Auotomated Aqua Invoicing System

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***Abstract*— Water scarcity and related stress issues pose a serious threat to the global population in the present scenario. Hence it is essential to manage the sustainable water resources effectively. This requires efficient, accurate and reliable monitoring techniques that enable the utilities sectors and consumers to know the level of water consumption in real time. The traditional way of manual meter reading is furthermore inconvenient and time consuming. Real time automated aqua invoicing system can constitute a key component of the water management system. The proposed water monitoring system will make users mindful of their water consumption and help them to reduce the water usage. At the same time users will be alerted to abnormal water usage to reduce wastage of water.**

Keywords*— *Aqua invoicing, GSM, Microcontroller, Python

I. INTRODUCTION

As we know, water supply is one of the basic needs that each and every citizen of the country requires and is essential for the survival of human beings. The Automated aqua invoicing system will help the private institutions, domestic users and local government to manage the water supply system in a better way. It will also help to get the billing or invoicing with reduced human intervention and hence better accuracy. In many developed countries, water meters are used to measure the volume of water used by residential and commercial buildings those are supplied by a public water supply system. Some scholars have proposed automatic water billing system based on Android application, LoRa Communication etc.to mitigate water billing information system integration and to overcome the challenges at municipalities[1-5]. The purpose of the works were to develop a framework with upcoming technology for prepaid billing of water along with sufficient monitoring of the water meter readings automatically from a remote place without any human intervention.

Water meters can be used at the water source, well or throughout a water system to determine the flow through a particular portion of the system. One of the difficult tasks of most water boards these days is billing at the end of the month and particularly sending the bill to all their consumers. Major problems that the water boards are finding difficult to address are due to the manual processes followed and they include calculation errors, delays in system updating and bill sending and report tracking issues. It is obvious that without technology there is no modernization, and modernization in turn brings about improvement in the quality of our lives. The invention of sensors, microprocessors and other related devices has certainly improved the quality of life. With the introduction of computers, many software were developed and has made those things, which seemed impossible, a reality.

This proposed work provides a solution called automated aqua invoicing system to collect, process and notify the consumers about the day today usage of water. This system will be reliable, efficient and accurate to suit the requirements of the water board. The proposed solution uses mobile technologies and database applications to handle the organization's day to day transactions which will facilitate the water board to send bills to their consumers via SMS. Apart from the reduced burden on billing, other new features have also been introduced such as consumer interaction with the water authority is improved, consumers can easily view their monthly water bill status regularly etc. Smart aqua invoicing system is specially designed to store and manage the records of all the billing activities, records of consumers and cashiers. It will facilitate invoicing, tackling the present-day problems.

II. LITERATURE REVIEW

NAKI, Duane Boucher and **Ogochukwu Nzewi** proposed a system named "Framework to mitigate water billing information Systems integration challenges at municipalities" developed a framework which municipalities can use to mitigate the challenges associated with integrating their water billing information systems [1].

Yuezhong Li and **Lingyuan Zeng Hauling Wu** proposed "Research on water metre reading system based on LoRa communication" which presents a wireless meter reading system by using both multilevel relay and the concentrator based on loRa communication [2].

Tanvir Rahman and **Md Ashraful Alam** presented "Automated household water supply monitoring and billing system" which automatically switches of the DC water motor based on the level of water present in reservoir along with the display of the amount of water used in each block. They have also included a set capacity of usage for each floor and billing according to usage [3].

Dhumale N D Thombare and **P M Bangare** developed a system named, "Automated Water Billing System Based on Android Application". In this system a low cost water flow meter is proposed which measures the flow rate of water passed through the supply pipe of particular user and bills are created according amount of water by that particular user [4].

Nusrat Sharmin Islam and **Md Wasir Rahman** proposed an integrated prepaid water meter system which is a technology for prepaid billing of water along with sufficient monitoring of the water meter readings automatically from the remote place without any human intervention [5].

Research Gap

The literature reviewed indicated that the formal method of billing is having more manual intervention which includes a designated person going to each and every individual house

collecting the readings and distributing the bills. This is hectic process and it uses a lot of human resource as this process introduces human prone errors. This method is not reliable and efficient. So they developed a system which was based on IOT. It had sensors to read the values and to transmit them over the internet with the help of microcontroller. This system had a disadvantage that it needs to be connected to the internet 24/7. The cost of connecting system to the internet is way higher than hiring a human resource. So to overcome this disadvantage in the proposed system and also to make it more cost effective, this uses a water flow sensor which works on Hall Effect to estimate the quantity of water that have been consumed with the help of a Raspberry Pie processor and using GSM for the communication purpose.

III. METHODOLOGY

The methodology used for implementation of the proposed system consists of three subsystems such as Meter system, Server system and the User system and the details of each systems are:

• Meter system: in which the water flow sensor is mounted to measure the flow of liquid inside the system at the incoming point and the readings are acquired. This is updated at the data base system and to user through SMS generated by the GSM Module.

• The Server system: main center receives the SMS at the end of the day from GSM module and the same data is updated into database this is used at the end of the month for the bill generation processes.

• The user: receives the message at the end of the day as per the consumption of water and bill at the end of the month. The block schematic diagram of the proposed model is shown in Figure 1.

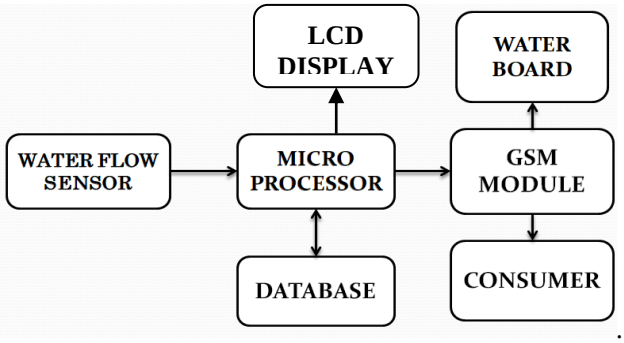

Fig. 1. Block diagram for the proposed model

A. *The design of the proposed model*

Whenever the underground reservoir is filled up with water with the help of water pump, the water is being supplied to the roof tank. From the roof tank water flows through the water flow sensor, when water flows through the valve it rotates the rotor and this changes the speed of the motor. The Hall Effect sensor converts this in to an electrical pulse signal. For a moderate average water flow rate, dividing the total pulse count by 7.5 will give total amount of water consumed in liters. Thus the rate of flow of water can be measured. Using this value the water bill is generated according to the usage of water. At the end of the day the information about consumption of water and water bill is send to the water board through GSM. When the water board receives an SMS, notification is displayed on LCD display at the consumer end as 'notifying board', 'message sent'. Update the same to the user and data base. When consumer receives SMS, notification is displayed on LCD display like 'notifying user', 'message sent'. The flow chart in figure2.shows the various steps in the operation of the system. The hardware components of the developed systems are Raspberry iPI iB+, GSM module, water flow sensor and an LCD module. The interfacing is done as in the block diagram and the devices were powered accordingly. The figure 2 depicts the steps involved in the program to implement the proposed system.

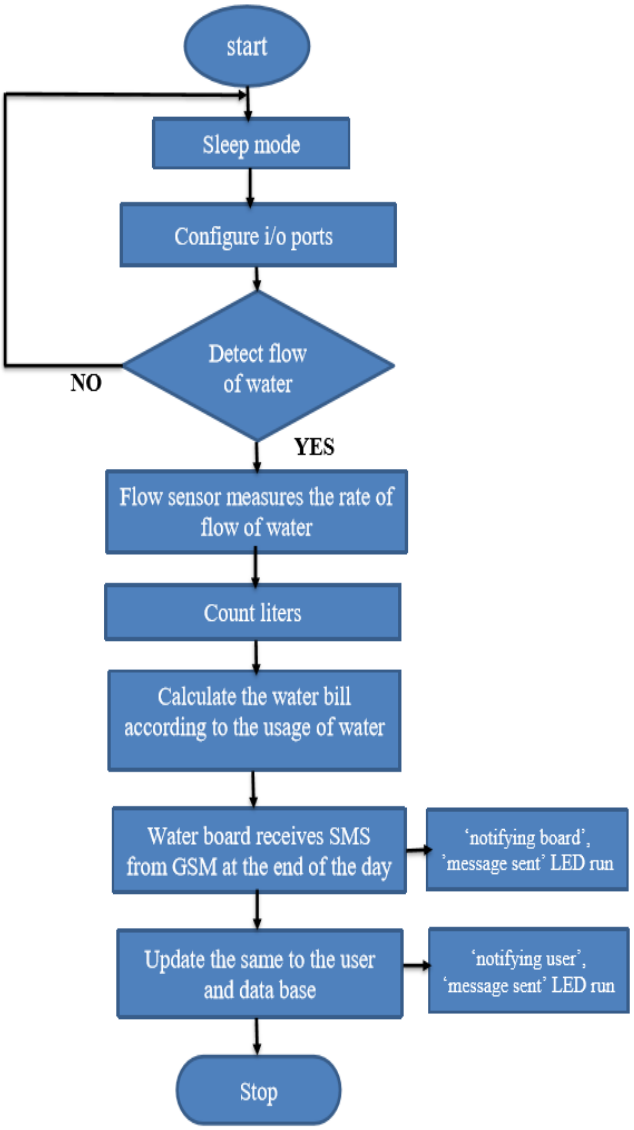

Fig. 2. Flowchart of the proposed system

IV. HARDWARE IMPLEMENTATION

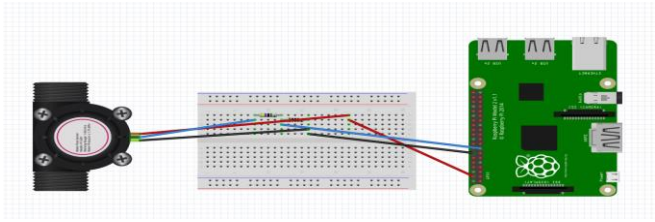

Fig 3.Interfacing of water flow sensor with microcontroller

The hardware implementation of the prototype which includes the interfacing of water flow sensor, GSM module and LCD display with the microcontroller is depicted in figure 3, 4 and 5 respectively.

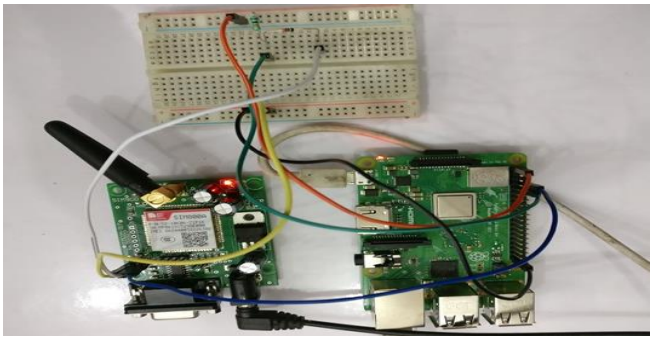

Fig 4.GSM module interfacing

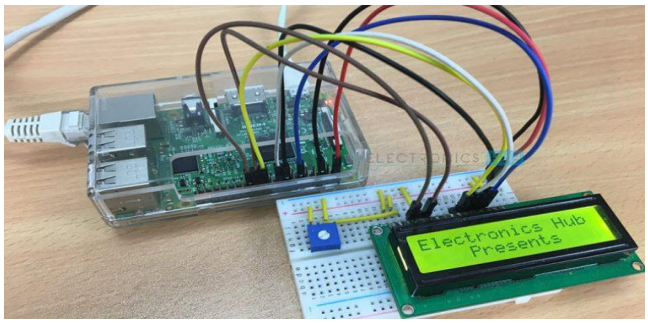

Fig 5.LCD interfacing

V. RESULTS

The results achieved are discussed as follows. With the customer ID of the consumer the total consumption of water and total amount is sent to the respective consumer from water board via GSM using SMS. The LCD display indicates the status of water meter. For the household water supply monitoring, it displays the welcome message and the parameters monitored that is total consumption of water in liters and total amount in rupees and finally notification message to verify whether the board/user receives SMS or not. The various status on the LCD display are shown in figure 3.

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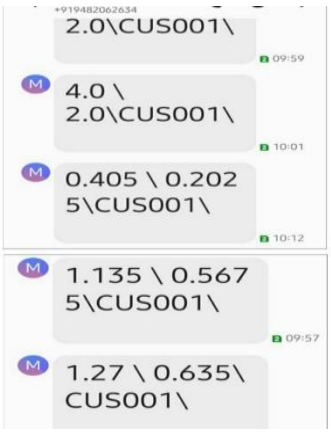
Fig. 6. LCD display Indications

The SMS received by the consumer at various intervals are shown in figure 7(a) and SMS received by the water board is shown in figure 7(b). The user can verify the bill by the help of this automated technology. This system can solve the issue of inequitable usage of water and billing. The detailed consumption information helps the consumers to know the quantity of water they have used. Less consumption also means less wastage of water resulting in multi-pronged savings.

Fig. 7(a). SMS Received by the Consumer.



. Fig. 7(b). SMS Received by the water board.

This system contributes multiple benefits such as:

• Fair billing: A large chunk of the population in cities resides in high-rise buildings that charge a flat fee per month for water consumption. It is not only unfair but leads to discomfort amongst the conscious residents as they feel unrewarded for their effort in reducing water wastage. So that this system enables housing societies to measure and charge individuals on their actual water consumption.

• All round cost reduction: A housing society with smart aqua invoicing system not only brings in fair billing but it also reduces up to 35% cost in overall water spent. With benefits like reduction in water consumption, reduced energy bill due to reduced need to pump water to overhead tanks and less sewage charge. This system provides an effective way to manage water in housing societies.

VI. CONCLUSION

Water is a precious resource. The system implemented will provide accurate and real time water billing in-turn helping conservation of water resource. This will provides accurate data of usage of water and reduces the cost of the whole system and will limit and reduce the usage of water. Billing is through SMS, so that consumer will get their bills displayed on their mobile phones.By using the proposed systems communities can significantly reduce consumption and ease the strain on our nation's water supplies. It is the most economical implementation to help mankind in this era of water crisis with upcoming technology. This is a suitable practical solution for water bill management. The system is user friendly too hence can be implemented in every society to save water. Due to minimum human intervention the risk of method being prone to human error is nullified. A huge amount of human resource wastage is mitigated.The structure has node processing capacity which removes the need of data to be processed at the server/water board which is a huge positive point for the structure.

VII. FUTURE SCOPE

The proposed system can be enhanced by incorporating the following :

- The system can be further modified to incoporate security aspects regarding tampering of the water meter.
- The water leakage checks can be included by incoporating sensors at the line connecting each and every house to detect the leakageof water.
- Provisions can be provided to the customers to send an alert message to the authority in case of any faults or damage occur to the meter or the pipe can be reported to the utility providers by sending an alert message which will stop the water connection to that particular house till the repair is done.
- Possibilities for future work include implementing a more advanced "smart aqua invoicing system" having level detector to monitor the water level in main water in order to avoid wastage of water.

REFERENCES

[1] Avuyile NAKI , Duane BOUCHER Ogochukwu NZEWI, "A Framework to Mitigate Water Billing Information Systems Integration Challenges at Municipalities", IEEE 2018.

[2] Tanvir Rahman Tanzia Ahmed Ibteaz Hasan Md. Ashraful Alam, "Automated Household Water Supply Monitoring & Billing System", IEEE 2015.

[3] Yuezhong Li, Xiaoqiang Yan, Lingyuan Zeng, Hualing Wu, "Research on Water Meter Reading System Based on LoRa Communication", IEEE 2017.

[4] R. B. Dhumale N. D. Thombare, P. M. Bangare , "Automatic Water Billing System based on Android Application", IRJET 2015.

[5] [5] Nusrat Sharmin Islam and Md. Wasi-ur-Rahman, "An Intelligent SMS-based Remote Water Metering System", IEEE 2010.