Distributed Control System for Micro-Factory Using Visual Studio. Net

Hla Myo Tun, Htin Lin, and Zaw Min Naing

***Abstract*—Advanced industrial automation system can be monitored and controlled by real time situation is more useful than other formal systems in the sector of industrial life. Distributed Control System (DCS) is more popular than any other control systems in the modern industrial processes. This research leads to "Real Time Graphical User Interface Monitoring System" for Micro-Factory. The current research project is based on the construction of DCS based Micro-factory. The Industrial Local Area Network (LAN) is built between the server for the operator and the clients for the two robots control and only one CNC milling machine. The client- server model is more suitable for this research. The existing DCS can be divided into two sections: the first one is cheap and inflexible control and the second one is expensive but it is flexible control system. This research leads to cheap and flexible distributed control system. In this research, the simulation of the whole process is described in real-time condition by using Visual Basic.Net programming under Visual Studio 2005 software. The parallel ports of Client computers and the controllers have been communicated with parallel port interface VB.Net program.**

***Index Terms*— DCS, Micro-factory, Visual Studio.Net, Control System.**

I. INTRODUCTION

The evolution of plant automation systems, from very primitive forms up to the contemporary complex architectures, has closely followed the progress in instrumentation and computer technology that, in turn, has given the impetus to the vendor to update the system concepts in order to meet the user's growing requirements. This has directly encouraged users to enlarge the automation objectives in the field and to embed them into the board objectives of the process, production, and enterprise level. The integrated automation concept [1] has been created to encompass all the automation functions of the company. This was viewed as an opportunity to optimally solve some interrelated problems such as the efficient utilization of resources, production profitability, product quality, human safety, and environmental demands. Contemporary industrial plants are inherently complex, large-scale systems requiring complex, mutually conflicting automation objectives to be simultaneously met. Effective control of such systems can only be made feasible using adequately organized, complex, large-scale automation systems like the distributed computer control systems [2]. It is a software application specially designed to work on client computers in the production control, providing communication with the devices (independent controllers, programmable robotics, etc) and controlling the process from the server computer. In this system, a server computer supervised and managed the data, as well as data processing and process control.

One or two operators can control the whole system from the server or client computers instead of many workers for large industrial automation systems. In addition, this system implementations have migrated from custom hardware and software to standard hardware and software platforms. These changes have led to reduced development, operational, and maintenance costs as well as providing executive management with real-time information that can be used to support planning, supervision, and decision making.

This research implements vehicle spare parts manufacturing plant for industrial automation, and this can also be used other industrial automation systems. It includes how DCS systems use in the industrial automation. It applied to interface sever protocol needed between the DCS software and the hardware process. It is applied to dc motor drivers, sensing drivers, Programmable Interface Controller (PIC) microcontroller device and parallel port communication.

II. RESEARCH DIRECTION

Format For the "Network Systems" portion, the client-server model has to be studied. To communicate client computer and server computer, the RJ45 and the Ethernet switch should be applied. So the various types and specifications of Ethernet switch will be studied. For the communication between the client computer and the server computer, the JAVA programming language will be studied because the client program and the server program can be applied to the JAVA programming language. For the "Real Time Graphical User Interface Monitoring System " portion, the Visual Basic.Net programming Language under Visual Studio 2005 Software has to be studied. For the "Agent Based Distributed Control" portion, the JAVA programming Language has been applied to

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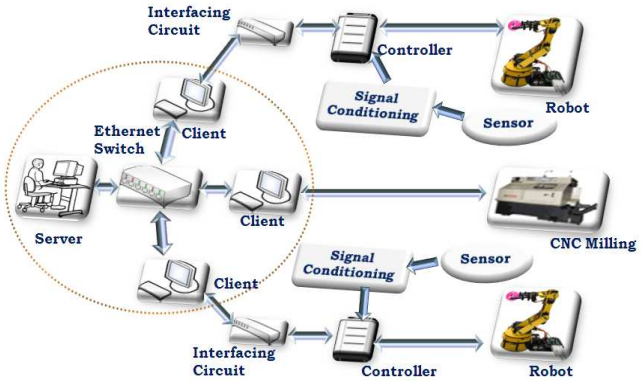

Fig.1. Block Diagram of DCS Based Micro-factory

communicate between the server computer and client computers. For the "Robots and Multiple Sensor Management" portion, it is to build the pick and place three degree of freedom robot and its driver control circuits. And also the interface circuit between the computer and controller must be constructed.

III. Experimental Procedures

A. *Writing VB.net Software from VB.net IDE*

The Project Designer provides a distributed location for managing project properties, settings, and resources. The Project Designer appears as a single window in the Visual Studio IDE, much the same as other designers such as the Form or Class designers. It contains a number of pages that are accessed through tabs on the left-hand side. Information entered into the Project Designer persists when it switch from one page to another, when it build the project, or when it close the designer; an Undo command is available on the Edit menu to roll back changes. It can access the Project Designer using the Properties command on the Project menu. Visual Basic.Net from IDE is used for the monitoring of the DCS system and uses window application form, classes, modules and etc. Properties boxes and Tools box are used to design components as real devices. And the monitoring and interfacing visual basic programs are written in the design .vb forms.

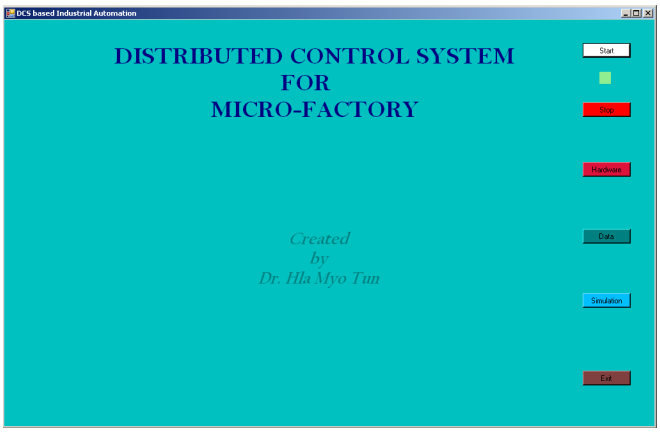

Fig.2.Simulation result of the Main Page

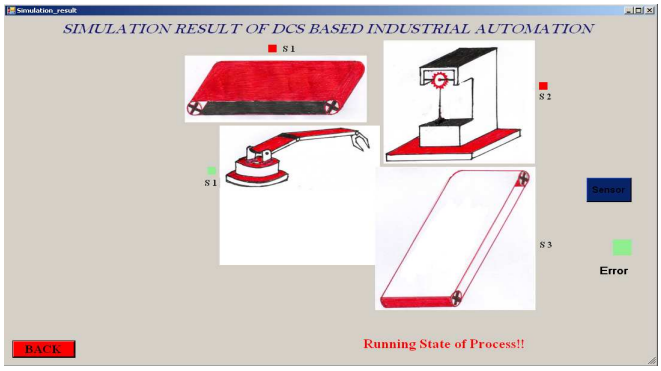

Fig.3.Simulation Result of Simulation Window

B. *Processing Acquired Window Forms for Main Page*

It can be designed a window form by using the software application data and used data by depending on the process from the properties of items. The control devices are used by using the toolbox of the form. And the code program for each component is written to the code viewer by using visual basic. Timer tools are used for timing of data interfacing and input/output process data. A Timer is used to raise an event at user-defined intervals.

C. *. Design Procedure for Monitoring of Simulation Page*

This page uses the simulation of components on the form (frmSimulation). The signal of simulation for each is get to display on the page from timer (timIn_Tick) of main page.

D. *Implementation Program for Sensor Page*

This page is linked with the simulation page to see the condition of sensors including in the system. It uses that by pressing the sensor button (btSensor) from the simulation. This uses back button to back the simulation page. The displaying of image for the running sensors is two colors of design for sensor. It uses timer tool (timer1_Tick) to get signal from input system.

IV. Implementations of Simulation Result on Computer

This section describes design requirements of displaying result on computer.

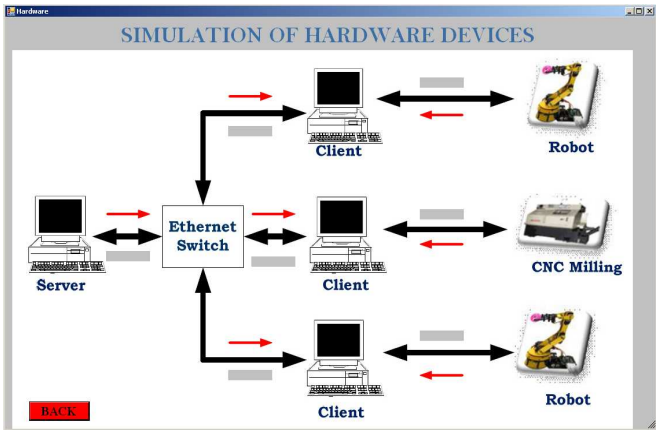

Fig.4.Simulation Result of Hardware Window

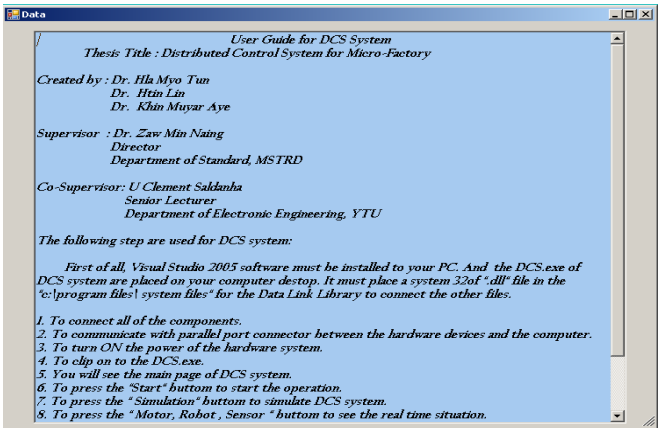

Fig.5.Simulation Result of Data Window

The real time monitoring software was processed using VB.net and the results were exported to PC parallel port. From then on, the data was sent to display unit. In order to do it, 16F877A microcontroller was used to interface parallel port and computer. These implementations were written in VB.net programming language.

The command provided by VB.net was exported to microcontroller via parallel port. If the signal from the remote terminal unit receive by master terminal unit, VB.net will sent a command to microcontroller to instruct the process of this manufacturing plant. Depending on instruction, MTU's signal would be sent to microcontroller. The results are shown in the following figures.

V. Results and Discussion

The software of DCS system can be used by writing programs with the other languages. The communication system for the process should be extended with other communication protocols. All of the industries uses large PLC system for automation process because it is particular device and can use various processes by changing program and communicate other interfacing sever software. So it can use more effectively for the real-time system of the processes. But PIC microcontroller is used for this process.

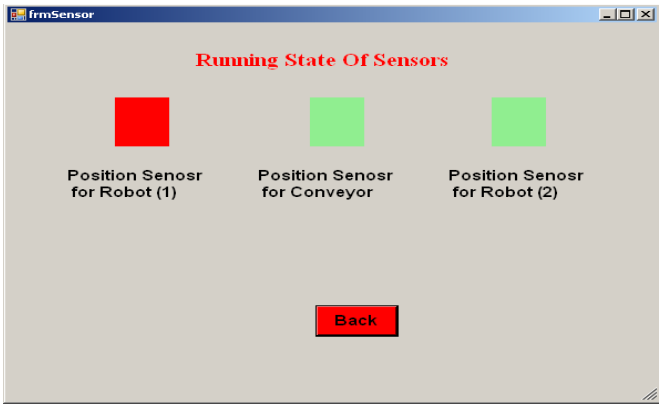

Fig.6.Simulation Result of the Sensor Window

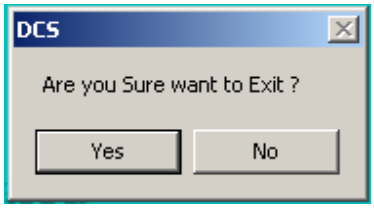

Fig.7.Simulation result of the Exit Window

So PIC has control limit like using various process at PLC. The hardware and software for the system is used only this process. If it uses with other process, it will increase control processand programming as this design and system.

VI. Conclusion

This system really aims to develop the controlling devices from anywhere by monitoring the whole system. This monitoring system can access with the other process. This system is developed to control the automation processes such as electrical distributed system, water waste system, and etc. Using this monitoring control system, it is intended to become security and reliability from the processes.

In this research, design and implementation of industrial automation that used Visual Basic.Net programming for the monitoring of DCS system have been studied. Communication system uses parallel port and interfacing circuit (including Multiplexers and Opt couplers).Hardware Units for this process is designed with the small sample model and tested by connecting hardware and computer, and it can start/stop with component using monitoring system and can see all of state running for the this processes.

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