POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

LEMANG BURNING MACHINE

NAME	REGISTRATION NO
MOHAMMAD AINIL NASIHIN BIN AZHARI	08DEP20F1034

This report submitted to the Electrical Engineering Department in fulfillment of the requirement for a Diploma in Electrical Engineering

JABATAN KEJURUTERAAN ELEKTRIK

SESI 1 : 2022/2023

Student Name & Matrix No	MOHAMMAD AINIL NASIHIN BIN AZHARI 08DEP20F1034
Course Name	Diploma in Electronic (Communication)
Department	Department of Electrical Engineering
Course's Code	DEE50102
Supervisor Name	NURUL AKMAR BINTI KAMARUDDIN

CONFIRMATION OF THE PROJECT

The project report titled "Lemang Burning Machine" has been submitted, reviewed and verified as a fulfills the conditions and requirements of the Project Writing as stipulated

Checked by :

Supervisor’s name : Puan Nurul Akmar Binti Kamaruddin

Supervisor’s signature :

Date :

Verified by :

Project Coordinator name :

Signature of Coordinator :

Date :

"I acknowledge this work is my own work except the excerpts I have already explained to our source"

1. Signature :

Name : **Mohammad Ainil Nasihin Bin Azhari**

Registration Number : **08DEP20F1034**

Date : **17 December 2022**

DECLARATION OF ORIGINALITY AND OWNERSHIP

TITLE : LEMANG BURNING MACHINE

SESSION: SESI 1 : 2022/2023

1. I, **1. Mohammad Ainil Nasihin Bin Azhari [08DEP20F1034]**

   is a final year student of **Diploma in Electrical Engineering, Department of Electrical, Politeknik Sultan Salahuddin Abdul Aziz Shah**, which is located at **Persiaran Usahawan, Seksyen U1, 40150 Shah Alam, Selangor**. (Hereinafter referred to as 'the Polytechnic').

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a) **Mohammad Ainil Nasihin Bin Azhari**)
(Identification card No: **020514060069** ....…….
) **Mohammad Ainil Nasihin Bin Azhari**

In front of me, **Nurul Akmar Binti Kamaruddin**) …….....……
NO IC: 0) **Nurul Akmar Binti Kamaruddin**
As a project supervisor, on the date:

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All thanks and thankfulness to Allah SWT, I beg for his abundant grace during my research so that this project can be effectively completed.

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ABSTRACT

Lemang is one of Malaysia's famous heritage foods and a traditional dish for the Malays when celebrating festivals such as Hari Raya. Usually, lemang is served with rendang or serunding. The basic ingredients to produce lemang are glutinous rice, coconut milk and a little salt as a flavor and it has a unique aroma. Lemang that has been cooked cylindrical in shape with a size measurement of approximately 1 foot long and 2 inches in diameter will cut into slices before serving. Each lemang stem is estimated to be appropriate to be served to five to six guests. Lemang is cylindrical as it is cooked in a cylindrical tube container of bamboo. Lemang bamboo is a type of bamboo that has long segment structure and thin walls. A bamboo tree should be cut accordingly each segment with an open top and a closed bottom to serve as a container cooking. The process of cooking lemang is done by placing the lemang bamboo at an angle on the edge of fire or embers and this process is done in the open. Ingredients needed for the preparation of lemang are glutinous rice, coconut milk, salt, banana leaves and bamboo.

ABSTRAK

Lemang merupakan salah satu makanan warisan Malaysia yang terkenal dan hidangan tradisi orang Melayu ketika menyambut perayaan seperti Hari Raya. Biasanya lemang dihidangkan bersama rendang atau serunding. Bahan asas untuk menghasilkan lemang ialah pulut, santan dan sedikit garam sebagai perisa dan mempunyai aroma yang unik. Lemang yang telah dimasak berbentuk silinder dengan ukuran ukuran lebih kurang 1 kaki panjang dan 2 inci diameter akan dipotong-potong sebelum dihidangkan. Setiap batang lemang dianggarkan sesuai untuk dihidangkan kepada lima hingga enam tetamu. Lemang berbentuk silinder kerana ia dimasak dalam bekas tabung silinder daripada buluh. Buluh lemang merupakan sejenis buluh yang mempunyai struktur ruas yang panjang dan berdinding nipis. Sebatang pokok buluh hendaklah dipotong mengikut setiap ruas dengan bahagian atas terbuka dan bahagian bawah tertutup untuk dijadikan bekas memasak. Proses memasak lemang dilakukan dengan meletakkan buluh lemang secara bersudut di tepi api atau bara api dan proses ini dilakukan secara terbuka. Bahan-bahan yang diperlukan untuk penyediaan lemang ialah pulut, santan, garam, daun pisang dan buluh.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Lemang is one of the typical Malay foods made from white glutinous rice and is cooked inside a bamboo stalk cavity using a direct open fire method. An existing cooking technique is still using manual methods especially for turning the bamboo, so it becomes harmful for hand. This research aims to design, fabricate, and evaluate a lemang rice cooking device integrated with a continuous rotating system. This project intends to create a prototype of a lemang burning machine that uses a heating rod and does not require a huge labour to run. The control of the mechanical movements connected by the moto and the chain is part of the prototype revenue with a system that uses an Arduino Uno and Motor Driver to control a revolving motor. The target for our project is for lemang seller but we also ask the lemang buyers for improvement for our projects. Analysis of the design had been carried out based on considerations of design alternatives, then the static load simulation was carried out using finite element analysis to obtain a robust device design that is ready for manufacture. By using a continuous rotating system, the risk of hand burning and the overcook bottom-part of lemang can be reduced.

1.2 Background Research

There are some production issues with the conventional lemang cooking procedure. Lemang being cooked unevenly, a lot of labour is needed, and fuels like charcoal are not consumed thoroughly. This project's goal is to create a semi-automatic lemang machine utilising a heating rod without using a lot of labour. Controlling mechanical motions is necessary for the creation of this prototype. This prototype can take the place of the conventional way of burning lemang and operates with little labour. This idea also creates a system that uses an Arduino Uno to control a revolving motor. After entering the coding into the Arduino Uno, we used the Motor Driver to control the motor's rotation directions speed. Rotational movements are created via sprocket, wiper link motor and chains. Sprocket and chain are used to connect these mechanical parts. I also utilise an alternating current to direct current power supply to power the arduino uno, motor driver, and wiper link motor. The trials' findings demonstrate that baking the lemang takes less than three and a half hours and doesn't involve a lot of labour.

1.3 Problem Statement

During the festive season, especially aidlifitri, lemang becomes the food of choice to celebrate the festive day. At a time when the demand for lemang is very high during the festive season. However, the traditional lemang cooking method has disadvantages in terms of work productivity, time and quality. It requires a lot of manpower, fuel consumption such as incomplete charcoal and lemang cooked unevenly or raw. At the same time the baked lemang needs to be inspected all the time and it is quite difficult as the traditionally baked lemang takes 4 to 5 hours.

1.4 Research Objectives

The objective of this project is to produce a prototype of a burning machine using heating rod and privately and to develop a system that can control rotating motor by using Arduino uno which operates without the need for a large workforce. Prototype income is generated by controlling mechanical motions. The term "responsibility" refers to the act of determining whether or not a person is responsible for his or her own actions. A motor and chain are used to generate a rotational motion. These mechanical components are connected to the motor and the chain. Also employ an

alternating current to direct current power supply to power the arduino uno, motor driver, and wiper link motor.

1.5 Scope of Research

This project proposes to construct a prototype of a lemang burning machine that employs a heating rod and does not demand a significant labour to run. The prototype income includes the use of a motor driver and an Arduino uno to control the mechanical motions linked by the motor and the chain. Our project's target audience is lemang sellers, but we also solicit feedback from lemang customers to enhance our initiatives.

1.6 Project Significance

The traditional practise of burning lemang is still employed by the majority of lemang traders today. There are several drawbacks to employing such methods, including overcooking, uneven cooking, which results in some raw lemang, and traditional burning, which produces smoke, air pollution, and greenhouse gas emissions. The purpose of our project is to create the hardware for a lemang burning machine that uses a heated rod as the heating element. We also wish to assist the lemang vendor in making their job easier while also satisfying the consumer. Following that, we used an Arduino uno in the project and discovered several programming and coding tools.

1.7 Chapter Summary

This chapter 1 explains the project's introduction. Lemang is a traditional Malay dish prepared from white glutinous rice and cooked inside a bamboo stalk cavity over an open fire. Following that, conduct background research on various production concerns with the traditional lemang cooking technique. Following that, a problem statement concerning During the festival season, especially during Aidilifitri, lemang is the cuisine of choice to commemorate the occasion. Finally, the extent of study on This project intends to build a prototype of a lemang burning machine that uses a heating rod and does not require a lot of labour to run.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

As a consequence of our research, we discovered a lot of new information about this project based on the research paper we reviewed. We investigate several types of heating and ways for developing the hardware of a lemang burning machine that uses a heating rod as the heating element. Following that, we used an Arduino uno and a motor driver in the project and discovered various tools to assist us with programming and coding in order to construct the rotating system that can spin the lemang mould for a decent cooking outcome.

2.2 Literature Review

Wan Mohd Fariz (2018) in this paper, a technological revolution of lemang production has been developed under the name of Machine Lemang Mini MARDI. The basic form of this machine innovation consists of a steel casing cylindrical in shape that serves as a cooking container. The cylindrical shape is chosen for retains the traditional physical characteristics of lemang cooked in bamboo. Technology these are capable of operating in two conditions i.e. singly or in combinationtechnology. The single concept means the lemang cooking container has been equipped with special electric heating system in one unit and while the concept of a combination of technologiesmeans the lemang cooking container is adapted to the cooking utensils in the kitchen i.e.rice cooker. The main focus of this technology developed is to produce a technology suitable for household or domestic use. Cooking period the length required if using a single concept is for 70 minutes with a cooking heat efficiency rate of 54% while the period for the combined concept the technology is for 120 minutes with a cooking heat efficiency rate of 8.83% [1].

Amir fitri bin samsuddin (2016), the traditional lemang cooking method has some drawbacks in terms of work productivity. It requires a lot of manpower, the

consumption of fuels such as charcoal is not thorough and lemang is cooked unevenly. The objective of this project is to produce a prototype of a lemang burning machine using the principle of an oven that operates without the need for a lot of manpower. The production of this prototype involves the control of mechanical movements. This prototype is able to replace the traditional method of burning lemang and does not require a lot of manpower to operate. The project started by producing technical sketches using INVENTOR software. Then based on the sketch, this prototype was produced. Couplings and chains are used to produce rotational movements. These mechanical components are connected to sprocket and chain. Through the experiments conducted, the results show that the lemang is ready to be baked in less than three and a half hours without requiring much labor[2].

Suhaila Hussain (2015) , the normal way of cooking lemang is by putting it in open fire for more or less 2 hours. By using the lemang oven, the cooking time was reduced to about 1 hour and 20 minutes. A 2-dimesional CFD simulation was done to look at the hot air distribution inside the oven and how it affects the conditions inside the oven and the lemang during cooking. Results for velocity profile, as well as turbulence kinetic energy were obtained. It was found that the turbulence which carries with it energy was highest at the bottom of the lemang which would mean that that part of lemang would cook the fastest as it receives greater amount of energy compared to other parts of the lemang. This was why the lemang was overcooked at that part as evident from the experimental results. These results would be used to further improve on the existing lemang oven [3].

S B Daulay (2021) in this paper ,tell about the weaknesses of Lemang cooking process can only be overcame by the use of machinery which replaces the need to turn Lemang every intervals of time and also diminish the exposure to smoke, hence, a need to design such machinery rises. We designed the Lemang cooker using heater element and steel cylinders to replace bamboo stems. In the operation of this Lemang cooker, we also need to measure the mechanical performance, the quality of the product and also economic analysis of the cooker's operation. The cooker hence would also be optimized in the terms of cooking time and temperature so that the optimum settings can be determined[4].

Diang Sagita (2021) in this paper research aims to design, fabricate, and evaluate a lemang rice cooking device integrated with a continuous rotating system. Analysis of

the design had been carried out based on considerations of design alternatives, then the static load simulation was carried out using finite element analysis to obtain a robust device design that is ready for manufacture. The overall dimension of the device is 2140 mm× 920 mm × 980 mm with a cooking capacity of 36 lemang per batch and has a bamboolemang speed of 15 rpm which is powered by a 0.5 hp electric motor. The new design of lemang cooking device has been manufactured by considering important parameters based on the requirement of the lemang producer i.e., still using bamboo due to the typical characteristic of lemang cooking and still using open fire cooking method due to the availability of biomass fuel. Performance test and evaluation of the cooking device has been carried out for observing heat distribution in bamboo using Analysis of Variance (ANOVA).[5]

2.2.1 Previous Research

Topic	Author	Method	Solution
Reka bentuk dan Penilaian prestasi mesin lemang mini MARDI	W.A. Wan Mohd Fariz, A. Mohd Shahrir, S. Asnawi, A. Saiful Azwan, J. Muhammad Aliq, A. Sha'fie, Z.A. Mohd Zaimi , S. Amir Redzuan, S. Mohd Azmirredzuan, M. A. T. Mohd Hafiz	Cooking using heating rod	a) Mesin Lemang Mini MARDI disambungkan kepada sumber elektrik dan tetapkan thermostat kepada 180 °C (Samsudin 1997). Lemang akan siap dimasak dalam masa 1 jam atau hingga 1 jam 30 minit bergantung kepada pengguna jika inginkan lemang bertekstur lembut atau yang rangup. b) Rod pemegang lemang dikepit perlahan-lahan dan tarik keluar pemegang lemang
Mesin pembakar lemang	AMIR FITRI BIN SAMSUDDIN, MOHAMAD MUHAIMEEN BIN MOHD HAZMAN , NURUL ASYIQIN BINTI ZAMRI	Cooking using charcoal	Beras pulut, santan, daun pisang, buluh serta arang. Selepas itu, buluh diletakkan diatas mesin dan bahan-bahan sedia dituang dibuluh yang telah diletakkan dimesin. Bahan dimasukkan kedalam buluh sebelum diletakkan ke atas tempat pembakaran. Seterusnya, proses diteruskan dengan

			menghidupkan arang. Proses pembakaran bermula.
2-DIMENSIONAL CFD SIMULATION OF THE AIR FLOW INSIDE A LEMANG	Suhaila Hussain, Roshaliza Hamidon	Cooking using oven method	the velocity of the hot air is higher near the bottom of the lemang. The velocity is higher there as it has the contribution of both forced convection from the fan on one side and natural convection from the heating element on the other side. Both opposing the paths of one and the other.
Lemang Cooker Optimization	S B Daulay*, A P Munir and L A Harahap	Cooking using oven method	Grains, rice in particular, is affected by several factors on its qualitative parameters, especially flavour, where the taste itself is a result of interaction between chemical reaction, cooking temperature, concentration, where the rise and decline of cooking temperature will affect mostly in sweet and salty taste.
Design, fabrication and thermal evaluation of *lemang* (rice bamboo) cooking device integrated with continuous rotating system	Diang Sagita*, Ari Rahayuningtyas, Yose Rizal Kurniawan, Novrinaldi	Cooking use charcoal	Parts of the cooking device are made from sturdy and heat-resistance materials The Cooking method uses direct fuel-burning system using available local biomass fuel (coconut shells, corn cob, firewood) The expected *lemang* capacity is 36 *lemang* per batch The Cooking device is designed to have a tilt adjuster mechanism

2.3 Chapter Summary

This section focusing on two different section, the this chapter extend the literature reviews that cater the information in accordance with the method of this project. The relevant information and other extra features were gathered as shown. The second section is discovered about the design was completed based on design choices, and the static load simulation was completed using finite element analysis to provide a robust device design that is suitable for manufacture.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

Our research method of this project is to produce a prototype of a lemang burning machine using heating rod and privately and to develop a system that can control rotating motor by using Arduino uno and motor driver which operates without the need for a large workforce.

3.2 Project Design and Overview

My project concept starts with an empty barrel and evolves into a complex shape with four critical hardware components: Arduino uno, motor driver, wiper link motor, heating rod, and power source. This project is also powered by an Arduino Uno and a motor driver. To create the schematic circuit, we utilise the proteus software.

3.2.1 Block Diagram of the Project

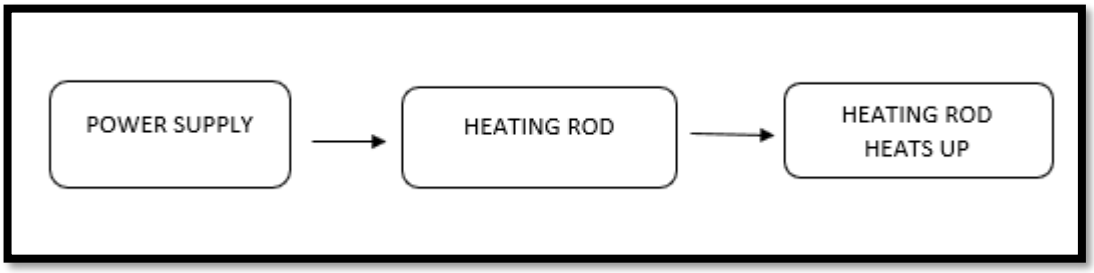


Figure 3.1

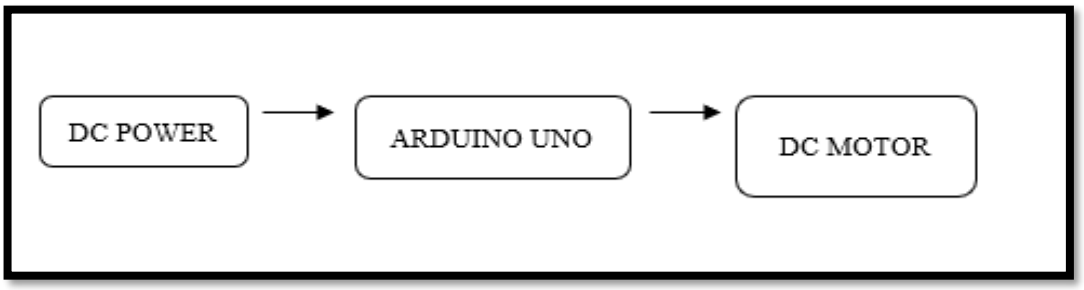


Figure 3.1.1

3.2.2 Flowchart of the Project 2

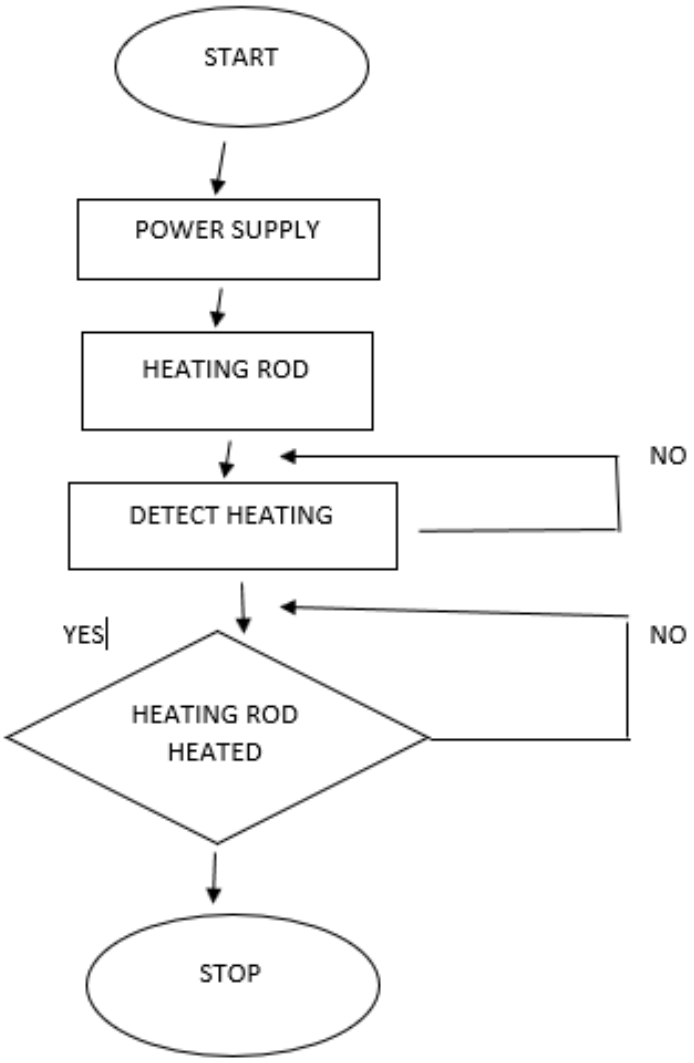


Figure 3. 1.2: Flow chart of operation of the system
*Images may be subject to copyright

3.2.3 Flow Chart (Figure 3.1.2) Description

According to the flow chart, the power supply ac to dc is the project's input. a power supply is a device that converts the output from an ac power line to a continuous dc output or many outputs. The alternating current voltage is rectified to produce pulsing direct current, which is subsequently filtered to produce a smooth voltage. The power supply powers components such as the arduino uno, heating rod, motor driver, and wiper link motor.

3.3 Project Hardware

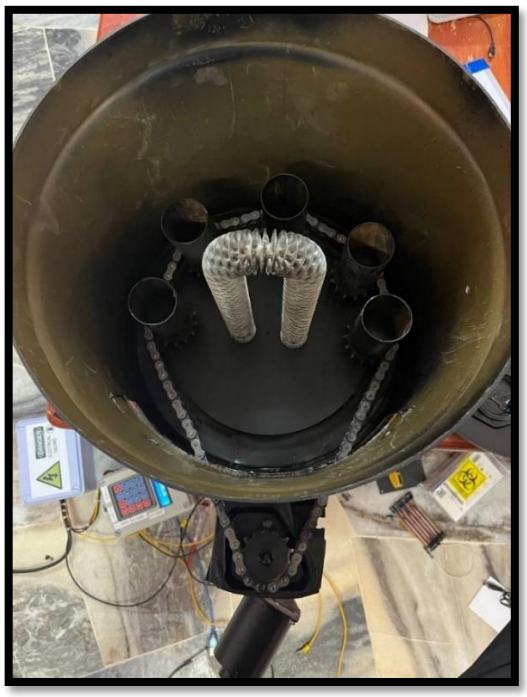


Figure 3.3.1

The combustion barrel has been welded with chains, gears, and mould placement, and the wiper link motor is ready to rotate.

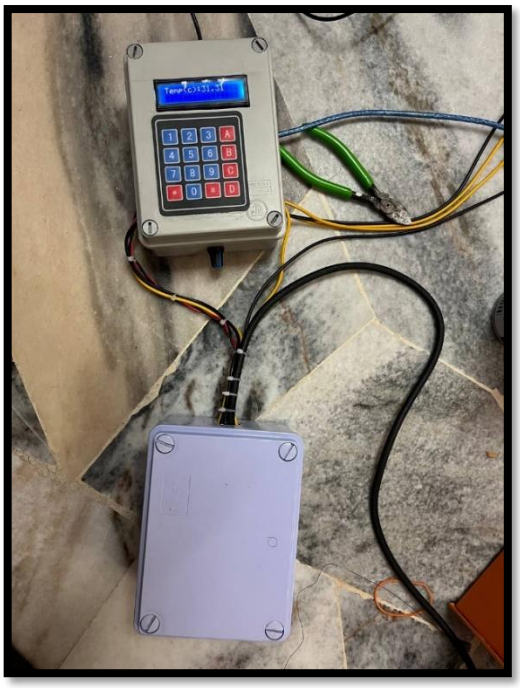


Figure 3.3.2

The power supply is what powers the arduino uno, LCD, motor driver, and heating rod. additionally, to move the mould, which is linked by gears and chains

3.3.1 Schematic Circuit

Figure 3.3.2shows the overall circuit diagram of this project

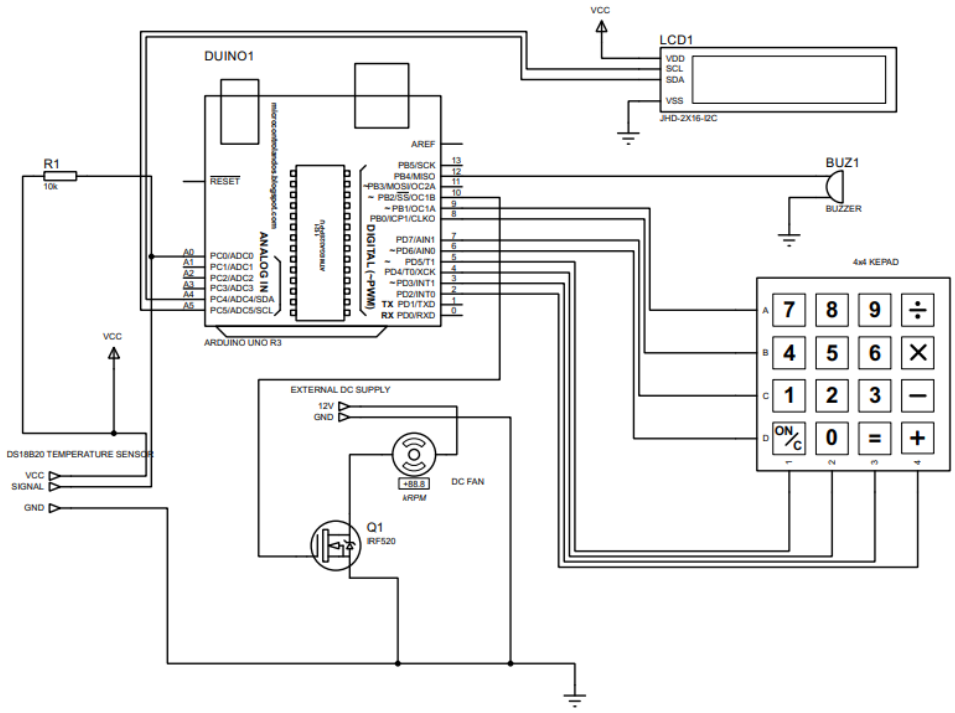


Figure 3..3.2: Circuit Diagram

*Images may be subject to copyright

Figure 3.3.2 shows a schematic circuit with an arduino uno as the main component controlling the programming of components such as an LCD, timer, temperature, dc current flow, and relay. The LCD acts as a timer and a temperature gauge. When the timer runs out, a buzzer will sound to signal the end of the game. Aside from that, the motor driver is a component that controls the movement of the motor.

3.3.2 Description of Main Component

The primary components are an arduino uno, a motor driver, a heating rod, and a wiper link motor. The arduino microcontroller is used to control time and temperature. The motor driver is then utilised to regulate the speed of the wiper link motor. Next, the

heating rod is used for the heating element and the last wiper link motor is used to move the lemang mould.

3.3.2.1 Component 1

Arduino Uno

Figure 3.3.2.1

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. Arduino UNO has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. The Arduino UNO board has six analog input pins A0 through A5. These pins can read the signal from an analog sensor like the humidity sensor or temperature sensor and convert it into a digital value that can be read by the microprocessor. Main microcontroller. Each Arduino board has its own microcontroller .

3.3.2.2 Component 2

MOTOR DRIVER

Figure 3.3.2.2

Motor speed controllers are electronic devices that control motor speed. They take a signal for the needed speed and drive a motor to that speed. There are a variety of motor speed controllers available. For applications where variable speeds are necessary, typically an AC motor with an Inverter or brush motors are used. Brushless DC motors are an advanced option due to their wide speed range, low heat and maintenance-free operation. Stepper Motors offer high torque and smooth low speed operation. Speed is typically controlled by manual operation on the driver or by an external switch, or with an external 0~10 VDC. Speed control systems typically utilize gearheads to increase output torque. Gear types range from spur, worm or helical / hypoid depending on torque demands and budgets. Mounting configurations vary to depending on space constraints or design of the application.

3.3.2.3 Component 3

Power Supply

Figure 3.3.2.3

Power supply is an electrical device that supplies electric power to an electrical load. The main purpose of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Some power supplies are separate standalone pieces of equipment, while others are built into the load appliances that they power. Examples of the latter include power supplies found in desktop computers and consumer electronics devices. Other functions that power supplies may perform include limiting the current drawn by the load to safe levels, shutting off the current in the event of an electrical fault, power conditioning to prevent electronic noise or voltage surges on the input from reaching the load, power-factor correction, and storing energy so it can continue to power the load in the event of a temporary interruption in the source power (uninterruptible power supply).

3.3.2.4 Component 4

Wiper Link Motor

Figure 3.3.2.4

Wiper motor function is to accelerate the lateral movements of the windshield wipers using a worm gear. This component is one of many safety features of the vehicles. Connected to wipers, the wiper motor enables the wiper to remove debris collected by the windshield for a clearer road view.

3.3.2.5 Component 5

I2C LCD 2004

Figure 3.3.2.5

I2C Serial Interface 20x4 LCD Module This is I2C interface 20x4 LCD display module, a new high-quality 4 line 20 character LCD module with on-board contrast control adjustment, backlight and I2C communication interface.

3.3.2.6 Component 6

DS18B20 TEMPERATURE SENSOR

Figure 3.3.2.6

The digital temperature sensor like DS18B20 follows single wire protocol and it can be used to measure temperature in the range of -67oF to +257oF or -55oC to +125oC with +-5% accuracy. The range of received data from the 1-wire can range from 9-bit to 12-bit.

3.3.2.7 Component 7

Heating Rod

Figure 3.3.2.7

Heating rod is a material or device that directly converts electrical energy into heat or thermal energy through a principle known as Joule heating. Joule heating is the phenomenon where a conductor generates heat due to the flow of electric current. As the electric current flows through the material, electrons or other charge carriers collide with the ions or atoms of the conductor creating friction at an atomic scale. This friction then manifests as heat. Joule‘s first law (Joule-Lenz law) is used to describe the amount of heat produced from the flow of electricity in a conductor.

3.3.3 Circuit Operation :

3.4 Project Software

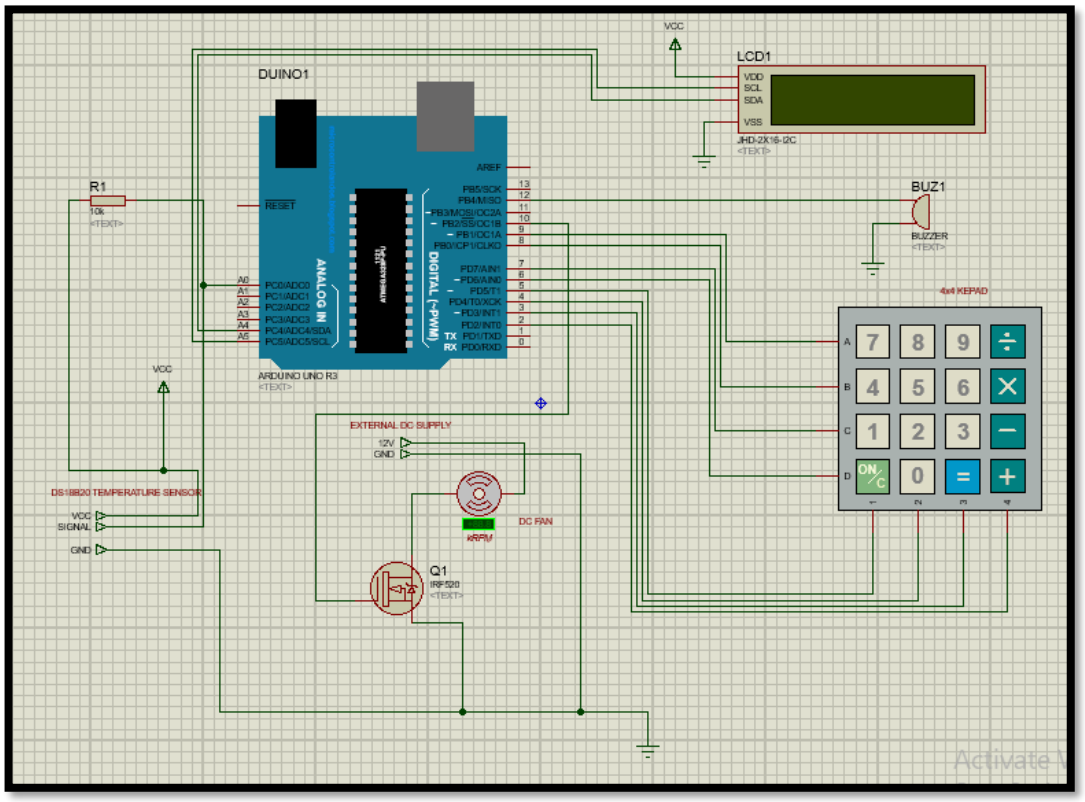


Figure 3.4

This circuit works when an Arduino uno. We were able to provide explanation of each circuits/components/I/O parts that use to develop the project very clearly and accurately using functional diagram and achieve the result. Next, I use I2C_LCD. I2c LCD is an easy-to-use display module, It can make display easier. Using it can reduce the difficulty of make, so that makers can focus on the core of the work. We developed the Arduino library for I2C_LCD, user just need a few lines of the code can achieve complex graphics and text display features. Depending on how the device maker designs the device, the keypad serves as a device for data entry in the form of numbers and letters on Arduino-based devices and is occasionally used as a navigation button to access the menus on a device.

3.4.1 Flowchart of the System

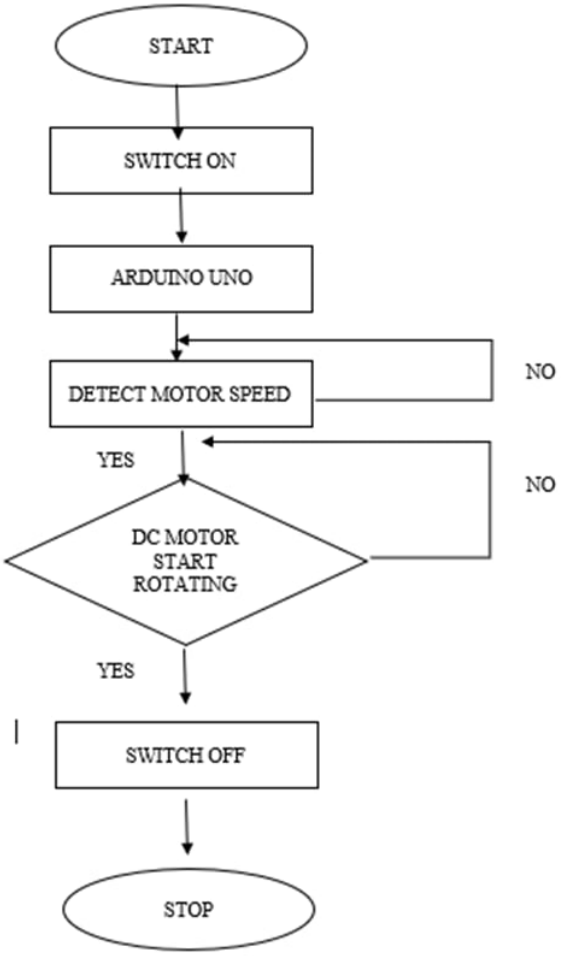


Figure 3.4.1

3.4.2 Description of Flowchart

We can see that this project software input data then the data and coding will give information to the arduino uno . The temperature and time required to run the programmed components are controlled by the arduino uno. Motor speed controllers are electronic devices that regulate the speed of a motor. They use a signal to determine the required speed and then drive a motor to that speed.

3.5 Prototype Development

Our project's input and processing components the motor driver and the Arduino Uno are finished. Other components include the motor driver, power supply, wiper link motor.

3.5.1 Mechanical Design/Product Layout

Figure 3.5.1

3.6 Sustainability Element in The Design Concept

Our project is safe and does not create fire since I use a heated rod and a power source that has its own short-circuit protection. There are several drawbacks to employing such methods, including overcooking, uneven cooking, which results in some raw lemang, and traditional burning, which produces smoke, air pollution, and greenhouse gas emissions. The purpose of our project is to create the hardware for a lemang burning machine that uses a heated rod as the heating element.

3.7 Chapter Summary

This chapter 3 discusses methodology, including its main component, the heating rod, which uses the Joule heating principle to convert electrical energy directly into heat or thermal energy. The arduino uno will receive information from the data and coding input by the project software, according to the flow chart's next description. The temperature and amount of time required to run the programmed components are controlled by the Arduino Uno. Last but not least, the design concept's sustainability component focuses on I use a heated rod and a power source with built-in short-circuit protection, which makes our project secure and prevents fire.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

This project's expected result is the ability to design a system that can obtain well-cooked lemang without the need for constant maintenance is the predicted outcome of this project. The movement and speed of the motor in this product are controlled by an Arduino Uno and motor driver. The purpose of this project is to develop a lemang machine that uses a heating rod and is semi-automatic while requiring little manual labour. For the production of this prototype, mechanical motion control is required. This prototype can replace the traditional method of burning lemang and requires less labour to run. The basic form of this machine innovation consists of a steel casing cylindrical in shape that serves as a cooking container. The cylindrical shape is chosen for retains the traditional physical characteristics of lemang cooked in bamboo. Technology these are capable of operating in two conditions singly or in combinationtechnology. The single concept means the lemang cooking container has been equipped with special electric heating system in one unit and while the concept of a combination of technologiesmeans the lemang cooking container is adapted to the cooking utensils in the kitchen rice cooker.

4.2 Results and Analysis

COOKING TIME (MINUTE)	TEXTURE	CONDITION
60	Not good(semi-liquid)	Raw
70	Not good(semi-liquid)	Raw
80	Not good (semi-soft)	Raw
90	Almost good(semi-soft)	Half cook
100	Almost good(semi-soft)	Half cook
110	Good	Cook
120	Good	Cook well
130	Good	Cook well
140	Not good(half hard)	Overcook
150	Not good(half hard)	Overcook

4.3 Discussion

By using a wiper link motor connected to a chain connected to a gear under each mold. Each mold will rotate clockwise in the barrel. Then the heating material is the heater rod will be turned on and heat and start cook the lemang in the mold. The heater temperature can be controlled. In a expected time the lemang will be cooked. The heater and motor connected to Dc/Ac power supply. The Wiper link motor rotation and temperature controlled by arduino UNO. The temperature will be display on lcd.

4.4 Chapter Summary

This project's expected outcome is the ability to design a system capable of producing well-cooked lemang without the need for constant maintenance. The basic form of this machine innovation is a cylindrical steel casing that serves as a cooking container. The cylindrical shape was chosen to preserve the traditional physical characteristics of bamboo-cooked lemang. The heating material, which is the heater rod, will then be turned on to heat and begin cooking the lemang in the mould.

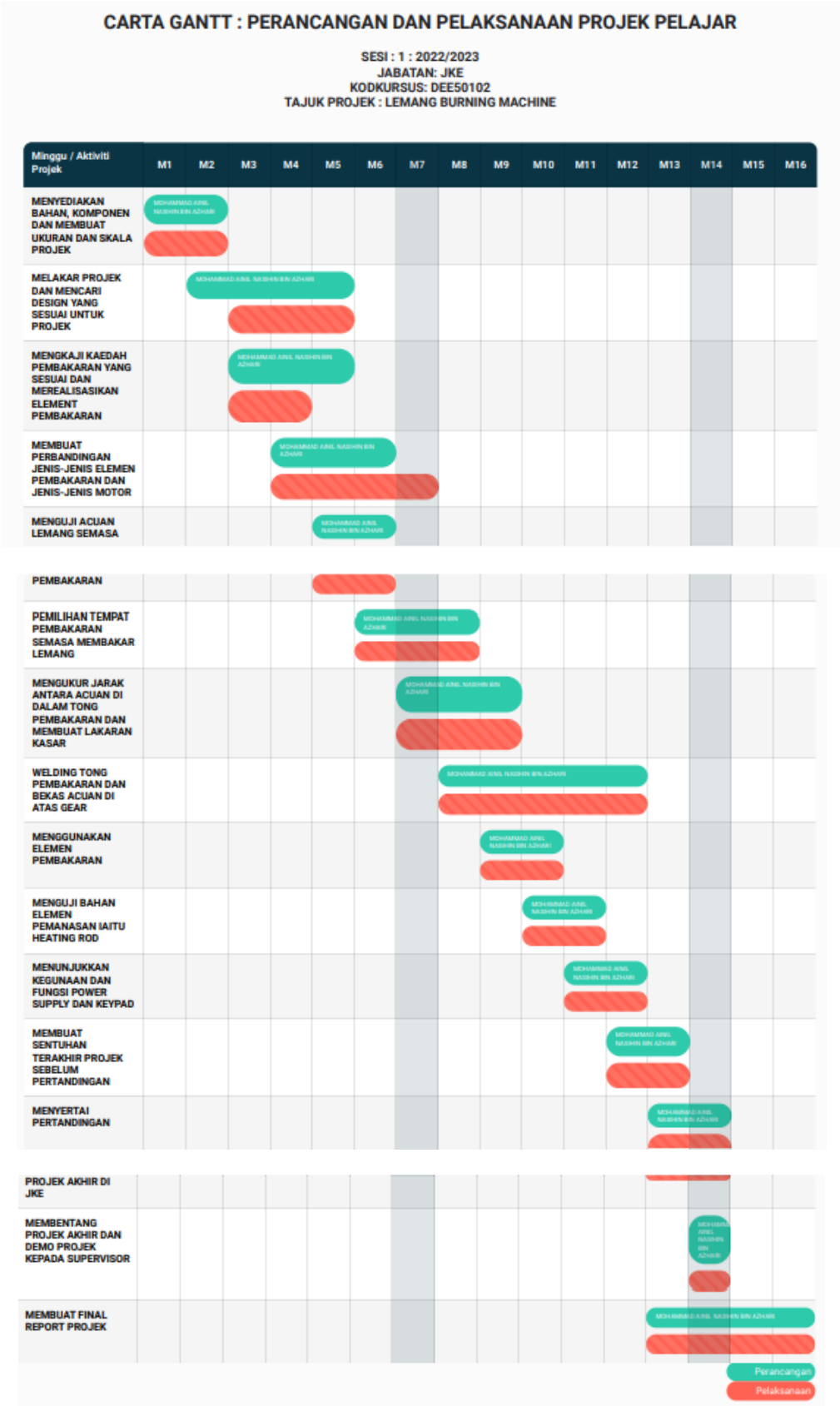
CHAPTER 5

PROJECT MANAGEMENT AND COSTING

5.1 Introduction

Every manufacturing process will have a cost to determine whether it is worthwhile. This project's element contains some used and rather expensive components. The arduino uno, temperature sensor, LCD display, wiper link motor, motor driver, relay, power supply, welding, and other project finishes have already been incorporated to estimate the true cost. The majority of the components are bought online because they are less expensive and more dependable after reading some of the comments in the section of the components you want to buy. The most expensive cost is in the welding section because skilled and experienced workers are required, and the cost is Rm1300. The project's pricing also aligns with one of the primary criteria of a competent project developer: a low-cost yet high-quality project.

5.2 Gant Chart and Activities of the Project



5.3 Cost and Budgeting

COMPONENT	QUANTITY	PRICE
ARDUINO UNO	1	RM 35.00
TEMPERATURE SENSOR	1	RM 5.00
LCD DISPLAY	1	RM 8.50
WIPER LINK MOTOR	1	RM 72.00
MOTOR DRIVER	1	RM 6.00
RELAY	1	RM 4.00
POWER SUPPLY	1	RM 25.00
WELDING		RM 1300.00
OTHER		RM 300.00
FINAL TOTAL		RM 1755.50

5.4 Chapter Summary

This chapter shown to determine whether a manufacturing process is worthwhile, it will have a cost. This project's element includes some used and rather costly components. The welding section has the highest cost because skilled and experienced workers are required, and the cost is Rm1300. The pricing of the project also corresponds to one of the primary criteria of a competent project developer: a low-cost yet high-quality project. This project's element contains some used and rather expensive components, but money cannot be purchased with life in the event of an incident. Although welding is quite expensive, I have applied for a grant to cover a portion of the cost.

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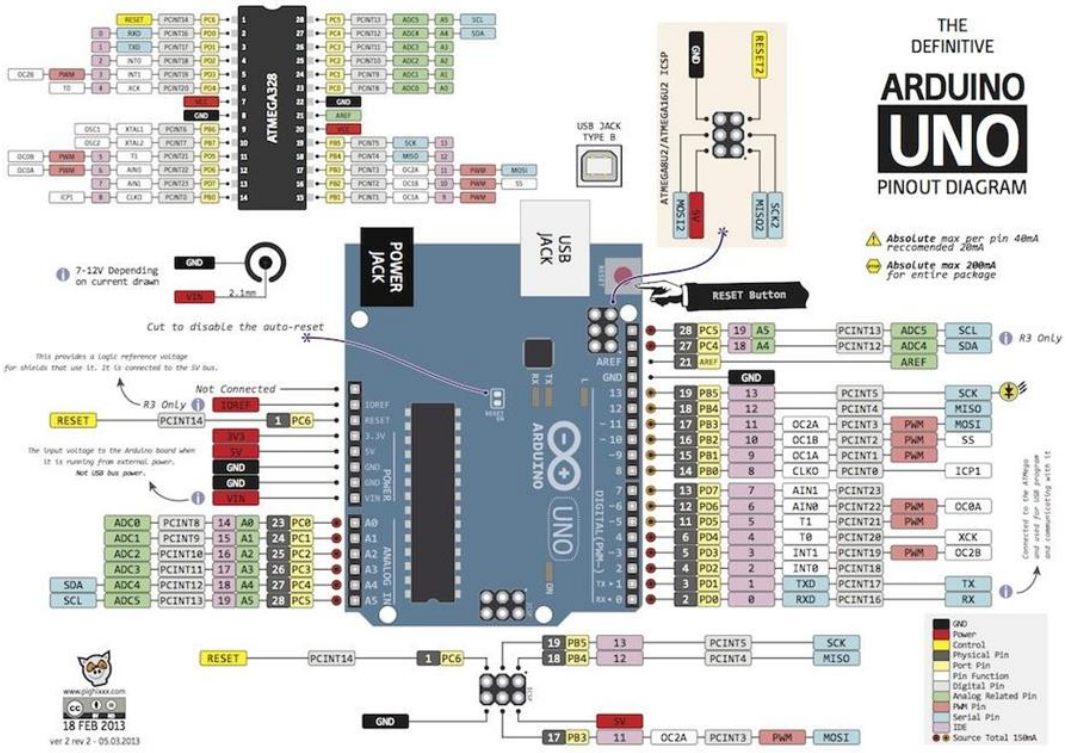
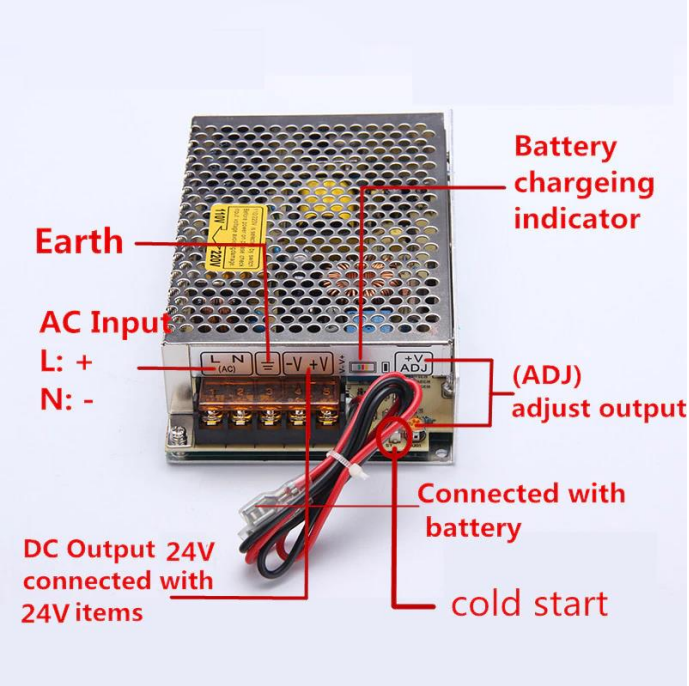
APPENDICES

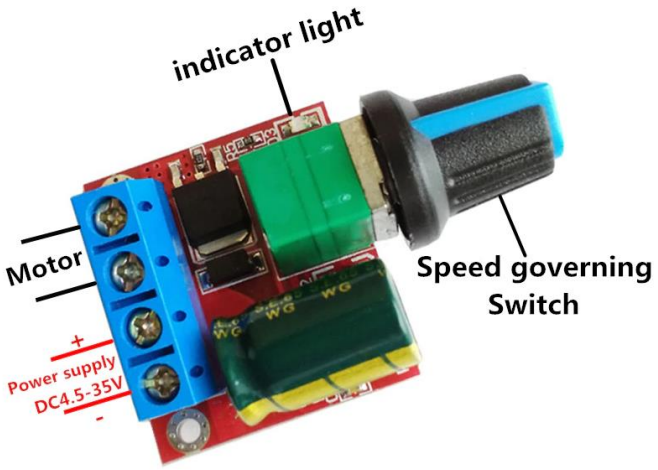
APPENDIX A- DATA SHEET



DATASHEET ARDUINO UNO



DATASHEET POWER SUPPLY



DATASHEET MOTOR DRIVER

APPENDIX B- PROGRAMMING

```
#include <Keypad.h>
#include <OneWire.h>
//#include <LiquidCrystal.h>
#include <Wire.h>  // Comes with Arduino IDE
#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x3F, 16, 2);
//LiquidCrystal_I2C lcd(0x27, 2, 1, 0, 4, 5, 6, 7, 3, POSITIVE);
// Set the LCD I2C address
//LiquidCrystal_I2C lcd(0x3F, 2, 1, 0, 4, 5, 6, 7, 3, POSITIVE);
//some address is different


#define Buzz 13
#define FAN 10
#define SW 12

OneWire  ds(A0);  // on pin 10 (a 4.7K resistor is necessary)

//Variable Declaration-----------------------------------------
-------
int WaitData=0;
String BTpassword="";
String dummy;
float SPEED=0;
int Ms1=0;
int Ms2=0;
int RQScount;
int WRONGCOUNT=0;
int countERROR;
int countPHONE;
int countOK;
int countKEY;
int commaPosition;
int index = 0;
int Pfull;
double PwordInx;
char check;
int  LOCK=0;
int Sec=0;
int minx=0;

String  PwordIn;
double  NowPword;
int mode=0;
int SMSX=0;
int StatusHIGHL;
float SetTemp=45;
float ActTemp=0;
String MESSAGE1="   WELCOME";
String MESSAGE2="  ";
int TSet=45;
int TimeSet=1;
int count;
int OP=0;
int FANSTATE=0;
```

```
int TXX=0;

const byte ROWS = 4;
const byte COLS = 4;
char keys[ROWS][COLS] = {
  {'D','#','0', '*'},
  {'C','9','8', '7'},
  {'B','6','5', '4'},
  {'A','3','2', '1'}
};
byte rowPins[ROWS] = {
  6,7,8,9}; //connect to row pinouts
byte colPins[COLS] = {
  2,3,4,5}; //connect to column pinouts

Keypad keypad = Keypad( makeKeymap(keys), rowPins, colPins, ROWS,
COLS );



void setup(){

  PwordIn = "";
  countKEY = 0;

 pinMode(Buzz,OUTPUT);
 pinMode(FAN,OUTPUT);
 pinMode(SW,INPUT);
 digitalWrite(SW,HIGH);
 digitalWrite(FAN,HIGH);
  Serial.begin(9600);

lcd.backlight(); // finish with backlight on
  lcd.begin();
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Initializing..");
  lcd.setCursor(0, 1);
  lcd.print("pls wait");
  delay(2500);


 lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print(MESSAGE1);
  lcd.setCursor(0, 1);
  lcd.print(MESSAGE2);




}

void loop(){
//-------------------------------------------------------------
```

```
  byte i;
  byte present = 0;
  byte type_s;
  byte data[12];
  byte addr[8];
  float celsius, fahrenheit,celsius1, fahrenheit1;
  //--------------------------------------------------------------
----------------------
  if ( !ds.search(addr)) {
  //  Serial.println("No more addresses.");
  //  Serial.println();
    ds.reset_search();
    delay(250);
    return;
  }

 // Serial.print("ROM =");
  for( i = 0; i < 8; i++) {
  //  Serial.write(' ');
  //  Serial.print(addr[i], HEX);
  }

  if (OneWire::crc8(addr, 7) != addr[7]) {
   //   Serial.println("CRC is not valid!");
      return;
  }
 // Serial.println();

  // the first ROM byte indicates which chip
  switch (addr[0]) {
    case 0x10:
   //   Serial.println("  Chip = DS18S20");  // or old DS1820
      type_s = 1;
      break;
    case 0x28:
   //   Serial.println("  Chip = DS18B20");
      type_s = 0;
      break;
    case 0x22:
     // Serial.println("  Chip = DS1822");
      type_s = 0;
      break;
    default:
    //  Serial.println("Device is not a DS18x20 family device.");
      return;
  }

  ds.reset();
  ds.select(addr);
  ds.write(0x44, 1);        // start conversion, with parasite
power on at the end
   digitalWrite(FAN,HIGH);
  delay(1000);     // maybe 750ms is enough, maybe not
  // we might do a ds.depower() here, but the reset will take
care of it.

  present = ds.reset();
  ds.select(addr);
```

```
  ds.write(0xBE);         // Read Scratchpad

//  Serial.print("  Data = ");
//  Serial.print(present, HEX);
//  Serial.print(" ");
  for ( i = 0; i < 9; i++) {           // we need 9 bytes
    data[i] = ds.read();
//    Serial.print(data[i], HEX);
//    Serial.print(" ");
  }
//  Serial.print(" CRC=");
//  Serial.print(OneWire::crc8(data, 8), HEX);
//  Serial.println();

  // Convert the data to actual temperature
  // because the result is a 16 bit signed integer, it should
  // be stored to an "int16_t" type, which is always 16 bits
  // even when compiled on a 32 bit processor.
  int16_t raw = (data[1] << 8) | data[0];
  if (type_s) {
    raw = raw << 3; // 9 bit resolution default
    if (data[7] == 0x10) {
      // "count remain" gives full 12 bit resolution
      raw = (raw & 0xFFF0) + 12 - data[6];
    }
  } else {
    byte cfg = (data[4] & 0x60);
    // at lower res, the low bits are undefined, so let's zero
them
    if (cfg == 0x00) raw = raw & ~7;  // 9 bit resolution, 93.75
ms
    else if (cfg == 0x20) raw = raw & ~3; // 10 bit res, 187.5 ms
    else if (cfg == 0x40) raw = raw & ~1; // 11 bit res, 375 ms
    //// default is 12 bit resolution, 750 ms conversion time
  }
  celsius = (float)raw / 16.0;
  fahrenheit = celsius * 1.8 + 32.0;


  //Serial.print("  Temperature = ");
  if (celsius>0){
    ActTemp=celsius;
  }
  //--------------------------------------------------------------
---------------------



//  Serial.print(" Celsius, ");
  //Serial.print(fahrenheit);
 // Serial.println(" Fahrenheit");



//*************************************************************
*****************************************
if (mode==0){
  lcd.clear();
```

```
   lcd.setCursor(0, 0);
  lcd.print("Temp(c):");
  lcd.print(ActTemp,2);



}
//*****************************************************************
********
if (mode==2){


  lcd.setCursor(0, 0);
  lcd.print("T(c):");
  lcd.print(ActTemp,1);
  lcd.print(" AUTO");
   lcd.setCursor(0, 1);
  lcd.print("ST(c):");
  lcd.print(TSet);
  lcd.print(" ");

if (minx>0 || Sec>0){
if (ActTemp<TSet){
  SPEED=0;
  FANSTATE=0;
   digitalWrite(FAN,LOW);
}
if (ActTemp>TSet){
 // analogWrite(FAN,SPEED);
  digitalWrite(FAN,HIGH);



}
}

Serial.print(celsius);
  Serial.print("\t");
  Serial.println(TSet);

//TXX++;
//if (TXX>=1){
  if (Sec>0){
    Sec--;
}
  if (Sec==0){
    if (minx>0){
      minx--;
      Sec=59;
    }

    if (minx==0 && Sec==0){
      minx=0;
      Sec=0;
      lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("COMPLETED...");
```

```
digitalWrite(FAN,HIGH);
    digitalWrite(Buzz,HIGH);
    delay(100);
  digitalWrite(Buzz,LOW);
  delay(100);
  digitalWrite(Buzz,HIGH);
    delay(100);
  digitalWrite(Buzz,LOW);
  delay(100);
  digitalWrite(Buzz,HIGH);
    delay(100);
  digitalWrite(Buzz,LOW);
  delay(100);
    }


  }

  TXX=0;
 // lcd.setCursor(0, 1);
  lcd.print(minx);
    lcd.print(":");
    lcd.print(Sec);
    lcd.print(" ");
//}

}
//*****************************************************************
********


  //--------------KEYPAD----------------


      char key = keypad.getKey();
    //  lcd.setCursor(0, 1);
    //  lcd.print(key);
      if (mode==2){
         if (key != NO_KEY && key =='D'){
          OP=0;  mode=0; FANSTATE=0;
          digitalWrite(FAN,LOW);
        }
      }

      if (mode==2){
         if (key != NO_KEY && key =='*'){
          mode=0;
        }
      }
      if (mode==0){
        if (key != NO_KEY && key =='*'){
          OP=1;
        }
         if (key != NO_KEY && key =='#'){
          OP=0;
        }
        if (key != NO_KEY && key =='A'){
          OP=0;  mode=1;
```

```
        }
         if (key != NO_KEY && key =='B'){
          OP=0;  mode=2;
          minx=TimeSet;
          lcd.clear();
          digitalWrite(Buzz,HIGH);
          delay(20);
          digitalWrite(Buzz,LOW);
          delay(20);
          digitalWrite(Buzz,HIGH);
          delay(20);
          digitalWrite(Buzz,LOW);
          delay(20);
          digitalWrite(FAN,LOW);
        }
              if (key != NO_KEY && key =='C'){
          OP=0;  mode=3;
        }
        if (key != NO_KEY && key =='D'){
          OP=0;  mode=0; FANSTATE=0;
          digitalWrite(FAN,HIGH);
        }
       }
       //-------------------------------------------------------------
---------------
     if (mode==1){
       lcd.clear();
       lcd.setCursor(0, 0);
       lcd.print("Set Temperature");
      lcd.setCursor(0, 1);
      lcd.print(PwordIn);
      //lcd.print(dummy);
     }
      if (key != NO_KEY && key =='*'){

      }
      /*
      if (key != NO_KEY && key !='*'){

        mode=1;

        PwordIn += key;
        dummy +="*";
        lcd.setCursor(0, 1);
        lcd.print(PwordIn);
        countKEY = countKEY + 1;
        Serial.println(countKEY);
        Serial.println(PwordIn);
        delay(500);
      }
      */
      while (mode==1){

              char key = keypad.getKey();
     if (mode==1){
       lcd.clear();
       lcd.setCursor(0, 0);
       lcd.print("Set Temperature    ");
```

```
       lcd.setCursor(0, 1);
       lcd.print(PwordIn);
      //lcd.print(dummy);
      }
       if (key != NO_KEY){
         mode=1;

         PwordIn += key;
         dummy +="*";
         lcd.setCursor(0, 1);
         lcd.print(PwordIn);
         countKEY = countKEY + 1;
      //   Serial.println(countKEY);
      //   Serial.println(PwordIn);
      //   Serial.println(PASSWORD.toInt());
         delay(500);
       }
       if (key == '*'){
         PwordIn = ""; PwordInx = 0;
           dummy="";
           countKEY = 0;
           SMSX=0; mode=0;
       }

        if (key == '#'){
         TSet=PwordIn.toInt();
          lcd.clear();
        lcd.setCursor(0, 0);
        lcd.print("Temp Set...");
        lcd.setCursor(0, 1);
        lcd.print(TSet);
        lcd.print("C");
        delay(2000);
         PwordIn = ""; PwordInx = 0;
           dummy="";
           countKEY = 0;
           SMSX=0; mode=0;
       }

//&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&
&&&&&&&&&&&&&&
        if(countKEY > 5){
        //NowPword = PASSWORD.toInt();
       // PwordInx = PwordIn.toInt();
        int Check=1;









       if (Check==1){
```

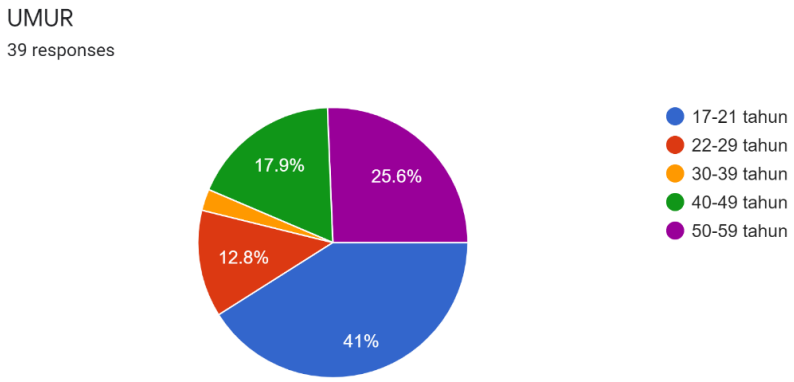
```
      }



      }
//&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&
        delay(10);

      }


//-----------------------------------------------------------------
----------------------
     if (mode==3){
       lcd.clear();
       lcd.setCursor(0, 0);
       lcd.print("Set TIMER (min)");
      lcd.setCursor(0, 1);
      lcd.print(PwordIn);
      //lcd.print(dummy);
     }
      if (key != NO_KEY && key =='*'){

      }
      /*
      if (key != NO_KEY && key !='*'){

        mode=1;

        PwordIn += key;
        dummy +="*";
        lcd.setCursor(0, 1);
        lcd.print(PwordIn);
        countKEY = countKEY + 1;
        Serial.println(countKEY);
        Serial.println(PwordIn);
        delay(500);
      }
      */
      while (mode==3){
              char keyx = keypad.getKey();
     if (mode==3){
       lcd.clear();
       lcd.setCursor(0, 0);
       lcd.print("Set TIMER (min)  ");
      lcd.setCursor(0, 1);
      lcd.print(PwordIn);
     //lcd.print(dummy);
     }
      if (keyx != NO_KEY){
        mode=3;

        PwordIn += keyx;
        dummy +="*";
        lcd.setCursor(0, 1);
```

```
        lcd.print(PwordIn);

        delay(500);
      }
      if (keyx == '*'){
        PwordIn = ""; PwordInx = 0;
          dummy="";
          countKEY = 0;
          SMSX=0; mode=0;
      }

       if (keyx == '#'){
        TimeSet=PwordIn.toInt();
         lcd.clear();
       lcd.setCursor(0, 0);
       lcd.print("Time Set...");
       lcd.setCursor(0, 1);
       lcd.print(TimeSet);
       lcd.print(" min");
       delay(2000);
        PwordIn = ""; PwordInx = 0;
          dummy="";
          countKEY = 0;
          SMSX=0; mode=0;
      }

//&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&
&&&&&&&&&&&&&&
        if(countKEY > 5){
        //NowPword = PASSWORD.toInt();
       // PwordInx = PwordIn.toInt();
        int Check=1;









      if (Check==1){




      }




      }

//&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&

        delay(10);
      }
```

```
      //-------------------------------------------------------------
--




//-------------------------------------------------------------------
-----------------


delay(100);



}

void Clear(){
          WRONGCOUNT=0;
          PwordIn = ""; PwordInx = 0;
          dummy="";
          countKEY = 0;  mode=0;
           digitalWrite(Buzz,LOW);

           delay(1000);
}
void DoorOpen(){




}
```

2.1 APPENDIX C :NEED ANALYSIS / MARKET ANALYSIS

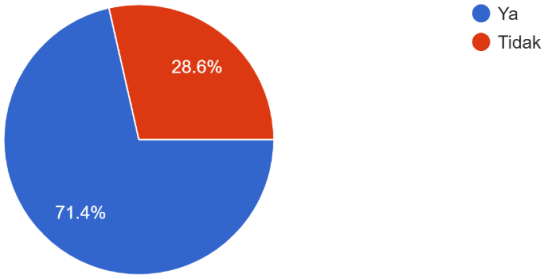
We have made an analysis of the survey we made using google form. our target respondent for this project is buyer and seller lemang. we have received 32 respondents from buyers and 7 sellers.



SELLER SECTION

Adakah tuan/puan pernah mendapat aduan daripada pembeli kerana kualiti lemang mentah atau terlebih masak ?

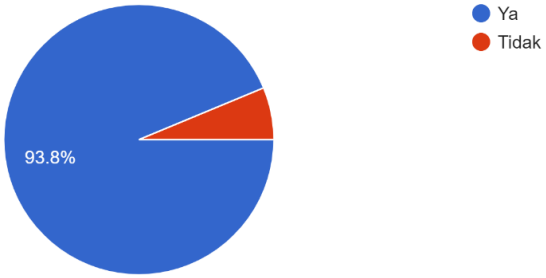
7 responses



BUYER SECTION

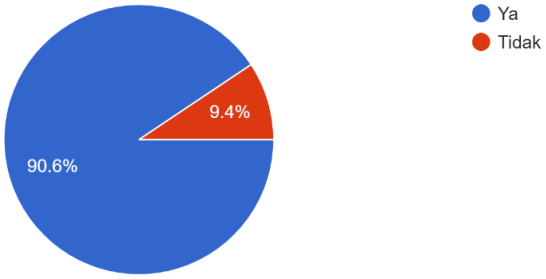
Adakah tuan/puan pernah menunggu masa yang lama untuk bakar/membeli lemang ?

32 responses



Adakah tuan puan pernah mendapat lemang yang kurang masak atau mentah ?

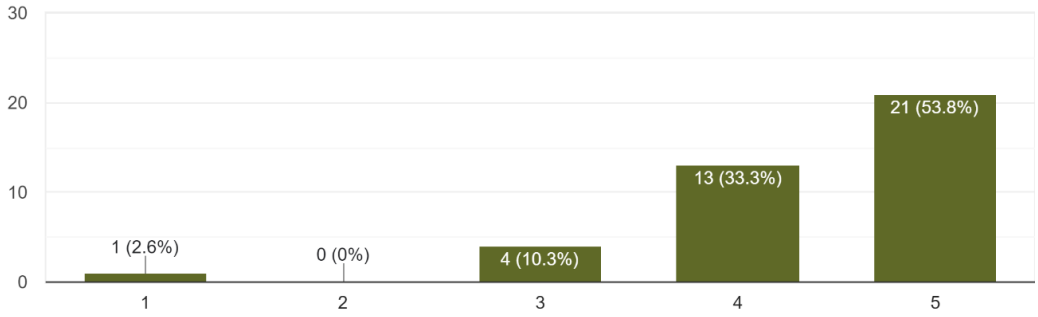
32 responses



GENERAL SECTION

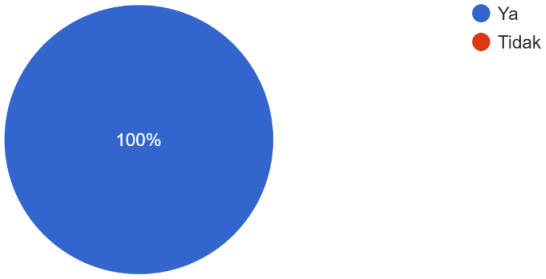
Adakah tuan/puan berminat dengan projek ini ?

39 responses



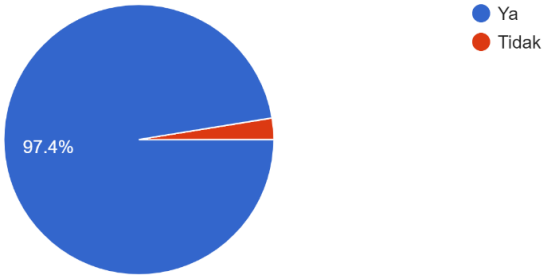
Adakah projek mesin lemang semi automatic perlu dibuat untuk dijual pada penjual lemang ?

39 responses



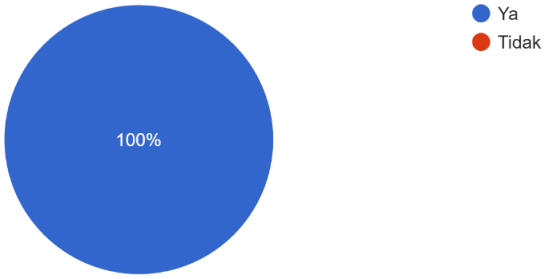
Adakah projek ini dapat meningkatkan ekonomi penjual lemang ?

39 responses



Adakah tuan/puan setuju projek ini dapat mengurangkan masa pembakaran lemang berbanding cara pembakaran yang tradisional ?

39 responses



Adakah projek ini dapat mengurangkan pembakaran terbuka dan kesan rumah hijau berbanding cara pembakaran yang tradisional ?

39 responses