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DESIGN THE HARDWARE FOR TEACHING AID:
BALL SORTER USING PLC

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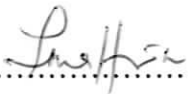
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I dedicate this to both of my beloved parents, friends and
electronic engineering education

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ABSTRACT

The project target is to design the hardware that can integrate with the PLC to show how the system works. This project will use the PLC to control the sorting of the ball regarding the specifications. The Ball Sorter Machine will compare and separate the ball according to the colour (black and white) and metal ball. The objective of this project is to design and fabricate the Ball Sorter Machine using hardware and software (PLC programming). This project will be used as the teaching aid for the student to understand about PLC easier. PLC becomes one of the subjects that need to be learnt by the engineering student. Without the help of trainer or hardware as a teaching aid especially for those who were weak in imagination, the student did not able to understand PLC programming easily. Beside that, the ball sorter machine can settle the problem when all balls were assorted in one container it will cause trouble to the users to separate the entire balls. The ball sorter process will be done by using the stopper and sensors. There are three sensors that be use in this machine and the stopper is use to block the ball and the ball will be sort. The counter will be used to count the number of ball inside the box. The main controller of the project is the PLC controller that uses CX-Programmer as a programming tool to design ladder diagram.

ABSTRAK

Target projek ini adalah untuk merekabentuk perkakasan di mana ia boleh disambungkan dengan PLC untuk menunjukkan bagaimana sistem ini bekerja. Projek ini menggunakan PLC untuk kawal pengagihan bola mengikut aspek yang ditetapkan. Mesin ini akan membezakan dan mengagihkan bola mengikut warna (hitam dan putih) dan bola besi. Objektif projek ini adalah untuk merekabentuk dan membina mesin ini yang merangkumi system perkakasan dan perisian. Projek ini akan digunakan sebagai alat Bantu sistem mengajar kepada pelajar-pelajar untuk lebih memahami PLC dengan lebih mudah. Ini kerana PLC menjadi salah satu mata pelajaran yang perlu dipelajari oleh pelajar kejuruteraan, jadi pelajar tidak mudah untuk faham perisian PLC dengan lebih mudah tanpa adanya alat bantuan sebagai bahan pengajaran terutamanya kepada pelajar yang lemah dalam imaginasi. Di samping itu, mesin ini boleh menyelesaikan masalah apabila pelbagai jenis bola dicampurkan dalam satu bekas, ini akan menyebabkan pengguna sukar untuk mengasingkan bola-bola ini. Proses mesin ini boleh dilaksanakan dengan menggunakan penahan dan pengesan. Terdapat tiga jenis pengesan yang digunakan dalam mesin dan penggunaan penahan adalah untuk menahan bola supaya boleh dapat diagihkan. Pembilang pula digunakan untuk mengira jumlah bola yang berjaya dimasukkan ke setiap bekas. Pengawalan utama mesin ini adalah pengawal PLC yang mana ia menggunakan CX-Programmer sebagai sistem kawalan perisian.

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LIST OF ABBREVIATION

AC	Alternating Current
CPU	Controller Processing Unit
CR	Coil Relay
DC	Direct Current
DP	Decimal Point
IC	Integral Circuit
I/O	Input/Output
NC	Normally Closed
NO	Normally Open
PC	Personal Computer
PLC	Programmable Logic Controller
PSM	Projek Sarjana Muda

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CHAPTER I

INTRODUCTION

1.1 Introduction Of the Project

Programmable Logic Controllers (PLC) is a solid-state devices used to control machines or processes. They are the “brains” within most automated processes and are the workhorses of modern industrial control. PLC’s extensively used in many kinds of industries as manufacturing, chemical, food, transportation, handling industries, etc. Today, a PLC can handle several hundreds of inputs outputs and many of them are integrated in the production machines themselves, in such a way that they are transparent to the machines users.

Important of the PLC in industrial has become one of the reasons why it needs to be learnt by the engineering students. Therefore, ball sorter machine will be designed by using PLC to control the sorting of the ball regarding the specifications. The most important aspect is to design the hardware that can integrate with the PLC to show on how the system works. This project is regarding machine that will be used as the teaching aid for the student to understand about PLC programming and PLC process easier.

1.2 Objective Of The Project

The objectives of this project are:

- i) To design and fabricate the Ball Sorter Machine using hardware and software (PLC programming).
- ii) To design and create machine that can differentiate the ball according to the type and color.
- iii) Study and familiarize with PLC as a programming tool.
- iv) Study and familiarize with sensor, solenoid stopper, counter and relay.
- v) To learn how to integrate between PLC controller, hardware and software.
- vi) To help the student to understand the programming of the ball sorter easily.

1.3 Problem Statement

The fundamental programming of the PLC is a must for engineering student since PLC becomes workhorse of modern industrial control nowadays. Without systematic hardware, the process of learning will become difficult especially for those who were weak in imagination.

Beside that, for the industrial there is no machine to separate the entire balls when all type of ball were assorted in one container. So without this machine it will cause trouble to the users to separate the entire balls. The ball sorter machine is a project that can settle this problem. This machine will compare and divide the balls according to the type and color. Other than that, there is no counter to display number of ball inside the box so the users need to count the number of balls inside the box.

1.4 Scope of Work

The scope of work is the process to produce a ball sorter machine using PLC programming and hardware. The scope of the project consists of making the hardware and PLC programming. The hardware parts concentrated on design and build the hardware which is the ball sorter machine that can separate the ball according to the type and colors. There are several topics to be study before starting to design the project such as the procedure of the designing hardware, component and electronic device it being used. Beside that, the existing PLC programming must be under stable using the ladder diagram method. This hardware will use 7 types of sensor to detect ball follow by it specifications, 4 stoppers is use to block the ball and the ball will be sort, and 3 counters to count the number of balls inside the box. In that case, the type of sensor, stopper and counter must to determine and to be studied before can be integrated for designing the hardware. The circuits from the hardware were to integrate with the software after all design was completed and troubleshooting of the hardware and software if required.

1.5 Methodology Project

Based on understanding about the PLC programming, a good design of hardware process can be built. The sorter machine can operate according to the specification that been set in order to ensure the objective obtained. After all design hardware was completed, modification is made to get a good function of the hardware. Then, the project progress is to links the software PLC programming to the hardware of the ball sorter machine. This is to prove that the software program actually can run the hardware of the Ball Sorter Machine using the PLC programming.

1.6 THESIS SYNOPSIS

The report PSM 1 contains four chapters that explain details about the project. The first chapter consists of introduction, objective project, problem statement scope and methodology of the project.

The second chapter will discuss about the research and information related to the project. Each of the information found from any reference books will be observed to choose the best method for the project. This chapter is about theoretical chapter and study about the concept of the project.

The third chapter will discuss about the techniques and methods that have been choose in second chapter. All the method while doing this project was discussed here. The fourth chapter will discuss about the result that is project achieving.

The last chapter in this report is about discussion and conclusion. The discussion made based on the result for the PSM and all the problem involves while doing this project. Beside that, the suggestion is made to improve the project in that it can be better in the future. The conclusion made based on project achieving and learning experience gained from starting until the end of the PSM.

CHAPTER II

LITERATURE RIVIEW

This chapter will discuss about the theory and concept of this project in overall perspective. The perspective and method that used will be explained and observed how the project can be related with theory and to solve the project problem statement. Every facts and information found from any reference books will be observed and debated to choose the best method and component for the project. In other word, this chapter is about theoretical chapter and study about concept of this project until the best method found.

2.1 Programmable Logic Control (PLC)

Ball Sorter Machine is one project by using Programmable Logic Control (PLC) to control operation of the machine. The PLC was choosing because of the feature which more rugged and has noise immune capabilities. Moreover the PLC is modular approach in construction, allowing easy replacement/addition of units. The PLC also has standard input and output terminal connection and signal level. Other than that the PLC program is easy to understand because the programming language is like ladder diagram. PLC is easy to program or reprogram if any modification needed to that system.

A Programmable Logic Control (PLC) is an industrial computer control system that continuously monitors the state of input devices and makes decisions based upon a custom program to control the state of output devices. Almost any production line, machine function, or process can be greatly enhanced using this type of control system.

PLC controllers are low cost, compact, versatile units based on the standard microprocessor architecture used in the control of machines or processes. They are designed for ease of programming and maintenance. The PLC systems replace the old relay logic control systems in automated manufacturing and are designed to provide an easy and efficient replacement for the bulky relay logic controllers. The PLC, also known as programmable controller (PC) is defined by the National Electrical Manufacturers Association (NEMA) in 1978 as:

"a digitally operating electronic apparatus which uses a programmable memory for the internal storage of instructions for implementing specific functions, such as logic, sequencing, timing, counting and arithmetic, to control through digital or analog input/output, various types of machines or process".

A personal computer can be made into a programmable controller if provided some way for the computer to receive information from devices such as pushbuttons or switches. A program required to process the input and decide the mean of turning off and on load devices. A typical PLC can be divided into three parts, as illustrated in the block diagram as shown in Figure 2.1. These three components are the central processing unit (CPU) the input/output section and the program device. The programmable controllers are an event-driven device which that the event taking places in the field will result in an operation or output taking place.