

SMART URBAN WATER SUPPLY SCHEME WITH WATER THEFT DETECTION SYSTEM

Gande Chaitanya¹, MudassiraTabassum.J², Akila.S^{*3}

¹gvr.chaitanya@gmail.com, ²mudassirayuvanja@gmail.com, ^{*3}akila@veltechmultitech.org

^{1,2} U. G Scholar, ³ Assistant Professor

Department of Electrical and Electronics Engineering

Vel Tech MultiTech Dr.Rangarajan Dr.Sakunthala Engineering College, Chennai

ABSTRACT

Background/Objectives: Automated Drinking Water supply has gained importance in Water Management Board recently. Fast growing of ultra-cities is also major reason to work on this area. Automated drinking water supply system is proposed in this paper to facilitate automation in water supply system and theft identification. **Methods/Statistical analysis:** Arduino supported instrumentation and control circuitry results in smart solution for water distribution system. Flow sensors supports in identifying the theft problem. **Findings:** The reliable composition interfaced with Arduino guarantee on-time monitoring of the foremost issues of huge urban water distribution networks. **Applications/Improvements:** Prototype of Proposed system can be extended to implement for wide geographical area, and also can be extended with assistance from Renewable energy systems.

Keywords—Water flow Sensor; Water tank; Pipe; Arduino.

1. INTRODUCTION

Every living things in this world cannot survive without water. Several countries have signed in various water agreement, about focusing on the sustainable development of water protection. Statistical analysis says water scarcity

will be the biggest problem in future years. Population versus available utilizable water is going dejected. The demand for industrialization in recent era results in urbanization that have led to an expectation of sophisticated living which has increased the scarcity for fresh water. Also, the water theft issues rise a lot when compared to previous era. But unlike energy and fuel, water usage optimization is not pronounced. Ambiguity arises from various sides of peoples that increased blocks in water distribution system may bring increased cost in water bills has acted as a major deterrent in the past years.

The ambiguous distribution system results in unrecorded scarcity in water supply. To overcome this paper aims at creating a system for water management board will guarantee measured, recorded and continuous supply of water with 24x7 supply of water, overcoming the major issues of unaccounted supply.

The current distribution system is based on time basis, not on the requirements by residents. When the resident is not available in the particular time, then they won't get the drinking water for the day. Hence instead of time-based water system high reliable, user friendly Quota based system is proposed and prototype is implemented.

1. EXISTING VERSUS PROPOSED SYSTEM

The existing system comprises branches directly taken from main truck or reservoir. There may be a chance of water becomes static instead to circulate due to more dead ends, and also chlorine residual at dead ends. To overcome this proposed system is commissioned with flow sensor, solenoid valve for every house supported by Arduino processor. Water flow time is fixed so we can get supply at right time. Water flow equipment's is confined for each house. Solenoid valve is used to cut the water in case of high or low flow. At that time intimation will be given to the head office.

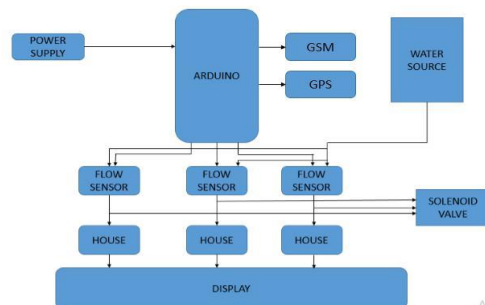


Fig: 2.1 Proposed system

The water is supplied to each house with the required piping connection. Initial flow is set by the water board department. Flow was continuously monitored by the flow sensor. If there will be a flow change means then solenoid valve gets

closed. GPS location and SMS will get immediately sent to the water board department.

2. METHOD OF OPERATION

The per capita requirement of a day is forecasted then the raw water is made to underwent suitable treatment, results in raw water is converted as drinking water. The total system can also be operated with solar system that results in more energy efficient scheme. The Water flow rate is given by $Q=VA$,

where

Q-Flow rate/Total flow of water through the pipe

V-Average velocity of the flow

A-Cross-sectional area of the pipe

So, based on the water flow rate easily the issues related with theft, leakage, segmentation and water logging in particular position can be easily identified. For doing this only flow sensor is not sufficient in addition to that GSM/GPS assisted system is required.

The microcontroller calculates the difference in flow rate of sensors. If the difference exceeds the threshold value, the leakage is recognized and valves behind the flow sensor and water distribution motor are turned off automatically using the GSM modem technology and SMS alert is received by control room officer.

This proposed system can be implemented through different controllers such as micro controller 89S52 and relay, PIC controller, ARM controller and also using PLC and SCADA.

3. COMPONENTS OF PROPOSED SYSTEM

ARDUINO

Hardware and associated user-friendly software with open source electronics platform is the best way to tell about Arduino. Arduino boards are able to read inputs, for example light on a sensor, a finger on a button, and turn it into an output - activating a motor, turning on an LED, or publishing something online. According to doses, the Arduino will react. Programming language is based on wiring. The Arduino code is actually just plain old c without all the header part

QUOTA DECIDING MECHANISM

- a) Estimated Rain falland Present Dam Water level:
Rainfall is predicted from the report given by Metrological department. Based on the water stored in reservoir, the water is distributed to the residents.
- b) Predicted Consumption:
The demand of city is increasing every day due to population increase as well as due to industrialization. The annual requirement for water is forecasted.
- c) Number of residents:
For a resident if maximum usage of water is 100 litres then for two persons it is 200 litres.

Based on the above consideration the quota is decided for every house, with the support from hardware and software implemented in the project. Quota is on the basis of required quantity not on timely basis.

GSM

Global system for Mobile Communication is used in this project to communicate the user segments with water board management. The uplink range of frequency specified is 933-960MHz. It is a station which consists of transceiver, the display, the processor and is controlled by a SIM card operating over a network. It acts as an interface between the mobile station and the network subsystem. Whenever there is fault or any discrepancies arises because of water sucking with usage of motor, the same is indicated to management board through SMS alert.

GPS

Global positioning system is used to map automatic realization of water theft identification location framework that can transmit the data to management authority's board.

SOLENOID VALVE

A solenoid valve is an electromechanically actuated valve to control the flow of liquids. When the pressure of water flow increases above the fixed pressure, the solenoid valve is kept closed.

It is also called as thermal actuator. The electrical signal will heat up the arms of solenoid, which will bend after reaching particular temperature. Also resembling bimetallic strip in a tube light.

The solenoid consists of several turns of the enameled wire wound around the ferromagnetic material like steel or iron. The coil forms the shape of the hollow cylinder. Externally this coil is covered with the steel covering and inside the hollow part there is a plunger or the piston, whose motion inside the hollow space is controlled by the spring.

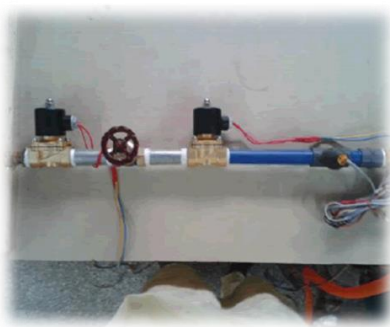


Fig:4.1 Solenoid valve

The solenoid valve that has been selected here is Direct Lift Diaphragm 2/2 way normally open (No) valve, operating with a pressure of 0-120 PSI enabled by 24/12V DC.

Fig.4.1 shows the real time pipeline arrangement, it has two solenoid valves (one input side and another near output side), another near output side), turbine flow sensor. It has been implemented with one node.

Fig:4.2 shows microcontroller section, it has a TRIAC switch, microcontroller section, Arduino section and a GSM modem. If fault is identified, then microcontroller communicate by a pulse with TRIAC to open the solenoid valve near the node. That will also have communicated to Authority board manager using GSM.

FLOW SENSOR

The water flow sensor is used to measure the volume of water flow in the pipelines. The flow sensor is

connected to the Arduino via the Vcc wires of the water flow sensor and the ground of Arduino. SMFM21F1000FGP Ultrasonic flow sensor is used, operating with a voltage of 24V DC, with current of 15mA, Operating temperature 0-80deg C, flow rate range 1-30 L/min, Liquid temperature of less than 120 deg C.



Fig:4.2 Microcontroller Section

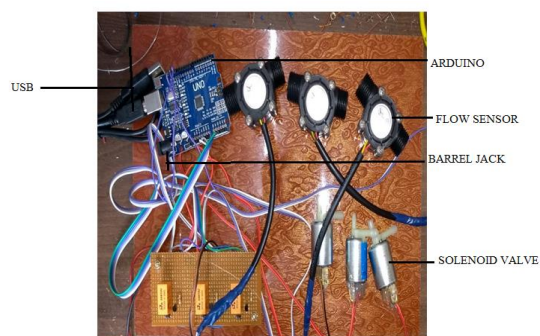


Fig: 4.3 Prototype model of Water theft identification system

Fig.4.3 shows the prototype model implemented for smart water distribution system. Barrel jack will have an

additional contact that allows the application to detect whether a power supply is plugged in to the barrel jack or not, thus allowing the device to bypass batteries and save battery life when running on external power.

4. RESULTS and DISCUSSION

LilyPAD Arduino 328 main board has been used in this project. It is an Arduino programmed microcontroller design. The LilyPAD Arduino consists of an ATmega 328 with the Arduino bootloader and a minimum number of external components. This board will run from 2-5V.

The Arduino uses the external interrupt on Arduino's digital pin2. This is used to read the output pulses coming from water flow sensor. When Arduino detects the pulse, the counter will function and initiates the SMS alert.

It can be observed from the Fig. 5.1 and Fig. 5.2 that water theft, overflow is communicated to the Water board authority as soon as the fault identified.

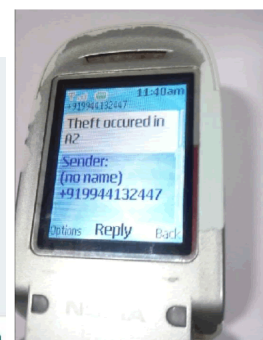
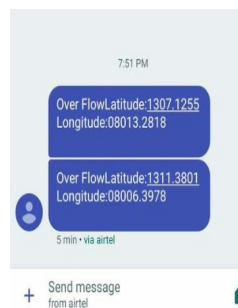


Fig: 5.1 Communication using GSM Fig: 5.2

Fig: 5.2 shows the image received by officer about theft

5. INFERENCE

Extensive growth of population, development in technology, reduced cultivation areas, poor rainfall has led to increased demand of water. With available drinking water, the government has to distribute to all residents with zero water theft. For this, our proposed system is definitely very much helpful. The automated system implemented into the water distribution network insures continuity of distribution, zero theft, flow rate identification, and supports the water board management authority to identify, detect and rectify the fault in a faster manner. The system implemented in cost effective and accurate in the era of water demand.

7. FUTURE SCOPE

In future work the system can be modified using SCADA along with PLC. So that it is possible to inspect and overcome fault in whole system from main control units. SCADA gives

graphical interface which will be beneficial for the unskilled operators to understand and stores data for the future use. Field device can be interfaced with PLC using various wireless communication technologies.

This prototype provides better solution for existing water storage and distribution network so that quality of water can be maintained as advanced automation using PLC and SCADA is used. Uninterrupted operation of water distribution takes place due to advantages of PLC over other controllers and SCADA gives graphical interface which can be beneficial for unskilled operators to understand and also stores data for future use. Web SCADA will be used to extend area of the project and technology of wireless communication will be used to interface field devices to PLC.

8. REFERENCES

1. S.Vishal, G.Prashanth and N. Srinath, Smart Water Supply Using Labview and Arduino, International Journal of Electronics Engineering Research. Volume 9, Number 8, 2017
2. SagarKhole, Tushar Kolape, Mrs.A.P.More, Automated Drinking Water Supply System and Theft Identification Using Embedded Technology, International Journal of Innovative Research in Computer and Communication Engineering Vol. 3, Issue 3, March 2015.
3. J.P.tharanaya, A.Jagadeesan , A.Lavanya "Theft identification and automated water supply control using embedded system" International Journal of Advanced Research in Electrical, Electronics, Instrumentation Engineering
4. Chang Liu, Foundation of MEMS, Tata McGraw Hill publication
5. Stancil, Stoian, Kovacs, "Urban water supply distributed system", Vol.3, pp.316-321, May.2014
6. Gaikwad, Sonali, Ashok, Water Anti-Theft and Quality Monitoring System By Using PLCandSCADA, International Journal of Electrical and Electronics, 2013
7. J. Gouthaman; R. Bharathwajanprabhu; A. SrikanthAutomated urban drinking water supply control and water theft identification system, IEEE Xplore, 2011.

