DESIGN AND DEVELOPMENT OF AN AUTOMATIC LEMANG BURNER USING IOT SYSTEM

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This report is submitted in partial fulfilment of the requirements for the degree of Bachelor of Electronic Engineering with Honours

Faculty of Electronic and Computer Engineering
Universiti Teknikal Malaysia Melaka

2023

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : Design and Development of An Automatic Lemang Burner using IoT System

Sesi Pengajian : 2022/2023

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I declare that this report entitled “Design and Development of An Automatic Lemang Burner using IoT System” is the result of my own work except for quotes as cited in the references.

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APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Bachelor of Electronic Engineering with Honours.

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DEDICATION

My humble effort I dedicated to Allah the All Mighty for granting me my beloved parent, Kharolazaman Bin Kassim & Nurazlen Binti Mohd Nasir, siblings, and my friends who's their affection, love, patient, encouragement and prays of days and nights make me able to get such success and honour. It might not be possible to fulfil all of these commitments without their assistance and encouragement. Additionally, I am very grateful that PSM's Supervisor, Ts. Dr. Khairuddin Bin Osman, has faith in me to accomplish the required thesis. Not to mention, a number of people that assisted me in finishing both the PSM and this dissertation are also acknowledged. Not to be forgotten are my classmates, who gave us a lot of help and collaboration so that we could complete our task effectively. Alhamdulillah

ABSTRACT

Lemang has been a traditional Malaysian food for generations and cooked inside a bamboo stalk using traditional methods such as direct open fire. However, an existing cooking technique still employs manual methods, particularly for turning the bamboo, which is dangerous to the hand. It also requires a lot of manpower, is cooked unevenly, and needs to be rotated every few minutes. The traditional method requires special attention and meticulous care so that the lemang is cooked perfectly. Addressing that, the main aim of this project is to design and development of an automatic lemang burner using the latest IoT system to facilitate human work to control according to the current situation. Whereby, an IoT-based online monitoring system monitors and control the motor in real-time for continuous rotating purposes by using the smartphone. At the end of this project, may help the Industri Kecil Sederhana (IKS), it will indirectly make it easier for new entrepreneurs to reduce operating costs such as employees and yet still cook over an open fire due to the abundance of biomass fuel. After that, by utilizing a continuous rotating system, the risk of hand burning is significantly reduced.

ABSTRAK

Lemang telah menjadi makanan tradisional Malaysia sejak turun temurun, dan dimasak di dalam batang buluh menggunakan kaedah tradisional seperti api terbuka. Walau bagaimanapun, teknik memasak sedia ada masih menggunakan kaedah manual, terutamanya untuk memusing buluh, yang berbahaya kepada tangan. Ia juga memerlukan tenaga kerja yang ramai, dimasak tidak sekata, dan perlu diputar setiap beberapa minit. Kaedah tradisional memerlukan perhatian khusus dan penjagaan rapi agar lemang masak dengan sempurna. Sehubungan itu, matlamat utama projek ini adalah untuk mereka bentuk dan membangunkan pembakaran lemang automatic dengan menggunakan system IoT terkini bagi memudahkan kerja manusia mengawal mengikut situasi semasa. Dimana, sistem pemantauan dalam talian berasaskan IoT, memantau dan mengawal motor dalam masa nyata bertujuan memutarkan secara berterusan dengan menggunakan telefon pintar. Di penghujung projek ini, dapat membantu Industri Kecik Sederhana (IKS), ia secara tidak langsung akan memudahkan usahawan baharu mengurangkan kos operasi seperti pekerja. Namun masih memasak di atas api terbuka kerana bahan api biojisim yang banyak. Selepas itu, dengan menggunakan sistem berputar berterusan, risiko tangan terbakar berkurangkan dengan ketara.

ACKNOWLEDGEMENTS

All praise and appreciation be to God, the Almighty, for his everlasting blessing during the project that made it possible for me to complete this thesis. I would want to express my gratitude to my supervisor, Ts. Dr. Khairuddin Bin Osman, for all his direction, encouragement, help, and support in finishing this study. I can't thank him enough for everything he's done to help me obtain all the outcomes I wanted. To finish this project, a lot of commitment, effort, and determination are required. Finally, I want to express my gratitude to my parents, families, and friends who have assisted me directly or indirectly for their constant support and encouragement throughout the project within a limited time frame.

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LIST OF SYMBOLS AND ABBREVIATIONS

AC	:	Alternating Current
CPU	:	Central Processing Unit
DC	:	Direct Current
FKP	:	Faculty of Manufacturing Engineering
GSM	:	Global System for Mobile communication
IKS	:	Industri Kecil Sederhana
IoT	:	Internet of Things
IP	:	Internet Protocol
IDE	:	Integrated Development Environment
ICSP header	:	In-Circuit Serial Programming header
I/O	:	Input/Output
LED	:	Light-Emitting Diode
MARDI	:	Malaysia Agricultural Research and Development Institute
PWM	:	Pulse Width Modulation
PNG	:	Portable Network Graphic
PDF	:	Portable Document Format
PCB	:	Printed Circuit Board
RPM	:	Revolutions Per Minute

RAM	:	Random-Access Memory
UART	:	Universal Asynchronous Receiver-Transmitter
USB	:	Universal Serial Bus
SPIM	:	Single-Phase Induction Motor
SD Card	:	Secure Digital Card
SPI	:	Serial Peripheral Interface
3D	:	3 Dimensional

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CHAPTER 1:

INTRODUCTION

This chapter will be briefly explained the introduction, problem statement, objective, scope, and the thesis outline.

1.1 Background of the Project

The government's long-term goal for the agri-food industry is to turn it into a major contributor to economic growth. To increase productivity and competitiveness, food businesses must modernize the nation's food industry and business practices. They must implement cutting-edge technology while utilizing best practices and agricultural goods that adhere to international standards. MARDI has made proactive measures to achieve the objective of expanding the modernization and automation technologies in the nation's food sector. One of the important technologies in the

growth and advancement of the nation's food sector today is mechanization and automation. By lowering production costs and increasing production rate, this technology can produce goods of consistently excellent quality. Innovation for food technology is one technique to address the issue of a worker shortage. To boost the productivity of the food sector, modernization and automation will play a larger role in the implementation of the most recent technologies [1]. Indirectly, it may help Industri Kecil Sederhana (IKS) for improve the productivity.

The Internet of Things is a network of both digital and mechanical computing devices that are all connected to each other. Machines, and people are fitted with sensors that collect important and detailed information about systems to make them better. From the point of view of supply chain management, the Internet of Things can make it possible for machines to make decisions with little or no human help by coordinating between "things" as they move between different entities in the supply chain. In particular, the idea of the Internet of Things (IoT) makes it possible to see how the supply chain works, gather information, and keep track of business growth in real time. In the food industry, IoT helps to keep safety standards up to date, reduce food waste, deal with unpredictable changes, and track and monitor the quality of foods [2]. In this project, this system has operating modes that enables users to select the speed of the motor using mobile apps by tapping three features on a smartphone that are classified as "SLOW," "MEDIUM," and "FAST" (Blynk software).

After that, to analyze and compare the performance of speed and rotation of the motor, need to know a suitable dc motor according for this project. Which type of dc motor that want to use? Because there are many motors that have such as dc brush motor, dc brushless motor and others. Need to know the specification of the dc motor such as torque, weight, voltage, current, and speed. For this project, approximately it

uses a likes chain drives system, so need to select the motor that can support heavy load for the chain to move the load. Chain drives are a particular kind of mechanical power transmission device that move power from one location to another using chains. Two or more sprockets and the chain itself make up a standard chain drive. The sprocket teeth are covered by the holes in the chain links [3].

1.2 Problem Statement

Firstly, the operation for cooking lemang requires to be rotated every few minutes. Lemang must be cooked while rotating the bamboo occasionally to ensure even cooking. For each bamboo lemang, rotation of the bamboo is handled by hand. After that, the workers need to spend a lot of time to monitor the condition of the lemang. Lastly, the risk of hand burning is high. Currently used cooking methods still involve manual labour, particularly when turning bamboo, which is dangerous for the hands. Additionally, workers typically pay less attention to workplace safety issues like the risk of hand burns.

1.3 Aim & Objectives

The objectives of this project are:

i. To design a circuit and prototype system to control the motor for continuous rotating purposes.
ii. To develop an IoT data logger system and automation system to monitor and control the motor in real-time via IoT platform (Blynk).
iii. To analyze and compare the performance of speed and rotation of the motor (Hall Effect Sensor).

1.4 Scope of the Project

For the scope that be involved in this project is to design a circuit and prototype system to control the motor for continuous rotating purposes with IoT. The completed prototype of automated lemang burner system will be connected to smartphones using Blynk Software via internet (IoT) connectivity. The prototype can use the phone's interface to control the speed and move the motor. All these involve C++ programming. For hardware, to design the prototype lemang burner that can carry on the bamboos using 3D CAD software such as SolidWorks. It is important to ensure that the bamboo supporting structure is robust enough and no deflection happens while all bamboo with the rice is placing on it. A few components will be used in this project such as hall effect sensor, dc motor, sprocket, and others. To make bushing for the sprocket, need to use the Lathe machines at FKP. The limitation that may be faced was experimental test may be conducted in the house instead of real environment. Moreover, the execution of the methodology will be processed to achieve the results.

1.5 Methodology

The research phase of this project begins with the proposed title. The research findings are discussed, and the project's title is accepted. As indicated in the literature review, the background of this project is reviewed and studied.

The subsequent phase is to create a prototype for which the project was separated into two parts: hardware of an automated lemang burner and software utilizing Arduino programming to move the automated lemang burner via Internet of Things (IoT) connectivity. The troubleshooting involved the combination of hardware and software.

In this research, the best criteria for automated lemang burner will be chosen and the management is needed to get the positive output results that needed by seller or user. The scope will be studying about the material selection for the construction of the cooking device was based on material qualities, availability, machinability, affordability, dc motors, connectivity interface and analysis system of this project. In the methodology section, the methodology for completing this project will be discussed in depth. Then, the optimal selection criteria for the design parameter will be chosen to achieve the desired outcome.

1.6 Thesis Outline

This project contains five chapters to describe the project of Design and Development of An Automatic Lemang Burner using IoT System's where chapter 1 contains introduction of the project discussed the background of the study, problem statement, scopes, and the objectives of developing this project. Followed by chapter 2 will elaborate about Literature Review consists of the background study and research before developing this project. The content of the background studies such as the information about the lemang burner, Internet of Things (IoT) and dc motor. Describe the methods or techniques used to complete this project in Chapter 3. In this chapter, all the steps taken from the project's inception until its conclusion were examined and documented. It will also cover the general flowchart, project software, and hardware for the prototype's development.

The chapter 4 concentrates on the results and discussions of this project. This chapter consists of the movement of the dc automated lemang burner as it rotates at a predetermined speed using dc motor that can be achieved by controlled using a

smartphone device and the hall effect sensor to show the revolutions per minute (rpm) of the dc motor. The summary of the project is included in the conclusion of Chapter 5. After the completion of a project, recommendations are given for a better project product or potential future upgrades.