UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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DEVELOPEMENT OF MICROCONTROLLER BASED AUTOMATED FOOD HANDLING SYSTEM

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

by

TEE SONG CHIEW
B071310504
930529-01-6821

FACULTY OF ENGINEERING TECHNOLOGY
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BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

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Alamat Tetap:

6, Jalan Abadi 19,

Taman Malim Jaya,

75250, Melaka.

Tarikh: 19/11/16

Disahkan oleh:

Cop Rasmi:

MASLAN BIN ZAINON
Pensyarah Kanan
Jabatan Teknologi Kejuruteraan Elektrik
Fakulti Teknologi Kejuruteraan
Universiti Teknikal Malaysia Melaka

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Name : .....TEE SONG CHIEW.....

Date : .....1/12/16.....

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as one of the requirements for the award of Bachelor's Degree of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours. The following are the members of supervisory committee:

(Supervisor)
MASLAN BIN ZAINON
Pensyarah Kanan
Jabatan Teknologi Kejuruteraan Elektrik
Fakulti Teknologi Kejuruteraan
Universiti Teknikal Malaysia Melaka

DEDICATION

To my beloved parents, Tee Pat Soon and Tan Sew Hwa for raising me become who I am today. It is also dedicated to my supervisor who taught and guided me when I faced the problem of doing this project.

ABSTRACT

Industrial automated robots have the capacity to dramatically improve product quality. Applications are performed with precision and high repeatability every time. With robots, throughput speeds increase, which directly impacts production. In most Industries, the path towards increased productivity is through increased automation process and control. Because an automated robot has the ability to work at a constant speed without pausing for breaks, sleep, vacations, it produce more than a human worker. Laborious and time consuming work in industrial plant and factories have made ease for workers to complete the operation. Industrial robots may lead to financial. It considers quality and customer satisfaction, which means returning customers and more business. In this research, Arduino will be introduced as a controller to setting the motion of the robot arm. Servo motor to control the movement of robot, such as elongation and rotation at the joint. MIT application Inventor will be used to gives order for the motion of robot arm.

ABSTRAK

Robot automasi industri dengan ketara meningkatkan keupayaan kualiti produk. Permohonan dengan ketepatan yang tinggi dan kebolehulangan setiap kali. Dengan robot, peningkatan kelajuan pemprosesan, yang secara langsung memberi kesan kepada pengeluaran. Dalam kebanyakan industri, jalan untuk meningkatkan kecekapan pengeluaran melalui peningkatan kawalan proses automasi. Sejak robot automatik untuk bekerja pada kelajuan yang tetap tanpa berhenti untuk berehat, tidur, kapasiti bercuti, menyebabkan lebih daripada seorang pekerja manusia. Kilang industri dan kilang-kilang dalam kerja-kerja yang memakan masa itu telah dibuat bagi memudahkan pekerja untuk menyelesaikan operasi. Robot perindustrian mungkin membawa ekonomi. Ia mengambil kira kualiti dan kepuasan pelanggan, yang bermaksud perniagaan ulangan dan lebih banyak perniagaan. Dalam kajian ini, Arduino akan diperkenalkan sebagai pengawal untuk menggerakkan lengan robot. Motor servo untuk mengawal pergerakan robot, seperti pemanjangan dan putaran sendi. MIT akan digunakan untuk gerakan bagi suatu perintah di lengan robot.

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Firstly I would like to express my utmost gratitude and appreciation to my supervisor, Encik Maslan Bin Zainon, who has guided and encouraged me along this semester. The supervision and supports from her is truly helping the progression of my project.

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APP	-	Application
LCD	-	Liquid Crystal Display
MIT	-	Massachusetts Institute of Technology
OS	-	operating system
FYP	-	Final Year Project
KFC	-	Kentucky Fried Chicken
3D	-	Three Dimension
DC	-	Direct Current

CHAPTER 1
INTRODUCTION

1.1 Introduction

Industrial Automation provides a higher level productivity, efficiency and quality, and reduce costs in industry. In most industries, productivity is increased through improved process control automation. Robot automation systems will increase productivity, efficiency and quality control. During operation, the robot can control to accommodate more work, even outside business working hours.

The robot technology reduces the time consumed in industrial plants by the help of factories mobile workers to complete the operation. Employees who are assigned to manipulate or control this robot, need bring their own tasks. This control becomes easier by implementing Programmable logic controller (PLC) that. PLC now is automatically used in every modern production process control, without human intervention every aspect of operations.

1.2 Background of Research

The aim of the study is to fascinate company other than SUBWAY, like (pizza hut, McDonald, AMW, Kentucky Fried System etc.) to investing this application on their working system. The core reason is making this idea came true is to bring convenient and easement to companies and the customers.

1.3 Problem Statement

Nowadays, people live in a hectic lifestyle. Humans try to save their time every day. This project aim is to bring convenient to people by saving queuing and waiting time for their food ordered. Traditional ordering system and manual hand-working is low efficient. Fast food like Subways have many varieties. This makes a customer takes time to choose their desired dishes and make their order. The customers only able to order after the person in front of them finish taking order. Situation like this causes the queue become long and slow.

1.4 Objectives

There are several objectives that will be achieved in this study:

- To design a prototype of a microcontroller based robot arm with MIT communication.
- To develop a control and monitoring system for the prototype using Arduino.
- To develop the prototype as a prototype of concept for fast food company.

1.5 Research Methodology

In the research methodology, it consist the steps to carry out the study in this semester PSM 1 and next semester PSM 2. The steps are the reference and guidance to finish the study.

1.6 Outlines of the Project

This research consists of 5 chapters. In the first chapter, the study begins with introduction of the study accompanied with the problem statement, objective, working scope and also research methodology for this study.

The literature review in chapter 2 discusses about motion of robot arm such as rotation of joint, picking up demonstration of gripper, and coding language used to programme the movement of robot arm. Finally the chapter shows the summary and reviews from the table comparison based on the previous journals.

The research methodology in chapter 3 explains the method that will be used to collect the data and shows how the analysis of the data will be made.

The result, analysis and discussion in chapter 4 present the findings, results of the study which will be presented in tables and figures. Several observations are projected from the findings.

The conclusion and recommendation in chapter 5 summarizes the outcomes of the study. The objective of this project will be achieved. This chapter outlines several recommendations for the further development and improvement on the method use for the analysis. Suggestions for future researchers will be also provided within this chapter.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This chapter provides the literature review based on the previous researches as well as theoretical readings based on manual lifting and also electromyography analysis.

2.2 Robot Arm System

A robotic arm is a type of mechanical arm, usually programmable, with similar functions to a human arm. (Robotics, E C E Embedded Blackmore, 2009) Industrial robotic automation has offered higher levels of productivity, efficiency, and quality as well as reduction to cost on the industry. Robot arm system operate quickly and effectively. Everything is done automatically. With automated system, people can sign into the testing system and see the results.

2.3 Robotic Pick and Place system

The Robotic Pick and Place system exploits an intelligent feed system to provide the robot clear targets to pick from. Product is fed to the robot in a dispersed fashion so that the vision system may distinguish individual pieces. The system can then follow the order, pick it up, and then place it into a container with a preferred orientation. Thus, the robot is improved by being integrated into the Food Systems Pick and Place machine. The Robotic Pick and Place with Product Feed system can integrate into an existing line or serve as the integral control component to a new production line. By extending mechanical power and sharing line with other machinery, Pick and Place food systems can effectively integrate line management to make production runs a smooth and efficient process.

2.4 Pros and Cons

2.4.1 Pros and cons of robot arm system

Figure 2.1 below shows the comparison between robot arm and manual workers.

PROS	CONS
1. Runs quickly and effectively Everything is done automatically.	**1. Tools can be expensive** The automation tools can be an expensive purchase.
2. Can be cost effective While automation tools can be expensive in the short-term, they save you money in the long-term.	**2. Tools still take time** A considerable amount of time goes into developing the automated tests and letting them run.
3. Everyone can see results With automated system, people can sign into the testing system and see the results.	**3. Tools have limitations** While automated tests will detect most bugs in your system, there are limitations.

Figure 2.1: The comparison between Robot Arm and Manual Workers

2.4.2 Pros and cons of manual workers

Figure 2.2 shows the pros and cons between robot arm and manual workers.

PROS	CONS
1. Short-term cost is lower Buying software automation tools is expensive.	**1. Certain tasks are difficult to do manually** There are certain actions that are difficult to do manually
2. More likely to find real user issues Automated tests are just that – automatic.	**2. Not stimulating** Manual testing can be repetitive and boring
3. Manual testing is flexible allow you to test ideas quickly and easily.	**3. Can't reuse manual tests** If there is any change to the software, you have to run the tests again by hand.

Figure 2.2: The comparison between Robot Arm and Manual Workers

2.5 Comparison of Manual workers and Robot arm system

Figure 2.3 shows the comparison of the working effect in industry between manual workers and robot arm system based on previous researches.

	Robot Arm	Manual workers
Productivity	High Material handling robots in high-temperature or freezer areas do not require frequent breaks. *(Ju, Wendy Takayama, Leila, 2011)*	Low. Human may sick, take leave and having emotional effects on work. *(United Nations, 1982)*
Flexible	Low. Robot only do consistent work. *(Hägele, Martin Schaaf, Walter Helms, Evert, 2002)*	High An operator may do a specific task (e.g., loading/unloading/stacking) which robot can't. *(Hägele, Martin Schaaf, Walter Helms, Evert, 2002)*
Precision	High Robots are dependable and precise. *(Kevin Kelly, 2012)*	Low. Manual workers will not be perfect. *(Rausman, I Lana K, 1997)*
Cost	Low Company may consider either buying a used one or leasing. *(Bjorn, Matthias ABB Corporate Research, 2014)*	High Calculation should include workers' compensation insurance, costs of vacations and other benefit packages, turnover, and the associated costs of recruiting and training replacement workers. *(MH&L Staff, 2002)*

Figure 2.3: The comparison between Robot Arm and Manual Workers

2.6 Conclusion

Based on the comparison between manual workers and robotic automation system, the robotic automation system is the most proven and suitable method to be used in industry.

CHAPTER 3
METHODOLOGY

3.1 Introduction

This chapter provides the overall plan for obtaining an answer to the research question or for testing the research hypothesis. The first stage shows the flow chat for the project which describes the procedures of the project. The second stage shows the block diagram for the project which explains about the procedure of the project.

3.2 Flowchart of the Robot Arm System

The flowchart below (Figure 3.1) shows the overall flow of the project flow and analysis. First, a lot of article and journal related to the project title Robot arm handling system analysis that written by the previous researches are needed to read in order to generate new idea to develop the study. After that, identify which electrical components shall be used in making this project. Once Identification of component is done, Robot design will be started. Robot design will be improved from using draft sketch, until using SolidWork, for the parts of the robot to be printed out using 3D printer. On the other hand, circuit design will be done structure of coding should be identified. Integrate the whole system when robot design and coding construction is produced. Then, several experiment and testing will be conducted with the subject selected. If the experiment failed, data from Robot arm design and development will be collected again. Robot arm motion signal will be analysed from MIT App Inventor through microcontroller.

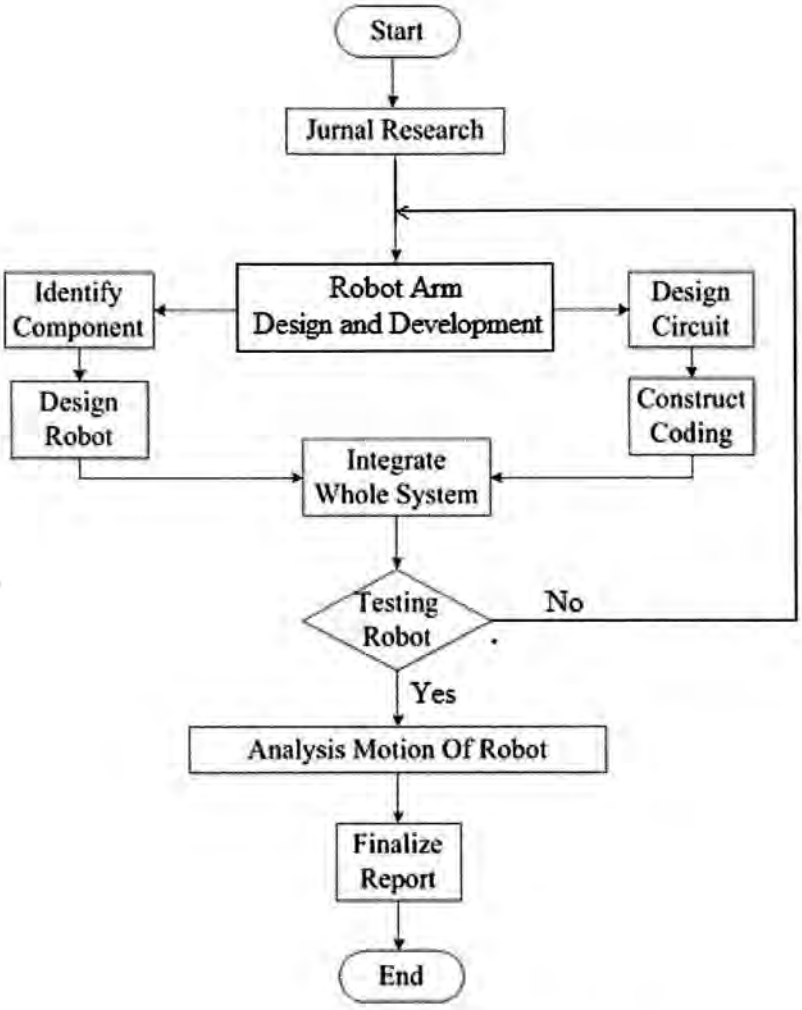

Figure 3.1: The flowchart of the Robot Arm System Methodology

3.3 Block Diagram

The figure 3.2 show the block diagram the Robot Arm System analysis. DC supply will act as power source to the microcontroller and also the robot arm system. The input component, which is the MIT app, will be connected with Arduino as microcontroller using Bluetooth system. From the MIT system, signal will be sent to the microcontroller, and microcontroller will interpret the signal into an output, that is, the motion of the robot arm.