Emerging Technology Trends in Power Electronics, Communication for Water Supply Management for Public Drinking

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Abstract*: In Today's Scenario there is a rapid increasing of population development and development of urban residential area, but as compare with rapid increasing of consumers still the water distribution system is using traditional method, which are still not atomized. Sideways with this alternative problem in the water supply system are facing now a days that public crowd are using suction pumps to suck the water directly from the domestic street pipeline. To overcome from this problem, the best resolution is to improve the automation and monitoring architectures which contain a management and control system for the real time installation, PLC (Programmable Logic Controllers) with basic occupations communication systems, standard interfaces or dedicated ones with proximity sensors, which includes all network components like flow sensor, GSM modules, pH sensor, electrical drive elements, measuring devices, etc. by using proposed solution to be improving and developing the PLC & SCADA based water monitoring and theft prevention, better water utilization and Controlling of water Distribution system with better efficiency and Cost Optimization & reduction in Operational & Maintenance. Control System is further coupled to SCADA unit. This paper primarily emphases mostly to a control system for controlling and monitoring within a Water Distribution System. By the using of latest Process Automation and Monitoring system based upon operation of a PLC and automation systems including all the network components represents the best way to improve the water distribution technological process. It subsidizes greatest profit and minimal consumption like water loss, consumption of electrical power, overtime work of pumps etc.

***Keywords*: Conventional drinking public crowd and Central Controlling Units (CCU)**

1. Introduction

The old Conventional drinking water supply system are facing many glitches & Challenges associated to filtration, pumping of water, distribution of water and testing of water. Old Traditional water distribution system contains different modules for water supply to public. The First component is the PS (Pumping Station), which slurping of water from water source. The second module is a filtration department in which filtration of raw water carried out, balancing the pH value of water and chlorination has been done. Last module is the distribution system through which water is distributed in all the consumers' homes. In current Scenario, these three modules are working individualistically. The foremost challenges in water supply system are, outflow or wastage of water and the commonly public crowd is using suction motors to pull water from main supply connection, which results decrease in water pressure. To resolve and reduce above challenges and difficulties an automated water distribution system has been introduced which augments the water supply, reduces wastage of water as well as categorize the theft of water. In the urban & rural infrastructure, the water distribution system is plat important role, which must pledge the steadiness of the water distribution, water quality control and the monitoring. Due to rapid increase in populations, the Usages of water diversity surges because of constraint obligatory by the water accessibility, hydrological conditions, storage ability of reservoir, control and process parameters. The distribution and supply system include pumping stations, filtering treatment utilities, storage tanks, piping distribution network and central dispatching unit. In this hybrid distribution and supply system the SCADA system structure implemented which contains one or more Central Controlling Units (CCU) (PC based) that communicates with more Programmable Logic Controllers (PLC's) executed into the pumping stations and Remote Client Terminal Units (RCTU) located in control panels throughout the network. The Programmable Logic Controllers (PLCs) grip the direct control of the technical process whereas the central dispatching unit user interfaces SCADA. The entire filtration and treatment of water statistics is executed by the Central Controlling Units. Which impacts a great drop of the operating cost as well as decrease in the water losses is now possible by the implementation of an Intelligent Automated Control System. This proposal the great support and enhancing efficiency for the optimization of the useful exploitation strategy and the optimization of technologies use. By using this technologies public distribution network will be online managed and will be realized by the central distribution department of government as well as the remote control of the actuators installed into the most important points of the system. Depending upon the water flow circumstances and requirements, the pressure and flow transducers (Digital Flow Meters) are being installed in Pumping Stations (PS) and

computing points throughout the network. The Automated devices are connected to the Remote Client Terminal Units (RCTU) which communicate the data to the Central Controlling Units (CCU) in order to offer dynamic behavior. The Remote Client Terminal Units (RCTU) offer the data acquisition capability for diverse sensors (detailed for water pressure, flow, level or chemical component concentration) using digital and analog modules; which insure the introductory signal treatment and wireless data communication to the Central Controlling Units (CCU). The SCADA system executed to the Central Controlling Units (CCU) accomplishes the data communication with all the Remote Client Terminal Units (RCTU) and PLCs, which store the received data from computing points in distribution network and the pumping stations. It purposes cutting-edge investigation functions as well as the remote control of the major technological parameters.

2. Methodology

The newly proposed automated water distribution and supply system consists of Central Controlling Units (CCU) (PC based) Programmable Logic Controllers (PLCs), PH sensors, chlorine measurement system, Digital Water flow Meters and sensors for water theft detection, GSM module, SCADA system and motor driver.
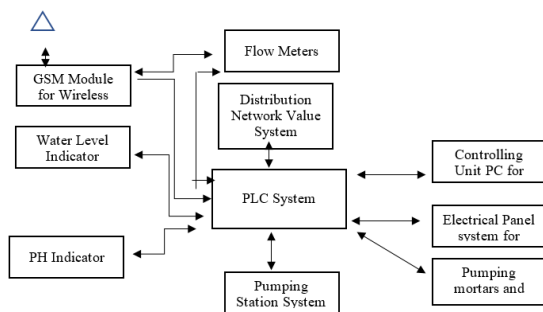

Fig. 1. System block diagram

Programmable Logic Controllers (PLCs) is plays important role in automated water supply system. Programmable Logic Controllers (PLCs) has been supporting in controlling pump station motor contactors, stirrer motors, distributed valves as well as measure pH of the water through Central Controlling Units (CCU) (PC based) and collecting the measuring data & monitoring the water level, flows, utilities & generates the complete reports about water distribution system. Programmable Logic Controllers (PLCs) programming is done by using language "Ladder Diagram". This language is specialized representation language commonly used to text industrial control logic systems. It is so-called as "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. Different electric motor is used for oxidation purpose at the filter plant reservoir. By using Programmable Logic Controllers (PLCs), pumping electric motors are turned on and off according to the requirement of

water. The Programmable Logic Controllers (PLCs) receives output from pH and chorine sensor; value presented on SCADA. It manages the different type's alarms according to equipment severities on computer screen of Central Controlling Units (CCU). Due to this the operations and maintained of water distribution system easily and with high efficiency manages.

3. Pumping station and distribution network automation system

The industrial automated equipment installed in the pumping stations (PS) are managed and controlled by a Programmable Logic Controllers (PLCs) based equipment which obtains all the hydraulic parameters (Water Pressure, Water flow, Basins water level, free and residual chlorine, PH of water) and the electrical parameters for all the electric pumping motors and other devices. In the Pumping stations water distribution and supply driving operational schedule & module implemented in the Programmable Logic Controllers (PLCs) comprises a schedule optimization tool based on the subsequent criteria:

- Recording, Capturing & Monitoring of the hourly electrical energy tariffs,
- Recording, Capturing & Monitoring the water demand and supply dynamic and constraints, inflows and outflows
- Recording, Capturing & Monitoring the operation of water distribution network for maintenance planning related to the public water demand.

In this SCADA automated water distribution system, there are different sensors and flow meters. They used for reservoir level measuring and detection; one is at bottom of reservoir, secondly will be placed at middle position of reservoir and thirdly will be kept at the top of reservoir. If water level indicator measuring a level at low or mid-level thus Programmable Logic Controllers (PLCs) will turn on and off pump station electric motor according water demand and supply. In the pumping station there has two set of pumping motors, one is for regular use and another is for standby emergency purpose. In this Automated SACDA system both the set of motors are included in the system and controlled as per need using Programmable Logic Controllers (PLCs). Present position of the entire sensor system is displayed on Screen of Controlling Unit (PC). SCADA Automated software used to establish graphical user interface. By using optimization components, which enables the move to the preventive or predictive abuse of the water resources and storage volumes based on smart control algorithms. They signify the backing for electrical energy cost optimization by real time monitoring the pumping schedule and the on/off electric drive brief load reducing, maintenance planning based on the purposeful wear and loading.

Traditional water distribution network system contains mechanical valves to distribute water. Since entire procedure is managed and controlled manually, it involves more time and

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man power resources, with noteworthy amount of wastage of water. Mechanical controlled valves are combined to avoid wastage of water. Choice of Mechanical controlled valves depend upon size of water supply pipe and pressure of the water.
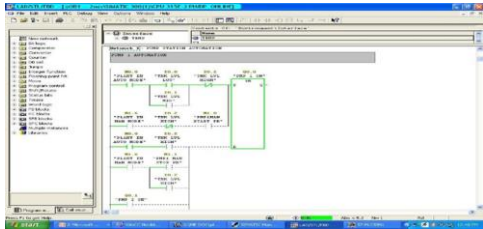

Fig. 2. Program in logic manager for pump station

4. SCADA communication

In the SCADA automated system, the data collected from the Remote Client Terminal Units (RCTU) riding to avoid vandalism, from the pumping stations to Programmable Logic Controllers (PLCs) and the water reservoirs are communicated to the transmitting unit computer installed in the water distribution controlling center of government. The Automated software system participates a SCADA application program specifically established for water distribution network management. The transmitting unit SCADA system explains& generates daily, monthly, yearly Data Reports& Trends related to the water distribution network requested parameters and stores the attained data in a precise database for future analysis and recovering.

5. Conclusion

This advance SCADA automation implemented in water distribution system is combination of intelligent water distribution system and Electrical & Mechanical system, which ensures to avoid wastage of water and reduces time. Using this intelligent automation system, it is thinkable to monitor and control whole system from single Control Station of government for better water distribution to public according to demand and supply requirement and it is monitoring all distribution network real time without extra man power resources and operational cost. This SCADA Automation system having subsequent benefits:

- Real time distribution network management & monitoring and unremitting water distribution according to water demand and supply requirement of public.
- It informs real time maintenance alarms generated in SCADA when any equipment fails in distributed network or pump station.
- Report Generation daily, monthly and yearly report in Central Controlling PC.
- Real time Monitoring of distribution network in the central controlling center.
- All the water distribution parameter is automated measured like pH and chlorine and real time demonstrate in SCADA by this government provides quality of water Provide to consumer.

References

[1] Mircea Dobriceanu, Alexandru Bitoleanu, Mihaela Popescu, Sorin Enache,Eugen Subtirelu, "SCADA system for monitoring water supply networks," WSEAS transactions on systems, Volume 7 , Issue 10 (October 2008),

[2] Mrs. Gaikwad Sonali Ashok, "Water antitheft and quality monitoring system by using PLC and SCADA", International journal of electrical and electronic engineering research, vol. 3, no. 2 ,June 2013, pp. 345-384.

[3] Miladin Stefanovic, Milan Matijevic, Milan Eric, Visnja Simic, "Method of Design and Specification of Web Services Based on Quality System Documentation," Information Systems Frontiers: vol. 11, no. 1 (2009), pp. 65-68

[4] Gouthaman. J, Bharathwajan prabhu. R and Srikanth. A "Automated urban drinking water supply control and water theft identification system" Proceeding of the 2011 IEEE Students' Technology Symposium14-16, January 2011, IIT Kharagpur.

[5] Gouthaman. J, Bharathwajanprabhu. R and Srikanth. A "Automated urban drinking water supply control and water theft identification system" Proceeding of the 2011 IEEE Students' Technology Symposium14-16 January 2011, IIT Kharagpur.