ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2015

PLC Controlled Water Distribution System

Pratiksha Hattikatti[1], Savita Karwande[2], Poonam S. Rode[3] Mrunalini Bhandarkar[4]

UG Student, Dept. of E&TC, PCCOE, Pune, Maharashtra, India [1,2,3]

A.P. Dept. of E&TC, PCCOE, Pune, Maharashtra, India [4]

ABSTRACT: Water is basic need of human being. Water treatment is one of the important process involved in the water distribution process. In PCMC area the water distribution infrastructure is widely spreaded effectively. Water management is a matter of high priority in India and those responsible for major operations of water distribution need to be educated in this endeavor. Automation provides optimized solution to all problems of distribution of water system. The entire system has features of SCADA (Supervisory Control and Data Acquisition) system to control and monitor the water supply and in case of power failures to maintain continuity of power supply. 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. By, considering above scenario we are trying to find solution for the problem. Hence, we are working with Water Supply Department of Pimpri Chinchwad Municipal Corporation. The main aim of this project is to provide effective water supply to each consumer & to detect the leakage sites and malpractices. In this project we are working on the distributed network under the area of single water tank. Mainly we are focusing on the pressure transmitter which are located at different branches in distribution network to indicate pressure variation at different location. Thus, we are going to develop a system in which we can analyze the pressure from different branches of distribution network and compare it with fixed benchmark. In this way, we are able to control& monitor the whole system.

KEYWORDS:- Automation, leakage, SCADA, Pressure transmitter, Benchmark.

I. INTRODUCTION

Automation plays an increasingly important role in the global economy and in daily experience. It improves the performance and also reduce 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. With the rapid development in technology, the more focus is on selection of application oriented Controllers and tools, hence the concept of proposed system to control application it is combined with PLC. This project explores the SCADA technology and its use for developing automation for monitoring purpose of water distribution for an entire city. Earlier the monitoring of the process was done by human which caused error. To reduce this error, automation is developed using PLC and SCADA.

The present system leads to unnecessary loss of water and due to improper handling, water is not properly distributed to the end users. Also the monitoring of the level, pressure, flow is done locally. Here we are working on the distribution network of single water tank. We are using the analytical instruments which gives all the information about flow, pressure & level of water tank. Also, 8 to 10 pressure loggers will be installed in the distribution network at various location. All operations of ESR will be carried out by PLC which controls inflow and outflow. The automation control reduces manual interference and proper work of opening and closing of control valves are carried out by the electric actuators.

II. LITERATURE SURVEY

Initially we studied about the working of distribution system of existing system. For this project we have taken the reference of this IEEE paper."Automation Of Water Distribution Plant (IJREAT International Journal of Research in Engineering & Advanced Technology, Volume 2, Issue 1, Feb-Mar, 2014)". Also we referred 'SCADA Supervisory

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2015

Control Data Acquistion'. This paper gives idea about SCADA system. We studied the paper 'Automation –The key to water management', In-depth for Instrumentation and process control.

A. Existing Technology:

Traditionally, In PCMC area the water distribution infrastructure is widely spreaded effectively. 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. Hence, their need to develop the system to overcome such problems.

B. Need for PLC:

Programmable Logic Controller is the heart of automated water supply system. PLC helps in controlling pump station motor contactors, stirrer motors, and distributed valves as well as to measure pressure transmitter of the water. PLC programming is done using Ladder Diagram Language. Ladder diagram is specialized schematic language commonly used to document industrial control logic systems.

C. Proposed System:

The conventional method used before in older times, results into problems like empty running, overflow, leakage. The automation of the process thus helped to overcome this problems based on level, pressure, flow parameters and it also minimizes human efforts for the same. If there is any problem in system then using SCADA system we can detect problem easily.

III. FUNCTIONAL DIAGRAM

Fig 1 shows the functional diagram of system. Which gives the whole idea of system. In this system we are controlling outlet valve by observing the inlet flow and level of water in tank. The data logger stores the reading of pressure transmitter, level sensor and flow meter. Here, 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 analyse them with data logger. We can control the flow of water from main pipeline of the one tank.

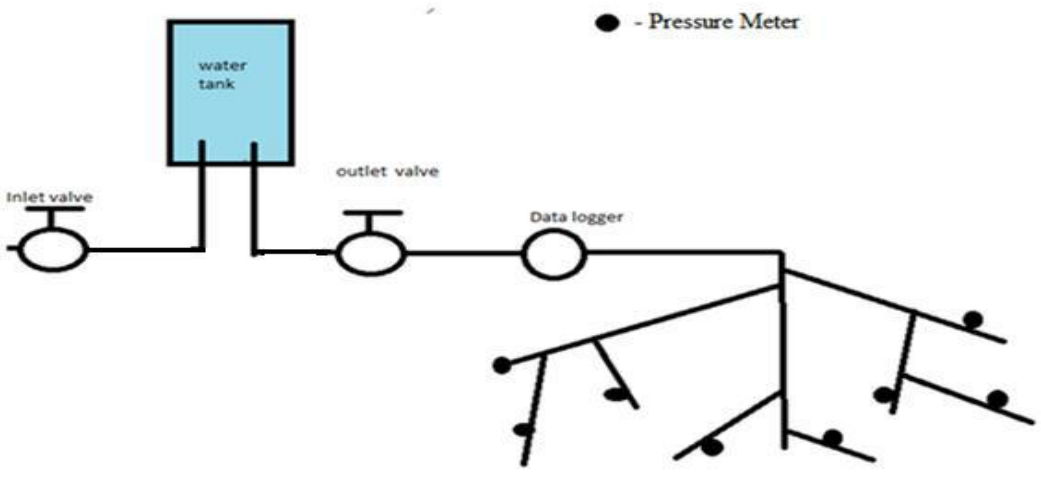


Fig.1 Functional Diagram Of System

IV. BLOCK DIAGRAM

- **Flow Meter:**

Here, we are using the Crone Marshall flow meter. Mainly, flowmeter is used for measuring the inflow and outflow of the water supply from main line. Exactly how much water is going and how much is getting that scenario can be detected.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2015

- **Pressure Transmitter:**

We are using Seimens pressure transmitter. Pressure Transmitter is used for measuring pressure of incoming flow. This works on the principle of pressure difference on both side of transmitter and thus the pressure of incoming flow is measured. And all this information is observed on SCADA system.

- **Level Sensor :**

Level sensor of SBEM is used here. Level sensor is used for measuring the level of water in water tank. Here, we are using ultrasonic level sensor. To know how much level it will get filled, the level sensor is used.

- **PLC :**

we are using Messung type PLC. Here, 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.All the inputs from flow meter, pressure transmitter, and level sensor are given to PLC. The PLC is main controller used for storing these all information and controlling purpose.

- **Control Valve :**

The input to the control valve is given from the PLC. According to the ladder program the valve will works and controls it's flow. As per following conditions outlet valve will get open.

a. The input flow to the tank should be > 4 Lakhs.
b. The level of water in water tank should be > 4.5 meter.
c. Time considerations: Valve open/close at= 5 am to 8 am

- **GPRS:**

General Packet Radio service (GPRS) system is communication medium used to transfer the data to the Water Distribution plant which has SCADA system which will gather all the data and displayed on the screen and on the mobile of operator. We can control whole system through SCADA system by sitting in control room.

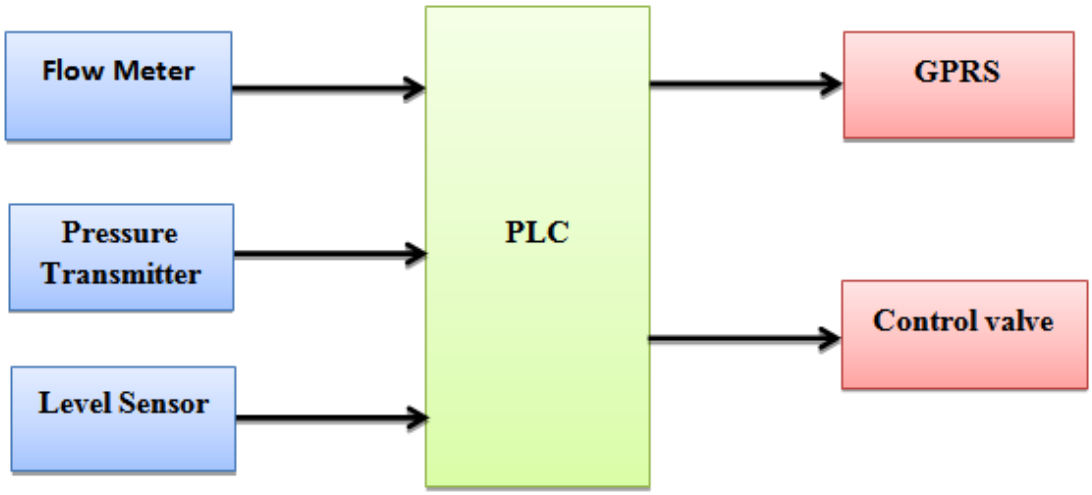


Fig.2 Block Diagram of System

V. IMPLEMENTATION

Flow chart describes the working of system. This also indicate the working of control valve and timing of opening and closing of control valve. In this flowchart, condition of pressure inlet flow and level of water are mentioned . Control valve are operated by observing the condition of pressure flow level and time.

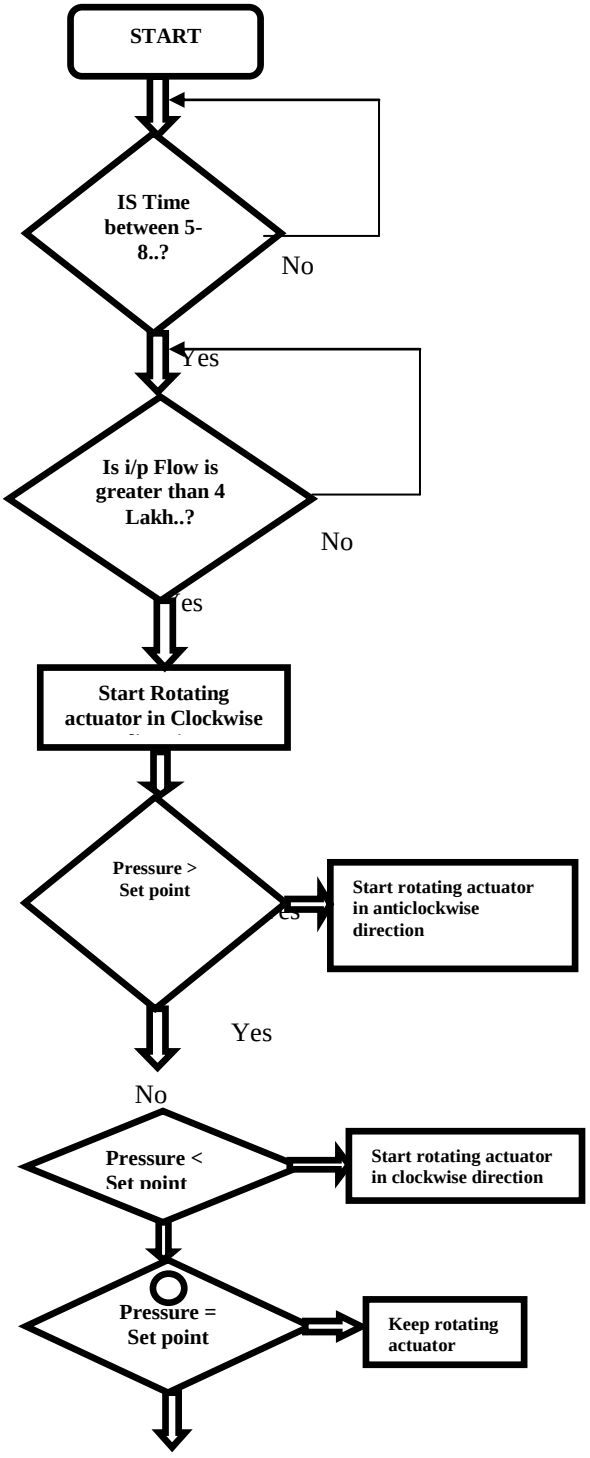
When we start the system it will first check time whether it in between 5-8 am/pm. After it check inlet flow tank level and pressure and by checking condition actuator start rotating. After that pressure of all pressure transmitter placed in distributed network are compared with their set value and from that error is detected. If any error is present then message is send on operators mobile phone using GPRS system.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2015

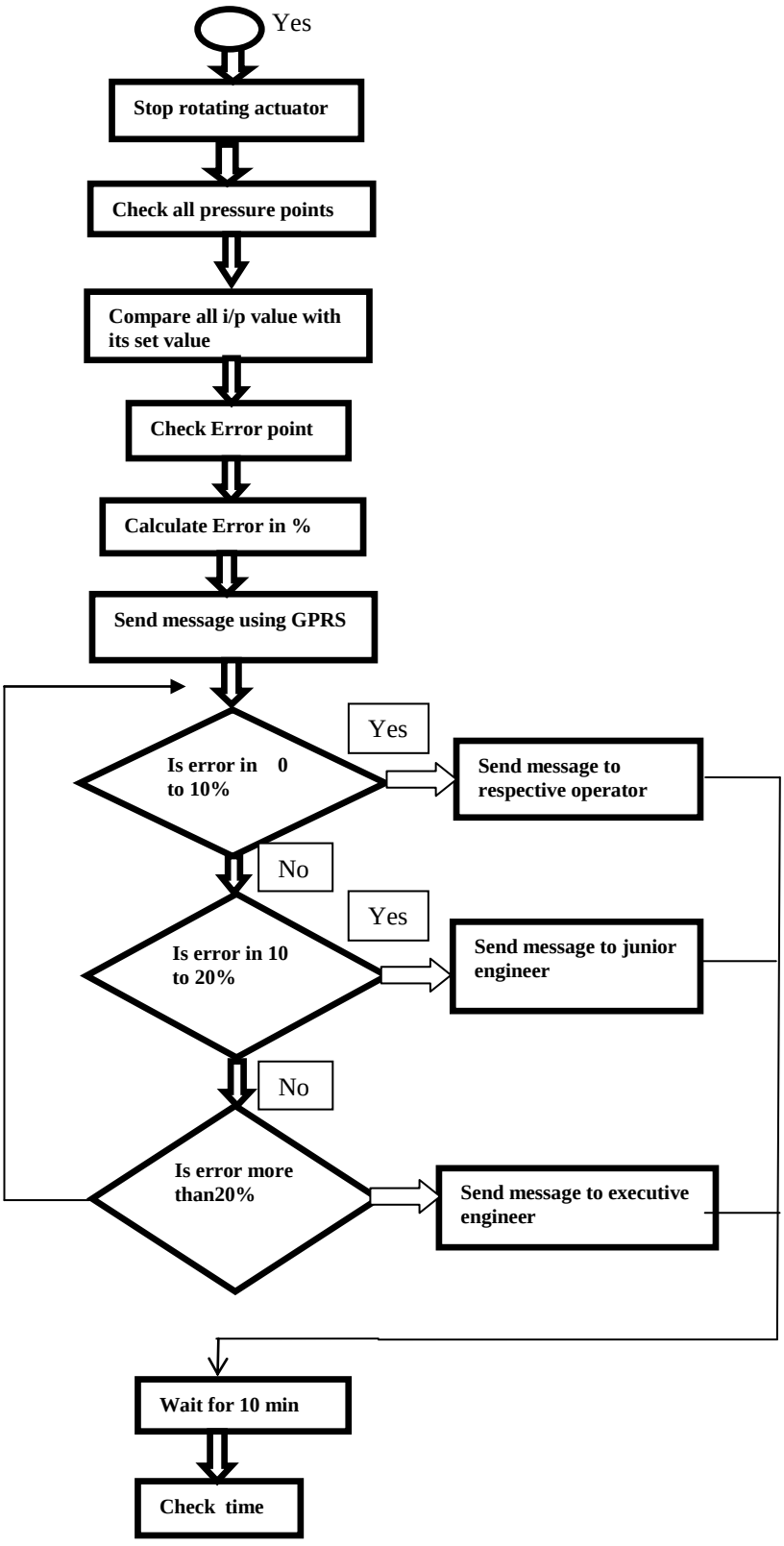


ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2015



ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2015

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

V.RESULTS

Fig.3 shows HMI display i.e human machine interface display is interfaced with PLC panel. It displays all the information of level , pressure , total flow & flow rate which.

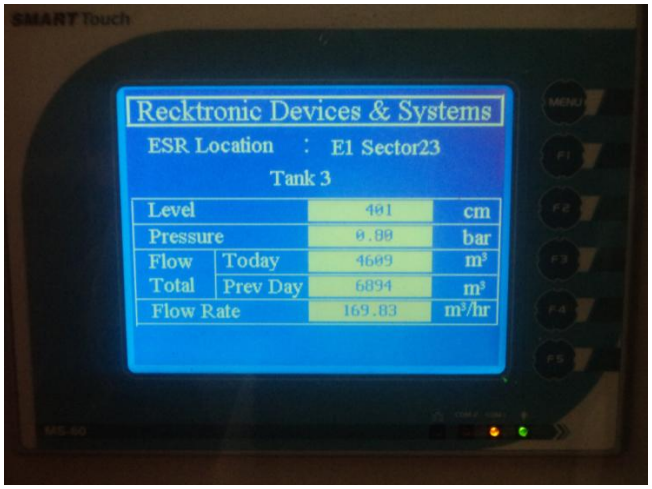


Fig.3 HMI Display

Fig.4 shows the system operation. In which it shows the results of water flow, pressure & level in water tank when actual process takes place. And this will be shown on SCADA screen.

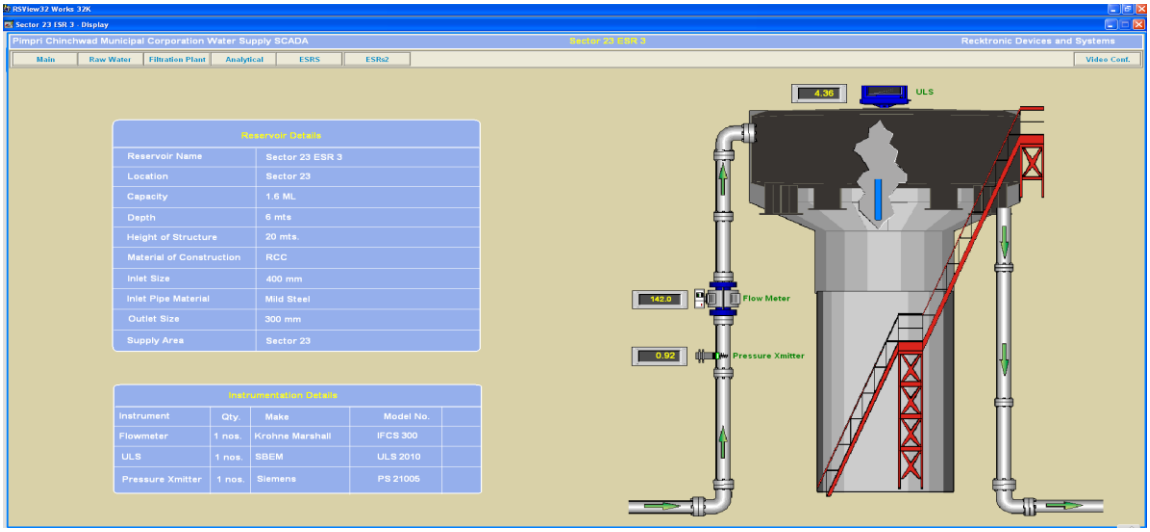


Fig.4 System Operation

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2015

VI.APPLICATIONS

This system itself is one of the application based project which is useful in water distribution network.

VII.FUTURE SCOPE

In future this system can be modified as, it will detect the exact location of pressure drop and this system can also be applied to other remaining ESR's for proper water distribution.

VIII.CONCLUSION

The project discussed here is "PLC controlled Water Distribution System". The conventional method used before in older times, results into problems like empty running, overflow, leakage. The automation of the process thus helped to overcome this problems based on level, pressure, flow parameters and it also minimizes human efforts for the same.
The automation thus implanted at the "PCMC Water Treatment Plant" has proved to be effective. In this project we have successfully studied the following objectives.

1. Thus we have successfully studied the programming by using ladder diagram using online simulators.
2. We have used Nexgine 2000 PLC and programming software is CoDeSys.
3. We have also introduced to central monitoring system using SCADA and HMI for this application.

REFERENCES

1. PCMC Lab manual
2. www.watermonitoring.com
3. CoDesys V2.3
4. RDS (Recktronic Devices & systems)
5. PrimeWorks manual
6. Ramleela Khare, Dr Filipe Rodrigues E Melo "Automation Of Water Distribution Plant (IJREAT International Journal of Research in Engineering & Advanced Technology, Volume 2, Issue 1, Feb-Mar, 2014
7. B.G. Liptak, "Process Control and Optimization" Butterworth-Heinemann Ltd, Volume 2, ISBN 0-8493-1081-4 (v. 2).
8. Stuart A.Boyer, 'SCADA Supervisory Control Data Acquistion',ISA ,4th edition, ISBN 978—1-936007-09-7