Water Metering and Water Quality Checking Using IoT

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Abstract

Water Efficiency is considered as a major aspect for every country in the world, many studies such as integrated Water management were developed to enhance the way Water resources are managed. Consequently, astute Water systems were developed to reach equity for Water utilization, economic benefits for both the consumer and the utility, amend system management and achieve maximum Water efficiency. Prepaid Water meter is a contrivance that measures the magnitude of Water consumed by householders who have the contrivance fitted within their premises. Water conservation is an astronomically immense issue in many dormitories. A prevalent meter is fitted and cumulative consumption amount is shared among households where they are being charged more than what is to be paid. There are several conceptions to surmount this issue. In this paper we have proposed a solution to this issue in which a contrivance is utilized to calculate the flow rate and quantity of Water consumed by the householders and send it to the cloud to monitor the consumption of Water in this paper, we present an IoT design for Water monitoring and control approach which fortifies internetpredicated data accumulation on authentic time bases.

Keywords— Water efficiency, Integrated water management, Smart water systems, Prepaid water meter, Water conservation, Flow rate, Quantity of water, Water monitoring, water Quality
Monitoring, Water Pollution, Water Conservation, Water Quality Monitoring using Smart Devices, Real-time monitoring.

I. INTRODUCTION

Water scarcity and mismanagement have become major ecumenical issues, affecting millions of people ecumenical. The world's population is growing, and with it, the ordinant dictation for freshwater resources, while the supply remains inhibited. Climate change and other factors further exacerbate the quandary, leading to droughts, Water contamination, and other Water-cognate issues. In this context, it is becoming increasingly paramount to

develop innovative solutions to manage and conserve Water resources.

Current Water meters utilized by Water utilities to quantify and monitor Water consumption are typically mechanical or electronic, with inhibited capabilities for data analysis or communication. These meters require manual reading and billing, which can be time-consuming and costly for utilities. Moreover, consumers often receive monthly bills that do not provide detailed information on their Water utilization, making it arduous for them to track and manage their consumption efficaciously.

Prepaid Water meters have emerged as a potential solution to these quandaries. These meters sanction consumers to prepay for their Water utilization and monitor their consumption in authentic-time, providing them with more preponderant control over their Water bills and utilization. Prepaid Water meters additionally avail utilities abbreviate operational costs associated with manual meter reading and billing, while ameliorating the precision of billing and truncating Water losses due to leaks or larceny.

The aim of our project is to develop a prepaid Water meter utilizing IoT technology, with the goal of providing a more efficient and utilizer-convivial Water management system. Our prepaid Water meter will be designed to monitor Water utilization in authentic-time, provide consumers with detailed information on their consumption, and enable timely payments. By incorporating IoT technology, we aim to provide utilities with the competency to remotely monitor and manage the Water supply, detect leaks or other abnormalities, and amend the overall efficiency of the Water management system. In summary, our project aims to address the challenges associated with current Water management systems and provide a more sustainable and efficient solution.

1.1. LITERATURE SURVEY

1) Gurung Ram proposed a paper that demonstrated how perspicacious metering and provide better handling the ordinant dictation involutions of contemporary Water supply methodology developed by astute meter. It fixated on optimal orchestrating of Water infrastructure network.

2) G Hauber-Davidson proposed a paper that discussed role of astute Water meter and working of perspicacious meter and shown the Water consumption in genuine time. He proposed a conception to took the action when increasingly sumptuous Water.

3) Sarah Darby proposed a conception of affordance and utilizing this theory of affordances, qualitative research is examined to understand how householders had utilized consumption feedback, with and without keenly intellective meters. Advanced Metering Infrastructure (AMI) relied in the transition to lower-impact energy systems. AMI offered possibilities for household energy management and customer–utility cognations.

4) Tracy C. Britton shared his conception about Water utilities to ameliorate Water distribution System and minimized the amount Water lost in the network. It estimated the customer post meter leakage for up to 10% of total Water consumption and concluded that truncated the Water loss by finding post meter leakage.

5) E. Idris proposed a paper about Keenly intellective Water Metering (IM) which offered the potential to transform the urban Water management. This paper was to provide an overview of prospect and pitfalls predicated on review of IM deployment.

6) Cara D. Beal proposed a paper that had shown that householders' perceptions of their Water use were often not well matched with their genuine Water use. This paper examined the contributions of end users to total Water use for each group that self-identified as "low", "medium" or "high" Water users. The consumers received level of information predicated on their Water bill.

7) Current Water tank systems are not able to monitor the caliber of Water in a tank. Author introduced a IoT (Internet of Things) predicated automatic On/Off system to control the caliber of tank and utilization of Water. System is turning ON when the Water level is lies between low caliber and high caliber. Motor is turning off when it is in between low caliber and above the high caliber. Utilizer are able to access the data on website.

8) To supply safe of the imbibing and utilizable Water for different purposes like agricultural, commercial, industrial etc. so the Water should be monitored quality and quantity level. Author developed a low-cost system that amassed data from the all sensors are utilized for analysis purport and for better solution of Water quandaries.

1.2. SIMILAR SYSTEMS REVIEW

1) Nairobi City Water and Sewerage Company Prepaid Water Meters: The prepaid Water meter project in Nairobi, Kenya, was launched in 2014 as a component of the company's efforts to ameliorate Water management and revenue amassment. The project involved the installation of keenly intellective prepaid Water meters that enable customers to prepay for their Water utilization. The meters are equipped with a tamper-proof design and a battery backup to ascertain uninterrupted accommodation. The prepaid Water meter system has been prosperous in minimizing Water wastage and ameliorating revenue accumulation for the Water company. According to the company's website, the project has led to a 20% increase in revenue amassment and a 40% truncation in non-revenue Water.

Figure.1: Prepaid Water Meter

2) Prepaid Water Metering System in South Africa: The prepaid Water metering system in South Africa was launched in replication to the country's Water crisis, which has been exacerbated by drought and a growing population. The system enables customers to prepay for their Water utilization and monitor their consumption in authentic-time.

The meters are equipped with tamper-proof features, including an alarm that sounds when the meter is tampered with. The system has been prosperous in minimizing Water wastage and ameliorating revenue accumulation for Water utilities in the country.

3) Prepaid Water Metering System in Ghana: The prepaid Water metering system in Ghana was launched as a component of the regime's efforts to amend Water management and revenue amassment in urban areas. The system enables customers to prepay for their Water utilization and monitor their consumption in authentictime.The meters are equipped with tamper-proof features, including a valve that shuts off the Water supply when the meter detects tampering. The system has been prosperous in truncating Water wastage and ameliorating revenue amassment for Water utilities in the country.

4) Thames Water Prepaid Water Meters: Thames Water, a

Water company in the UK, launched a prepaid Water meter system in 2012 as a component of its efforts to abbreviate Water wastage and amend revenue amassment. The system enables customers to prepay for their Water utilization and monitor their consumption in authentic-time. The meters are equipped with a tamper-proof design and a battery backup to ascertain uninterrupted accommodation. The system has been prosperous in minimizing Water wastage and amending revenue accumulation for the Water company.

5) Prepaid Water Meters in India: In India, prepaid Water meter systems have been implemented in some states to ameliorate Water management and revenue accumulation. The systems enable customers to prepay for their Water utilization and monitor their consumption in authentic-time. The meters are equipped with tamper-proof features, including an alarm that sounds when the meter is tampered with. The systems have been prosperous in truncating Water wastage and ameliorating revenue amassment for Water utilities in the country.

1.3.PROPOSED SYSTEM

Project is divided in three modules, Hardware Module consists of hardware components like Flow Sensor,

Solenoid Valve, Turbidity Sensor and Arduino for controlling the flow of Water. Web Server Module consists of server components like web server, database, and web app to fetch and store the reading of meter. Website/Application: It consists of application part like website or mobile application to monitor utilization of Water. A solenoid valve is utilized as a Water controlling valve, it is a simple electromagnetic contrivance that converts electrical energy directly into linear mechanical kineticism. A solenoid valve is the coalescence of a mechanical valve and rudimentary solenoid. So a solenoid valve has two components namely-Electrical solenoid and a mechanical valve. Solenoid converts electrical energy to mechanical energy which operates a mechanical valve that is to open, close or to adjust in a position. The system will be a cyberspace-predicated approach to quantifying Water quality and utilization of Water to provide comprehensive and precise information about Water resources on an authentictime substratum.

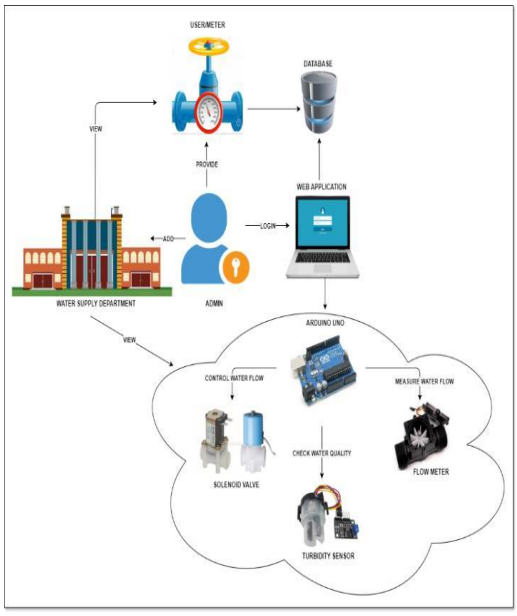

Figure.2: System Architecture

The proposed system is fully automated. Here human work and time are saved. We use this approach so that everyone gets the equal amount of water. It is also used to avoid the wastage of water during the distribution period. Municipal Corporation Water Distribution System will be automated system and become easy and efficient to monitor the consumption of water centrally. Also, people will get the information about their water consumption. Prepaid Water Meter will monitor the flow and consumption of water by each family.

The system will get planted on the water supply pipes of every house. It will monitor and control the flow of water. We get real time data of consumption and can control the valve to restrict flow of water. User can see their usage anytime through dashboard or web application. Proposed methodology is to develop a meter which calculate amount of consumption of water which is wirelessly directed to server which store records. The web portal or mobile application access information from server and display it to customer. Customer can interact with web-based portal or with mobile application to monitor the usage and for payment of bills or to stop or start the service.

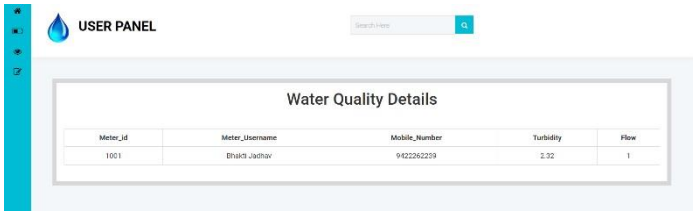

Figure.3: Water Quality and Metering

1.4. CRITICAL ANALYSIS AND DISCUSSION

The development of a prepaid Water meter utilizing IoT technology has several potential benefits for both Water consumers and utilities. The utilization of prepaid Water meters can avail amend the financial sustainability of Water utilities by ascertaining timely payments and truncating the costs associated with billing and accumulation. Concurrently, prepaid Water meters can avail consumers better manage their Water utilization and truncate their Water bills by providing authentic-time feedback on their consumption.

However, there are withal some potential challenges associated with the implementation of prepaid Water meters utilizing IoT technology. For example, there may be concerns about data privacy and security, as the meters amass and transmit sensitive data about Water consumption. Moreover, the cost of implementing and maintaining prepaid Water meters may be high, which could be a barrier for some utilities and consumers.

Furthermore, there may be equity concerns associated with the implementation of prepaid Water meters. In some cases, prepaid Water meters may be utilized as an expedient of inhibiting Water access for low-income households who may not be able to afford the upfront costs associated with prepayment. This can lead to gregarious omission and worsen Water impecuniosity, which is already a consequential quandary in many components of the world.

In conclusion, while the development of prepaid Water meters utilizing IoT technology has several potential benefits, it is paramount to conscientiously consider the potential challenges and equity implicative insinuations of their implementation. Prepaid Water meters should be designed and implemented in a way that ascertains data privacy and security, as well as equitable access to Water accommodations for all.

Overall, the proposed system will be much more frugal than the available commercial Water quality monitoring contrivances. The approximate prices of the component are as follows:

- Processor -i3 (Minimum)
- Hard Disk -5GB(Minimum)
- Memory -1GB RAM (Minimum)
- Solenoid Valve
- Arduino Board Uno: RM30
- Turbidity Sensor: RM70 • Flow Sensor

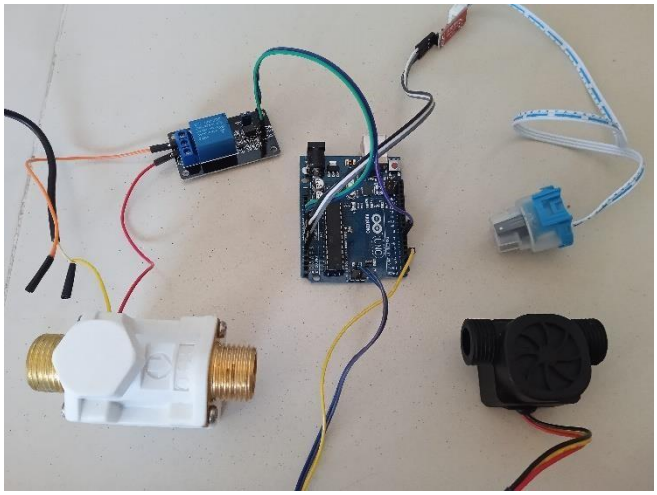

Figure.4: Hardware Requirements.

The total price integrates up to around RM375. If the utilizer wishes to utilize a more refined (industrial scale) Water level sensor, that will cost four times more than the price of this setup.

1.5. CONCLUSION

In conclusion, the prepaid Water meter utilizing IoT technology is a promising solution to address the challenges associated with current Water management systems. The project aims to provide a more sustainable and efficient Water management system by incorporating IoT technology to enable genuine-time monitoring of Water utilization, timely billing, and efficient Water management.

In summary, the prepaid Water meter utilizing IoT technology has the potential to revolutionize the Water management system and address the challenges associated with Water scarcity and mismanagement. It provides an innovative solution to ameliorate the efficiency of Water management, minimize operational costs, and provide consumers with more preponderant control over their Water bills and utilization.

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