UPGRADING FMS 200: STATION 5 USING HUMAN MACHINE INTERFACE (HMI)

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

Faculty of Electronic and Computer Engineering
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UNIVERSTI TEKNIKAL MALAYSIA MELAKA
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BORANG PENGESAHAN STATUS LAPORAN
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Tajuk Projek : UPGRADING FMS 200: STATION 5 USING HUMAN MACHINE INTERFACE (HMI)

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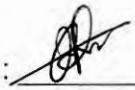
Signature : 

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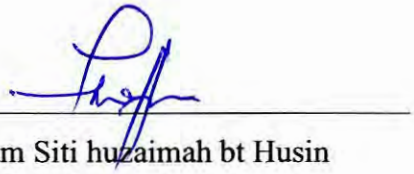
Signature : 

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DEDICATION

For the viewing of :

Faculty of Electronics and Computer Engineering ,Lecturers , friends & family.

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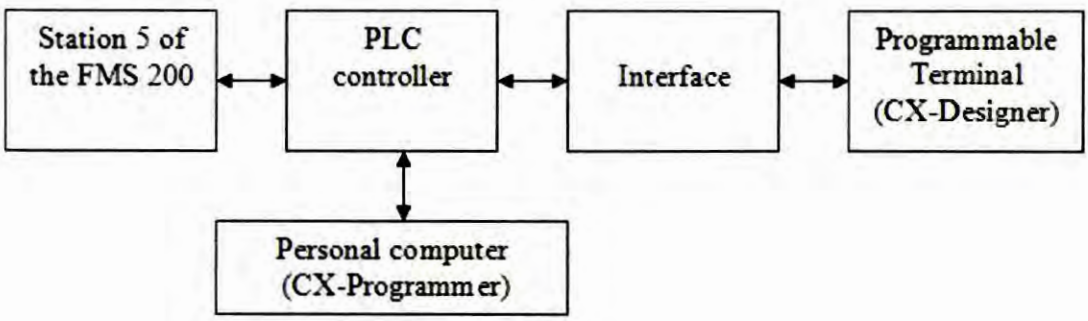
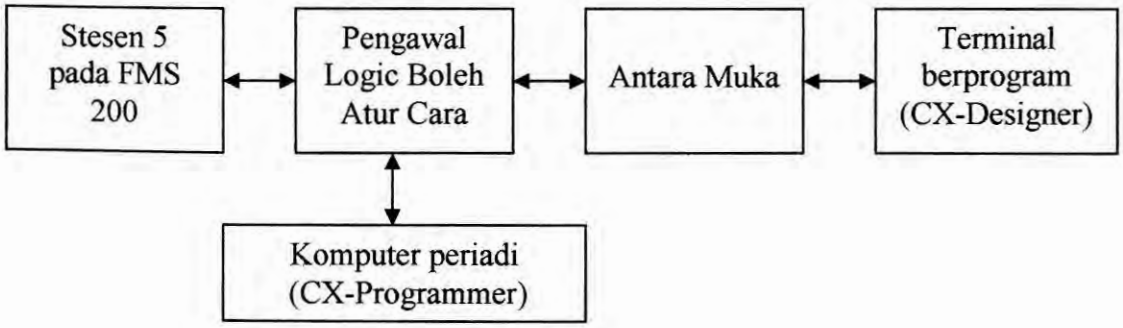
ABSTRACT

The Flexible manufacturing system (FMS 200) is an automated system that is able to control the process with little or no human labor. It is consists of 8 stations, however, this project will only focus on the fifth station of the system. The aim is to upgrade the station 5 of the Flexible Manufacturing System (FMS 200) using Human Machine Interface (HMI) and make selection of the covers based on the material, height and colors. Modification and added up programs will be done using CX-Programmer. This program is more towards ladder programs. When the programs have been modified, the instruction to transfer to the Programmable Logic Controller (PLC) mounted on the station will be executed. As for interfacing process between Personal computer with the Programmable Terminal, cable ports are needed to transferring screen data. The Human Machine Interface (HMI) will replace the pushbuttons mounted on the station as the controller. The screen data is designed using CX-Designer, a software tool to allow the users to enhance the operational system. With the help of the screen data, this will ease the users to operate the system in a quick time by just a touch on the screen.



ABSTRAK

Flexible manufacturing system (FMS 200) adalah sebuah sistem berautomatik yang berupaya mengawal sesebuah proses yang melibatkan sedikit atau tiada tenaga manusia. Sistem ini terdiri daripada lapan stesen tetapi projek ini lebih fokus kepada stesen yang ke-lima. Tujuan projek ini dijalankan adalah untutk menaiktaraf stesen 5 pada Sistem Pembuatan Fleksibel dengan penggunaan Antara Muka Manusia-Mesin dan pemilihan objek berdasarkan material, ketinggian dan warna. Segala pengubahsuaian dan penambahan program dilakukan menggunakan perisian CX-Programmer, Perisian ini lebih kepada Gambar Rajah Tangga. Setelah program tersebut diubahsuai, arahan untuk penghantaran maklumat ke Pengawal Logic Boleh Atur Cara akan dihantar. Untuk proses antara muka komputer ke Terminal Berprogram, kabel diperlukan untuk penghantaran data skrin. Antara Muka Manusia-Mesin akan manggantikan punat butang yang sedia ada sebagai pusat kawalan. Bagi maklumat pada skrin sesentuh, perisian CX-Designer akan digunakan untuk meningkatkan operasi sistem. Dengan bantuan maklumat yang ada pada skrin, para pengguna akan lebih mudah untuk mengoperasikan sistem tersebut dengan cepat dan mudah hanya dengan menyentuh pada data yang tersenarai pada skrin tersebut.



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LIST OF ABBREVIATION

PLC	- Programmable Logic Control
FMS	- Flexible Manufacturing system
HMI	- Human Machine Interface
OFN	- Oxygen-free nitrogen
PT	-Programmable Terminal
USB	- Universal Serial Bus

CHAPTER 1

INTRODUCTION

1.1 Background

The evolution, innovation and flexibility in today's automation have led the society to an expedition of better management, storage, communication, handling and analyzing information. Thus, the industrial automation system ability to ease factories and manufacturing applications by using advance and sophisticated advance technology such as robots has gone beyond replacing manually practiced labor of skilled workers which served well in terms of cost and time savings.

In this thesis, the key topic is related to Flexible Manufacturing system (FMS 200) mainly for its high flexibility in managing manufacturing resources such as time and effort in order to manufacture a new product. An industrial flexible manufacturing system (FMS) consists of robots, computer controlled machines, instrumentation devices, computers, sensors and inspection machines. Due to the evolution in today's technology, it has led us to upgrading the Flexible Manufacturing System through Human Machine Interface better known as the touch screen technology. Hence in this

research, the upgrading development is applied to Station 5 of the FMS which is the cover handling fitting selection.

1.2 Project Objectives

The main objective for this project to develop a system that enables the selection of the cover based on the material, color and height. Few modifications will be done on the program so that the machine will operate according to the command set.

Another objective of this project is to be able to discover the FMS 200 operating system including the operating principle of the technology used in the station such as pneumatic technology, sensors, and programmable logic controller (PLC) and the switches involved.

Next is to upgrade the process control of Station 5 using touch screen as the controller where option is displayed on the screen and all it takes is just placing finger on it. This touch screen technology is mainly used to replace the manual operation that use buttons as controller.

1.3 Scope of the Project

The project work scope is all about the concern area in order to accomplish the project objectives.

i. Familiarization on the station 5 function

Study all about FMS 200 from the manual provided by SMC training. As the project is focusing on upgrading Station 5 of FMS 200, the operation system has to be explored properly for smooth ongoing project outcome. Furthermore, the study on the technology used in the station operation such as pneumatic technology, programmable logic controller (PLC) as well as the sensors is carried out by doing research in the books and related journal.

ii. **Study on cover selection in terms of material, color and height**

Enable the user to select the cover based on the material (metal and non-metal), color (aluminum, black and white) and height (high and low).

iii. **Using touch screen as the controller**

Mainly to replace the manual switches of start, stop, emergency, and reset with an advanced technology of touch screen technology.

1.4 Problem Statement

In early days, computers have always been the choice for controlling and monitor purposes. The users would have to interact with what is displayed on the screen directly with a mouse and touchpad. In heavy industries and in other situation, mouse systems do not allow rapid or satisfactory interaction as they can only do the work task by task in moderate condition. Not only this may affects the time consumption but also cost.

This project is focusing on upgrading station 5 of FMS 200 through Human Machine Interface (HMI). Overall, there are 6 conditions of cover; metal low, metal high, white low, white high, black low and black high. From the ladder diagram, some modification needs to be done to enable the selection of the 6 condition of the cover respectively. Therefore, troubleshooting method needs to be done from time to time for error detection. Moreover, the modification is done to enable the system interfacing with the touch screen. With some re-program and modification, the touch screen can be interfaced with the system replacing the manual control panel as the controller. Another problem statement would be interfacing the personal computer to the hardware (touch screen).

1.5 Methodology of the Project

i. Project Planning

Consult the supervisor for guidance and project planning for PSM 1. The duration needed for each task to be completed in order to achieve the project objective is scheduled in Gantt chart.

ii. Familiarize FMS 200

Study all the knowledge and research about FMS 200. Apart from that, understand the operation and technology in used of station 5.

iii. Program modification

The program of station 5 will have to undergo some modification to enable the cover selection based on the material (metal and non-metal), color (aluminum, black and white) and height (high and low).

iv. Troubleshooting program

In case of error detection, troubleshooting development needs to be done. This is important to enable the system follows the specification and initial process flows.

v. Familiarization with the Human Machine Interface (HMI)

Research on the history, functions, benefits including the comparison between touch screen with conventional computer screen are done for references.

vi. Interface the Programmable Logic Controller (PLC) with the Human Machine Interface (HMI)

The touch screen will replace the current control button panel as the system controller so that the operator can operate the system at ease.

1.6 Project Outline

This report consists of 5 chapters that provide all the information needed regarding this project. The first chapter of this report is the project introduction that consists of introduction, objectives, problem statement and work scope.

The second chapter of this report includes the literature review and the project concept that involves type of sensors in used, upgraded operation and the advantages of using HMI over conventional computers.

Next, the third chapter of this report is the project methodology. In this chapter, the guideline of the time completion for this project is scheduled and presented in the Gantt chart. Moreover, flowchart picturing the entire operation is included for better understandings.

The fourth chapter is about the preliminary result of the project together with the expected result. Moreover, solution to encounter problems due to unexpected result will be mentioned out in this chapter.

As for the last chapter, the discussion and conclusion regarding this project will be clarified.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will elaborates more on the literature review for better visualization of the whole system operations and the best inputs, devices and outputs. A complete explanation on the Flexible Manufacturing System (FMS 200) will be explained at the beginning to give overview of the functionality of the system to the users. The material handling process of the station 5 of Flexible Manufacturing System (FMS 200) will be further analyzed including the sensors and actuators involved in the operation. Moreover, the software involved in building ladder programming and also for the design of the screen of the Human Machine Interface (HMI) will also be elaborated. Furthermore, the type, operation and functionality of the Human Machine Interface (HMI) will also be explained and the comparison between the devices used in this station with other devices will be put in schedule for the advantages and disadvantages purposes.

The project overview is shown as in Figure 2.1 below. The ladder programs are done using CX-Programmer software in personal computer before proceeding to transfer to the Programmable Logic Controller (PLC) mounted on the station 5 of the FMS 200. Then proceed to interfacing the NS hardware to the PLC and the personal computer using interface cable ports of RS232 and USB. For the NS hardware, the software of CX-Designer is used for the screen designs.

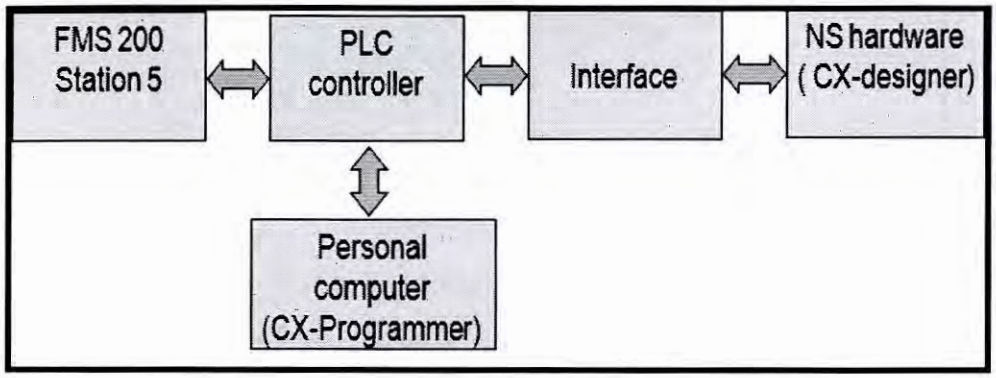

Figure 2.1: Overview of the project

2.2 Flexible Manufacturing System (FMS)

The development of Flexible Manufacturing System (FMS 200) training system is to satisfy the training needs of educative centres and companies all over the world. It enables the development of various skills associated with pneumatic, electro-pneumatic, electrical, robotic and handling automatisms, programming and Programmable Logic Controller (PLC) technologies, industrial communications, supervision, quality control, and fault diagnosis and repair. Furthermore, the Flexible Manufacturing System (FMS 200) as shown in Figure 2.2 offers a whole wide range of study on the sensor types.

Figure 2.2: Layout of FMS 200

The Flexible Manufacturing System (FMS 200) comprises of 8 stations adapting to the different requirements of companies and training centers. The system includes a whole series of feeding, handling, verification and loading operations etc. carried out using components from different technologies (pneumatics, hydraulics, electrotechnics, robotics, etc.). The breakdown simulation system TROUB-200 generates up to 16 malfunctions to be diagnosed by the user. The different process stations assemble a turning mechanism which consists of the following elements:

i. Base or body
ii. Bearing
iii. Shaft
iv. Lid
v. Screws

The final products which is assembled in the different station is transferred in two alternative forms; using a 4 meter bidirectional conveyor belt which allows attaching of up to 8 stations or using modular conveyor belts. (*SMC training manual and journal*)

Each station has its own electrical panel, where the wiring system and automation are fully visible for study while new elements may be fitted to the panel if desired. This electrical control panel may be made entirely independent at each station for use in programmable automation training. The front of each station incorporates the start, stop, and single continuous cycle pushbuttons as shown in Figure 2.3.

Figure 2.3: Manual control button panel

The system is modular and may be extended, allowing future incorporation of other process stations according to user needs. The stations are mounted on aluminum sections, forming tables with a large surface area and multiple slots to allow all types of extension and modification. The assembly process performed (turning mechanism) is as follows:

i. Feed body to which the other parts are assembled.
ii. Pick and Place bearing.
iii. Press bearing and hydraulically.
iv. Pick and Place shaft and verify.
v. Pick and Place cover.
vi. Fit screws.
vii. Robot screw driving.
viii. Unloading, storage and palletization of final assembly.

2.2.1 Flexibility

The flexibility of the Flexible Manufacturing System refers to its capabilities that a manufacturing system must possess to both manual and automated systems. These include the ability to identify and distinguish among the different part processed by the