

PICK AND PLACE ROBOTIC ARM WITH TRAINING KIT (SOFTWARE)

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To the Only God, my parents, teachers/lecturers, my family, friends and soul mate. No words can describe how much I love you all...

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ABSTRACT

Pick and Place Robotic Arm with Training Kit was developed in purposed to fulfill the need in educational field. The main objective of this project is to develop a prototype of a robot arm that can be used as a relevant method in teaching basic programming and basic operation of robotic arm. The main operation is to pick and place material and it was basically equipped with the hardware and software. In the other hand, this robot can be control by two methods, which by using transmitter and receiver remote controller and also by using computer program. Basically the computer program was developed using Visual Basic software. A user-friendly Graphic User Interface (GUI) was developed to control 8 movements of the robot. The data/instruction will be send from the computer to the interface circuit where then it will be transmitted to the receiver and the data will be analyze before it be send to the robot. As a training kit, a set of lab sheet procedure were provided to ensure the better deliverance of operation, function and programming knowledge of the robot arm. The application of this project can be used in the other related fields such as military, medical, industry and so on.

ABSTRAK

“Pick and Place Robotic Arm with Training Kit” telah dibangunkan untuk memenuhi keperluan di dalam bidang pendidikan. Objektif utama pembangunan projek ini adalah untuk membina sebuah prototaip ‘robot arm’ yang boleh menjadi satu kaedah yang relevan untuk mempelajari asas pengaturcaraan, asas operasi, fungsi dan pangaturcaraan sesebuah robot. Fungsi utama robot ini adalah untuk mengangkat material dan ianya juga dilengkapi dengan sistem perkakasan dan perisian komputer. Dengan maksud lain, robot ini boleh di kawal dengan menggunakan 2 cara iaitu dengan menggunakan “Transmitter and Receiver Remote Controller” dan juga menggunakan program komputer. Secara asasnya, program komputer ini telah dibangunkan dengan menggunakan perisian “Visual Basic”. Antaramuka yang mesra pengguna telah dibangunkan untuk mengawal 8 pergerakan asas robot ini. Data atau signal dari komputer akan dihantar kepada litar antaramuka sebelum di hantar ke “Receiver” dimana data atau signal akan dianalisa sebelum dihantar ke robot. Sebagai kit latihan, perisian telah disertakan dengan manual makmal untuk memastikan pemahaman yang lebih baik kepada pengguna dan pelajar dapat mengenatahui asas pergerakan, operasi, fungsi dan aturcara robot ini. Aplikasi projek ini boleh digunakan didalam bidang ketenteran, perubatan, industri dan juga sebagainya.

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LIST OF ABBREVIATIONS

PSM	-	Projek Sarjana Muda
IC	-	Integrated Circuit
GUI	-	Graphic User Interface
DC	-	Direct Current
PC	-	Personal Computer
LED	-	Light Emitting Diode
VB	-	Visual Basic
UTeM	-	University Teknikal Malaysia Melaka
FKEKK	-	Faculty of Electronic and Computer Engineering

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CHAPTER 1

INTRODUCTION

1.1 Introduction of the Project

Nowadays, they are so much application that used robot as main part to assist job and so on. Hence, they are a lot of robot and there are a lot of solution and way to build and to develop robot to assist the job.

Pick and place robotic arm with training kits are basically designed and developed for educational purposes where the finished robot will be used to teach student and lecturer about how the robotic arm work and so on.

Technically, the robotic pick and place arm interface is developed to enhance the system with the automatic control. The developed robot arm could be control using personal computer (PC) and the system integration will be made between the hardware and the software system. Basically, the interface is developed using Visual Basic software. Thus, the software system is basically is the 40% from the rest of the project and it is relevant to use the system for educational purposes and so on.

Initially, the software of the robot will be developed using Visual Basic program as the automatic control element of the robot. The purposes of using Visual Basic as the main program are because the program is most flexible language today and easy to use. The program is also user friendly and used to interface the hardware to the parallel port of the computer.

Thus, the objective and the main reason of the development of this project will be stated in this thesis.

1.2 Objectives

Below are the objective of the project and the main purposes of developing this project:

- i. To develop a robot that can be control manually and automatically by using Visual Basic software.
- ii. To build and to develop software system that could be integrated to support the application system of Pick and Place Robot arm.
- iii. To investigate the operation/performance of Pick and Place Robot Arm.
- iv. To develop Pick and Place Robot Arm with Training Kit that can be used as a teaching Industrial Robotic subject in University Teknikal Malaysia Melaka (UTeM).

1.3 Problem Statement

Robots have become important over a wide range of applications--from manufacturing, surgery to the handling of hazardous materials. Consequently, it's important to understand how they work, and what problems exist in designing effective robots. In designing the robot especially robotic arm, we must understand it requires a lot of knowledge and basic information about the robot. From the research and studies, there is several problem statements that is clarify and noticed.

i. Cost

Initially, the cost for purchasing the material for robotic arm is very expensive. A quality and suitable material for the robot will cost a lot of budget and it's clearly not affordable. This will cause a difficulty for educational purposes and many students and lecturer will find lots of difficulties in doing their studies and research. Thus this project will help them to deliver a better understanding about the basic operation and function of the robot.

ii. Software System.

Basically, in developing the software system of the robotic arm, it requires lots of basic knowledge about programming. There are numbers of programming language can be used such as JAVA, C, C++, PHP etc. It is difficult to start a programming without a basic programming knowledge for the beginner. In this project, the programming languages that are used are Visual Basic. These easy programming languages will help the beginner to understand better about programming the robot.

iii. Lack of Robot Arm in FKEKK

A survey had been done and it is noticed that there is lack of robot arm in FKEKK. With the development of this project, this will be a great effort to help the faculty to develop a robot arm as a relevant teaching method.

1.4 Scope of Work

Technically, the scope of works had been divided to 3 levels. The levels are beginning level, intermediate level and finishing level:

i. Beginning Level.

In the beginning level, the Research and Development (RND) had been done. It consists of activities of gathering information about the project from multiple sources such as internet, journals, and magazines, book and so on. In this state, the massive analysis about the project also been implemented to find the solution for this project. Last but not least, a meeting with lecturer and supervisor also been done to get the guidelines so the project could be implemented according to the procedures

ii. Intermediate Level.

In this level, the proposal had been done according to the procedures. The discussion with lecturer and supervisor also been done to ask and purchase the material for this project. The presentation of Projek Sarjana Muda 1 (PSM 1) had

been done to elaborate and deliver understanding to the developed project. And also, the research had been done to add more knowledge about the developed software.

iii. Finishing Level.

At the finishing level, the development of the hardware had been done. The software development and designing interface had been done to integrate both hardware and software. Then the integration between hardware and software had been done and also performance testing and trouble shooting had been done to ensure that the system is working well without errors. Finally, the robotic arm which functions to pick and place with training kit is completely able to run.

For the next chapter, Literature Review will describe about the theory and research that have been done to support the development of this project. This chapter will also describe about the circuit selection and the exact reason of why Visual Basic have been chosen as a language program.

CHAPTER 2

LITERATURE REVIEW

As an introduction, this project is about the development of 'Pick and Place Robotic Arm with Training Kit'. This robot is mainly control using the two way, manually which means using the remote control and in automatic way, using interface or software. This chapter will explain and will show the relevant theory that will support the development of the project.

2.1 Definition and Early Development of Robot

A robot is an electro-mechanical device that can perform autonomous or preprogrammed tasks. A robot may act under the direct control of a human (e.g. the robotic arm of the space shuttle) or autonomously under the control of a programmed computer. Robots may be used to perform tasks that are too dangerous or difficult for humans to implement directly (e.g. nuclear waste clean up) or may be used to automate

repetitive tasks that can be performed with more precision by a robot than by the employment of a human (e.g. automobile production.)

Robot can also be used to describe an intelligent mechanical device in the form of a humanknown as humanoid robot. This form of robot (commonly referred to as an android) which is common in science fiction stories. However, such robots have yet to become commonplace in reality, especially with the difficulties (and expenses) involved in making a bipedal machine balance itself or move in human-like ways without losing balance

The word robot is used to refer to a wide range of machines, the common feature of which is that they are all capable of movement and can be used to perform physical tasks. Robots take on many different forms, ranging from humanoid, which mimic the human form and way of moving, to industrial, whose appearance is dictated by the function they are to perform. Robots can be grouped generally as mobile robots (eg. autonomous vehicles), manipulator robots (eg. industrial robots) and self reconfigurable robots, which can conform themselves to the task at hand.

Robots may be controlled directly by a human, such as remotely-controlled bomb disposal robots, robotic arms, or shuttles, or may act according to their own decision making ability, provided by artificial intelligence. However, the majority of robots fall in between these extremes, being controlled by preprogrammed computers. Such robots may include feedback loops such that they can interact with their environment, but do not display actual intelligence.

The word "robot" is also used in a general sense to mean any machine which mimics the actions of a human (biomimicry), in the physical sense or in the mental sense. It comes from the Czech and Slovak word *robota*, labor or work (also used in a sense of a serf). The word robot first appeared in Karel Čapek's science fiction play

R.U.R. (Rossum's Universal Robots) in 1921, and was probably invented by the author's brother, painter Josef Čapek.

The word robot was introduced by Czech writer Karel Čapek in his play *R.U.R.* (Rossum's Universal Robots) which was written in 1920 (See also Robots in literature for details of the play). However, the verb *robotovat*, means "to work" or "to slave", and the noun *robota* (meaning corvée) used in the Czech and Slovak languages, has been used since the early 10th century. It was suggested that the word *robot* had been coined by Karel Čapek's brother, painter and writer Josef Čapek.

Concepts akin to today's robot can be found as long ago as 450 BC when the Greek mathematician Archytas of Tarentum postulated a mechanical bird that called "The Pigeon" which was propelled by steam. Heron of Alexandria (10AD-70AD) made numerous innovations in the field of automata, including (allegedly) one that could speak. Al-Jazari (1136-1206) an Ortoqid (Artuk) Turkish inventor designed and constructed automatic machines such as water clocks, kitchen appliances and musical automats powered by water.

One of the first recorded designs of a humanoid robot was made by Leonardo da Vinci in around 1495. Da Vinci's notebooks, rediscovered in the 1950s, contain detailed drawings of a mechanical knight able to sit up, wave its arms and move its head and jaw. The design is likely to be based on his anatomical research recorded in the *Vitruvian Man*. It is not known whether he attempted to build the robot

An early automation was created in 1738 by Jacques de Vaucanson, who created a mechanical duck that was able to eat grain, flap its wings, and excrete. Many consider the first robot in the modern sense to be a teleoperated boat, similar to a modern ROV, devised by Nikola Tesla and demonstrated at an 1898 exhibition in Madison Square Garden. Based on his patents 613,809, 723,188 and 725,605 for "teleautomation", Tesla