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Smart Water Management Using PLC & SCADA

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ABSTRACT*:* Water is important resource for all the livings in the earth. In that some people are not getting the sufficient amount of water because of unequal distribution of water. To avoid this unequal distribution of water, we are working with Water Supply Department of Pimpri Chinchwad Municipal Corporation. This project is used for distributing the water equally. So that everyone will get equal amount of water. It is also used to prevent the water theft during the distribution period. In previous method, person in charge will go to that place and open the valve for a particular time period. Once the time over again the in charge person will go to the same place and close the valve. It is wastage of time. The proposed system is fully automated by connecting it to the PLC & SCADA (Supervisory Control & Data Acquisition). Here human work and time is reduced. The water wastages such as leakages, mankind laziness and operating error can be avoided. The main aim of this project is to rationalize water supply to consumers, understanding losses & taking corrective decisions also to build transparent, accountable and efficient water supply system. Thus, we are going to develop a system in which we can analyze the different parameters like benchmark of water, water pressure and management by comparing them with fixed benchmark. Also depending on the density of population, we are going to manage pressure and flow readings. In this way, we are controlling & monitoring our system.

KEYWORDS: PLC & SCADA, Benchmark, Pressure, Sensors.

I.INTRODUCTION

The distribution of water on the Earth's surface is extremely uneven. Only 3% of water on the surface is fresh; the remaining 97% resides in the ocean. Of freshwater, 69% resides in glaciers, 30% underground, and less than 1% is located in lakes, rivers, and swamps. Looked at another way, only one percent of the water on the Earth's surface is usable by humans, and 99% of the usable quantity is situated underground. Water requirement is increasing day by day as the population is increasing. Hence water management and distribution must be done efficiently. This system works on different parameters of water like pressure, level and flow rate. Using these parameters water wastage, water leakage and water theft can be avoided. In this system, automation plays the major role by which human errors are fully controlled. Earlier, the monitoring of the process was done by human who causes huge error which in turn causes heavy losses. To reduce this loss, automation is developed using PLC and SCADA.

The present system leads to unnecessary loss of water and due to improper handling; the water is not properly distributed to the end users. Also the monitoring of the level, pressure and flow is done locally. In this system we are working on the distribution network of single water tank called ESR i.e. elevated Service Reservoir. All operations of ESR will be carried out by PLC which controls inflow and outflow. PLC is a main controller which takes i/p from data logger & passes this information to the respective engineer, with the help of GPRS system. Also, here we will monitor the pressure from the pressure meter placed at different branches of the distributed network and analyze them with data logger.

A. Motivation of the Project

Water management is a matter of high priority in India. Now-a-days, water distribution system faces some problems like water leakage & improper water supply. This leakage causes drastic reduction in pressure of water flowing through supply line. Due to this, consumer gets less amount of water. Also in earlier days, person in charge will go to

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that place and open the valve for a particular time period. So, wastage of time was the major issue. By considering the above scenario, we are trying to find solution for the problem. The main objective of this paper is to improve water management and distribution of water. With the automated technology, the human intervention can be minimized.

B. Existing Technology

In existing system, consumer is not getting proper water supply as well as there are some disadvantages like human errors, water theft and leakage in water distribution system. Hence, to overcome these problems there is need to design a system which can detect these problems and can correct them.

C. Need for PLC: -

PLC acts as the heart of the system. It is used to operate solenoid valve, flow sensor, level sensor and pressure transmitter. The whole operation is done by ladder diagram programming.

II. LITERATURE SURVEY

Firstly we have studied existing system operation. For this project we have taken the reference of IEEE paper "Automation in drinking water supply distributed system and testing of water" [1]. They give idea about continuous water distribution according to water level. The real time alarm created in SCADA when any equipment fail in distributed or pump station [2].

We also referred "PLC based system for effective water distribution from canals." which gives idea that the system is based on Programmable Logic Controller having powerful capabilities to tackle number of input and output devices. Also using "Automated Water Distribution System for Smart City using PLC and SCADA" we came to know how we can save natural and important resource like water [3]. Also after discussing with the engineers, we came to know that there are some problems like leakages & water theft is present in some areas. So, people in that respective area are not getting sufficient & proper water supply. To overcome these problems, an automated system has been proposed which optimize the water distribution by reducing wastage of water as well as eliminates the theft of water.

III. PROPOSED SYSTEM

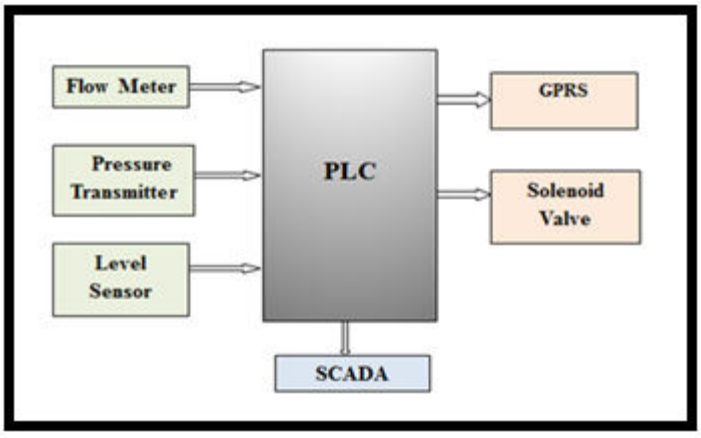

Fig .1: System Block Diagram

A. Elements of block diagram are as follows:

a) Flow Meter:

Krohne Marshall flow meter is used for measuring the flow of inlet and outlet valve.

b) Pressure Transmitter:

Siemens type pressure transmitter is used for measuring the pressure at different points. It works on the principle of difference between pressures of different points.

c) Level Sensor:

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Ultrasonic level sensor is used for measuring the level of ESR. On the basis of these level sensor readings, output valve is operated.

d) PLC:

Mitsubishi type of PLC is used for operating above elements.

e) SCADA:

It is used to monitor and handle the whole operation of the system.

f) GPRS Module:

General Packet Radio Service (GPRS) is a packet oriented mobile data service on the 2G and 3G cellular communication system's global system for mobile communications (GSM).

g) Control Valve:

It is operated by PLC on the different conditions designed for it.

IV. FUNCTIONAL BLOCK DIAGRAM

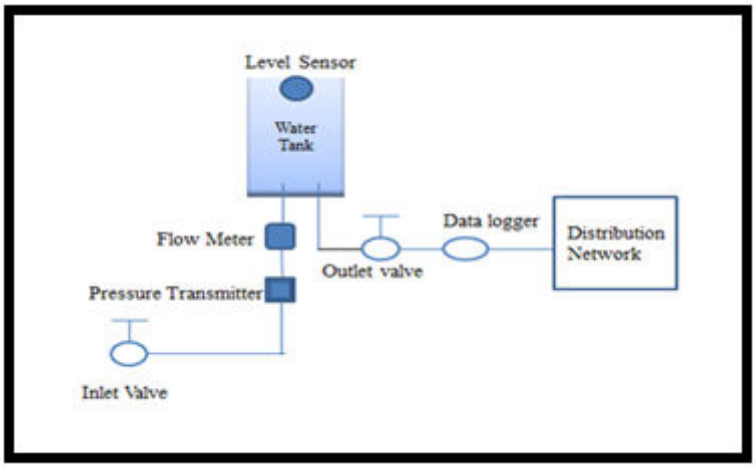

Fig .2: System Functional Diagram

Above figure shows the functional diagram of the system which gives the whole idea of the system. In this system, we are controlling outlet valve by observing the inlet flow and level of water in tank. The data loggers store the reading of pressure transmitter, level sensor and flow meter.

The input to the control valves is given from the PLC. According to the ladder program the valves will work and control its flow.

As per following conditions outlet valve will get open.

1. The input flow to the tank should be >4 Lakhs ltr/hr.
2. The level of water in water tank should be > 4.5 meter.
3. Time considerations: Valve open/close at= 5 pm to 9 pm.

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V. RESULTS

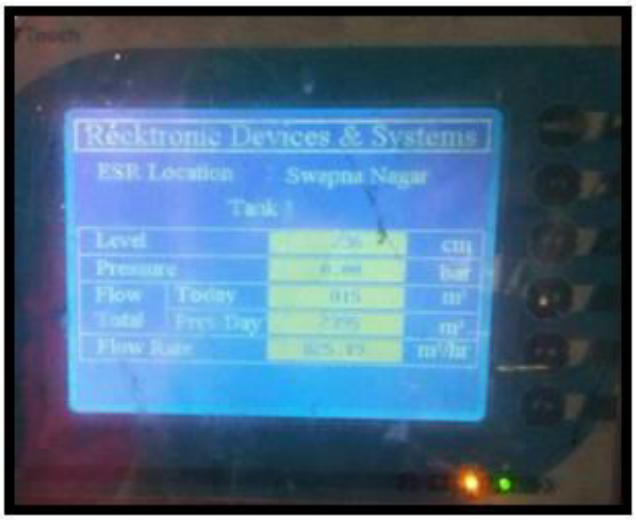

Fig -3: HMI Display

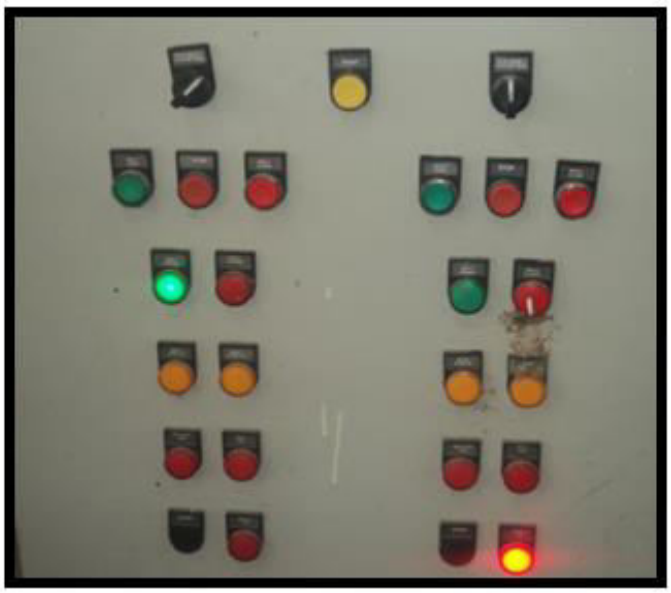

Fig .4: ON-OFF Control panel of PLC

Fig-3 shows HMI display i.e. Human Machine Interface display. It displays all the information of level, pressure & flow rate. Fig-4 shows ON-OFF control panel of PLC. Through this panel we can start / stop the valve.

VI.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.

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- Human safety.
- Any non-technical person can handle the whole system.

VII.APPLICATIONS

- Water management in rural & urban areas.
- Water distribution networks in Industrial issues.

VIII. CONCLUSION

The automation of water distribution system eliminates water wastage. Automation system provides continuous water flow according to the set point. This project is automatic so it reduces lots of man power. The automation implemented in water distribution system ensures to avoid wastage of water and reduces time & also we can completely avoid the water theft in the pipelines. So that people could get equal share of water. This system is excellent and cost effective to prevent the drinking water from the theft.

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