

**POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ  
SHAH**

**‘HUNGRILL’**

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**MECHANICAL ENGINEERING DEPARTMENT**

**JUNE 2020**



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**This report is submitted to the Department of Mechanical  
Engineering in partial fulfilment of the requirements for Diploma in  
Mechanical Engineering**

**MECHANICAL ENGINEERING DEPARTMENT**

**JUNE 2020**

# DECLARATION OF ORIGINAL WORK AND INTELLECTUAL PROPERTIES

TITLE : HUNGRILL

SESSION : JUNE 2020

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(Hereafter referred to as “the Polytechnic”).

2. We acknowledge that the ‘Project above’ and its intellectual property are the original work/copy of our work without taking or imitating any intellectual property from others.
3. We agree to give up the intellectual property ownership of 'The Project' to the Polytechnic in order to meet the requirements for awarding us Diploma in Mechanical Engineering.

Made and truly recognized by	)
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as the project supervisor on the date: .....

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## **ACKNOWLEDGEMENT**

Alhamdulillah, In the name of Allah the most gracious and the most precious, first and foremost, I would like extend our deepest praise to Allah SWT who given us the patient, strength, determination, that helping us to think wisely in making a decision and courage to completed this project. Plus, many thanks and highest gratitude to Cik Madya, our supervisor, which helps, lead and guides us with our project 'HUNGRILL'.

## **ABSTRACT**

This research is based on the current manual method of grilling. Grilling is a form of cooking that involves dry heat applied to the surface of food, commonly from above, below or from the side. Grilling usually involves a significant amount of direct, radiant heat and tends to be used for cooking meat and vegetables quickly. It has been noted that grills used today are huge, not easily portable, deliver unevenly cooked food and time consuming. There are a few objectives that have been highlighted, which is to design and develop an auto smart grill, as well as to minimize grilling time. However, the grill is limited for small size dishes. The grill design is based on rectangular shape, a simple design which combines with another two product, a cooling plate and a condiment dispenser. The fabrication process comprises of cutting the wooden and iron plate and then welding the iron plate for each part. Finishing is conducted accordingly before thoroughly testing the product. Modifications were then carried out to resolve problems met during testing process. It is expected for the Hungrill to be available for commercial use and reduce cooking time. Future recommendation include installing cooling dispenser and DC motor.

Keywords : grilling, auto smart grill, cooling plate, grill, barbecue

## ABSTRAK

Penyelidikan ini berdasarkan kaedah pemanggangan manual terkini. Memanggang adalah bentuk memasak yang melibatkan panas kering yang disapukan pada permukaan makanan, biasanya dari atas, bawah atau dari sisi. Memanggang biasanya melibatkan sejumlah besar panas langsung, dan cenderung digunakan untuk memasak daging dan sayur-sayuran dengan cepat. Telah diperhatikan bahawa panggangan yang digunakan sekarang sangat besar, tidak mudah dibawa, makanan yang dimasak tidak rata dan memakan masa. Ada beberapa objektif yang telah didapati, iaitu merancang dan membina pemanggang pintar automatik, dan juga untuk meminimumkan waktu memanggang. Walau bagaimanapun, panggangan terhad untuk hidangan bersaiz kecil. Reka bentuk panggangan berdasarkan bentuk segi empat tepat, reka bentuk sederhana yang menggabungkan dengan dua produk lain, plat penyejuk dan dispenser perasa. Proses fabrikasi terdiri daripada memotong plat kayu dan besi dan kemudian mengimpal plat besi untuk setiap bahagian. Penamat dilakukan dengan sewajarnya sebelum menguji produk secara menyeluruh. Pengubahsuaian kemudian dilakukan untuk menyelesaikan masalah yang dihadapi selama proses pengujian. Diharapkan Hungrill tersedia untuk kegunaan komersial dan mengurangkan masa memasak. Cadangan masa depan termasuk memasang dispenser penyejuk dan motor DC.

Kata Kunci : memanggang, panggangan pintar automatik, piring penyejuk, panggangan, barbeku

# TABLE OF CONTENTS

CHAPTER	CONTENTS	PAGE
	<b>DECLARATION OF ORIGINAL WORK</b>	<b>i</b>
	<b>AND INTELLECTUAL PROPERTIES</b>	<b>ii</b>
	<b>ACKNOWLEDGMENT</b>	<b>iii</b>
	<b>ABSTRACT</b>	<b>iv</b>
	<b>TABLE OF CONTENTS</b>	<b>v</b>
	<b>LIST OF TABLES</b>	<b>vi</b>
	<b>LIST OF FIGURES</b>	<b>vii</b>
<b>1</b>	<b>INTRODUCTION</b>	<b>1</b>
	1.1 Introduction	1
	1.2 Research Background	2
	1.3 Problem Statement	2
	1.4 Research Gap	3
	1.5 Research Objectives	3
	1.6 Significance of study	3
	1.7 Scope and limitations	3
<b>2</b>	<b>LITERATURE REVIEW</b>	<b>4</b>
	2.1 Introduction	4
	2.2 Theory/Concept	4
	2.3 Existing concepts	5
	2.3.1 Concept 1	5
	2.3.2 Concept 2	6
<b>3</b>	<b>METHODOLOGY</b>	<b>7</b>
	3.1 Introduction	7
	3.2 Product design	9
	3.2.1 Design 1	9
	3.2.2 Material Selection	10

3.3	Analysis	11
3.4	Prototype	12
<b>4</b>	<b>RESULTS AND DISCUSSION</b>	<b>14</b>
4.1	Introduction	14
4.2	End Product	14
4.3	Verification	15
4.4	Product Testing	15
4.4.1	Part Testing	16
4.4.2	Food Testing	16
4.5	Data Analysis	16
4.6	Ergonomic Factor	20
<b>5</b>	<b>BUSINESS PLAN</b>	<b>21</b>
5.1	Introduction	21
5.2	Background Partners	21
5.2.1	Partner 1	21
5.2.2	Partner 2	22
5.2.3	Partner 3	22
5.3	Organization / Management / Administration Plan	23
5.3.1	Mission, Vision & Objective	23
5.3.2	Organization Chart	24
5.3.3	Schedule of task and responsibilities	25
5.4	Marketing Plan	27
5.4.1	Target Market	27
5.4.2	Competitor ( strength / weakness )	27
5.4.3	Advertising Strategy	28
5.5	Sale and Marketing Plan	29
5.5.1	Marketing Strategies	29
5.5.2	Operational Objective	30
5.5.3	Operational Process	32
5.6	Conclusion	33

<b>6</b>	<b>CONCLUSION AND RECOMMENDATION</b>	<b>34</b>
	6.1 Introduction	34
	6.2 Conclusion	34
	6.3 Recommendation	34

**REFERENCES**

**APPENDICES**

## LIST OF TABLES

<b>TABLE</b>	<b>TITLE</b>	<b>PAGE</b>
Table 4.1	Time Taken to Grill	16
Table 5.1	Mission, Vision & Objective	23
Table 5.2	Responsibilities description	25
Table 5.3	Strengths and Weakness Competitors	27
Table 5.4	Marketing Strategies with description	29

## LIST OF FIGURES

<b>FIGURE</b>	<b>TITLE</b>	<b>PAGE</b>
Figure 2.1	Concept 1	5
Figure 2.2	Concept 2	6
Figure 3.1	Methodology chart	8
Figure 3.2	Design 1	9
Figure 3.3	Wooden Plate	10
Figure 3.4	Iron Pate	10
Figure 3.5	Non-sticky Stainless Steel	11
Figure 3.6	Isometric view	12
Figure 3.7	Top view	12
Figure 3.8	(a) front view (b) side view	13
Figure 4.1	End Product (gambar sebenar)	14
Figure 4.2	Final Product (a) front view (b) side view	15
Figure 4.3	Graf Charcoal Grill vs Time	17
Figure 4.4	Graf Hungrill vs Time	18
Figure 4.5	Different in cooking time between Charcoal Grill and Hungrill	19
Figure 5.1	Organization Chart	24
Figure 5.2	Operational Process	32



# CHAPTER 1

## INTRODUCTION

(Prepared by NURHAMIZAH SHAHIREEN BINTI NOR HISHAM)

### 1.1 Introduction

A barbecue grill is a device that cook food by applying heat from below. There are several varieties of grills, with most falling into one of three categories: gas-fueled, charcoal or electric [1].

Gas fuelled grills typically use propane or butane (liquefied petroleum gas) or natural gas as their fuel source, with the gas flame either cooking food directly or heating grilling elements which in turn radiate the heat necessary to cook food. Gas grills are available in sizes ranging from small, single steak grills up to large, industrial sized restaurant grill which are able to cook enough meat to feed a hundred or more people. Some gas grills can be switched between using liquified petroleum gas and natural gas fuel, although this requires physically changing key components including burners and regulatory valves [1].

Charcoal grills use either charcoal briquettes or natural-lump charcoal as their fuel source. When burned, the charcoal will transform into embers radiating the heat necessary to cook food. There is contention among grilling enthusiasts on what type of charcoal is best for grilling. Users of charcoal briquettes emphasizes the uniformly in size, burn rate, heat creation and quality exemplified by briquettes. of all-natural lump charcoal emphasize it's subtle smoky aromas, high heat production and the lack of binders and fillers often present in briquettes [1]

## **1.2 Research Background**

Grilling is a form of cooking that involves dry heat applied to the surface of food, commonly from above, below or from the side. Grilling usually involves a significant amount of direct, radiant heat and tends to be used for cooking meat and vegetables quickly. Food to be grilled is cooked on a grill (an open wire grid such as gridiron with heat source above or below) using a cast iron / frying pan or a grill pan (similar to frying pan but with raised ridges to mimic the wires of an open grill) [2].

Heat transfer to the food when using a grill is primarily through thermal radiation. Heat transfer when using a grill pan or griddle is by direct conduction. In the United States, when the heat source for grilling comes from above, grilling is called broiling. In this case, the pan that holds the food is called a broiler pan, and heat transfer is through thermal radiation [2].

Direct heat grilling can expose food to temperatures often in excess of 260 °c (500 ° F). Grilled meat acquire a distinctive roast aroma and flavour from a chemical process called the Maillard reaction. The Maillard reaction only occurs when foods reach temperatures in excess of 155 °c (310 ° F) [2].

## **1.3 Problem Statement**

As you know, the barbecue is now popular at this time. Many people use it for picnics and event with family and friends, but the barbecue grill uses manual energy which are hard to handle also requires the expertise to handle it. There are several problem statement has been identified, which is, huge and difficult to brought anywhere, the food didn't cook evenly and normal grill consume more time to cook.

## **1.4 Research Gap**

There are few researches that has been identified, which is existing design does not have a complete automatic system that only require battery to fully function in the grilling process and also there is still not a single design that add a cooling dispenser that also work on Direct Current (DC) motor which need battery to function.

## **1.5 Research Objectives**

To achieve the aims that has been stated above, there are few objectives has been highlighted:

- To design and develop an auto smart grill.
- To minimize grilling time.
- To improve ergonomic factor in the product.

## **1.6 Significance of study**

This project we have innovated by installing cooling dispenser and DC motor. Cooling dispenser is an electronic device that functions as a freezer. Cooling dispenser has small size and have a high level of mobility.

## **1.7 Scope and limitations**

There are several scopes has been identified and will be used to complete the analytical research which is, for commercial use and limited to small size dishes.

## **CHAPTER 2**

### **LITERATURE REVIEW**

(Prepared by ABDUL AZHAR BIN ABDUL RAHMAN)

#### **2.1 Introduction**

Literature review are the previous studies that have been produced before. Every good research is a research that has a reference to every opinion or statement presented. It indicates that the research is a well-researched and has valid source.

#### **2.2 Theory/Concept**

The concept of heating, rotating elements and cooling dispenser is applied unto the project. A rotating grill system consists of a double grill mounted onto a shaft and the whole grill-axle assembly is rotated by a simple drive assembly over a live charcoal fire in general. The rotating grill system is suitable for grilling various food include whole chicken or large flat chunks of meat or foodstuffs in general, placed between the two grills. Continuous and uniform rotation of the grill assembly by electrical from the 24V battery means assures uniform grilling hence enhanced flavour and does away with the necessity of hand manipulation and saving time. Thermoelectric cooling concept used the Peltier effect to create a cool flux at the junction of two different types of materials for the cooling dispenser. A Peltier cooler or thermoelectric heat pump is a solid-state active heat pump which transfers heat from one side of the device to the other, with consumption of electrical energy, depending on the direction of the current. It can be used for cooling, although in practice the main application is cooling. It can also be used as a temperature controller for cooling.

## 2.3 Existing concepts

Griddle and electric grill both use electric to cook and does not use coal or charcoal, but both needs more attention than the grill that use coal while cooking [2]. Griddle legs can be folded up allowing for easy transport, while electric grill uses static legs with roller to push the grill anywhere [3]. Both grill uses static grill cooking space to cook.

### 2.3.1 Concept 1

Figure 2.1 below shows griddle grill. The concept of griddle grill is using gas to cook and suitable for limited small dishes. This griddle grill has 28.5 inch x 16.5 inch cooking surface. The material that use this grill is long lasting stainless steel burner in H-Formation for even heating [3].



Figure 2.1 Griddle grill

### 2.3.2 Concept 2

Figure 2.2 shows the electric grill. The concept of this grill is using electric to cook. Searing food is not ideal for this grill. This electric grill has 48 x 32 cm cooking surface. The material that use this grill is die casting aluminium [4].



Figure 2.2 Electric grill

# **CHAPTER 3**

## **METHODOLOGY**

(Prepared by MOHAMMAD SHAHRIL BIN YUSOF)

### **3.1 Introduction**

As emphasized below, in any approach to the selection of methodology according to a smart grill performance. In this context, it is necessary for the material selection process to be supported by decision-making methods in the design phase so that the smart grill can be audited.

Based on this assumption, this study proposes to identifications of problem which is engineering problem solving method, the relevant themes processes and techniques of application and design. The material selection model that compares and assesses the heat impact data of materials and reduces the assessment criteria to a single criterion. In this model, after selected material the most important is to understanding the traditional method during project development and requirement. The heat impacts of materials are assessed based on their heat impact classes, and materials are listed in ascending order, from the materials with low heat impacts to the materials with high heat impacts. The suggested model also defines the basics of a smart grill that aimed to ease material selection that we can draw upon when determining a smart grill performance. In the next of the process, a multiple-criteria decision-making method, which is decide one design for project also make comparisons of necessary and affordable costs. The flowchart of the research methodology is shown in Figure 3.1 below. In the research, the objective and scope of the study are defined testing method that the dimensions are define the framework of the study are identified. The testing of the model makes use of the heat impact values for the periods of extraction of raw materials and the production of the finishing materials used on the table spaces. In the final of the research, the assessment results are interpreted, and suggestions are made.

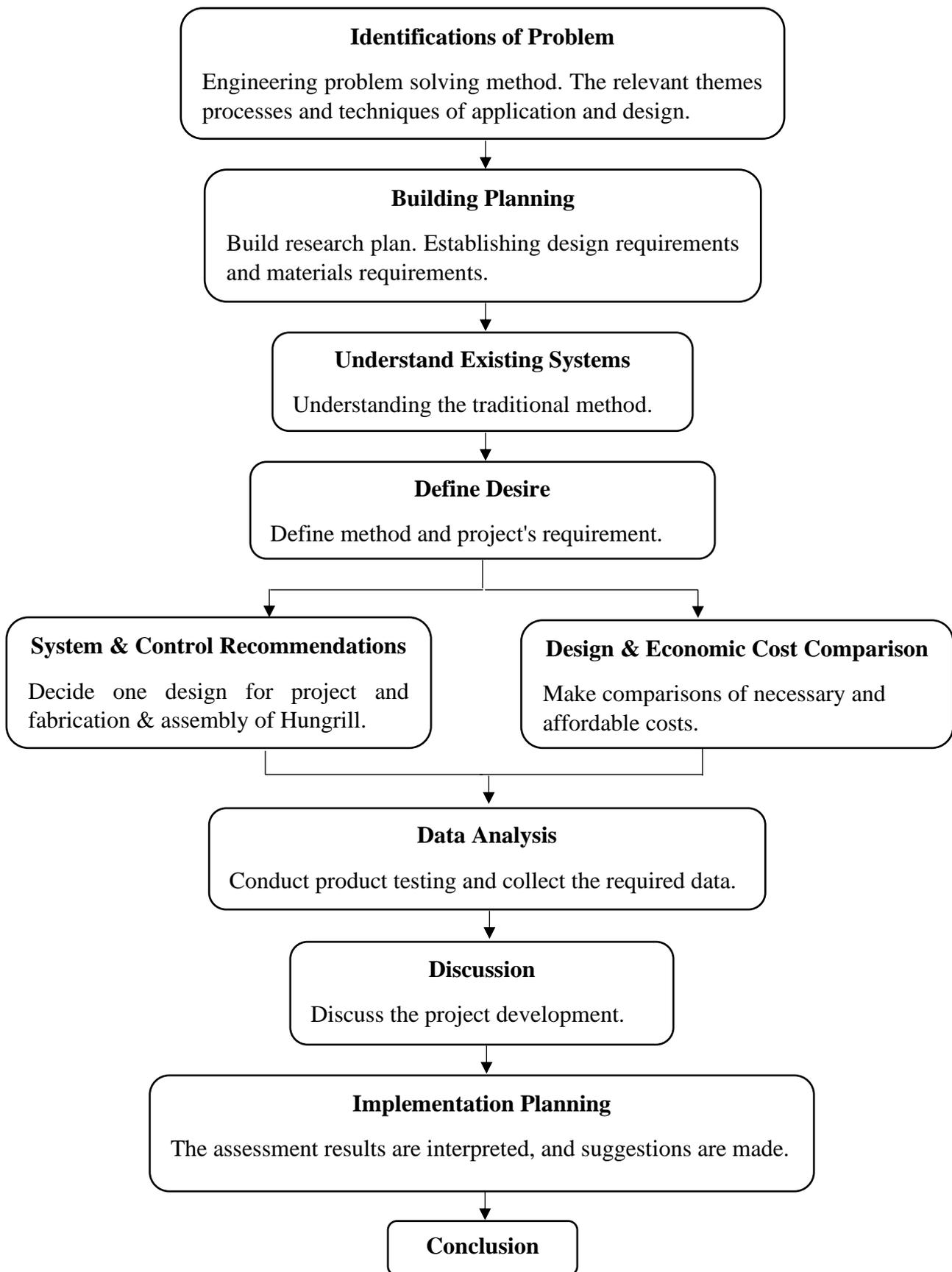


Figure 3.1 Research methodology

## 3.2 Product design

The grill consists of 4 parts which is the grill itself, motor part of auto grill, cooling dispenser and the last one is the sauce and ketchup holder. It uses the concept of heating, rotating and cooling in the box. The grill has 2 types, the auto type and the static type, while the motor part is in the middle of the product and it can be open for maintenance. The cooling dispenser is used as a fridge to store stock and food, this part use peltier as the cooling elements, both the grill and the cooling dispenser use direct current as a power supply to operate.

### 3.2.1 Design 1

First idea was just to make a grill that has two part which the auto grill and the static grill. Then the first idea is combine with another two item and that is cooling dispenser and the topping slot space. After that, the final decided to still proceed with this design as shown in Figure 3.2.

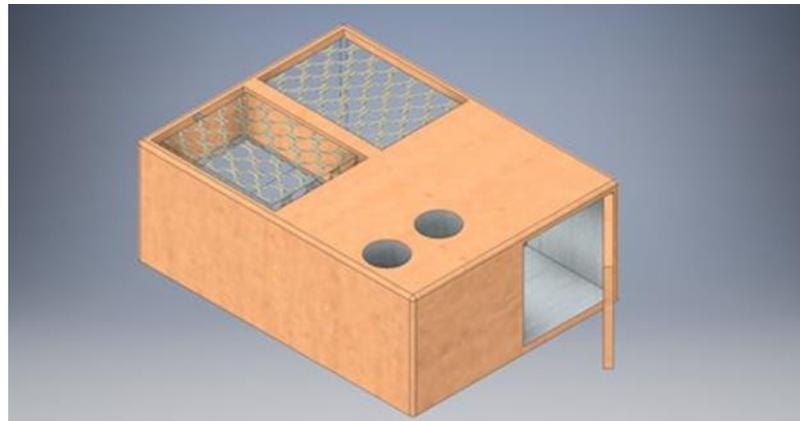


Figure 3.2 Sketch/Design 1

### 3.2.2 Material Selection

i. Wooden Plate

Wooden plate is used because it is very light considering that the product has to be a one person job. This item used as outside cover to absorb a little heat. This item has the thickness of 12mm. That is why it is very easy to handle and also has a great stability. Wooden plate also has strength with cold weather while retaining its toughness as shown in Figure 3.3.



Figure 3.3 Wooden Plate

ii. Iron Plate

Figure 3.4 below shows iron plate is used it's the most versatile metal that can be easily manipulated. This is because it can be weld and machined. The item has the thickness of 3mm that can absorb heat from the charcoal while grilling. The structures are very ductile and have tremendous toughness. Iron plate also has strength to preserve the cold weather that used in cold dispence.

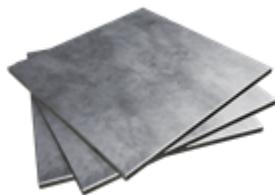


Figure 3.4 Iron Plate

### iii. Non-sticky Stainless Steel

Figure 3.5 shows non-sticky stainless steel used because it can conduct heat very evenly and make for a quick meal. This item also durable and long-lasting, so can be viewed as an investment. With design as a grill plate, it having a non-stick coating on steel saves time and energy to wash the dirt. A non-stick coating also allows for cooking with less butter or oil.



Figure 3.5 Non-sticky Stainless Steel

### 3.3 Analysis

Hungrill consist of 3 part, that is grill, cooling dispenser, and topping slot space, the first idea was just to make a grill that has two part which the auto grill and the static grill, but the grill will still be using coal as a heat supply while the auto grill use direct current as a power supply. Then the first idea is combine with another two item and that is cooling dispenser and the topping slot space. Based on research, heat will highly affect the cooling dispenser when it is put side by side, because of that we build a space to separate them to lower the chance of the heat affect on the cooling dispenser, the space is then used as a space to hold the auto grill part such as motor and battery. While the topping slot space is build beside the cooling dispenser it is cover with layer of wood to help keeping the cooling dispenser from affecting the topping slot temperature.

### 3.4 Prototype

Figure 3.6 below shows design is based on rectangular shape, it is a simple design that we can come up with when combine with another two product and that is cooling dispenser and also (ketchup space). Figure 3.7 shows the grill consist of 2 grill, auto grill and static grill and it still use a coal as a heat supply for cooking. A space is build to separate the grill and the cooling dispenser so that the heat doesn't affect the cooling dispenser.

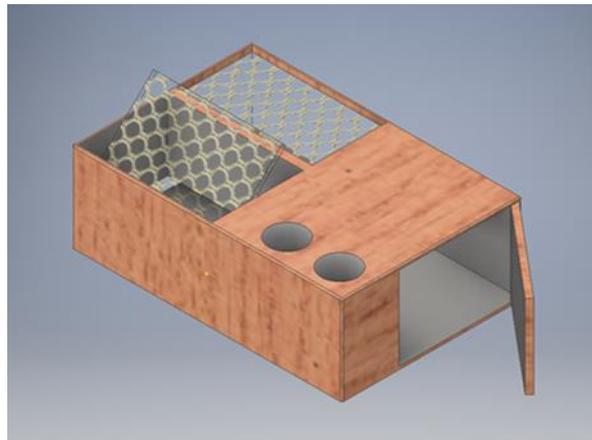


Figure 3.6 Isometric view

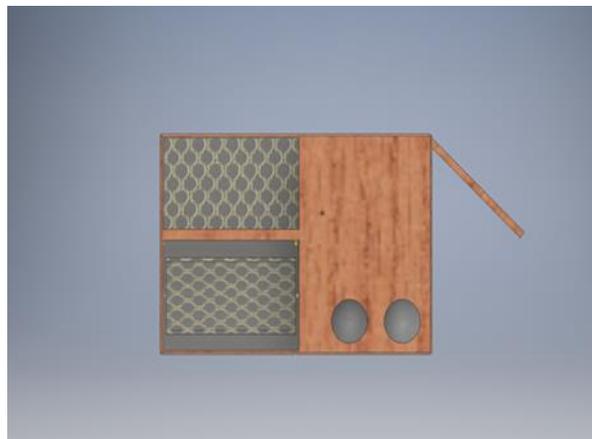
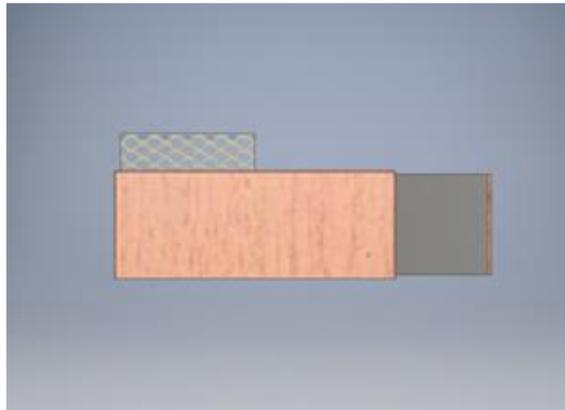
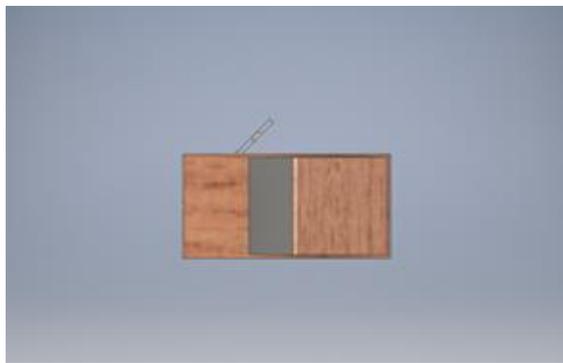


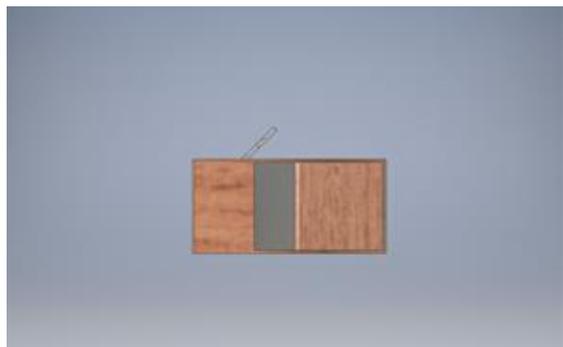
Figure 3.7 Top view



(a)



(b) (i)



(b) (ii)

Figure 3.8 (a) Front view and (b) (i) and (b) (ii)

# CHAPTER 4

## RESULTS AND DISCUSSION

(Prepared by ABDUL AZHAR BIN ABDUL RAHMAN)

### 4.1 Introduction

Discussions were held every week to discuss the project development. All the problems are discussed so that it can be solved quickly. Problem that can't be handled were addressed quickly to the lecturers. To make the project difficult everything that is going to be done must be planned properly (proper planning). This can ensure the project move smoothly without any interruptions.

### 4.2 End product

Each and every part of this product can work simultaneously. Figure 4.1 below shows the grilling part, it is divided by two part which is static grill and auto grill, the auto grill is powered with 12v DC motor. Both grill can be taken out of their base for cleaning purpose while cooling dispenser used a peltier as the cooling system and is powered with battery.



Figure 4.1 End product



(a)



(b)

Figure 4.2 Final product (a) front view and (b) side view

### 4.3 Verification

Hungrill has been tested on the working part for each compartment include consumption, wiring and full function for whole product. Every objective has been achieved according to the test data that we have collected. While it may not be perfect, this product is only prototype which is not the real end result.

### 4.4 Product testing

After Hungrill was assembled, it was subjected to a variety tests. There's a huge variety of product tested, but some of the main product would be testing include automatic and static grill controller. The cooling dispenser controller also tested so can cool the whole part of the cooling dispenser. The automatic and static grill is tested by cooking a few basic ingredient such as chicken, meat, lamb, sausage and time is recorded for result data, while the cooling dispenser is tested by turning on the dispenser and a few soft drinks is put inside the cooling dispenser to see the effectiveness of the cooling part. Common accessories include tongs, grill brush and airflow for combustion also the smoke emissions tested make sure the grilling went smoothly. The wiring test all the arrangement for the dc motor, peltier, 24V battery, and switch are tested so that there is no possibility for short circuit. Testing is performed with each and every ingredient. Each food took different time to cook, depending on the thickness of the food, but mostly took roughly the average time when it is cooked with existed charcoal grill. Hungrill reduce a little bit of the average time needed by existed charcoal grill to cook each and every food.

#### 4.4.1 Parts Testing

Hungrill have two part which controlled by switching button for each part that is powered by 24V battery. One of the part is auto grill which use DC motor to move and the other part is cooling dispenser which use peltier as a cooling medium. Both part is tested by switching on the button that is already wired and connected to a 24V battery. The grill also tested to see if the ventilation and ash tray space is working correctly by setting a fire for the grill part.

#### 4.4.2 Food Testing

A few ingredients that is used in the food testing are chicken, meat, lamb and sausage. All the ingredients are marinated then the weight is taken for data. Fire is started for Hungrill and waited for the right heat and temperature. After the right temperature is achieved all the ingredients is cooked one by one and time is taken for each ingredients. The same procedure is done with the charcoal grill and time is also taken.

#### 4.5 Data Analysis

The Data from food testing is tabulated into Table 4.1.

Table 4.1: Time taken to grill

Food	Time(minutes)	
	Existing charcoal grill	Hungrill
Chicken	10-14	9-12
Meat	20-22	18-21
Lamb	45-60	43-56
Sausage	2-3	1-2

Figure 4.3 shows charcoal grill vs time. Existing charcoal grill took longer than Hungrill. Table 4.1 shows the average time roughly 2 to 4 minutes lesser than the charcoal grill. Current charcoal grill took 10-14 minutes to cook chicken, 20-22 minutes for meat or steak, 45-60 minutes for lamb, and 2-3 minutes to cook sausage.

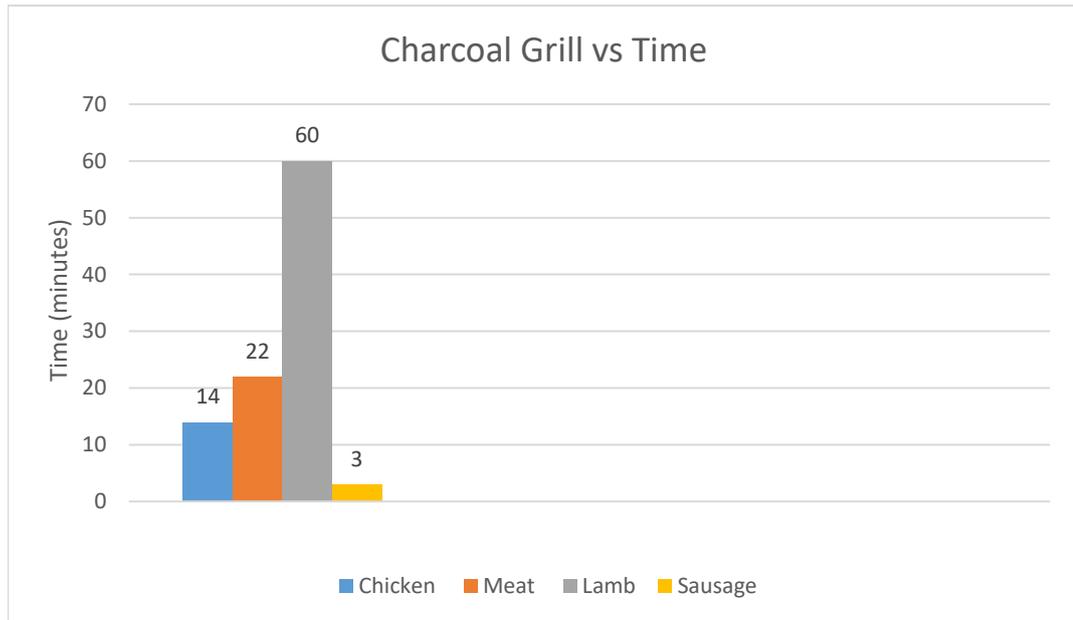


Figure 4.3 Charcoal Grill vs Time

Hungrill lessen the time by 9-12 minutes for chicken, 18-21 minutes for meat or steak, 43-56 minutes for lamb and 1-2 minutes for sausages. This proof that Hungrill take less time to cook each food. Figure 4.4 below shows Hungrill vs time.

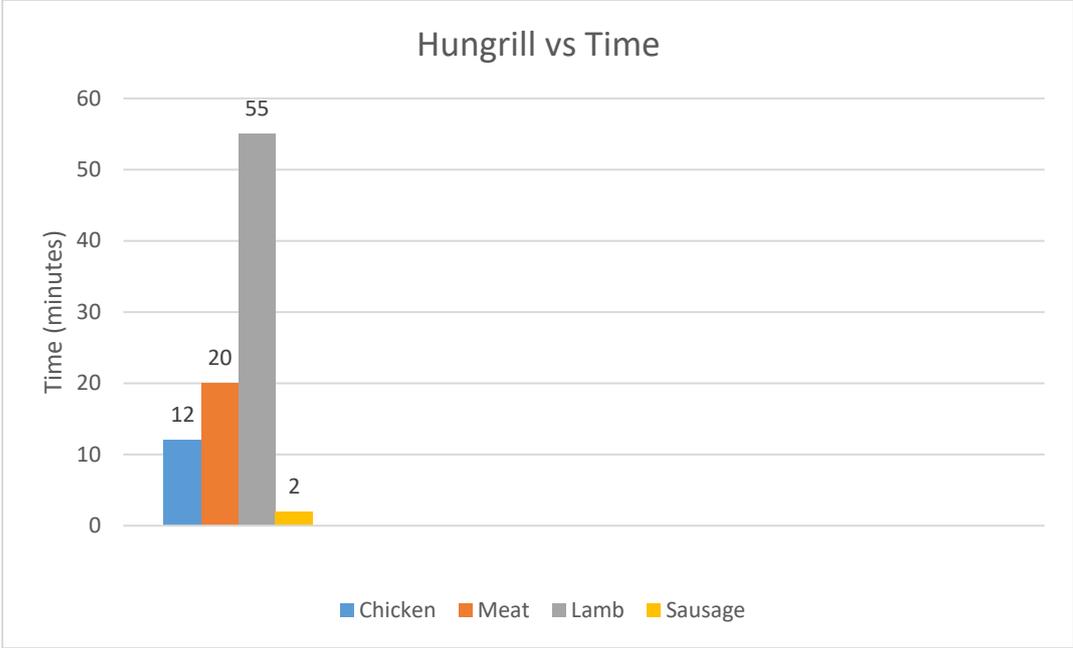


Figure 4.4 Hungrill vs Time

There's a slight difference between Hungrill and charcoal grill and that is how it is built more specific with the depth of the grill itself, which played a big role in cooking, too deep will make it longer to cook the food while too shallow will burn the food. The ventilation space also a big factor for a good grill, if the hole is too small makes it hard for oxygen cause it is blocked by ash and too big will make the fire burn too big that it will burn the food. The Hungrill, we make it so that it has a little space between the hole for the coal to fit in and a good hole size. Figure 4.5 below shows the different in cooking time between charcoal grill & Hungrill.

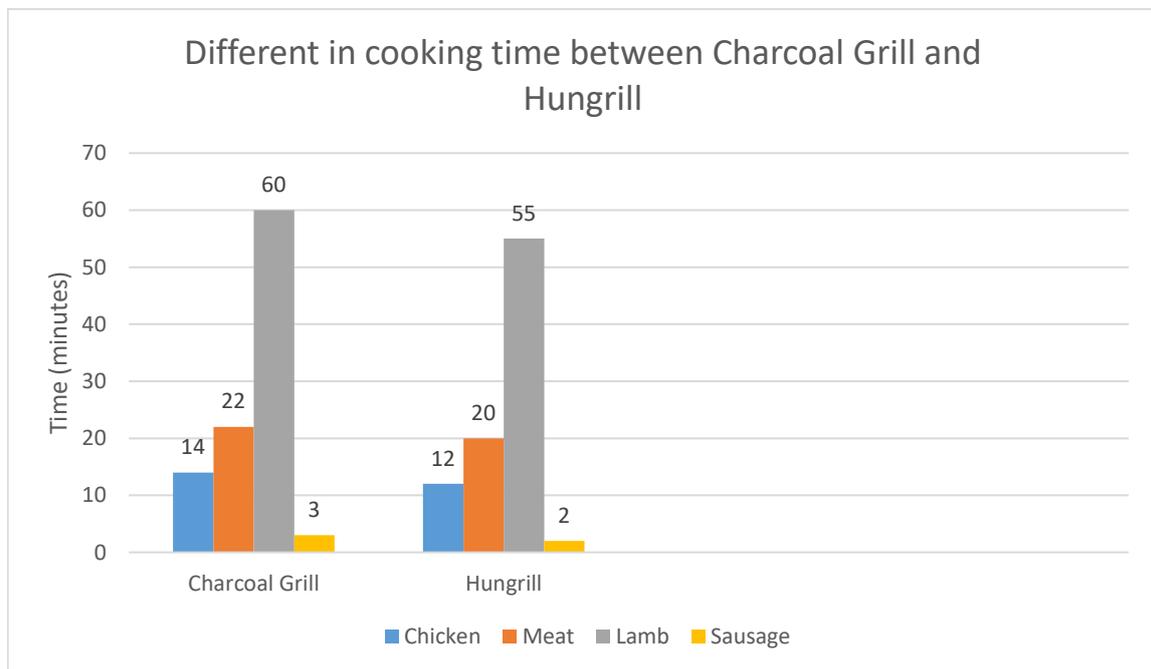


Figure 4.5 Different in cooking time between Charcoal grill & Hungrill

## **4.6 Ergonomic Factor**

Hungrill was design a workspace and streamline the work flow with the aim of encouraging efficiency, providing comfort, and increasing grilling productivity. Its elements balance the movement all around the grilling place. The portable design include accuracy spacing that can improve ergonomic factor so that can less the ergonomic accident. Hungrill allows to complete a task with as minimal steps, bending, reaching and walking as possible. These small alterations can save time and effort and avoid annoyance, strain, pointless movements and inconvenience. Hungrill aims at creating work faster and more pleasant while improving the interface right between the human body and all the things to interact with to get each work done.

# CHAPTER 5

## BUSINESS PLAN

(Prepared by NURHAMIZAH SHAHREEN BINTI NOR HISHAM)

### 5.1 Introduction

Hungrill is a business of producing innovation projects targeting Small Industries (SMI) established on 10 December 2019 especially for grilling project.

### 5.2 Background Partners

#### 5.2.1 Partner 1

Name : MOHAMMAD SHAHRIL BIN YUSOF  
Identity card number : 000614-14-1773  
Address : LOT 48 JALAN GAJAH 1 KAMPUNG KUBU GAJAH  
SUNGAI BULOH 47000 SELANGOR  
Telephone number : 017-6390874  
Email address : [shahrilm553@gmail.com](mailto:shahrilm553@gmail.com)  
Date of birth : 14 / 6 / 2000  
Age : 21 years old  
Marital status : Single  
Academic : Diploma in Mechanical Engineering  
Qualification  
Course attended : Project 2  
Skills : Mechanical Workshop and Maintenance  
Experience : Handle Lathe Machine and Various type of welding  
Present occupation : Student in Politeknik Sultan Salahuddin Abdul Aziz Shah

### 5.2.2 Partner 2

Name : ABDUL AZHAR BIN ABDUL RAHMAN  
Identity card number : 000216-13-0219  
Address : NO 70, LORONG 4A, TAMAN SOURABAYA INDAH,  
93050, KUCHING SARAWAK  
Telephone number : 012-8220219  
Email address : [aabar1602@gmail.com](mailto:aabar1602@gmail.com)  
Date of birth : 16 / 2 / 2000  
Age : 21 years old  
Marital status : Single  
Academic : Diploma in Mechanical Engineering  
Qualification  
Course attended : Project 2  
Skills : Machine handling  
Experience : Restaurant Maintenance  
Present occupation : Student in Politeknik Sultan Salahuddin Abdul Aziz Shah

### 5.2.3 Partner 3

Name : NURHAMIZAH SHAHIREEN BINTI NOR HISHAM  
Identity card number : 000919-14-0296  
Address : 39 DESA DAMAI, PERSIARAN ALAM DAMAI, ALAM  
DAMAI CHERAS, 56000 KUALA LUMPUR  
Telephone number : 011-33191609  
Email address : [nurhamizah.shahireen@gmail.com](mailto:nurhamizah.shahireen@gmail.com)  
Date of birth : 19 / 9 / 2000  
Age : 21 years old  
Marital status : Single  
Academic : Diploma in Mechanical Engineering  
Qualification  
Course attended : Project 2  
Skills : Maintenance  
Experience : Used to work as Cashier at Popular  
Present occupation : Student in Politeknik Sultan Salahuddin Abdul Aziz Shah

### 5.3 Organization / Management / Administration Plan

#### 5.3.1 Mission, Vision & Objective

Table 5.1 Mission, Vision & Objective

<b>Mission</b>	<b>To fabricate smart grill that help ease grilling action</b>
<b>Vision</b>	<b>i. Establish a firm budget to operate and manage the business from concept to start up to operation, with good cash flow and consistent profits.</b> <b>ii. Explore potential growth in downtown market and evolve new sources of business.</b>
<b>Objective</b>	<ul style="list-style-type: none"><li><b>• To design and develop an auto smart grill</b></li><li><b>• To minimize grilling time</b></li><li><b>• To improve ergonomic factor in the product</b></li></ul>

**5.3.2 Organization Chart**

The organization chart is shown in Chart 5.1.

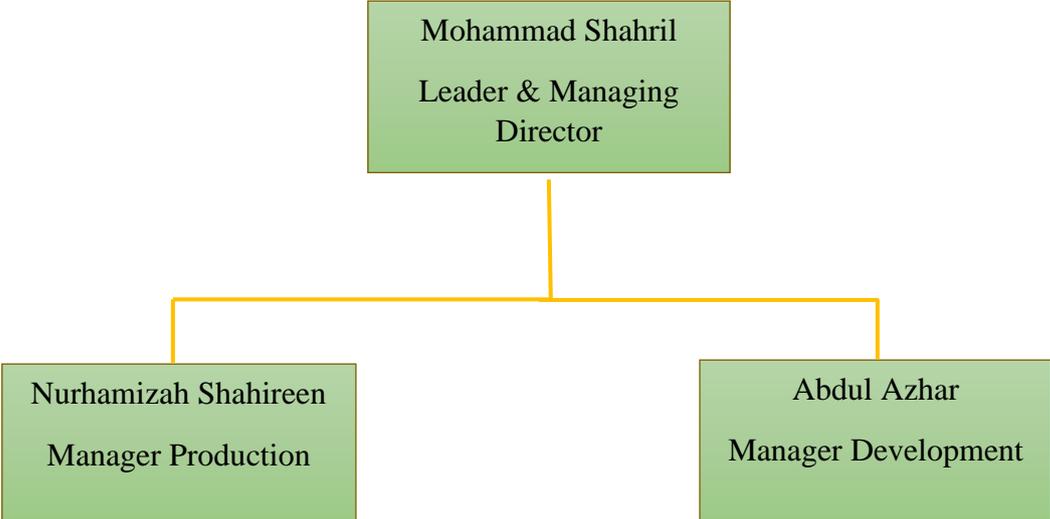


Figure 5.1 Organization Chart

### 5.3.3 Schedule of task and responsibilities

Table 5.2 Responsibilities description

<b>Task</b>	<b>Responsibilities description</b>
<b>Leader</b>	<ul style="list-style-type: none"> <li>• Provides encouragement to team members, including communicating team goals and identifying areas for new training or skill checks.</li> <li>• Answers team member questions, helps with team member problems, and oversees team member work for quality and guideline compliance.</li> <li>• Provides quality customer service, including interacting with customers, answering customer enquiries, and effectively handling customer complaints.</li> </ul>
<b>Managing Director</b>	<ul style="list-style-type: none"> <li>• Developing and executing business strategies to achieve short and long-term goals.</li> <li>• Assessing, managing, and resolving problematic developments and situations.</li> <li>• Overseeing the company's business operations, financial performance, investments, and ventures.</li> </ul>
<b>Manager Production</b>	<ul style="list-style-type: none"> <li>• Ensure that the production will be cost effective by estimating costs and negotiating and agreeing budgets with both clients and managers.</li> <li>• Monitor productivity rates and product standards and implement quality control programs.</li> <li>• Ensure customer orders are completed on time and to budget and that quality standards and targets are met.</li> </ul>

<b>Manager Development</b>	<ul style="list-style-type: none"><li>• Analyze and create project scope and milestones for several company initiatives.</li><li>• Ensure proper communication concerning changes in established milestones or challenges that may affect the outcome of a project's completion date.</li><li>• Communicate and organize with team members to increase the company's outreach.</li></ul>
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## 5.4 Marketing Plan

### 5.4.1 Target Market

The target market of this product is for every households and for small industries. Hungrill reduce a little bit of the average time needed by other grill to cook and has improve ergonomic factor in the product.

### 5.4.2 Competitor ( strength / weakness )

Competitors refer to other businesses that offer similar product/service.

Table 5.3 Strengths and weakness of competitors

<b>Competitor</b>	<b>Product</b>	<b>Strengths</b>	<b>Weakness</b>
Home Pro	Selling varies types of innovative products.	-Marketing and promotional strategies. -Uniqueness and ergonomic.	-Product pricing.
Aeon Big	Selling many types of bbq product	-The price is quite affordable with the quality of the product.	-Had competitor in market.

### **5.4.3 Advertising Strategy**

#### **i. Direct Marketing**

- Selling products directly to consumers. In this model, sales agent build face-to-face relationship with individuals by demonstrating.

#### **ii. Flyer / Business Card**

- Enable to track the number of response and purchase precisely.

#### **iii. Website**

- After discovering the wide range benefits of website in promoting products and services online, it has soon become the leading medium for marketing all over the world.

#### **iv. Direct Mail**

- Introduce a new products to customers from time to time.

## 5.5 Sale and Marketing Plan

### 5.5.1 Marketing Strategies

Table 5.4 below shows the marketing strategies.

Table 5.4 Marketing strategies with description

<b>Criteria</b>	<b>Description</b>
Product	<ul style="list-style-type: none"><li>• Using quality materials.</li><li>• Safety priorities for product use.</li></ul>
Price	<ul style="list-style-type: none"><li>• Affordable price.</li><li>• Able to be bought by various types of society.</li></ul>
Promotion	<ul style="list-style-type: none"><li>• Every purchase of 1 Hungrill or more units will get 5 free gifts.</li><li>• Get cashback if the product is damaged.</li></ul>

## 5.5.2 Operational Objective

In business, **operational objectives** are short-term goals whose achievement brings an organization closer to its long-term goals. It is slightly different from strategic objectives, which are longer term goals of a business, but they are closely related, as a business will only be able to achieve strategic objectives when operational objectives have been met. This business term is typically used in the context of strategic management and operational planning. There a few operational objective has been highlighted:

### a) Improving Product Quality

Improving, or at least maintaining, the quality of services, products and marketing practices is always to be the first plan for any business success. Often many business managers/owners wonder they provide the same product/service to customers as their competitor do, but the competitor is winning and they are losing. This is just because they lack something called ‘dedication for quality’. Although the difference will be very minute but it is the deciding factor.

### b) Cross-sell Product

The action or practice of selling an additional product or service to an existing customer. In practice, businesses define cross-selling in many different ways. Elements that might influence the definition might include the size of the business, the industry sector it operates within and the financial motivations of those required to define the term. Cross-selling involves an element of risk that existing relationships with the client could be disrupted. For that reason, it is important to ensure that the additional product or service being sold to the client or clients enhances the value the client or clients get from the organization.

**c) Reliable Product**

Reliability is the probability that a product or equipment will perform satisfactorily for a given time under normal conditions of use. So reliability is related to quality but it is something more than that. Quality is concerned with the initial performance of a product or a service whereas reliability is related to the continuation of performance over a period of time.

**d) Improve Customer Retention**

Customer retention refers to the ability of a company or product to retain its customers over some specified period. High customer retention means customers of the product or business tend to return to, continue to buy or in some other way not defect to another product or business, or to non-use entirely. Selling organizations generally attempt to reduce customer defections. Customer retention starts with the first contact an organization has with a customer and continues throughout the entire lifetime of a relationship and successful retention efforts take this entire lifecycle into account. A company's ability to attract and retain new customers is related not only to its product or services, but also to the way it services its existing customers, the value the customers actually perceive as a result of utilizing the solutions, and the reputation it creates within and across the marketplace.

**5.5.3 Operational Process**

The operational process chart is shown in Chart 5.2.

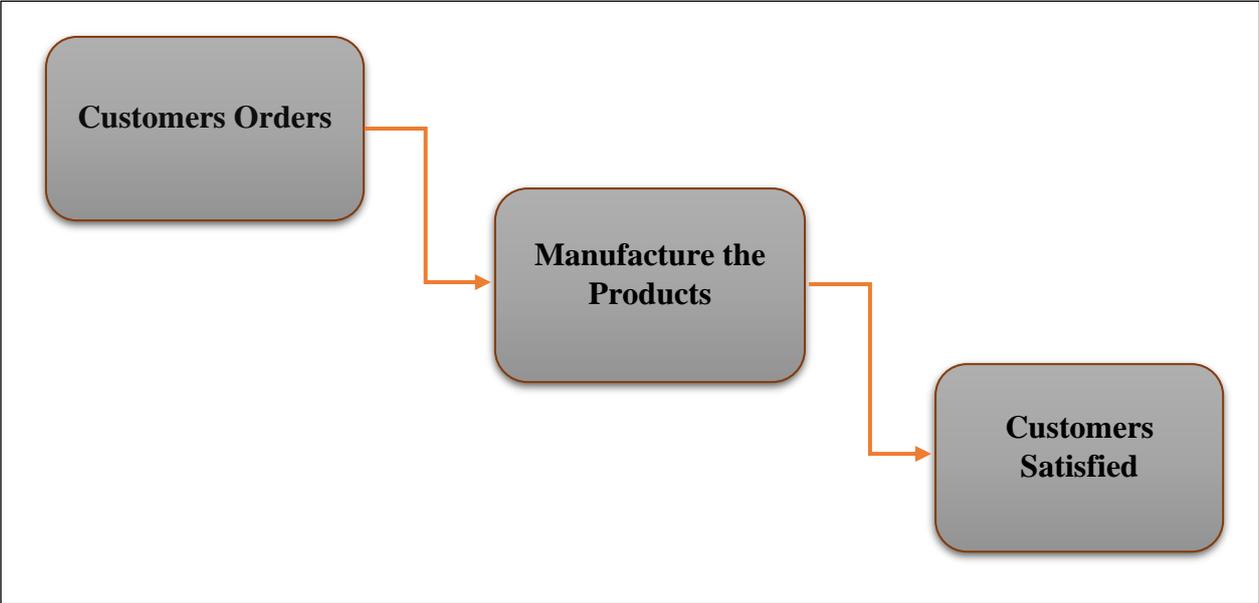


Figure 5.2 Operational Process

## **5.6 Conclusion**

Hungrill main product is a barbecue or grill sets and its main consumer's targets are household and small industries. The objectives stated has been achieved by improvements made on the automatic grill. Ergonomic factors has been improved by having a very portable size, since the size of Hungrill has been minimized to a size that is effective enough to grill food in small quantities.

## **CHAPTER 6**

### **CONCLUSION AND RECOMMENDATION**

(Prepared by MOHAMMAD SHAHRIL BIN YUSOF)

#### **5.1 Introduction**

Each project has its own advantages and objectives. Although there are many weaknesses but many objectives have been achieved. The findings of this study are supported by opinions that can strengthen the results of the study and thus reach its conclusion.

#### **5.2 Conclusion**

Through this project, it helps develop creativity in creating a project and modify existing project to be more energy efficient while working with new method of fabrication. The objectives stated has been achieved by improvements made on the automatic grill. Cooking time has been reduced as the food can be grilled evenly on each side. Ergonomic factors has been improved by having a very portable size, since the size of Hungrill has been minimized to a size that is effective enough to grill food in small quantities. This can be evidenced by the addition of a cooling dispenser on Hungrill that can be used by every user to store raw materials, thus easing the burden of the user.

#### **5.3 Recommendation**

Hungrill is based on rough idea that is combine together from three people while it is still new the product, a lot of improvement can be added to this product. For example, build in a smaller and more ergonomic in size and weight, make a stand separately from the product or make so it can be modified on the product.

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## **APPENDICES**

APPENDIX A1	Gantt Chart 1
APPENDIX A2	Gantt Chart 2
APPENDIX B	Cost and expenses
APPENDIX C1	Poster Pitex

**TIMEFRAME FOR FINAL YEAR PROJECT 1**

MONTHS/ WEEKS	January				February				March			
	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
Identify problems and come up with ideas												
Data collection and proposal implementation												
Created design												
Product selection and material study												
Manufacturing process												
Proposal												

	<b>Planning</b>
	<b>Implementation</b>

**TIMEFRAME FOR FINAL YEAR PROJECT 2**

MONTHS/ WEEKS	August				September				October			
	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
Abstract	Planning	Planning	Planning									
		Implementation	Implementation									
Registration MyIpo				Planning	Planning	Planning						
				Implementation	Implementation	Implementation						
Innovation report and video PITEX							Planning	Planning				
							Implementation	Implementation	Implementation			
Finishing product								Planning	Planning	Planning		
								Implementation	Implementation	Implementation		
Product test										Planning	Planning	
										Implementation	Implementation	
Report											Planning	Planning
											Implementation	Implementation

APPENDIX A2

Planning	
Implementation	

List of Materials and Approximate Expenses (cost)

<b>NO.</b>	<b>MATERIAL</b>	<b>PRICE PER UNIT</b>	<b>QUANTITY</b>	<b>AMOUNT</b>
1	Cooling Dispenser	RM 37	1	RM 37
2	Wood Plate	RM 60	1	RM 60
3	Bright Light Iron Hinges	RM 1.50	1	RM 1.50
4	CSK Head	RM 0.50	10	RM 2.00
5	Magnet Round	RM 1.20	4	RM 4.80
6	DC Motor	RM 26	1	RM 26
7	Iron Wire	RM 2.74	1	RM 2.74
8	Grill Plate	RM 10.90	2	RM 21.80
9	Gear	RM 0.20	2	RM 0.40
10	Pulley Offer	RM 8	2	RM 16
11	Matrix (12v/2.2AH) Sealed Lead Acid Battery	RM 48	1	RM 48
12	DC Motor 200rpm (DC12v)	RM 34	1	RM 34
13	Wire Single Core	RM 1	2	RM 2
14	Screw + Nut M3*10	RM 0.30	2	RM0.60
15	M3.5X16 Hemex Chipboard Screw	RM 3.50	1	RM 3.50
16	Screw	RM 1.50	3	RM 4.50
17	Bracket 20*20MM	RM 1.70	2	RM 3.40
18	White Wheel	RM 6.50	1	RM 6.50
19	Hinge GQ	RM 1.70	1	RM 1.70
20	Rubber Door Seal	RM 48	1	RM 48
21	Gold Twist Drill	RM 2.35	1	RM 2.35
22	Spray Paint Flat White	RM 5.50	1	RM 5.50
23	Spray	RM 18	1	RM 18
24	Shellac	RM 34	1	RM 34
25	Soft Pack Thermal Paste Compound Heatsink	RM 1.90	1	RM 1.90
26	Paint Brush	RM 2.80	1	RM 2.80

<b>27</b>	Bracket L (Flat) 4"x4"	RM 2.80	4	RM 11.20
<b>28</b>	Wood Filler	RM 10.50	1	RM 1.50
			<b>TOTAL</b>	<b>RM 401.70</b>

## APPENDIX C1



# HUNGRILL

Mohammad Shahril Bin Yusof

Abdul Azhar Bin Abdul Rahman

Nurhamizah Shahireen Binti Nor Hisham

Politeknik Sultan Salahuddin Abdul Aziz Shah



### PENERANGAN INOVASI

This research is based on the current manual method of grilling. Grilling is a form of cooking that involves dry heat applied to the surface of food, commonly from above, below or from the side. Grilling usually involves a significant amount of direct, radiant heat and tends to be used for cooking meat and vegetables quickly. It has been noted that grills used today are huge, not easily portable, delivers unevenly cooked food and time consuming. There are a few objectives that have been highlighted, which is to design and develop an auto smart grill, as well as to minimize grilling time. However, the grill is limited for small size dishes. The grill design is based on rectangular shape, a simple design which combines with another two product, a cooling plate and a condiment dispenser. The fabrication process comprises of cutting the wooden and iron plate and then welding the iron plate for each part. Finishing is conducted accordingly before thoroughly testing the product. Modifications were then carried out to resolve problems met during testing process. It is expected for the Hungrill to be available for commercial use and reduce cooking time. Future recommendation include installing cooling dispenser and DC motor.

### OBJEKTIF

- To design and develop an auto smart grill
- To minimize grilling time

### IMPAK INOVASI

- Easy to use and operate
- Easy to clean
- Portable and eco friendly
- Minimize grill time
- Efficient in grilling
- Keep food constantly fresh
- Low cost maintenance

### BLOK DIAGRAM/CARTA ALIR OPERASI



Atas



Sisi



Hadapan



Sisi