DEVELOPMENT OF AUTOMATED HEIGHT MEAUREMENT SYSTEM (SOFTWARE DEVELOPMENT)

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This report is submitted in partial fulfillment of requirements for the award of Bachelor of Electronic Engineering (Industrial Electronics) with honours

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UNIVERSTI TEKNIKAL MALAYSIA MELAKA

FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN

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Sesi Pengajian : 2-2006/2007

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Dedicated to my beloved mother, father, families, supervisor, lecturers, technicians and fellow friends.

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ABSTRACT

Non-contact shape measurement using structured light optical techniques has found many applications in health care and industry. Although various phase-to-height models exist in the literature, these models are usually restricted to a certain optical arrangement dedicated by the system components. Furthermore, the different approaches adopted in deriving these models employ numerous assumptions in order to simplify the analysis. This could make the derived models very sensitive to parameter variations (height) of the model inputs (workpiece). This project presents approach to develop an automated height measuring system. The main objective is to measure height for the desired product. Work piece will pass trough the height sensor one by one continuously and being move by a conveyor. This system is also capable to identify acceptable workpiece according to the required specification (height). Workpeice that does not meet the specification will be labelled as reject product and eliminated from production line. The design also involves pneumatics technology in order to perform motion and movement. For the control system, PLC is being selected to manage the control sequence accordingly and GRAFCET method had being used to design the program.

ABSTRAK

Pengukur tanpa sentuh menggunakan teknik pancaran optik telah banyak digunakan di pusat penjagaan kesihatan dan industri. Walaupun pelbagai model fasa ke ketinggian dilampirkan di dalam kajian latarbelakang, model ini adalah tertakluk kepada sebahagian susunan optik daripada komponen sistem. Tambahan lagi, pendekatan berbeza digunakan untuk memudahkan analisis dilakukan dalam pembuatan model. Ini membuatkan model yg direka amat sensitif terhadap perubahan parameter (ketinggian) produk. Projek ini adalah mengenai pendekatan untuk membangunkan sistem automasi mengukur ketinggian. Objektif utama projek ini adalah untuk mengukur ketinggian produk. Produk akan melalui sensor ketinggian satu persatu dan digerakkan oleh penghantar. Sistem ini juga berkeupayaan untuk mengenalpasti produk mengikut spesifikasi ketinggian yang ditetapkan. Produk yang tidak memenuhi spesifikasi akan disingkirkan daripada tempat pengeluaran. Rekaan sistem ini mengaplikasikan teknologi pneumatik dalam pergerakan sistem. Untuk sistem kawalan pula, PLC digunakan bagi mengawal susunan program. Kaedah GRAFCET telah digunapakai untuk membina program.

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CHAPTER 1

INTRODUCTION

1.1 Background

Height is a vertical measurement of an object. If the measurement is not taken vertically, then the measured value turns out to be length (or sometimes, the width). Like length and width, it is measured in units of length. In geodesy, height is the metric distance of a point (usually on the terrain surface, such as a mountain top) vertically above a *reference surface* such as mean sea level. A more precise definition of a reference surface would be the geoid, the equipotential surface of the geopotential that coincides in the mean with mean sea level. Such heights are called orthometric heights. In aviation, height is the distance of a point above the surface of the Earth, as compared to Altitude, which is the distance above mean sea level. There are many physical and application variables that affect the selection of the optimal height measurement solution for industrial and commercial processes. In industry such as automation, dimension is critical. Indirectly it involve with height measurement system. This project was proposed to measure the height of a work piece, automatically with aid of PLC as a controller. The system requires human interface only to start, reset and stop during emergencies, whereas the whole system will operates on its own. This system also capable to reject the work piece which do not meet the height specification. Pneumatic cylinder is chose to work as an actuator for rejection sequence in this system. Products that meet the height specification will be delivered to next process or section.

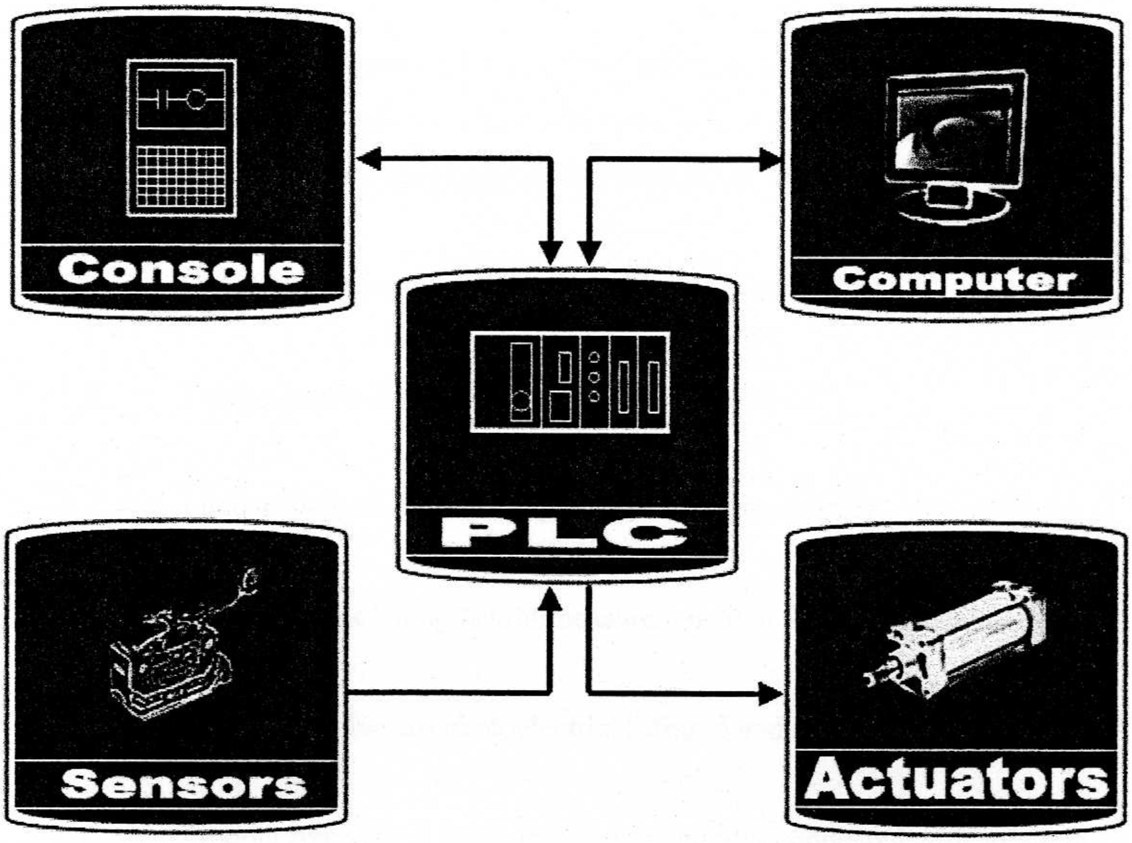

Figure 1.1: System Particle of Diagram

1.2 Objectives

The main objective of this project is to perform an automated height measurement system, which controlled by PLC. The work piece that meets the height requirement will be delivered to next process. As for the work piece that do not meet the height specification, instant discarding step then will be performed in order to draw it from the production line. All of these objectives must be implemented in this project as the highest priority.

1.3 Scope of the project

The scopes of this project focus on a several concern criteria in order to accomplish the project objectives. This is important as it will provide a guideline during this project execution. The scopes of this project are stated below:

1. PLC (Programmable Logic Controller) as a controller.

2. Design ladder diagram using GRAFCET Method.

3. Ladder diagram constructing using CX - Programmer.

4. Research concerning height measurement and the best suitable sensor.

5. Sensors involve are photoelectric, infrared and magnetic reed sensors.

6. Product rejection is using pneumatic cylinder connected with solenoid valve.

1.4 Problem statement

Before automated height measurement system exists, discarding process for the rejected product was determined by human being. In a typical operation in factory nowadays, human interface produces more blunders in the production line. This caused lack of efficiency and wasting time during system execution. Hence, to eliminate this error, human interface will be replaced by automatic controlled system, thus enhance productivity and efficiency.

In industries typical control system, pneumatic and electronic type is widely being used. It can be fully pneumatic, fully electronic and combination pneumatic and electronic. In this project, electronic (PLC) is decided as the main controller and it connected with pneumatic by using solenoid valve as an interface.

1.5 Project outline

This report consist 5 chapters where each chapter filled with detail of scope.

Chapter 1: Reviews about Automated Height Measurement System such as Introduction, Objectives, Problem Statement and Scope of Project.

Chapter 2: This chapter describe about the research and information about the inputs, outputs and devices.

Chapter 3: This chapter discuss about project methodology used in this project

Chapter 4: This chapter describe about the project finding as earlier results and analysis.

Chapter 5: This chapter comprise the future planning for this project, discussion and conclusion.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In order to accomplish this project, literature review must be done to comprehend the whole system and determined the best inputs, outputs and devices. From the literature review, there will be an analysis concerning the advantage and disadvantage for each phase in this project. Equipment and part manuals provide information such as dimension, operation and specification.

2.2 Controller

Nowadays there are numerous types of controller used in industries. For this project, PLC is chosen as the controller since it is the most suitable compared to the other controllers.

2.2.1 Programmable Logic Controller (PLC)

Automation of many different processes, such as controlling machines or factory assembly lines, is done through the use of small computers called a programmable logic controller (PLC). This is actually a control device that consists of a programmable microprocessor, and is programmed using a specialized computer language. Before, a programmable logic controller would have been programmed in ladder logic, which is similar to a schematic of relay logic.

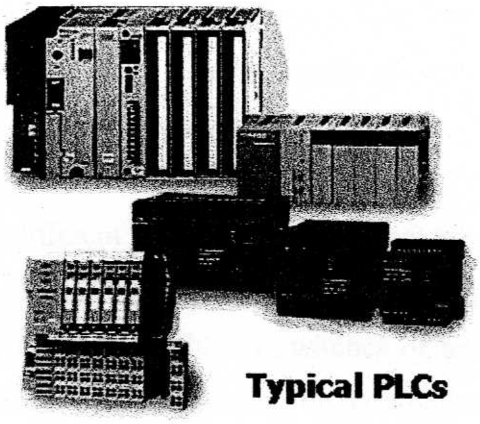

Figure 2.1: Typical of PLCs

A modern programmable logic controller is usually programmed in any one of several languages, ranging from ladder logic to Basic or C. Typically, the program is written in a development environment on a personal computer (PC), and then is downloaded onto the programmable logic controller directly through a cable connection. The program is stored in the programmable logic controller in non-volatile memory.

Programmable logic controllers contain a variable number of Input/Output (I/O) ports, and are typically Reduced Instruction Set Computer (RISC) based. They are designed for real-time use, and often must withstand harsh environments on the shop floor. The programmable logic controller circuitry monitors the status of multiple sensor inputs, which control output actuators, which may be things like motor starters, solenoids, lights and displays, or valves.

The programmable logic controller has made a significant contribution to factory automation. Earlier automation systems had to use thousands of individual relays and cam timers, but all of the relays and timers within a factory system can often be replaced with a single programmable logic controller. Today, programmable logic controllers deliver a wide range of functionality, including basic relay control, motion control, process control, and complex networking, as well as being used in Distributed Control Systems.

Digital signals yield an on or off signal, which the programmable logic controller sees as Boolean values. Analog signals may also be used, from devices such as volume controls, and these analog signals are seen by the programmable logic controller as floating point values.

There are several different types of interfaces that are used when people need to interact with the programmable logic controller to configure it or work with it. This may take the form of simple lights or switches or text displays, or for more complex systems, a computer of Web interface on a computer running a Supervisory Control and Data Acquisition (SCADA) system.

Programmable logic controllers were first created to serve the automobile industry, and the first programmable logic controller project was developed in 1968 for General Motors to replace hard-wired relay systems with an electronic controller.

For the store data in PLC, there will be a memory to store and dump data. At the most basic level, non volatile memory stores data without power. Two examples of devices that use non volatile memory are hard drives and CMOS chips (the chip that holds your BIOS information).

Non-volatile memory is important for long term storage of essential system information and data. Just imagine how much trouble it would be to reenter everything contained on the hard drive.

EPROM (erasable programmable read only memory) is another form of non-volatile memory. There are a few varieties of this type including:

- Flash EPROM (which erases and replaces the data all at once, as opposed to one byte at a time)
- EEPROM (electronically erasable programmable read only memory)
- OTP (one time programmable) EPROM. Many pieces of hardware use these chips to upgrade their firmware (software contained on the hardware).

There are a few advantages to products using non-volatile memory. They are typically less costly to produce than volatile memory (such as RAM), data can be stored up to ten years (sometimes longer) without a power source, and it allows hardware to become upgradeable. This allows developers to both adjust to new technologies, and helps to stave off complete hardware upgrades.

Table 2.1: Advantage and Disadvantage of PLC and PIC

PLC	PIC
Current output from PLC can be a decimal range (AC=240V, & DC= 24V,2.1A) – OMRON manual (S82V)	Current output is only at miliampere range (DC= 24mA) Microchip UMS2 PIC manual
Input and output slot can be inserted according to system requirement.	Limited input and output pin
Operated at High Voltage (120@240V AC) OMRON manual (CJ1M)	Low operated Voltage (5V DC) Microchip UMS2 PIC manual
Simple programming technique and can be modified easily http://cq.cx/ladder.pl	Complicated programming where it need to use certain programming language http://cq.cx/ladder.pl
Less wiring	Needs more wiring
High cost	Low cost
Printout (hard copy) of the PLC can be done in minutes.	Any program changes can only being made by a certain software in Computer
User friendly where there is a portable console to fix any small programming problem.	Any program changes can only being made by a certain software in Computer.

Table 2.2: Difference between PLC and Conventional Controller

PLC	Conventional Controller
Less wiring Omron – Beginner's guide to PLC	Too much wiring work. Omron – Beginner's guide to PLC
Less power consumption Omron – Beginner's guide to PLC	Power consumption might be high as the coil consumes power Omron – Beginner's guide to PLC
Machine cycle time is improved tremendously due to the PLC operation speed (in milliseconds) Omron – Beginner's guide to PLC	Multiple delay time due to relays and timers operation. Omron – Beginner's guide to PLC
PLC self-diagnostic function enable easy and fast troubleshooting of the system. Omron – Beginner's guide to PLC	Troubleshooting might be troublesome Omron – Beginner's guide to PLC

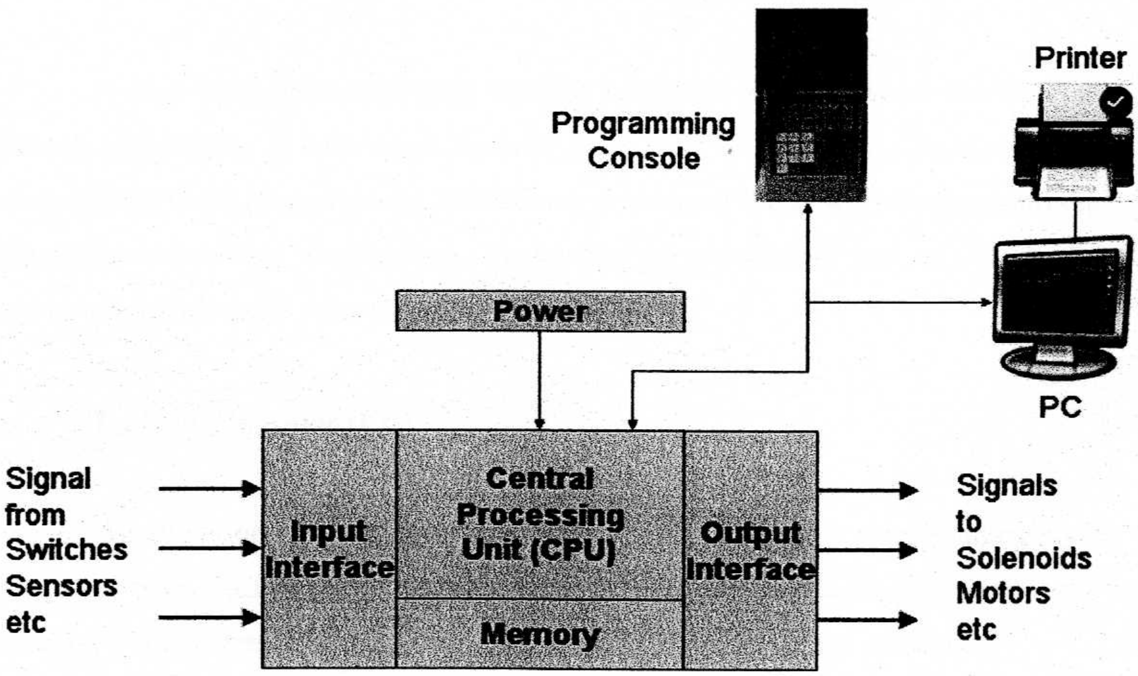

Figure 2.2: PLC Wiring Block Diagram