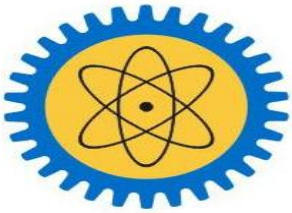

FACULTY OF ENGINEERING

DEPARTMENT OF COMPUTER ENGINEERING

A REAL-TIME WATER QUALITY MONITORING SYSTEM

BY

MAGEZI DANI

BU/UG/2017/1860

TEL: 0756200819

EMAIL: magezidandaniz@gmail.com

SUPERVISOR: Dr. GODLIVER OWOMUGISHA

A FINAL YEAR PROJECT REPORT SUBMITTED TO THE DEPARTMENT OF COMPUTER ENGINEERING IN PARTIAL FULFILLMENT FOR THE AWARD OF A BACHELOR OF SCIENCE IN COMPUTER ENGINEERING OF BUSITEMA UNIVERSITY

ABSTRACT

Since the 21st century, there has been lots of inventions, but at the same time, pollutions and because of this, there is no safe drinking water for the world's pollution. water utility operators are vested with task of extracting water, treating it and supplying it to the customers. Most water quality operators with national water and sewerage cooperation not being exclusive follows a conventional method of monitoring water quality where samples are manually collected from different suitable locations, taken to the lab to be tested and recorded. This method is however inefficient because its time consuming and tiresome and doesn't give data in real time.
With the advancement in technology, the internet of things has been incorporated into water quality monitoring systems.

The real-time water quality monitoring system makes the use of sensors which take readings for water quality, processes them using a micro-controller to which the sensors are always in constant communication and finally displays the results to an LCD onsite, causes a buzzer to sound if the water quality parameters are out of the range, and also send the water quality information to a database of a website.

DECLARATION

I hereby declare that all the work material portrayed in this final year project is my original work except where explicit citation has been made and it has not been presented to any Institution of higher learning for any academic award.

Sign: ……..……

Date: …….

APPROVAL

I approve the project "*A real-time water quality management system*" that was done under my supervision.

Dr. Godliver Owomugisha

Department of Computer and Electrical Engineering

Signature:

Date: ……13/03/2022……

TABLE OF CONTENTS

Contents

ABSTRACT ……...i
DECLARATION ……ii
APPROVAL ……iii
TABLE OF CONTENTS iv
LIST OF FIGURES vii
LIST OF TABLES viii
LIST OF ABBREVIATIONS ix
CHAPTER ONE: INTRODUCTION 1
1.1 Background 1
1.2 Problem Statement 2
1.3 Objectives 3
1.3.1 Main Objective 3
1.3.2 Specific Objectives 3
1.4 Justification 3
1.5 Scope 3
1.5.1 Technical Scope 3
1.5.2 Geographical Scope 4
CHAPTER TWO: LITERATURE REVIEW 5
2.1 Introduction 5
2.2 Water quality parameters 6
2.2.1 pH 6
2.2.2 Temperature 6
2.2.3 Turbidity 7
2.2.4 Conductivity 7

2.2.5 Total dissolved solids 7
2.3 Existing water quality monitoring systems 8
2.4 Proposed System 10
CHAPTER THREE: METHODOLOGY 12
3.1 Introduction 12
3.2 Requirements Elicitation 12
3.3 Data Collection Methods 12
3.3.1 Literature Review 12
3.3.2 Interviews 12
3.3.3 Other sources of data 12
3.4 Requirement Analysis 13
3.4.1 Functional requirements 13
3.4.2 Non-functional requirements 13
3.5 System Design 13
3.5.1 Hardware tools 13
3.5.2 Software Tools 14
3.5.3 System Block Diagram 14
3.6 System Implementation 14
3.6.1 Data Acquisition Layer 15
3.6.2 Data Transmission Layer 15
3.6.3 Application Layer 15
3.7 Testing and Validation 15
3.7.1 Unit testing 15
3.7.2 Integration testing 16
3.7.3 System testing 16
CHAPTER FOUR 17
4.1 System requirements and Architecture 17
4.1.1 System Architecture 17
4.1.2 System requirements 17
4.1.3 Functional Requirements 18
4.1.4 Non-Functional Requirements 18
4.2 System Design 18
4.3 System components 20

4.3.1 Arduino nano 20
4.3.2 TDS Sensor 20
4.3.3 Turbidity sensor 21
4.3.4 PH sensor 22
4.3.5 Temperature sensor 23
4.3.6 Buzzer 23
4.3.7 Website 24
4.4 Logical design of the system. 24
5 CHAPTER FIVE: IMPLEMENTATION AND TESTING 25
5.1 Hardware section 25
5.2 Software section 25
5.3 System Testing 26
5.3.1 Unit testing 26
5.3.2 Integration testing 27
5.3.3 System testing 28
6 CHAPTER SIX: RESULTS AND DISCUSSION 29
6.0 Summary of my work 29
6.1 Critical analysis/appraisal of the work 29
6.2 RESULTS AND DISCUSSION 30
6.3 Recommendations. 30
6.4 Conclusion 30
6.5 REFERENCES 31

LIST OF FIGURES

Figure 1:System block diagram 14
Figure 2:System Architecture 17
Figure 3:System design 19
Figure 4:Arduino nano micro-controller 20
Figure 5:TDS Sensor 21
Figure 6: Turbidity Sensor 22
Figure 7: Temperature Sensor 23
Figure 8: Buzzer 23
Figure 9:Logical design of the system 24
Figure 10:pH for different water samples 26
Figure 11:Turbidity for different water samples 26
Figure 12: Water quality not safe displayed on LCD 27
Figure 13: Water quality safe displayed on LCD 27
Figure 14:Website showing the different water quality parameters. 28
Figure 15:Website with turbid water. 28

LIST OF TABLES

Table 1:Comparison of the existing system and the developed system 29

LIST OF ABBREVIATIONS

MoWE-Ministry of Water and Environment

NWSC-National Water and Sewerage Cooperation

IoT-internet of things

COD-Chemical Oxygen Demand

BOD-Biological Oxygen Demand

NTU- Nephelometric Turbidity Units

TDS-Total Dissolved Solids

HTML-Hyper Text Markup Language

CSS-Cascading Style