



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF RICE COOKER INTEGRATED
WITH ARDUINO CONTROLLER**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Automation and Robotics) with Honours.

by

MUHAMMAD FARIDZWAN BIN AZMAN SHAH

B071610060

930127-14-5137

FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING TECHNOLOGY

2019

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: DEVELOPMENT OF RICE COOKER INTEGRATED WITH ARDUINO
CONTROLLER

Sesi Pengajian: 2019

Saya **Muhammad Faridzwan Bin Azman Shah** mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (X)

- SULIT* Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972.
- TERHAD* Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan.
- TIDAK TERHAD

Yang benar,

Disahkan oleh penyelia:

.....
 Muhammad Faridzwan B. Azman Shah
 Alamat Tetap: Blok A-1-12 Pangsapuri
 Permai, Jalan Landai Permai
 Sungai Besi,
 57100 Kuala Lumpur,
 Wilayah Persekutuan Kuala Lumpur

.....
 MR. ARMAN HADI BIN AZAHAR
 Cop Rasmi Penyelia

Tarikh: 23 Disember 2019

Tarikh: 23 December 2019

*Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini

DECLARATION

I hereby, declared this report entitled DEVELOPMENT OF RICE COOKER INTEGRATED WITH ARDUINO CONTROLLER is the results of my own research except as cited in references.

Signature:

Author : Muhammad Faridzwan Bin Azman Shah

Date: 23 December 2019

APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Automotive) with Honours. The member of the supervisory is as follow:

Signature:

Supervisor: MR. ARMAN HADI BIN AZAHAR

ABSTRAK

Objektif utama inisiatif ini adalah pembangunan skim automatik dimana bertujuan untuk membantu membersihkan dan juga untuk memasak beras. Ciptaan ini membantu mengurangkan penggunaan masa untuk membersihkan dan memasak beras dalam proses yang biasanya mengambil masa yang lama untuk disediakan. Seterusnya, pengukuran kejernihan air akan diukur dan jika nilai yang dibaca melebihi yang ditetapkan, beras perlu dibersihkan sekali lagi sehingga nilai yang diinginkan tercapai. Sistem pembersihan beras dibuat berulang kali untuk menjamin kebersihan beras. Proses menanak nasi akan dijalankan pada proses yang terakhir selepas semua proses pembersihan dilaksanakan. Kecekapan dan kualiti perkakas ini akan dinilai dan dipantau untuk peningkatan selanjutnya menggunakan maklumat analisis yang diperoleh daripada system.

ABSTRACT

The primary objective of this initiative is the development of an automated scheme which is to assist clean and cook rice. This invention helps to reduce the time taken to clean and cook the rice in the standard process which taking a lot of time to prepare it. Next, the water clarity measurement will measure the clarity of the rice water. If the reading exceeds that set value, the rice needs to be re-cleaned again, until the desired value is achieved. The system will repeat the cleaning method to guarantees the lower impurities. The rice cooker will be responsible for the final portion of the rice-cooking operation to ensure that this process is carried out. The efficiency and quality of the appliance will be evaluated and maintained for further enhancement using the analysis information obtained from the system.

DEDICATION

Allah, our Creator.

Muhammad, our Prophet.

Faezah Binti Hassan, my mother.

Azman Shah Bin Md Isa, my father.

All of my family.

My Supervisor, Mr Arman Hadi Bin Azahar.

My friends.

To all Muslimin and Muslimat.

ACKNOWLEDGEMENTS

I want to thank Mr. Arman Hadi Bin Azahar, my mentor who is always giving me the inspiration, enthusiasm, moment, and willingness to be my supervisor during all the moment he has brought me to finish the project and offer me my gratitude for his guidance. I also thank to Mr. Ahmad Zubir Bin Jamil as Panel 1 and Mr. Fareq Bin Ibrahim as Panel 2 for their willingness to evaluate my project, whom gives a brilliant ideas and opinion to improve my project in this period and to help me gain more knowledge about my project.

TABLE OF CONTENTS

	PAGE
ABSTRAK	vi
ABSTRACT	vii
DEDICATION	viii
ACKNOWLEDGMENT	ix
TABLE OF CONTENTS	x
LIST OF TABLES	xiii
LIST OF FIGURES	xiv
LIST OF SYMBOLS	xvii
CHAPTER 1	1
1.1 Introduction	1
1.2 Background of the project	1
1.3 Problem Statement	5
1.4 Objective of Project	5
1.5 Scope of Project	5
1.6 Outline of Project	6
CHAPTER 2	7
2.1 Introduction	7

2.2	Rice	7
2.3	Method to clean the rice	12
2.4	PH Measurement	17
2.5	Water Clarity	22
2.6	Equipment That Being Used	23
2.7	Previous Research	26
CHAPTER 3		29
3.1	Introduction	29
3.2	Flow Progress of the Project	33
3.3	Hardware and Circuit Design	36
3.4	Project Testing	39
3.5	Hardware Specification	40
CHAPTER 4		56
4.1	Introduction	56
4.2	Project Development	57
4.3	DC gear motor	58
4.3.1	Comparison of Result	60
4.4	Water Pump	61
4.5	Water Level	64

4.6	Time taken to cook rice	66
4.7	Turbidity value check	68
CHAPTER 5		71
5.1	Introduction	71
5.2	Conclusion	71
5.3	Recommendation	72
REFERENCES		73

LIST OF TABLES

TABLE	TITLE	PAGE
Table 3.1	The Option For The Quantity Of Rice.	34
Table 3.2	L298N Specification	42
Table 3.3	I2LPC2148 4-bit Specification	48
Table 3.4	Features and Spec for Turbidity Sensor	53
Table 3.5	Specification for Water Flow Sensor YF-S401	53
Table 3.6	Specification for TowerPro MG946R Metal Gear Servo	55
Table 4.1	Comparison between both DC Gear Motor	60
Table 4.2	Time taken water pump to complete transfer 375ml of water	63
Table 4.3	Water Level Ratio	64
Table 4.4	Time recorded to cook the rice	66
Table 4.5	Turbidity Value Recorded	69

LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 1.1	Clean Rice Manually	2
Figure 1.2	PILOT Rice Washing Machine use in industry	3
Figure 1.3	Rice Cooked Perfectly	4
Figure 1.4	Overcooked Rice	4
Figure 2.1	Rice Cooked Perfectly	8
Figure 2.2	Rice Cultivation	9
Figure 2.3	Manual Harvesting	10
Figure 2.4	Harvesting Using Machine	10
Figure 2.5	Impurities in Rice	11
Figure 2.6	Clean water inside the bowl	13
Figure 2.7	Cloudy water inside the bowl	14
Figure 2.8	Finger Measurement	15
Figure 2.9	Commercial Product	15
Figure 2.10	pH Measurement to Human Body	17
Figure 2.11	Water Scale in pH level	18
Figure 2.12	pH Scale to Cook Rice	19
Figure 2.13	Pocket ION Meter	20
Figure 2.14	Litmus Paper	21
Figure 2.15	Cloudy Water Rice	22
Figure 2.16	Arduino Uno	23
Figure 2.17	Arduino Uno Pin Configuration	24

Figure 2.18	Example Fuzzy Logic Control System	26
Figure 2.19	UML Sample	27
Figure 2.20	Temperature curved recorded	28
Figure 3.1	Flow Chart of Methodology	30
Figure 3.2	K-Chart Project	32
Figure 3.3	Main Block Diagram	33
Figure 3.4	Flow Chart of the Project Process	35
Figure 3.5	Flow Chart of Project Design	37
Figure 3.6	Flow Chart of Circuit Design	38
Figure 3.7	Testing Flow Chart	39
Figure 3.8	L298 Dual Full-Bridge Motor Driver	41
Figure 3.9	Arduino Uno ATmega328	43
Figure 3.10	Example of Connection Arduino	44
Figure 3.11	Arduino IDE Software	45
Figure 3.12	LCD 2 x 16	46
Figure 3.13	Arduino to LCD Connection	47
Figure 3.14	Arduino to LCD Pin Connection	49
Figure 3.15	One Way Water Pump	50
Figure 3.16	Relay	51
Figure 3.17	Turbidity Sensor	52
Figure 3.18	Water Flow Sensor YF-S401	54
Figure 3.19	TowerPro MG946R Metal Gear Servo	55
Figure 4.1	Aluminium extrusion has been fitted using bracket	57
Figure 4.2	6v 85Rpm DC Micro Metal Gearmotor	58

Figure 4.3	12V 225 Rpm 1.3kgfcm Brushed Dc Geared Motor	59
Figure 4.4	One Way Water Pump	61
Figure 4.5	Two Way Water Pump	62
Figure 4.6	Total Level Water chart	65
Figure 4.7	Rice Cooking Chart	67
Figure 4.8	Turbidity Value Check	68
Figure 4.9	Data obtained from Serial Monitor at Arduino Software	69
Figure 4.10	Turbidity Value vs Rice Quantity Graph	70

LIST OF SYMBOLS

D, d	-	Diameter
F	-	Force
g	-	Gravity = 9.81 m/s
I	-	Moment of inertia
l	-	Length
m	-	Mass
N	-	Rotational velocity
P	-	Pressure
Q	-	Volumetric flowrate
r	-	Radius
T	-	Torque
Re	-	Reynold number
V	-	Velocity
w	-	Angular velocity
x	-	Displacement
z	-	Height
q	-	Angle

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter will clarify about the background, problem statement, objective, scope and outline of the project.

1.2 Background of the project

Rice has fed more people over a longer period than any other crop. As far back as 2500 b.c. rice has been documented in the history books as a source of food and for tradition as well. Beginning in china and the surrounding areas, its cultivation spread throughout Sri Lanka, and India. It was then passed onto Greece and areas of the Mediterranean. Rice spread throughout southern Europe and to some of north Africa. From Europe rice was brought to the new world. From Portugal it was brought into brazil and from Spain to central and south America. Rice could be taken to many parts of the world due to its versatility. It can grow in the desert conditions of Saudi Arabia, in the wetland deltas of southeast Asia in the flooded rice plains which we are most familiar with.



Figure 1.1 Clean Rice Manually (<https://bakedbree.com>)

White rice generally needs a good rinse before cooking, to remove its starchy coating – not washing it leads to smellier rice that spoils faster. You put the rice in a bowl, cover with cold water and swirl around with your hand, repeating this several times until the water runs clear. To get clean rice from dirt, most users wash rice manually. This is very important because we do not know what happened during the rice packing process. When the packaging process occurs, potentially small stones or insects enter the rice during this process, and this can cause illness to the user's body due to eating unsanitary rice.

In today's era, technology is growing rapidly and developing. With the existing technology, the industry will develop a machine that facilitates humanity and in addition it ensures that the resulting product is more of a quality and good.

Out there there's a lot of rice cleaners on the market right now, but most is rice cleansing on a large scale that's used in the industry. For example, this product name is a Pilot. Figure 1.2 PILOT Rice Washing Machine use in industry show the example of rice washing machine. This machine will be used to wash the rice by removing all the dirt, rocks, bugs and also rice that's broken. The machine removes floating impurities,

sand particles below 800 microns, dust and other washable impurities. It is also used for soaking rice to the required level of moisture and rinsing the excess water. It consists of a perforated vessel with stirrers. The washed material can be kept in the same vessel for soaking. Then it is rinsed and discharged through bottom for further processing. This machine can wash from 50 kilograms to 250 kilos of rice with one single wash. So, it's just used in the industry instead of home.



Figure 1.2 PILOT Rice Washing Machine use in industry

(<https://www.pilotsmithindia.com>)

For the project this time, this rice washing is focused using the Arduino controller to make this project run smoothly. This project automatically functions to clean rice and indirectly ensures that rice is cleared safe and tasty to eat.

For the project this time, this rice washing is focused using the Arduino controller to make this project run smoothly. This project automatically functions to clean rice and indirectly ensures that the rice is clearly safe and tasty to eat.

Before the rice being cooked, cooking pan, lid, measuring cup need to be clean first by using clean water and soap. After cleaning it, rinse it and dry it by using clean

cloth. Quantity rice are being measured by cup provided in the packaging. Next step put the rice inside the clean bowl, the place the measured water inside the bowl together with rice. After the quantity of water and rice are correct, plug into the 230-240-volt AC and turn ON the switch. After turning ON the switch, the KEEP WARM light will light up. Press the automatic control lever to COOK to begin the cooking process. After the rice completely cooked, the lever at rice cooker will automatically turn to KEEP WARM back. Figure 1.3 displays the rice that being cooked is in perfect condition. This process is to ensure the rice not overcooked and keep the rice warm and ready to eat condition.(Perfect et al. n.d.). Figure 1.3 illustrates the overcooked rice.



Figure 1.3: Rice Cooked Perfectly (<https://surfingruinedmylife.net/>)



Figure 1.4: Overcooked Rice (<https://www.pinterest.com>)

1.3 Problem Statement

Nowadays, to cook the rice perfectly the users need to know how the suitable amount of water need to be poured into the bowl. Effect from it, the rice that been cooked maybe chewy or hard in the middle after the allocated time. Even using an automated rice cooker, the user still needs to know the amount of water need to be measured in the bowl. Furthermore, the another problem that we can find is , the user didn't clean the rice perfectly and this will harm the user which eat the unclean rice .For the user which didn't have enough time, this process will be a burden to them. They didn't care the cleanliness of the rice which they will cook.

1.4 Objective of Project

The project focusses on the following three objectives:

- 1) To implement an automated rice cooker with IoT system.
- 2) To determine the value of water clarity that represent the cleanliness of the rice.
- 3) To evaluate the effectiveness of the performance of the rice cleaner.

1.5 Scope of Project

- Design system that can automatically clean and cook rice.
- Implemented the rice cooker with IoT system.
- Determine the rice quality by using water turbidity.

1.6 Outline of Project

This project consists of five main chapter:

- 1) Chapter 1: Introduction of the project
- 2) Chapter 2: Literature review
- 3) Chapter 3: Methodology
- 4) Chapter 4: Result
- 5) Chapter 5: Conclusion

For this progress of the project, students will discuss about the introduction, objective, problem statement and scope of the project. On the next chapter, we focused on the theoretical things such literature review, software and the hardware specification. Furthermore, this chapter discussed about the product which is already in the market right now. In the chapter 3, methodology and project development will be discuss in this chapter. In the chapter 4, the result that we obtain from this project progress will be discuss. This will show the project improvement and unsuccessful result that we get during this period. At the end of the chapter 5, it will discuss about the conclusion of this project and what improvement that can be done in the next project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter, it will discuss about the project researches. Every topic in the title explained the case study which is related for this topic. This chapter will be written based on article, books, blog, magazine, information in the websites or the case study which is related and already published. It generally follows a discussion of paper thesis statement or the study's goals. This chapter is important because it have a conclusion of cognition from practical and theory perspective.

2.2 Rice

Rice is the main supply to almost all the world's population. At this moment, grain is the one of the vital commercial food crops. 535 million ton of rice are being produce and consume everyday by the users. In the world, there are 50 countries that yield rice, China and India manipulated half of the production. Almost 9 to 23 million metric of rice production are being support by Southeast Asian countries. In Asian lands, over 300 million acres are used to growing the rice. For them, it is already act as a main trade mark because rice is important for Asian people. Figure 2.1 depicts the rice cooked perfectly.