products they have given.

ii. Safety

Safety features are necessary on each product produced. If security features are not highlighted, products may not be accepted by consumers nor the authorities who approve the results of the product creation. Each security feature should be highlighted on the manual.

iii. Color

Colors also play an important role in making choices to create a product invention. In order to gain attractiveness from consumers, the featured products are coloured according to the concept of dark color. It is so that our products can last longer.

2.6 PROJECT IMPLEMENTATION STUDY

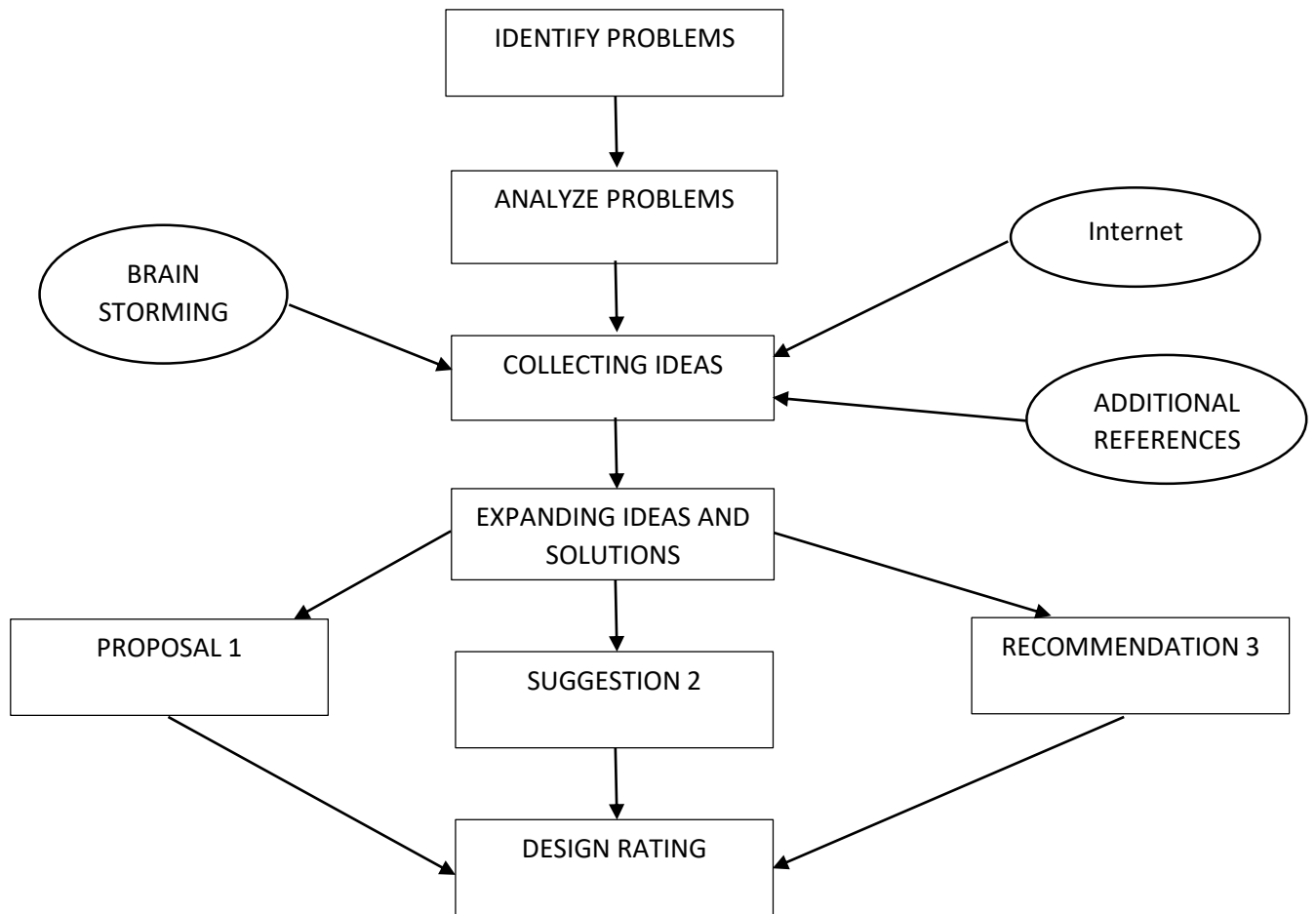


Figure 2.6 Project Planning Review

2.7 CONNECTION BETWEEN STRUCTURAL PERSONNEL

The strength of a build depends on the circumstances or manner of the connected structure. The selection of each of these connections depends on the form of structure, functions, design, surrounding conditions etc.

2.7.1 Other Factors To Take Into account:

- Size

The size used on this machine is not too large and easy to carry

- Structure and Stability

The connectivity structure on this machine is strong because it uses welding techniques. The iron used is also strong. The selection of iron type also according to the iron capacity bears the burden

- Quality

The quality of our goods and equipment is of high quality in order to extend the life span of the machine.

- Texture and Color

The textures and colors selected must be in accordance with the use of machines and look beautiful and attractive. We scrutinised before the painting process is done.

2.8 ANALYSIS

Analysis is the process of using all kinds of technological methods to perfect the design. Some preliminary ideas that have been chosen, studied, in detail and developed. The sketch is then drawn on a scalable drawing. The size of the design is specified.

The implementation of the project is carried out in stages and systematically so that the project can be completed at a smooth set time. The proposed order are:

- i. Preparing a proposal paper on projects done*
- ii. Provide an engineering drawing (Inventor) complete with project parts implemented*
- iii. Conduct surveys on materials that need to be used such as resources, specifications, pricing and other alternatives*
- iv. Identify potential problems and find solutions through discussions with supervisors.*

2.9 MATERIAL SPECIFICATIONS

2.9.1 Mini Washing Machine



Figure 2.9.1 Mini Washing Machine Machine

A washing machine is a machine designed to wash clothes including shirts, towels and sheets. The term refers to machines using water as a major washing solution, unlike dry cleanings that use alternative detergents.

2.9.2 50W Solar Monocrystalline Panel



Figure 2.9.2 Solar Panels

Solar panels absorb sunlight as an energy source for producing electricity or heat. It is used as a component in a larger photovolta system to generate electricity for commercial and residential use. We use *Monocrystalline-type* solar panels because more efficiently than amorph-type solar panels in turning sunlight into electricity, amorph solar panels with the same watt will be larger physically.

2.9.3 Solar Charge Controller



Figure 2.9.3 Solar Charge Controller

Some functions of *solar Charge Controller* are arranging currents for filling to batteries, avoiding excessive filling and excessive tensile, managing discharged/relieved currents from the battery until the battery is not fully exhausted, and the advantages of load and monitoring of battery temperature.

2.9.4 Solar Inverter



Figure 2.9.4 Solar Inverter

Solar Inverter not only has a direct AC conversion function, but also has functions that maximize solar cell function and system error maintenance function. It works actively and functions of power closure, maximum power tracking control function, anti-free operation function (for grid-related systems), active voltage adjustment functions (for grid connection systems), D.C. detection functions (for grid-related systems), DC base detection functions (for grid-related systems).

2.9.5 Battery



Figure 2.9.5 Battery
Battery

When the battery supplies electricity, its positive terminal acts as a cathode while its negative terminal acts as an anode. This "anode" is an electron source that will flow and send energy to the external tools connected to it. When the battery is connected to an outdoor circuit, the electrolytes are able to move like an ion in it and allow the chemical reaction to be completed on a separate terminal which in turn transmits energy to the external circuit. The movement of ions in this battery is what allows the current to move out of the battery and provide its function,

2.10 DESIGN SPECIFICATIONS

Product design specifications that are the answer to existing product problems are:

- This product is efficiently produced for consumers' use
- This product can be used at hostel, laundry and home
- This product be able to save electricity
- This product also does not require large space and is easy to store

2.11 ERGONOMIC

- Machines should be able to be used by less skilled users
- Storage weight and methods should correspond to the user's ability
- Any signs of safety should be clear and understood by the user.

2.12 ENVIRONMENTAL FACTORS

Selection of manufacturing materials is important and environmentally related. The selection of inappropriate materials can have an environmental impact and thus can be polluting and harmful to life.

2.13 SUMMARY

Overall, obtained from this chapter is an experiment that will be tested to the sources of previous studies to complete the work done. In addition, some information from the washing machine, solar panels and several other components are identified functions. This implementation can facilitate the use of *Solar Washing Machine* to users.

CHAPTER 3

STUDY METHODOLOGY

3.1 INTRODUCTION CHAPTER

Research methodology is a process for the implementation of a research and information acquisition, as well as an art to carry out a work. Generally it has been classified into 2 types of methodology:

- *Quantitative Study*

A research involving measurement of study variables using scientific and experimental tools. The use of statistical tests on a study is an attempt to explain, explain or seek the relationship between variables in a research. (Experimental Study Methods and Survey Studies)

- *Qualitative Study*

A qualitative approach is a research procedure that produces data on the diameter that can be identified (Lexy, 2007), a certain tradition of social knowledge that fundamentally depends on the human compliance within its own area and relates to those people in its language and persistence (Kirk & Miller, 1986). The qualitative approach in this research is a case study, is a research done on a system union, whether in the form of a program or an incident bound by a particular place, time or bonding (Nana, 2005).

3.2 METHODOLOGY FLOW CHART

Research methodology is a method and technique for designing, collecting and analyzing data so as to produce evidence that can support a study. Methodology describes how a problem is studied and the reason for a particular method and technique is used. The purpose of the methodology is to help understand more broadly or more detailedly about the application of methods by making a description of the study process.

According to the Fourth Edition of the House Dictionary of The Fourth Edition of the Methodology, the meaning of the system encompasses the methods and principles used in an activity or discipline. Other meanings of methodology are methods, roads, techniques, styles, rags, beats, patterns and systems. Methodology also means knowledge about the methods or disciplines used when conducting certain studies to achieve specific purposes. The methodology of the study refers to the most appropriate methods for conducting research and determining effective procedures for answering study problems.

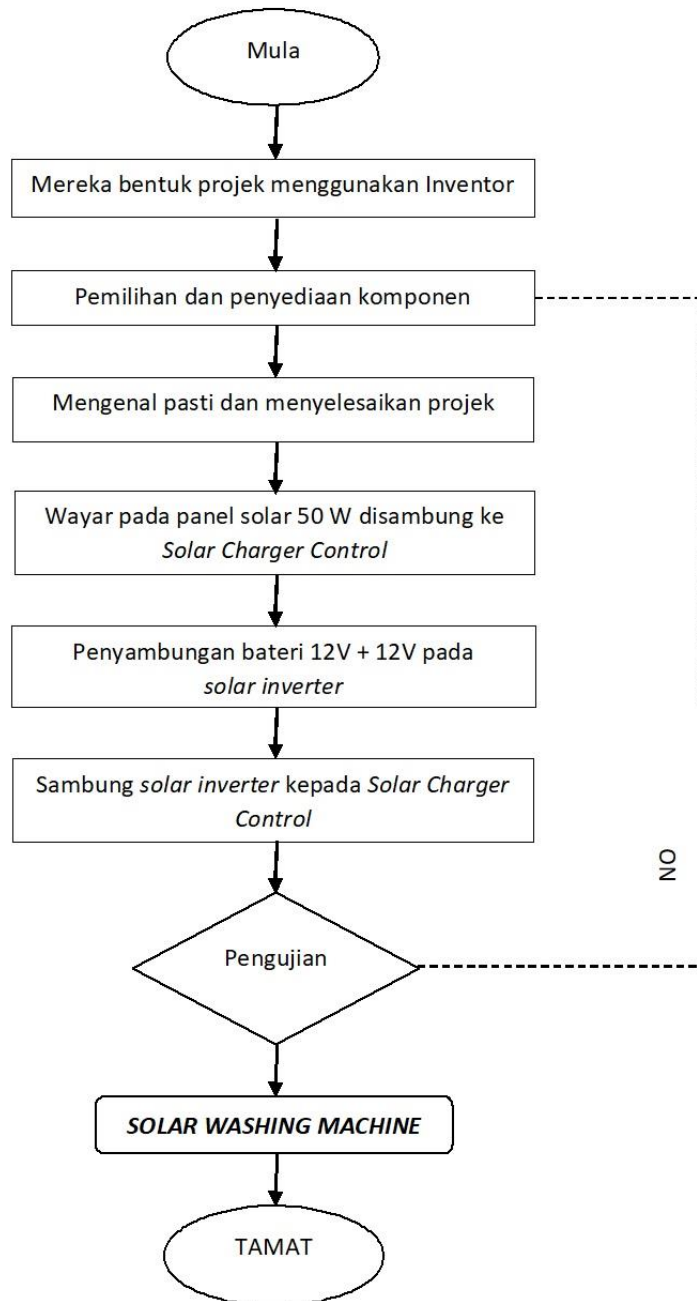


Figure 3.2 Methodological Flow Chart

3.3 DISCUSSION

3.3.1 IDENTIFY PROBLEMS

At the beginning of the study, it was identified the problem of using washing machines in the absence of electricity supply in the residential areas of the local community. Thus, careful planning was implemented to overcome the problem by listening to the compilation from laundry operators and the local community. This is due to the monthly cost of electricity bill spending which is increasing in the present era of globalisation.

3.3.2 ANALYSIS

The data collected were collected, processed and analyzed to enable further measures to be taken and the determination of the study was carried out as required in the objectives.

3.3.3 DESIGN

Before a solar washing machine is implemented, a design was designed to know the characteristics of accommodating the quantity of clothing to be washed. In fact, the design is intended to be before implementation, it can reflect before the project is implemented even if the design will provide more detailed information to build a solar washing machine.

3.3.4 IMPLEMENTATION

When a solar washing machine is completed, this product should be tested under sunlight to find out the results of whether it works properly or otherwise. Subsequently, to determine the energy generated from the solar can accommodate the load of clothing to be washed. Hence, the use of iron has been chosen to properly build the solar washing machine frame.

3.3.5 SYSTEM

When the Solar Washing Machine has achieved the desired objective, the product will be placed in every consumer's home and facilitate the washing of clothing as well as reduce electric wastage.

3.4 PROJECT DESIGN SPECIFICATIONS

Specifications of product design which are the answers to existing product problems:

- This product is efficiently manufactured for consumer use.
- This product can be used to wash our clothing which has limited electricity supply.
- This product is able to save manpower washing clothing.
- This product is able to save users time from washing your hands.

3.5 STUDY INSTRUMENTS

In this study instrument, a questionnaire method was selected. The selection of respondents was made up of residents of Taman TTDI Jaya. The questionnaire used consists of Google Form format. The questionnaire provided is divided into two (2) main parts:

- a) Part A : Demographics of Respondents (Gender, Age)
- b) Section B : General views on the study

3.5.1 Product Production

Here are the ways for the production of *Solar Washing Machine*:

1. Ensure Equipment goods Sufficient To Launch Manufacturing Project



Figure 3.5.1.1 Components Solar Washing Machine Components

2. Make Test At Circuit Project With Connect All Materials.

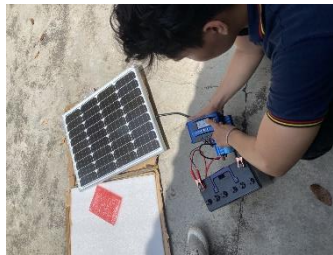


Figure 3.5.1.2 All materials connectivity

3. Measure the height, width and size of the washing machine to innovate the existing amplifare as a *Solar Washing Machine frame*.
4. Perform clothing washing on amplifiers to test stability while projects run for improvement



Figure 3.5.1.4 Washing clothing

5. Installation of each material on the framework of the project (ample) and makes wiring to form a complete solar circuit



Figure 3.5.1.5 Installation of each material on the project framework

6. Perform tests at the end of project production



*Figure 3.5.1.6 Finals
Project Project
Production*

7. Updating projects to attract buyers' attention when marketed later

3.6 DATA COLLECTION METHODS

To carry out this study, there are methods of data collection that have been practiced to obtain data that are important for the stage of analysis. Among the data collection methods are questionnaire methods. Data collection can be classified into two types, namely primary and secondary data.

3.6.1 Primary Data

Primary data were important data in the study. Without major data, the objectives of the study will not be achieved. The data collection process is carried out through the distribution of questionnaires to the respondents. Thus, 70 respondents were randomly selected.

3.6.2 Secondary Data

Secondary data consist of literature studies and other sources such as thesis, books related to research, local newspapers, journals and other publications related to the study. These materials are analyzed accordingly and are the basis of reference to this study.

3.7 DATA ANALYSIS METHODS

In the process of analyzing this, the data collected will be analyzed and the results to be achieved are displayed in the form of pie charts, cross graphs and tables.

3.8 PROJECT DRAWINGS

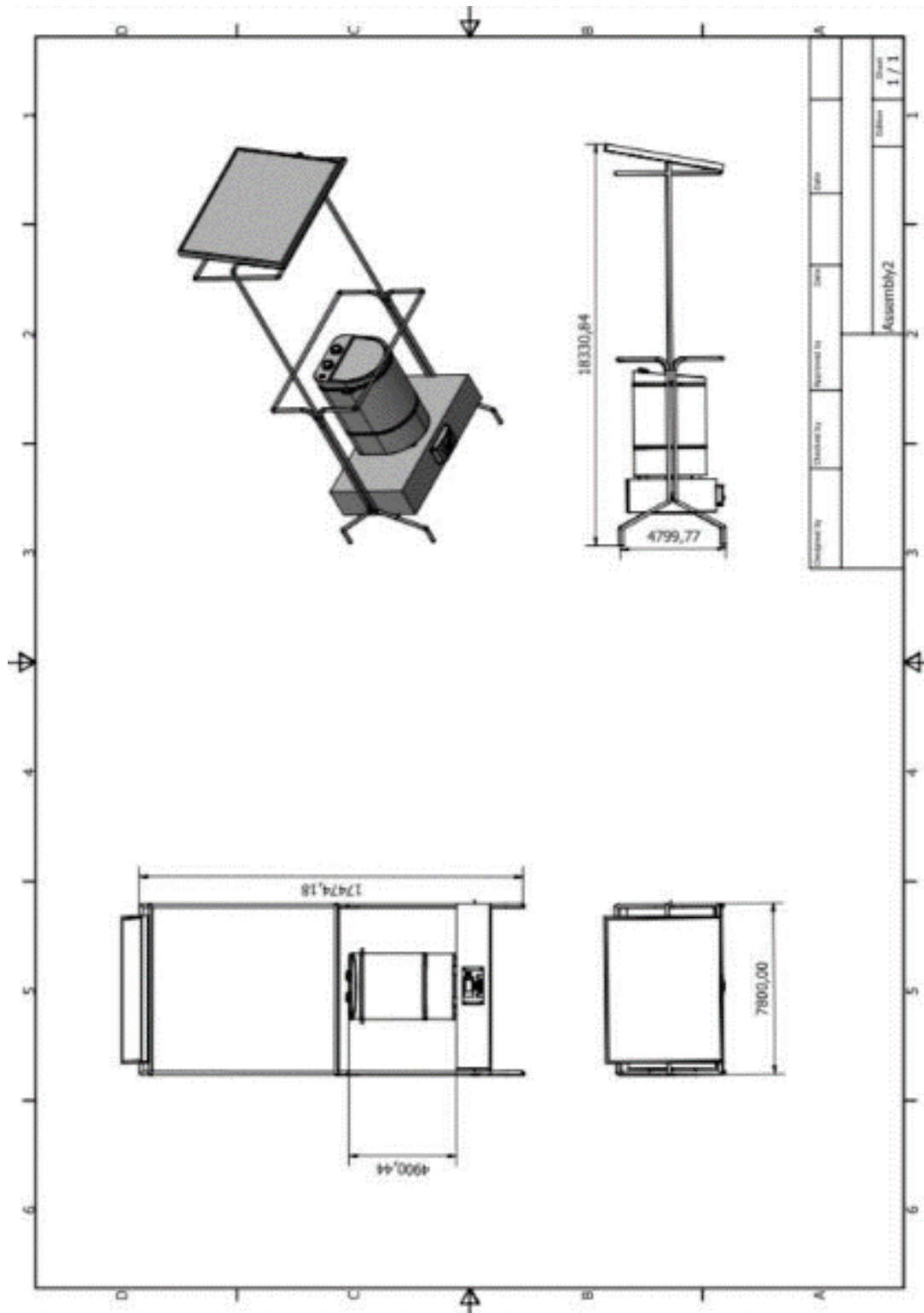


Figure 3.8.1 Washing Machine Solar Plan

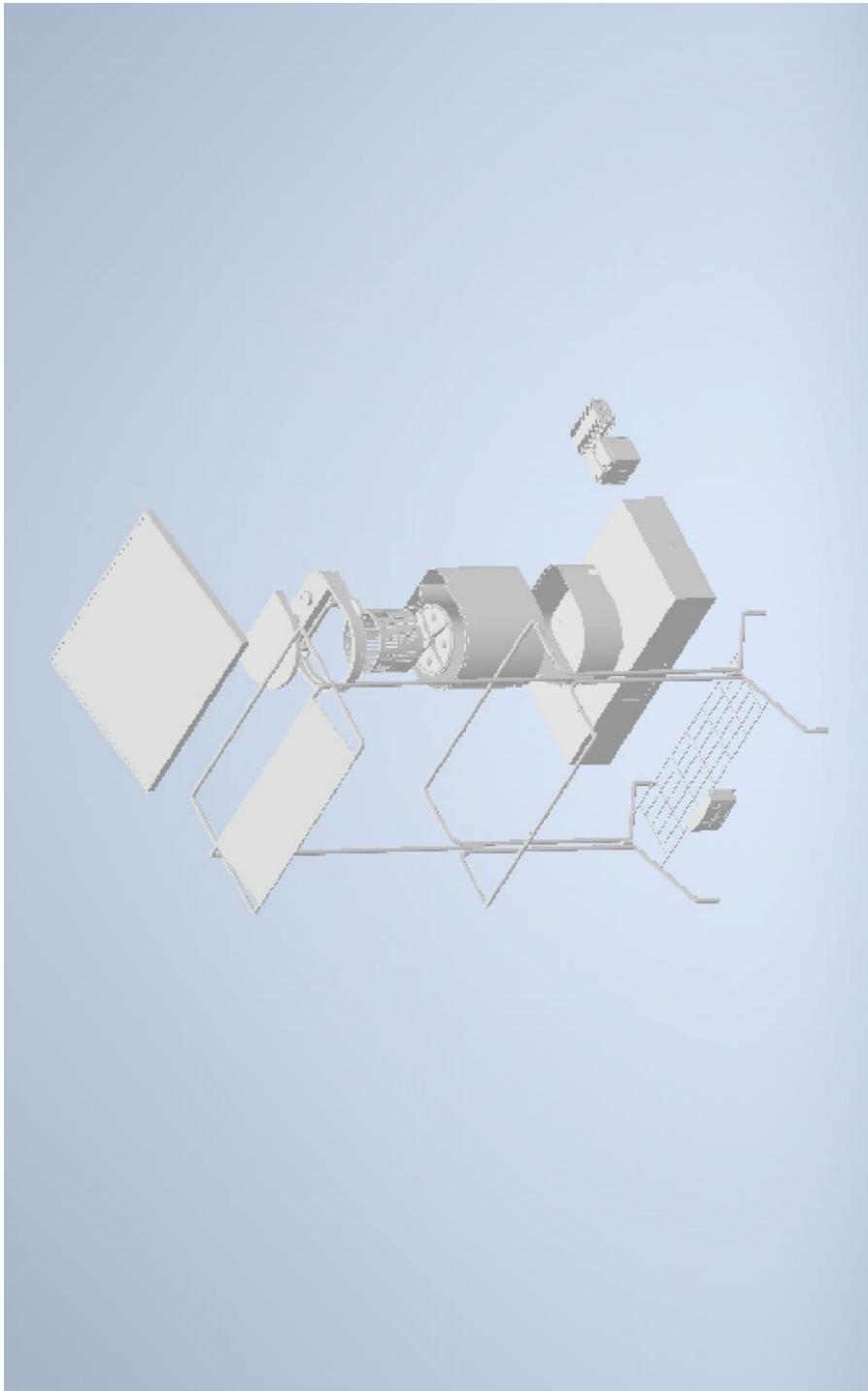


Figure 3.8.2 Breakdown Photos of Solar Washing Machine

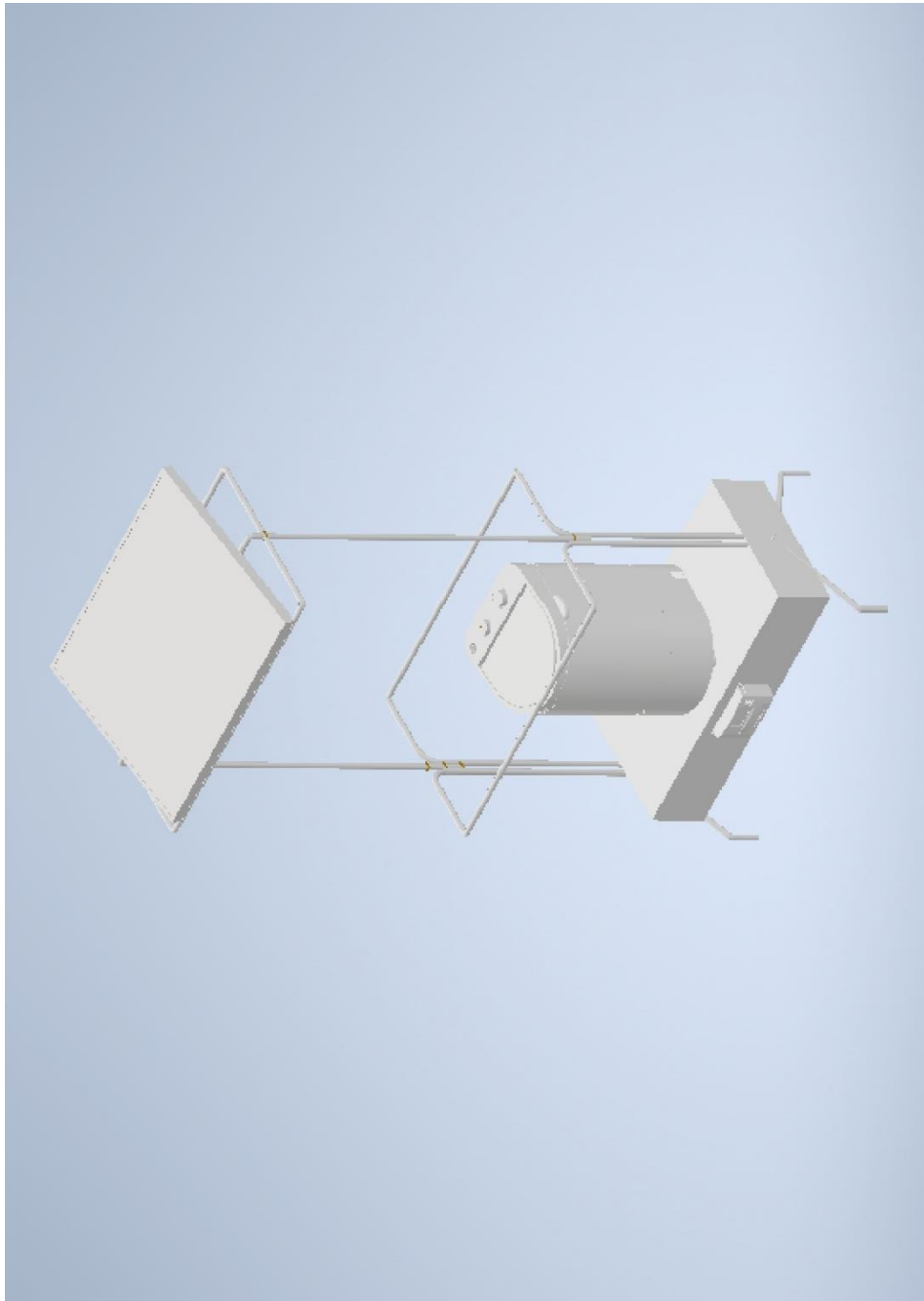


Figure 3.8.3 Solar Washing Machine in in the Inventor 2020

3.9 SUMMARY

In the initial stage, the study design, data collection methods, study instruments, data sampling techniques and data analysis methods were made systematically in methodological studies to find out the facts and information to support the instruments of the study and clearly reflect in the study.

After the analysis of the data is done, it is important to perform a formulation or conclusion on the results and hypothesis that is whether the washing machine is effective or not.

CHAPTER 4

FINDINGS

4.1 INTRODUCTION

There are several major studies conducted and will be discussed in comparing the project. The results were obtained not only in the form of a study chart that was carried out however in the form of the pros and disadvantages of the concept. Therefore, it can be seen as well as the advantages and disadvantages of the projects that have been done. From the whole project, it has achieved the objectives of *which the Solar Washing Machine* project can function without the use of electricity and facilitate clothing washing. The results shown are very positive where the objectives are successfully achieved and work properly.

Once all the data and information is obtained, analysis is carried out to see the *effectiveness of installation of solar Washing Machine* located with limited electricity supply.

The results obtained in this chapter are the results obtained from questionnaires and experiments conducted in the study area. Data resulting from experiments in the study area were analyzed in more detail to draw conclusions based on the objectives of the study already stated.

The study was conducted using 70 respondents from the local residents of Taman TTDI Jaya. There are several aspects that are the main focus:

- 1) Demographics of Respondents (gender and age)
- 2) General view of the study
- 3) Perspective of respondents against *Solar Washing Machine* :-
 - i. Design
 - ii. Function
 - iii. Materials used
 - iv. Advantage

4.2 DEMOGRAPHIC PROFILE OF RESPONDENTS

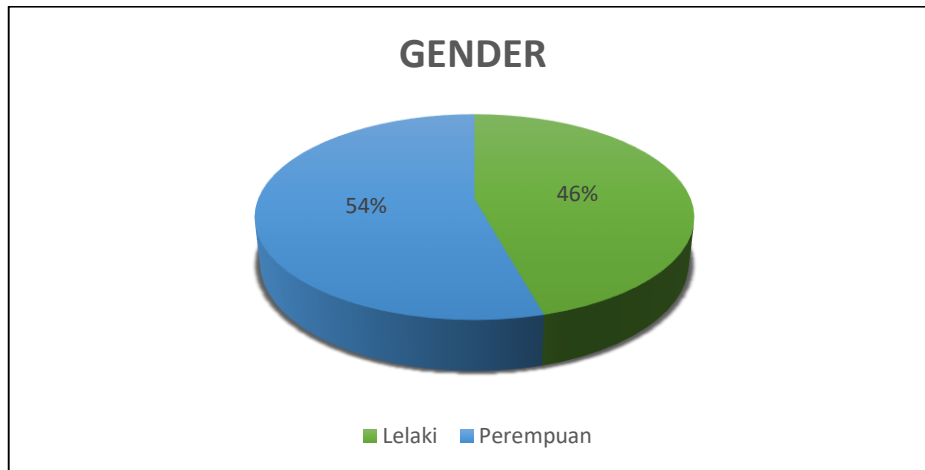


Figure 4.2 a: Gender Respondent

Figure 4.2 a shows the number of residents of Taman TTDI Jaya who responded to the study. A total of 54% of the respondents were 38 females while 46% of the respondents were 32. The high number of female respondents due to most of the respondents washing clothes from women compared to males, especially housewives. Most housewives will wash their entire family members' clothes.

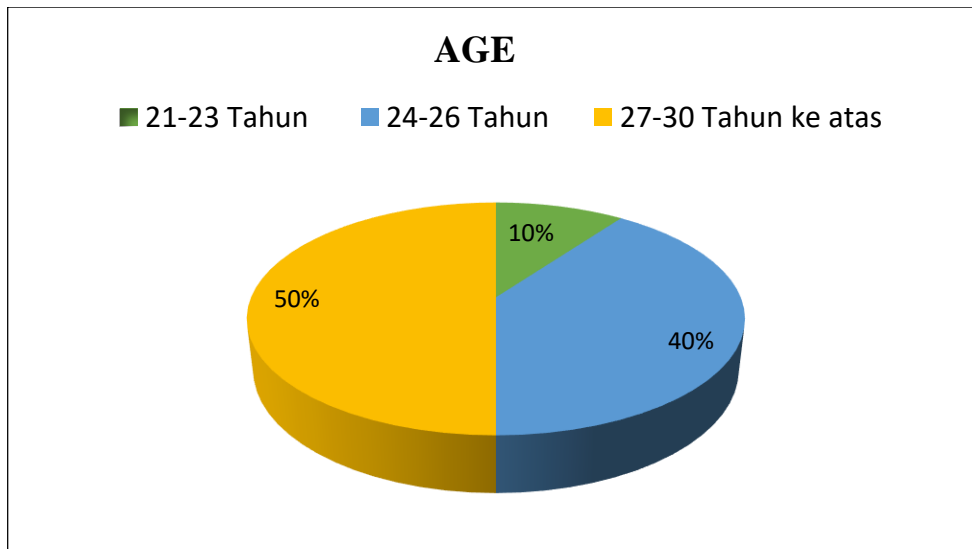


Figure 4.2 b: Age of Respondent

Subsequently, the results showed that 70 respondents were 50% aged 27-30 years old and more answered this questionnaire. This is because, they consist of households who do the cleaning every day. Most of them are housewives who wash their clothes using hands. In addition, 28 respondents were 40% aged 24-26 years old. Most of them are self-employed singles and live in rental homes. Meanwhile, 7 respondents, 10% comprised 21-23 years and above. Of these, it consists of university students.

4.3 MANUFACTURING AND PRODUCTION COSTS

Bill	Materials	Quantity	Price per unit (RM)	Sum (RM)
1.	Mini Washing Machine 4.5KG	1	145.99	145.99
2.	Solar Panel Mono 50W	1	150.00	150.00
3.	Solar Charger Control 50A	1	55.20	55.20
4.	Solar Power Inverter 24V to 220V 3000W	1	68.00	68.00
5.	Battery	2	50.50	101.00
6.	Anti Rust Clothes Hanger	1	57.90	57.90
7.	Spray Paint Black	2	5.57	11.14
8.	Screw Machine M5 X 10	4	0.50	2.00
9.	Steel Band	1	10.00	10.00
10.	Nut M5	10	1.5	1.5
11.	Playwood	4	12.5	50
Total				RM652.73

Table 4.3 : List of Component Costs

Table 4.3 shows the cost of the material allocated to implement the Solar *Washing Machine* project. Besides that, plywood are used as 2 pieces to become battery storage boxes and other important components.

4.4 FINDINGS

4.4.1 Analysis of Study Data

The process of analyzing research data will be shown in the form of graphs, tables and charts. Solar Washing Machine analysis *includes washing* time using washing machines rather than using hands. As a result of the results of data analysis obtained will be presented in the form of histograms.

4.4.2 Survey Survey

To further strengthen the study, questionnaire methods were carried out by engaging residents of Taman TTDI Jaya. The data obtained will be used in the form of graphs to facilitate information being studied and analyzed. The following is the information on the questionnaire that has been carried out.

4.4.2.1 Questionnaire (Example Questionnaire)

(APPENDIX A)

Existing washing machine problems

Mark (/) or (X)

1. Do you use a washing machine at home?

2. Will your washing be restarted from scratch if the washing machine stalled due to the absence of electricity supply?

3. Does your washing become too long if the electricity supply is disconnected?

4. Is it difficult for you to wash your shirt without using electricity supply?

5. For you, does the use of Solar Washing Machine save on the cost of electricity supply?

6. Is the existing washing machine expensive in price?

7. Is it necessary for each house to have a Solar Washing Machine?

8. Is the solar washing machine suitable for home use?

9. In your opinion, does solar Washing Machine get marketed?

4.4.3 Analysis of the use of washing machines at home

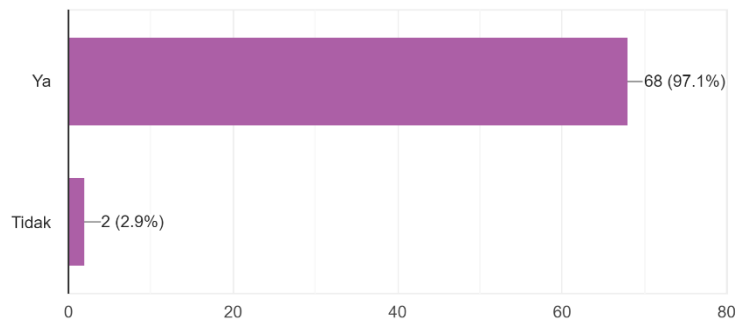


Figure 4.4.3 Use of Washing Machine At Home

The results of the questionnaire showed 68 people (97.1%) using washing machine at home and the remaining 2 persons (2.9%) do not use washing machine at home. As a result of the analysis, most of the respondents had washing machines at home. This is because the washing machine is among the mandatory requirements at home.

4.4.4 Washing analysis will be restarted if the washing machine stalls due to absence of electricity supply

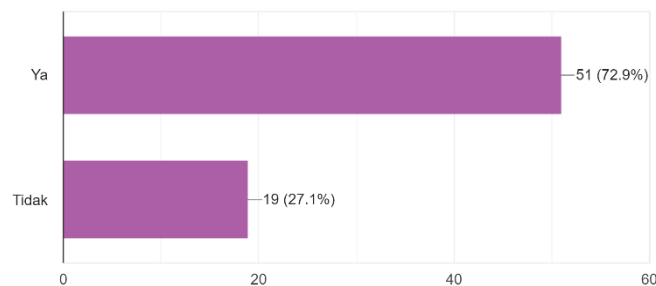


Figure 4.4.4 Washing Will Be Restarted If Washing Machine Stalls Due to Absence of Electricity Supply

Figure 4.4.4 shows 51 people (72.9%) experience riot problems if the washing machine stalls due to the absence of electricity supply and the remaining 19 (27.1%) do not suffer from this problem. As a result of the analysis found, the average respondent who answered "Yes" was more than those who answered "No". Most respondents admitted they were experiencing this problem and it caused a waste of washing costs such as clothing detergent.

4.4.5 Analysis of difficulty in washing in the absence of electricity supply

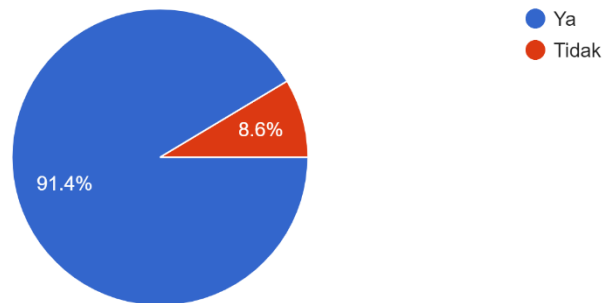


Figure 4.4.5 Difficulties In Washing In The Absence of Electricity Supply

The results of the questionnaire showed 64 people (91.4%) respondents had difficulty washing clothing in the absence of electricity supply and 6 people (8.6%) the respondent did not have any difficulties. From these statistics, we can make a common picture that the number of respondents who have difficulty washing clothes is more crowded. This is due to the fact that washing machines nowadays require fully electricity supply to generate power.

4.4.6 Analysis of difficulty washing shirt without using washing machine

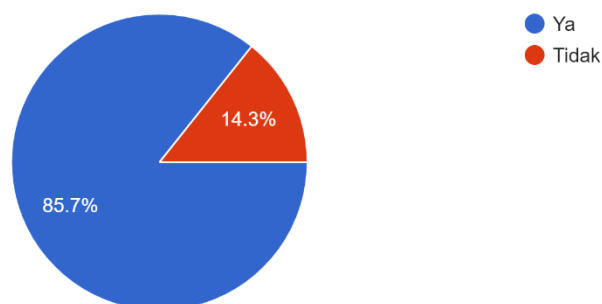


Figure 4.4.6 Difficulty Washing Shirt Without Using Washing Machine

Figure 4.4.6 shows 60 people (85.7%) had difficulty washing shirts without using washing machines and the remaining 10 people (14.3%) is the opposite. As a result of this analysis, respondents who replied "Yes" were more than those who replied "No". This is due to the

fact that most of the respondents admitted washing the shirt without using a washing machine would take longer.

4.4.7 Solar Washing Machine usage analysis saves on electricity supply costs

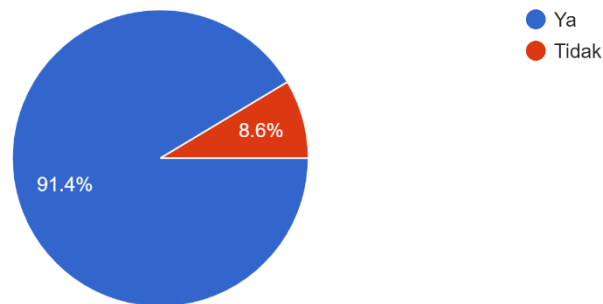


Figure 4.4.7 Use of Solar Washing Machines Saves Electricity Supply Costs

The results of the questionnaire showed 64 people (91.4%) agreed that the use of Solar Washing Machine saves the cost of electricity supply and the remaining 6 people (8.6%) have an opinion otherwise. The results of interviews against a small number of respondents stated that the use of Solar Washing Machines could altogether save electricity. At the same time, respondents also admitted being able to save on expenses to pay electricity bills.

4.4.8 Analysis of existing washing machine prices

Adakah mesin basuh sedia ada mahal harganya?
70 jawapan

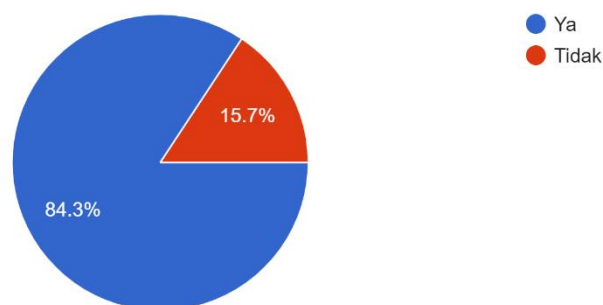


Figure 4.4.8 Existing Washing Machine Price

Figure 4.4.8 shows 59 people (84.3%) saying the price of the existing washing machine is expensive and 11 people (15.7%) say otherwise. As a result of the analysis found, most respondents acknowledged in this era of globalization the price of existing washing machines was expensive.

4.4.9 Analysis of the needs of each house to have Solar Washing Machine

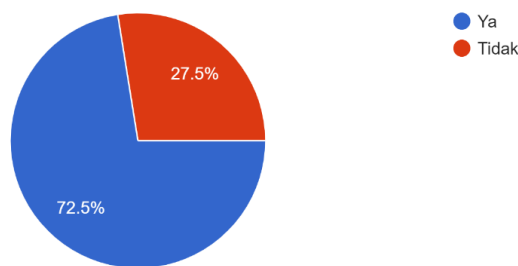


Figure 4.4.9 Needs Per House To Have a Washing Machine

As a result of the analysis of the **questionnaire in figure 4.4.9**, indicating that the need for each house to have a Solar Washing Machine gets a good response from the respondents. The majority of respondents of 72.5% (50 people) strongly agreed for the Solar Washing Machine to be needed in every house. This may be due to the savings of solar Washing Machines. Only 27.5% (14 people) disagreed about this.

4.4.10 Analysis of the suitability of Solar Washing Machine used across the house

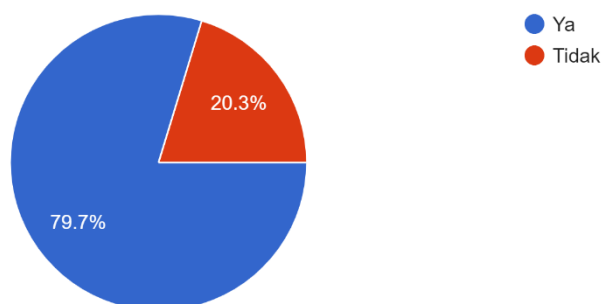


Figure 4.4.10 Suitability of Solar Washing Machine Used Across House

In figure 4.4.10, many respondents agreed that the Solar Washing Machine was suitable for use in houses at 79.7% (55 people). Meanwhile, 20.3% (14 people) among them disagreed. This may be because respondents are not convinced solar Washing Machines can work at home.

4.4.11 Solar Washing Machine abilities analysis marketed

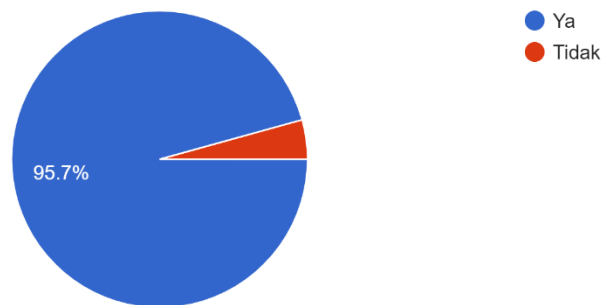


Figure 4.4.11 Solar Washing Machine Market Capability

As a result of the questionnaire given to the respondents, a figure of 4.4.11 showed 95.7% (67 people) among respondents agreed to the Solar Washing Machine to be marketed. However, 4.3% (3 people) of respondents said the Solar Washing Machine was marketed.

4.4.12 Average Survey Results Involving *Solar Washing Machine*

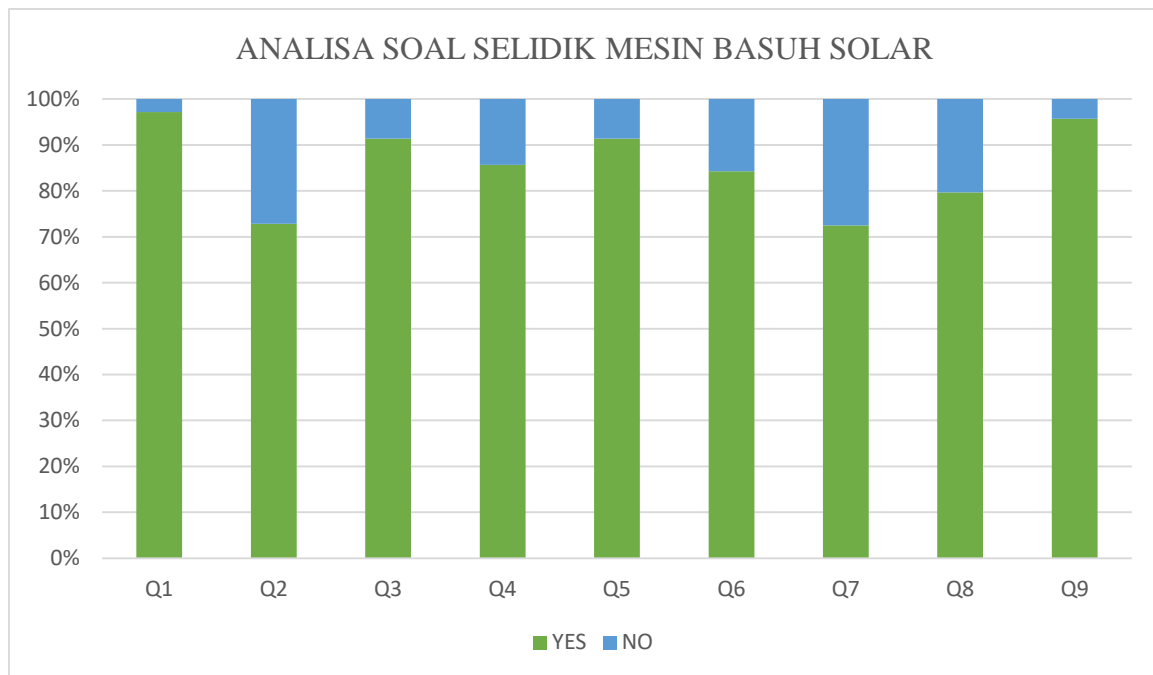


Figure 4.4.12 *Solar Washing Machine questionnaire analysis*

Figure 4.4.12 shows the analysis of respondents on the suitability of the Solar Washing Machine to be marketed. A total of 60 people agreed to the statement. This may be because in Malaysia, there is less use of solar power as the main ingredient for electricity supply. This factor also caused respondents to feel confident with the Solar Washing Machine to be marketed. However, a handful of respondents disagreed with the suitability of the Solar Washing Machine to be marketed at 10.. When observed, more than half of respondents agreed to the Solar Washing Machine to be marketed. This is a good sign for our project.

4.5 DATA OBSERVATIONS

Once the project is completed, testing was made by *washing clothes using Solar Washing Machine* to see the project's capabilities and durability. Having done the testing, we have seen the ability that this project can function for 2 days once in a solar energy charging. It takes approximately 15 minutes for each washing. Such time records are shorter time records when compared to washing hands.

Besides that, the use of energy using *Solar Washing Machine* is at a minimum. This is because the project does not use any electricity to do washing work. This can indeed save electricity when used in urban areas.

According to some references, most washing machines swirl between 1.8 to 2.7 kW/h. For calculations, the standard value of 1kW/h is usually taken. Washing clothes often takes 2 hours and will cost as much energy as 2 kW. If a household has many households. It is likely that there will be a lot of cost increases.

	<i>Solar Washing Machine</i>	Automatic Washing Machine	Washing Using Hands
Time Franchity	30 minutes	30 minutes	1 hour 15 minutes
There is an energy supply	Can work	Cannot work	Can work
No energy supply	Can work	Cannot work	Can work

Table 4.5 Data Insights

4.6 SUMMARY

As a summary at the end of this chapter, it has described the findings and analysis related to the *Solar Washing Machine project*. There are a number of analyses that have been described in this chapter. Finally, this chapter has also shown goodness and weakness on this project.

CHAPTER 5

DISCUSSIONS AND CONCLUSIONS

5.1 INTRODUCTION

For this chapter, decisions are based on all decisions obtained from experiments conducted and discussions in previous chapters. In this chapter, the relevant matters relate to the objectives of the study as well as recommendations on the studies carried out. In addition, conclusions were made for this experiment. Without proper planning, it is likely that the resulting work results are moderate and unsatisfactory. After discussion and research was done, there was a project called *Solar Washing Machine*. The process in designing these tools covers several stages. Among the matters and issues to be discussed are capital, project quality, surveys on use and effective ways of implementing their manufacturing.

5.2 DISCUSSIONS

For *Solar Washing Machine*, a *stability* test was conducted throughout the process. The test was done according to the maximum weight that can be seen in the mini washing machine around 4kg. This product has been tested by us and several neighborhood residents in Taman TTDI Jaya. Next, we have also done this research and as a result the use of this washing machine works without electricity supply when doing washing.

5.3 CONCLUSIONS

The main objective of this study was to wash clothing without the use of electricity in the interior. Data collection and information on how to wash clothes are through interviews with housewives and villagers. Data obtained from them will be assessed alongside data from site studies. Site studies are done to *prove that solar Washing Machine* placed at the study is effective and helps in washing clothing easier.

In the study, the effectiveness of washing machines was more focused on energy channelled by solar panels and clothing washing times. Most of the inland residents wash their clothes using hands as electricity supply is limited. From the assessment, the overall solar panels installed on the washing machine are effective and meet the design features set and require low cost in the maintenance of the washing machine. Besides that, the workforce required in the manufacturing process of this product is three. *Solar Washing Machine* is able to wash clothing without electricity. This washing machine needs to be charged with sunlight to turn on this washing machine. This is because the main source of this washing machine is solar energy from sunlight.

Overall, with solar *Washing Machine* it can make it easier for the locals to wash their clothes with minimal energy and time saving. Moreover, it will also save electricity if used in the city.

5.4 RECOMMENDATIONS

Set the project has advantages and disadvantages. The *Solar Washing Machine project* also does not escape the matter. General know, the advantage of this project is that it is capable of functioning even though there is no electricity supply. However, on our products there are also some shortcomings that the design of this project is not ergonomic and rather twenty to carry. We also use plywood to store some important components. Plywood are not resistant to moisture and liquids that will spill from the washing machine.

Here are some suggested to further enhance the study to be done against *Solar Washing Machine* to find out the effectiveness of :-

- 1) Suggested placing an automatic shirt washing soap that is likened to water levels.
- 2) Suggest using a more stable and stainless frame because the existing frame is less stable due to lack of costs.
- 3) Propose to replace plywood boards to *drywall* as they are more moisture-resistant than plywood.

5.5 Summary

As a result of the experiments conducted on the washing machine, it can be formulated that *Solar Washing Machine* has achieved the objective of the study, building a prototype capable of washing clothing without using electricity and saving washing time rather than using hands. Besides that, *Solar Washing Machine* has proven to be successful and useful for the residents in the interior for having facilitated housewives and local residents to wash their clothes.

REFERENCE

Gaurav Raut, portable washing machine, Technically Complex Project Design Research

www.oswash.org, 2009,

G.D. Rai, Non Conventional Energy Sources, 9th edition, Khanna Pub.,

H P Garg, Solar Energy, 7th edition, Tata Mc GrawHill,

https://en.wikipedia.org/wiki/Washing_machine

[www.google.com/images/solar charge controller](http://www.google.com/images/solar_charge_controller)

Yang lebih baik: papan lapis atau drywall? - Perbaikan dan reka bentuk - 2020

(abcdadecoracao.com)

Expensive Electric Bill? Start Calculating Your Electricity Cost to Save Monies

(loanstreet.com.my)

Berapa banyak elektrik yang digunakan oleh peralatan rumah tangga? - Meluruskan

(hairsalonsnaples.com)

<https://washerhouse.com/ms/funkcii-i-rezhimy-stirki-v-stiralnoj-mashine-obyasnyaem-na-palcax/>

APPENDIX B

Weekly / Activities	M 1	M 2	M 3	M 4	M 5	M 6	M 7	M 8	M 9	M 10	M 11	M 12	M 13	M 14	M 15
Project Group Formation															
Project Title Selection and Project Supervisor															
Preparation of Project Proposal Paper															
Project Proposal Paper Review															
Producing Chapter 1															
Producing Questionnaire Framework															
Producing Chapter 2															
Finding Information or Related Articles Chapter 3															
Distribute Questionnaire to Respondents															
Producing Chapter 3															
Revision of All Reports (Chapter 1, 2 And 3) By Supervisor															



PROPOSAL WEEK



EXECUTION WEEK

APPENDIX C

Weekly / Activities	M 1	M 2	M 3	M 4	M 5	M 6	M 7	M 8	M 9	M 10	M 11	M 12	M 13	M 14	M 15
Planning (Before)															
Buying Goods															
Creating a Project Framework															
Analyze Project Requirements															
Improving Projects															
Making Data Insights (Current)															
Analyze Data Insights (Current)															
Making Product Testing															
Preparation of Chapter 4															
Identifying Product Problems															
Making Discussions															
Describing Suggestions															
Preparation of Chapter 5															