AUTOMATIC WATER DISTRIBUTION FOR SMART CITIES

[1]Soham Mancharkar, [2]Kartikey More, [3]Nikhil More, [4]Sanket Badwaik, [5]Rahul Patil,
[1]Student, [2]Student, [3]Student, [4]Student, [5]Assistant Professor,
[1] Department of Civil Engineering,
[1]Pimpri-Chinchwad College of Engineering and Research, Ravet, Pune, India

Abstract : In a Smart city, there are many houses. Water is an essential thing. The usage of water in each house is different depends on their user's need. According the season, water usage is varying. Particularly, the water usage is increasing on Sundays like washing clothes, cleaning houses etc., where female partners also going for work. Similarly, in summer season, water necessity is more. In winter and rainy season, water is used in lesser. Based on these reasons, user should be take control over water management. So, the proposed model has been developed for water management, it was controlled by sensor devices. This system should be such that any user would not be without water during repair of any portion of the system. For example, each house needs 300 litres of water approximately. Generally, the Corporation will supply a sufficient amount of water for a smart city, it is regulated by a sensor device. The sensor device is controlled 300 litre waters for one house. The volume of the water tank is 500 litres. After reaching the level of 300 litres of the tank, automatically, it should be directed to a next house. Each 100 litre can be marked in the water tank. There are 100 litre water is there, it if filled in the first line. In each water tank, there was the sensor chip, which used to sense the water level in the tank. If already 100 litre of water is remaining in the tank, then balance 200 litre must be filled in to the tank. This can be controlled by the sensor chip. Such as on weekend days, the amount of litre must be increased for each house as 400 litres. Because, the usage of water is high for those particular days. As like that, if a particular house needs a large amount of water due to their personal occasion, then the particular house must be filled with extra water as they required. But the extra amount of water also supplies by the same pipe; it is maintained by a sensor chip. Similarly, there is no change in the water level in the tank of smart city houses after three days, a total amount of water in the tank is redirected to the corporation. It is slightly complicated, because of this process is reversible.

IndexTerms **- Sensors, Water management, Valve, Distribution.**

I. INTRODUCTION

There are many challenges in the Smart city. One of them is water management. To overcome the water problem, the proposed model has been developed for the water management. Water is most important for our life and man cannot live without water. Already, the water management system exists for finding the leakage of water in the pipelines and also the pH level of water. The monitoring system has been designed with sensors. Readings from the sensor are processed with microcontroller and communicate through computers or wireless networks.

Smart city has been developed for human life for comfort and convenient. In foreign countries used such as Europe, America and Asia, Smart city is a well-established and world class technology has been used. It is based on advanced urban cities with civic amenities. Smart City may vary based on the countries, cultures, life styles, technology, environment and also needs of society. Smart city is an enhanced city with smart designs in method of housing, infrastructure, mobility, technology, security system, transportation etc. A Smart City would have a different meaning in India than in Europe. Even in India, there is no clear way of defining a Smart City.

Smart city era brings different ideas and innovations through information and communication areas. The present scenario, it is used in various fields like networking, energy platforms, decision making system, service architectures, power grids etc to establish the full equipped cities for the future. Not only in these fields, but also used in conversion of traffic system to energy management system, e-governs and emergency management.

In cities, the population is very high and also industry, schools etc, which are affected by the services. Cities have a many infrastructures, services and group of peoples both public and private. They share their ideas. A smart city has complex structure that shares space and buildings with stakeholders and service providers. It is an extension of city to allow the use of resources to improve the quality of human life in urban areas and to overcome the issue of water management in smart cities.

1.1 PROBLEM STATEMENT

- To avoid water theft and to overcome the problem of water scarcity.
- Current water distribution solutions are based on centralized management systems.
- These systems offer limited control and are filled with inefficiencies.
- Water losses, high contamination levels, and difficulty in maintenance are some of the common problems faced by the current system.

1.2 OBJECTIVE

- Uniform distribution of water to every consumer in the cities.
- Creating greater customer awareness of water consumption habits, leading to conservation improvement.
- Consideration of new metering system including improving the cities meter reading.
- Enhancing new services to the customers.

1.3 SCOPE OF PROJECT

- The main scope of our project is to provide safe and clean, reliable water supply to the cities.
- We are considering a new metering system including improving the cities meter reading.

1.4 RESEARCH

The related research was done through research papers published at national and international level. Various data and provisions were studied from "Hydrology and Water Resource Engineering" - S. K. Garg, Khanna Publisher.

1.5 ADVANTAGES OF SYSTEM

- Equal water supply for each consumer according to number of members.
- Least wastage of water.
- Least electric power consumed.
- Accurate readings.

1.6 LIMITATIONS

- Continuous electric supply needed.
- Expert installation needed.

1.7 EXPECTED OUTCOMES

- Large number of water can be saved in the reservoirs.
- Accurate revenue of water supply will be generated.

II. LITERATURE REVIEW

A) Water Anti-Theft and quality monitoring system by using PLC and SCADA

Gaikwad Sonali Ashok (2013) has planned this strategy as a model for water circulation framework involving a control framework, communication means, funnelling, actuators, sensors and valves. This paper concentrates especially to a control framework for controlling and checking segments inside a water dispersion framework. To transmit or receive the control and status information man machine and electrical interfaces are incorporated to PLC (Programmable Logic Controller)

B) Design of a PI controller for a computerized building water distribution system with PLC system

Hassaan Th. H. Thabet (2011) has considered and built up the framework for water supply framework's energy conservation guideline of a pump with flow control as indicated by unsettling influences. The framework can distribute the water with steady weight and spare energy effectiveness. The framework was tried for every whole day for 21 days with limit of (20 - 120) litre/minute of water, and around ten meters building elevation. The weight of the supply system is around 1.2 Bar. The test results of the simulated and actualized framework demonstrate enhanced proficiency and expanded precision in the variable heaps of the water devoured in a multi-story working with a constant pressure controlled operation. The PLC connects and controls the operational parameters to the speed asked for by the framework and screen the framework amid typical and anomalous conditions (over-loading and dry running)

C) PLC based automatic corporation water distribution system using solar energy

P. Mukesh Aravind (2013) has implemented the strategy to depict about the PLC based programmed enterprise water circulation framework, which encourages to disseminate the water naturally as per the requirement of the particular region. In conventional framework there is no legitimate strategy took after for the dissemination of water. To defeat the trouble in the regular framework, the PLC based automated framework utilizing embedded controller is used for disseminating the water to the general population similarly as indicated by their usage. The embedded controller is as of now pre-modified to do the tasks and results are appeared in ladder diagram utilizing Pico software. So as to make the framework more effective and contamination free, solar based energy is utilized as an elective hotspot for control supply activity of the PLC unit.

D) Wireless Sensor Networks for monitoring and controlling of water distribution systems

A. J. Whittle (2013) has built up the technique for in-situ, on-line checking of water dissemination frameworks with a precise target to support effective administration and task. Specifically, it is critical to recognize and restrict pipe failures not long after they happen, and pre-emotively, distinguish 'hotspots', or zones of the circulation arrange that will probably be helpless to basic failures. These capacities are indispensable for diminishing the time taken to recognize and repair failures and thus, alleviating impacts on water supply. This paper depicts the Waterwise venture in Singapore, concentrating on the utilization of Water Wise as a tool for observing, recognizing and foreseeing unusual occasions that might be demonstrative of auxiliary pipe failures, for example, blasts or breaks

E) Automated drinking water system and theft detection using embedded technology

Sagar Khole (2015) has exhibited the technique to implement the proposed water supply framework, every purchaser ought to be furnished with an embedded based water flow observing framework comprising of a microcontroller to record the flow rate

utilizing a flow sensor and to transmit the same to a remote checking station utilizing wireless transmitter and it is likewise furnished with an electrically worked solenoid valve to supply water to the buyers. The valve turns on/off to stop the water supply at whatever point the flow rate surpasses a predefined restrict. The solenoid valves are likewise controlled utilizing continuous clock to control flow of water appropriately for a settled span of time. It is proposed to utilize a GSM modem for wireless communication so the data can be passed to specific capable officer's PDA for quick activity.

F) Controlling and Monitoring of Automation of Water Supply scheme based on IOT with theft detection

Ahmad T. Jaiad (2017) has proposed the strategy to concentrate on persistent and constant supervision of water supply in IOT scheme. Water distribution with constant supervising formulates a legitimate dispersion so quantity of water in tanks, flow rate, variation from the norm in supply line can be made. Internet of things is only the method of substantial items embedded with electronics, sensors, programming, and system network. Monitoring should be possible from any place as central server. Utilizing Ada natural product as free disjoin information constantly pushed on cloud so information can be seen continuously. Utilizing typical sensors with controller and raspberry pi as Minicomputer can supervise information and moreover control task from cloud with skilled customer server communication. This framework is centred on, Internet of things which is new state of affairs to make city as a smart city with various applications. Principle target to implement this scheme is to sketch out and make up a negligible effort dependable and productive system to make appropriate water conveyance by consistent checking and furthermore controlling it from a central server with the goal that water related problems will be taken care. Arduino collects the data from sensors and forward it raspberry pi. The important issues of water distribution process which includes overflow, over utilization and water quality are solved.

III. METHODOLOGY

The proposed name 'Automated Water Distribution System' consists of various enhanced components. It is created and assembled in a package which is advancement of current water distribution system which will play a part in future technologies to come.

Initially, the water distributaries are fitted with the new introduced system. Data such as amount of water to be discharge, time of discharge, etc is embedded into it before use. When the water distribution is started from any corporation it travels through distributary lines and reaches sub-tanks situated in buildings. The system attached to the distributary water line consists of solenoidal valve.

Once the main solenoid valve gets opened, the water flows through the pipe into the sub-tank. The sensor attached to the solenoid valve will measure the amount of water discharged into water tank. The flow rate is measured with the help of pulse output from the flow sensor. Once the given amount of water discharged is achieved into water tank, the solenoid valve will shut off and stop the flow of water. A RTC (Real Time Clock) is also combined in this system which will automatically open the solenoid valve after 24 hours and allow the flow of water. Monthly routine checks can be conducted on this system to check any malfunction occurs. This will also help to solve any circumstance which may occur in coming future.

This automatic process of shutting on and off of water supply can continue on daily basis without any man power or human assistance. This will definitely help us to avoid misuse as well as theft of water on large scale.

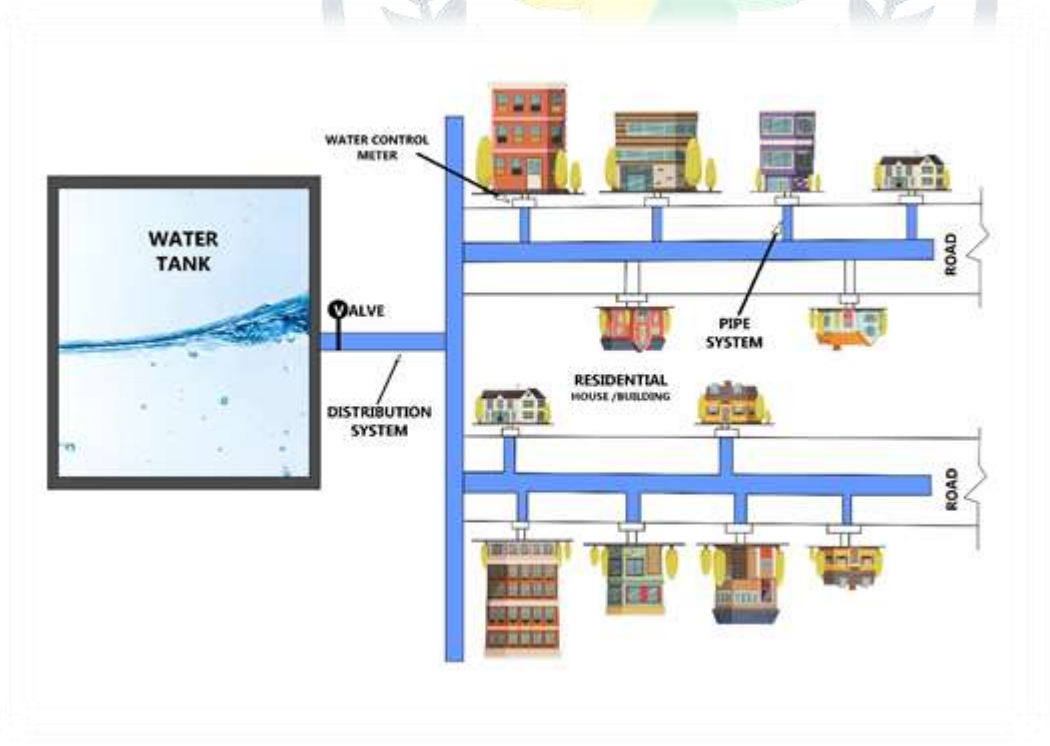


Fig 1.1 Flow Chart of Proposed System

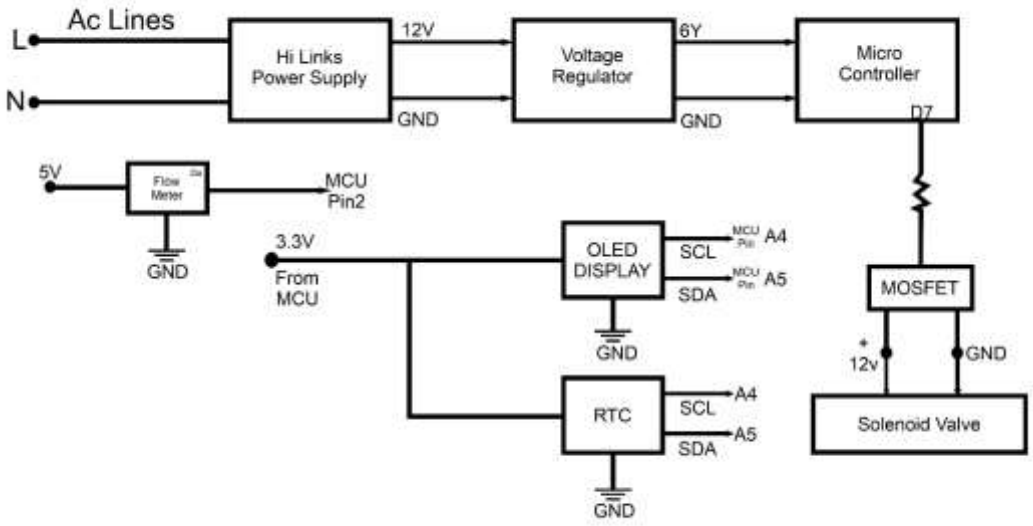


Fig 1.1 Flow Chart Diagram of AWDS Device.

3.1 COMPONENTS AND THEIR PARTS

- Solenoidal Valve
- Flowmeter
- Real Time Clock (RTC)
- Microcontroller
- Hi-Link Power Supply
- MOSFET (IRF540N)
- OLED Display
- Diode
- Capacitor
- Screw terminal
- PCB

Fig. 3 AWDS System

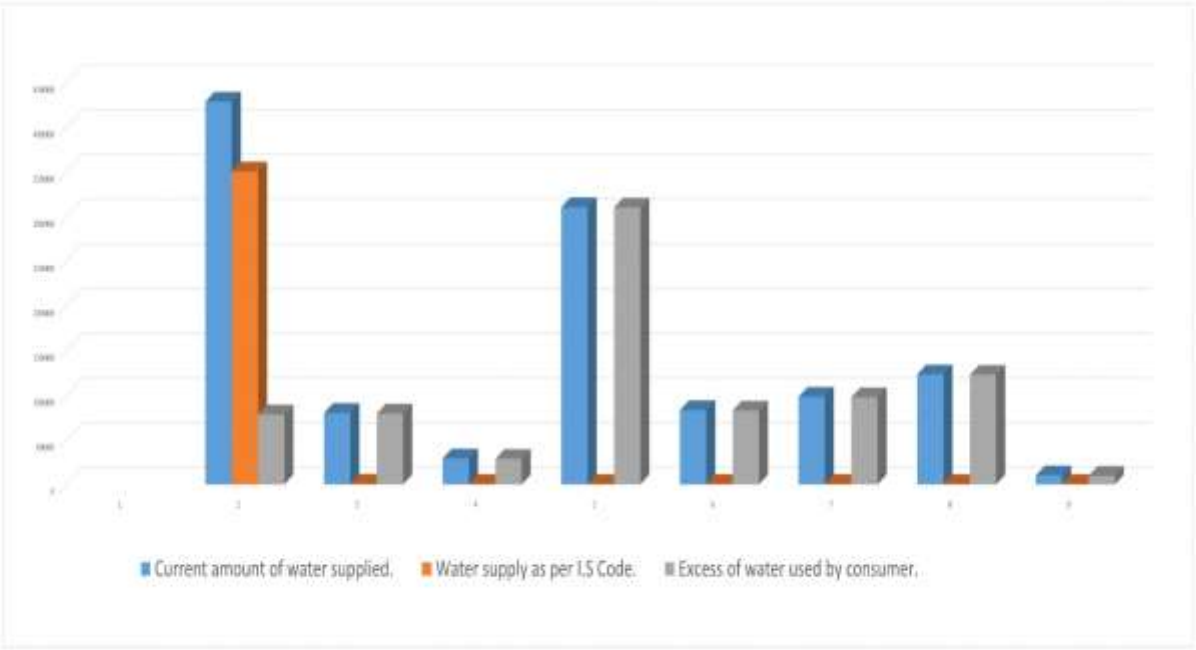
3.2 TABLES AND CHARTS

A.)Following Is The Collective Data of Water Consumption By Consumers of Pimpri Chinchwad Municipal Corporation (PCMC):

Consumers	15Mm	20Mm	30Mm	No. Of Members	Current date of meter reading	Preceding date of meter reading	Duration in days.	Meter reading before month.	Meter reading after month.	Reading difference	Current amount of water supplied.	Water supply as per I.S Code.	Excess of water used by consumer.	Season S/W/R
1	1			3	19-12-2020	01-04-2020	264	369	377	438	438000	349650	88350	S
2			1	5	07-04-2021	09-05-2021	32	488	568	80	80000	670	79330	S
3	1			3	07-04-2021	09-05-2021	32	2884	3084	29	29000	420	28580	S
4	1		1	6	09-10-2020	11-05-2021	94	2500	3500	1000	1120000	420	1099580	W
5	1			3	06-04-2021	07-05-2021	31	9062	9145	83	83000	420	82580	W
6		1		4	09-12-2020	09-05-2021	92	4415	4513	98	98000	580	97420	W
7	1			3	07-04-2021	09-05-2021	32	714	837	123	123000	420	122580	S
8	1			3	06-05-2021	17-05-2021	11	8522	8542	20	20000	420	19580	S
9	1			3	07-04-2021	09-05-2021	32	3864	3906	42	42000	420	41580	S
10	1			3	04-12-2020	03-05-2021	91	1455	1641	186	186000	420	185580	W
11	1			3	06-09-2020	07-04-2021	32	1837	1844	7	7000	420	6580	S
12	1			3	05-02-2021	07-04-2021	63	147	153	5	5000	420	4580	S
13			1	5	08-04-2021	10-05-2021	32	1685	1699	184	184000	670	183330	S
14	1			3	09-03-2021	08-04-2021	33	9797	9869	72	72000	420	71580	S
15	1			3	03-12-2020	04-05-2021	153	3855	3143	92	92000	420	91580	S
16			1	5	04-02-2020	05-02-2020	30	13309	13498	89	89000	670	88330	S
17	1			3	08-04-2021	10-05-2021	32	3600	3610	10	10000	420	9580	S
18	1			3	02-04-2021	08-05-2021	37	305	431	83	83000	420	82580	S
19	1			3	09-04-2021	10-05-2021	31	1025	1063	44	44000	420	43580	S
20	1			3	08-03-2021	09-04-2021	34	93	97	4	4000	420	3580	S
21	1			3	09-12-2020	06-12-2020	27	62	77	15	15000	420	14580	W
22	1			3	03-05-2021	04-04-2021	32	910	930	20	20000	420	19580	S
23		1		4	07-10-2020	03-02-2021	128	8017	8725	708	708000	540	707460	S
24		1		4	07-10-2020	13-05-2021	208	3464	3499	35	35000	540	34460	W
25		1		4	13-01-2021	01-04-2021	78	1850	1890	39	39000	540	38460	S
26	1			3	18-02-2016	19-05-2016	91	2729	2863	91	91000	420	90580	S
27		1		4	11-04-2021	10-04-2021	94	132	146	14	14000	540	13460	S
28	1			3	09-04-2021	10-05-2021	31	118	125	7	7000	420	6580	S
29	1			3	02-04-2020	03-04-2021	365	3888	4155	67	67000	420	66580	S
30		1		4	02-04-2021	08-05-2021	37	771	944	173	173000	540	172460	S
											Approximate Average of Water = 242485 Litre/M			

Table – 1 Calculation on Excel sheet of random 30 Consumers

B.)Following Is The Graphical Representation Of Consumption of Water By Random 4 Consumers of Pimpri Chinchwad Municipal Corporation:



Graph – 1 Graphical Representation of random 30 Consumers

IV. CONCLUSION

The project has given a solution for real time water management and data generation. The data calculated from these systems can be gathered and stored digitally. So as in future, local and higher authorities such as WRD, Jal Sansadhan Mantri can collect this data and plan more efficiently on water resources and generate water resources if in need.

In this project a major module in Water Controlling in AWDS is successfully implemented using which water misuses are detected in different parts of the system by processing the data collected from module to the server and hence analysing the water wastage in different parts of any area.

The final outcome of the project is a novel smart system that monitors the water discharge in distribution system and prevents wastage of water and also records the data regarding flow rate and total water flow. AWDS is the future of the water distribution system which will operate without zero human assistance.

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