OBJECT RECOGNITION AND SORTING USING PNEUMATIC MANIPULATOR AND PLC

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"I hereby declared that I have read through this report and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Industrial Power)".

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"I admit this report is produced by me except the summary and extraction for each I have been clearly presented."

Signature :.....

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Date : 18 November 2005

Thank you Allah for my beloved mother and father, my family,
all my teachers and friends.

ACKNOWLEDGEMENT

Assalamualaikum warahmatullahi wabarakatuh

Grateful to Allah S.W.T because of his willingness, Alhamdulillah I have finished my Projek Sarjana Muda (PSM) I &II that takes about two semester to be finished. As we known, this PSM project which carries 6 credits is a compulsory subject that must be taken and passed by all the last semester degree students in Kolej Universiti Teknikal Kebangsaan Malaysia (KUTKM) before they can be graduated.

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Last but not least, thanks a lot to all the people that help me directly or indirectly to finish my project successfully. I hope all the effort gone through will be blessed by Allah! Amin.

Thank you so much!

ABSTRACT

Pneumatic driven system is widely used in industrial automation, mainly for relative simple tasks with open-loop control. The Pneumatic System's considered difficult to control in a precise motion control system because of compressibility and few stop position. Pneumatic Manipulator mainly use to pick and place the object in the manufacturing process. The remote user could command the robot to move to the position and to grab the object. This project is about designing and building an 'Object Recognition and sorting Using Pneumatic Manipulator and PLC'. It is a mechatronic project, which combined the knowledge of mechanical, electrical and electronics. The objective of the project was to design and build a system that should be able to pick and place (sort out) the object with different type of the materials and colors. This project uses a PLC as the control system to control all the activities. The input device like sensors, limit switches and push buttons will send a signal to PLC and PLC will made a response. The response normally involves turning ON or OFF an output signal to activate the output devices. The motion of the Pneumatic manipulator is control by PLC. A control panel is design as the input device for PLC. The technology of this project is can be used for the manufacturer process plant.

ABSTRAK

Sistem Pemacu, Pneumatik digunakan dengan meluas dalam industri automasi, terutamanya yang berkait dengan pengawalan gelung terbuka. Pengawalan sistem pneumatic dianggap sukar untuk dikawal lebih-lebih lagi dalam pergerakan yang tepat dan posisi berhenti. Pneumatik Manipulator digunakan untuk mengambil dan meletakkan objek dalam sesuatu proses pembuatan. Pengguna boleh membuat arahan kepada manipulator supaya bergerak ke posisinya dan mengambil objek tersebut. Projek ini berkenaan dengan merekabentuk dan membangunkan sistem bagi 'Mengenalpasti Objek dan Mengasingkannya dengan menggunakan Pneumatik Manipulator dan Program Kawalan Logik (PLC). Ini merupakan projek mekatronik dimana gabungan pengetahuan antara elektikal, mekanikal dan elektronik. Objektif projek ini adalah untuk mereka dan membangunkan sistem bagi memastikan Pneumatik Manipulator yang boleh mengambil dan meletakkan (mengasingkan) objek mengikut jenis objek dan warnanya. Projek ini menggunakan PLC sebagai pengawal sistem untuk mengawal semua aktiviti. Perkakasan dalaman seperti sensor, suis penghad, dan suis butang tekan akan beri isyarat pada PLC dan PLC akan bertindak. Tindakan tersebut biasanya memberikan arahan 'ON' dan 'OFF' kepada perkakasan luaran yang tertentu. Pergerakan Pneumatik Manipulator dikawal oleh PLC. Panel kawalan akan direka sebagai perkakasan masukan untuk PLC. Teknologi projek ini boleh digunakan untuk kilang proses pembuatan.

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CHAPTER 1

INTRODUCTION

1.1. Introduction

Generally, a robot is a reprogrammable, multifunctional manipulator designed to move materials, tools, or specialized devices, through variable programmed motions for the performance of variety of tasks

Today 90% of all robots used are found in factories and they are referred to as industrial robots. Ten years ago, 9 out of 10 robots were being bought by auto companies - now, only 50% of robots made today are bought by car manufacturers. Robots are slowly finding their way into warehouses, laboratories, research and exploration sites, energy plants, hospitals, even outer space

Robots are useful in industry for a variety of reasons. Installing robots is often a way business owner can be more competitive, because robots can do some things more efficiently than people. Robots never get sick or need to rest, so they can work 24 hours a day, 7 days a week. When the task required would be dangerous for a person, they can be do the work instead. Robots don't get bored, so work that is

repetitive and unrewarding is no problem for a robot. In the application for industry, robot can do the any task :

a) Spray Coating
b) Assembling Operations for electronic component
c) Material Removal
d) Cutting Operations
e) Part Transfer
f) Inspecting
g) Arc Welding
h) Automated Warehouse

The picture below to show the application robot system in industries for car manufacturing.

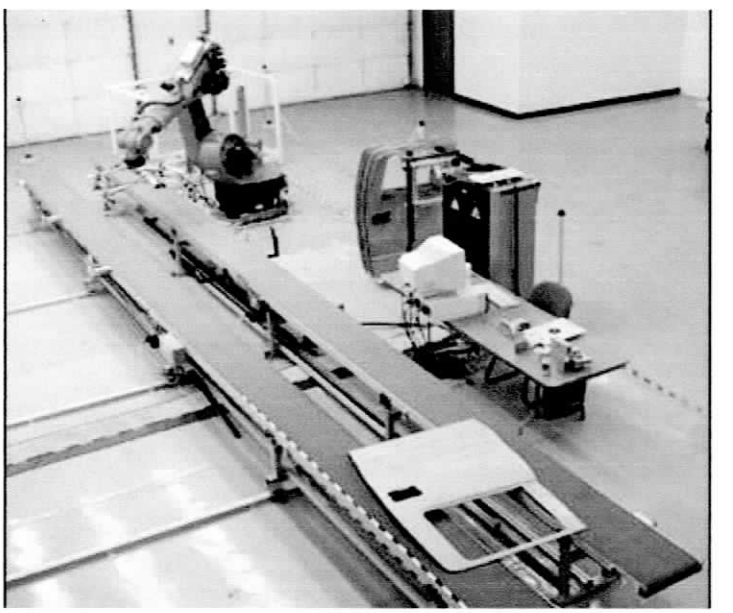

Figure 1.1 Robot application for industrial use

Various manufacturing operations require pick and place operations that are conventionally done manually. These include line transfers, inspection, sorting, packaging, etc. As a result, the human speeds and bottlenecks determine the process speed, and bottleneck the complete line operation. Furthermore, to avoid bottleneck effects, higher buffer storage are required increasing costs of inventory, storage, space and manpower. Finally, certain processes make manual operations for pick and place too risky and hazardous, or adversely affect quality of the product as a result of handling errors and defects:

a) Fully automated high productivity operation

b) Machine utilization up to 95%

c) Increases machining line efficiency 30-50% saving of floor space

d) No operational manpower requirement

e) Integration with machines and inspection equipments

f) Reduces machine idle time to 6-8 seconds

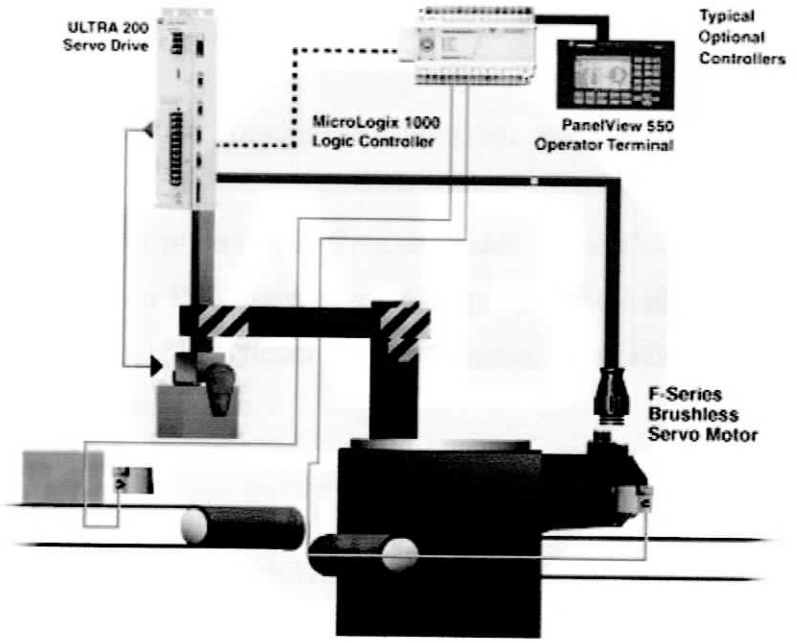

Figure 1.2 Robot in industries

1.2. Project

This project is to develop the application system of Robotic in Industry. The name of the project is 'Object recognition and sorting system using the Pneumatic Manipulator controlled by Programmable Logic Controller (PLC). The function of the Pneumatic Manipulator is to pick and sort the object with different type of the materials and colors

The function of the sensor on the conveyor system other than detecting the present of the object or work piece at the input, they also be able to detect the type of the materials (metal or plastics) and colors (black or white) that passing through them. The operation of the system ultimately controlled by the Programmable Logic Controller (PLC).

1.3. The project objectives

I. To understand the Principle of Automation System.

II. To be able to program the Programmable Logic Controller (PLC) using the most common PLC programming languages (i.e Ladder Diagram, Structure Text Program, Functional Block Program, Instruction List and Sequential Function Chart).

III. To understand the concept of the Pneumatic Robotic/Manipulator, the pick and place and also the material sorting mechanism.

IV. To be able to build a complete system for object recognition and sorting system using "Pneumatic Robotic Manipulator & PLC.

V. To understand the principle of the sensors and their application.

VI. To be able to select the appropriate or suitable sensors for certain application.

VII. To understand the conveyor system operation.

VIII. To be able to design and build the conveyor system for material handling application

1.4. Benefits this Project.

By using robot controllers, it can bring a lot of benefits for the users:

I. The object can be sort depend on program that been specified with Programmable Logic Controller (PLC)

II. As in a production on factory, can be increase via robot application and also gain profit

III. Damage of a goods can reduce by using robot compare to manpower

IV. The manpower can reduce while saving cost

1.5.Scope Project

The scopes of this project are:

I. Using CX-programmer V3.0 software write program (ladder diagram).

II. Electronics components are use in this project.

III. A prototype (structure) of the project will design and build up.

CHAPTER 2

AUTOMATION SYSTEM

2.1. Overview

Automation is a technique that can be used to reduce costs and to improve quality. Automation can increase manufacturing speed, while reducing cost. Automation can lead to products having consistent quality, perhaps even consistently good quality. Automated processes can be controlled by humans operators, by computers, or by a combination of the two. If a human operator is available to monitor and control a manufacturing process, open loop control may be acceptable. If a manufacturing process is automated, then it requires closed loop control.

One major difference is the presence of the sensor in the closed loop control system. The motor speed controller uses the feedback it receives from this sensor to verify that the speed is correct, and drives the actuator harder or softer until the correct speed is achieved. In the open loop control system, the operator uses his/her built-in sensors (eyes, ears, etc.) and adjusts the actuator (via dials, switches, etc.) until the output is correct. Since the operator provides the sensors and the intelligent control functions, these elements do not need to be built into an open loop manufacturing system.

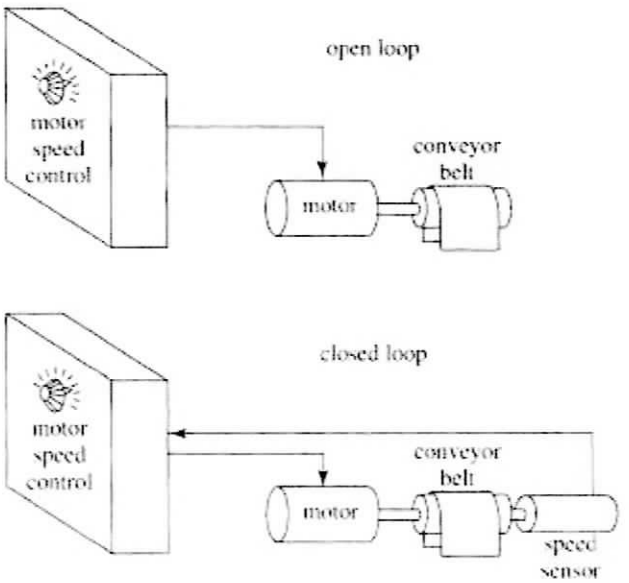

Figure 2.1 Open loop and close loop

2.2. Components in automation

There are illustrates the essential components in a controlled automated system:

I. The actuator (which does the work)

II. The controller (which "tells the actuator to do work)

III. The sensor (which provides feedback to the controller so that it knows the actuator is doing work)