POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

SMART TRASH SYSTEM

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DECLARATION

SMART TRASH SYSTEM

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2. I acknowledge that the 'Project above' and the intellectual property contained therein are the result of my original work/ invention without taking or copying any intellectual property from other parties.

3. I agree to relinquish ownership of the intellectual property of 'the Project' to 'the Polytechnic' to meet the requirements for the award of a **Diploma in Mechanical Engineering (Packaging)** to me.

Made and truly acknowledged by the said;

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APPRECIATION

In preparation of our report, we had to take the help and guidance of some respected persons, who deserve our deepest gratitude. As the completion of this assignment gave us much pleasure, we would like to show our gratitude to Puan Salhana Binti Sahidin@Salehudin, our Course Lecturer, on Polytechnic Sultan Salahuddin Abdul Aziz Shah for giving us a good guideline for assignment throughout numerous consultations. I would also like to expand my gratitude to all those who have directly and indirectly guided us in writing this proposal. Many people, especially our classmates have made valuable comment and suggestions on our paper which gave us an inspiration to improve the quality of the assignment

ABSTRACT

Smart Trash is an ingenious technology that will aid in cleaning up of towns. Smart Trash will allow them to save time and effort in more effective manner. Smart Trash is adapted with Internet of Things (IoT) system for monitoring purposes. Additionally, Smart Trash support the development of a green and smart city as mentioned in Sustainable Development Goals (SDG). Existing problems in waste management was recycle waste management system were not well managed. Objectives of this project are to design, fabricate and analyses the performance of Smart Trash. Smart Trash is fabricate using mild steel material with size of 1100 mm x 612 mm x 337 mm. The development of Smart Trash is focusing in educational institution usage. Conventionally, rubbish used to be collected manually but Smart Trash will allow them to save time and effort in more effective manner. Smart Trash is adapted with Internet of Thing (IoT) system for monitoring purpose. Additionally, Smart Trash support the development of a green and smart city as mentioned in Sustainable Development Goals (SDG). Therefore, an autonomous Smart Trash with sensor could detect waste and send the information to the garbage collector management system. An empty Smart Trash will be ready for next trip of waste.

Keyword: Smart Trash, recycle, rubbish.

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LIST OF SYMBOLS

SYMBOL	UNIT
x	TIMES
&	AND
%	PERCENTAGE

LIST OF ABBREVIATIONS

kg	kilogram
AC	Alternating current
DC	Direct current
QR	Quick Response
cm	centimeter
IR	Infrared
IoT	Internet of Thing
RFID	Radio-Frequency Identification

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Noticeable changes in the environment over the last 2 years and in general the number of waste incidents has increased since the 80s. This factor is the main driving force in the study of how to make throwing waste more effective than any other factor. The average daily volume of garbage in Malaysia has hit a record of 30,000 to 33,000 tons, making the Malaysian government have to spend 1.2 billion ringgits in garbage collection within a year. Minister of Environment, Malaysia, Datuk Tuan Ibrahim Tuan Man said that in 2020, the country's average daily waste volume is estimated to reach 30,000 tons, but as of 2013, the country's average daily waste volume has reached 30,000 tons to 33,000 tons. According to the data, the average amount of garbage produced by a Malaysian is 0.80 kg per day. However, in large cities in the country, the average amount of garbage produced by one person in a day is 1.25 kg. Therefore, the smart trash is designed as an automatic operation, no manual labor, use of electronic equipment and sensors recycle bin.

1.2 PROJECT BACKGROUND

A reverse vending machine is a device that accepts used (empty) beverage containers and returns reward to the user (the reverse of the typical vending cycle). The main vendors of reverse vending machines are Tomra of Norway and Wincor Nixdorf of Germany, while there is also some competition from smaller companies such as Envipco and Repent. Reverse Vending Machines are widely used overseas as a way to motivate recycling. All the Reverse Vending Machines are using AC power supply from plug to operate the machine. It usually used a transformer to step down the voltage and a rectifier to convert AC to DC to operate the machine. The reverse vending machines that are available in the market allows detection of one type of material only. In order to recycle plastic, glass, or tin, it requires 3 Reverse Vending Machines with each of them in charge of different types of material of container.

1.3 PROBLEM STATEMENT

- Student's management of daily waste.
- Process of sorting the waste for recycling purpose.
- Method to facilitate students for recycling as well as saving money and sustain clean environment.

1.4 PROJECT OBJECTIVE

- To design a smart trash system for a better environment
- To fabricate a smart trash and a QR code program system
- To analyze the performance of the smart trash

1.5 PROJECT QUESTIONS

This study will answer the following research questions:

- How we can save money on recycling?
- What type of machine and materials we can use to solve the problem?
- How we can design a system for green environment?
- How to analyses the performance of the product?

1.6 PROJECT SCOPE

- Smart Trash has 2 compartments to isolate plastic and Aluminum.
- Smart Trash is fabricated specifically for students in café and food court.
- Size of Smart Trash: length x width x height (1100 mm x612 mm x337mm).
- Smart Trash will be provided with QR Code alongside with manual instruction.
- Smart Trash is fabricated to support green environment.
- Capacity of Smart Trash – 10KG of each for plastic bottle and Al can.
- Smart Trash will be provided with QR Code alongside with manual instruction.
- Capacity of Smart Trash – 40 units of each for plastic bottle and Al can.

1.7 IMPORTANCE OF THE PROJECT/STUDY

The outcomes of the research will help to create a better and healthier environment. This research entails the investigation of technologies capable of generating a favorable environment while it is subjected to loads. Using this technique, we may pique the public's interest in protecting the environment from pollution. This is due to a 100.75 percent rise in trash proportion in early January 2020.

1.8 OPERATIONAL DEFINATION

When applied to data collection, operational definitions are clear, concise and detailed definitions of metrics. When collecting all types of data, the need for operational definitions is critical. This is especially important when deciding whether something is correct or incorrect, or when performing a visual inspection when there is room for confusion. For example, if we who have completed the inspection have different views on the failure of the sensor, the data collected will be wrong. A defective sensor connection may pass, and a good sensor connection may be rejected. Similarly, when checking the system for errors, if the definition of the error is not specified, data collection will be meaningless. When collecting data, it is vital that everyone in the system has the same understanding and collects the data in the same way. Therefore, operations should be defined before starting to collect data.

1.9 SUMMARY

It is envisaged that by the end of this research, smart trash will be developed, with the ability to manage waste disposal based on the content

CHAPTER 2 LITERATURE REVIEW

2.1 INTRODUCTION

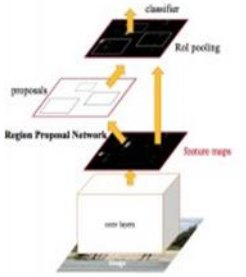
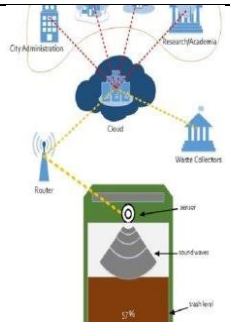
A smart trash or dustbin is a public appliance that is used to separate waste especially, aluminum and plastic without touching the trash. Most smart trash consist of material called IR (infrared). The infrared sensors are able to detect a change in temperature. When the sensors detect a temperature that is warmer, representing a human, it will activate the opening and closing mechanism of the Smart Trash's door. The sensor converts the physical action to be measured into an electrical equivalent and processes it so that the electrical signals can be easily sent and further processed. In addition, we use the light motion sensor for night use.

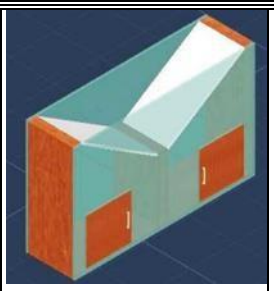
2.2 PREVIOUS RESEARCH

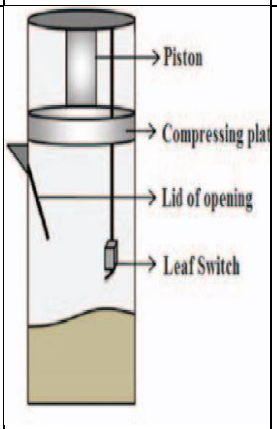
2.2.1 Product Comparison

TITLE	AUTHOR/ PUBLISHING/ YEAR	FIGURE	ADVANTGES/ DISADVANTAGES

1.SMART TRASH BIN	Fady E. F. Samman 2017 Academic Journal of Nawroz University (AJNU)	 Figure 2.1	Advantages ▪ Full bin alert system. ▪ Collecting waste. Disadvantages ▪ Cost a lot of money.
2. SMART RECYCLE BIN	Reeny Zackarias1 , Dr. S. Brilly Sangeetha2, 2018 International Journal for Research in Applied Science & Engineering Technology (IJRASET).	 Figure 2.2	Advantages ▪ Increase the utilization of the particular bin for waste disposal. ▪ The recycling process rewarding points to the user who contribute to waste. Disadvantages ▪ System requires 3R card for waste disposal

3.SMART TRASH NET	Oluwasanya Awe Robel Mengistu	 Figure 2.3	Advantages ▪ Detect trash just by look at the image. Disadvantages ▪ Only used ZF Net [8] that has 5 convolutional layers and 3 fully connected layers.
4. CLOUD-BASED SMART WASTE MANAGEMEN T FOR SMART CITIES	2016 IEEE 21st International Workshop on Computer Aided Modelling and Design of Communication Links and Networks (CAMAD)	 Figure 2.4	Advantages ▪ Timely waste collection. Disadvantages ▪ System requires number of waste bins for separate waste collection.

5. SMART TRASH	International Journal of Advanced Science and Technology Vol. 29, No. 03, (2020), pp. 8374 – 8383. Henita Rahmayanti1,2*, Ilmi Zajuli Ichsan1, Vina Oktaviani2, Yusuf Syani2, Winoto Hadi2 , Giry Marhento3.	 Figure 2.5	Advantages ▪ Can be used in various places not only in schools. ▪ Focuses on implementing smart trash in students. Disadvantages. ▪ Students' environmental attitude scores are low. ▪ Students have not agreed to do the processing according to the right procedure.
6. SMARTBIN: SMART WASTE MANAGEMEN T SYSTEM	2015 IEEE Tenth International Conference on Intelligent Sensors, Sensor Networks and Information Processing (ISSNIP)	 Figure 2.6	Advantages ▪ Obtain litter bin utilization Disadvantages ▪ The sensor node was deployed with battery power.

7. INTERNET OF BINS: TRASH MANAGEMEN T IN INDIA	2017 2nd International Conference on Computing and Communications Technologies (ICCCT)	 Figure 2.7	Advantages ▪ Less expensive Lock based System with alert system. ▪ Two threshold limits are being fixed. Disadvantages ▪ Sigsbee are short range, low complexity, and low data speed
8. IOT BASED SMART GARBAGE ALERT SYSTEM USING ARDUINO UNO	2016 IEEE Region 10 Conference (TENCON)	 Figure 2.8	Advantages ▪ Itis transportable low-price RFID tag; the system provides options for the customers to lodge their complaints in case of discrepancies.

9. RFID-BASED REAL- TIME SMART WASTE MANAGEMEN T SYSTEM	2007 Australasian Telecommunication Networks and Applications Conference	 Figure 2.9	Advantages ▪ Waste disposal charge can be calculated, can track missing or stolen bins quickly ▪ Automates customer invoices. Disadvantages ▪ Metal objects or liquid containers difficult to tag and track with a RFID system.

11. SMART BINS	MTS Metropolitan Transfer Station Figure 2.10 Tue, 31 Dec 2019.	 Figure 2.11	Advantages ▪ Smart bins are environmental y friendly. By reducing the need for collection visits, smart bins lower emissions of carbon dioxide and other gases. Disadvantages ▪ It reduces man power requirements

12. SMART TRASH CANS	Written by Big belly | 12/18/15 9:04 PM Reposted from LA Magazine	 Figure 2.12	Advantages ▪ Solar-powered trash compactor helps to make overflowing thing of the past. Disadvantages ▪ High power consumption

13. SMART TRASH BINS TO OFFER Wi-Fi	Published: November 24, 2015 18:47 BY GULF NEWS	 Figure 2.13	Advantages ▪ The solar panels provide the energy required to operate the compactor. ▪ Have sensors linked to the Bee'ah control room. Disadvantages ▪ People only use it for Wi-Fi ▪ many people gather nearby it and disturb society
GROUP PROJECT: SMART TRASH	1. KEE JUN YONG. 08DMP19F1003 2. AN-NUR BALQIS BT HAIRULLIDZAM. 08DMP19F1020		Advantages ▪ Can reduce waste and low cost/save money ▪ With medium size machine, save space and more cost

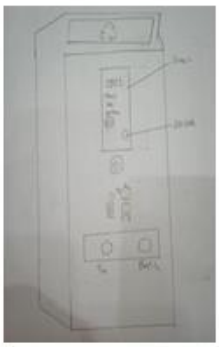
	3.NUR SYAKILA BT NAZERI. 08DMP19F1019	 smart trash sketch   Figure 2.14	savings. ▪ A better recycle place for waste ▪ Helps disposing without touch the bin. Disadvantages ▪ Created for students. ▪ 2 categories disposal only.

Table 2.1 is the first table found in Chapter 2

2.2.2 Study Type Project

From what we have analyses, the concept of intelligent garbage cans and systems has been discussed for a long time. The technology needed to create this smart system have also changed, such as the Internet of Things (IoT). Each concept appears identical on the surface but is fundamentally different, and our proposed work is no exception. This is our original concept for building a smart waste collection system that includes public involvement and data analysis for improved decision making when the IoT sector has taken root in our lives. A garbage bin with an ultrasonic sensor, a microcontroller, and a Wi-Fi module for data transfer make up the smart system's hardware.

2.2.3 Literature Survey

STYLE	CITATION AND REFERENCES LIST
IEEE	[1] Mohd Helmy Abd Wahab, Aeslina Abdul Kadir, Mohd Razali Tomari, and Mohamad Hairol Jabbar (2014) presented a Smart Recycle Bin that accepts glass, paper, aluminum cans, and plastics. It calculates the worth of the garbage thrown and generates a 3R card automatically. The recycling system allows users to accumulate points in order to execute a disposal action in specified recycle containers by enabling points to be redeemed for items or services, such a system encourages recycling. The system keeps track of information about disposal operations, discarded materials, user identity, and points acquired by the user. At the recycle bin, the user must tap his card to the designated RFID reader. The doors to the recycling bins open, and the user fills them one by one with trash. A microcontroller sends data to a database server regarding his user ID

	and the number of wasted. The user points are computed and updated by the database server. The technology allows the user to check his total points using an online system. [2] The Smart bin system presented by Fachmin Folianto, Yong Sheng Low, and Wai Leong Yeow (2015) features a three-tier architecture. Every Smart bin has an ultrasonic sensor that detects bin fullness and reports readings and sensor statuses. Every sensor cluster has a gateway nod, which sends the sensor readings to the gateway nod. The data is forwarded to the backend server. The data gathered by the bin subsystem is analyses by the analytics module on the back-end server. When fullness measurements surpass a threshold, the analytics module compares them to specified rules and creates an event. The bin sub-system transmits data to the workstation and displays relevant data to users via a graphical user interface. [3] Dr. N. Sathish Kumar, B. Vijayalakshmi, R. Jenifer Prarthana, and A. Shankar (2016) [2] describe the creation of an electronic monitoring (e-monitoring) system to solve the difficulties in the conventional method using RFID technology. The monitoring system is a 16 utilized 16 zed embedded system that consists of RFID technology interfaced with an Arduino microcontroller and a web base. Dr. N. Sathish Kumar et al. created a smart trashcan that blocks when it exceeds a certain threshold value. The waste volume is measured by an ultrasonic sensor. The data from the sensor is received by the microcontroller, which then sends an alarm to the server. The RFID tag (cleaner's ID card) stops the RFID reader during the verification process, and the ultrasonic sensor checks the dustbin's state and transmits it to the web server. At the server end, an android application is 16utilized to view the alerts and status. [4] Mohammad Azzam, Marc St-Hilaire, Chung-Horng Lung, and Ioannis Lambada is (2016) propose sensor-based garbage containers that can alert users to the status of waste

	levels. To develop a more robust and effective smart waste management system, an automated trash bin and the cloud computing paradigm will be used. Waste management affects a wide range of stakeholders, including recyclers, importers and exporters, the food industry, healthcare, research, environmental protection and related organizations, and the tourism industry. Mohammad Azzam et al proposed Cloud SWAM, in which each bin is fitted with sensors that alert the user to the level of waste in the bin. Each type of trash has its own bin, such as organic, plastic/paper/bottle, and metal. As a result, each sort of garbage has already been separated, and the status indicates how much rubbish has been collected and of what type. The accessibility of cloud-based data may be beneficial to many organisations and stakeholders in various ways. **References List** 1. Reeny Zackarias1 and Dr. S. Brilly Sangeetha2, 2018, International Journal for Research in Applied Science & Engineering Technology (IJRASET). 2. 2015 IEEE Tenth International Conference on Intelligent Sensors, Sensor Networks and Information Processing (ISSNIP) 3. 2016 IEEE Region 10 Conference (TENCON) 4. 2016 IEEE 21st International Workshop on Computer Aided Modelling and Design of Communication Links and Networks (CAMAD)

Table 2.2 Literature Survey

2.2.4 Pros and Cons of Existing Machine

Advantages of smart trash

- Environmentally friendly.
- Collecting waste for disposal.
- Improve product quality.
- Support recycle activity.

Disadvantages of smart trash

- Expensive initial cost.
- The product may have a short life.
- Small space (frequently trash to be removed is high).

2.3 SUMMARY

In summary, innovation of smart trash is a worldwide trend to support green environment. However, the use of smart trash is still low in Malaysia due to the price which is quite expensive. The equipment and materials used are not as sophisticated and of high quality as abroad. For example; India had introduced smart trash that can tell the capacity of garbage if full. Every day, the world's population grows, generating millions of tons of trash each year. In many nations, city administrations, municipalities, and waste management organizations confront the problem of providing an efficient and effective system for collecting, properly disposing of, and recycling garbage while maintaining health standards and environmental friendliness. The smart waste management system gathers trash on time, disposes of it properly, and recycles it properly. Many waste management systems based on various technologies have been mentioned above, and these systems aid in improved waste management and the clean and efficient operation of cities. Trash management systems improve the health of the environment by properly managing waste without requiring much human interaction.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter will cover the details explanation of methodology that is being used to make this project complete and working well. Many methodology or findings from this field mainly generated into journal for others to take advantages and improve as upcoming studies. The method is use to achieve the objective of the project that will accomplish a perfect result. In order to evaluate this project, the methodology based on System Development Life Cycle (SDLC), generally three major step, which is planning, implementing and analysis.

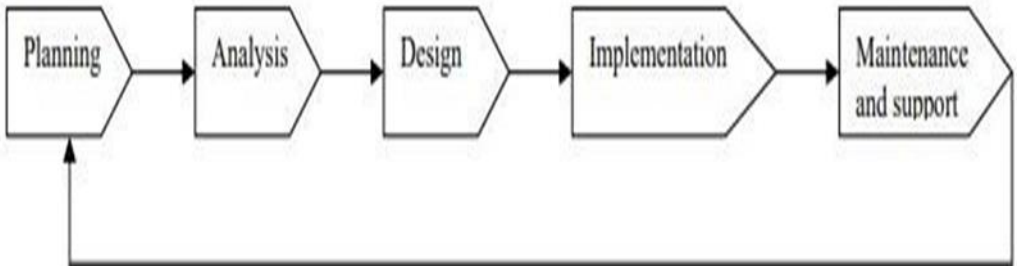


Figure 3.1: SLDC Phase

3.2 PROJECT DESIGN

3.2.1 Method/Procedure/Project Production Technique

I) Flow Chart

Figure 3.2 FLOW CHART

II) Gant Chart

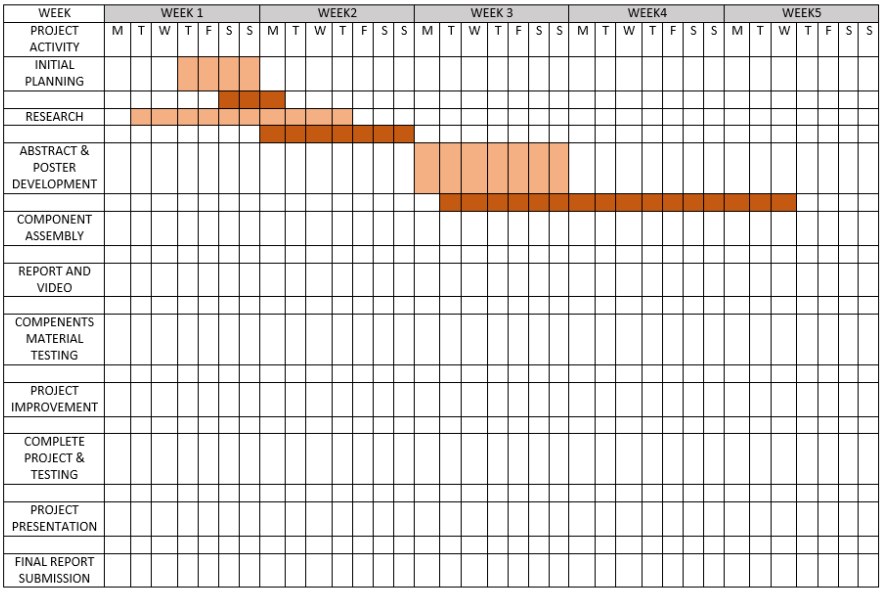


Figure 3.3 Gant Chart 1

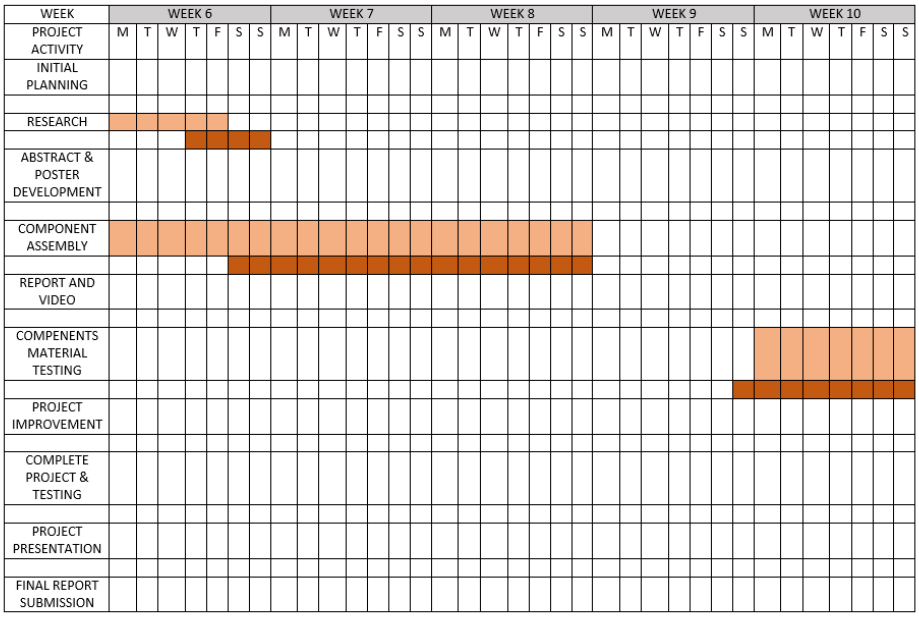


Figure 3.4 Gant Chart 2

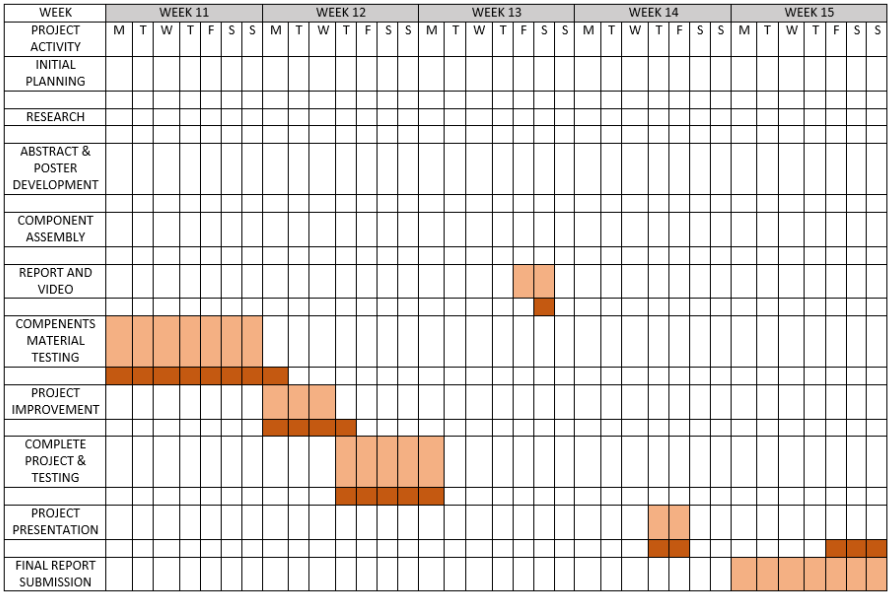
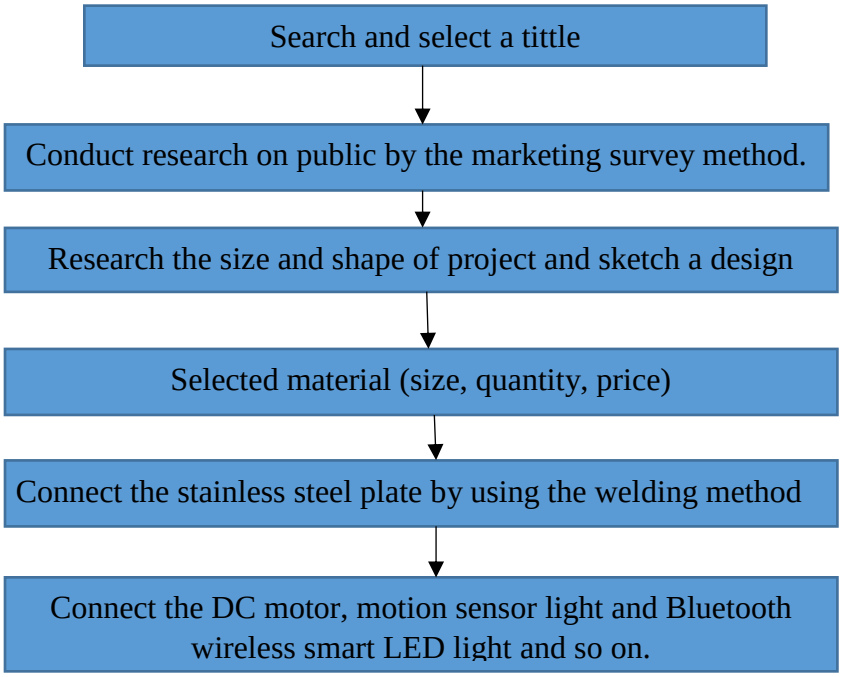
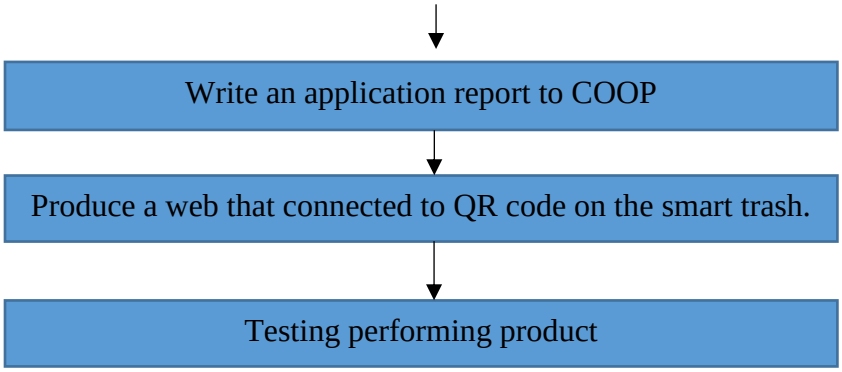


Figure 3.5 Gant Chart 3

III) Project planning and designing procedure.





3.2.2 Materials & Tools / Safety Equipment

a) Measuring tape

This tool is used to measure something long.

Figure 3.6: Measuring tape

b) MiG Welding Machine

This machine is used to mix one material with another using special materials as metal

Figure 3.7: MiG Welding Machine

c) Angle L ruler

This tool is used to measure an accurate 90’angles

Figure 3.8: Angle L Ruler

d) Drilling Machine

Used to drill holes in the work piece.

Figure 3.9: Drilling Machine

e) Grinding Machine

This machine is used for cutting purpose and is also used for levelling welded surfaces. The points of this machine can be changed to cut or to level the surface.

Figure 3.10: Grinding Machine

f) Welding Gloves

Gloves can protect the hands from burns due to the heat generated during the welding process.

Figure 3.11: Gloves

g) Welding Helmet

It is very important to prevent UV rays from reaching the eyes during the welding process

Figure 3.12: Welding Helmet

h) Safety Shoes

Safety shoes can protect the feet from unwanted things from happening.

Figure 3.13: Safety Shoes

i) Safety Glasses

Eye protection is used to protect the eyes and face being exposed to iron debris during the grinding and drilling process

Figure 3.14: Glasses

j) Stainless Steel Sheet

Made of external of our product.

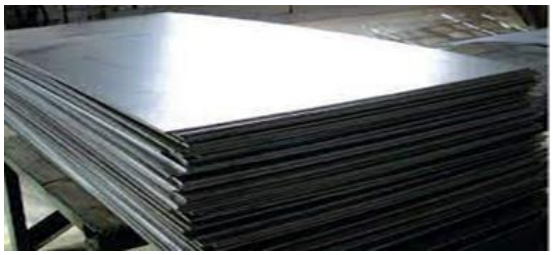


Figure 3.15: Stainless steel sheet

k)Solar Motion Sensor Light

Motion sensor light triggers a response when motion is detected. Some kinds of motion sensor lights, called occupancy sensors, operate by turning off lights in unoccupied rooms and spaces. When motion is detected, the sensor triggers the light; when motion stops being detected, the sensor shuts off the light.

Figure 3.16: Sensor Light

l) Explosion-proof Glass

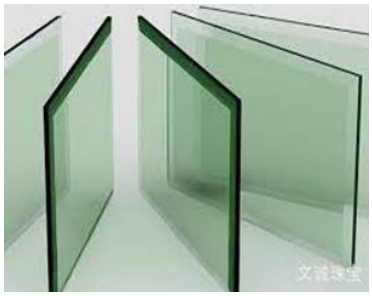


Figure 3.17: Explosion-proof Glass

m)Spray paint

Paint the external and the instruction and logo of our product.

Figure 3.18: Spray Paint

n) 12VDC GEARED MOTOR

Any rotary electrical motor that transforms direct current electrical energy into mechanical energy is referred to as a DC motor. The most popular varieties rely on magnetic fields to create forces. Almost all DC motors contain an internal mechanism, either electromechanical or electronic, that changes the direction of current in a section of the motor on a regular basis.

Figure 3.19: DC Motor

o) Small Wheels

To move our product easily.

Figure 3.20: Small Wheels

3.3 DATA ANALYSIS

a) Search and select project title

This is the first step that must be taken before starting work related to the project. The title of the project must be in accordance with the diploma status as this is a final project throughout the study in this Diploma in Mechanical Engineering (Packaging) course.

In addition, the selection of appropriate projects can help creative and innovative thinking as well as it symbolizes the level of thinking of an individual and the level of knowledge of the individual in the field of mechanics. After we take a project's article, the title for the project should be selected in order to be able to attract others to learn more about the project. Titles that are able to attract the attention of others symbolize the initial status of the project and the audiences should able to have a big picture about the project from the title.

b) Conduct research on public by the marketing survey method.

At this stage, the study was conducted using a counteractive survey method that is by conducting a questionnaire on public. Through this marketing survey method, we can find out the various problems faced by consumers with existing product

Figure 3.21 Survey Form

c) Research the size and shape of project and sketch a design.

We research the size and shape for our project before we start sketching and drawing a draft using inventor. The project sketch is made using the inventor to give a more in- depth explanation of the sketch to the supervisor. In addition, fractional sketches for the project were also made as well as placing dimensions to facilitate size measurement

Figure 3.22 Products sketching.

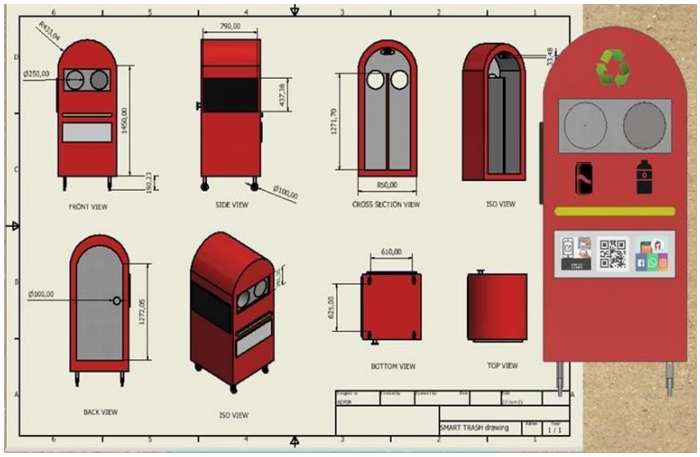


Figure 3.23 Product's final design (Inventor)

d) Selected materials (size, quantity, price)

We make a selection in terms of material, size, weight and even price. This selection is made to facilitate the project manufacturing process. The selection of materials is made by looking at the quality and life expectancy. In addition, the size and weight chosen also not be too large and not heavy so that user is easy to use and handle it.

In addition, we also make a market survey on LAZADA, SHOPEE, AMAZON and so on to determine the price of material and the budget of our project even the project cost.

ITEM	AMOUNT	PRICE(RM)
STAINLESS STEEL SHEET	180cm x 85cm x 85 cm	RM 200
SOLAR MOTION SENSOR LIGHT	1 unit	RM 30
QR CODE (BOARD)	1 unit	RM 10
EXPLOSION-PROOF GLASS	2 pieces	RM 100
SPRAY PAINT	2 unit	RM 20
12VDC GEARED MOTOR	2 unit	RM 99
BLUETOOTH WIRELESS SMART CONTROLLER LED	1 unit	RM 50
SMALL WHEEL	4 unit	RM 30
TOTAL	RM539	

Table 3.1: Project budget

PROJECT COST

Machining Costs

Machining costs are required when there are raw materials that need to be carried out certain processes to produce the desired shape. After completing this part of the machining, it can be concluded that the total cost of machining is RM 100

Overhead Cost

Overhead costs in the construction of this project are such as electricity, and so on. We estimate an overhead cost of 30% of machining costs

Overhead Cost:

= machining cost x 30%

= RM 100 x 30%

= RM 30

Labor Costs / Work

The expenditure used to make expenditure on the manpower used in the construction of this project is known as the labor cost/work

Total cost

The total cost of this project is the total expenditure for the construction of this project. Total project cost = raw material cost + overhead cost + labor cost

= RM 539 + RM 30 + RM 100

= RM 669

e) Connect the stainless-steel plate by using the welding method

Welding is a fabrication process whereby two or more parts are fused together by means of heat, pressure or both forming a join as the parts cool. Welding is usually used on metals and thermoplastics but can also be used on wood. The completed welded joint may be referred to as a well-meant. There are several welding processes that are commonly done in the industry:

i. Metal Protective Arc Welding (SMAW)

ii. Tungsten gas arc welding (GTAW)

iii. Gas metal arc welding (GMAW)

iv. Sink arc welding (SAW)

In addition, safety during welding is emphasized. It is important because every welding process has a very high risk. Before performing the welding process, safety and application must follow the prescribed procedure.

f) Connect the DC motor, motion sensor light and Bluetooth wireless smart LED light and so on

In this procedure, we connect the electrical material by using the tool.

(Refer to 3.2.2)

g) Write an application report to COOP

We write an application to COOP and discuss with their team for cooperation to proceed us redeem program at their shop.

h) Produce a web that connected to QR code on the smart trash

We produce a website that connected to QR code on the smart trash to let people can get the point and redeem the point at our website.

i) Testing performing product

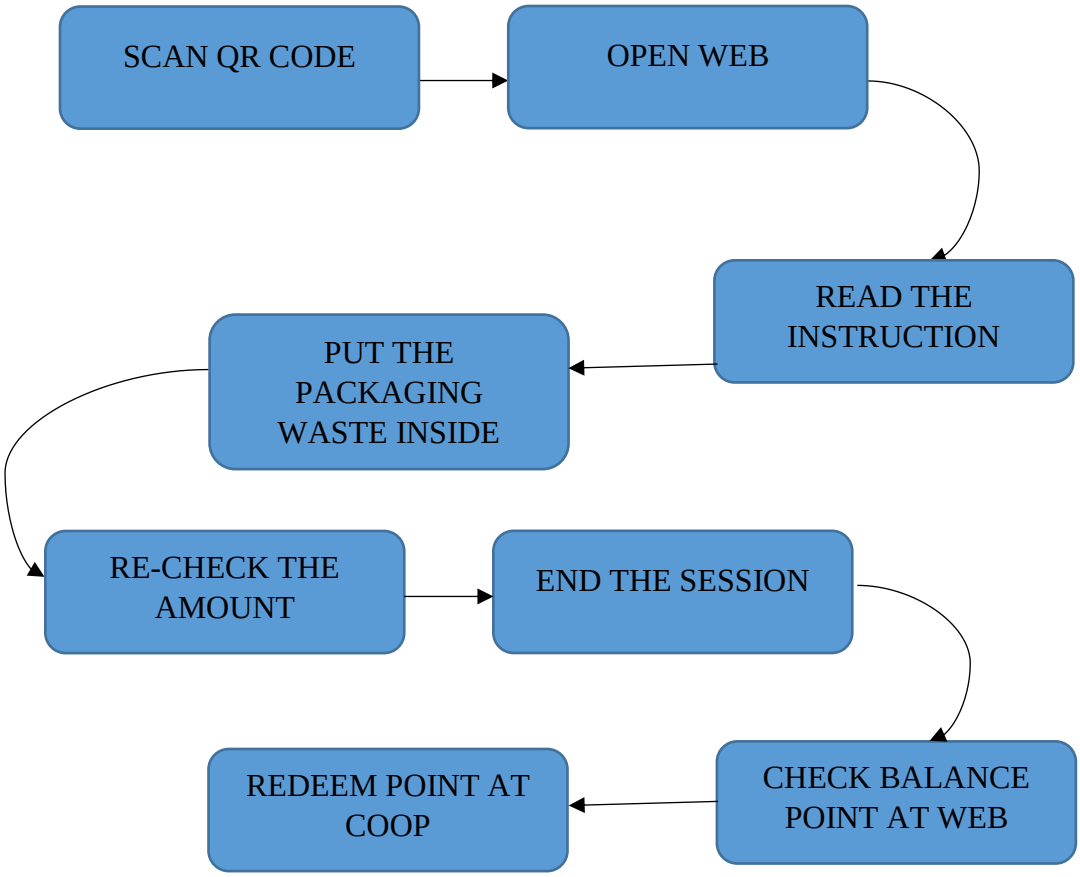


Chart 3.6: Ways to use our product

3.4 METHODS OF DATA COLLECTION

To conduct this research, several data collecting approaches were used to get data that would be useful during the analysis stage. The questionnaire method is one of the data collecting methods. Primary data and secondary data are the two forms of data that may be collected.

3.4.1 PRIMARY DATA

Primary data are crucial to the research. The study's objectives will not be met until critical data is collected. Respondents were given questionnaires to fill out throughout the data gathering procedure. As a result, a total of 52 people were chosen at random.

3.4.2 SECONDARY DATA

Literature reviews and other sources such as these, books in the topic of research, local newspapers, journals, and other publications relating to the study are examples of secondary data. These resources were evaluated for appropriateness and served as the foundation for this research.

3.4.3 SAMPLING

Sampling is the process of preparing garbage for testing on smart garbage. Plastic bottles and beverage cans are among the waste categories identified for this study. This item is initially recorded before being discarded to earn redeemable points. Each piece of trash will be worth one point. Coop receives points for redemption.

3.4.4 RESEARCH INSTRUMENTS

The questionnaire approach was used as the study's tool. The responders were chosen from the general population. The survey employed a four-point Likert scale (1 = Strongly Agree, 2 = Agree, 3 = Disagree, and 4 = Strongly Disagree). The questionnaire will be broken into three (4) primary components, which are as follows:

a) Part A: Respondent Demographics (Gender, and Age)

b) Part B1: Behaviors of drink/canned food consumers.

c) Part B2:- Recycling awareness

d) Part B3: Smart Trash (Innovation Ideas)

(Based on the objectives of the study)

3.4.5 PRODUCT MANUFACTURING

Figure 3.24: Installation of a 12VDC Geared Motor

The installation of a 12VDC Geared Motor to move the plate to shut or open the Smart Trash is shown in **Figure 3.24.**

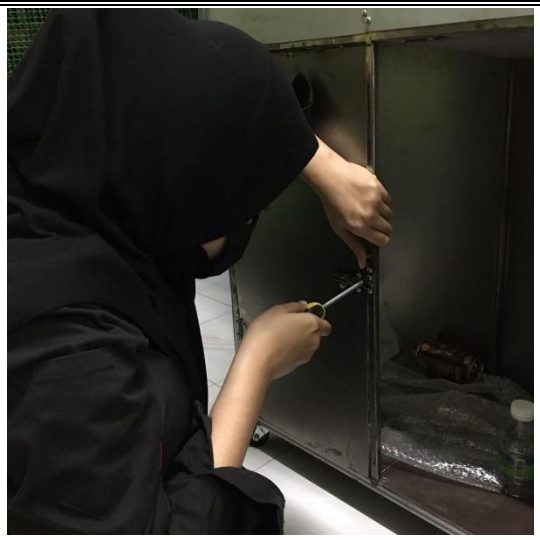


Figure 3.25: Hinge installation

A hinge is installed on a Smart Trash door in **Figure 3.25**. This door is utilized to collect rubbish that has been dumped and will be taken to a recycling facility.

Figure 3.26: Installation of rubber wheels

To assist the movement of Smart Trash when it is transported to another location, rubber wheels are installed as illustrated in **Figure 3.26**.

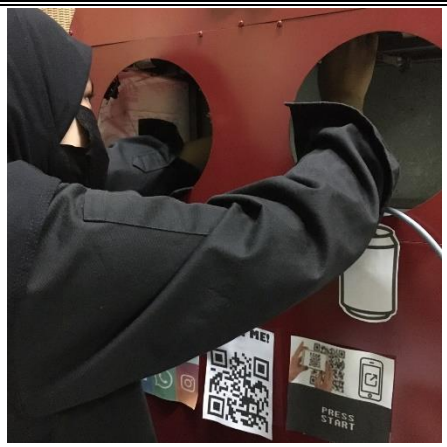


Figure 3.27: Installation of lighting.

The placement of lights, as shown in **Figure 3.27**, is designed to make it easier for students to dispose of trash while filming videos for point collecting.

Figure 3.28: Product packaging

The product's ultimate finish is shown in **Figure 3.28**.

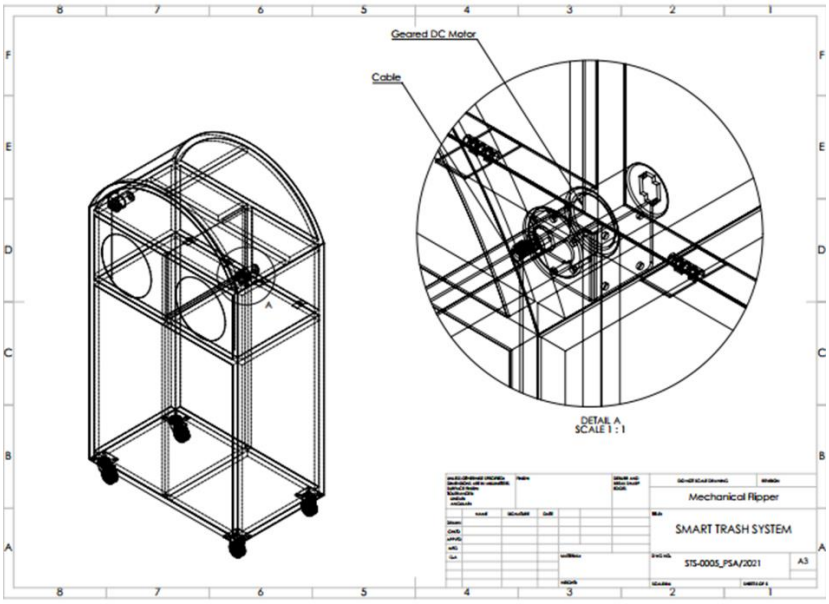


Figure 3.29: Inventor Drawing

The inventor drawings that have been created are shown in **Figure 3.29**.

3.5 SAMPLING TECHNIQUES

Data analysis was done using Google Form after data collection via questionnaires and sampling. The programmed will analyze 52 questionnaire forms with 16 study-related questions. The three aspects of data analysts are beverage/canned food consumer behaviors', recycling awareness, and innovative ideas.

3.5.1 MODEL ANALYSIS

Mathematical models are used to run this analytical model. The goal is to simplify data analysts. The predictive model is the mathematical model used. The regression approach was chosen because of the effectiveness and suitability of the model. A pie chart will be used to display the findings of this investigation. This approach was chosen because the assessment is easy to complete and the findings are easy to understand.

3.5.2 QUANTITATIVE ANALYSIS

The data gathered for quantitative analysis must have an equitable distribution. It is desired that there be no extreme values in the analysis that will produce skew (refraction) and mistakes.

3.6 METHOD OF DATA ANALYSIS

To conduct this research, several data collecting approaches were employed in order to get data that would be useful during the analysis stage. One of the approaches employed is the usage of surveys created using 'Google Form.' Social media networks such as 'Whatsapp,' 'Instagram,' and others have been used to distribute the form. Respondents must complete the questionnaire in order for us to obtain accurate data to aid in the project's creation. According to the data we collected, the vast majority of respondents favors the creation of this 'Smart Trash System' initiative to address the challenges they have encountered this far.

3.7 CONCLUSION

Methodology is an important part in the project to make sure the project can proceed successfully. SMART TRASH ’is effective in enhancing the ability to improve adolescents’ cognitive abilities in understanding the concept of trash. Adolescents can differentiate between types of waste based on the categories of plastic and aluminum waste. Therefore, it can be concluded that SMART TRASH is useful tool for teenagers in increasing knowledge in schools regarding types of waste materials so that a clean and harmonious school environment can be produced. Lastly, a simple but useful project called Smart Trash using DC Motor is designed and developed here. Using this project, the lid of the dustbin stays closed, so that waste is not exposed (to avoid flies and mosquitos) and when you want dispose any waste, it will automatically open the lid.

CHAPTER4: FINDINGS/DATA/PRELIMINARY INVESTIGATION OF THE STUDY

4.1 INTRODUCTION

A total of 52 people has responded to the questions that were submitted using Google Form. The questions are divided into two parts: part A and part B. Part A contains respondent information, whereas Part B is organized into three sections that is consumer habits of canned drinks or food, recycling awareness, and idea of innovation. For the 16 questions, 52 people utilized Google forms. A total of 51 people responded entirely, while 1 person responded partially. A total of 55.8% strongly favor the use of technology in the recycling process.

4.2 FINDINGS/DATA/PRELIMINARY INVESTIGATION OF THE STUDY

4.2.1 Respondent Information

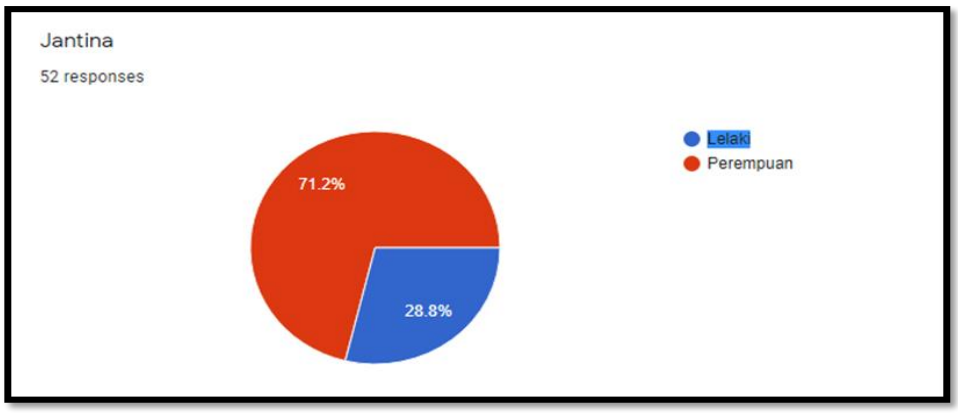


Figure 4.1

The basic information for the 52 respondents revealed that they were made up of 28.8 % male respondents and 71.2 % female respondents.

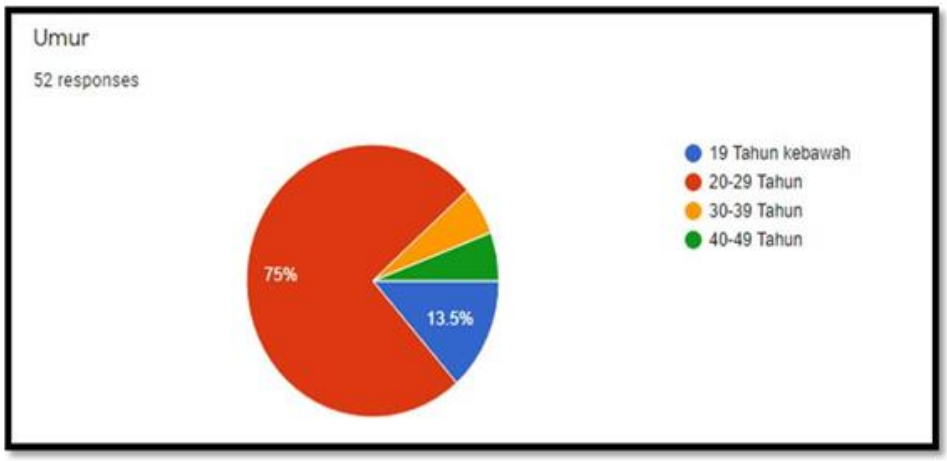


Figure 4.2

In terms of age, 9.75% are aged 20-29, while 13.5% are aged 19 years and below, followed by 5.8% aged 40-49 and 5.8% of respondents aged 30-39.

4.2.2 Habits of Consumers of Drink or Food Canned.

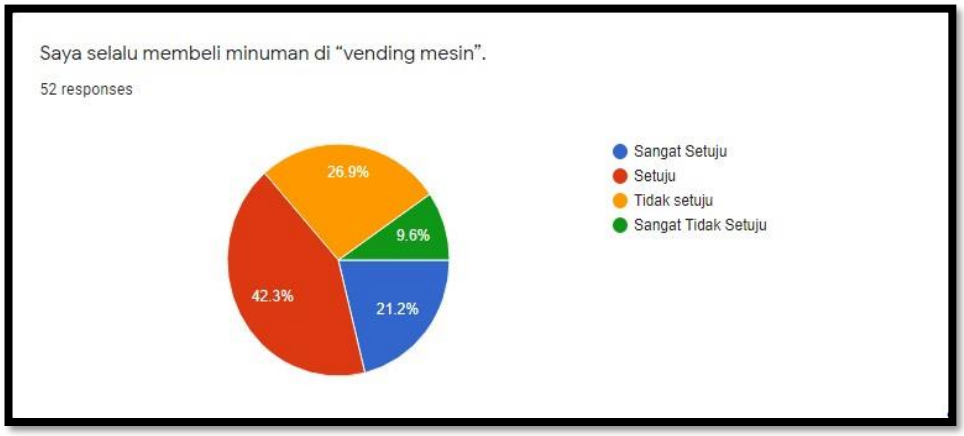


Figure 4.3

A total of 42.3 % of respondents who agreed with the statement always buy food and beverages at vending machines.

Figure 4.4

In addition, as many as 69.2 % of respondents recognize the kind of packaging of beverages and food.

Figure 4.5

A total of 57.7% disapproved with the consumption of water and canned food on a registrable basis.

Figure 4.6

Finally, 61.5% of respondents strongly agreed with the predicament of those who do not recycle.

4.2.3 Recycling Awareness

Figure 4.7

A total of 53.8% know how to separate garbage according to the type of recycled material.

Figure 4.8

A total of 67.3% agreed with the disposal of garbage into the bins by type.

Figure 4.9

Next 69.2% strongly agree with the importance of throwing garbage into the bin.

Figure 4.10

48.1% of the respondents find recycling bins to dispose of garbage.

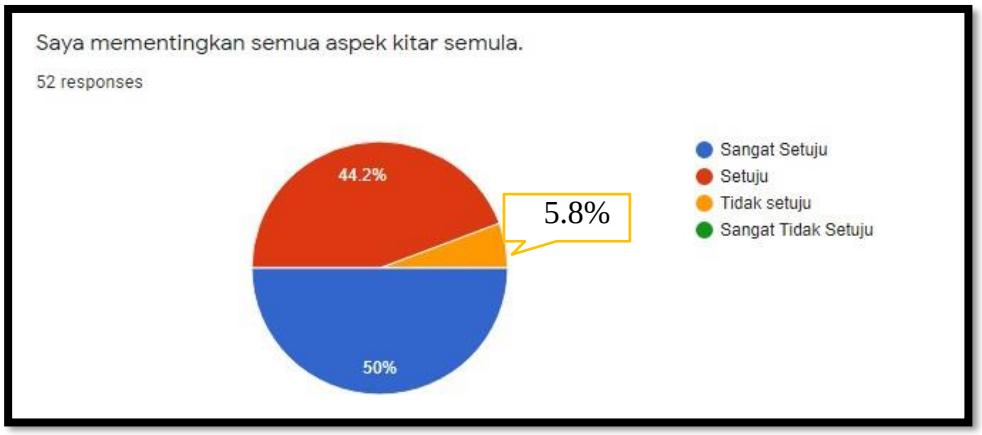


Figure 4.11

Finally, 50% strongly agree with the importance of all aspects of recycling.

4.2.4 Innovation Ideas

Figure 4.12

55.8% of respondents agreed with the benefits in terms of financial return.

Figure 4.13

37.3% agree and not agree with the trash cans that are often damaged in their place.

Figure 4.14

Next, 48.1% agreed with the difficulty of throwing rubbish into the rubbish bin.

Figure 4.15

A total of 59.6% strongly agree with the statement that high -tech bins can improve the local area.

Figure 4.16

Then, 48.1% strongly agree with the attraction in disposing of rubbish in smart trash.

Figure 4.17

Furthermore, 55.8% strongly agree that high -tech bins will facilitate the recycling process.

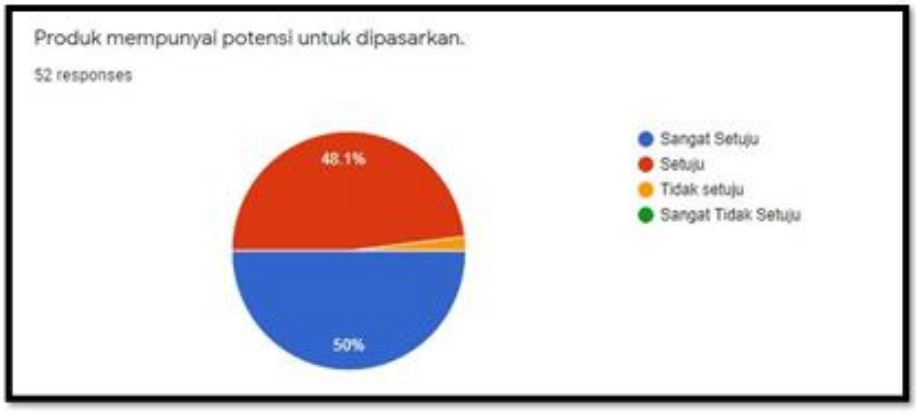


Figure 4.18

Finally, as many as 50% strongly agree our products have the potential to be sold.

4.3 DISCUSSION

Perhaps, our Smart Trash will be well received and very useful in the future, especially for the student. With new invention of Smart Trash with QR Code for the 2 components that isolate plastic and Aluminum will solve the environmental issues. When the packaging waste is about to throw in the Smart Trash, an DC motor will help to activate the opening and closing mechanism of the lid that is able to detect a change in temperature, representing a human and become effectively hygienic. Hopefully our solar motion sensor light can help students to dispose of trash at any time.

4.4 CONCLUSION

Smart trash should be placed in crowded areas as many people can use it.

In addition, smart trash should be placed near vending machine to make it easier for people to use it. Finally, the project's execution demonstrates that smart trash can entice customers to help prevent the environment from pollution. It also demonstrates that, though producing smart trash involves a significant investment, the effort may return positive outcomes in terms of reducing pollutants

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

Through our preliminary market research, we will discuss the existing eco-friendly recycling bins in society and the market, and then compare with our upcoming product (SMART TRASH). In addition, we evaluate the strengths and weaknesses of our products and their function and benefit. If the product is successfully launched, we will also obtain the public's evaluation and rating of the product through questionnaires, as well as whether the community agrees to buy our product.

5.2 CONCLUSION

In this era of global warming, environmentally friendly recycling has become an action to save our earth, and recycling bins are becoming more and more widely used. Whether in residential or industrial areas, the purpose of recycling bins is to facilitate the public can use an easy and quick way to throw or put away recyclable items like plastic bottles and tins. Therefore, through market research, we have produced a more professional, smarter and more effective smart recycling bin "SMART TRASH". Through this product, we not only have to make a contribution to environmental protection, but also hope that this product can attract people to save the earth with its unique performance.

Recycling Bins In The Community	**Our Product "SMART TRASH"**
The lid is opened and closed manually using hands and even some of them are not contain lid	The lid can open and closed by button up and down
-Hard to spot at night -It must be placed under street lights for the public to see	At night, it can be illuminated and easily visible to the public by linear motion light
There is no system or website to record the recycling volume of the public	Have a secure system, QR code and website to record the recycling volume of the public and give rewards
No wheels, can't move at will	Equipped with 4 wheels and can move freely

Table 5.1 Comparison between Recycling in the community and our product "SMART TRASH"

5.3 RECOMMENDATIONS

Through various tests and feedback, we have found some improvements and enhancements to our product "SMART TRASH". First, we can install solar panels on top of the product. Solar panels convert solar energy into electricity. This saves resources and protects our Earth. In addition to environmental protection, the biggest benefit of installing a solar panel system is saving electricity bills! In addition, we also plan to add sensors to sense the fullness level of the recyclables. This measure allows us to clearly and easily know whether the recyclables have filled the recycling bin, and to deal with the full recycling bin in time.

In addition, we plan to strengthen our system and add face recognition function to the product to record the recycling volume and reward points of the public. This function can protect the important information and privacy of the public. Finally, we hope that our products can not only be promoted in Malaysia, but also sold abroad, so that the whole world can become a part of environmental protection and protect the earth through this product.

5.4 PROJECT LIMITATION

Through our tests and observations, we have obtained the limits of our products in various aspects, and obtained accurate data.

CATEGORIES	**OBSERVATION**
PLASTIC WASTE	10 KG
ALLUMINIUM WASTE	10 KG
LIMIT PER PERSON	5 UNITS
1 UNIT WASTE	1 POINT

Table 5.2 Project Limitation

5.5 SUMMARY

In a nutshell, our product SMART TRASH ’is effective in enhancing the ability to improve adolescents’ cognitive abilities in understanding the concept of trash and recycle items. Adolescents can differentiate between types of waste based on the categories of plastic and aluminum waste. Therefore, it can be concluded that SMART TRASH is useful tool for teenagers in increasing knowledge in schools

regarding types of waste materials so that a clean and harmonious school environment can be produced.

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[3] International Journal of Advanced Science and Technology Vol. 29, No. 03, (2020), pp. 8374 – 8383. Henita Rahmayanti1,2*, Ilmi Zajuli Ichsan1, Vina Oktaviani2, Yusuf Syani2, Winoto Hadi2 and Giry Marhento3.

[4] Oluwasanya Awe oawe@stanford.edu, Robel Mengistu robel@stanford.edu and Vikram Sreedhar vsreed@stanford.edu.

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ATTACHMENT

ATTACHMENT A	GOOGLE FORM
ATTACHMENT B	FLOW CHART
ATTACHMENT C	FLOW CHART
ATTACHMENT D	GANTT CHART
ATTACHMENT E	INVENTOR DRAWING

ATTACHMENT A

SMART TRASH

Assalammualaikum.Kami pelajar semester 4 tahun akhir dari Politeknik Sultan Salahuddin Abdul Aziz Shah,Shah Alam, sedang melakukan kajian tentang projek akhir tahun kami iaitu 'SMART TRASH'.

syakilanazeri2001@gmail.com (not shared) Switch accounts

*Required

Bahagian A
(Maklumat Respodan)

Jantina *

- ◯ Lelaki
- ◯ Perempuan

Umur *

- ◯ 19 Tahun kebawah
- ◯ 20-29 Tahun
- ◯ 30-39 Tahun
- ◯ 40-49 Tahun

B1-Tabiat Pengguna minuman/makanan bertin.

Saya selalu membeli minuman di "vending mesin".

- ◯ Sangat Setuju
- ◯ Setuju
- ◯ Tidak setuju
- ◯ Sangat Tidak Setuju

Saya kerap mengambil air atau makanan bertin.

- ◯ Sangat Setuju
- ◯ Setuju
- ◯ Tidak setuju
- ◯ Sangat Tidak Setuju

Saya tahu jenis pembungkusan minuman dan makanan.

- ◯ Sangat Setuju
- ◯ Setuju
- ◯ Tidak setuju
- ◯ Sangat Tidak Setuju

Saya kerap melihat orang ramai tidak menggunakan tong kitar semula.

- ◯ Sangat Setuju
- ◯ Setuju
- ◯ Tidak setuju
- ◯ Sangat Tidak Setuju

B2- Kesedaran Kitar Semula

Saya tahu untuk mengasingkan sampah mengikut jenis bahan kitar semula.

- ◯ Sangat Setuju
- ◯ Setuju
- ◯ Tidak setuju
- ◯ Sangat Tidak Setuju

Saya kerap membuang sampah mengikut jenis.

- ◯ Sangat Setuju
- ◯ Setuju
- ◯ Tidak setuju
- ◯ Sangat Tidak Setuju

Saya sedar kepentingan membuang sampah ke dalam tong kitar semula

- ◯ Sangat Setuju
- ◯ Setuju
- ◯ Tidak setuju
- ◯ Sangat Tidak Setuju

Saya mementingkan semua aspek kitar semula.

- ◯ Sangat Setuju
- ◯ Setuju
- ◯ Tidak setuju
- ◯ Sangat Tidak Setuju

Mencari tong sampah kitar semula jika saya hendak membuang sampah.

- ◯ Sangat Setuju
- ◯ Setuju
- ◯ Tidak setuju
- ◯ Sangat Tidak Setuju

B3-Idea Inovasi : SMART TRASH

Mendapat manfaat dari segi kewangan daripada tingkah laku kitar semula.

- ◯ Sangat Setuju
- ◯ Setuju
- ◯ Tidak setuju
- ◯ Sangat Tidak Setuju

Tong sampah ditempat saya kerap rosak.

- ◯ Sangat Setuju
- ◯ Setuju
- ◯ Tidak setuju
- ◯ Sangat Tidak Setuju

Terdapat kesukaran untuk membuang sampah menggunakan tong sampah sedia ada.

- ◯ Sangat Setuju
- ◯ Setuju
- ◯ Tidak setuju
- ◯ Sangat Tidak Setuju

Tong kitar semula yang berteknologi tinggi dapat memajukan kawasan kita.

- ◯ Sangat Setuju
- ◯ Setuju
- ◯ Tidak setuju
- ◯ Sangat Tidak Setuju

Masyarakat lebih tertarik untuk membuang sampah di tong sampah berteknologi tinggi.

- ◯ Sangat Setuju
- ◯ Setuju
- ◯ Tidak setuju
- ◯ Sangat Tidak Setuju

Tong sampah kitar semula yang berteknologi tinggi akan memudahkan proses kitar semula.

- ◯ Sangat Setuju
- ◯ Setuju
- ◯ Tidak setuju
- ◯ Sangat Tidak Setuju

Produk mempunyai potensi untuk dipasarkan.

- ◯ Sangat Setuju
- ◯ Setuju
- ◯ Tidak setuju
- ◯ Sangat Tidak Setuju

Terima kasih diatas kerjasama yang anda berikan. Selamat maju jaya!

ATTACHMENT B

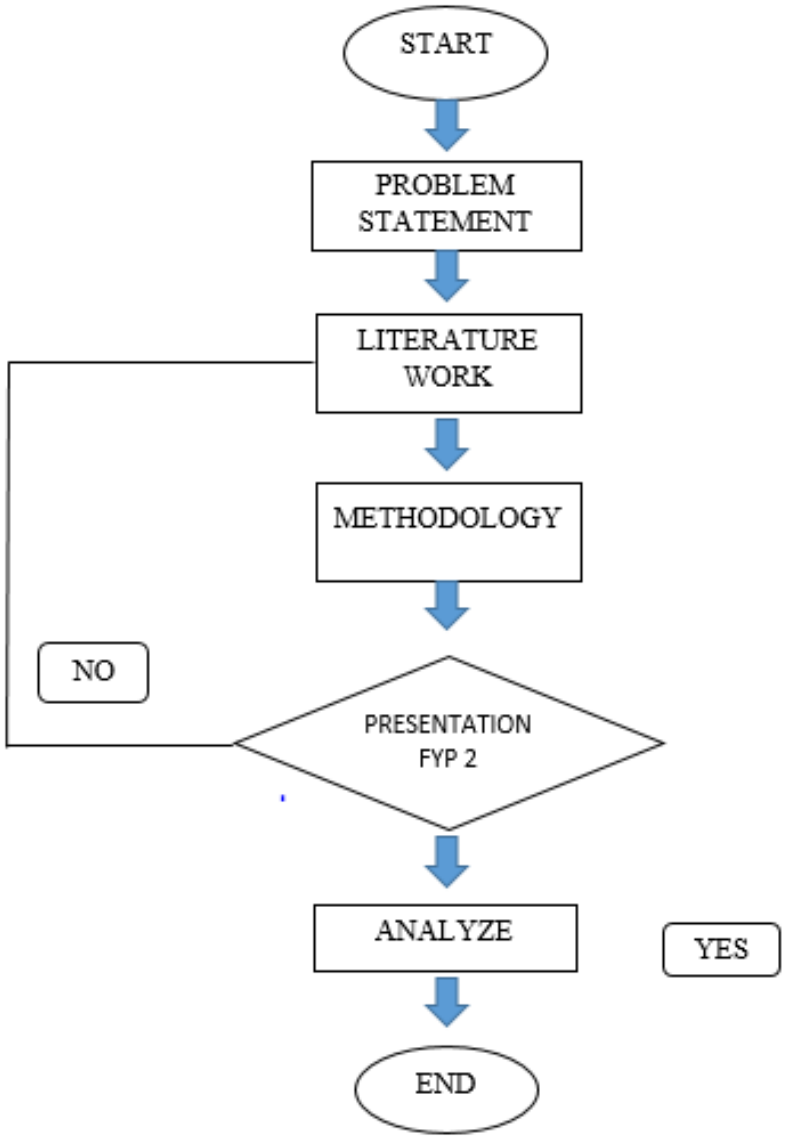


Figure 3.2 FLOW CHART

ATTACHMENT C

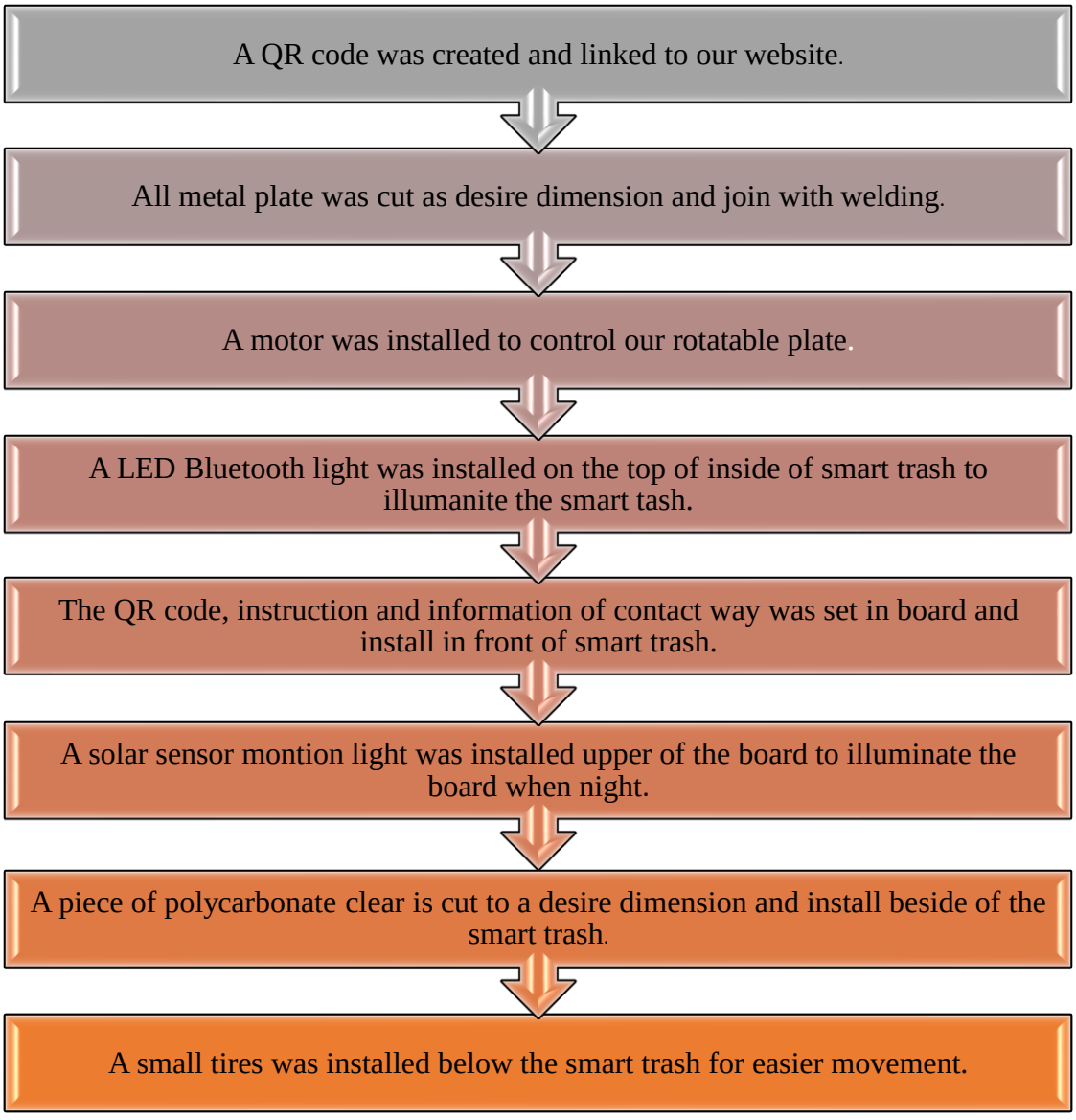
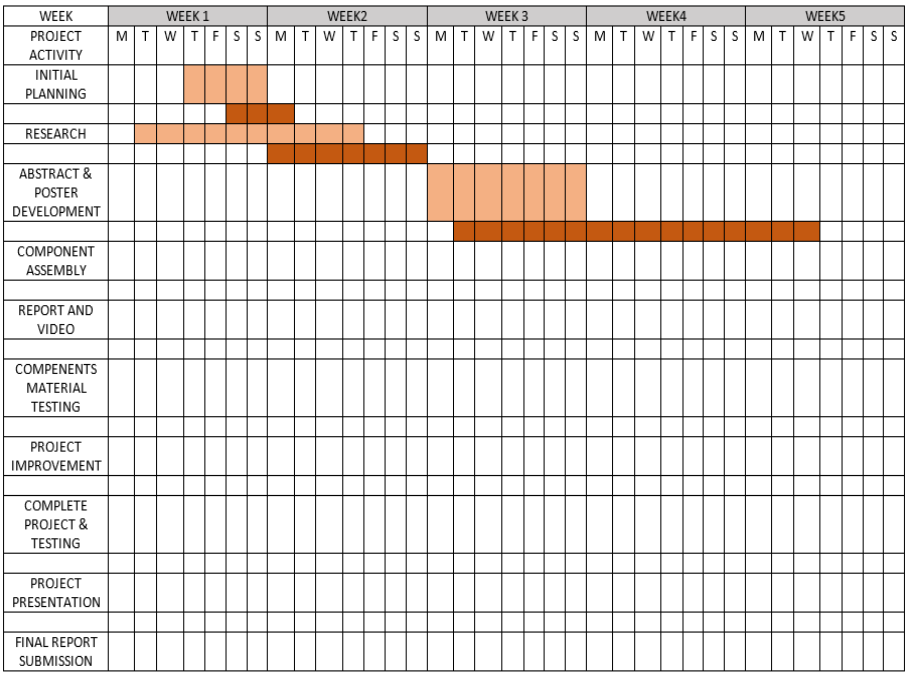
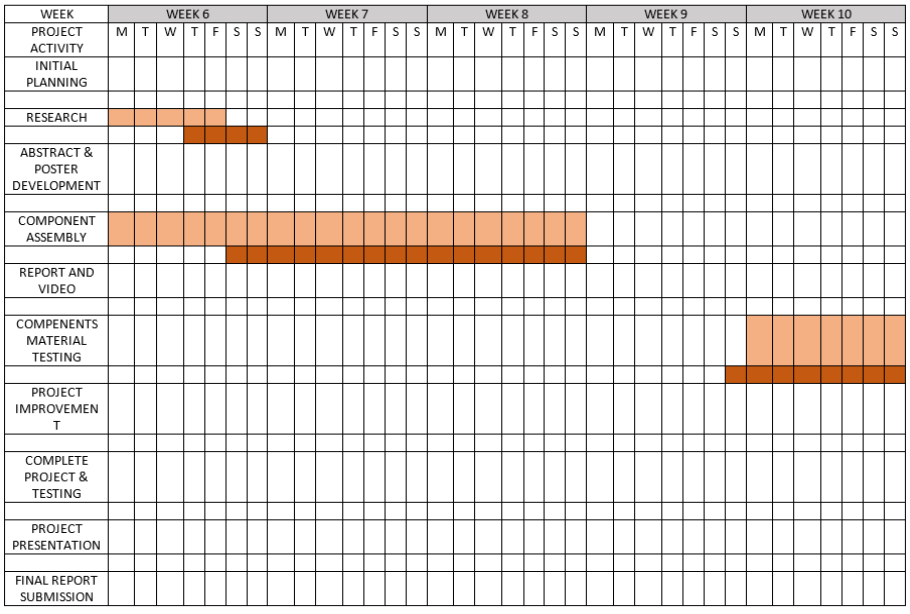
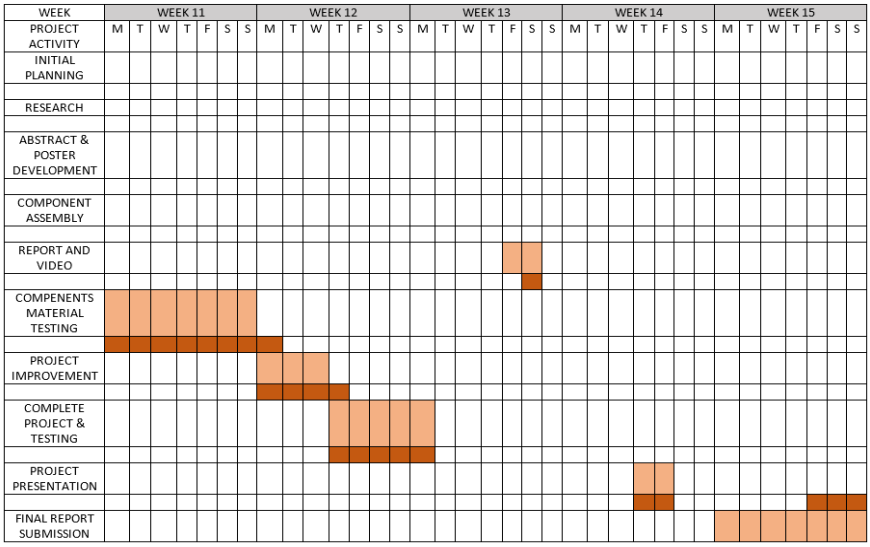


Figure 3.2 FLOW CHART

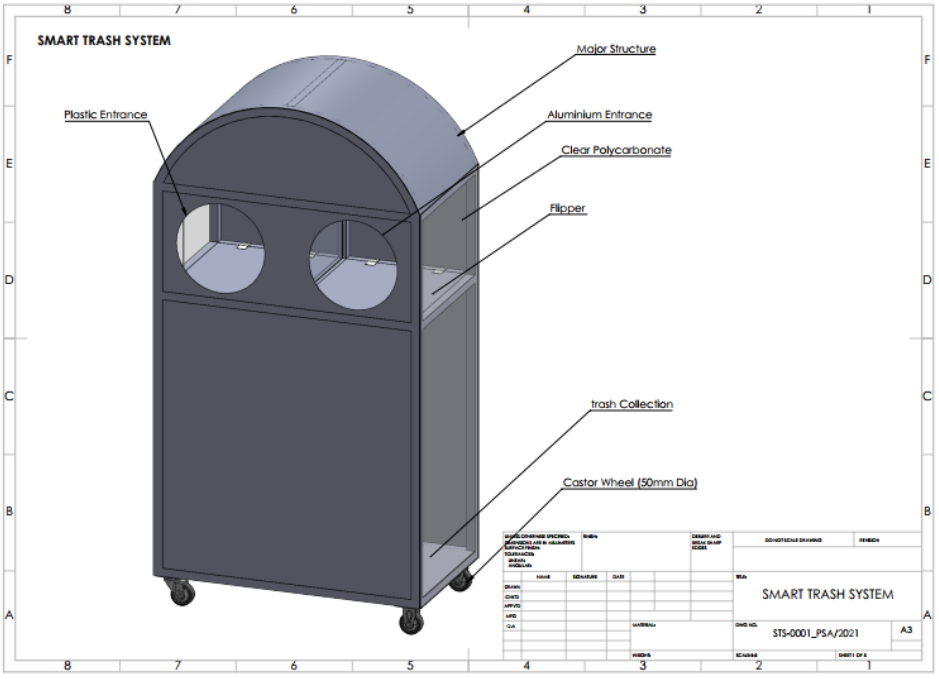
ATTACHMENT D

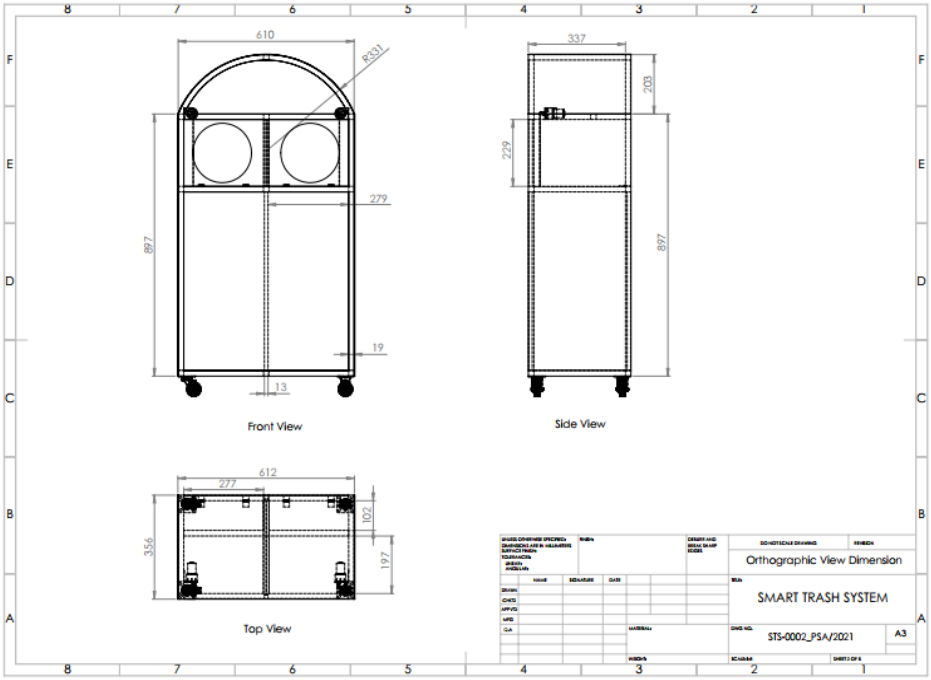


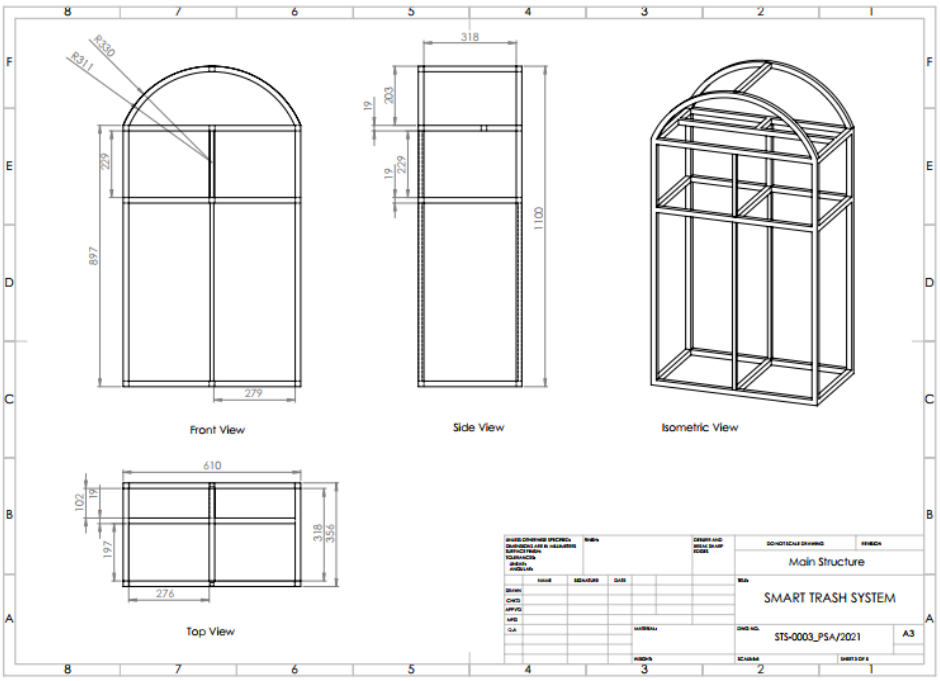


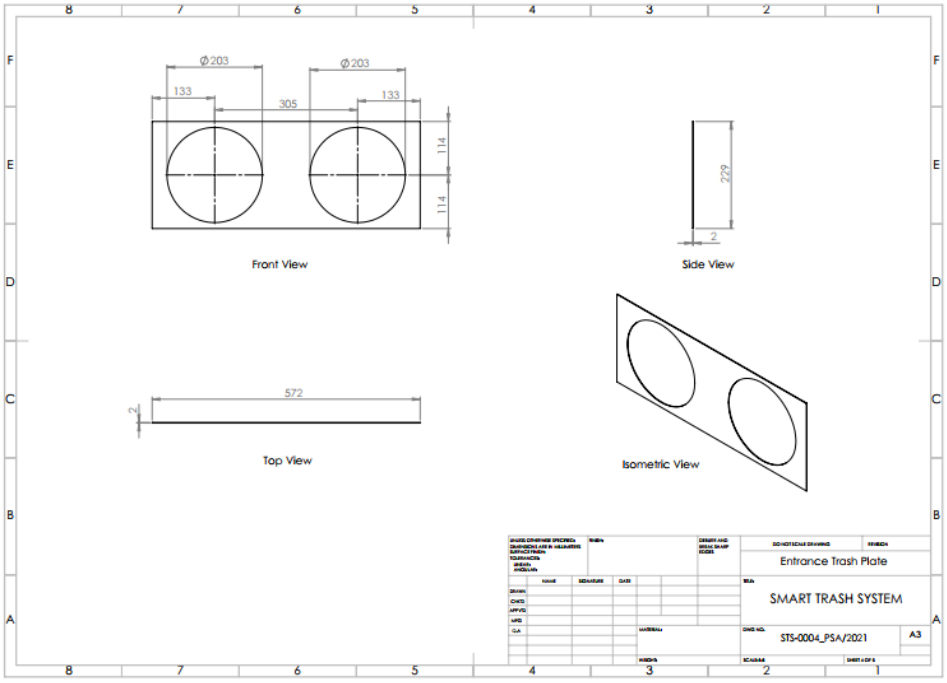

WEEK
WEEK 11
WEEK 12
WEEK 13
WEEK 14
WEEK 15
PROJECT ACTIVITY
M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S
INITIAL PLANNING
RESEARCH
ABSTRACT & POSTER DEVELOPMENT
COMPONENT ASSEMBLY
REPORT AND VIDEO
COMPENENTS MATERIAL TESTING
PROJECT IMPROVEMENT
COMPLETE PROJECT & TESTING
PROJECT PRESENTATION
FINAL REPORT SUBMISSION

ATTACHMENT D






R330
R311
229
897
279
Front View
318
19
203
19
229
1100
Side View
Isometric View
610
102
19
197
318
356
276
Top View
Main Structure
SMART TRASH SYSTEM
STS-0003_PSA/2021
A3


Ø203
Ø203
133
305
133
114
114
Front View
229
2
Side View
572
2
Top View
Isometric View
Entrance Trash Plate
SMART TRASH SYSTEM
STS-0004_PSA/2021
A3