

# Water Anti-Theft and Quality Monitoring System by Using AVR and SCADA

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**Abstract-**Water is one of the most important substances on earth. All plants, animals & humans must have water to survive. If there was no water there would be no life on earth. There is rapid growth in wide urban, residential & industrial area; therefore it is a need to provide better Water Supply system. For industrial water distribution system the problem arises due to the leakage of water, fluctuation in water pressure, theft of water directly from main channel and quality of distributed of water. This paper presents a prototype for water distribution system comprising a control system, communication system, piping & sensors for quality monitoring system. This system utilizes a communication bus for controlling and monitoring of water distribution system. Control System is further coupled to Supervisory Control & Data Acquisition (SCADA) unit. This system includes Man Machine & Electrical Interfaces to AVR (Atmel AVR ATmega16) for transmitting/receiving control and status data over communication bus.

**Index Terms-** AVR; SCADA; pH.

## 1. INTRODUCTION

Water supply systems are the crucial part of industrial area. The industries require a ideal water distribution system, water quality monitoring and control of technological parameter. Appropriate flow rate, pressure, and water quality are necessary for effective use. In Industrial areas as per the processes there is excessive need of water. Best policy to save water is to use it properly for this purpose here we develop such type of system. The today's water distribution system is disturbed with the major problems of water leakage and theft cases of water. There is no any system which senses the water leakage or catches the water theft case. In order to catch the water theft or water leakage there must be provision to sense water level of distributed tank and receiver's tank. The level sensors sense the water level of both the tank and compare it with the help of SCADA system.

Fig.1 shows the Water Supply system overview mainly consists of AVR controller, distribution network, SCADA unit, and sensors. In order to make system more efficient the concept of automation is included in system. Storage tank contain instruments of level sensors and pH sensors connected to device being controlled and monitored. They convert physical parameters to electrical signals. These field instruments are connected to AVR controller (Atmega32L). AVR controls field devices and provide data to control room. Control room contains SCADA server which stores data from AVR controller and regulate the control system. Connection between the

AVR controller and SCADA server is established using direct technique.

The paper focuses on the parameter of water quality monitoring and water anti-theft system covered by an ideal water distribution system. The quality of water is checked on the parameter of pH value. Ph stands for "potential of hydrogen". It is used to control and minimize corrosion of water mains, pipes and processing machines. It affects the various processes in which the use of water is compulsory.

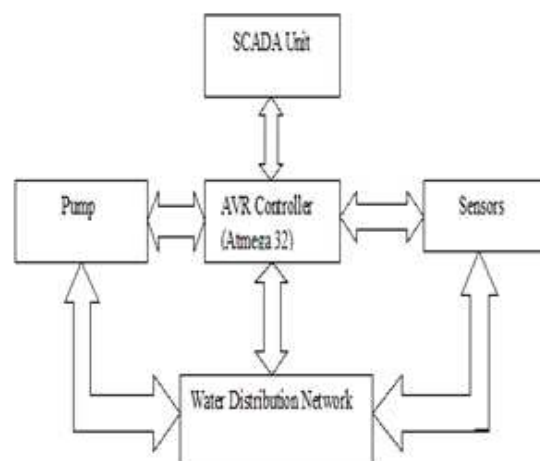


Fig.1 System Overview

Here in this paper one of the quality parameter of water is focused that is Ph value which stands for “potential of Hydrogen. Exposure to extreme pH values results in irritation to the eyes, skin and mucous membrane. The pH of the water entering into the distribution system must be controlled to minimize the corrosion of water mains and pipes in household water systems. Failure to do so can result in the contamination of drinking water and its adverse effect on its taste. SCADA systems are widely used in most industrial processes .It provides information on real time basis, which helps to identify the problem as they occur and take corrective action when needed. Proper monitoring of process can maintain operations at an optimal level by identifying and correcting problems before they turn into significant system failure.

## 2. STRUCTURE OF THE SYSTEM

The fig.2 shows the functional block diagram of the system. The overall system enclosed with ‘water distribution system’, quality monitoring system and water anti-theft system. All these system s are connected to SCADA system. This SCADA system is connected to other SCADA substation system via LAN connection. The system mainly consists of AVR controller, which is central part of the system. AVR controller is interfaced with the motor driver ULN 2803, suction pump, and level sensor and pH sensors. The motor driver ULN 2803 makes control over the water suction pump. Suction pump is used to distribute the water from tank 1to tank 2 via distribution network. Level sensor is used to calculate the level of Distribution and receivers tank. the Ph sensor is used to calculate the pH value of water. Most of the distribution system recommends the pH value between 5 to 9. The RS-232 cable is used for data transmission between RS-232 & SCADA system. The RS-232 (Recommended Standard 232) is a standard for serial binary data signals connecting between a DTE (Data Terminal Equipment) and a DCE (Data Circuit terminating Equipment). In our System Electrical signal characteristics such as voltage levels, signaling rate, timing and slew-rate of signals, voltage withstand level, short-circuit behavior, and maximum load capacitance value are shared with the SCADA system. . Distribution network consist of pipeline for water flow.

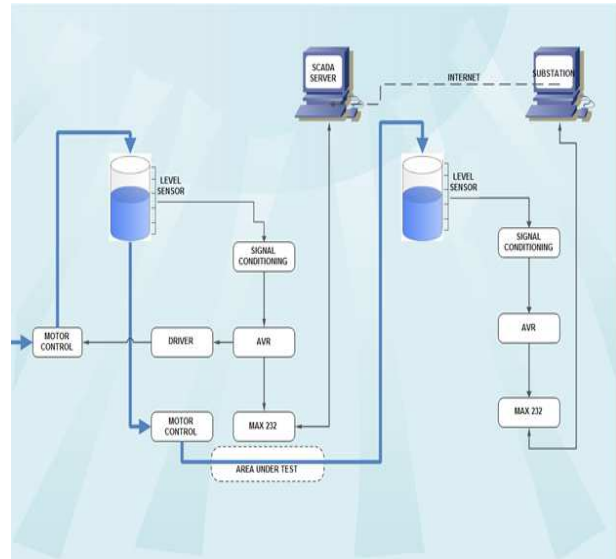


Fig.2 Block diagram of the System

Water distribution network consist of Pipeline structure, with motor. The motor is used to make control over water flow through pipes.

## 3. HARDWARE IMPLEMENTATION

The following sensors have been included in the project system. These sensors are controlled and monitored through software.

### 3.1 PH sensor

The Fig.3 indicates the pH sensor. It is an a electronic device used for measuring the pH of a liquid. It indicates the acidity or alkalinity of the liquid. The pH meter consist of a glass electrode wired via probe. pH meter vary between 0 to 14. Below 7 it indicate the acidic nature of water and above 7 it shows alkalinity nature of the water.

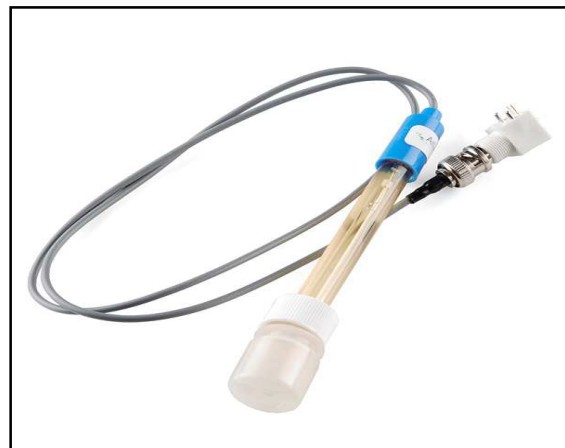


Fig.3 PH Sensor

We cannot interface pH sensor directly to the AVR controller because the output of a pH sensor is very minor as compare to other sensors. As we deep the pH sensor in solution it gives output in mile volt. For pH 7 it gives 0mV output. We can use an amplifier to amplify the voltage level of pH sensor. This amplified voltage is given to on chip A to D converter which converts analog signal in to digital data sequence. This data sequence is used to monitor the pH value of water continuously. by checking the pH value of water we can observe that the supplied water is acidic or not!

### 3.2 Level sensors

The figure 4 indicates a level sensor which is installed in Distributor and receiver's tank. As the level of water increases the connectivity between two lines passes the value towards Atmega 32. The 4 capacitor passes the value 0 or 1. This value helps SCADA system for monitoring of water level tank continues. The SCADA system monitors the tank in the part of 4 levels. Each capacitor covers the 25% level of the tank. As water level of the tank increases these 4 capacitor passes the value of 0000, 0001, 0011, 0111, and 1111. These value indicates the level with sequence of 'Empty, 25%, 50%, 75%, Full' respectively. It is a simple water level sensors which is helpful for minimizing the cost of the project.

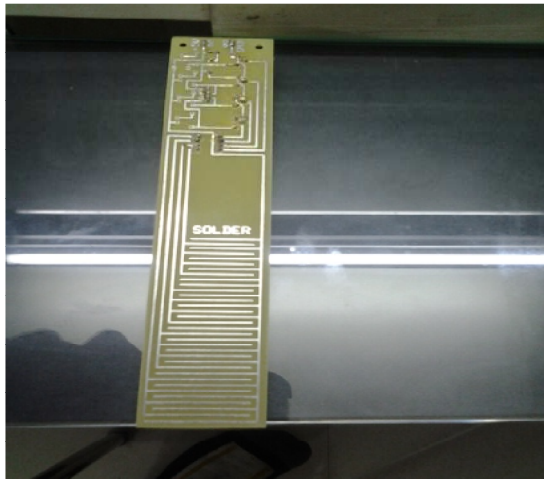


Fig.4 Track side of level sensor.

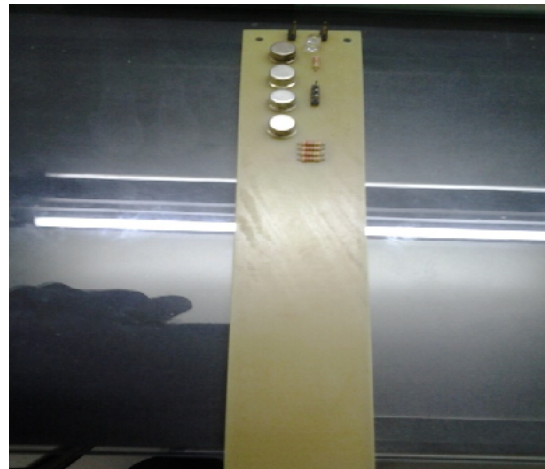


Fig.5 Component side of Level Sensors

### 3.3 SCADA Layer Design and Development

#### 3.3.1 SCADA Unit

SCADA (supervisory control and data acquisition) is computer controlled system which monitors & control all the processes. In SCADA system the concept of HMI (Human-Machine Interface) is used. SCADA system collects all the information from AVR in the form of binary. This collected information is monitored on the SCADA system. The system includes two SCADA systems one is the SCADA server and second is the substation's SCADA unit. These two system are connected to each other by a LAN connection. With the help of LAN connection the substation share the all parameter with main server. At the main server all the values are collected and compare with original value. The difference between the distributed water and receivers water calculate the total amount of leakage/theft water.

### 4.SOFTWARE IMPLEMENTATION

The software system is developed with the help of Netbeans IDE 7.1. It gives chance for improving the capability of SCADA system. We can form the system with the help of simple procedure. The left side of the software system indicates the file format and right side indicates the java code of the application. We have to write the code belongs to java package and JFrame form. We can develop the various window systems as per the requirement. The developed code is written under the various Frames. By utilizing all these Frames here we develop the SCADA system

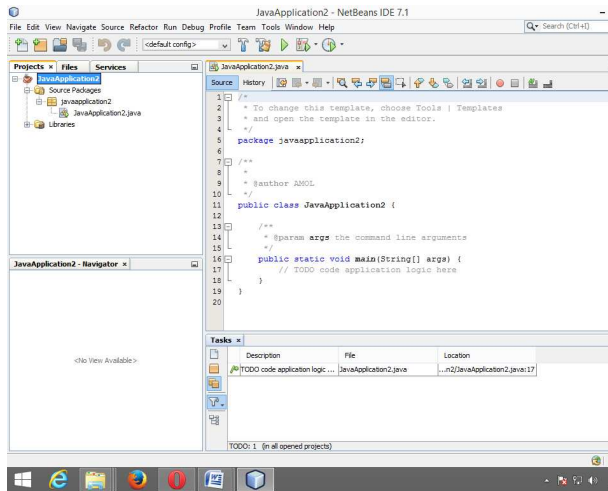


Fig.6 Net Beans IDE 7.1

## 5.RESULTS

The project system “Water anti-theft & monitoring by using AVR and SCADA” setup consists of one water distributor & one water storage unit, piping distribution network, AVR controller (Atmega 32) interfaced with PC (SCADA dispatching) unit. The distribution unit starts if and only if the water contents are within normal range. If the water has acidic contents then water distribution unit closed and distribution of water stop immediately. This system also gives the result to identify excessive flow of water. The sound indicate for the water theft cases.

## 6. CONCLUSIONS

As the system uses AVR controller and SCADA the system becomes more reliable and rugged. It provides better system support to Water Distribution Network. SCADA provides a real-time change into the system from operator’s desk. The pH sensor senses the pH value of water and updates the system continuously. It will helpful against the corrosion of industrial equipment and pipes. This system gives the answer over the conventional water distribution system, water leakage-theft and about its nature.



Fig.7 Starting window of SCADA

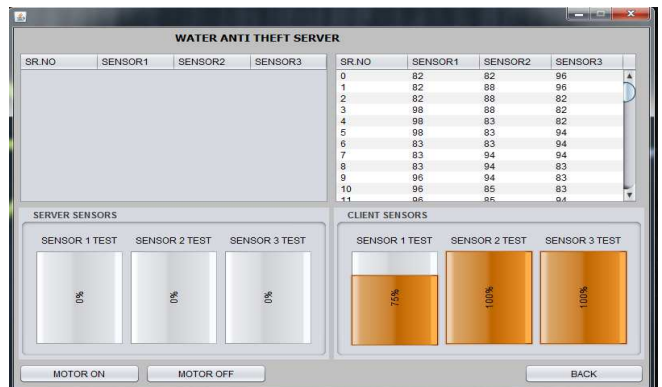


Fig.8 System status shown on SCADA server

## REFERENCES

- [1] Gaikwad Sonali Ashok” water anti-theft and quality monitoring system by using PLC and SCADA” International Journal of Electrical and Electronics Engineering Research (IJEEER) ISSN 2250-155X Vol. 3, Issue 2, Jun 2013, 355-364
- [2] Ayman Alihussein and Mohammed Abedalati”A Supervisory Control AND DATA ACQUISITION (SCADA) FOR WATER PUMPING STATIONS OF GAZA ”The Islamic university Journal ,Vol 19 No.1 pp 303-321,2011 ISSN 1726-6807
- [3] M.Duran-Ros, J.Puig-Bargues, G.Arbat J.Barragan, F.Ramirez de Cartagena”Definition of a SCADA system for a microirrigation network with effluents”Computers and Electronics in Agriculture 64(2008)338-442 Elsevier
- [4] E. Stancel, I. Stoian, I. Kovacs, B. Z. Gyurka, Sz. Balogh SC IPA SA Subsidiary Cluj,” Urban Water Supply Distributed Control System”2008 IEEE