DIGITIZATION OF WATER DISTRIBUTION SYSTEM IN URBAN AREA USING PLC & SCADA

Ms.Vaishali Bagde , Assistant Professor
Mr. Sudarshan shelke , Mr. Rohit salunkhe , Mr. Narendra padwal
Alamuri Ratnamala Institute of Engineering and Technology,Sapgaon

Abstract - Whether you are in residential area or industrial area, the water supply system in urban area is the conventional. As more &more demand of water is generated in urban area, weather for people or industries, the present conventional water system cannot meets the requirements. The PLC & SCADA came up with the features that can meet the need of automation in various fields. Introducing the automation technology in the day to day life can evolve the human life rapidly. Meanwhile a large amount of water is not distributed evenly due to malfunction & defects in current water supply system. This project aims at overcoming the disadvantages of existing water distribution system.

This proposed automated water distribution system is used to distribute the municipal water equally to all street pipe line. So that everyone will get the equal amount of water. The set point is fixed for each pipe line. The water from the storage tank is measured with the help of level sensor. Flow sensor measures the flow rate of the water. Solenoid valve is used to open and close the valve automatically. If the Water level reaches to set point, Solenoid will be turned OFF and it will be turned ON after high indication by level sensor. Here we also identify the water theft accurately during the distribution time period. This system consists of PLC and SCADA. PLC is used to control the distribution of water. SCADA is one of the emerging technologies which are used for complete monitoring. The overall system is connected to PLC with the help of RS-232 cable. PLC gives the signal to the solenoid valve according to the set point written in the program.

Sustainability of water resource has been a big issue being discuss lately. From the reason of lack of resources to the attitude of end user that frequently waste water, the problem seems not having any improvement on finding ways to at least contain it from increasing. The problem is related to poor water allocation and monitoring, inefficient use, wastage and also lack of adequate integrated water management. There are some Reason that this cannot be controllable such as raw resources and the attitude of end user. But there is an area that we can at least control it to the lowest level possible by applying better technology and management. The area that can be improved is the monitoring and management of water storage and distribution. Usually we see water pipe leaks, which results in a fountain of burst water. As a result, there will be a water shortage problem because of the pressure lost, which prevents the water from being supplied to the storage tank.

INTRODUCTION

With the continuous economic growth, the water demand of enterprise is also increasing. The monitoring of water resource for these enterprises can prevent the occurrence of stealing water and leaking water effectively. Therefore , the monitoring system of urban water supply has aroused extensive attention in recent years. Urban water supply networks form the link between water supply and water consumers. These large scale networks are vital for the survival of urban life, for maintaining a healthy level of economic development , and for the continuous operations of factories and hospitals. In world , urban water supply system are public enterprises, usually part of local government, and the recent increased interest in privatizing public enterprises has not led to reforms of water systems. Nevertheless, in about fifty cities in the developing world, the water system either has been privatized or franchised to a non-

governmental entity for its operation and maintenance. One of the most important aspects of any town management includes water management. It is a crucial aspect as now a days water resources are very limited and nobody can afford its wastage. These project deals about the automation in water distribution and management in technical advances. In this system the level of water in consumer and supply tank will be sensed by water level sensor. Depending upon the level of water the motor will be switched on or off to maintain the sufficient level of water. This project deals about the automated PLC & SCADA controlled the water distribution in different areas and generation of bill according to usage of water. One of the measured features in the project is even distribution of water along with the bill status update on mobile/computer through GSM module by SMS/E-mail. The ever-increasing population and the wide growth of residential and industrial areas has increased the necessity of proper water distribution. Previously, technology was not so developed as it is now and water sources are also limited. To overcome this crisis, we have decided to work on the digitization of water distribution in urban area using PLC and SCADA. Also to overcome the problem of distribution of the water bills to the consumer, we have used the GSM module for direct communication also the data is stored for future references. The transparency will be maintained between consumer and supplier. The overall idea of this project was very challenging. While selecting this project the important consideration was that it should benefit the day to day life of the people, it should meet the needs of every human being and industries, a project module which would be beneficial to society and reduce their problem

I. PROBLEM STATEMENT

In the present scenario, the per ca-pita usage of water in a community with a population of between 20000 to 100000 is nearly 100 to 150 liters, per day. For communities with a population of over 100000 the per ca-pita usage is nearly 150 to 200 liters, per day. This is according to the BIS standard 1172:1998. The ever increasing population of metropolitan cities have led to significant crisis of water.

Meanwhile a large amount of water is not evenly distributed due to the malfunction in the current water supply system. The current water supply system i.e BWSSB for Bangalore supplies approximately 900 million liters of water per day, despite a municipal demand of 1.3 billion liters. The per ca-pita water supply that BWSSB is able to provide averages 100 to 125 liters, per day. However, the actual availability of water to the poor areas of the city is limited by infrastructure, and so for these areas, the per capita supply can be as low as 40 to 45 liters per day. Hence there is an excess of supply in water for many areas resulting in scarcity water in few areas.

Creepy water meter Reading: This is by far the most popular meter problem. Whether it is you or your local water company that is reading the meter, not all persons are aware of the correct way of reading a water meter. Knowing the right way to read the water meter can tell you how to locate leaks, conserve your water and monitor your water usage.

Air Accumulation Problem: Air pressure in the piping system can lead to major water meter issues such as erroneous water metering and damage to the internal components of the water meter. An air valve prevents air from travelling through the piping system and passing through the water meter. When public or private water supply is irregular or inconsistent, water channels through from upper levels of the distribution system and gathers in the lower levels. Air replaces the water drained from the upper levels. As soon as the water supply is restored, water refills the pipeline, moves the air, forcing air through the water meter, rotating the impeller and gears very quickly. Air flowing through the meter causes damage to its internal components and escalates its readings **Uneven distribution of water:** The analog meters which cannot keep the track of the amount of water supplied results in uneven distribution of water.Hence there is a requirement in replacing the smart water meter with a Digitization of water distribution system in urban area using plc and scada. which is capable of overcoming he disadvantages mentioned.

II.PRESENT SCENERIO

Most rural water supply schemes in India use a centralised, supply-driven approach, i.e. a government institution designs a project and has it built with little community consultation and no capacity building for the community, often requiring no water fees to be paid for its subsequent operation. Since 2002 the Government of India has rolled out at the national level a program to change the way in which water and sanitation services are supported in rural areas. The program, called *Swajaldhara*, decentralises service delivery responsibility to rural local governments and user groups. Under the new approach communities are being consulted and trained, and users agree up-front to pay a tariff that is set at a level sufficiently high to cover operation and maintenance costs. It also includes measures to promote sanitation and to improve hygiene behaviour. The national program follows a pilot program launched in 1999.[50]

According to a 2008 World Bank study in 10 Indian states, *Swajaldhara* results in lower capital costs, lower administrative costs and better service quality compared to the supply-driven approach. In particular, the study found that the average full cost of supply-driven schemes is ₹38 (58.2¢ US) per cubic meter, while it is only ₹26 (39.8¢ US) per cubic meter for demand-driven schemes. These costs include capital, operation and maintenance costs, administrative costs and coping costs incurred by users of malfunctioning systems. Coping costs include travelling long distances to obtain water, standing in long queues, storing water and repairing failed systems. Among the surveyed systems that were built using supply-driven approach system breakdowns were common, the quantity and quality of water supply were less than foreseen in designs, and 30% of households did not get daily supply in summer. The poor functioning of one system sometimes leads to the construction of another system, so that about 30% of households surveyed were served by several systems. As of 2008 only about 10% of rural water schemes built in India used a demand-driven approach. Since water users have to pay lower or no tariffs under the supply-driven approach, this discourages them to opt for a demand-driven approach, even if the likelihood of the systems operating on a sustainable basis is higher under a demand-driven app. In the cities of Hubli, Belgaum and Gulbarga in the state of Karnataka, the private operator Veolia increased water supply from once every 2–15 days for 1–2 hours, to 24 hours per day for 180,000 people (12% of the population of the 3 cities) within 2 years (2006–2008). This was achieved by carefully selecting and ring-fencing demonstration zones (one in each city), renovating the distribution network, installing meters, introducing a well-functioning commercial system, and effective grass-roots social intermediation by an NGO, all without increasing the amount of bulk water supplied. The project, known by its acronym as KUWASIP (Karnataka Urban Water Sector Improvement Project), was supported by a US$39.5 million loan from the World Bank. It constitutes a milestone for India, where no large city so far has achieved continuous water supply. The project is expected to be scaled-up to cover the entire area of the three cities. In Tiruchirapalli in Tamil Nadu, the NGO Gramalaya, established in 1987, and women self-help groups promote access to water supply and sanitation by the poor through microcredit. Among the benefits are that women can spend more time with their children, earn additional income, and sell surplus water to neighbors. This money contributes to her repayment of the WaterCredit loan. The initiative is supported by the US-based non-profit Water Partners International The Jamshedpur Utilities and Services Company (JUSCO) provides water and sanitation services in Jamshedpur, a major industrial center in East India that is home to Tata Steel. Until 2004 a division of Tata Steel provided water to the city's residents. However, service quality was poor with intermittent supply, high water losses and no metering.[19] To improve this situation and to establish good practices that could be replicated in other Indian cities, JUSCO was set up as a wholly owned subsidiary of Tata Steel in 2004.

Efficiency and service quality improved substantially over the following years. The level on non-revenue water decreased from an estimated 36% in 2005 to 10% in 2009; one quarter of residents received continuous water supply (although the

average supply remained at only 7 hours per day) in 2009; the share of metered connections increased from 2% in 2007 to 26% in 2009; the number of customers increased; and the company recovered its operating costs plus a portion of capital costs. Identifying and legalising illegal connections was an important element in the reduction of non-revenue water. According to the results of a Service Level Benchmarking (SLB) Program carried out by the Ministry of Urban Development (MoUD) in 2006 in 28 cities, the average level of non-revenue wateer (NRW) was 44 percent. Another study of 20 cities by the Jawaharlal Nehru National Urban Renewal Mission with the support of the Asian Development Bank showed an average level of non-revenue water (NRW) of 32%. However, 5 out of the 20 cities did not provide any data. For those that provided data there probably is a large margin of error, since only 25% of connections are metered, which makes it very difficult to estimate non-revenue water. Also, three utilities in the sample show NRW levels of less than 20%, two of which have practically no metering, which indicates that the numbers are not reliable and actual values are likely to be higher.[3] In Delhi, which was not included in the ADB study, non-revenue water stood at 53% and there were about 20 employees per 1000 connections. Furthermore, only 70% of revenue billed was actually collected.

III. SYSTEM ARCHITECTURE

The certain level of water is maintained in the primary & secondary water tanks with the help of automated pumping & draining system with the help of PLC & SCADA. The measuring module will provide the measured data of water usage to the PLC the data will be simultaneously displayed on LCD interfaced with PLC. The supervisory control is available to control the whole system manually by the supervisor incharge from the remote location. At the end of every month bill of the total water usage will be generated from the data acquired from system & will be sent to the consumer via SMS/ E-mail. The warning system alerts the user if there is extensive/ unnecessary usage made so as to prevent precious water being wasted. Due to centralized distribution system the excess usage or leakage can be monitored from base station & can be handled. This is a remedy measure for water being stolen.

COMPONENTS

water distribution system is made up of many different operational components, including sensors, meters, pumps, and control valves. Components can be monitored or controlled onsite or from a central location. In the past these operations were normally accomplished through the use of onsite instrument and control panels. These panels typically consist of a series of electro mechanical devices such as indicators, push buttons, lights switches, relays and analog control instruments. In recent years many utilities have made the transition to computerized Supervisory Control and Data Acquisition (SCADA) systems in which commands are entered through a keyboard, mouse, or touch screen instead of through the use of switches or push buttons.

IV. RESULT

In addition to smart water mater it will give full customer transparency & water thief will be controlled also water wastage will be controlled by this. And also, we can completely avoid the water theft in the pipe lines. The automatic bill generation reduces man power and time

required to calculation of water bill.

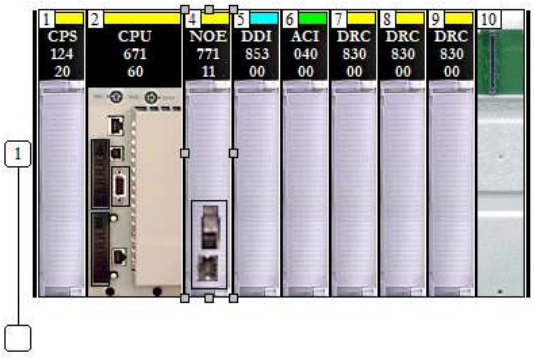

Fig. PLC module

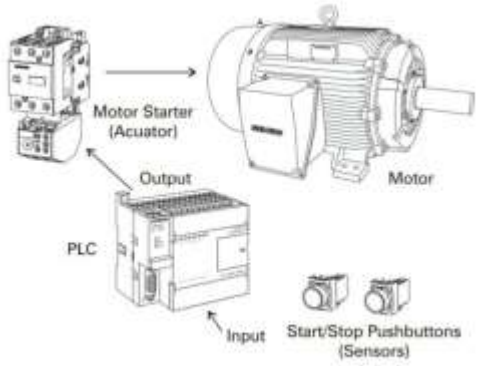

Fig. basic components

V. CONCLUSION

The automation of water distribution system eliminates water wastage. Automation system provide continues water flow and maintains sufficient level of water in water tanks. This project is automatic so it reduces the man power. The automation implemented in water distribution system ensures to avoid wastage of water and reduces time. And also, we can completely avoid the water theft in the pipe lines. The automatic bill generation reduces man power and time required to calculation of water bill. Also, sending the bill over SMS/E-mail reduces time required for distribution of bill. So that every consumer gets equal and sufficient share of water. This system is excellent and cost effective.

VI. FUTURESCOPE

This project can be implemented practically on larger scale by government municipal corporation for any city or village. Also, private enterprises can install the setup for commercial or non-commercial applications. Private or non-private industries can implement this project for industrial water distribution system. The same system can be implemented in any town for automated town electricity management system. This system can be used for multi-purpose by configuring it for either residential or industrial applications under Digital India project.

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