SMART WATER METER

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EMBEDDED SYSTEM DEVELOPMENT - 04633-A

FINAL PROJECT PROPOSAL

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Introduction

This proposal summarizes the concept of our final year project, called 'Smart Water Meter', in embedded systems development at Carnegie Mellon University Africa. It will be developed by Bagirishya Rwema Dominique and Nshuti Elie.

The proportion of the Rwandan population with access to improved drinking water sources increased from 77% to 87% after 2005 and According to the latest Integrated Household Living Conditions Survey, EICV3 report, the proportion of Rwandan households using surface water (rivers or lakes) as drinking water has decreased from 18 to 12 per cent over last five years. [1]

This exemplifies that over 87% of institutions and organizations still use an analog method to pay their water bills. Currently, there is no digital system that WASAC Company can utilize to manage and collect revenues from these customers, other than deploying their workers to each household in the country to collect those bills. This current system is unconventional, analog, and costly for the water supplier company, as it demands significant effort and a large workforce. Additionally, from the customers' perspective, it is ineffective, often leading to complaints about receiving unfair bills that do not accurately reflect the amount of water consumed. [2]

Project Objectives

The project aims to introduce several innovative solutions through the implementation of a new system known as the Smart Water Meter. This system is designed to revolutionize the way water is purchased, allowing customers to buy water based on the quantity they desire. A significant objective of this initiative is to assist the WASAC Company in streamlining its operations by reducing the need for a large workforce currently deployed to collect payments from customers. Additionally, the project seeks to enhance the company's ability to gain deeper insights into their billing and water consumption patterns on a monthly and yearly basis, facilitating a digital approach to analyze these aspects. Additional goal is to address and eliminate the prevalent issue faced by customers, where their water supply is locked due to delayed payments, thereby improving customer satisfaction and service reliability. Finally, by introducing a digital payment method for water, it aligns with Rwanda's vision for 2050, setting a precedent for modernizing utility services in line with national development goals. This approach will not only promises to optimize operational efficiency for WASAC but also significantly contributes to enhancing the customer experience and aligning with Rwanda's long-term development strategies.

Methodology

The methodology we adopted for this project entails a multifaceted approach aimed at developing an efficient embedded system to address the identified objectives. Utilizing the Agile methodology, [3] we will embark on the development of a web-based platform designed to serve as the central control hub for managing and monitoring the system's data. This platform will essentially function as a dashboard, the company's system administration, providing real-time insights and facilitating seamless interaction with the Smart Water Meter box. Concurrently, the project will involve the development of a USSD code, offering users a convenient and accessible means to initiate transactions and interact with their respective Smart Water Meters. And to ensure the system's functionality and performance align with project requirements, we will integrate the necessary hardware components within the box. Through this methodology, the project will endeavour to establish a robust framework for the successful implementation and deployment of the Smart Water Meter system, fostering efficiency, accessibility, and reliability in water management practices.

Free The africa's talking platform's API will be used to provide the interaction of the system.
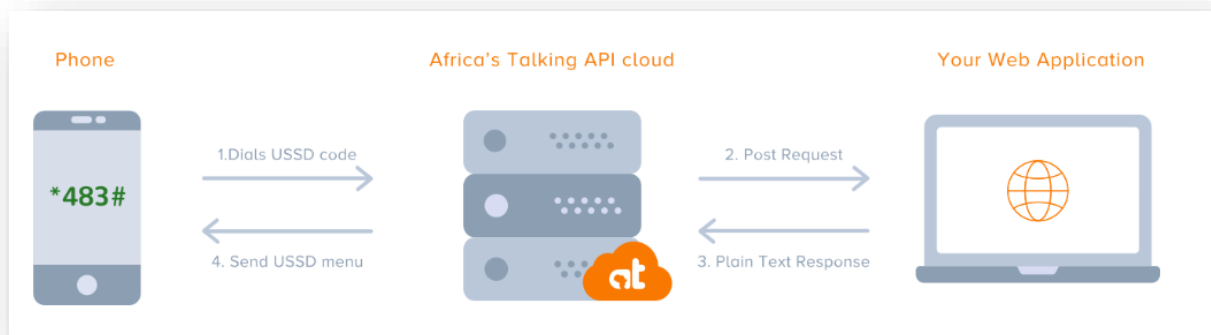
Source: [4]

Expected outputs.

The expected output of the project entails a streamlined and user-friendly process for purchasing water. Users will have the convenience of selecting the desired quantity of water through a USSD code. Once the purchase is made, the chosen quantity will be promptly updated in the user's smart water meter. Upon depletion of the purchased volume, the water meter will automatically lock, ensuring efficient management of water distribution. Subsequent unlocking will occur upon the user's purchase of another water packet. The system administrator will have full access to a comprehensive overview of all transactions conducted by customers, facilitating efficient monitoring and management of the system's operations. This expected output not only promises enhanced user convenience but also underscores the system's capability to optimize water resource utilization while providing administrative oversight for effective system management.

List of components

-LCD display

-I2C

-STM32 Microcontroller

-Breadboard

-Water-Flow censor

-Solenoid Valve

- Breadboard + Jumpers (Wires)

- Relay Module

- water Valve

- 50 cm pipe + Bucket Water Jug.

Software:

USSD, Africa's talking app, and a web Hosting platform.

Conclusion

In conclusion, the implementation of the Smart Water Meter project represents an advancement in water management and utility services in Rwanda. By introducing innovative technologies mentioned, the system will address the above challenges faced by both water supplier and consumers. Through these efforts, our aim is to enhance operational efficiency, reduce workforce requirements, improve customer satisfaction, and align with national development objectives paving the way for sustainable and efficient water resource management in Rwanda and beyond.

Reference

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[2] Rwanda Water Resources Board, 07 february 2021. [Online]. Available: https://www.rwb.rw/.

[3] J. Griggs, "What is the Agile methodology?," Atlassian, 21 july 2014. [Online]. Available: https://www.atlassian.com/agile#:~:text=What%20is%20the%20Agile%20methodology,READ%20ON%20BELOW. [Accessed 05 march 2024].

[4] "Developer Documentation," Africa's Talking website, 21 Feb 2010. [Online]. Available: https://developers.africastalking.com/. [Accessed March 2024].