DEVELOPING PLC BASED GANTRY ROBOT USING POSITIONING SERVO DRIVE WITH PROFIBUS – DP COMMUNICATION PROTOCOL

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Dedicated to my beloved wife

Dr Rokiah Binti Khalid

Son,

Yasir Adham Ali

Parents ,

Janathul Nisa & Mohd Yaseen

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ABSTRACT

PLC (Programmable Logic Controller) is one of the most important device in industrial automation nowadays. PLC is the device which control the machine so that the machine can run fully automatically. PLC is rarely use to control movement of the axis. Usually axis movement will be controlled by CNC (Computer Numeric Controller) machines. But in this Project, PLC is used to control gantry robot with three axis using positioning servo drive and its communicate via PROFIBUS (Process Fieldbus). The reason that PLC used to control the robot is because, PLC based machine is relatively much cheaper compare to machine that use CNC.

ABSTRAK

PLC merupakan salah satu alat yang terpenting dalam bidang automasi industri pada masa kini.PLC merupakan alat yang mengawal mesin untuk berfusngi secara automatik sepenuhnya.PLC jarang digunakan untuk mengawal pergerakan paksi sesuatu mesin.Kebiasanya tugas mengawal paksi ini dilakukan oleh CNC.Tetapi dalam Projek ini , PLC digunakan untuk mengawal pergerakan robot gantri tiga paksi yang digerakkan oleh motor servo dan berkomunkasi mengunakan PROFIBUS. Tujuan mengunakan PLC sebagai alat mengawal ialah kerana mesin yang berlandaskan PLC secara relatifnya adalah lebih murah berbanding dengan mesin yang mengunakan CNC.

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LIST OF ABBREVIATIONS

PLC	-	Programmable Logic Controller
NC	-	Numeric Controller
PWM	-	Pulse Width Modulation
CPU	-	Central Processing Unit
IO	-	Input Output
MS-DOS	-	Microsoft Disk Operating System
MTC	-	Machine Tool Control
DP	-	Distributed Peripheral
USB	-	Universal Serial Bus
PROFIBUS	-	Process Field Bus System
HMI	-	Human Machine Interface
PA	-	Process Automation

CHAPTER 1

INTRODUCTION

1.1 Project Introduction

SKF Bearing Industries Sdn Bhd is world-class manufacturer of bearings employing the most modern technology in the industry. Plant is located in Nilai and supplies the world with quality bearings.

In order to manufacture Cylindrical Roller Bearing (SRB) , heat treatment process for the roller is one of the crucial and importance process. Every minute thousands of rollers need to supply to the furnace to undergo heat treatment process.

To supply the roller for the furnace, SKF Nilai is using fully automated gantry robot loading system. There is three major component of the gantry system. First system is loading station. In loading station the roller is sorted at the tray and then it will be transported to the furnace by robot. Robot will arrange the tray at pallet in several layers before deliver the pallet into furnace.

Second system is unloading system. After the roller finished heat treatment process, robot will unload the pallet from furnace and deliver the tray to unloading station. Unloading station will distribute the roller for grinding process.

Previous gantry robot system is using ABB automation control design. This robot's design is outdated & not efficient in this new era. The ABB robot is using CNC controller and using three separate PLCs to control loading and unloading station.

The idea is to replace old fashion of automation control to new , fast , reliable , user friendly , easy to troubleshoot & easy to maintain gantry robot automation system.

This project is to upgrade the old gantry robot system to cheap & reliable robot control system using PLC control system. After I had done some research and studies, I had found out the simplest & much reliable robot design using PLC & positioning servo drive.

Another aspect which was given high priority before design the system is availability of spare part in our store & local support of the device that we use. Almost 70% of the items include (PLC CPU, Input Output Card, Communication Card, Touch Screen) is available in our spare part store. This will drastically reduce downtime for robot due to availability of spare parts.

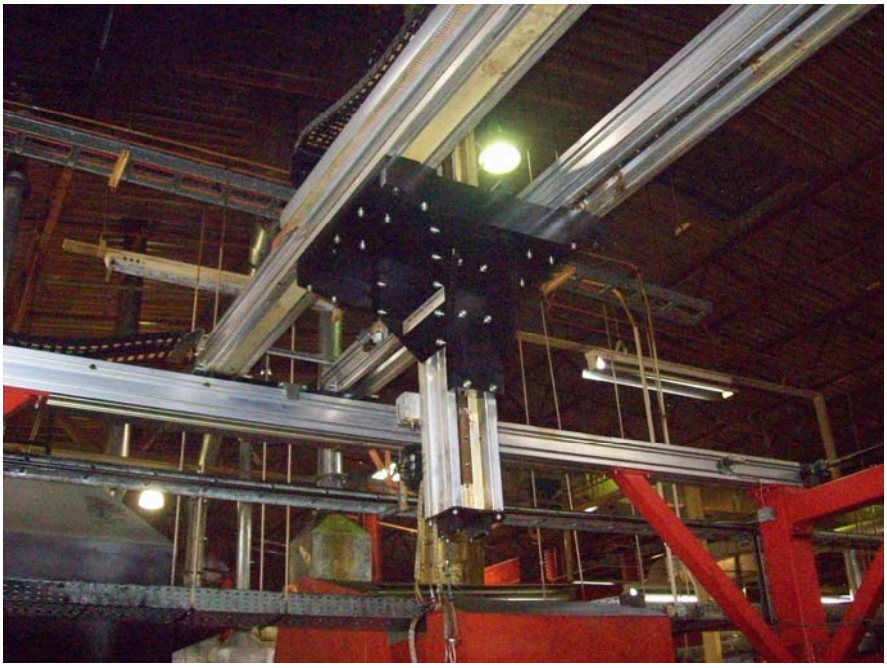

Figure 1.1 : Gantry Robot Structure

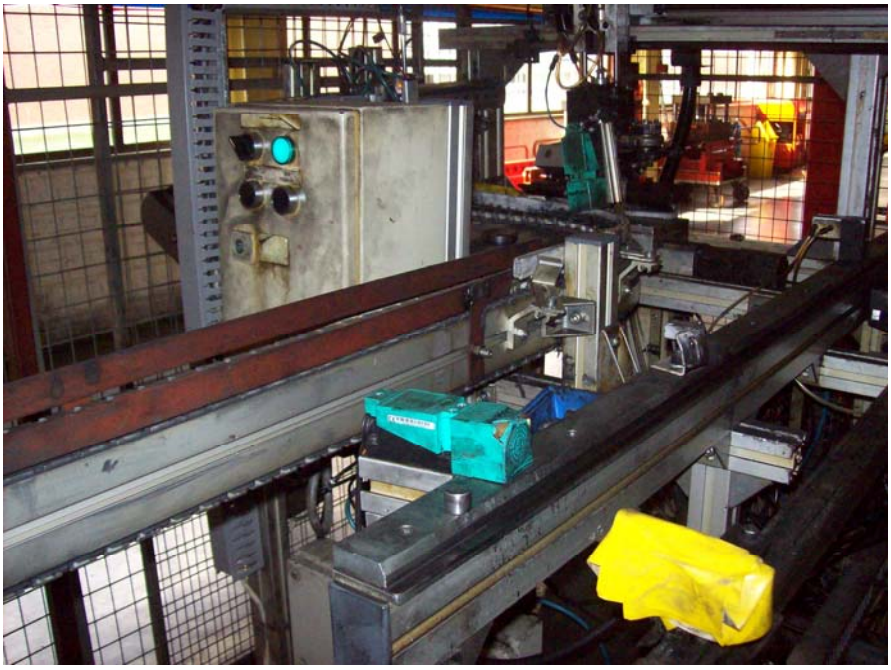

Figure 1.2 : Loading Station

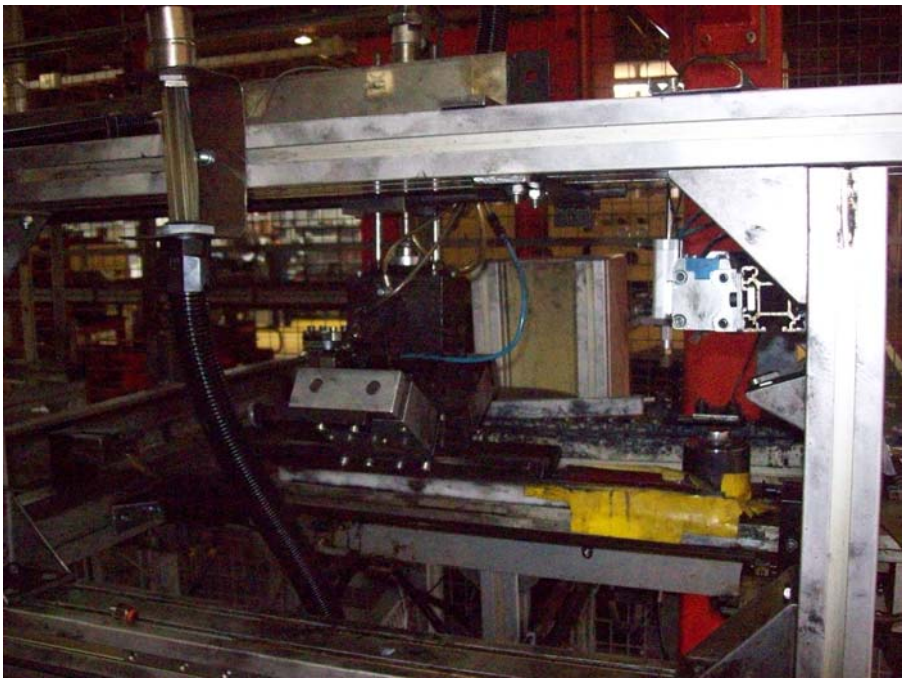

Figure 1.3 : Unloading Station

1.2 Project Objective

Project objective is to develop complete control system for 3 axis gantry robot using Siemens s7 PLC, Lenze positioning servo drive, Siemens touch screen and these devises is communicate via Profibus - DP protocol.

1.3 Scope Of Project

In order to achieve the objective of the project, there are several scope had been outlined. The scope of this project includes writing PLC software using Siemens Step 7 software, writing and designing HMI program Siemens WinCC

Flexible 2008 and configuring and writing Lenze drive program Global Positioning Drive software.

1.4 Organization of Thesis

This thesis consists of eight chapters. Chapter 1 provides preliminaries studies on the current scenarios of this project. In Chapter 2, literatures on devices and technology that used in this project will be discussed briefly.

Chapter 3 describes and briefs the theoretical background of the project. In this chapter, will discussed comparison between previous robot system and future robot system will be discussed.

Chapter 4 will discuss methodology that used in order to complete these projects. In this chapter, software and hardware that used for the projects will be discussed briefly. Meanwhile in Chapter 5, PLC program implementation will be discussed. This chapter will go thorough entire function that developed in order to complete this project.

Chapter 6 will discuss about HMI implementation. In this chapter HMI design and development will be discussed. Chapters 7 will focus on drive implementation. In this chapter drive configuration and programming will be discussed briefly.

Chapter 8 will discuss results and discussion regarding this project and finally Chapter 9 is conclusion and recommendations.

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