International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES)
Impact Factor: 5.22 (SJIF-2017), e-ISSN: 2455-2585
Volume 5, Issue 04, April-2019

# Wireless Monitoring & Controlling of Chemical Mixing Plant using PLC & SCADA

Nandish Bhatt[1], Yuvrajsinh.Rathod[2], Jay.Kapadia[3], Charandasi.Parmar[4], Anuj.Patel [5]

[1]*Departmentof Electrical Engineering,Government Engineering College,Bharuch,Gujarat,India*
[2]*Departmentof Electrical Engineering,Government Engineering College,Bharuch,Gujarat,India*
[3]*Departmentof Electrical Engineering,Government Engineering College,Bharuch,Gujarat,India*
[4]*Departmentof Electrical Engineering,Government Engineering College,Bharuch,Gujarat,India*
[5]*Departmentof Electrical Engineering,Government Engineering College,Bharuch,Gujarat,India*

***Abstract— The purpose of this Wireless Monitoring & Controlling of Chemical Mixing Plant using PLC (Programmable Logic Controller) & SCADA (Supervisory Control And Data Acquisition) project is to integrate a PLC with the SCADA to control a chemical mixing plant by wireless communication. The machine uses various normally open and normally closed contacts, to mix and heat/cool up to three different liquids. The PLC is used to control the various AC and DC inputs and outputs of the plant to achieve the desired preset conditions of the chemical process. The inputs of the plant are used to collect the data from a flow meter and temperature sensors. The SCADA allows the operator to employ additional functions and the integrated PLC provides a variable control for a pressure transducer, heater and mixer. [10pt Bold, Italic]***

***Keywords— Wireless, PLC, SCADA, Normally Open, Normally Closed, flow meter, temperature sensor.***

## 1. INTRODUCTION

Automation is the creation of technology and its application in order to control and monitor the production and delivery of various goods and services. It performs tasks that were previously performed by humans. Automation is being used in a number of areas such as manufacturing, transport, utilities, defense, facilities, operations and lately, information technology. Automation is evolving quickly and business intelligence in applications is a new form of high-quality automation. In the technology domain, the impact of automation is increasing rapidly, both in the software / hardware and machine layer. However, despite advances in automation, some manual intervention is always advised, even if the tool can perform most of the tasks. The system is designed for filling the mixture of two liquids in equal proportion. It consists of three sub system namely level controller; liquid mixer and bottle filler. The entire process is controlled and automated with the help of PLC. PLCs are widely used in automation industry and process control systems due to its ability for being user programmable. Automated liquid mixer performs mixing of different liquid in predetermined proportions. The main controller used for this is PLC for storing these all information and controlling purpose. For indicating the level of liquid, level switch is used.

## 2. PROJECT GOAL:

To understand the concept of PLC & SCADA, control the physical paramters like temperature, pressure, flow, etc; design graphically structure of our plant in Wonderware Intouch Software, achieve wireless communication between PLC & SCADA, monitor & control the plant, secure the plant by security and provide Alarm feature. In addition to this, we have enhaned login window by security by introducing login id and password.

## 3. PROBLEM IDENTIFICATION:

A big percentage of problems are the result of I/O modules or field equipment. I/O wires can break and so due to that error exist on giving signal to PLC. In many small scale industries, nowadays also there is Manual scheme of mixing chemicals for various operations, so to eliminate that problem automatic plant is obtained by using PLC & SCAD. Another problem for the PLC can be the effects of electromagnetic interference (EMI) or radio frequency interference (RFI). These can be related to lightning strikes, welding in the area or handheld radio transmitters. The handheld radios used by maintenance staff, emit powerful radio frequency radiation, disrupting and interfering with any unprotected electronic equipment. Improvements in shielding, grounding and power conditioning can combat any EMI or RFI problems. In most of the industries (small & medium), there is a PLC for process instrumentation and controlling. But there are no monitoring softwares i.e., SCADA due to which online monitoring & controlling is not possible

## 4. BLOCK DIAGRAM:

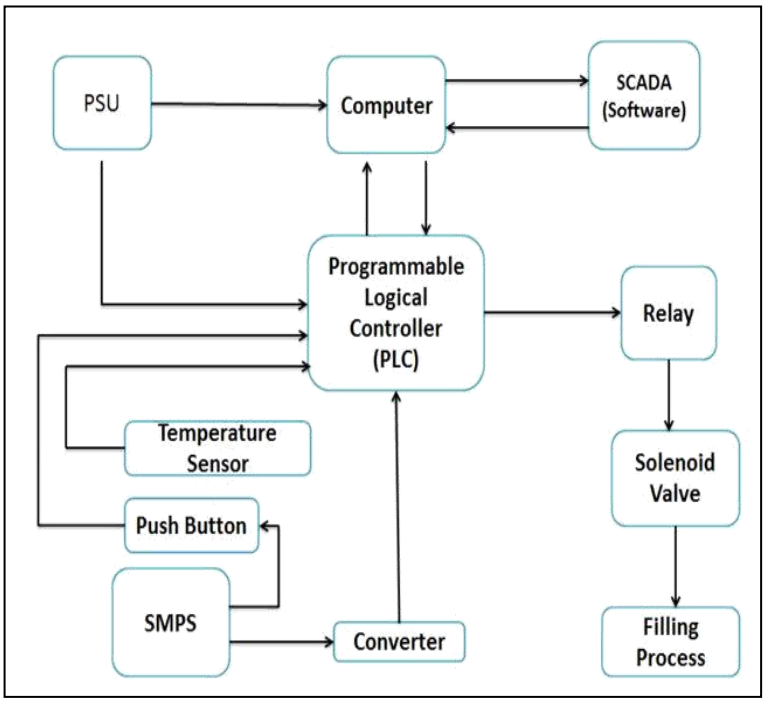


**Figure -1:** Block diagram

As shown in fig-1, input is taken from RTD (Resistance Temperature Detector) and it goes to the PLC (Programmable Logical Controller) for further operation. Value is compared with prefixed value and if it is greater than the prefixed value then the cooler starts and if it is less than prefixed value than heater starts. When Input is given through Push Button or SCADA, it process information and by opening solenoid valve it initiates process. SMPS (Switch Mode Power Supply) converts 230V AC to 24V DC. The reason behind this is PLC used is Allen Bradley Micro Logix 1200 which require 24V DC supply for operation. Resistance Temperature Detector (RTD) is used as temperature sensor for sensing the temperature of chemical whose pulse is given to the PLC. Power Supply Unit (PSU) is given to the computer for operatinng purpose. Computer interacts with SCADA software that is Wonderware Intouch Software. PLC will give command signal to relay and relay will give that command to solenoid valve for filling process.

## 5. HARDWARE COMPONENTS REQUIREMENT:

Allen Bradley MicroLogix 1200 (24V DC Input), Router, LAN Cable, SMPS (Switch Mode Power Supply), Wires, Relay, Valves, Resistance Temperature Detector (RTD), Motor.

## 6. CATALOGUE DETAILS:

Name of PLC- Rockwell Automation Allen Bradley Micrologix 1100
Name of Programming Software: RS Logix500
Name of Communication Software: RS Linx Classic
Name of driver: RS 232 DF1
Type of protocol: Full Duplex
Baud Rate: 9600 bps (bits per second)

## 7. APPLICATIONS:

The main appication of this can be chemical mixing, colour mixing, petrochemical mixing, concrete mixing, mixing of harmful or toxic components. This applications can be used in pharmaceutical industries, chemical industries, dye industries.

## 8. OBJECTIVES:

The prime objectives of this are errors in Input/Output Module decreases. In additiion to this, wireless connectivity of PLC and online monitoring & controlling by SCADA is done. Overall, automated system is achieved.

## 9. PROGRAMMING IN PLC:

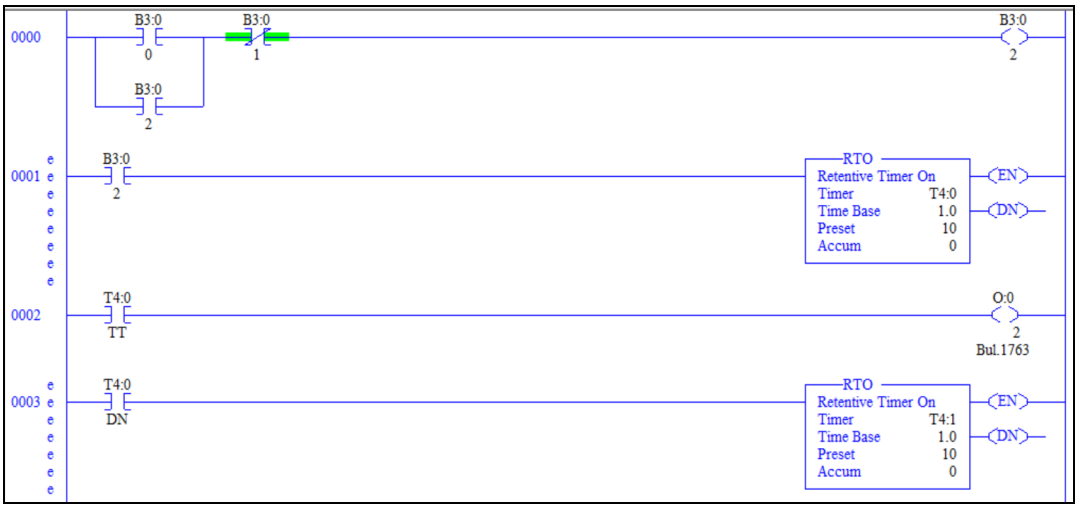


**Fig -2**: PLC Programming Part-1

As shown in figure 2,
B3:0/0 is Input and is Normally Open(NO) contact;
B3:0/1 is Input and is Normally Closed(NC) contact;
B3:0/2 is Output and is latching contact;
RTO is Retentive Timer On;
T4:0/TT is Timer T4:0's timing bit;
T4:0/DN is Timer T4:0's done bit;
O:0.0/2 is Output;
EN is Enable bit of timer;
DN is Done bit of timer;

In rung-0, simple input-output latch is given to B3:0/2 for turning ON the output. After that B3:0/2 input is given to RTO in rung-1.The main benefit of using RTO timer is that when electrical power gooes off, the data gets stored, instead of vanshing as in Normal Timer. Upto preset value of timer, T4:0/TT gets closed from NO contacts and thus giving output for the preset time period, untill accumulator becomes equal to preset value. After that in rung-3,T4:0/DN bit gets closed, so that retentive timer T4:1 operates .

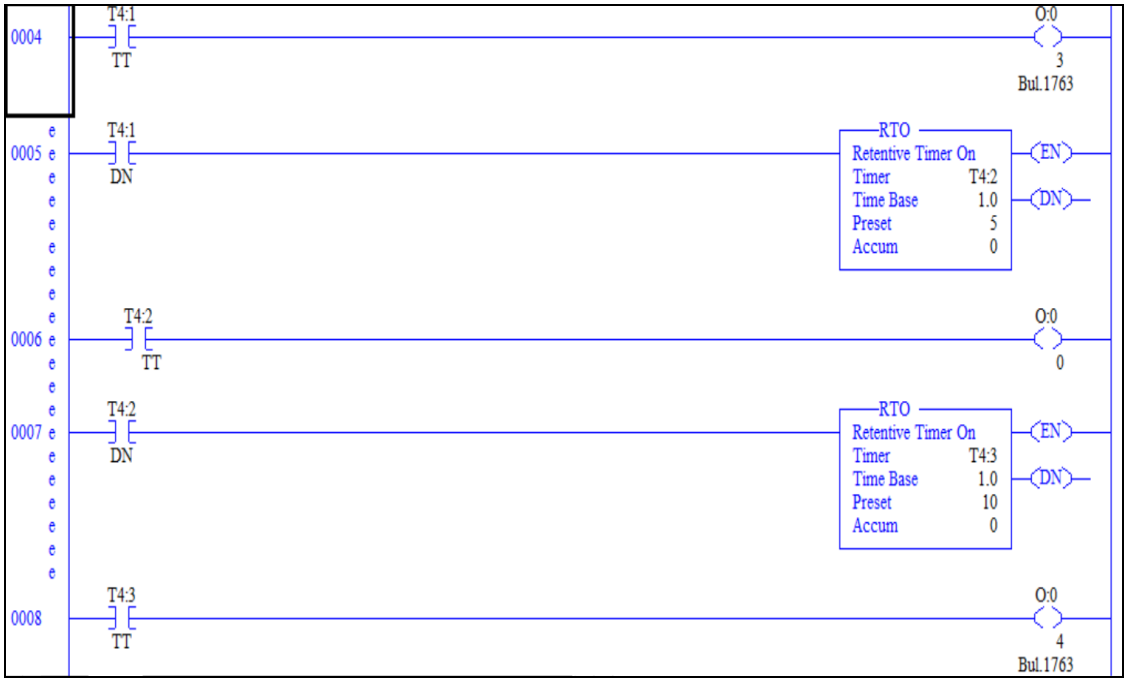


**Fig -3**: PLC Programming Part-2

Following that in fig-3, in rung-4 T4:1/TT gets closed for predetermined time. When preset value equals to accumulator value ,T4:1/DN gets closed and thus retentive T4:2 gets in operation and thus T4:2/TT's timing bit gets ON . Succeeding that, T4:2/DN bit gets latched and thus retentive timer T4:3 gets operated. During that, T4:3/TT that is timing bit of T4:3 timer gets latched and thus operation of output O:0/4 take palce.

## 10. DESIGNING IN SCADA:

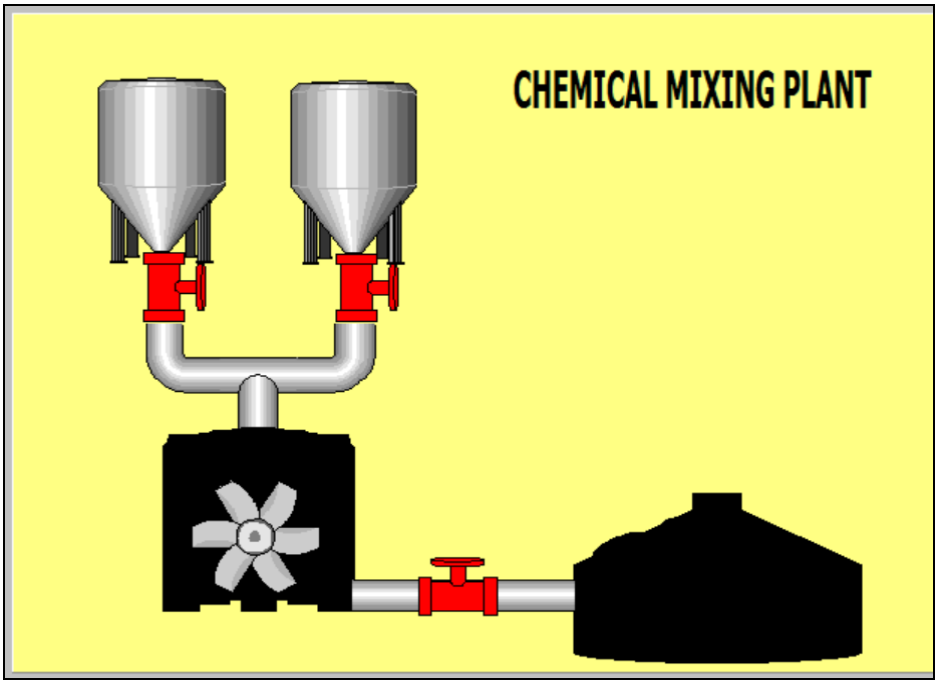


**Fig-4** SCADA View of Plant

Supervisory Control And Data Acquisition (SCADA) supervises and control the plant. It is software application for plant supervisory control and acquisition of data, gathering of data in real time from remote locations used to monitor and control plant or equipment. It is used for the data collection from PLC and it is used for process control and security of plant along with the graphical representation of process.

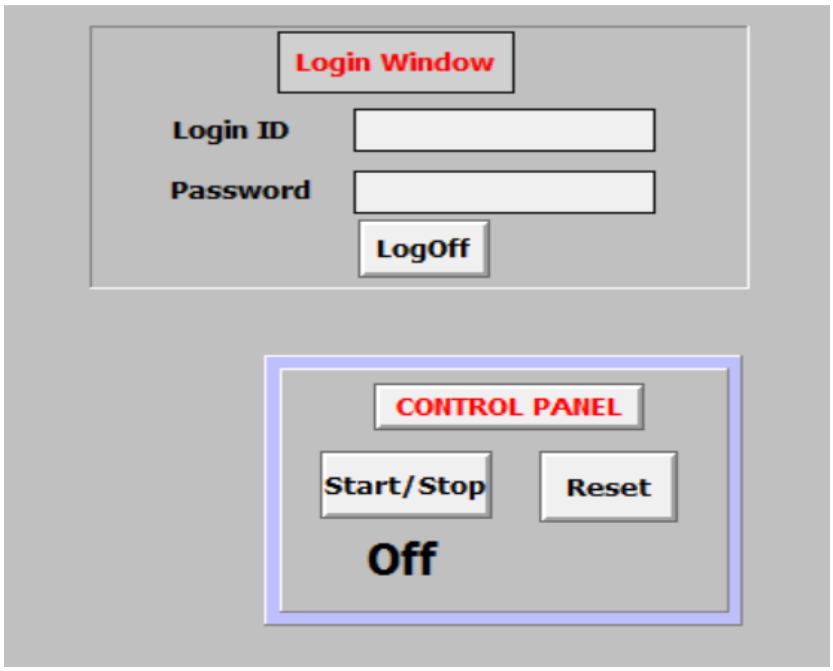


**Fig-5** Control Panel

As shown in fig-5, control panel with security is added. So that one with login id and password only can Login. In addition to that Start, Stop and Reset buttons are added.

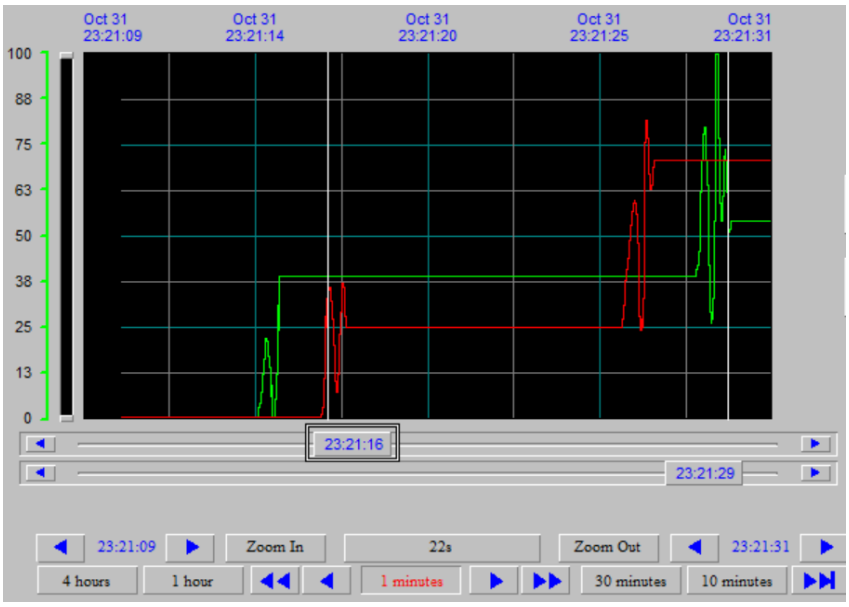


**Fig-6** Real & Historical Time Trend

By fig-6,real time value of physical quantities such as temperature, pressure and level can be seen on control panel in SCADA view. Furthermore, historical values of such physical quantities can be seen by enterung just date, month and year. In figure-6, red depicts temperature whereas green represents pressure. As this physical parameters are very important in chemical industries.

## 11. CONCLUSIONS:

In this, we have achieved wireless communication betweeen PLC and Personal Computer in control room with the range of 5 km using full duplex comunication at 9600 bits per second. Based on the programming and designing, security is achieved, automated system, profit increases, durability increase, cut-off losses and incline efficiency of production. The best part is human safety increases as one can operate plant remotely from control with the secured network having range of 5 km. Moreover, alarm based system makes operator alert for minor and major faults.

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