

Smart City Water Supply Control System

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Abstract - Smart cities are the heart of the country, Cities are called smart when they are integrated with smart systems i.e. Water Supply, Electricity Control System and smart communication technology. In our Paper we have developed a demo model of PLC (Programmable Logic Controller) and SCADA (Supervisory Control and Data Acquisition) for Smart city water supply control system in which the process is going to be controlled manually as well as remotely. In this system we have used different components like motor, switches, solenoid valve, sensors i.e. flow sensor, level sensors that can be controlled from system and different values generated through this components are calculated and saved in the SQL database. And by fetching the saved records from the database we are going to display these values on an online portal of our system.

The connection made between the SCADA and SQL Database plays an important role in saving the real time data so that the records can be accessed from database itself. This system can be actually implemented in any developing smart city for better improvement of water supply, as the whole process can be controlled locally as well as manually from the panel or our personal SCADA system. Data which is stored in SQL database can be accessed through online portal of water supply system.

Keywords — Intouch Wonderware, IO Server, Motorola ACE3600, Online portal, SCADA, SQL Server.

I. INTRODUCTION

Automation plays an increasingly important role in the global economy and in daily experience. It improves the performance and also reduces human efforts hence we are implemented PLC based water distribution system. The main objective behind selecting this project is to improve the performance of water distribution system with minimum human efforts.

Cities are getting smarter and smarter now a day's using new different technologies, so living in smart cities makes people reduce the work load and provide the security as well as living comfort. A city can be called smart by the way of people's living and culture in it, where every problem of environment can be controlled and everything should be automated. This system of water supply can be implemented in cities by using technologies like PLC and

SCADA with the help of government taking efforts to initiate it. This whole water supply system can be accessed by users through online portal made for our project. [1]

The main goal of this system is to take water from source and supply it to overall city areas and generate the records as per the saved values.

So we took the survey of different cities that what actually they are implementing and what we have implemented. Given below are the Literature Survey and the information on the implementation part with system architecture and some snapshots.

II. EXISTING SYSTEM

a) Real time SCADA Model for taking water from Well and pumping in farm Automatically

In this system of PLC controlled water distribution system, the controlling is done through PLC and SCADA. They have done the project on simulation, and the project was not actually implemented. The main goal of their project is that they have generated crystal reports of the records using this technology. The flow meter and the pressure meter calculates the flow and pressure and saves the records in the SQ database from which they can generate the crystal reports as well as check the records of the users. The SCADA design in this system detects and shows the point that where actually the problem occurred so that they can correct from the exact place. [2]

b) PLC Controlled Water Distribution System

The methods used now days in different cities form water supply system are running into problems like overflow, leakage and empty running of tank so to overcome these problems they made project based on flow, level and pressure sensors to reduce the human efforts. This project can be handled even with a non-technical person. [3]

c) AMR and Controlling Water Supply Using PLC

The main goal of AMR and Controlling Water Supply Using PLC is to measure the amount of water supplied through pipeline to its particular areas and control it through solenoid valve so that after the supply of water the connection can be on idle mode. The reusing and recycling of waste water is the motivation of the project and the AMR (Automatic meter reading) will calculate the flow of water through the pipeline which is supplied to the city. [4]

III. PROPOSED SYSTEM

Smart City Water Supply Control System

Our project smart city water supply control system is completely based on PLC and SCADA technologies. In SCADA model of this system the activities like date, time, flow and volume of water are recorded in Database system (SQL Server 2008) and data which is recorded in SQL Database will be shown on the online portal of water supply control system. User can access the information as well as bills, usage of water as per the dates and time as well. Data can be monitored through SCADA software as the whole SCADA is connected remotely to the SQL Database server 2008. Even the non-technical person can access the online portal made for our project.

We are using Motorola ACE3600 RTU as a PLC. In our system we are developing a SCADA model for recording all the activities, activities like time, date and flow in liters are calculated and stored in the database (SQL Server 2008).

The components that are required for this system are sensors, tanks, panel, led lights, switches and wireless Wi-Fi router.

When we start the execution of the system the PLC checks the level of the sensors whether the city tank is full or not, if the tank is empty then according to the condition the water pump gets started and once the city tank gets full then the level sensor indicates that the city tank is full and then automatically the water pump gets off. This procedure is carried out every time when the city tank gets empty. Now, here the question arises in mind that what happens when the source water and city tank both are empty? So we have placed a level sensor in source water too, to check the empty condition of the source water and if it is empty then water pump doesn't get started.

When the city tank gets full then it is time to proceed further with the water supply in city in a smart way so PLC checks the tank full condition and opens the solenoid valve connected to the city pipeline to supply the water to different areas of city. On the same pipeline we have connected Flow sensor to generate the records of flow in liters at the time of water supply to the city. When the values are collected they are saved in database with the help of SCADA and SQL Connectivity. This project can also be handled by any non-technical person.

To display the generated values i.e. Flow in liters, date and time according to particular day we have made an online portal named same as our project. User can access daily usage and own information as well as monthly bills from portal itself.

IV. SYSTEM DESIGN

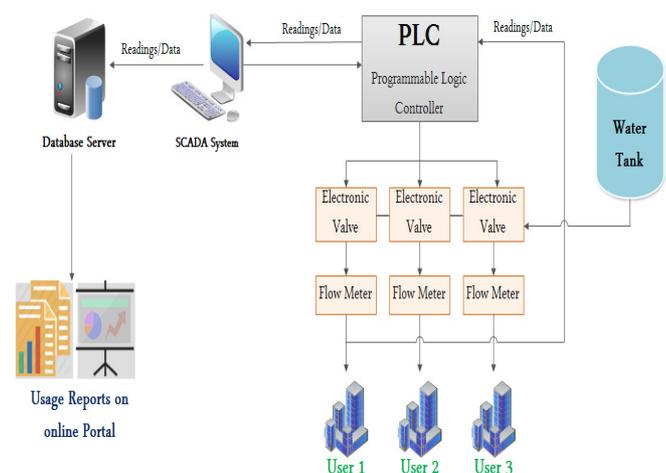


Fig.1: System Architecture

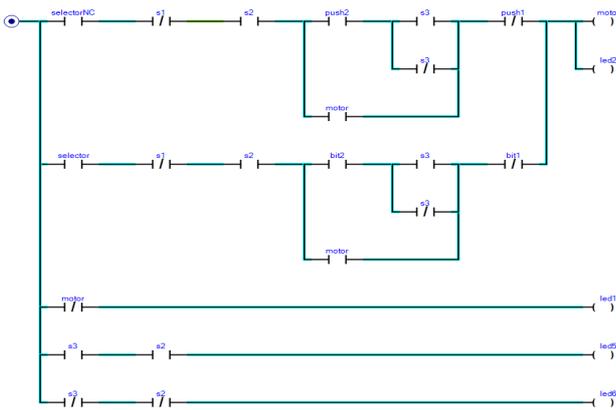


Fig.2: Ladder Logic

Ladder Programming is the programming language used by PLC for controlling components according to its logic. Fig.3 shows the ladder logic of our project.

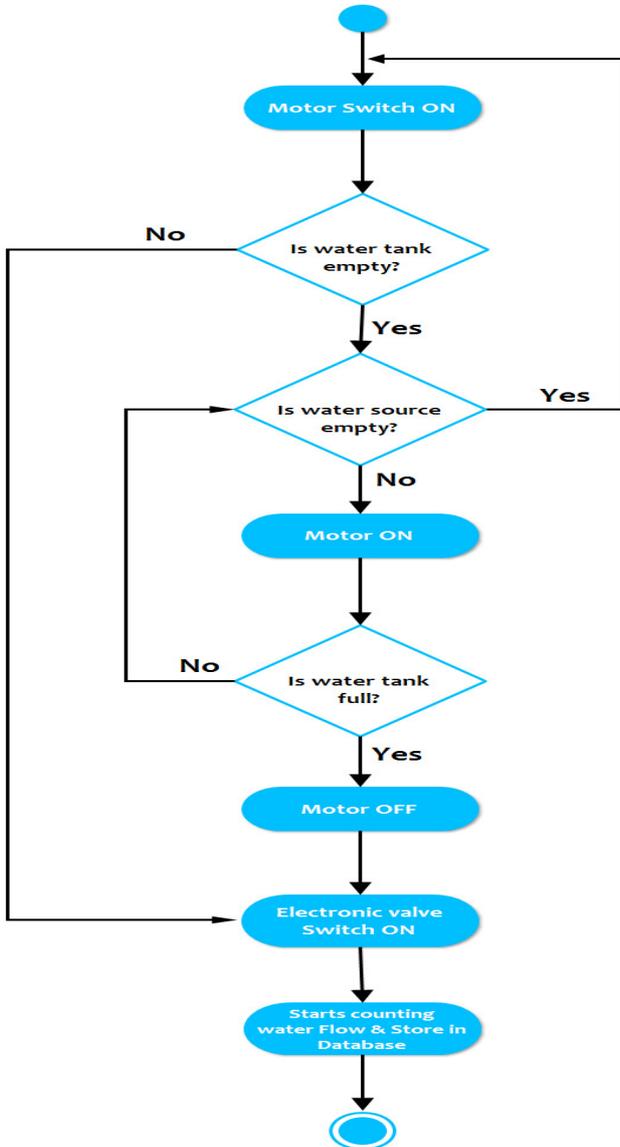


Fig.3: Activity Diagram

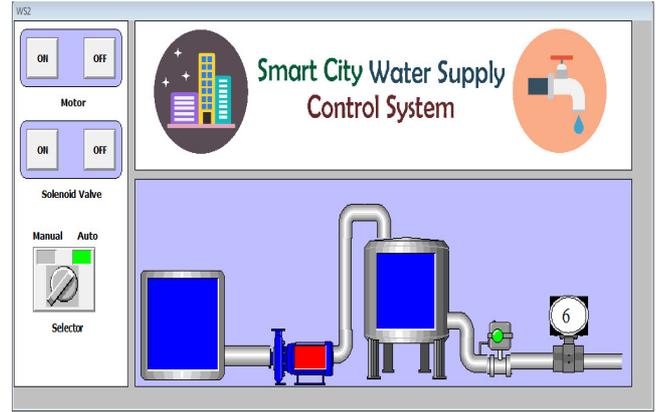


Fig.4: SCADA Design

Supervisory Control and Data Acquisition (SCADA): SCADA systems are used for monitoring and controlling. In SCADA Intouch Wonderware 10.1 software is used for developing an application. [5]

Fig.4 shows the actual SCADA designed Window

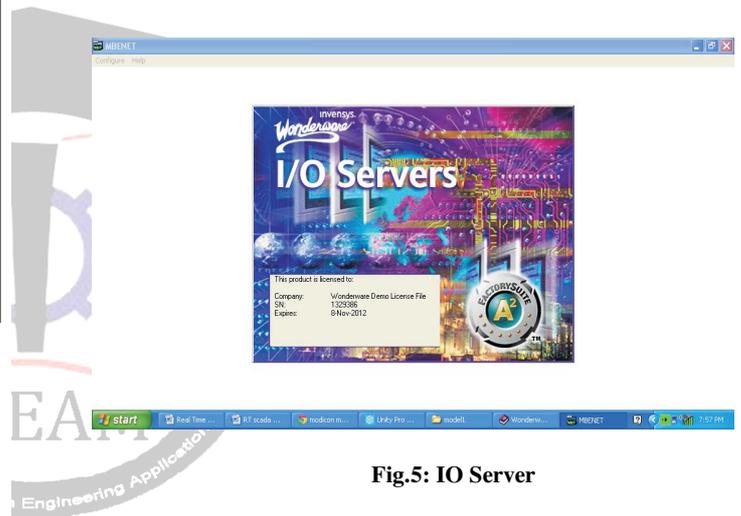


Fig.5: IO Server

IO server (Modicon MODBUS Ethernet): The Wonderware Modicon MODBUS Ethernet I/O Server is a Microsoft Windows application Program that allows access to data in Modicon PLCs (also referred to as devices) over an Ethernet network. The server requires only a standard 10BaseT Ethernet network card to access the Ethernet network. Each Ethernet Network Card provides an interface to as many PLCs as the Ethernet topology allows. The server supports Modicon Quantum (6-Digit) Automation Series controllers equipped with Quantum Ethernet TCP/IP NOE modules. The function of the IO server is to provide the connection between the PLC and SCADA software Wonderware Intouch 10.1

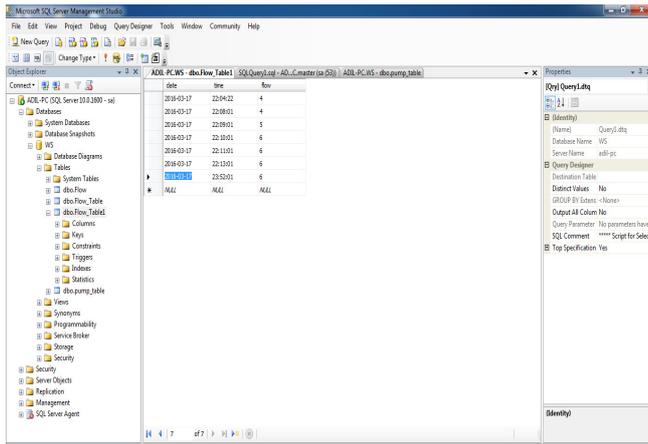


Fig.6: SQL Server 2008 (Database)

Database System(SQL SERVER 2008): Microsoft SQL Server is a relational database server, developed by Microsoft: it is a software product whose primary function is to store and retrieve data as requested by other software applications, be it those on the same computer or those running on another computer across a network (including the Internet). Microsoft SQL Server is a Relational Database Management System (RDBMS) designed to run on platforms ranging from laptops to large multiprocessor servers. SQL Server is commonly used as the backend system for websites and corporate CRMs and can support thousands of concurrent users. [6]

In these models SQL server 2008 database is connected with Wonderware Intouch10.1 the real time data which are save in memory address of PLC are access by Intouch Wonderware are store in the tables created in the SQL server 2008.



Fig.7: Display Daily Usage on Online Portal

Online Portal: Now a day everything gets online for ease of access. So we develop an online portal for users to access there bills & usage in a smart way. Values recorded in the database from PLC are displayed in this portal.

When a user login in a portal he/she is redirected to the welcome page, welcome page has two options first one is daily usage and second one is bills. In this way user will able to see his/her daily use as well as usage amount. In this system the data is arranged according date and time format.

V. ADVANTAGES

- Through SCADA system we can monitor the whole system and according to that we can detect errors & control it.
- Increases overall efficiency of water distribution.
- Effective utilization of resources.
- Reduces Human Efforts.
- Any non-technical person can handle the whole system easily.

VI. CONCLUSION

In smart city water supply control system the methods used in older times results into problems like overflow, leakage and empty running of city tanks. So to overcome these problems the automation system is made to reduce the human efforts. This procedure made for a particular city has proved important and effective for future implementation.

In this system we represent PLC and SCADA technology from which the project is completely controlled from SCADA as well as Panel. Thus for reducing the human efforts and save the real time data in Database this technology has helped a lot to implement the actual demonstration.

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