BUSITEMA UNIVERSITY

FACULTY OF ENGINEERING

DEPARTMENT OF COMPUTER ENGINEERING

AN AUTOMATIC SURGICAL SUCTION PUMP CONTROLLER DEVICE

By

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DECLARATION

I **LOCIA PETER** Reg No: **BU/UG/2012/1976**, declare that this project report is original and has been carefully made to the best of my knowledge and has not been submitted to any Institution of Higher Learning for any kind of award.

Signature ……. Date …….

APPROVAL

This is to approve that this project report has been fully and consistently read and hereby recommend for acceptance of Busitema University a project report entitled “An automatic surgical suction pump controller device”.

.

Signature ……. Date ……

Mr. Lusiba Badru

University Supervisor

DEDICATION

I dedicate this report to my lovely mother Alum Duculina, Okongo Moyaii my father and to all my beloved brothers and sisters for the love and care they always offers to me.

ACKNOWLEDGEMENT

My supervisor **Mr. Lusiba Badru** have been vital in helping me to accomplish this project. Thank you so much for the aid offered to me.

Also, I acknowledge all the other department lecturers who have always given me time for consultation regardless of whether they are my supervisors or not, thank you for the helping attitude.

Many fellow students have offered help in form of advice and information and such is greatly recognized.

Above all, I acknowledge the **Almighty God** for the gift of life, wisdom and guidance for without Him, I wouldn't have been able to accomplish this project

ABSTRACT

An automated surgical suction pump controller device is a subject system. that relies on the algorithm that monitors the maximum fluid level and the decision depending on the monitored values of sensor that it point to .this system improves the technology of the existing surgical controller device which completely curb down the breakdown of the surgical suction control board system.

In gathering the information, consultations and document reviews concerning the existing surgical control systems and their corresponding subsystems responsible for detecting and notifying the maximum fluid level required for the replacement of new reservoir tank for used during an operation. It was from the analysis of the gathered information that the development of the surgical suction pump control device kicked-off.

I designed the system in Protius ISIS software and wrote a code in AVR Studio5 which provided me with the basic picture on how the system was to work and be integrated from its constituent subparts.

The components of the system were tested prior to system testing using a braid board after which they were soldered on a copper board. The functionality of the system was under the control of the algorithm/code that was written on the microcontroller.

The system was finally subjected to system testing to validate and verify its working by me and some of my other classmates before presenting to Busitema University.

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LIST OF ABBREVIATION

DH	District Hospital
US	United States
IDA	Integrated Development Environment
MCU	Microcontroller
WHO	world health organization
ASCPD	Automatic surgical suction pump controller device
IC	Integrated circuit
A/D	Analogue digital conversion
V	Voltage
MHz	Megahertz
USI	Universal serial interface
DVCC	Digital supply voltage
DVSS	Ground
LEDS	Light emitting diodes
DC	Direct current
AC	Alternating current
EMF	Electromotive force

CHAPTER ONE:

INTRODUCTION

This chapter gives an introduction that led to the development of an automatic surgical suction pump controller device. It is composed of the following subsection: the background of the project; problem statement; objectives of the project, main object and specific objectives; scope; significance of the project limitations and assumptions.

1.1 Project background.

The estimated number of operating theatres ranged from 1·0 (95% CI 0·9–1·2) per 100 000 people in west sub-Saharan Africa to 25·1 (20·9–30·1) per 100 000 in Eastern Europe. High-income sub regions all averaged more than 14 per 100 000 people, whereas all low-income sub regions, representing 2·2 billion people [7], had fewer than two theatres per 100 000. Pulse oximetry data from 54 countries suggested that around 77 700 (63 195–95 533) theatres worldwide (19·2% [15·2–23·9]) were not equipped with pulse oximeters.

Lodwar District Hospital (DH) is the only functional government regional referral hospital for all of Turkana region, spanning a population of almost 1,000,000. This is where the vast majority of the Turkana and other populations of Northwestern Kenya as well as people from across the borders to Uganda and South Sudan seek help when they need more advanced care requiring medical equipment and specialized skills that cannot be provided at dispensaries, health centers, or private health clinics. Lodwar DH has been struggling for years with wards in need of major repair, and supplies and drugs that come in with great irregularity from the government health supplies department in Nairobi.

Surgical operations are one of the most risky activities in the medical world with critical care, skilled man power (professional medical practitioners) and high quality surgical tools required [8].

cFigure 1.1 showing pictures of doctors during an operation in Lodwar district Hospital Turkana, Kenya

Recently, surgical services have been gaining greater attention as an integral part of public health in low-income countries. Up to 11% of the global burden of disease is estimated to be secondary to surgical conditions, led by injuries, complications of childbirth, congenital anomalies, and cancer. This estimate does not include acute abdominal emergencies and surgical infections that are likely to also contribute substantially to the burden [1]. Evidence suggests a tremendous unmet need for surgical services in low income countries; only 3% of global surgical output occurs in poor or low health expenditure countries compared to 75% in richer countries [2]. The significant preventable morbidity and mortality from surgical conditions has prompted leading experts in public health to refer to surgery as the ‘‘neglected stepchild’’ of global health [3], and others to point to the essential role of surgical services in meeting the Millennium Development Goals [4]. The recent Copenhagen Consensus also ranked essential surgery as one of the highest priority investments to improve the health of the world’s poor [5]. Despite these calls to action, there has been very limited discussion about the key aspects of health policy development to improve access to surgical services in low-income settings, In Uganda, the most recent burden of disease estimates, from 1995, showed especially high mortality from complications of pregnancy and trauma [6]. More recent evidence from nine rural hospitals also suggests high unmet need for surgical services

At a hospital, modern surgery is often done in an operating theater using surgical instruments, an operating table for the patient, and other equipment. The environment and procedures used in surgery are governed by the principles of aseptic technique: the strict separation of "sterile" (free of microorganisms) things from "unsterile" or "contaminated"

things. All surgical instruments must be sterilized, and an instrument must be replaced or re-sterilized if it becomes contaminated (i.e. handled in an unsterile manner, or allowed to touch an unsterile surface) [14].

Depending on the nature of the surgery, several wastes can be accompanied e.g, waste blood and mucus for a tumor surgery. Suction pumps are usually used during and after surgery to remove surgical fluids, tissues (including bones), gases or bodily fluids of the patient. The high quality vacuum technology has been designed to deliver a reliable buildup of suction power. Improvements in public-health strategies and monitoring are needed to reduce disparities for more than 2 billion people without adequate access to surgical care [12].

1.2 Problem statement:

Suction pumps contain a reservoir which is usually a glass bottle with volume marks up the side and has a float valve so that the vacuum is cut off before the bottle becomes full enough to allow the contents to be drawn into the pipework of the pumping mechanism. Due to lack of a wastes monitoring strategy into the reservoir, breakdown of the container usually occur and hence leading to the defeat of the float valve mechanism thus wearing down of the whole machine. There is need for an affordable, robust and effective monitoring strategies suction device that will deliver the required fluid volume, control suction process to a desired level, notification system to alert operators and stepper locking system to stop sucking of more fluid when its level has reached. This will reduce the breakdown of this machine and yet they are very expensive**.**

1.3 Main Objective:

The aim of the study was to develop an automatic surgical suction pump controller device.

1.3.1 Specific objectives:

i. To conduct a study on the existing suction pumps and suction monitoring strategies.
ii. To design suction wastes monitoring strategies prototype from problem deliverables.
iii. To analyze requirements, design proposed system.
iv. To develop, test and validate the system.

1.4 Scope:

In This system I came up with a system used in monitoring the fluid in the reservoir tank with functionality limited to detecting fluid level that will lead to automatic turning of the surgical suction pump machine.

The system will be used specifically in the hospital which used power, the system was thus developed for used by the doctor in the theater only.is specifically for medical use on surgical operation. Any other form of application e.g. industrial use shall not be recommended. The devise will ensure automatic turning off of the suction pump if the reservoir tank has reached the required level.

1.5 Significance:

The project has brought an innovation into the existing monitoring system for a reliable, efficient, automated surgical suction pump control system. Upon deployment of the system the hospital management will gain the revenue that would have been lost via machine getting spoil due to frothing during the operation.

The digital suction pump controller will ensure that the suction pump responsible for pumping surgical wastes into an attached reservoir is automatically turned off before frothing of wastes occurs. This will be due to the reservoir wastes level monitor with a notification mechanism.

1.6 Project limitations

The following hindered my fast accomplishment of the project:

- There were limited finances to facilitate me in making movement in trying to access experts.
- There were no electronic laboratories in and around Busitema University. These laboratories were only accessible in Kampala.
- There was limited access to e-resources. This was because the internet facilities at Busitema University could not provide stable and fast internet.

1.7 Project Assumption

- Worker replace the reservoir tank immediately upon warning by sensor 1.
- All sensors are embedded inside the reservoir tank.
- Assume medical officer is always available.
- There is constant power supply.

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