BUSITEMA UNIVERSITY

FACULTY OF ENGINEERING

DEPARTMENT OF COMPUTER ENGINEERING

ELECTRIC CURRENT CARRYING CABLE LOCATOR

BY

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A PROJECT REPORT SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF A BACHELOR'S DEGREE IN COMPUTER ENGINEERING OF BUSITEMA UNIVERSITY

JUNE, 2016

DECLARATION

This project report is my original work and has not been presented for a degree in any University or any other award.

Sign: ………………….

Date: ………………….

Ssekyanzi Grace Edward

BU/UG/2012/1799

APPROVAL

This is to certify that this project report entitled "***Electric Current Carrying Cable Locator***" has been done under my supervision and hereby recommend for its acceptance of Busitema University.

Sign: ………………………………….

Date: …………………………………..

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DEDICATION

I dedicate this work to my lovely mother Ms. KYEYUNE Justine for the unending support throughout this period of study. May the most High Father reward her abundantly.

ACKNOWLEDGMENT

All in all I acknowledge the Almighty Father for His Grace that enabled me to overcome all hardships throughout this study period and has lead me to victory. Glory be to God.

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ABSTRACT

This project is intended to wirelessly detect the presence of live electric cables beneath the surface. These cables are made inaccessible at finished and furnished surfaces. Therefore without prior knowledge of the location of these inaccessible electric cables, injuries are usually caused by fire or flames that may follow when the sheath of a cable and the conductor insulation are penetrated or when a cable is crushed severely enough to cause internal contact between the sheathing and one or more of the conductors. However, due to the fact that current carrying electric cables do emanate magnetic fields, whose strength depends on the current flowing through the cable, which strength also decreases as the distance from the source conductor increases. For this reason low magnetic field sensors were used to pick these emanated magnetic fields, feed them to the microcontroller and the microcontroller makes the necessary calculations so that the position and depth of the cable from the surface are displayed on the LCD screen. In regard to using this system, electric cables can be detected and located before any work can be done by a technician, thereby doing away with the unnecessary injuries on site. Also this system can be used to map paths of electric cables and hence develop the electrical plans for already existing installations which do luck these plans. Due to the portability, mobility and ease of use of the system, it can be operated by any individual at home, offices, and even on construction sites.

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LIST OF ACRONYMS

CATs	Cable Avoidance Tools
EMF	Electric and Magnetic Field
IDE	Integrated Development Environment
LCD	Liquid Crystal Display
MC	Microcontroller
MFD	Magnetic field density
MRS	Magnetoresistive Sensor
PCB	Printed Circuit Board
RF	Radio Frequency
RFID	Radio Frequency Identification

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

Patrick Mahagwa, an electrician with Roko construction company Uganda, in his article published on Wednesday, October 16th 2013 in the Monitor newspaper, says 95% of electrical wiring is done within walls immediately below the surface, or sometimes deep underground.

Electricity power cables are used to deliver electricity to consumers, in most busy business centers in Uganda say like in Kampala, these cables are passed underground to supply power to different buildings, where therefore in the buildings, electric current carrying cables are passed through pipes which are fixed in walls during construction of these buildings [1]. Therefore without prior knowledge of the location of inaccessible electric cables, risks can be posed to excavators and other construction workers [2]. On the other hand, technicians doing renovations, demolishing, carpentry or interior designs need to identify and locate the existence of these electric current carrying cables right before their work commences. This could make the inaccessible electrical cable distribution network more reliable and avoid unnecessary power interruption, property destruction or electrical accidents [3].

Electricity cables, if damaged, may course a direct danger to personnel who are working on the site. Injuries that result from damage to live electricity cables are usually caused by the explosive effects of arcing current and by any associated fire or flames that may follow when the sheath of a cable and the conductor insulation are penetrated by a sharp object such as the point of a tool, or when a cable is crushed severely enough to cause internal contact between the sheathing and one or more of the conductors. Typically, this causes severe and potentially fatal burns to the hands, face and body [4].

A self-employed sub-contractor was burnt when he struck a 415 V electrical cable with an electrical breaker he was using to break up some concrete. The client had chosen to build over the cable rather than have it diverted. The cable had been protected by a conduit and its location was known. The client did not tell the contractor of its location before starting work and the contractor did not ask. The cable was diverted following the incident [5].

Nowadays cable avoidance tools (CATs) are used to detect and locate underground power cables [6]. These kind of devices work in different modes.

1. In passive mode (50/60 Hz), CATs provide the approximate horizontal location of the target cable.
2. In active mode, CATs measure the depth of an electric current carrying cable with the aid of a signal generator which typically injects 33 kHz signal into the cable.

However, cable avoidance tools can only detect spatial parameters of the electric current carrying cables. They cannot provide any electrical information in most cases. In addition, CATs heavily rely on the expertise, experience, and judgment of the operator to properly locate the electric cables. CATs are in principle just a magnetometer and they do not provide much analysis about the measured data. A certified personnel is typically needed to use this kind of tool to carry out underground cable detection. These cable avoidance tools are expensive; particularly, the signal generators needed in active mode are costly [6]. Therefore, it is of great application value to develop an electric current carrying cable locator for the underground and inaccessible electrical cables.

1.2 PROBLEM STATEMENT

Damaging live electricity cables may cause injuries to personnel who are working on the site. These injuries are usually caused by fire or flames that may follow when the sheath of a cable and the conductor insulation are penetrated by a sharp object such as the point of a tool, or when a cable is crushed severely enough to cause internal contact between the sheathing and one or more of the conductors. In business towns where shopping malls, arcades, shops and offices are rented sequentially by people with different business plans and requirements, care should be taken whenever there is need to do renovation.

1.3 OBJECTIVES

1.3.1 Main objective

To develop an electric current carrying cable locator system that will detect and give the horizontal and vertical positions of the inaccessible live electric cables basing on the magnetic fields being emanated by these cables.

1.3.2 Specific objectives

i. To review literature of the existing systems that may be related to the electric current carrying cable locator system.
ii. To identify and analyze user requirements which will be used in the design of the electric current carrying cable locator system.
iii. To develop an algorithm that will give the horizontal and vertical positions of the current carrying cable in regard with the sensors used.
iv. To design and implement the electric current carrying cable locator system.
v. To test and validate the electric current carrying cable locator system.

1.4 JUSTIFICATION

Electrical injuries due to ignorance of people's knowledge towards electrical cable's existence in buildings or underground may include; electrical burns, electric shocks, or fire outbreak caused by short circuits. All this is caused by technicians working on buildings with live power with no prior knowledge of the paths of inaccessible electric current carrying cables, which on the other hand may cause deaths and destruction of property. This designed system will help prevent inaccessible or underground cable damage due to construction or renovation works, hence eliminating electrical shocks and injuries.

On the other hand, many of the buildings in Uganda lack electrical plans to help identify the actual positions of the electric cables and even if they have, ignorance and negligence causes people not to consider them [1]. This system can also be used to map paths of electric cables and hence develop the electrical plans for already existing installations.

1.5 SCOPE

This system intends to cover electrical cables that are passed through the walls of commercial and domestic buildings.

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