



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

MANUAL CONTROL TOBOT FOR PICK AND PLACE APPLICATION

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

By

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DECLARATION

I hereby, declare this thesis entitled “Manual Control Robot For Pick And Place Application ” is the result of my own research except as cited in the references.

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APPROVAL

This thesis submitted to the senate of UTeM and has been accepted as partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Robotic And Automation) with Honours. The members of the supervisory committee are as follow:

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ABSTRACT

Pick and place robot is a very common robot that being used in the industries for the purpose of palletizing. However the pick and place robot that being used is stationary and only capable of performing palletizing job within it's limited working area. The manual control robot for pick and place application is designed in order to overcome this situation. The robot will be able to move around as being wish by it's operator. As the name implies, the robot will need human handling in order to perform it's task. This is however this is not a bad thing. By doing so, the robot will be able to perform much better because the decision is made by the most powerful computer on earth which is human brain. The construction of this robot can be divided into two different areas which is mechanical parts and also electrical and electronic parts. In the mechanical parts, the rigidity of the whole robot structure, the effectiveness of the gripper and also the lifting mechanism. The design and development of the mechanical structure had being done using Solid Works software which had enable the design to be prototype first before actual fabrication can be carried out. This method had save lots of time in the fabrication process because all the parts for the robot had been predetermined. The electrical and electronic areas consist of the driver circuit, PIC circuit, hand hold controller, programming and also the whole robot wiring. The most important part in this section is how to suppress the electrical noise. Electrical noise can be a big problem in electrical and electronic because it can cause the whole system to malfunctions. This particular robot however had managed to overcome that by using a few methods that had being researched and practice such as by using an opto-isolator in the driver circuit. Besides that the whole robot wiring is also being done with noise suppression in mind. By combining the mechanical and also the electrical and electronic parts together, the robot had managed to function remarkable well were able to do it's task with flying colours.

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LIST OF ABBREVIATIONS

PIC	-	Programmable integrated circuit
MSD	-	Musculoskeletal disorder
ABS	-	Acrylonitrile butadiene styrene
PVC	-	Polyvinyl chloride
AC	-	Alternate current
DC	-	Direct current
DPDT	-	Double-pole double-throw
PLC	-	Programmable Logic Controller
CPU	-	Central processing unit
CNC	-	Computer numerical control
MCU	-	Microcontroller unit
LED	-	Light emitting diode
IC	-	Integrated Circuits
PSU	-	Power supply unit
PSV	-	Photovoltaics
Ni-Cad	-	Nickel cadmium
NiMH	-	Nickel metal hydride

CHAPTER 1

INTRODUCTION

In today's modern world, more and more robot has been developed. Regardless of it's purposes robot has become more popular in these past new years than it was before. Robot can be defined as a machine that resembles a human and does mechanical, routine tasks on command [1].

As the name applied, manual control robot for pick and place application are being used to pick an object from one location and placed it somewhere else. This robot is being design in order to eliminate the use of human strength in order to lift things for the manual sorting application. Operator's will no longer have to face an awkward working posture and repetition of works with these robot thus it will eliminate the work injury that being associated with these jobs.

This robot will be controlled via a hand hold controller. The hand hold controller will act as a link between the robot operator and the robot controller circuit which determined the robot movements. The robot controller circuit used simple switching method combined with the driver circuit for the motor. This robot also being developed with a steady base support and well function of gripping & lifting mechanism in order to enhance the performance of the robot.

1.1 Problem Statements

In small company, there are still some of the sorting processes that still being conducted manually. Manual sorting process can take a long time because human will usually be tired doing the same task over and over again. This will result to inefficient work condition. The repetition of these works over long period of time can cause the workers to experiencing lower back pain and in some cases of musculoskeletal disorder (MSD). In some serious cases, this type of injury can cause the operator to be paralyzes.

Automated sorting system which being used in big company does not suit the application of the smaller company. These systems usually required a very high cost to be implemented. These systems also required an amount of space if the systems want to be installed depending on the size of the system. The space of the system can't be used for other purposes.

With this project of manual robot for pick and place application, all problems that being mentioned earlier can be eliminated. With this robot the sorting process can be done faster than before. This is because the robot will be doing all the lifting process while the operator will only control the movement of the robot. This will result in higher material handling efficiency. Although the sorting process is being done by a robot, the cost of this unit is lower than the automated sorting system. The robot can be considered as semi automating sorting equipment. It is considered as semi auto because the robot still need an operator in order to control it's movement.

1.2 Objectives

The main objective of this project is to develop a manual robot that can be used in sorting process which is pick and place application. Additional objective of this projects are:-

- a) To eliminate the needs of relying on human strength in lifting process.
- b) To develop a fully functional controller that can be used to control the robot movement.
- c) To develop smooth movement of lifting and gripping mechanism.

1.3 Scope

In order to develop a working robot that can be used to conduct the sorting process, scopes are required to assist and guide the development of the project. The scope should be identified and planned to achieve the objective of the project successfully on the time.

The scopes for this project are:-

- a) To design and develop an electrical circuit to control the robot movement using hand hold controller.
- b) To design and develop motor driver circuit that will not have any electrical noise effect.
- c) To design and fabricate a solid base structure of the robot.
- d) To design and fabricate a smooth lifting and gripping mechanism.

1.4 Benefits Of The Project

This manual control robot for pick and placed application are being developed in order to assist the sorting process that usually being done by using human power. The benefits of this project are:-

- a) Eliminating the usage of human power to pick up things.
- b) Preventing back pain/back injuries due to picking up heavy loads by the operator.
- c) Increasing productivity and efficiency.

CHAPTER 2

LITERATURE REVIEWS

2.1 Introduction To Robot

There are lots of definition that being used to describe what robot really is. Some of them are [2]:-

- a) A mechanical device that sometimes resembles a human and is capable of performing a variety of often complex human tasks on command or by being programmed in advance
- b) A machine or device that operates automatically or by remote control
- c) A person who works mechanically without original thought, especially one who responds automatically to the commands of others

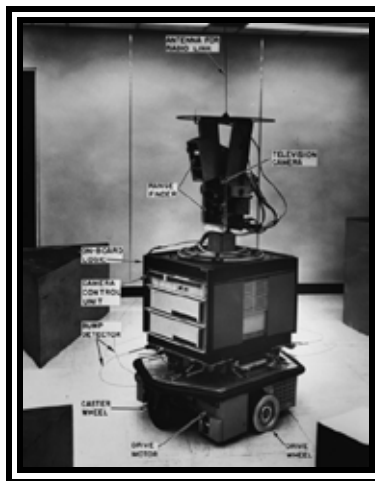


Figure 2.1: Shakey the robot [2]

Figure 2.1 shows an example of an intelligent robot that being develop for the purpose of research. While there is still discussion about which machines qualify as robots, a typical robot will have several, though not necessarily all of the following properties [3]:-

- a) Is not natural
- b) Can sense its environment
- c) Can manipulate things in its environment
- d) Has some degree of intelligence, or ability to make choices based on the environment or automatic control / preprogrammed sequence
- e) Is programmable
- f) Can move with one or more axes of rotation or translation
- g) Can make dexterous coordinated movements
- h) Appears to have intent or agency

There is more than one spectrum of robot intelligence. Fully remote control or fully autonomous is not the only option. The level of intelligence of the robot can be predetermined according to the application that it supposed to perform before any construction can be carried out. Generally, the more intelligent of the robot had, the more difficult it is to build. The main categories of robot intelligence are [4]:-

- a) Automaton 'Intelligence'
- b) Remote Control 'Intelligence'
- c) Teleoperation

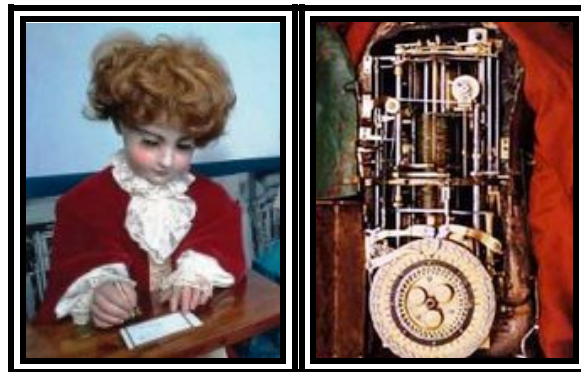


Figure 2.2: Writing automaton [5]

Automaton intelligence is the lowest level of robot intelligence. As shown in Figure 2.2 an automaton robot usually consists of a simple automaton device. An automaton is a device where there are absolutely zero decisions made no matter the given environment. They are simple devices where the action it does is repetitive and automatic [5]. A simple circuit with a motor or a combination of gears and a spring could easily be an automaton. The automaton device simply has no fault tolerance, and will continue attempting the action it is supposed to do. They did not even have a method to sense the environment - a requirement of decision making. BEAM robots basically fall into the same category, except they are made from very well designed electronics instead of gears.

Remote control is the next level of robot intelligence. Although our current technology has enable us to design various machine that capable to do various things such as flying more than the speed of sound, went to the deepest of the ocean bed, but our current super computer still cannot even match a roach brain in term of autonomy. To solve these problems, we can integrate human brain to the application. It's like putting human brain in the driving seat of the machine. This allows for the best of both worlds. Strength and expendability of a machine, brain of a human [4].

According to the society of robotic, teleoperation is one step above remote control. The advantage a computer has over the human brain is speed. A typical home computer today can crunch more numbers in a few seconds than a human can in an entire lifetime. But despite that speed, the computer does not have a good understanding of the situation. Added to that, the most advanced electronic sensors cannot match our human eyes and ears for observing the situation. The solution for this is to let the human make the decisions, but have the computer carry them out. A perfect use for this would be a robot spider as shown in Figure 2.3. A human operator in no way can control 8 legs with 3 joints each. Instead, the human would give commands like go forward or rotate and the computer will handle the rest. This method is also very common with space robots because of the long transmission delay [4].

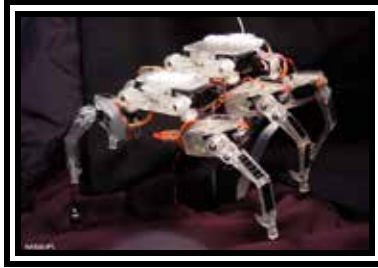


Figure 2.3: Spider robot [6]

Like human, robot also has its anatomy which is essential in order to enable it to be build. The anatomies of the robot are:-

- a) Mechanical structure
- b) Motor
- c) Controller
- d) Electrical and electronic components
- e) Sensor
- f) Power supply

In real world application the robot, the robot can be divided into two big categories which are:-

- a) Autonomous robot
- b) Industrial robot

2.1.1 Autonomous Robot

Autonomous robots are robots which can perform desired tasks in unstructured environments without continuous human guidance. Many kinds of robots have some degree of autonomy. Different robots can be autonomous in different ways. Fully autonomous robots are still a dream. It is a huge area in current state-of-the-art robotics research. It concerns artificial intelligence, consciousness, advanced sensory perceptions and the list goes on. Autonomous robots are robots which can perform desired tasks in