

**BUSITEMA
UNIVERSITY**
Pursuing excellence

FACULTY OF ENGINEERING

DEPARTMENT OF WATER RESOURCES ENGINEERING

**DESIGN OF A REAL TIME OPTIMIZATION OF SALT ELECTRO
CHLORINATION SYSTEM FOR WATER TREATMENT**

BY

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CASE STUDY: BUSITEMA UNIVERSITY

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**“A final year project report submitted to the Department of Water
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ABSTRACT

This project presents the design and development of a real-time optimized salt electro-chlorination system for water treatment at Busitema University. The system aims to locally generate sodium hypochlorite, reducing dependency on costly and hazardous commercial chlorine supplies. Utilizing solar energy, an electrolytic cell, and an Arduino-based automation setup, the system precisely regulates salt and water dosages to ensure consistent and effective chlorine production. Key innovations include the integration of smart sensors, servo-controlled valves, and real-time monitoring to enhance disinfection efficiency and operational safety. Extensive experimentation was conducted to optimize operational parameters such as voltage, current, brine concentration, flow rate, pH, and temperature. Using Response Surface Methodology (RSM), optimal settings were established and validated through prototype testing, which achieved a hypochlorite concentration of 1090 ppm, energy consumption of 2.8 kWh/kg, and efficiency above 80%. The system supports Sustainable Development Goals by promoting clean water access, innovation, and energy-efficient solutions in resource-limited settings.

DECLARATION

I **EPU ANDREW**, certify that all the information presented in this project report is original and has never been submitted for the granting of a degree, certificate, or diploma to any university or other higher education institution.

Signature..........

Date: 14/05/2025.....

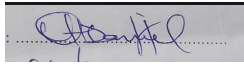
APPROVAL

This report on Design of a real time optimization of a salt electro chlorination system for water treatment was written under the supervision of.

SUPERVISOR:

Name: MR OLOGE HECTOR DANIEL

Signature:



Date...14/O5/2025.....

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LIST OF ACRONYMS

Cl	Chlorine
ClO ⁻	Hypochlorite
DPD	N-Diethyl-p-Phenylenediamine
H ₂	Hydrogen
HCl	Hydrochloric acid
HOCl	Hypochlorous acid
NaOCl	Sodium Hypochlorite
NWSC	National Water Sewage Corporation
SDGs	Sustainable Development Goals
UGX	Ugandan Shilling
WHO	World Health Organization

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Investigate the scalability of the system for larger community or municipal-level water treatment plants. Modular designs could be explored for easy integration and replication.

Enhance the system with data logging and remote monitoring capabilities (e.g., via GSM or IoT) for performance tracking and early fault detection, particularly in unattended installations.

Develop easy-to-follow operational manuals and training modules for operators to ensure safe use, especially in areas where technical expertise may be limited.

Add a water flow sensor on the brine tank

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APPENDICES

