UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN AND SIMULATION OF AN ELECTRO PNEUMATIC SYSTEM FOR FOOD INDUSTRY (PUTU MAYAM)

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

by

MOHAMAD FAHMI BIN MOHAMED NASIR

B071610688

941124-14-6437

FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING

TECHNOLOGY

2019

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk:Design and Simulation of an Electro Pneumatic System for Food Industry (Putu Mayam)

Sesi Pengajian: 2019

Saya **Mohamad Fahmi Bin Mohamed Nasir** 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,

.....

Mohamad Fahmi Bin Mohamed Nasir

Alamat Tetap:

Lot 1055 Kampung Kuala Ina,

Pulau Sebang, 78000

Alor Gajah, Melaka

Tarikh: 13 DECEMBER 2019

Disahkan oleh penyelia:

.....

PUAN HALYANI BINTI MOHD YASSIM

Cop Rasmi Penyelia

Tarikh:

*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 Design and Simulation of an Electro Pneumatic System for Food Industry (Putu Mayam)is the results of my own research except as cited in references.

Signature: ……

Author : Mohamad Fahmi Bin Mohamed Nasir

Date: 13 DECEMBER 2019

APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of University Technical Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electrical and Electronic Engineering (Power Industry) with Honours. The member of the supervisory is as follow:

Signature: …….

Supervisor: PUAN HALYANI BINTI MOHD YASSIM

Signature: …….

Co-supervisor: DR ALIZA BINTI CHE AMRAN

ABSTRAK

Putu mayam atau dikenali sebagai Idiyappam adalah makanan tradisional masyarakat India. Salah satu kaedah untuk meghasilakan putu mayam bagi mengelakkan berat putu mayam tidak seimbang adalah dengan menggunakan electro pneumatik. Cabaran elektro pnematik adalah sukar untuk mengawal kawalan kedudukannya. Fokus utama dalam projek ini adalah untuk mereka bentuk sistem elektro penumatik yang dapat menghasilkan putu mayam yang sama berat dengan menggunakan perisian FluidSim(P). Pengawal Derivative Integral Proportional (PID) digunakan dalam sistem ini untuk mengawal kedudukan. Hasil penentukuran PID akan dikumpulkan dan dianalisis trend berat dan masa yang diambil oleh sistem untuk menghasilkan seribu unit putu mayam. Kadar peningkatan terbaik (Kp) ditetapkan kepada 1 dengan 'Integral gain' (Ki) adalah 0 dan Derivative gain (Kd) ditetapkan kepada 0. Sistem konsep ini juga boleh menghasilkan berat putu mayam yang berbeza. Sistem ini boleh digunakan pada masa akan datang bagi mengawal kedudukan injap dan silinder.

ABSTRACT

Putu mayam also known as Idiyappam is a traditional Indian food. One of the method to produce putu mayam for avoiding unbalance putu mayam weight is using electro pneumatic. The challenge of electro pneumatic is difficult to control its position control. The main focus in this project is to design an electro-pneumatic system that able to produce an even weight putu mayam using FluidSIM(P) software. PID controller are used in this system to control the position. The result of PID calibration will gather and analyze the trends of the weight and time taken by the system to produce one thousand unit of putu mayam. The best proportion gain (Kp) is set to 1 with the Integral gain (Ki) is 0 and Derivative gain (Kd) is set to 0. It also been discovered this concept system also can produce the different weight of putu mayam. This system can be use in future for developing control the position of valve and cylinder.

.

DEDICATION

This research is dedicated to Almighty God for proving me peace, strength and make it easier for me to complete it.

"Trying something makes you eligible to hope, and No success gained without pain and effort (BP)"

ACKNOWLEDGEMENTS

Alhamdulilah, with His blessing's, I was able to complete this research to fulfil the requirements of bachelor's degree.

I would like to express my thankfulness to both of my parents, Mohamed Nasir Bin Yusof and Siti Zaliha Binti Ibrahim for their countless support during my four years study in University Technical Malaysia (UTEM). Without them, I will lost my motivational and strength.

I also would like to thank to my principal supervisor, Puan Halyani Binti Mohd Yassim and my Co-Supervisor Dr Aliza Binti Che Amran for the guidance idea comment and motivation through the process of completing this project.

Next, I would like to express my gratefulness to lectures, friend, siblings and whoever involved in this project. Without their guidance and support, this project won't complete in give time. May Allah grant all of you with endless blessing.

Thank You!

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF SYMBOLS

D, d	-	Diameter
F	-	Force
I	-	Moment of inertia
1	-	Length
m	-	Mass
g	-	Gram
P	-	Pressure
V	-	Velocity
x	-	Displacement
mm	-	Mile Meter
T	-	Instantaneous Time
Sec	-	Second
V	-	Voltage
%	-	Percentage

LIST OF ABBREVIATIONS

UTeM	-	University Technology Malaysia Melaka
(P)	-	Pneumatic
Kp	-	Proportional Gain
Ki	-	Integral Gain
Kd	-	Derivative Gain
PID	-	Proportional Integral Derivative
Kd	-	Derivative Gain

CHAPTER 1

INTRODUCTION

1.0 Introduction

In this chapter, the purpose is described generally including problem statement, objective and scope. The problem statement is related to the current issues while the objective is the targets for this research in solving the problem arise.

1.1 Background

Putu mayam also known as Idiyappam is a traditional Indian food that has received overwhelming response from all nations and is now enjoyed by all races. Putu mayam is a rice noodle dish originating from Indian subcontinent. This food popular in Sri Lankan cuisine, Indian cuisine and also spread to Southeast Asia. The process for making putu mayam is consists of mixing rice flour with water and coconut milk and pressing the dough through a sieve to make vermicelli like noodles.

Variety of ways to make a putu mayam either conventionally or using a machine. At, present there are two types of machine used to make putu mayam that is by semiautomatic and automatic either using pneumatic system, electro pneumatic system, hydraulic system or electrohydraulic system.

Almost the earlier pneumatic control systems were used in the process control industries, where they can be easily obtained and provide sufficiently fast response. (hazem ali, s.m.bashi, samsul noor, mohammad hamiruce marhaban, 2009).

The pneumatic position servo system is used in many applications due to their capability to position loads with great dynamic response and to raise the force required to move loads. Pneumatic systems are also highly accurate (Clements and Len, 1985). The pneumatic system also has some weaknesses. Due to compressed air, control and speed in pneumatic system are more complicated. For example, more equipment to the pneumatic system need to be added to make the device get the requires specific speed at the relevant levels.

Therefore, electro pneumatic system is created to solve the weaknesses that founded in the pneumatic system. One of the advantages of electro pneumatics is higher reliability due to the lower number of mechanical parts required to move or subject to wear and tear. Besides that, electro pneumatic action requires less current to operate that an direct electrical action. For the compression, electro pneumatic is not always possible to archive uniform and constant piston speeds with compressed air.

1.2 Problem Statement

The challenge of electro pneumatic is difficult to control its position control. This will cause the unbalance weight of the putu mayam. The weight that needed for every piece is 40g. Besides that, the printing of putu mayam must have three different weight which is 40g, 30g and 15g.

1.3 Objectives

This project will be done accordingly to achieve several objectives as follows:

1) To design an electro-pneumatic system that able to produce an even weight putu mayam.
2) To simulate electro-pneumatic system using FluidSIM (P) software.
3) To analyse the effectiveness of the purpose system.

1.4 Scope Project

The scopes of this study include:

1) Design the electro-pneumatic System.
2) Simulate electro-pneumatic with PID controller using FluidSIM (P).
3) Analyse the time taken by the system to produce 1000 unit of putu mayam (40g/unit) and different weight of putu mayam which is 40g,30g and 15g.

1.5 Contribution of Research

This research is briefly focused on identifying the tuning for PID controller to control position cylinder of electro pneumatic that can produce putu mayam with the balance weight. At the same time, the project was implemented to assist the supplier to produce a large number of putu mayam in a brief period of time. FluidSIM (P) is the software used in this study.

1.6 Thesis Outline

This research consists of main chapter as listed below.

1. Chapter 1: Introduction
2. Chapter 2: Literature Review
3. Chapter 3: Methodology
4. Chapter 4: Result and Discussion
5. Chapter 5: Conclusion

Chapter 1 will discuss regarding the introduction, problem statement, scope of the project and the outline of the project. On the following chapter, the theoretical information such as literature review and previous research will be discussed. Chapter 3 will explain about the methodology of the project and track of the research. The flowchart of the project also is illustrated. In chapter 4, the discussion is discussed. From the result gathered, an analysis is done based from the research. It will show project improvement and failure result that were faced during this period. The fifth chapter is about the conclusion of the project and recommendation can be propose in future research.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

In this section will show the previous research, journal, reports and articles from various sources about the component used for conducting this project. This includes the theoretical part and also the best ways that can be used to fulfill the objectives of this project.

2.1 Pneumatic System

Pneumatics is the compressed air technology, but in some circles, it is more fashionable to refer to it as a type of automation control. Pneumatic system is widely used in the automation of production machinery and in the field of automatic controllers. Pneumatic circuit that convert the energy of compressed air into mechanical energy enjoy wide use, and various type of pneumatic controllers are found in industry (Hazem I. Ali, 2009). In industries that include medical, packaging, material handling, entertainment, and even robotics, engineers commonly use pneumatics. And pneumatics can be useful for very specific applications where hazards are critical. In a mine for example where a stray spark could mean disaster and lose lives.

The final decision on the best type and design configuration for pneumatic actuator can only be made in relation to the requirements of a particular application. The pneumatic actuator was the most common type of piston cylinder due to its low cost and simplicity (Tablin et al., 1963). Due to their ability to position loads with high dynamic

response and to increase the force required to move the loads, the pneumatic position servo systems are used in many applications. Also, pneumatic systems are very reliable (Clements and Len, 1985).

Table 2.1 : Advantage and Disadvantage Pneumatic System

Source: (parr, 28 jan 2011)

Advantages	**Disadvantages**
Low Priced	Lack of accuracy control
Clean	Sensitive to vibrations
Secure and easy to use	Strong and noise

A pneumatic system's beauty is that if it leaks, it does not contaminate or affect the environment or atmosphere, reducing the safety hazards of using such a system. Most of the components in a pneumatic system consisting of materials such as plastics, aluminium and zinc (He et al., 2015).. All of these materials are available and low cost, making then a cost-effective system. Pressure air system required limited cleaning because air is their power source and nothing else can enter the sealed system.

For the disadvantage of pneumatic system are Control and speed are more difficult due to compressed air compared to electrical or hydraulic systems (Brenner, 2018). For example, if a device requires a specific speed, you may need to add more pneumatic system equipment to make it work at the desired level. If water leaks in a pneumatic system, the entire system can freeze. If they lose with the open nozzle, air hoses attached to pneumatic system pose a safety hazard. Pneumatic system are