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FACULTY OF ENGINEERING

DEPARTMENT OF COMPUTER ENGINEERING AND INFOMATICS

FINAL YEAR PROJECT REPORT

AN AUTOMATIC WATER SOFTENING PUMPING SYSTEM FOR SOFTENING WATER IN HARD WATER REGIONS

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REG NO: BU/UP/2019/1204

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This Final Year Project Report Submitted to The Department of Computer Engineering and Informatics in Partial Fulfillment of The Requirement for The Award of The Degree of Bachelor of Science in Computer Engineering Busitema University

SEPTEMBER 2023

DECLARATION

I **BUMBA ALLAN ENOCK TALWANA**, hereby declare that this report, written in partial fulfilment of the requirement of the award of a Bachelor of Computer Engineering degree at Busitema University, is my very own authentic work and the content of this document has never been submitted before to the Department of Computer Engineering of Busitema University and any another institution of high education.

Signature..... **Date**02/10/23.....

BUMBA ALLAN ENOCK TALWANA

APPROVAL

This final year project report under the title **AN AUTOMATIC WATER SOFTENING PUMPING SYSTEM FOR SOFTENING WATER IN HARD WATER REGIONS** has been compiled by **BUMBA ALLAN ENOCK TALWANA** Registration Number **BU/UP/2019/1204** under the supervision and guidance of the University supervisor PROF. SEMWOGERERE TWAIBU and It is now ready for submission to the Department of Computer Engineering.

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BUMBA ALLAN ENOCK TALWANA

Signature: .....

Date: 28/09/23

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Abstract:

The Automated Water Softening Pumping System is an innovative solution designed to address the challenges of water treatment from hard water sources. It combines automation, precise chemical dosing, and continuous water softening while minimizing resource wastage and manual intervention. The system comprises submersible pumps, ultrasonic sensors, microcontrollers (Arduino), and chemical dosing mechanisms. It operates through a sequential process, automating the water treatment journey from sourcing water to distributing softened water. The integration of smart technologies ensures accurate dosing of sodium carbonate solution and optimized water level management. Through its continuous operation, adaptability, and resource efficiency, the system aims to enhance water quality, reduce chemical consumption, and promote environmental sustainability. The Automated Water Softening Pumping System demonstrates the potential to modernize water treatment processes, offering a dynamic approach to achieving consistent, highquality water treatment outcomes.

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1.0 Introduction

1.1 BACKGROUND

Water is an essential resource that plays a crucial role in various aspects of human life, from domestic consumption to industrial processes. However, the quality of water can vary significantly, and one of the common challenges is the presence of hard water. Hard water, characterized by an elevated concentration of minerals such as calcium and magnesium ions, poses considerable problems for both households and industries.

The mineral content in hard water leads to the formation of mineral deposits, commonly referred to as scale, in pipes, appliances, and equipment that come into contact with water. This scale buildup can impede the flow of water, reduce the efficiency of appliances like water heaters and dishwashers, and result in increased energy consumption. Furthermore, the reduced lathering of soaps and detergents in hard water affects cleaning effectiveness and can lead to dissatisfaction among consumers.

Traditional methods of water softening involve the use of ion exchange systems, where calcium and magnesium ions are replaced with sodium ions. While effective, these methods often require manual monitoring and maintenance, making them less efficient and potentially leading to inconsistent water quality.

The development of an Automatic Water Softening System addresses these challenges by combining technology, automation, and efficient chemical treatment. This system aims to automatically transfer water between tanks, administer precise doses of chemical softening agents such as sodium carbonate, and provide real-time monitoring and control for users. By automating these processes, the system eliminates the need for constant manual intervention and ensures a continuous supply of treated water.

1.2 PROBLEM STATEMENT

Many regions suffer from the adverse effects of hard water, leading to scaling, reduced cleaning efficiency, and increased energy consumption in appliances. Conventional water softening methods often involve manual intervention, imprecise dosing of chemicals, and inconsistent results. This presents a need for an automated water softening system that can ensure accurate dosing, continuous operation, and efficient resource utilization while minimizing human involvement.

hard water through automation, the project contributes to improved water quality and user convenience. With continued maintenance and potential enhancements, the system has the potential to become an even more valuable solution for water treatment.

In conclusion, the development and successful implementation of the Automatic Water Softening Pumping System marks a significant stride towards enhancing water quality and user convenience. The project aimed to automate the process of water transfer, chemical treatment, and continuous operation in order to combat the challenges posed by hard water sources. Through meticulous design, integration, and testing, the system has achieved its objectives and proven its effectiveness.

7.0 APPENDICES

7.1 References

https://scholar.google.com/scholar?q=Chen+et+al.+(2021)+proposed+a+hybrid+water+softening+system+that+combined+ion+exchange+and+electrocoagulation+techniques&hl=en&as_sdt=0&as_vis=1&oi=scholart

Jan, F.; Min-Allah, N.; Saeed, S.; Iqbal, S.; Ahmed, R. IoT-Based Solutions to Monitor Water Level, Leakage, and Motor Control for Smart Water Tanks.

https://www.usgs.gov/special-topics/water-science-school/science/hardnesswater#:~:text=The%20simple%20definition%20of%20water,time%20you%20washed%20your %20hands.

https://www.mcgill.ca/oss/article/health-you-asked/you-asked-hard-water-dangerousdrink#:~:text=Hard%20water%20can%20interfere%20with,making%20for%20less%20efficient %20heating. https://www.luminoruv.com/education/softening/

https://www.britannica.com/technology/water-softening https://sswm.info/sswm-university-course/module-6-disaster-situations-planning-andpreparedness/further-resources-0/ion-exchange https://www.bootsontheroof.com/3-water-softening-methods-explained/

7.2 CODE

```
// Libraries

#include <NewPing.h>


// Ultrasonic sensor pins

#define TRIG_PIN_TANK_B 3

#define ECHO_PIN_TANK_B 4

#define TRIG_PIN_TANK_D 7

#define ECHO_PIN_TANK_D 8
```