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Automatic Water Billing System based on Android Application

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Abstract - *Wastage of water in process of manually operated water pump, human error associated with manually operated system, improper bill creation, delay in bill availability and delay in payments process are problems that lead to the development of an "**Android based Automatic Water Billing (AWB)**" system. In AWB system a low cost water flow meter is proposed, which measures flow rate of water passed through the supply pipe of particular user and bills are created according the usage of water by that particular user. This provides control on usage of water without applying more charges to the user. The deadline is given to the user to pay bill otherwise the water supply will be stopped by supplier. Bills and notifications regarding due payment are forwarded to the user on **Water Bill Management Application (WBM-App)** which is designed in Andiron Studio. Graphical representation of the water usage with respect to time is provided to the user with the help of cloud platform called Thing Speak. The main aim of the system is to avoid wastage of water and minimize human interference to avoid mismanagement in payment process.*

Key Words: Android, Billing, Flow control, Level Measurement.

1. INTRODUCTION

The modern digital era is focusing on smart city applications based on Internet of Things (IoT), Wi-Fi, etc [1]-[4]. This work focuses on modern automation techniques based on Android system for water billing system.

Sustainability of available water resource in many region of the world is now a serious issue. This problem is silently related to inadequate use of water and integrated water mismanagement. Water is widely used for agriculture, industry, and domestic consumption. The water monitoring is important constraint for the different applications of human being. The unnecessary wastage of water can be controlled by applying small charges which is bearable by poor people. At present only one bill is produced for the whole building which is divided evenly among the users in the building. So people who use large amount of water are equated to those who use less quantity of water and they unnecessary pay extra money for water usage. Current manual water billing systems are costly and having other disadvantages like missing of water bill. Also user has to wait till the end of the month to know water usage and the water bill. Automatic water billing system came into existence because of human error and inconsistence that is associated with manually operated system. There is also problem in the process of turn ON-OFF the water pump. This is because it takes time for individual who is manually operating the water pump to turn off the water pump and this may cause water wastage and at times the individual might not know that the water level has drop so low until the tank is completely empty. Human error associated with manually operated system, improper bill creation, Bill availability and payments process which are time consuming activities, Wastage of water in process of manually operated Water pump, these are the problems that lead to the development of an **"Android based Automatic Water Billing (AWB)"**System.

This proposed work also applicable for automatic water level control, automatic pump control and valve control to turn ON/OFF the water flow. In this Paper, a low cost water flow meter is proposed, which measures flow rate of water passed through the water supply pipe of particular user and bills are created according the flow rate of that particular user. This provides control on usage of water per user without affecting or increasing cost of other user. The deadline is given to the user to pay bill within limit, else the water flow is stopped by admin until bill is paid. Bill notifications are provided on the designed **WBM-App.** User can check the bill on **WBM-App** and can pay from **WBM-App** itself. For payment option one can use different applications available like PAYTM, PHONE_PE or PayPal plug. The PayPal, ATM, Debit card payment facilities are provided for online payment.

"Electronic Water Billing System" has been implemented to take the water readings and send it wireless communication to the base station of Water Management Company. The readings are automatically stored into the database and automatically uploaded on the website. The user can pay online after getting notification through Short Message Service (SMS) from base station [5].

"GSM based Water Meter" has been used to measure the consumption of water in real time. The amount paid for month or particular time period to use water can be preciously used in the remaining days of month or particular time period to avoid extra bill. The records for used water is compared with storage and loss is detectedto avoid loss in water distribution system [6]. Flow meter has been used to measure the quantity of water consumed by user in terms of flow rates. The consumed water have been displayed and the bill forwarded through the Global System for Mobile (GSM) communication module to website in "Smart Water Leakage Detection and Metering Device" [7].

"Automatic water flow meter" which is designed to provide low cost water meter to measure water flow rate passed through the pipe used for water supply in house. This involves supplying water according to the customer's requirement of water [8].

The purpose of "IOT Based Automated Water Billing System" is to present the water billing system for urban home. Android based water billing system (AWBS) measures the water flow rate through the house hold pipe and sends an SMS at the end of every month. In addition to that, detail information of the water usage is shown in graph by using cloud platform called as "Thing speak" and the mobile app is also use to pay the water bill [9].

"Smart City Billing System for Homes through IOT" is used for the smart city billing system for the homes through the IOT platform. This system consists of two modules one is prepaid water billing system and second is prepaid electricity billing system. Because of that system we can check our water and electricity consumption and according to that we can pay the bill online [10].

Flow sensor based water meter is very low costly and reliable. Paddle wheel flow sensor is used to measure the water flow accurately with the help of rotating paddles. Monthly water bill readings send to the municipal corporation office and calculate the monthly bill by using these readings and create the correct bill using "Implementation of GSM Based Water Meter A Step towards Automation in Billing System" [11].

In Nanded City which is one of the huge living and corporate township in Pune, India, this management is using prepared water billing system. Readings of the flow meter are forwarded through wireless communication media to the monitoring unit and bills are created according to consumption of water per user [12].

In this way by studying all above papers to improve the water billing management system **"Android based Automatic Water Billing (AWB) System"** is designed.

In day to day life every user needs proper management of its all resources which are in use. Electricity is one of the important resource daily required for the user. In societies proper management is used for electricity, like automation in turn ON-OFF light, automation in bill creation and bill creation according to usage. This leads to the proper use of electricity because of every user has to pay for individual usage and the money is the most important resource required to fulfill all requirement. If user has to pay for something then there gets automatic control over usage.

Water is one of the important resources required in daily life of human being. But there is no such a proper management for the water as like electricity. For water total usage in one building is calculated and one common bill is created among all. Therefore there is no control over individual to avoid wastage of water. This gives improper management for most valuable resource. By analyzing the condition to avoid over water usage there should be control over the every user. Therefore every user will get serious about the usage of water to avoid extra payment. This gives full control and proper management of the water usage. Therefore this idea comes in mind that this system should be implemented in every society to avoid extra water usage and to save water. The water monitoring is important constraint for the different applications of human being. The existing systems are manually operated, hence to provide automation in billing and management of water "**Android based Automatic Water Billing (AWB) System**" system is implemented. The readings are forwarded to the **WBM-App**. This leads to correct bill creation of the system reducing human error. In this system, user will pay the amount in accordance with the usage of water. There is also automation in turn ON-OFF the water pump to avoid wastage of water. This has done by using level management using level sensor. The objectives of this paper are given below:

- To implement fully automatic water billing system.
- To measure the water flow according to the consumption of water per user.
- To provide accurate bill and bill payment facility through the Android based Application.
- To detect level of main tank for automatic turning ON-OFF of water pump.

2. METHDOLOGY

The AWB System consists of two modules as shown in Fig. 1 and listed below:

- Main Tank Module
- Users Module

An **AWB system** consists of flow sensor, solenoid valve, ultrasonic sensor and node-microcontroller. Flow sensor is used to measure the flow of water, ultrasonic sensor is used as level sensor to measure the level of the water in tank, solenoid valve is used to control the water flow from supply pipe and node-microcontroller is the main part of **AWB system** which calculates all the readings and directly transfer to the **"Water Billing Management Application" (WBM-App)** based on android application through Wi-Fi to pay bill.

In **AWB system**, normally all valves are in OFF state which are turned ON by using **WBM-App**. Water will start flowing through main tank after turning ON valve. Each supply pipe consists of a valve to control the supply of water to every user and flow sensor is used to measure the water flowing through it towards user. The valve connected to user supply pipe is controlled based on payment status by administrative person.

The main tank module consists of level sensor, flow sensor, valve, main water tank and the reserve tank. Normally the main tank valve is open first we close it by using android app and flow starts from main tank towards the users supply pipe. In main tank there is one level sensor which is used to check the level of the tank. According to the level measured two set points are decided by using these set

points we can detect the level of the tank to turn ON or OFF the water pump.

The water level is indicated by Light Emitting Diode (LED) and ON-OFF process of water pump is automatically controlled by **AWB system**. If water tank is empty then automatically AWB system will start filling water in tank and turn off process is also automatically controlled. In this way the water level in main water tank is controlled by using ultrasonic sensor.

User's module consists of flow sensor, solenoid valve, node microcontroller and the tank for the user. Each user has a

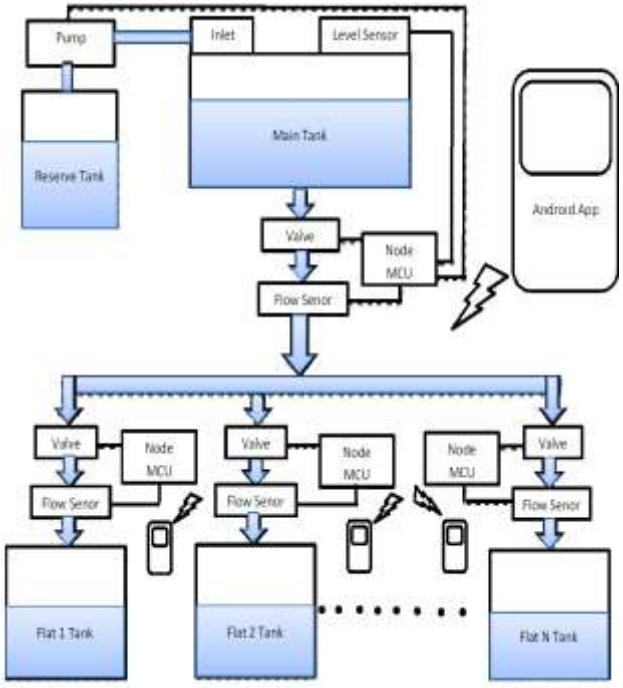

Fig. 1. Block Diagram of Android based Automatic Water Billing System

One module mounted at the supply pipe. Module consists of flow sensor to measure usage of water by the user. Valve is used to control the water flow according to bill payment. Node-microcontroller is used to calculate water flow hence the total usage of water by individual user. The readings are sent directly to the **WBM-App** kept at administrative office and user mobile phone. The amount of bill is created accordingly the reading and it can be checked by login into **WBM-App** which is based on Android as mentioned earlier.

An **AWB system** consists of flow sensor, solenoid valve, ultrasonic sensor and node-microcontroller. Flow sensor is used to measure the flow of water, ultrasonic sensor is used as level sensor to measure the level of the water in tank, solenoid valve is used to control the water flow from supply pipe and node-microcontroller is the main part of **AWB system** which calculates all the readings and directly transfer to the **"Water Billing Management Application" (WBM-App)** based on android application through Wi-Fi to pay bill.

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User's module consists of flow sensor, solenoid valve, node microcontroller and the tank for the user. Each user has a one module mounted at the supply pipe. Module consists of flow sensor to measure usage of water by the user. Valve is used to control the water flow according to bill payment. Node-microcontroller is used to calculate water flow hence the total usage of water by individual user. The readings are sent directly to the **WBM-App** kept at administrative office and user mobile phone. The amount of bill is created accordingly the reading and it can be checked by login into **WBM-App** which is based on Android as mentioned earlier.

User can pay bill through the **WBM-App** without wasting human energy and time. For testing purpose 2 minutes deadline is given to user for paying bill. If the bill is paid within the deadline, then the user will get benefit of it otherwise the valve of user pipeline will turn off to restrict use of water. Graphical representation of the water usage in liter per second is also provided to user on the **WBM-App.** In this way the **AWB system** is proposed to provide fully automated water billing system actual system is shown in Fig. 2.

3. Algorithm

Algorithm of **AWB System** is as explained as below.

1. Start
2. Start the Android app "Water Management Billing".
3. Go to setting and check the IP address of the broker.

4. Login to the admin.
5. First turn on the main valve and check the level of the main tank.
6. If the level is low then turn ON the motor to fill the main tank otherwise turn OFF the motor if level is high.
7. Check the status of bill of individual users and turn ON/OFF the respective valves.
8. When the valve is close then water flows from flow sensor and flow readings forwarded to the android app.
9. Bill is created in the android app.

Fig.2. Android based automatic water billing (AWB) system Module

10. Login to the respective flat and check the amount of bill to pay and before deadline

11. If the bill is paid within dead line then water flow towards user is continue otherwise it will be stopped.

4. Results and Discussions

The **Water Bill Management Application (WBM-App)** gives the results of the AWB system as shown in Fig. 3 to Fig. 10. Start **WBM-App** and click on the button to start the project as shown in Fig. 4, then go to the setting and enter the Message Queuing telemetry transport (MQTT) broker Uniform Resource Locator (URL) in the top of login page as shown in Fig. 5. After entering the URL click ok, then clear Random Access Memory (RAM) of **WBM-App** and again start **WBM-App** and login with Admin using username and password same as 'Admin' as shown in Fig. 6. After login to admin then next page is opened having icons of main tank and users as shown in Fig. 7 by clicking on the respective icon pages are opened with their information such as water usage, status of the bill as shown in Fig. 7 to Fig. 10. Admin has given authority to control the valves of water supply pipe according to the bill status. The status of the bill payment success or not is at the admin login page as shown in fig.(h) and fig.(i). By clicking on the ON/OFF button of respective icons main tank or users the valves are controlled.

In admin and users page by clicking on graph button graphs of respective users' water flow is opened as shown in Fig. 10.

Fig. 3. Main page

Fig. 4. Start page

Fig. 5. Settings

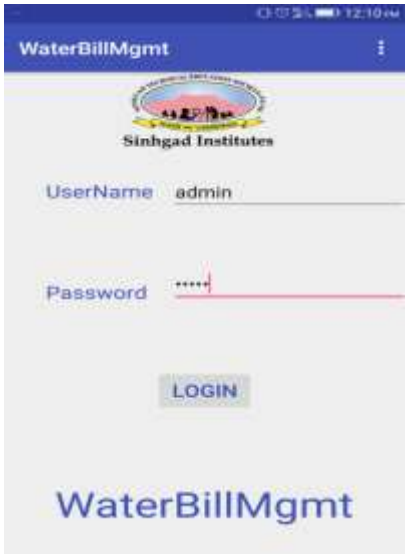

Fig. 6. Login Page

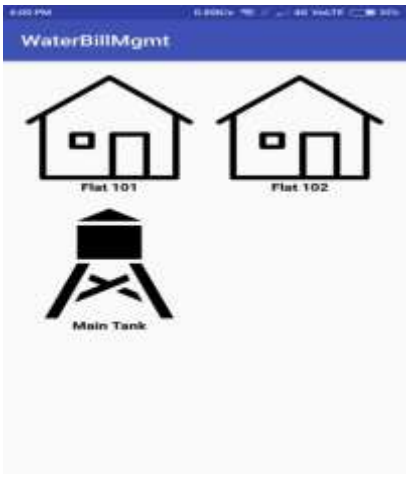

Fig. 7. Icons for user and admin

Fig. 8. Water usage and water flow

Fig. 8. Graphical presentation

Fig. 9. Status of the bill (User 1)

Fig. 10. Status of the bill (User 2)

Results of the user's login page are obtained. User's login pages in **WBM-App** are Flat101 and Flat102 respectively. Users can check their bill by using the login identification (ID) and password. Different user ID and password are given by the supplier to different users. User ID and password for user1 and user 2 are 'Flat101' and 'Fat102' respectively. By

login into the user1 and user2 page in **WBM-App** deadline of the bill, water usage of the user, bill amount and graph of the water usage information is available; also the payment option is given. Bill of the user is generated by clicking on generate bill button and payment process of the bill is done by using pay bill button in the **WBM-App.** Payment of bill is through by using Pay Pal, debit card or credit card. Graphical representation of the water usage of user1 and user2 is also shown on WBM-App.

5. Conclusion

Proposed system will provide accurate and real time water billing system. This overcomes existing systems in terms of cost and manpower required. This is suitable practical solution for water bill management. Billing is through **"Water Bill Management Application (WBM-App)"** that is connected with the server thus the consumers will get the real time reading in their **WBM-App** and also graphical representation of the water usage. Water level of main tank water is monitored to avoid wastage of water. This system is user friendly for water supply management. This gives fully control and proper management of the water usage. Therefore this system can be implemented in every society to avoid extra water usage and to save water. Possibilitiesfor future work include implementing a more advanced**"Android based Automatic Water Billing (AWB)System"** having leakage detection by comparing total flow is equal to the outgoing flow to the users. This will improve the accuracy in the bill of water usage as well as the wastage of water. These systems also advanced by automatically controlling the all actions like bill generation, valve control without help of user.

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