

PC BASED ROBOTIC ARM

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**UNIVERSITI TEKNIKAL MALAYSIA MELAKA  
(UTeM)**

## **PC BASED ROBOTIC ARM**

Thesis submitted in accordance with the partial requirements of the  
Universiti Teknikal Malaysia Melaka for the  
Bachelor of Manufacturing Engineering (Robotics and Automation) with Honours

By

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This thesis submitted to the senate of UTeM and has been accepted as fulfillment of the requirement for the Bachelor of Manufacturing Engineering (Robotics & Automation) with Honours. The members of the supervisory committee are as follows:

.....

(Mr. Ruzaidi bin Zamri)

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## DECLARATION

I hereby, declare this thesis entitled “PC based robotic arm” is the result of my own research except as cited in the references.

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## **ABSTRACT**

Robotic arm has been widely use in manufacturing industry as part of automation system. Typical applications of robots in industry include welding, painting, assembly pick and place, packaging and palletizing, product inspection, and testing. PC based robotic arm has the same mechanism as the robots in industry. The pc based robotic arm is fully controlled by a computer, where the user has to control the movement of robot using the serial servo controller software. The serial servo controller circuit is serially connected to the pc, thus provide communication between the pc and the circuit. The signal from the computer will be received by the PIC at the circuit. The justified signal will then be use to execute the output to the servo motor, thus provide the necessary movement of the robotic arm. This project is to fabricate the robotic arm that can be directly controlled by computer. The special attributes of the project is the robotic arm is pc based. Its mean that the robot is fully controlled by the computer, makes it different than typical automatic and manual control robot. The project is very useful in gaining new experience and knowledge on robot arm fabrication and programming.

## **ABSTRAK**

Robot lengan telah digunakan secara meluas di dalam sektor industri dan pembuatan sebagai sebahagian daripada sistem automasi. Di dalam industri, robot lengan sering diaplikasikan dalam proses kimpalan, semburan cat, pemasangan, pengangkutan dan pemindahan barang, kawalan produk, dan sebagainya. Robot lengan berasaskan komputer ini mempunyai ciri ciri dan mekanisma yang sama dengan robot robot lengan yang digunakan di dalam industri. Robot jenis ini dikawal sepenuhnya, pergerakannya dengan menggunakan komputer. Pengguna mengawal pergerakan robot melalui pemuka yang telah dibangunkan khas di komputer. Litar pengawal motor servo bersiri disambungkan secara bersiri ke komputer, seterusnya memberi laluan komunikasi di antara komputer dan litar. Signal dari komputer diterima oleh PIC yang dipasang di litar. Signal yang telah diproses akan menggerakkan motor servo yang dikehendaki oleh pengguna dan seterusnya memberi gerakan robot yang dikehendaki. Secara mudahnya, projek ini mengkehendaki pelajar membina sebuah robot yang mampu berfungsi dengan sempurna. Kelainan robot ini berbanding robot automatik dan kawalan manual ialah pergerakannya dikawal sepenuhnya menggunakan komputer. Projek ini sangat bermanfaat dalam memperolehi pengetahuan dan pengalaman baru kepada pelajar.

## **DEDICATION**

*For my parents, Mizan Bin Hashim and Siti Maryah Binti Amat, for my siblings and for my beloved fiancée, Masna bt.Zainol Abidin*



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## LIST OF ABBREVIATION

PC	-	Personal computer
PIC	-	Programmable integrated circuit
PCB	-	Printed Circuit Board

# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

A robot is a reprogrammable, multi-functional, manipulator designed to move material, parts, tools, or specialized devices through variable programmed motions for the performance of a variety of task. - **Robot Institute of America**. The word robot has many different definitions, if it is refer to dictionaries and many encyclopedias. According to Robot Institute of America:

*A robot is a re-programmable multifunctional manipulator designed to move material, parts, tools, or specialized devices through variable programmed motions for performance of a variety of tasks.*

In a robot system, the number of independent Joint variables can be used to determine the number of degrees of freedom .The term degrees of freedom are the set of independent displacements that specify completely the displaced or deformed position of the body or system.In the simplest way, its describe the number of ways a robot can move. In general, there are four different geometric configurations of robots. They are Cartesian Robots, Cylindrical Robots, Spherical Robots, and Articulated Robots. The base rotations simulate the twisting of a human torso. The shoulder and elbow pivots on axis each. A robot can be actuate by three kind of means, which are hydraulic actuating system, electrical actuating system, and pneumatic actuating system

A robot manipulator can be divided into three sections, which are the arm, that consisting of one or more segments and joints; the wrist, that usually consisting of one to three segments and joints, and a gripper or other means of attaching and grasping.

A particle that moves in three dimensional space has three translational displacement components as DOFs, while a rigid body would have at most six DOFs including three rotations. Translation is the ability to move without rotating, while rotation is angular motion about some axis.

In three dimensions, the six DOFs of a rigid body are sometimes described using these nautical names:

1. Moving up and down (heaving);
2. Moving left and right (swaying);
3. Moving forward and backward (surging);
4. Tilting up and down (pitching);
5. Turning left and right (yawing);
6. Tilting side to side (rolling).

The robotic arm to be construct in this project is only have 5 degrees of freedom, where it doesn't have the Part of Yaw. It means that the wrist cannot turn to left or right, depending to base rotation and shoulder movement to pick material that beyond the picking area of the wrist part. Most of the robot developed is a computer controlled robot. In a computer controlled robot system, the robot software consist of the control software and the application software. The control software or operating system of the robotis was designed to controlling the basic operations of robot, processing data measurements from the sensor, planning the path for the motions, and communicating with internal and external devices. The operating system is written using the high level computer programming such as FOTRAN, COBOL, PROLOG and LISP. The application software is the program written by user for applications. The robot can perform the task specified in the user's written program.

## **1.1 Background of problem**

The major problem will be occurred in the most critical part, which is constructing the serial servo controller circuit. Using the concept of learn from the basic, there is lack of knowledge in constructing the circuit, and there will be some difficulties too, in applying the electrical and electronic knowledge in this project. Huge effort and full guidance from mr.wise suprevisor is crucial in order to completing the project. The software used is also fresh in project executor's thought. It will need an extra effort to finally understand the concept and how to applicate it in this project. When constructing the mechanical part, the main consideration will be time, and machine availibility. at the lab. The competition will be between all the final year students who are constructing their project's prototype. Instead, the available machine will not be in a good condition too. The students will have too wait and queu for their turn.

## **1.2 Objective**

The main objective of this project is to build a pc based Robotic arm that are capable of picking and placing an object. During the completion of this project, the objectives to be achieved is to:

- Understand the basic Configuration of Robot
- To understand and apply the Microsoft Visual Basic 6.0 for robot programming.
- To construct the electrical Diagram
- Fabricate and run the robot

### **1.3 Scope**

In this project, the scope is to build a pc based robotic arm that are capable of picking and replacing and object. Although the task is looked like simple, its actually consumed a hard work and time in applying the knowledge in electrical, mechanical and computer programming. The physical of the robot is manually constructed using the skills gained in Manufacturing Process Subject. The mechanical job involved in this project including fabricating the aluminum body of the robot using MagnaBend machine, drilling holes using the drilling machine, cutting the material using horizontal bandsaw machine and other machine that are appropriate to be used in this project. Knowledge in electrical and electronic is also compulsory to build this robotic arm, because the most critical part in this project is to build the serial servo controller which cost a lot of knowledge and deep understanding in electrical and electronic field. Instead, the PIC to be used in this project is also need to be programmed and build. The software to control the robotic arm is also an essential part.in this project. The software will be build by using the Microsoft Visual Basic 6.0. The position and sequence of the servo motor will be controlled using the software.

## **1.4 Significance of Study**

The study of robotic is a very broad topic because the study consists of three main fields of engineering, which are electrical, mechanical and electronics. Firm knowledge on these three disciplines is compulsory in order to develop the fully functioning basic robotic system. Reference from the previous researcher may offer good input to the newcomers in building a successful functioning robot.

The completion of this project is very useful especially to undergraduate robotic major students. It can be very helpful to them, in which, a clear view about the concept of robotics can be obtained through the hands-on activity, using the existing completed robot. Cost can also be reduced by using the existing prototype robot rather than to purchase a brand new robot. The low initial cost compared to the readily available robot and low cost of maintenance can help in gaining more money to develop the more sophisticated equipment for instructional purposes. A project like this should be encouraged to all students, because it can help to build self-confidence, to challenge themselves to build something that is beyond their capability.

## **1.5 Conclusion**

During the completion of this chapter, a brief understanding about the robotic arm should be achieved. An adequate knowledge in three disciplines of engineering is essential in order to build a successful functioning robot. The main goal of this project should always be highlighted each time the project is being undergone.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.0 Introduction**

This chapter will discuss and describe about the robotic arm. Nowadays, the robotic arm is widely used as part of automation system in a manufacturing field. The robotic arm is assigned for many tasks that are described as repetitive, continuous and cumbersome for human operators to accomplish. Although the initial cost is high, the company will not sigh to pay the bill because of its effectiveness and it's undoubtedly efficiency. This project is about to build a smaller scale pc based robotic arm. The concept used is similar to the larger scale but the capability is different. The safety measurement for the robot will be lower as it is not sophisticated as industrial robot, which was equipped with many sensors to detect the presence of human as a maximum safety precaution. However, the project will benefit to the new comers and can be a platform for next further understanding to robotics. In this chapter, it will discuss the previous research made by the researchers and university's lecturer. The researches were stressed on about the advance control of the robot and safety precautions for the robot in human environment.