



**BUSITEMA
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Pursuing Excellence

FACULTY OF ENGINEERING

**DEPARTMENT OF MINING AND WATER RESOURCES
ENGINEERING**

BSc. Water Resources Engineering

FINAL YEAR PROJECT

**DESIGN OF A FLOOD MONITORING AND DETECTION SYSTEM FOR
UNYAMA RIVER IN AMURU DISTRICT**

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A final year project submitted to the Department of Mining and Water Resources Engineering as a partial fulfillment of the requirement for the award of a Bachelor's of Science Degree in Water Resources Engineering

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ABSTRACT

This project research report is about Design of a Flood Monitoring and Detection System for river Unyama.

Flood being a natural disaster, can't be prevented but its impact can be reduced.

River Unyama has been massively flooding year after year; ever since 13th May 2009 causing massive destruction of both lives and property.

This work is presented in chapter form. Chapter one is composed of the introduction to the research problem. Chapter two contains a review of literature which has been produced by other scholars and researchers about monitoring and detection systems. The third chapter presents the various methods which were employed to achieve the objectives; amongst them were: to generate the hydrological model of the catchment which was generated using ArcGIS, HEC-GeoHMS and HEC-HMS soft wares, to develop the hydraulic model of river Unyama which was done using HEC-RAS software, and to design and assemble the components that make up the system and build its prototype model where Python, JavaScript, HTML, CSS and SQL were used. The Fourth chapter presents the findings from the research and also bears the design analysis of the system like determining, sizing and selecting the components of the system. It further contains the reliability determination. In conclusion, the study was able to determine achievable flood mitigation measures, design a highly reliable flood monitoring and detection system with a working prototype model.

The main purposes of the research are to serve 1) as information channel for flooding warning when conditions exceed preset thresholds and 2) as a web based information source for the public, responding to their need for information on water condition and flooding.

The developed system is composed of three major components: sensor network,

This research was developed by using Raspberry pi 3 model B ++ microcontroller using the concept of the ultrasonic waves and groove water sensor.

DECLARATION

I KALOKWERA PONSANO declare that this project proposal is as a result of my own research and has never been presented in any academic institution for any award.

Signature:  Date: 29th/05/2017



APPROVAL

This research project on the Design of a Flood Monitoring and Detection system was done under the supervision of;

Main supervisor

Mr. Okirya Martin

Signature

Date.....

Co-supervisor

Eng. Badaza Mohammed

Signature

Date.....

DEDICATION

This report is dedicated to my mother Akello Teddy for her tireless efforts and sacrifices throughout my education.

ACKNOWLEDGEMENT

This project research has been out of unreserved toil, restless consultation and persistent prayer.

We owe profound gratitude to a number of persons.

I thank the Almighty God for the great provision and guidance towards my final year project accomplishment.

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I would also like to thank my academic supervisors Mr. Okirya Martin and Eng. Badaza Mohammed and the entire staff of the department of Mining and Water Resource Engineering Busitema University who endeavored their best to guide me where necessary throughout this project, may the good Lord bless them.

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ACRONYMS

FMDS -Flood Monitoring and Detection System

WSN -Wireless Sensor Network

GUI -Graphical user interface

FMEA -Failure Mode and Effect Analysis

FMEA -Failure Modes Effects and Criticability Analysis

HTML -Hypertext Markup Language

CSS -Cascading Style Sheets

SQL -Standard Quantum Limit

NARO -National Agricultural Research Organization

UNMA - Uganda National Meteorological Authority.

GIS -Geographical Information System.

DEM -Digital Elevation Model

DTM -Digital Terrain Model

DWRM -Directorate of Water Resources Management

HEC-HMS - Hydrologic Engineering Center's Hydrologic Modeling System

HEC-GeoHMS- Hydrologic Engineering Center's Geospatial Hydrologic Modeling System

HEC-RAS- The Hydrologic Engineering Center's River Analysis System

HEC GeoRAS - Hydrologic Engineering Center's Geospatial River Analysis System.

AC: Alternating Current

DC: Direct Current

RF: Radio Frequency

RPN: Risk Priority Number

USB: Universal Serial Bus

Wi-Fi: Wireless Fidelity

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CHAPTER ONE

INTRODUCTION

A flood is a disaster where massive water spills off the river banks, lake shores or even the sea. During floods, there is an overflow of water that submerges land which is always dry. Floods often occur when there is an increase in the water level; such that excess water bursts the banks and finds its own way outside to the land which is always dry. Due to the high velocity of flow of the run-off water during the floods; there is always massive destruction of life, property, and animals occupying the affected areas.

Most of the natural disasters in the world take place in the developing countries, causing massive destruction and human suffering. Due to its geographical setting and economic dependence on agriculture, Uganda is especially vulnerable to a number of natural hazards. Among all kind of natural hazards, flood is one of the devastating, widespread and frequent. River flooding is a recurrent natural phenomenon. Floods are becoming a more pronounced disaster in many parts of the country costing lives and also damaging property. *(Kitutu, 2013)*

Among all kinds of natural hazards of the world flood is probably the most devastating, wide spread and frequent. Floods resulting from excessive rainfall within a short duration of time and consequent high river discharge damage crops and infrastructure. *(Nsengiyumva, 2012)*

Structural approaches like construction of dams, reservoirs and embankments to prevent the over bank flow from reaching the nearby settlements for flood prevention have been quite popular throughout the 1950s to 70s. However, are very cost intensive. Apart from the tangible shortcomings, protection works create a false sense of security among the settlers that leads more intensive land use in the flood-prone areas. *(Ansari, 2001)*

Over 5,000 people were affected by landslides and floods in Eastern Uganda particularly in Bududa district where an estimate of 400 people were killed in the area and 105 bodies recovered. *(DREF, 31 July 2010)*

Uganda is not exceptional because Butaleja District (Eastern Uganda) on 13 March, 2013 experienced heavy rains, accompanied by hailstorm and strong winds. In less than an hour, 40

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