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Using Information and Communication Technology to Enforce Non-Payment of Water Bills: The Case of Water Supply and Sanitation Authorities in Tanzania

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ABSTRACT

Sanitation and having access to clean water are human rights. To serve everyone, water and sanitation service providers must be able to run and maintain a profit. However, this capability is frequently jeopardized by missed or late water bill payments. The ability of utilities to provide appropriate service is directly impacted by non-payment, which also hinders the fulfillment of human right regarding to water and sanitation services. In this study, a mechanism for enforcing prompt payment of water bills which utilize the Electricity Prepaid Metering System is designed. In order to put the designed mechanism into practice, a prototype application has been created. Through in-person interviews with system administrators, data about the Electricity Prepaid Metering System and Water Management Information System was gathered. The proposed enforcement mechanism was designed with the use of a Design Science Research technique. The findings indicate that people who owe unpaid water bills areautomatically denied access to electricity services.

Key Words: *Application prototype, Enforcement framework, Water & Sanitation, Water bill non-payment.*

1. INTRODUCTION

There are a number of dynamics that cities and towns around the world are currently dealing with [1-2]. The majority of urban residents struggle to effectively and openly manage the increasingly restricted water resources, as well as with inadequate water supply and sanitation services [3]. According to reports, there are significant issues with both disposing of waste water and reducing harmful effects on the environment in cities [4]. Urban water system design and management should be strongly driven on a global and regional scale in order to create solutions for the efficient management of urban water supply and service provision under the growing demand of fast urban growth [5]. Urban water services in many developing nations are typically branded by poor service quality, inefficient, and dependent on government subsidies. According to [6] water utilities end up in a "low-level equilibrium" where low tariff revenues constrain maintenance and investment, which leads to a drop in service quality, for which clients are progressively less ready to pay. In order to break this vicious cycle, policy actions are required. These interventions must raise the amount of money available and ensure that it is used effectively to enhance and expand service.

The capacity to recoup the cost of providing water is hampered by nonpayment habits, which put the financial viability of water systems in jeopardy given that service fees account for the majority, if not all, of the revenue for many water utilities. Nonpayment behavior and its antecedents have received relatively little attention in the research, despite their frequency and harmful repercussions. Unfortunately, both affluent and emerging countries exhibit nonpayment behavior[7]. Given that poor cost recovery ultimately has a negative impact on the quality of the water supply, this could provide families with more motivation to avoid paying their water bills.It has been stated that nonpayment habits create a vicious cycle [8]. In addition, nonpayment habits may result in excessive usage of water resources, as [7] have demonstrated. When nonpayment of water bills is intended, excessive water use may be high [9].

Both industrialized and developing nations have had issues with inadequate enforcement of unpaid water bills. In Tanzania and other developing nations, the majority of water supply and sanitation agencies rely on cutting off water service to clients who don't pay their water fees on time. Numerous government regulations governing the provision of water services are violated by this enforcement measure. If customers owe them money, water utility providers are prohibited by law from cutting off or restricting water service. For instance, in India, cutting off the water supply—whether for non-payment of fees or for other reasons—represents a violation of the fundamental right to subsistence that is protected by Article 21 of the Constitution [10]. Therefore, it is still necessary to develop and apply ICT-based enforcement tools for unpaid water bills that do not compromise the fundamental right to use water for survival as a result of service disconnection. This research creates an ICT-based framework to enforce defaultersof water bill andimplements a prototype application to realizedesigned framework.

2. LITERATURE RIEVIEW

Life depends on water, a natural resource. Water is essential for both vegetation and fauna to survive. Development, administration, and exploitation of water are therefore crucial activities to ensure the success of these sectors and the survival of the nation's population [11]. Water has been prioritized as a fundamental need and human right from a global perspective [12].He argued that nations all over the world are changing how they manage their water resources in an effort to provide adequate, clean, and affordable water to all of their users. The World Health Organization (WHO) estimates that around 1.1 billion people lack access to clean drinking water throughout the world[13]. By 2025, the United Nations predicts that two-thirds of the world's population would likely be living under stressful circumstances, and 1.9 billion people would be living in areas or countries with a complete water shortage [14]. The worst water issue, according to [12] is in Africa because of its financial difficulties. Africa's coverage of both water supply and sanitation at the time was, in fact, 62% for water supply and 60% for sanitation.

The income theory places a strong emphasis on income when explaining why a consumer is unwilling to pay for a service. Unwillingness to pay is a behavioral characteristic of a piped water consumer according to the income model. While income and socioeconomic factors (such as level of education, size of household, housing type, status of marriage, gender, water costs, and locality) may impact willingness to pay forservices of water [15][16][17], they may not be enough to account for the factors limiting this willingness.For instance, [18] found no evidence to support a connection between non-payment behavior and income of household in the research of non-payment behavior in Guatemala. In their study of the Ijebu Ode Local Government Area in Ogun State, Nigeria, [19] discovered that money had little bearing on a person's willingness to pay forservices of water or for better drinking water services.[20]found that the reliability of public water supply, service interruptions without notice, maintenance delays, the price per unit charged, and the unequal treatment households encountered when collecting water all had an impact on households' willingness to pay for public water services.[21]found that household welfare, quality, quantity, and continuity, socioeconomic performance, price, and affordability inhibited willingness to pay, whereas educational attainment had a secondary effect in their research of Tirta Riau in Tanjungpinang, Indonesia. [22]noted that disruptions and unstable water supply have the potential to reduce customers' willingness to pay for water services.

In Tanzania, the Water Supply and Sanitation Authorities (WSSAs) have been dealing with significant difficulties caused by customers to pay for water later than expected. Actually, customers' unwillingness to pay for water on time has led to a buildup of unpaid arrears[23].This Financial constraints as a result have limited water distribution, which has decreased customer access to water. As a result, water is no longer a human right but rather a commodity for a select few, typically the wealthy[11]. The inability to continuously and reliably supply water could cause the nation's operations to halt.Studies, publications, and theories have demonstrated that the billing system, revenue collection method, non-payment enforcement method, water cost, and water consumer behavior all affect how much water is paid for [7].The non-payment enforcement mechanism serves as the theoretical foundation for this investigation.

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3. METHODOLOGY

In order to understand how Water ManagementInformation system is used in the processing, production, and payment of water bills, and howelectricity prepaid metering system delivers recharge token, thestudy involved the collection of primary data fromTanzania Electricity Supply Company (TANESCO) and Dodoma Urban Water Supply and Sanitary Authority (DUWASA) through face-to-face interviews with system administrators. To acquire information about the legal and administrative enforcement measures used to enforce water bill defaulters, secondary data from pertinent sources, including as textbooks, journals, and government documents were used. The proposed water bill nonpayment enforcement mechanism was created using the Design Science Research (DSR) methodology. DSR is, at its core, a problem-solving paradigm that focuses on thinking, comprehending, and trying to solve the problem [24]. DSR encourages design science knowledge or produces new artifacts in an area of focus while working to identify solutions to challenges [25]. The definition of the artefacts includes constructs, which are words and symbols, models, which are representations and abstractions, methods, which are actions and rules, and instantiations, which are system prototypes and finished products [24]. The DSR creates innovations that are meant to address real-world societal issues and advance the theory of the field in which they are used [26].The application prototype was created using agile programming to implement the proposed mechanism

4. FRAMEWOEK FOR PROPOSED WATER BILL NON-PAYMENT ENFORCEMNT MECHANISM

Tanzania's Urban Water Supply and Sanitation Authorities (UWSSAs) are responsible for providing water services to residents of urban areas. After the customer has paid the water connection fees, the authority connects the main water pipe to the customer's home and installs a meter to track water usage for billing purposes. The customer runs the pipes from the meter point to offer water connections to his or her building. For the purpose of delivering energy service to the building owner, the electricity prepaid meter is linked to the same structure. In order to provide an electronic water bill non-payment enforcement mechanism by withholding electricity service to defaulters until water bills are paid in full, Figure 1 depicts the framework connecting the Electricity Prepaid Metering System with the Water Management Information System. For this framework to function, changes must be made to the water management information system by including information about the available energy prepayment meter on the building where the water meter is situated.

The prepaid electricity metering system connects to the Water Management Information System to check for any outstanding water bills when the electricity consumer (water consumer) requests an electricity recharge token. Only customers without any outstanding water bills will receive the recharge token. If not, people in default will receive notification of their outstanding water bills and be instructed to settle them before reapplying for the power recharge token.

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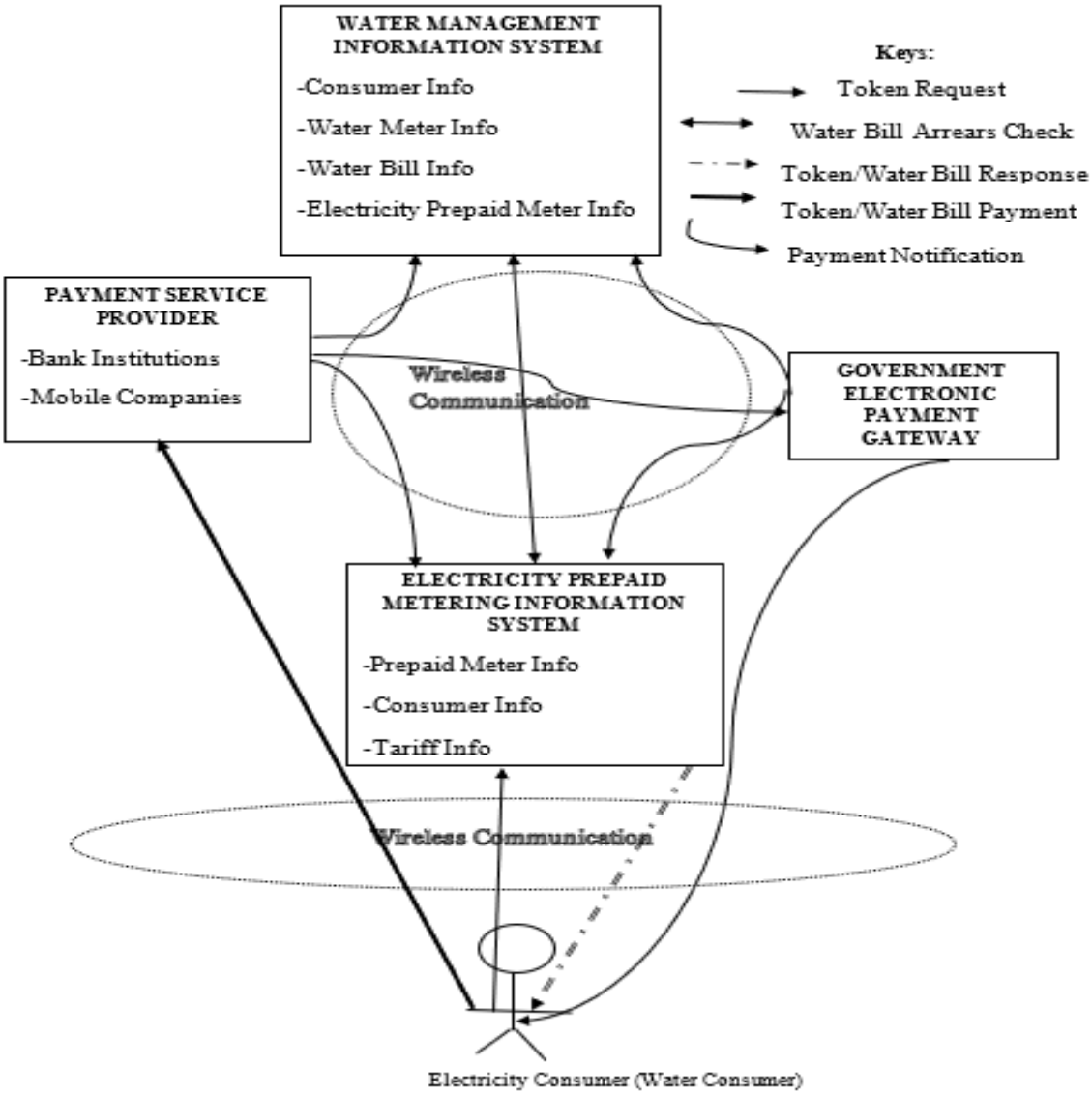

Figure1: Framework for the proposed water bill nonpayment enforcement mechanism

5. RESULTS AND DISCUSSION

The outcomes of the developed application prototype have been shown using the water consumer with water meter number 342556 and water bill arrears of 24500 Tanzanian Shillings. The water meter is installed on consumer's residence connected to the electricity national grid through prepaid meter number 2267892. A form used by the consumer to request for an electricity recharge token is shown in Figure 2.

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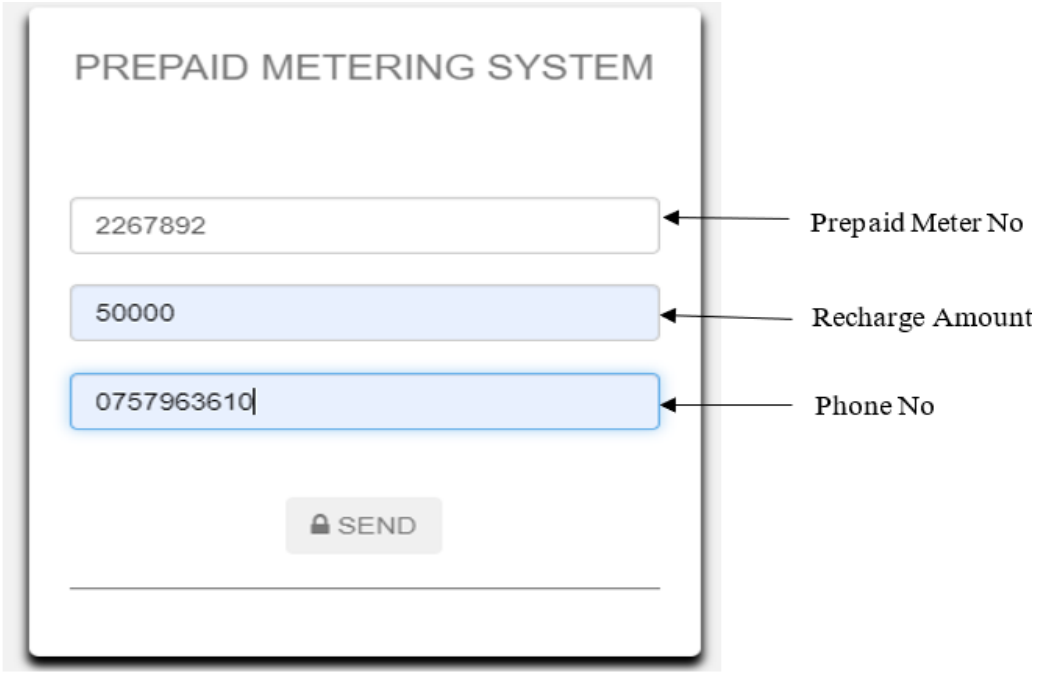

Figure2: Electricity recharge token request interface

After receiving the information in Figure 3, the electricity prepaid metering system will connect to the Water Management Information System using the received prepaid electricity meter number to determine whether the consumer has an unpaid water bill and return the amount owed. Figure 6 displays the outcomes following the submission of the data.

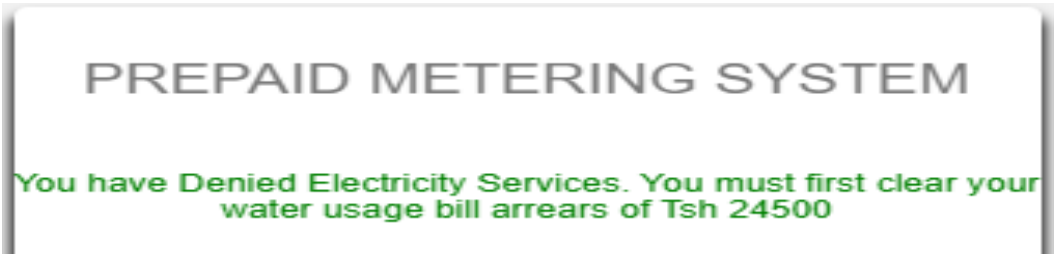

Figure3:Water bill arrears response

The consumer must pay the full balance of the outstanding water bill before they can resume receiving power. Figure 4 depicts a completed water bill payment form.

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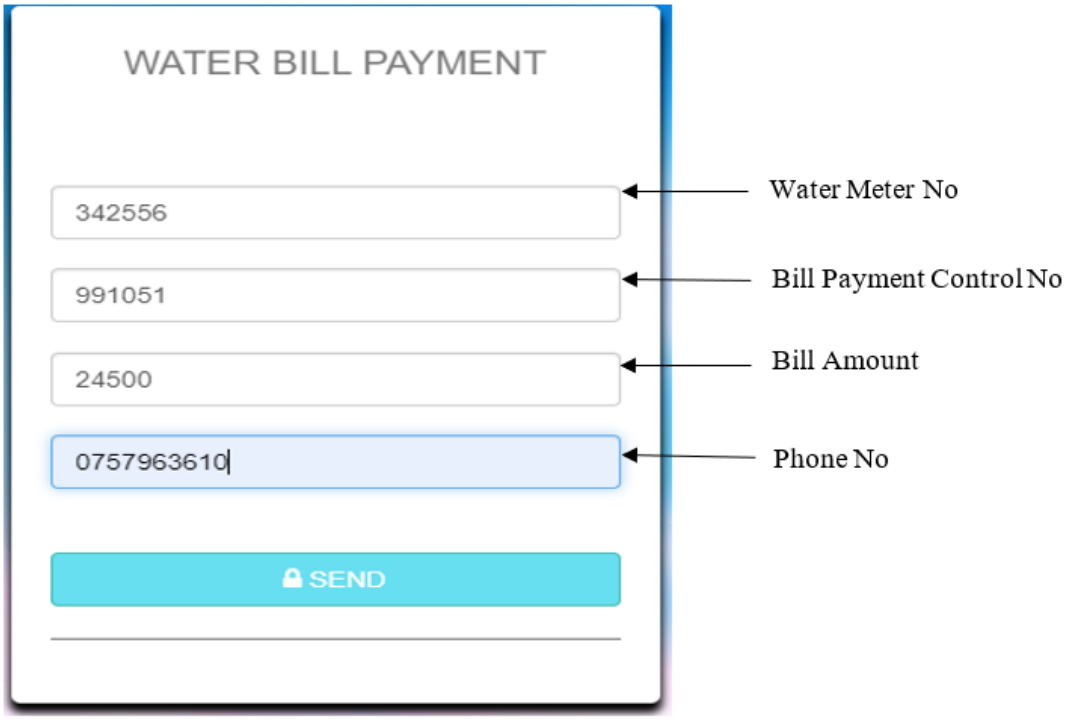

Figure4: Water billarrears paymentinterface

As shown in Figure 5, the consumer receives notification that the authority has successfully received the money after transmitting the bill payment information.

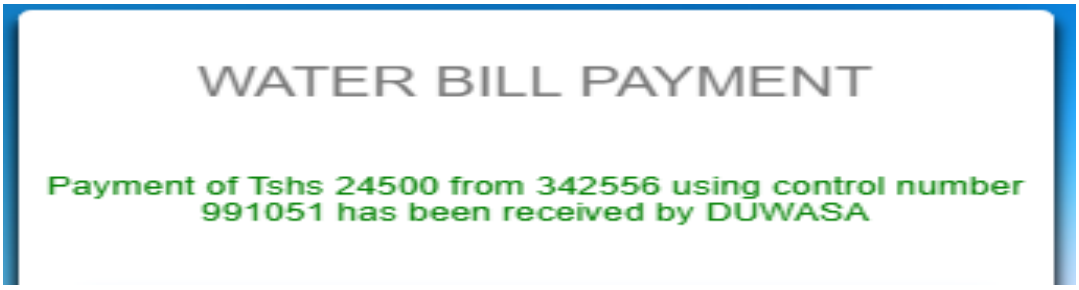

Figure5: Water bill payment notification

The consumer can request the electricity recharge token one more after paying any outstanding water bill balances. Figure 6 depicts the consumer receiving a recharge token in response from the electricity prepaid metering system. The consumer continues to use electricity after entering the received recharge token into the prepaid electricity meter.

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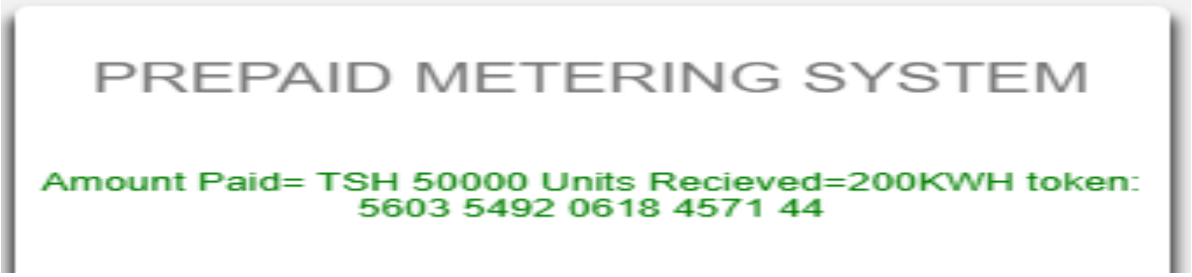

Figure6**: Electricity recharge token response**

6. CONCLUSION

Since water is essential for human living, it becomes impractical to enforce non-payment of water bills to consumers by cutting off their access to water services. Customers abuse this power to rack up unpaid water bills, which puts the authorities in a difficult financial situation and prevents them from offering customers better water services. This paper's proposed enforcement method is one potential remedy for this issue. Customers who accumulate water bill arrears while still receiving water services are automatically denied access to electricity services by the system. Since electricity is not a basic need for survival, this enforcement method does not violate human rights and is effective in collecting debts.

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