DEVELOPMENT OF VISUALIZATION SYSTEM FOR MATERIAL HANDLING SYSTEM USING WONDERWARE INTOUCH SOFWARE

KAMAL SYAHIDI BIN KAMARUDDIN

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Robotic and Automation) with Honours.

by

KAMAL SYAHIDI BIN KAMARUDDIN

FACULTY OF MANUFACTURING ENGINEERING

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Alamat Tetap:

Lot 171 Kg Kutan Hilir,

16250 Wakaf Bharu,

Kelantan

Tarikh: 21/05/09

Cop Rasmi:

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I, hereby, declared this report entitled "The Development of Visualization System for Material Handling System using Wonderware InTouch Software" is the result of my own research except as cited references.

Signature : .....

Author's Name : KAMAL SYAHIDI BIN KAMARUDDIN

Date : 21/05/09

APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as partial fulfillments for the degree of Bachelor of Manufacturing Engineering (Robotic and Automation) with Honours. The member of supervisory committee is as follow:

.....

SHARIMAN BIN ABDULLAH
Pensyarah
Fakulti Kejuruteraan Pembuatan
Universiti Teknikal Malaysia Melaka

ABSTRACT

There are several techniques of visualization to control the automation system. One of the most common techniques is the Human Machine Interface (HMI). The task of an HMI is to make the function of a technology self-evident. In this case, the Programmable Logic Controller (PLC) is programmed by using the Step 7-Micro/Win software. In order to develop the visualization system, Wonderware InTouch software is been used. The report covers from the literature stage and the designing until the finishing stage. The literature stage is about how to collect the information and generate the ideas, while the designing covers with the programming and drawings of the system, then the interaction between them will be tested and analyzed until the desired result is obtained. The result obtained in this project shows the effectiveness of the virtual controller in InTouch design that replace the real control panel on the conveyor, in which affect the simulation of material handling system that mainly programmed by the PLC programming software as well as the programming in the InTouch software itself.

ABSTRAK

Terdapat pelbagai teknik untuk menggambarkan serta mengawal sesuatu sistem automasi. Salah satu teknik yang paling biasa digunakan ialah manusia-mesin-pemuka (HMI). Tujuan penggunaan HMI adalah untuk menjadikan sesuatu sistem itu itu menerima maklumat serta bertindak dengan sendiri. Di dalam kes ini, pengawal logik boleh ubah (PLC) diprogramkan menggunakan perisian Step 7-Micro/Win, manakala untuk menggambarkan sistem tersebut, perisian seperti Wonderware InTouch digunakan. Laporan untuk projek ini merangkumi dari peringkat sastera hinggalah ke peringkat rekaan dan penamat. Peringkat sastera adalah bertujuan untuk mengumpul maklumat serta menjana idea. Peringkat rekaan pula adalah bertujuan untuk meraka bentuk HMI yang digunakan untuk sistem serta membuat atur cara untuk PLC. Selain itu, pada peringkat ini juga interaksi dan komunikasi antara kedua-duanya akan diuji dan dianalisis sehingga mendapat keputusan yang terbaik. Keputusan projek ini menunjukkan bagaimana efektifnya penggunaan pengawal maya yang menggantikan fungsi pengawal sebenar yang terdapat pada panel sistem pengedali Pengawal maya ini dibina menggunakan rekaan InTouch yang mana memberi kesan ke atas simulasi sistem pengendalian bahan yang diprogramkan melalui perisian program PLC dan juga melalui program di dalam perisian InTouch itu sendiri.

DEDICATION

To my family, my friends, and lectures as well as my beloved ones

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LIST OF ABBREVIATIONS

CAD	-	Computer Aided Design
CIM	-	Computer Integrated Manufacturing
CP	-	Communications Processor
CPU	-	Central Processing Unit
DDE	-	Dynamic Data Exchange
FBD	-	Functional Block Diagram
FMS	-	Flexible Manufacturing System
FKP	-	Fakulti Kejuruteraan Pembuatan
GUI	-	Graphical User Interface
HMI	-	Human Machine Interface
I/O	-	Input / Output
LAD	-	Ladder Diagram
LAN	-	Local Access Network
MPI	-	Multipoint Interface
PC	-	Personal Computer
PL1	-	Pilot Light 1
PLC	-	Programmable Logic Controller
PSM	-	Projek Sarjana Muda
RTDB	-	Real Time Data Base
SCADA	-	Supervisory Control and Data Acquisition
SE	-	Sensor
UTeM	-	Universiti Teknikal Malaysia Melaka

CHAPTER 1
INTRODUCTION

Talking about the interface, it exists in many forms and there is a commonality among them. A simplest word to say about the interface is that what connects two dissimilar materials, devices, systems, or processes so that they can work together but in the fact they would not interact with each other under the ordinary circumstances. Thus, the interface makes the interaction is possible.

The specific meaning of the interface always changes with time. In hardware, an interface is a connector used to link devices. In software, it allows communication between two software systems or between people and systems. An interface is a shared boundary, in which a physical point of demarcation between two devices where the electrical signals, connectors, timing and handshaking are defined. The other meaning for interface is the procedures, codes and protocols that enable two entities to interact for a meaningful exchange of information.

There are two general categories of interface that must be concerned with. The first one is HMI. HMI allow people to talk to machines. The interface translates information from the machine into something we can understand, and translates information from us into language that machine can understand. The second one is machine-machine interfaces (MMI) in which allow the machines to talk to one another by converting the signals that one understands into signals that the other understands.

The task of an HMI is to make the function of a technology self-evident. HMI effectiveness is measured by a number of components, such as learn ability and productivity. These components are sometimes brought together under the title of

"usability," also known as quality of use. Through the graphic based HMI, it is easy for the operator to monitor the process, set the working condition of the treatment, search the historical data, and reminder and alarm the operator when necessary. The HMI also enable the user to visualize and control industrial processes while providing engineers with an easy-to-use development environment and extensive functionality to rapidly create test and deploy powerful automation applications that connect and deliver real-time information. Generally, the hardware that controls the system is programmable logic control (PLC).

Esposito (2003) states that, PLC is a user –friendly electronic computer designed to perform logic functions such as AND, OR, and NOT for controlling the operation of industrials equipment and processes.

In addition, there are several advantages of PLC compared to the relay control system. They are more reliable and faster in operation and come out in smaller size and can be readily to be expanded. They also require less electrical power and are less expensive for the same number of control functions. Furthermore, they does not taking any modifications of hard-wiring to perform specific functions.

SCADA is stands for Supervisory Control and Data Acquisition that focuses on the supervisory level. It normally use in the PLC to supervise its condition or prediction of the processes involved.

1.1 Problem Statement

The current flexible conveyor system in Faculty of Manufacturing Engineering (FKP) Computer Integrated Manufacturing (CIM) Laboratory in Universiti Teknikal Malaysia Melaka (UTeM) that uses the PLC has no visualization system. The system operation can only be seen from the simulation of ladder diagram. There is a need for user to visualize the operation of the system. In order to make this flexible conveyor system to be a reliable control system, a HMI must display the necessary information and sufficiently for competent decision making. In the other word, HMI will

visualize the operations of the hardware system that controlled by PLC. Moreover, the control panel of the conveyor system also can be replaced by this HMI.

1.2 Aim of The Project

This project is aimed to design and develop a HMI system (or visualization system). In this case, a visualization system will be developed to simulate PLC (Siemens) program. The simulation shall be created based on the real condition of PLC (Siemens) that located on the conveyor in FKP CIM Laboratory.

1.3 Project Objectives

There are two objectives involved in this project. These objectives will determine the basic requirement of the target in which the project may result.

(a) A visualization system for PLC Siemens in FKP CIM laboratory must be developed to show the effectiveness of the replacing the control panel of the conveyor system with the virtual control panel in HMI.
(b) PLC software and HMI software must be communicated to each other to show the relationship between both of them

1.4 Project Scopes

In order to develop a visualization system, a computer is used to create the design in HMI software such as Wonderware InTouch, as well as to create the proramme that will control the design by using PLC programming software such as Step 7-Micro/Win. The computer also will simulate the visualization system after both tasks above is done.

The path communication between Siemens STEP 7-MicroWIN software and Wonderware InTouch software will be generated before the simulation of the system is started. This means, both software must interact to each other and can be functional properly. In the case of the unexpected condition, such as the communication between both of them is failed, the CoDeSys software will replace the MicroWin, but using the same programming in MicroWin.

1.5 Project Planning

The planning for this project is based on the Gantt chart that was design in order to organize the time that must be taken to complete the project Table 1.1, shows all the steps taken in the chart. By using this chart, the researcher can estimate on what time he must be taken to complete such of task.

Table1.1: Gantt chart for the project

No	Detail/Week																			
1	**Selection of Project Topic**																			
2	**Preliminary Research Work (Report)**																			
	Introduction																			
	Objective & Scope of Project																			
	List of references/literature																			
	Project Planning																			
3	**Progress Work (Report)**																			
	Literature Review																			
	Methodology																			
4	**Studying Configurations**																			
	Siemens Step 7 software																			
	Wonderware InTouch software																			
	CoDeSys software																			
5	**Project Work (Practical)**																			
	Creating PLC programming (MicroWIN)																			
	Creating PLC programming (CoDeSys)																			
	Design the visual system																			
	Creating visual programming																			
	Testing & analysis																			
6	**Progress Work (Report) Continue**																			
	Development& Implementation																			
	Result & Discussion																			
	Conclusion & Recommendation																			

CHAPTER 2
LITERATURE REVIEW

This chapter will cover all the information related to this project, such as Flexible Manufacturing System (FMS), PLC, HMI, and Dynamic Data Exchange (DDE)

Using this information, the element in the project will be presented to give more understanding about the title, objective, problem statement and the scope of project. The source that may be taken is either from book, journal, patent, conference paper, research paper and website.

2.1 FMS

A manufacturing system is a collection of integrated equipment and human resources, whose function is to perform one or more processing and/or assembly operations on a starting raw material, part, or set of parts.

A FMS is a group of numerically-controlled machine tools, interconnected by a central control system. The various machining cells are interconnected, via loading and unloading stations, by an automated transport system. Operational flexibility is enhanced by the ability to execute all manufacturing tasks on numerous product designs in small quantities and with faster delivery. It has been described as an automated job shop and as a miniature automated factory. Simply stated, it is an automated production system that produces one or more families of parts in a flexible manner. Today, this prospect of automation and flexibility presents the possibility of producing nonstandard parts to create a competitive advantage. (Advameg Inc, 2007)

The general objectives of an FMS are to approach the efficiencies and economies of scale normally associated with mass production, and to maintain the flexibility required for small- and medium-lot-size production of a variety of parts.

A generic FMS is said to consist of the following components.

(a) A set of work stations containing machine tools that do not require significant set-up time or change-over between successive jobs. Typically, these machines perform milling, boring, drilling, tapping, reaming, turning, and grooving operations.
(b) A material-handling system that is automated and flexible in that it permits jobs to move between any pair of machines so that any job routing can be followed.
(c) A network of supervisory computers and microprocessors that perform some or all of the following tasks:
    (i) Directs the routing of jobs through the system;
    (ii) Tracks the status of all jobs in progress so it is known where each job is to go next;
    (iii) Passes the instructions for the processing of each operation to each station and ensures that the right tools are available for the job;
    (iv)Provides essential monitoring of the correct performance of operations and signals problems requiring attention.
(d) Storage, locally at the work stations, and/or centrally at the system level.
(e) The jobs to be processed by the system. In operating an FMS, the worker enters the job to be run at the supervisory computer, which then downloads the part programs to the cell control or NC controller.

(Advameg Inc, 2007)

The potential benefits from the implementation and utilization of a flexible manufacturing system have been detailed by numerous researchers on the subject. A review of the literature reveals many tangible and intangible benefits that FMS users will experience (Advameg Inc, 2007). These benefits include:

(a) Less waste
(b) Fewer workstations