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Development of Web-Based Supervisory Control and Data Acquisition System for Temperature Control Applications

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ABSTRACT:In general, the idea of monitoring of various equipments and devices over the internet is becoming a desirable practice in the process plants industries over the few decades. Over the years, there has been constant increase in the development of industrial automation through remote monitoring and control virtually through computers and internet. The strong emphasize of remote monitoring and control for real time process both online and offline mode is the main focus of this project. The internet based automation is made possible by the use of PLCs (Programmable Logic Controllers), SCADA (Supervisory control and Data Acquisition), Internet and other network elements.

The system is developed using PLC and SCADA, Programmable Logic Controller programmes for controlling real time industrial process. As a result, the system will be more secured with the use of XML (Extensible Markup Language) encoding and the data is protected by using firewall for connection between the server and client. Thus, logging and archive data of the real- time data corresponding to the process plants can be used for further process analysis.

KEYWORDS: PLC, SCADA, Automation, HMI.

I. INTRODUCTION

In general, the idea of monitoring of various equipments and devices over the internet is becoming a desirable practice in the process plants industries over the few decades. Over the years, there has been constant increase in the development of industrial automation through remote monitoring and control virtually through computers and internet. The strong emphasize of remote monitoring and control for real time process both online and offline mode is the main focus of this project. The internet based automation is made possible by the use of PLCs (Programmable Logic Controllers), SCADA (Supervisory control and Data Acquisition), Internet and other network elements.

II. OBJECTIVE

To develop a typical web-based remote monitoring and control system for Temperature process control applications.

III. METHODOLOGY

In order to implement a remote monitoring and control system, a Temperature monitoring and control pilot plant is considered. To achieve a real time temperature monitoring and control system, a control logic is developed by using RS Logix 500. This is done through Allen Bradley PLC (Micrologix 1400). PLC Ladder program is used for the accomplishment of real-time process monitoring and control. The remote monitoring and control of process application is developed using SCADA. Using this report, analysis of the real-time data and then diagnose of the process parameters accordingly over the intranet/internet can be achieved.

The actual model of the system is developed using Client/Server architecture. Wherein the client side, is considered to be the remote plant whose process parameters are to be remotely monitored. In the server side there are

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two nodes in which from one node gateway device is connected through the IP address and the other node is connected to the LAN through a number of data channels.

IV. PROBLEM IDENTIFICATION

Network connectivity problem between PLC and server due to the DHCP. Whenever the either PLC or Server goes to Shutdown and then restart, we have to configure the PLC and Server from the initial stage. The static IP assigned to PLC and server provides solutions for the above said reasons.

V. TOOLS REQUIRED FOR THE PROJECT

The hardware and software used in the study as listed below:

- Temperature process control pilot plant
- Personal computer
- Allen-Bradely PLC (Micrologix 1400 PLC)
- SCADA
- Network switch
- RS Linx Classic
- RS Logix 500 Pro
- Movicon 11.0

The major using components of the project are:

- Thermocouple signal conditioning unit
- Allen-bradely plc(micrologix 1400)
- SCADA

a. Thermocouple Signal Conditioning Unit

A thermocouple signal conditioner is a device that convert a thermocouple output voltage to PLC analog module read form.

b. Allen- Bradely PLC (Micrologix 1400)

Allen-Bradely PLC (Micrologix 1400) is mostly used for many of the industrial application projects. The features of Micrologix 1400 are as given below:

- Ethernet port provides Web server capability, email capability and protocol support for DNP3 protocol support and built-in LCD with backlight lets you view controller and I/O status
- Built-in LCD provides simple interface for messages, bit/integer monitoring and manipulation
- Expands application capabilities through support for as many as seven 1762 MicroLogix Expansion I/O modules with 256 discrete I/O
- As many as six embedded 100 kHz high-speed counters (only on controllers with DC inputs)
- Two serial ports with DF1, DH-485, Modbus RTU, DNP3 and ASCII protocol support
- 10 KB words in user program memory with 10 KB words in user data memory)
- Up to 128 KB for data logging and 64 KB for recipe

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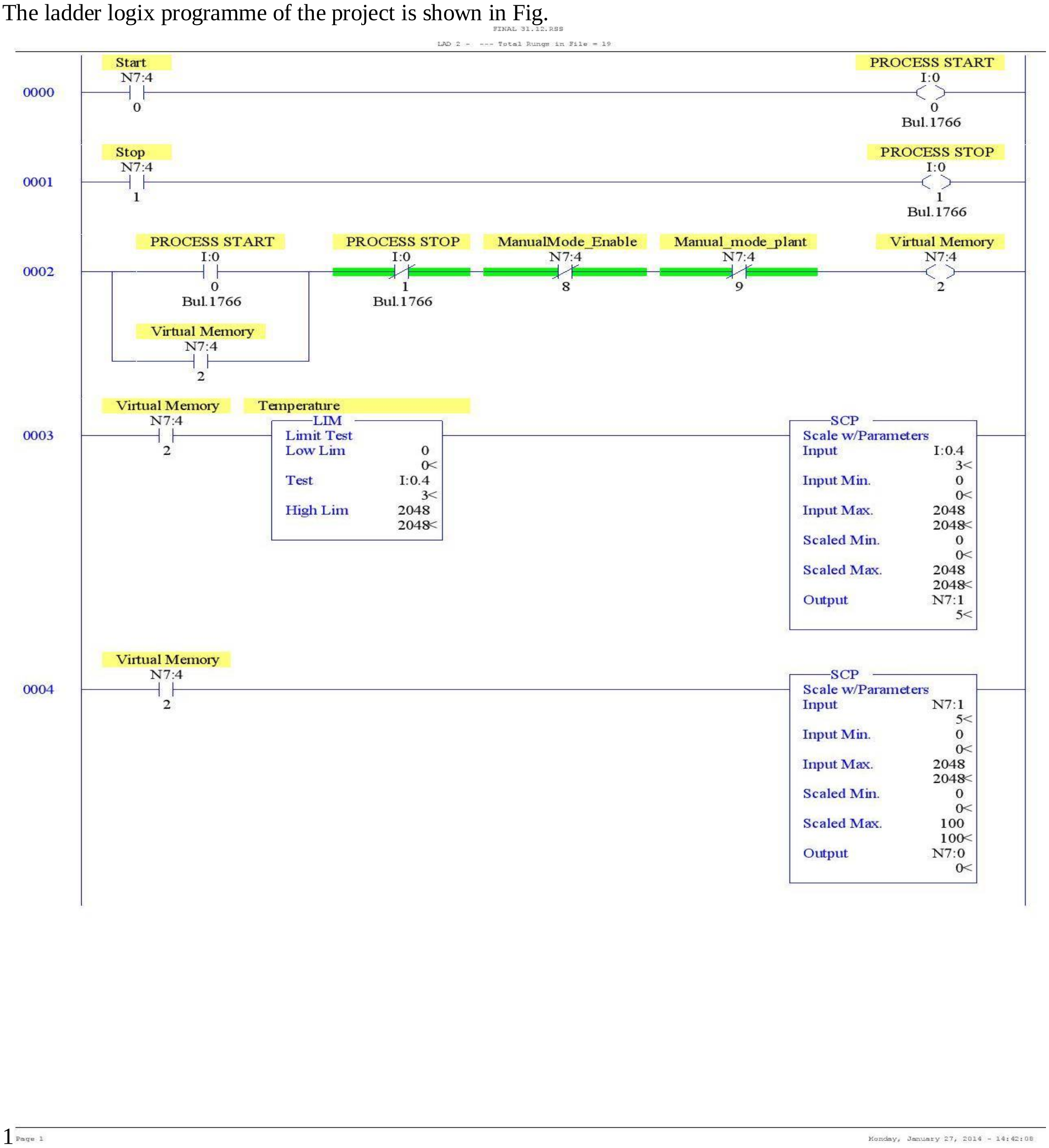
The ladder logix programme of the project is shown in Fig.



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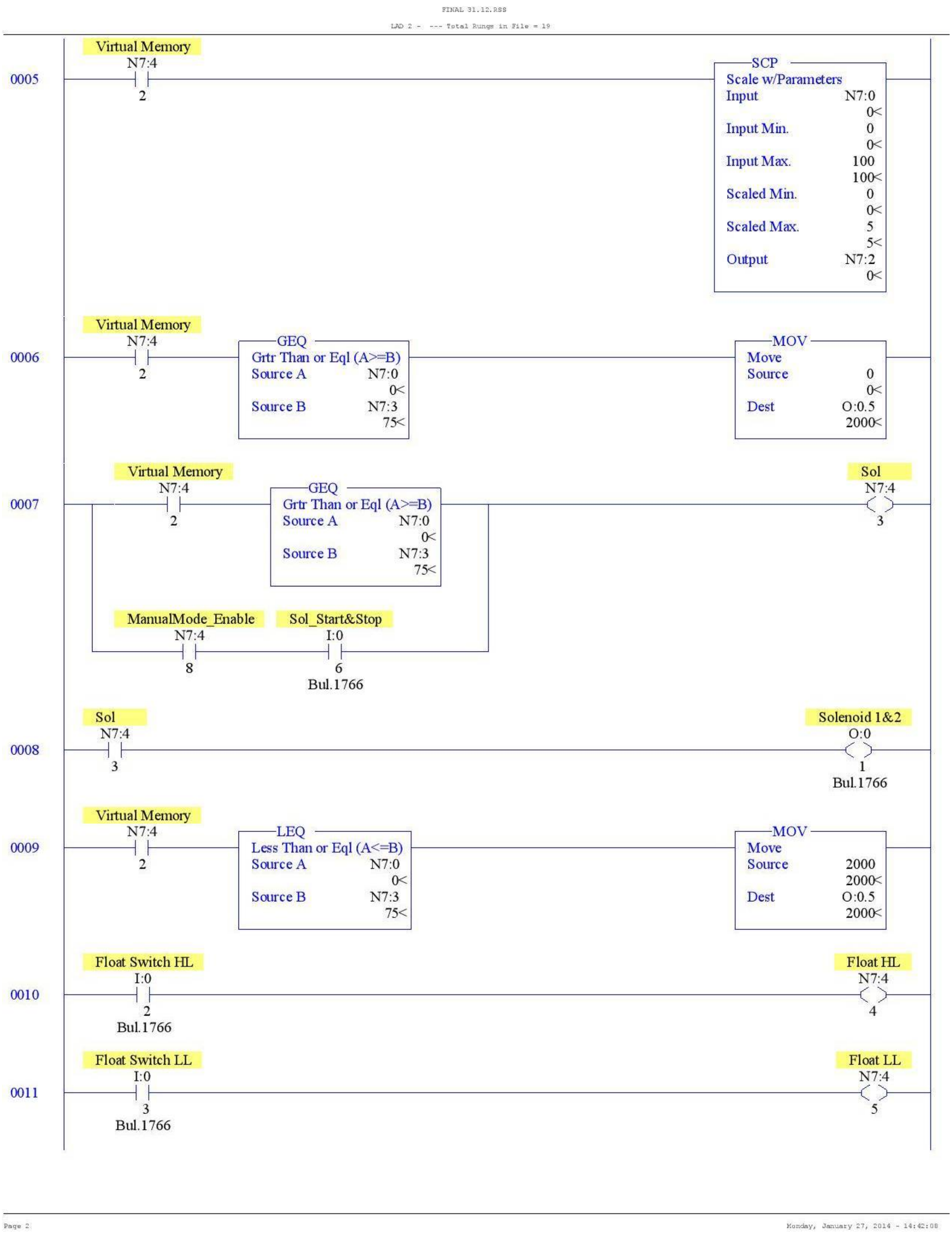

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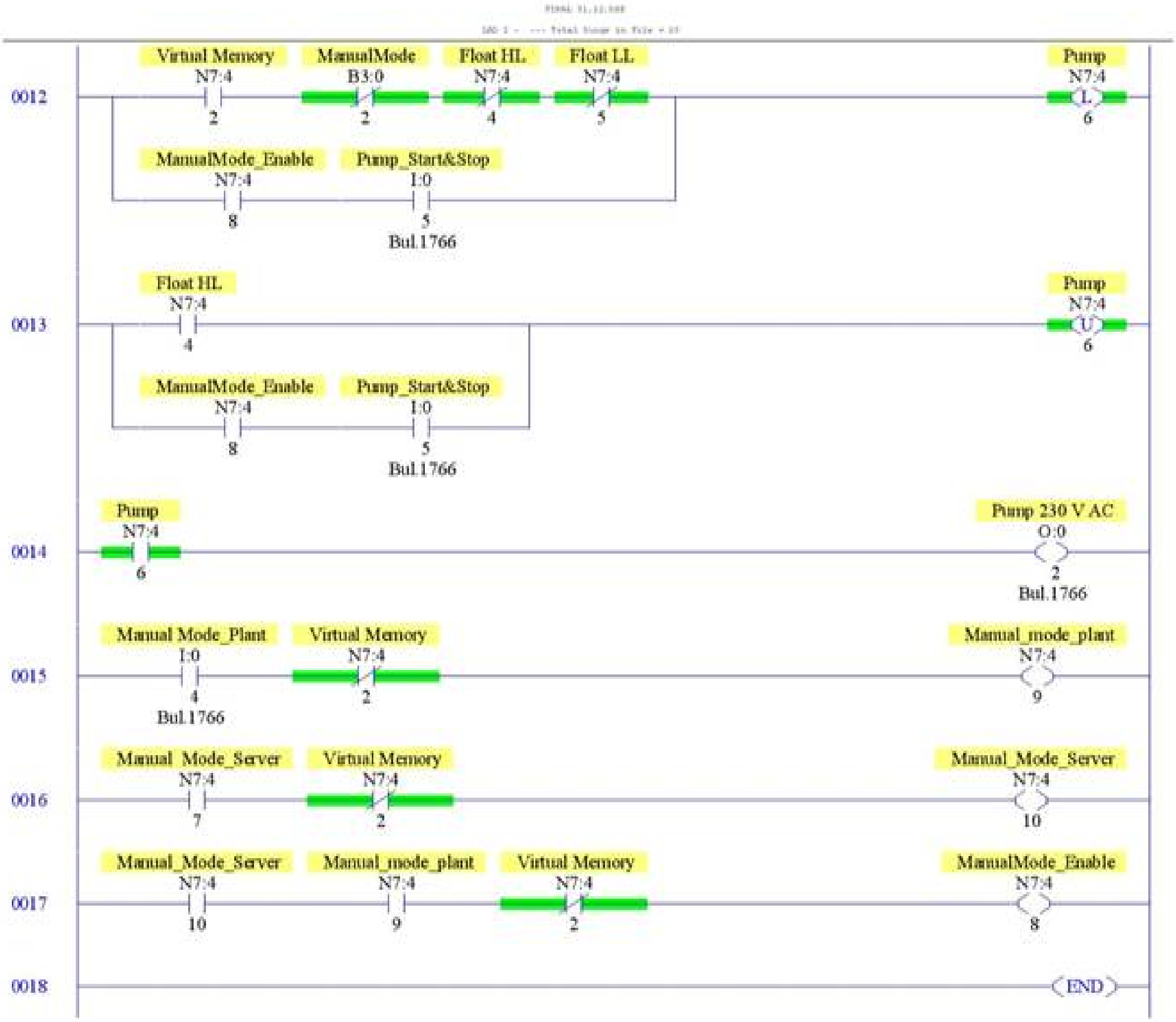

Fig.1 Ladder Logic Program for Temperature Process Control Experimental Setup

The input and output of the ladder logic diagram (Fig . 1) is mentioned below with corresponding address

S No.	Input	Address	Output	Address
	Start	I:0.0/0	PUMP	O:0.0/1
	Stop	I:0.0/1	SOLENOID	O:0.0/2
	Float switch high level	I:0.0/2	MEMORY COIL	N7:4/2
	Float switch low level	I:0.0/3		
	Manual mode plant	I:0.0/4		

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S No.	Input	Address	Output	Address
	Manual mode server	N7:4/7	Manual Mode Enable	N7:4/8
	Manual mode Start&stop Pump	I:0.0/5		
	Manual mode Start&stop Solenoid	I:0.0/6		
	Thermocouple output	I:0.4	Input To Power Controller	O:0.5
	Set temperature	N7:3	Actual Temperature	N7:0

c. Supervising Control And Data Acqusation (Scada)

The process experimental setup is monitoring and control through SCADA. SCADA program is developed for the Temperature control process which reflects the actual physical experimental setup in the SCADA screen. SCADA program is shown in **Fig .2.**

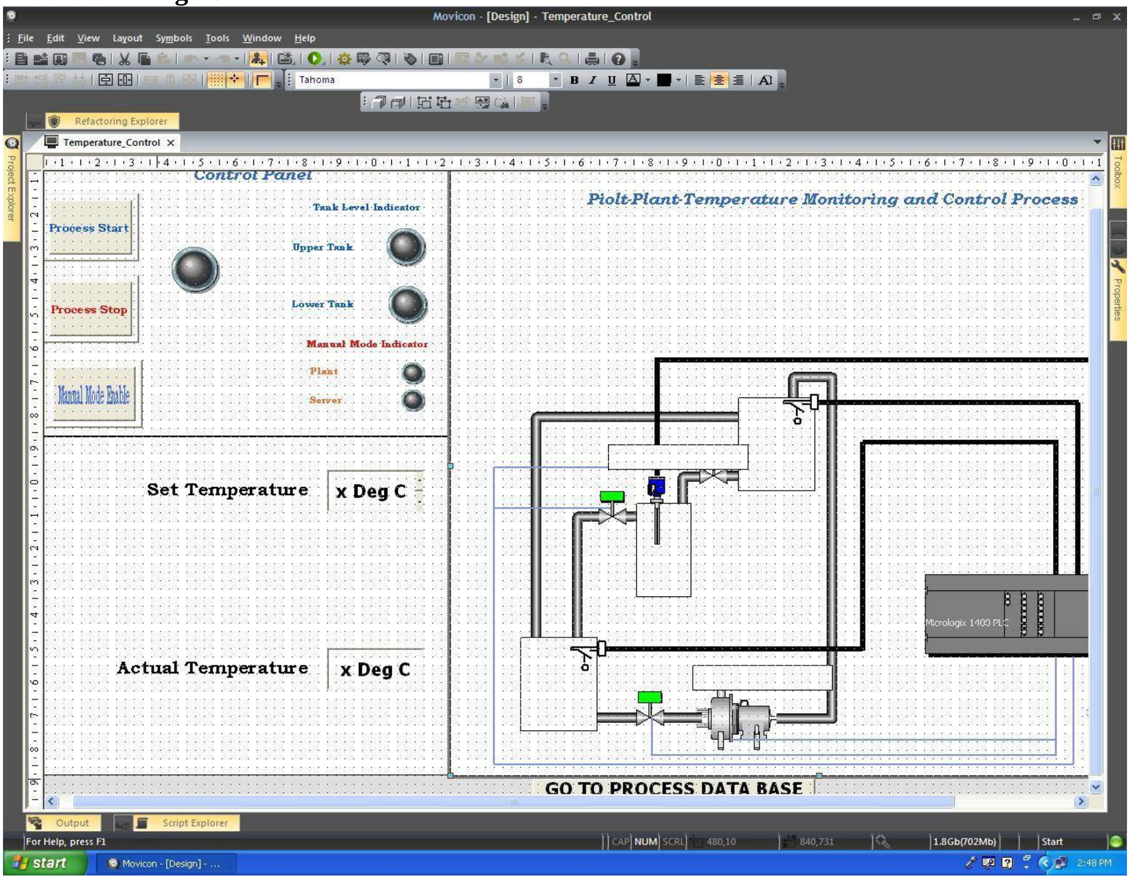

Fig .2 SCADA program for Temperature monitoring and control process

Here, this Fig. 2 describes the Temperature monitoring and control module where in the status of the motor and Solenoid over a particular time is indicated in the Text boxes (PUMP. SOL ON/OFF). The **Fig. 2** also describe parameter status of set temperature and actual temperature, water level indication and manual mode indication.

The GUI provides current status of the process to the end user. Also, based on the authentication level end user can monitor as well as control through specified I/O. To avoiding unauthorized access SCADA program is authorized and the authorized remote user can change set temperature if required, then on promoting to the screen it then asks for user authentication. The data logging of the real-time process Online and Offline is one of the striking features of this system.

VI. CONCLUSION

The Novelty of the system is that an Industrial process can be controlled and monitored from anywhere from the remote location just by giving the host name/IP address of the corresponding system. Also, online data logging of the real time process can also viewed through Internet browser environment The Remote Monitoring system considered here is a temperature monitoring and control process experimental setup, therefore further it develop the same system for the use of Industrial level monitoring. User authentication is provided at different levels through SCADA programs in order restrict unauthorized access, and to enable authorized users to access real-time parameters. Whenever a failure occurs remote diagnosis is done over the Intranet/Internet to the plant operators. The system is not only user-friendly; it is also reliable, flexible and cost effective. Moreover, the existing structure can be adapted to several real –time systems in different laboratory Environment.

VII. SCOPE FOR FUTURE

From the experiments that have been made so far, it is inferred that there are three main considerations of this system namely

- Network communication delay (time latency)
- Security of the system
- The interface design of the system.

Further improvements in these areas would improve the efficiency of the system. Also, the number of real-time processes that are controlled and monitored can also be increased and configured accordingly.

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