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## Research Article

# INSTALLATION OF WATER METERING SYSTEM TO THE EVERY FLAT OF THE BUILDING WITHOUT INCREASING THE DEAD LOAD OF PIPELINE NETWORK

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### ABSTRACT

By using water metering system, wastage of water can be avoided due to the charges with respect to use of water. According to past survey, due to water metering system, 10% to 18% water was saved than unmetered houses. Hence, it is clear that, water metering system is one of the part of the contribution to save the water. Instead of water tax, now a day's water bill is paid according to the usage. But if only one water meter is present for the building having number of flats and all flats are paying equal contribution of the bill, then disputes may occur between them due to the uneven use of water. So, we should provide the water metering system to each flat of the building also. To provide metering system to each flat of the building, study has been done by estimating various methods which will be effective in the any case of pipeline network. So, we have taken the problem as hard as possible to find the solution. By using the Electronics and Programing System, total water consumption is calculated. Due to this solution, we can reduce the dead load of the pipeline networks on the buildings by paying Rs. 2528/- only for one flat. In this study, due to the flow meters, flow has been calculated. By using the program, sum of flow reading has been showed on the LCD screen with help of Microcontroller. Arduino Software has been used for the system, to show the readings of water meters on the computer as an output for monitoring on water supply. Also by using this system, Water Supply Management and leakage control for entire city can be possible. This is one of the better way to solve the disputes of the flat holders in a building efficiently according to the use of water. This will be the good solution for Water Supply Management under the Smart City Project also.

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### INTRODUCTION

A water meter is a device that measures how much water you use. If water meter is used, the amount which we have to pay will depend on how much water we have used. If there is no water meter, we are charging a fixed amount each year ('unmetered' charges). These charges usually relate to the ratable value of that property.

Measuring the use of water is called as Water metering. In many countries, water meters are used to measure the volume of water supply which is used in residency. This water is supplying by a public water supply system. Metering is generally recognized to reduce the water use [6]. Also water meters can be used near the source of water in supply system [5]. Water meters measure the flow of water in cubic metre (m<sup>3</sup>) or litre.

Having a meter will make more aware about how much the water has been used. We may be able to save money on the bill

if we use less water. Water conservation is possible due to charges according to use of water. Water Meter helps to detect the water leakage in the distribution network of water supply[2], [7].It is easy to calculate the quantity of water used due to water meter. More number of water meters can help to detect the location of water leakage [1].

In UK, decrement is found by 10% when meters are installed [4]. In Germany, domestic water consumption for metered flats was 18% lower than that of unmetered flats in 1992.

Now a days, there are water metering system is used for the residential use. Optimal Water meters placement is required to increase the efficiency of water metering system [3]. Due to this system, instead of water Tax, people are providing the water usage bill to the Municipal Corporation. According to the use of water in the house, water meter shows the reading in liter or in m<sup>3</sup>. According to the rate of per liter or per m<sup>3</sup>, people are paying the water bill to their Municipal Corporation.

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But to provide the water meter to each flat of the building is difficult. Disputes may occur in the building about the use of water, due to only one water meter has been provided to each building having number of flats. Due to this, if one family in the flat in that building was not present during the month, then why they should pay the bill contribution for that month?

Also, if in the building, use of water in one flat is more and use of water in another flat is less, then why the another flat member will pay the equal contribution in the water bill? This situation is occurring now a days when family members in one flat are more and the family members in another flat are less. At this situation, there is the high chance of disputes.



Fig 1 Complicated Networks of the Pipes

To avoid that disputes, now a days, in the building, per flat water meter system is provided at very rare places as shown in Fig. No. 1. But this is not going well due to the complicated network of the pipelines and use of more numbers of pipes. Due to the use of more number of pipelines, dead load on the roof increases. Due to these reasons, many apartments pay the equal contribution of water bill. There is the loss of that families which are using the less amount of water.

### Objectives

1. To suggest the suitable method for water metering system to each and every house.
2. To suggest the economical method for water metering system to each flat of the building effectively and without using complicated pipeline network system and avoiding extra usage of pipeline network.
3. To suggest the efficient method for collection of the reading of water usage from the water meters which are provided to multistoried apartment buildings.
4. To suggest the avoidance of the disputes between the peoples due to the contribution of water meter bill of water usage due to the single meter provision for one building having number of flats.
5. To suggest the way to collect the exact bill of water usage of the house.
6. To suggest the idea for calculation of quantity of supplied water to the area.
7. To give the idea for water leakage detection.

### Case Study

In Nanded City, Sinhagad Road, Pune, water meters are provided for each flat. Per flat, there are two meters. One is for cold and other is for hot water.

This water metering system is based on the prepaid recharge. We can use cold as well as hot water in individual flat by doing

prepaid recharge. Nanded City has their own office, which controls the water supply system. Total record keeping of the available and used water is going on in that office. Nanded City have their separate water treatment plant. Water treats in that plant as same as RO purifier. Hence, there is no need to do extra purification. By symphonic action, water is delivered from water treatment plant to the storage tank which is present on every building. Then by gravity action, water is delivered to each flat.

When the cock of the pipeline is kept as on, then meter shows the reading of water is used in  $m^3$ . This reading is noted in electronic digits which is the remaining currency balance which has been prepaid for water.

Every meter which is provided in the Nanded City having electromagnetic sensor system. Due to this system, meter is working on the recharge card which is unique for every flat. Also that card matches with its own meter only. That one unique card is using for both meters that is cold as well as hot water meter. Due to sensor system in that card, recharge is taking in the office. And that card is using to check the prepaid currency of the account.

This meter is working on the energy cells. Three cells are required for the battery of that meters. Due to the energy cells, battery of the meter is working for the electromagnetic system.



Fig 2 Well Planned Metering System

Details about water metering system in Nanded City, Pune.-  
Cost of each water meter = Rs 7000 to Rs 8000.  
Minimum recharge = Rs 50.  
Reserve Balance = Rs 100.  
Rate of water = Rs 20.50 per 1000 liter for monthly use.  
Rs 22.60 from 5000 liter upto 12000 liter for monthly use  
Rs 24.80 from 12000 liter for monthly use.

In Nanded City, Pune, it was preplanned that to provide the water meter system to each flat as shown in Fig. No. 2. So that, metering system has been applied properly in that scheme for per flat two meters i.e. cold meter and hot meter without wasting the pipes and without complicated networks of pipelines on the buildings.

### Background

No one is showing the results to provide the individual water meter system for the each flat of existing building economically and efficiently. All referred research papers are showing the management system improvement of water metering system. But in India, now a days, implementation of water metering system for all household is necessary in the economic and efficient way. After that, these researches are

will be our future scope to improve and maintain water metering system.

In Magarpatta City, Pune, provision of water metering system to individual flat is difficult due to the existing plans of the buildings. During the construction of Magarpatta City, Pune, they had not any thought about the individual water metering. But now a days, they want to apply the water meters for each flat like a Nanded City, Pune. But in Magarpatta City, Pune, due to the existing plan of buildings, provision of individual metering system will be complicated and non-economical.

If we want to provide the individual water meter for each flat in the apartment then number of pipeline required will more. Also the pipeline network becomes complicated as shown in figure No. 3.

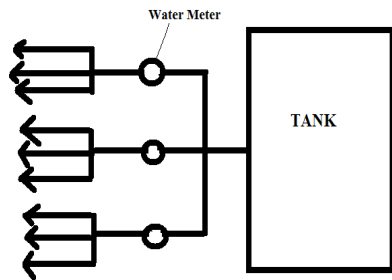


Fig 3 Current System for metering in apartment

**METHODS**

There are many practical problems during the water meter implementation. We are providing only one water meter to each apartment. In the building if there are some number of flats, then usage of all families is different. Then, why should they pay the same contribution in the bill of water? Also, if one family is not living that house for one or two months, then why they should pay the same contribution for the bill of water for that months even they had not used the water. But now a days, they are paying the same contribution. In future, due to this, many disputes can be occurred. Pune City is facing the same problem.

If in the apartment, there is kitchen at one side and toilet at another side, then there will be problem to provide the water metering system for individual flat, due to usage of more number of pipelines and complicated network. To solve this problem, if number of water meters are increased instead of increase in the pipeline network, then dead load on the roof will be reduced. Also it is efficient method for the existing building. And the total reading is shown at the ground floor on the screen, then it will be the efficient to take reading to the person of Municipal Authority.

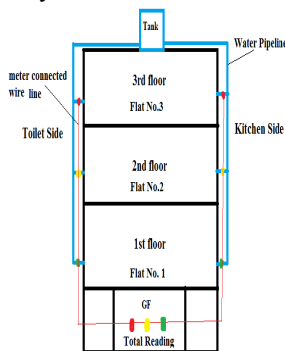


Fig 4 Building Elevation with efficient water metering system

In this elevation of the building Fig. No. 4, kitchen is on one side and toilet is on other side on each floor. To avoid the complicated pipeline network during the water metering system, separate two water meters are provided at both sides for each flat. For Flat No. 1, green colored water meters provided at both sides. For Flat No. 2, yellow colored water meters are provided at both sides. For Flat No. 3, red colored water meters are provided at both sides. Also total of all water meters for each flat (that is total reading of Flat 1, Flat 2 and Flat 3) shown at the ground floor separately by using the wire connection.

To provide this system, design is required like as shown in Fig. No. 5.

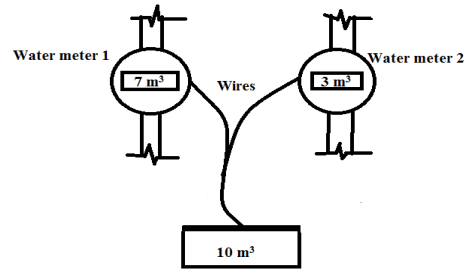


Fig 5 Reading Sample of Proposed Design

This is the proposed design of water metering system which shows the addition of two or more water meters which provided for one flat. To design this system, wire connection is required with the connection of microcontroller. Microcontroller will control the meter working by using the program which is in the java language. The total will be displayed on the LCD screen. In this system, we can use the GSM. Due to the GSM, SMS billing system can be provide to the water user with the interval of one month. The Fig. No. 6 shows the design of system-

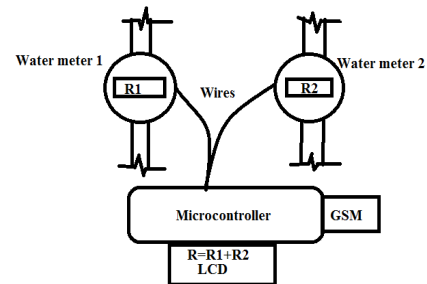


Fig 6 Design of the Metering System

To prepare this working model, we have used Microcontroller. 16 X 2 cm LCD is used to display the readings. We have used Global System for Mobile (GSM) to connect the users' mobile phones to our system. Due to GSM, SMS will send to user to know user's usage of the water. Also bill will send to the user.

On Arduino software, we have prepared the software program. Arduino is an open source computer hardware and software company, project and user community that designs and manufactures single board microcontrollers and microcontroller kits for the building digital devices and interactive objects that can sense and control objects in the physical and digital world. Arduino boards are able to read inputs light on a sensor, a finger on a button, or a Twitter message and turn it into an output activating a motor, turning on an LED, publishing something online. Over the years

Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. This total model will help to show the reading of water discharge due to the use of programming and the hardware as shown in the Fig No. 7. Due to this, we know the exact water quantity which we have used for the flat. The total use of water is shown on the LCD Screen which is present at the Ground Floor of the building.



Fig 7 Entire Water Supply System

This technique will be most suitable for water supply management in residency. Total reading of water usage will be displayed on the screen and due to the GSM, usage reading and bill amount will be send to user's mobile phone. Also entire flow reading will be displayed on the screen of computer. Hence monitoring on the water supply will be easy for management. Also to collect the reading of each flat of the building will be easy for the person of Municipal Authority for the record. Also entire record will be displayed on the screen of computer.

In the Smart City, this system also can be helpful for entire water supply management for the city. Monitoring and controlling on the colonies, residencies, wards, areas etc. can be done in the easy way.

## RESULTS

Estimate of three cases are calculated here. First case is as usual a case which is without the water metering supply system. It requires Rs. 5746.54/- for the pipeline network.

In second case, number of pipelines are increased due to separate water metering system for each flat of the apartment. In this case, cost of the pipeline system is Rs. 21077.355/-. In this building, there are total 8 flats. So, estimated cost for per flat will be Rs. 2635/-

In the third case, number of water meters are increased due to separate water metering system for each flat of the building that is proposed case. In this case, total estimated cost of the network system is Rs. 43677.804/- In this building, there are total 8 flats. So, estimated cost for per flat will be Rs. 5460/-

Table I

Cases	Total Rate Analysis	Rate Analysis for each Flat
Case 1	Rs. 5746.54/-	Rs. 718.32/-
Case 2	Rs. 21077.355/-	Rs. 2635/-
Case 3	Rs. 43677.804/-	Rs. 5460/-

## Future Scope

By using this water metering technique, we can detect the leakage of water from the pipelines. We can do entire water supply management effectively for City. If this system will be applied for one society, then we can control the water flow rate, leakage and unnecessary use of water. We can create an APP for City to monitor and control the water supply system.

## CONCLUSION

The ratio of cost of metering system per flat with more number of pipelines to the cost of proposed method per flat is 1:2.07. Problem of provision of water metering system for the any case of the apartment will be solved by using proposed design. Also water metering system application of per flat in the apartment is possible with less usage of pipelines and without using complicated network of the pipeline.

Disputes about water bill contribution will be minimized due to separate water metering system for per house even in the apartment.

By using the program, sum of flow reading has been showed on the LCD screen with help of Microcontroller. Arduino Software has been used for the system, to show the readings of water meters on the computer as an output for monitoring on water supply. Also by using this system, Water Supply Management and leakage control for entire city can be possible.

Also, SMS of the bill of exact water usage will be possible to send to the water users in the interval of every month like postpaid bill system.

Collection of the metering data of the water usage will be easy for the person of Municipal Authority due to the provision of meter at the ground floor of the apartment only like electric meters.

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