

# BUSITEMA UNIVERSITY

## FACULTY OF ENGINEERING

### DEPARTMENT OF COMPUTER ENGINEERING

#### A FINAL YEAR PROJECT REPORT

**TITLE: A MONITORING AND NOTIFICATION SYSTEM FOR THE  
EPILEPTIC SEIZURE PATIENTS**

BY

KIREVU SAMUEL

Regno: BU/UP/2015/2144.

Email: [Ksamzvictor@gmail.com](mailto:Ksamzvictor@gmail.com)

Tel: 0705069093

SUPERVISOR: MR. LUSIBA BADRU



A Final Year Project Report Submitted to the Department of Computer Engineering in  
Partial Fulfillment for the Award of the Bachelor's Degree in Computer Engineering of  
Busitema University.

May, 2019

**DECLARATION**

I, KIREVU SAMUEL do hereby declare that this Project Report is original and has not been submitted for any other degree award to any other University before.

Signature AS I ..... Date 29<sup>th</sup>/05/2019

Name: KIREVU SAMUEL

Department of Computer Engineering

Faculty of Engineering



### APPROVAL

I certify that the project report titled "A MONITORING AND NOTIFICATION SYSTEM FOR THE EPILEPTIC SEIZURE PATIENTS" has been implemented under my supervision and is submitted to the board of examiners with my approval.

Signature: .....  ..... Date: .....  .....

Name: Mr. LUSIBA BADRU

Department of Computer Engineering

Faculty of Engineering

## **DEDICATION**

I dedicate this report to our family especially my mum Mrs. Bamwiite Mebra and my brother Mr. Bamwiite Emmanuel for the love, prayers and the support rendered to me during my course and to my dear friends who have been with me as we pursue excellence.

### **ACKNOWLEDGEMENT.**

I appreciate the Almighty God for His mercies in the course of my research, my supervisor Mr. Lusiba Badru for his continual guidance and contribution towards the success of my research, my dear friends who have been contributing to my ideas in the project implementation. I also thank my benefactors my lovely mum Mrs. Bamwiite Mebra, brothers especially Mr. Bamwiite Emmanuel for their support financially and encouragement during the research. May the Almighty God reward you for all your efforts rendered for the success of my research.

## ABSTRACT.

The purpose of this research is to ease the process of monitoring epileptic patients and notify the caretaker in case there is an epileptic attack so that they offer First Aid. According to WHO, health is the state of complete physical, mental and social well-being and not absence of diseases. Existence of Non-communicable diseases (NCD) caused genetically or due to mental illness have effects on an individual's life expectancy. In developing countries, NCD's are currently responsible for 35% of all deaths which will rise in the near futures, thus there is need to lower the percentage of deaths. Epilepsy, an NCD is one of the leading neurological disorder in which the brain activity becomes abnormal, causing seizures and loss of awareness. Epileptic patients need a special mechanism to monitor and notify caretakers so as to offer immediate First Aid in case of an attack to avoid further injuries. Monitoring in hospital setting in ICU limit their mobility though accurate, other systems are limited to home coverage and are for detecting seizure and sleep apnea during sleeping hours. With these limitations a system that allow patient mobility and comfort should is needed thus the developed system consists of vibration sensor to detect any onset of limb jerking, skin conductance sensor to measure the rate of skin conductivity and display on an LCD, and GPS module to locate the patients and GSM modem to generate a message that is sent to caretaker's phone. The prototype has the capacity to generate a message in case of abnormal values with patient's location seeking the caretaker's attention.

## TABLE OF CONTENT

DECLARATION.....	i
APPROVAL.....	ii
DEDICATION.....	iii
ACKNOWLEDGEMENT.....	iv
ABSTRACT.....	v
TABLE OF CONTENT.....	vi
LIST OF ACRONYMS.....	ix
LIST OF TABLES.....	xi
CHAPTER ONE INTRODUCTION.....	1
1.1 BACKGROUND OF STUDY.....	1
1.2 PROBLEM STATEMENT.....	2
1.3 OBJECTIVES.....	2
1.3.1 Main Objective.....	2
1.3.2 Specific Objectives.....	2
1.4 JUSTIFICATION.....	2
1.5.1 Technical scope.....	3
1.5.2 Geographical scope.....	3
CHAPTER TWO LITERATURE REVIEW.....	4
2.1 KEY TERMS.....	4
2.2 RELATED SYSTEMS.....	4
2.3 EXISTING SYSTEM COMPARISON TABLE.....	6
2.4 PROPOSED SYSTEM.....	7
CHAPTER THREE METHODOLOGY.....	8
3.1 REQUIREMENT ANALYSIS.....	8
3.1.1 Data sources.....	8
3.1.2 Functional requirements.....	8

3.1.3 Non-functional requirements.....	8
3.1.4 Interface specifications.....	8
3.2 SYSTEM ANALYSIS AND DESIGN.....	9
3.2.1 Hardware Components.....	9
3.2.2 System Software.....	9
3.3 SYSTEM IMPLEMENTATION.....	9
3.4 SYSTEM TESTING.....	10
3.4.1 Unit testing.....	10
3.4.2 Integration testing.....	10
3.4.3 System testing.....	10
3.5 SYSTEM VALIDATION.....	10
CHAPTER FOUR: SYSTEM ANALYSIS AND DESIGN.....	11
4.1 REQUIREMENT ANALYSIS.....	11
4.1.1 Functional Requirement.....	11
4.1.2 Non-Functional Requirements.....	11
4.2 SYSTEM DESIGN.....	11
4.2.1 Logical design of the system.....	12
4.3 PHYSICAL DESIGN.....	13
4.3.1 Wearable Hardware Device.....	13
CHAPTER FIVE: SYSTEM IMPLEMENTATION AND TESTING.....	17
5.0 INTRODUCTION.....	17
5.1 CODE DESIGN.....	17
5.2 SOLDERING.....	17
5.3 TESTING.....	17
5.3.1 Unit Testing.....	17
5.3.2 Integration System Testing.....	17
5.4 SYSTEM VERIFICATION.....	18



<b>5.5 SYSTEM VALIDATION.....</b>	<b>18</b>
<b>CHAPTER SIX: DISCUSSIONS AND RECOMMENDATIONS.....</b>	<b>19</b>
<b>6.0 INTRODUCTION.....</b>	<b>19</b>
<b>6.1 SUMMARY OF YOUR WORK.....</b>	<b>19</b>
<b>6.2 CRITICAL ANALYSIS /APPRAISAL OF THE WORK .....</b>	<b>19</b>
<b>6.3 RECOMMENDATIONS.....</b>	<b>19</b>
<b>6.4 CONCLUSION.....</b>	<b>19</b>
<b>REFERENCES:.....</b>	<b>20</b>
<b>APPENDICES.....</b>	<b>22</b>
<b>APPENDIX A: ARDUINO CODE FOR THE SYSTEM.....</b>	<b>22</b>
<b>APPENDIX B: PICTURES TAKEN DURING IMPLEMENATAION.....</b>	<b>29</b>

## **LIST OF ACRONYMS**

<b>ECG</b>	<b>Electrocardiogram</b>
<b>EEG</b>	<b>Electroencephalogram</b>
<b>GPS</b>	<b>Global Positioning System</b>
<b>GSM</b>	<b>Global System Monitoring</b>
<b>ICU</b>	<b>Intensive Care Unit</b>
<b>NCD</b>	<b>Non-communicable diseases</b>
<b>WHO</b>	<b>World Health Organization.</b>

## LIST OF FIGURES

<b>Figure 4. 1: Shows the data flow diagram for the developed system .....</b>	<b>12</b>
<b>Figure 4. 2: Shows the Physical diagrams for the system .....</b>	<b>13</b>
<b>Figure 4. 3: Show the design of Skin conductance Sensor .....</b>	<b>15</b>
<b>Figure 4. 4: Shows the Vibration Sensor .....</b>	<b>16</b>
<b>Figure 4. 5: Show the schematic Diagram for the developed system .....</b>	<b>16</b>

**LIST OF TABLES.**

Table 2 1: Existing System Comparison Table.....6

## **CHAPTER ONE INTRODUCTION**

### **1.1 BACKGROUND OF STUDY**

The current struggle today is to promote and improve health, the state of complete physical, mental and social well-being and not the absence of diseases or infirmity WHO[1], basing on physical, economic environments and personal behavioral factors[2] [3]. Non-communicable diseases (NCD), are noninfectious health conditions caused genetically or due to mental disorders have long-term effects on an individual's well-being and the life expectancy mainly in Uganda[4]. In developing countries, NCDs are currently responsible for 35% of all deaths and the figure is predicted to rise in the future[4][5], thus there is need to lower the percentage of deaths.

Epilepsy, an NCD is one of the leading neurological disorder worldwide in which the brain activity becomes abnormal, causing seizures or periods of unusual behavior, loss of awareness[6][7]. Patients with such diseases especially generalized tonic clonic (grand mal) seizure attract concerns from caretakers and specialists.

These attacks can occur at any time and this requires a special mechanism to notify caretakers so as to offer immediate First Aid and avoid further injuries that lead to prolonged hospitalization[8][9][10]. Monitoring such patients by physical observation is tedious since it requires the caretaker to be near to frequently monitor them for their safety. In hospital setting medical devices used in ICU for epilepsy monitoring limit the patient's mobility, other systems like home based mobile solution for video ambulatory EEG monitoring is limited to home coverage, real time wearable system for monitoring and analyzing physiological signals based on blood oxygen level, heart rate and its data transmitted to the phone through Bluetooth for seizure and sleep apnea events detection is suitable for sleeping hours only thus these limitations need further consideration in the patient monitoring systems[11][6].

During the onset of seizure, there is a relationship between the skin conductance as an indicator of sympathetic activity that increases with increasing emotional, physical and cognitive load which is sign of seizure onset, patients do experience motor body activity shown by jerking of the limbs which can be detected to assess their status[12]. Developing a monitoring system considering patient mobility based on the above parameters is of great benefit that allows analysis of the obtained results to assess patient health status and notify the caretaker of the progress by message from the system to seek their attention[13][14].

## REFERENCES:

- [1] "Definitions\_of\_Health\_C.pdf."
- [2] I. Levin and J. Tröst, "Understanding the Concept of Health," *Fam. Relat.*, vol. 41, no. 3, pp. 348–351, 1992.
- [3] "FACTORS AFFECTING HEALTH."
- [4] S. M. S. Islam, T. D. Purnat, N. T. A. Phuong, U. Mwingira, K. Schacht, and G. Fröschl, "Non Communicable Diseases (NCDs) in developing countries: A symposium report," *Global. Health*, vol. 10, no. 1, 2014.
- [5] C. K. Mondo, M. A. Otim, G. Akol, R. Musoke, and J. Orem, "The prevalence and distribution of non-communicable diseases and their risk factors in Kasese district, Uganda : cardiovascular topics," *Cardiovasc. J. Afr.*, vol. 24, no. 3, pp. 52–57, 2013.
- [6] E. Ontario, *All-About-Seizures*.
- [7] A. Paul, D. Adeloye, R. George-Carey, I. Kolčić, L. Grant, and K. Y. Chan, "An estimate of the prevalence of epilepsy in Sub-Saharan Africa: A systematic analysis," *J. Glob. Health*, vol. 2, no. 2, pp. 1–13, 2012.
- [8] A. Loss, M. Sporadic, C. Repetitive, and T. Atonic, "Epileptic Seizure Types and Symptoms."
- [9] M. B. Duggan, "Epilepsy and its effects on children and families in rural Uganda.," *Afr. Health Sci.*, vol. 13, no. 3, pp. 613–23, 2013.
- [10] M. B. Duggan, "Epilepsy in rural Ugandan children: Seizure pattern, age of onset and associated findings," *Afr. Health Sci.*, vol. 10, no. 3, pp. 218–225, 2010.
- [11] K. Vandecasteele *et al.*, "Automated Epileptic Seizure Detection Based on Wearable ECG and PPG in a Hospital Environment," pp. 1–12.
- [12] P. Assignment, S. H. Cycle, and B. Sat, "EDA ( Introduction to EDA )," pp. 2–5, 2006.
- [13] S. Ramamoorthy, "Personalized Health Monitoring System Using IOT and Cloud," *Int. J. Comput. Sci. Trends Technol.*, vol. 5, no. 3, May – Jun 2017, pp. 122–126, 2017.

- [14] "Vital Signs & Symptoms."
- [15] A. F. Lange and C. Gilbert, "Using GPS for GIS data capture," *Geogr. Inf. Syst.*, pp. 467–476, 1999.
- [16] T. Derivatives, "Source of EEG activity."
- [17] "Electrodermal Activity," p. 2015, 2015.
- [18] "Core medical equipment - Information Other common names ;," vol. 2011, p. 16231, 2011.
- [19] K. Vandecasteele *et al.*, "Automated epileptic seizure detection based on wearable ECG and PPG in a hospital environment," *Sensors (Switzerland)*, vol. 17, no. 10, pp. 1–12, 2017.
- [20] S. Consul-Pacareu, R. Mahajan, N. Sahadat, and B. I. Morshed, "Wearable Ambulatory 2-Channel EEG NeuroMonitor Platform for Real- Life Engagement Monitoring Based on Brain Activities at the Prefrontal Cortex," 2014.
- [21] E. Glukhov, "HealthGear: A Real-time Wearable System for Monitoring and Analyzing Physiological Signals," *J. Biol. Chem.*, vol. 280, no. 40, pp. 33960–33967, 2005.
- [22] S. Chacko and P. McCullagh, "Home based mobile solution for video ambulatory EEG monitoring," *Proc. - 2014 Int. Conf. Intell. Environ. IE 2014*, pp. 107–110, 2014.
- [23] B. R. Myung and S. K. Yoo, "Development of 16-channels Compact EEG System Using Real-time High-speed Wireless Transmission," *Engineering*, vol. 05, no. 05, pp. 93–97, 2013.
- [24] A. Uno and R. Front, "Arduino Uno."
- [25] M. T. Hasan and S. Khan, "GSM Based Automatic Water Quality Control Analysis," pp. 5522–5529, 2016.
- [26] W. Physiology, "Galvanic Skin Response ( GSR ) and Investigation into ' Cheating ,'" vol. 03820, 2013.