FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

FINAL YEAR PROJECT

DESIGN AND IMPLEMENTATION OF A MULTI-TENANT PREPAID ELECTRICITY MANAGEMENT SYSTEM (MPEMS) FOR SINGLE PHASE CUSTOMERS

By

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This Final Year Project Report submitted to the Department of Electrical and Electronics Engineering in a partial fulfilment of the requirement for the award of the degree of Bachelor of Science in Electrical Engineering of Busitema University

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DECLARATION

I **Emmanuel Peter Fida** hereby declare to the best of my knowledge, that this Final Year Project Report is an outcome of my original work except where explicit citation has been made and that it has not been presented to any institution of learning for an academic award.

APPROVAL

This final Year Project Report has been done under our supervision and submitted to the faculty of engineering for examination with our approval.

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DEDICATIONS

With gratitude I would like to dedicate this my Final Year Project Report to my parents' my father late. SIMON PETER ODOI, mother Mrs. NYADOI POSIANA and all my brothers, sisters and relatives who have been of great importance and contributed a lot towards my achievements in life and most importantly making me through my education journey.

I do also dedicate this report to all my friends and fellow students for being such supportive and willing to share their knowledge with me and lastly to my grate supervisors for the knowledge and skills given to me.

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Acronyms

MPEMS- Multi-tenant Prepaid Electricity Management System

CIU- Consumer Interface Unit

LCD- Liquid Crystal Diode

LED- Light Emitting Diode

SBD- system block diagram

FLD-Flowchart Diagram

KWH- kilowatt hour

CTs- current transformer

NO- Normally open

NC- normally closed

GSM- global system for mobile communications

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ABSTRACT

In the year 2011, with the introduction of YAKA system in Uganda which acts as a prepaid billing system and can be installed in any room, many landlords have taken it up. In a single block, you can find around four to six people sharing the same YAKA meter and also sharing the power bills but none of them can tell how much of the power each consumes. Since the tenants can't tell how much power is consumed by each individual as they have different appliances, many of these tenants end up having quarrels over power since the power bills are expensive and there is no clear way of billing themselves after the YAKA meter. The development of this system was therefore motivated by the need to solve this problem. The system is able to solve this problem by monitoring the power consumed by each tenant. It displays the energy consumption of each tenant on an LCD in real time. When the energy consumption is equal to the allocated units of a particular tenant, the system is able to turn off the specific tenant automatically and leave the rest that still have units to run which eliminates the problem of people paying overdue. For purposes of demonstration, two sockets have been used each representing a single tenant.

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CHAPTER ONE: INTRODUCTION

1. 1 Background

Umeme operates under a concession with a structural monopoly on the distribution of electricity across Uganda, distributing 99 % of electricity in Uganda through a single buyer model. As of 2012, the UMEME distribution network consisted of 6, 394 km of 33 KV lines, 4, 809 km of 11 kV and 15, 933 km of low voltage (5-0,41 kV) lines. It has 69 substations and over 6000 pole-mounted transformers, low voltage (less than 1 kV) distribution wiring and meters. The control centre at Lugogo controls 35 out of the 69 substations. It only controls up to the substation level not the feeders. For communication to the control centre, the substations and control centre are connected by a combination of fibre optic and GPRS links. The fibre optic links are used in urban areas, the GPRS links are used for the substations that are far away from Lugogo[1]. When umeme entered into the 25 years contract to run the distribution network in 2005, the system was dilapidated, loses were as high as 38%, power rationing and blackouts were rampant and customer service delivery was at its worst. The customers were not paying their bills and only about 70% of potential revenue were being collected. All these was because initially postpaid energy meters were being used for billing customers where the staffs would regularly go and record meter reading (number of consumed units) and the amount to be paid could be calculated and added to the pending unpaid amount and a detailed bill would be delivered to the customer.

Umeme therefore, has changed this. Revenue collection for 2018 remained strong with an outturn of 100.2% registered. This performance is partly as a result of the prepayment metering code called Yaka which since it was implemented in 2011 has continued to make Umeme's job easier and customers happier. From the surveys carried out yearly from the time it was implemented, Yaka has always come out as the best thing that has happened for Umeme's customers and Umeme has also become more efficient. The change from the postpaid metering system to the trendy Yaka has not only opened the business to new technological opportunities, it has come with many benefits to Umeme, the customers and to other enterprises. The benefits include; reduction of operational costs through business efficiencies by optimizing operational costs of billing (meter reading, billing, bill printing, bill delivery, cash collection and money movement and security at our offices), disconnection and reconnection for credit control and need for cash offices at Umeme business centers, Yaka also provides the business an effortless platform through which customers debt/arrears

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