

PLC and SCADA Based Automation in Testing of Water and Drinking Water Supplying Unit

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Abstract: *In normal days there is a rapid development in urban residential area, whereas in case of water distribution system they are using traditional method, which is not atomized. The best way to improve the water distribution system is by using industrial PLC and PC system, which includes all network components like flow sensor, GSM modules, pH sensor etc. The water theft can be best monitored by the flow variations given by the flow sensors mounted on the several channels. The reliable instrumentation connected to PLC or RTU assure real time monitoring of the main technological parameters of large water distribution networks. The data acquired of SCADA system represent the support for optimization of the process and data- driven Decision Support System. The system includes Remote Terminal Units (RTU), flow transducers and actuators distributed on a wide geographical area, control and power panels for the pump stations etc.*

Keywords: GSM, pH sensor, PLC, SCADA, DSS, Remote Terminal Unit

1. Introduction

In traditional drinking water supply system is facing many problems related to pumping of water, filtration, distribution of water and testing of water in the plant. Conventional water supply department comprises three different sections for supplying waters on it. First is the pumping station unit, which does the sucking of water from water source. The second section is a filtration department unit in which measurement of pH and chlorine is done. Third section is the distribution section through which water is distributed in the entire municipal ward. Currently these three sections are working independently [1]. The major problems in water supply system are wastage of water and these distributed places is using suction motors to suck water from main supply connection in these systems, which produces results decrease in water pressure.

To advance above said problems an automated functioning system has been proposed which enhances the water distribution, reduces wastage of water as well as identify the theft of water.

The global online supervision of the water distribution network is realized by the central dispatching operator as well as the remote control of the actuators installed into the most important points of the system to be worked. Depends to the requirements of the water flow of condition, the pressure transducers and flow transducers are installed in booster stations or measuring points throughout the entire network. These electronic devices are connected to the RTUs which transmit the data to the central dispatching station in order to offer dynamic behavior in nature.

The RTUs provide the data acquisition facility for different sensors (specific for pressure level, water flow, level or chemical component concentration) using digital and analog modules; which insure the preliminary signal treatment and wireless data communication. These SCADA system implemented to the central dispatching unit manages the

data communication with all the Remote Terminal Units and Programmable Logic Controllers, which store the received data from measuring points and the pumping station [2]. It offers advanced analysis functions as well as the remote control of the major technological parameters.

Programmable Logic Controller is the heart of automated water supplying system. PLC has been help in controlling pump station motor contactors, stirrer motors, distributed valves as well as measure pH of the water. PLC programming is done using a Ladder diagram Language among several languages. Ladder diagram is specialized schematic language commonly used to document industrial control logic systems. It is called "ladder" diagram because it resembles a ladder with two vertical rails (supply power) and as many "rungs" (horizontal lines) as there are control circuits to represent.

The water supply system is a part of the urban infrastructure which must assure the water quality control, continuity of the water distributions, and the monitoring process. The system having storage of tanks, piping network process, filtering processing utility functions, central dispatching functional units [3]. These Programmable Logic Controller(s) handle the direct control of the technological process whereas the central dispatching unit user.

Supervisory Control and Data Acquisition system structure includes one or more central main-station (PC based) that communicates with more PLC's implemented into the pumping stations or RTUs located in control panels throughout the entire network. This contributes for the optimization of the functional exploitation strategy and the optimization of equipment usage. Working cost can be minimized as well as reduction in the water losses is now possible by the implementation of intelligent control system units.

2. Proposed System

The proposed automated in urban water supply system consists of PLC, Ph sensors, chlorine measurement system, and sensors for water theft detection, GSM module, SCADA system and motor driver.

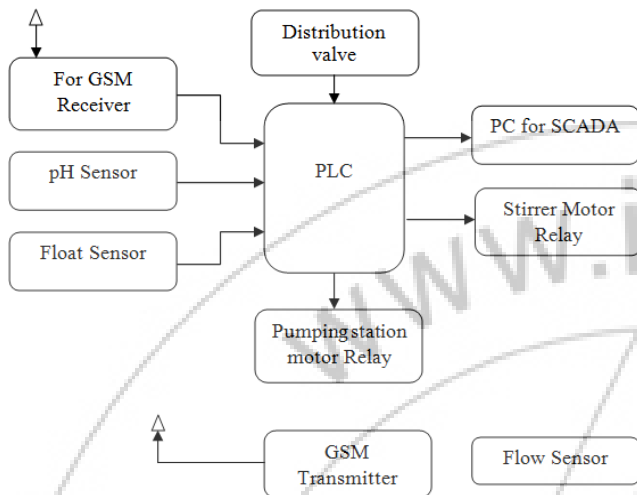


Figure 1: Block Diagram

Stirrer motor is used for oxidation purpose at the filtration tank. These motors are turned on and off using PLC according to the purification of water. The PLC take output from Ph and chlorine sensor; value displayed on SCADA.

3. Distribution and Pumping

3.1 Automation System

These technology equipment installed in the pumping stations are controlled by PLC based equipment which acquires all the hydraulic parameters (pressure, flow, reservoirs water level, free and residual chlorine, pH) and the electrical parameters for all the electric drives.

The pumping function module is connected in the PLC includes a schedule optimization tool based on the following criteria:

- The hourly electrical energy tariffs,
- The water demand dynamic and inflows constraints,
- Maintenance planning related to the market demand.
- In the system have three different sensors for corresponding application. It used for tank level detection; one is at bottom of tank, second will be positioned at middle position of tank and third will be kept at the top of tank. If water level detector detects a level at low or mid level thus PLC will turn on pump station motor. We consider water supply department has two motors in pump station, one of these motor is for regular use and another motor is for emergency purpose which is shown in figure 2.
- Using proposed system both the motors will be included in the system and controlled as per need using Programmable Logic Controller. Current status of the entire sensor will be displayed on Personal Computer. SCADA software will used to developed graphical user interface.

The optimization module facilitates the move to the preventive or predictive exploitation of the water resources and storage capacities based on intelligent control algorithms for specific purposes. They represent the support for electrical energy cost optimization by real time monitoring the pumping schedule and, maintenance planning based on the functional wear and the on/off electric drive transient load reducing loading constraints.

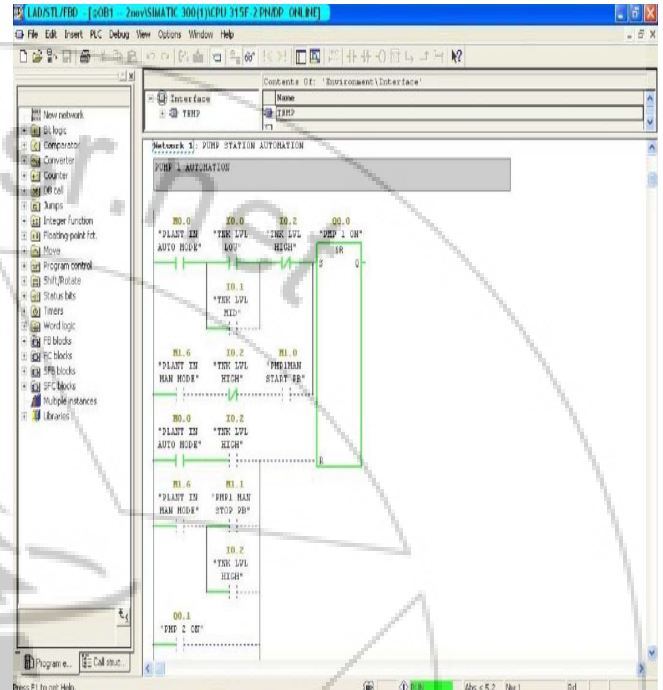


Figure 2: Program for pumping station

Conventional water distribution system comprises mechanical valves to distribute water for convenient usage. System undergone process is controlled manually; it requires man power and more time, with specified amount of wastage of water for an system. Selection of solenoid valves depends upon size of water supply pipe and pressure of the water Solenoid valves handles will be to avoid wastage of supply water.

3.2 SCADA Communication Process

The data acquired from the remote site panels RTU pole mounted to avoid vandalism, from the pumping stations PLCs and the water reservoirs are transmitted to the dispatching units of computer installed in the water distribution plant company's headquarter among any one of plant. The computer software system integrates an SCADA application program specifically developed for water distribution management.

The dispatching unit SCADA system elaborates daily, monthly, yearly diagrams, tables and reports related to the operator requested parameters. The system stores the acquired data in a specific database for later use analysis and retrieving.

4. Conclusion

The automation can be implemented in water distribution system ensures to avoid wastage of water and reduces time. Due to SCADA it is possible to monitor and control whole system from head quarters units. Distributed system is intelligences it monitoring all time without man power. Automation system having following benefits:

- Uninterrupted water distribution according to water level.
- The real time indications are induced in these SCADA when any components fail in distributed or pump station.
- They displaying databases can be enlarged throughout of year, month and daily report in Centralized PC.
- It Measures data functions by the entire monitoring of the network in the central dispatching unit.
- Shows automatic measurement of chlorine and pH and display in SCADA due to this quality of water Provide to consumer.

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