FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF WATER RESOURCES ENGINEERING

DESIGN AND CONSTRUCTION OF A WATER QUALITY MONITORING SYSTEM AT BUSITEMA UNIVERSITY

By

BAAYA SONIA DOROTHY

BU/UP/2020/2850

baayasoniadorothy226@gmail.com

SUPERVISOR: DR. RESTY NABATEREGA

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ABSTRACT

Water is an indispensable resource vital for numerous applications including agriculture, domestic use, and industrial processes. Despite its importance, water pollution remains a significant challenge, often monitored through traditional laboratory methods that fail to detect contaminants promptly and in real-time. To address this issue, the integration of Internet of Things (IoT) technology offers a promising solution for continuous, real-time water quality monitoring. This thesis presents the design and construction of a cost-effective IoT-based water quality monitoring system at Busitema University. The system comprises both hardware and software components, enabling comprehensive water quality analysis and facilitating web-based data access.

The study's findings demonstrate that the developed system effectively monitors key water quality parameters with high sensitivity, flexibility, and accuracy. The real-time data acquisition and transmission capabilities of the system allow for early detection of water contaminants, ensuring timely intervention and management. The results underscore the potential of IoT technology in enhancing water quality monitoring practices, contributing to improved water resource management and public health protection.

DECLARATION

I **BAAYA SONIA DOROTHY** declare that the contents of this final year report are out of my effort and originality and have thus not been submitted anywhere for any academic purpose or award.

Name: BAAYA SONIA DOROTHY

Signature: .....Baaya.....

Date: .....19th JUNE 2024.....

APPROVAL

This is to certify that this final year project report has been done by **BAAYA SONIA DOROTHY** and is ready for submission with my approval.

PROJECT SUPERVISOR: Dr. RESTY NABATEREGA

SIGNSTURE: 

DATE: .....19th JUNE, 2024.....

DEDICATION

I would like to dedicate this report to my parents; Mr. Babungi Baaya Sylivio and Mrs. Katusabe Betty Awino, sponsors (FAWE UG), family members, colleagues and supervisors, for all their support. May God bless you all.

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ABBREVIATION AND ACRONYMS

SWMS:	Smart Water Monitoring system
IoT:	Internet of Things
NWSC:	National Water and Sewerage Corporation
WHO:	World Health Organization
UN:	United Nations
UNICEF:	United Nations Children's Fund
SDGs:	Sustainable Development Goals
IWSN:	Industrial Wireless Sensor Networks
LCD:	Liquid Crystal Display
GUI:	Graphical User Interface
LED:	Light Emitting Diode
LDR:	Low Dynamic Range
NTU:	Nephelometric Turbidity Unit
NPV:	Net Present Value
ROR:	Rate Of Return
pH:	Positive Hydrogen
GSM:	Global System for Mobile Communication
Wi-Fi:	Wireless Fidelity
RDBMS	Relational Database Management System
MySQL	My Structured Querry Language

CHAPTER ONE: INTRODUCTION

1.1Background

Although water is a natural resource that is important to farming, manufacturing, and life on earth, about 2.1 billion people still have no access to safe water globally and about 40% of deaths result from consumption of contaminated water, (WHO., 2022). The United Nations' 2030 Agenda for Sustainable Development Goal 6 is to ensure availability and sustainable management of water and sanitation for all (Gregucci et al., 2023). However, this is still a far goal to reach for most Sub-Saharan countries since their drinking water sources are still facing a major threat of pollution and contamination (Fedoriw et al., 2019). For example, about 102 million people are still using unsafe surface water, with an estimated 695 million people still using unimproved facilities in most Sub-Saharan countries, such as Uganda (Walekhwa et al., 2022).

In Uganda, a given percentage of the population has access to water, yet most of it is unsafe. For instance, Kampala, the capital city of Uganda, had 60% of its enhanced water sources contaminated in 2017 (Murphy et al., 2017). This had a part in the tragic typhoid fever outbreak that claimed the lives of over 51 persons (Kabwama et al., 2017). Furthermore, bottled water in Kampala was also found to be contaminated, although this water is still regarded as one of the safer and better sources of water. (Halage et al., 2015). This situation therefore calls for routine assessment of the quality of water from improved water sources across the country.

Given the escalating levels of drinking water contamination and pollution, there is an urgent need to source, develop, and use alternative, cost-effective, non-conventional, locally available suitable automatic systems for monitoring both water quality and levels. (Arshad et al., 2019) explored the role of Internet of Things (IoT) in flood monitoring for smart cities, emphasizing its significance in water level monitoring. The interconnected sensors enabled the timely detection of rising water levels, facilitating automated responses and contributing to effective flood prevention strategies. Similarly, (Fataftah., 2022) delved into the importance of cloud-based solutions for environmental monitoring, emphasizing the role of cloud computing in managing and analyzing large-scale environmental data. Cloud platforms served as centralized repositories for the vast amount of data collected by IoT-enabled sensors, allowing for seamless access, analysis, and visualization.

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