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Automation in Urban Drinking Water Supply System with Theft Detection

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Abstract— Now a day's 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. Along with this another problem in the water supply system is that public is using suction pumps to suck the water directly from the home street pipeline. The best way to improve the water distribution system is by using industrial PLC and computer system, which includes all network components like flow sensor, pressure sensor GSM modules, pH sensor etc. The water theft can be best monitored by the pressure variations given by the sensors mounted on the channels. 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. 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 (Supervisory Control and Data Acquisition) represent the support for optimization of the process and data- driven Decision

Keywords—*SCADA, PLC, RTU, Theft Detection, GSM modules.*

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I. INTRODUCTION

Conventional drinking water supply framework is confronting numerous issues identified with filtration, pumping of water, circulation of water and testing of water. Customary water supply division contains three distinctive segments for water supply. To begin with is the pumping station, which does the sucking of water from water source. The second area is a filtration division in which estimation of pH and chlorine is finished. Third area is the conveyance segment through which water is circulated in all the city wards. As of now these three areas are working freely. The significant issues in water supply framework are spillage or wastage of water and in larger part open is utilizing suction engines to suck water from fundamental supply association, which results diminish in water weight.

To overcome above said issues a mechanized framework has been created which upgraded the water dispersion, lessens wastage of water and also distinguish the robbery of water. The water supply framework is a part of the urban foundation which must guarantee the congruity of the water appropriation, water quality control and the checking. The utilization of water assorted qualities expands due to limitation forced by the water accessibility, hydrological conditions, stockpiling capacity of tank, control and process parameters [1]. The framework incorporates pumping stations, sifting treatment utilities, stockpiling tanks, channeling dispersion system and focal dispatching unit. The complete SCADA framework structure incorporates one or more focal primary station (PC based) that speaks with more PLC's actualized into the pumping stations or RTUs situated in control boards all through the system. The PLC(s) handle the immediate control of the innovative procedure while the focal dispatching unit client interfaces SCADA. Focal station is utilized to handle the information. The decrease of the working expense and additionally diminishment in the water misfortunes is presently conceivable by the execution of an astute control framework. This offers the backing for the streamlining of the utilitarian abuse procedure and the advancement of hardware use.

The worldwide online supervision of the water conveyance system is acknowledged by the focal dispatching administrator and in addition the remote control of the actuators introduced into the most vital purposes of the framework. As indicated by the prerequisites of the water stream condition, the weight and stream transducers are introduced in sponsor stations or measuring focuses all through the system. These electronic gadgets are associated with the RTUs which transmit the information to the focal dispatching station to offer element conduct. The RTUs give the information procurement office to various sensors (particular for water weight, stream, level or concoction segment focus) utilizing computerized and simple modules; which safeguard the preparatory sign treatment and remote information correspondence to the dispatching unit. The SCADA framework executed to the focal dispatching unit deals with the information correspondence [2] with all the RTUs and PLCs, which store the got information from measuring focuses and the pumping station.

II. SYATEM DETAILS

The created mechanized urban water supply framework comprises of PLC, pH sensors, chlorine estimation

framework, and sensors for water robbery identification, GSM module, SCADA framework and engine driver.

Programmable Logic Controller is the heart of mechanized water supply framework. PLC has been help in controlling pump station engine contactors, stirrer engines, dispersed valves and in addition measure pH of the water. PLC writing computer programs is done utilizing Ladder Diagram Language. Step graph is specific schematic dialect normally used to record mechanical control rationale frameworks. It is called "step" chart since it takes after a stepping stool with two vertical rails (supply power) and the same number of "rungs" (level lines) as there are control circuits to speak to.

Stirrer engine is utilized for oxidation reason at the filtration tank. These engines are turned on and off utilizing PLC as per the refinement of water. The PLC take yield from pH and chorine sensor; esteem showed on SCADA.

III. PUMPING STATION AND DISTRIBUTION AUTOMATION SYSTEM

This system has three different sensors. 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, PLC will turn on pump station motor. We consider water supply department has two motors in pump station, one is for regular use and another is for emergency purpose which is shown in figure 2. Using developed system both the motors will be included in the system and controlled as per need using PLC. Current status of the entire sensor will be displayed on PC [3]. GUI has been designed by SCADA software. The optimization module facilitates the move to the preventive or predictive exploitation of the water resources and storage capacities based on intelligent control algorithms. They represent the support for electrical energy cost optimization by real time monitoring the pumping schedule and the on/off electric drive transient load reducing, maintenance planning based on the functional wear and loading. The technological equipment installed in the pumping stations are controlled by a PLC based equipment which sense all the parameters (pressure, flow, reservoirs water level, free and residual chlorine , pH) and the electrical parameters for all the electric drives[1].

The pumping functioning module implemented in the PLC includes a schedule optimization tool based on the following criteria:

- The hourly electrical energy tariffs,

- The water demand dynamic and constraints, inflows,

- Statistical records regarding the water demand.

Conventional water distribution system comprises mechanical valves to distribute water. Since process is controlled manually, it requires more time and man power, with significant amount of wastage of water. Solenoid controlled valves will be incorporated to avoid wastage of water. Selection of solenoid valve depends upon size of water supply pipe and pressure of the water [3].

IV. THEFT DETECTION UNIT

The major problems in water supply system are, leakage or wastage of water and the majority public is using suction motors to suck water from main supply connection, which results decrease in water pressure. The theft detection unit helps in collecting the information regarding theft detection from remote area. We use pressure sensor for theft detection. Pressure calculations are done by using following formulas. Discharge of water is define as $Q=A\times V$

Where Q=Discharge of water

A= Area of discharge

V= Velocity of water

Therefore $Q=(\pi 4\times d2)\times\sqrt{2}\times g\times h$ I

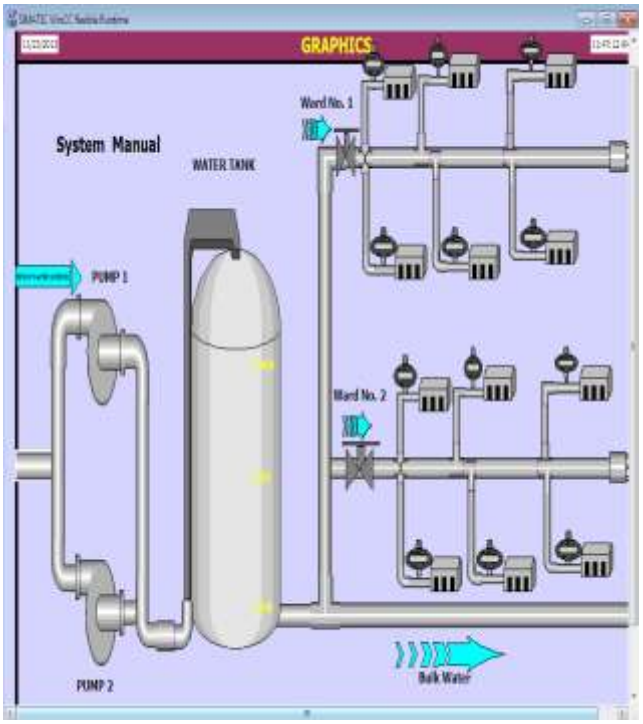

Fig. 1 Water Distribution System in SCADA

The RTUs interfaces are associated with transducers to quantify the weight and pH, the water level in the stores and particular transducers for the water quality examination. The PLCs introduced in the pumping stations screen the pressure driven parameters of the outward pumps

and the electrical parameters [5] of the electrical drives and control the begin/stop arrangements [6] as indicated by the water powered situations in light of imperatives, vitality costs and constant observing of the pumping proficiency/execution. The administrator console permits the administrator to arrange the principle working parameters, the coordination of measuring gadgets with various kind of sign yield (simple current/voltage yield, information serial port correspondence convention). The framework gives apparatuses to appointing (re-going, units changing) and the capacity to analyze and can encourage the move for a preventive or prescient upkeep framework. The RTU gives the device to transformation of information (balance and incline alteration for simple flags), the programming of lower and upper estimations restrains, the researching rate and the information transmitting filter time. The stream sensor is utilized to gauge stream of association. The yield stream of stream sensor is contrasted and standard stream of association. The yield of stream sensor is more noteworthy than the standard stream then it demonstrate as a burglary.

Calculation of pressure reduced by one connection by using Bernoulli's equation is,

$$P1W+V1_2 2\ g+Z1=P2W+V2_2 2g+Z2 \quad II$$

V. SCADA COMMUNICATION

For the automation in drinking water supply system and theft detection, Siemens PLC (S7 1200) and SCADA is used. By applying input to PLC from different sensors, results are captured in SCADA. Further these results matched with standard values for theft detection.

Graphical User Interface (GUI) has been designed in SCADA (WinCC) flexible toolbox for executing each step smoothly as shown in figure 3.

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 unit computer installed in the water distribution company's headquarter. The computer software system integrates an SCADA application program specifically developed for water distribution management show in fig.3. 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 [2].

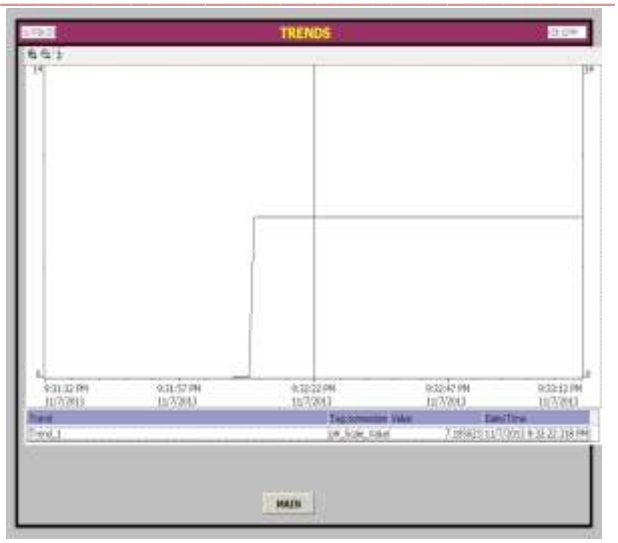

Fig. 2 Trends in SCADA

VI. RESULTS

This system implemented at palkarwadi and tried for 15 days. Day wise samples reading have been added in table no. 1 shows reading of pH and table no. 2 shows reading of Pressure in ward which helps for theft detection.

Table No. 1 pH reading

Var Name	Time String	Var Value
pH	25-08-2013 13:41	7.534688
pH	25-08-2013 13:42	7.611256
pH	25-08-2013 13:43	7.612775
pH	10-09-2013 16:41	6.536241
pH	10-09-2013 16:42	6.499783

Table No. 2 pressure reading

Var Name	Time String	Var Value
Pressure	25-08-2013 13:41	10.45693
Pressure	25-08-2013 13:42	10.30093
Pressure	25-08-2013 13:43	10.36793
Pressure	10-09-2013 16:41	10.36793
Pressure	10-09-2013 16:42	10.37593

VII. CONCLUSION

The automation 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 control room. Distributed system is intelligences it monitoring all time without man power. Developed automated system has following merit.

- Continuous water distribution according to water level.

- The real time alarms created in SCADA when any equipment fail in distributed or pump station.
- Database elaborate daily, monthly and yearly report in Central PC.
- Measurement data reliability by the global monitoring of the network in the central dispatching unit.
- Automatic measurement of pH and chlorine and display in SCADA due to this quality of water Provide to consumer.

References

[1] *Gouthaman.J, Bharathwajanprabhu.R&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.*

[2] *Stancil, Stoian,andkovacs "Urban water supply distributed system",Vol.3,pp.316-321,May.2008.*

[3] *PrashantPalkar&ShrinivasPatil" Automation in drinking water supply distributed system and testing of water" IOSR Journal of Electronics & Communication Engineering (IOSR-JECE) ISSN : 2278-2834, ISBN : 2278-8735, PP : 36-38.*

[4] *Siemens system manual "S7-1200 Programmable controller"*

[5] *ProMinent Group, "Process Overview Water Supply",vol.1,pp.26-43,2007.*

[6] *Westermo Handbook 5.0, "Industrial data communication theoretical and general application ",pp 64-9*