



BUSITEMA UNIVERSITY
FACULTY OF ENGINEERING
DEPARTMENT OF ELECTRICAL AND COMPUTER
ENGINEERING
FINAL YEAR PROJECT REPORT
2024/2025
DESIGN OF POWER LOAD MONITORING AND CONTROL
SYSTEM FOR AN OFF GRID INSTITUTION SETTING
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BU/UP/2021/0434
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Final Year Project Report Submitted to the Department of Electrical Engineering in Partial Fulfillment of the requirements for the Award of Bachelor of Science in Electrical Engineering Degree.

JUNE 2025

DECLARATION

I MULLER GEORGE, BU/UP/2021/0434 hereby declare that the presented final year report is uniquely prepared by me after thorough research work at Busitema University. I also confirm that this proposal report has been written by me and has never been submitted to any academic institution.

SIGNATURE.....

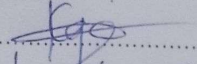
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APPROVAL

This is to certify that this final year report has been compiled by **MULLER GEORGE** under the supervision and guidance of the University supervisor. It is now ready for submission to the Department of Electrical and Computer Engineering.

UNIVERSITY SUPERVISOR

Eng. KILAMA GEORGE

Signature 

Date..... 21/07/2025

DEDICATION

I dedicate this report to the special people in my life who, with or without my knowledge, have made substantial sacrifices to assist me get here. I am especially grateful to my beloved dear ones, Mr. Otema Patrick Ben Emoi, Mr. Obia Richard Johnstones and my mother Latoo Maurina, for their words of support and push for persistence. My colleagues and supervisors have never left my side and are incredibly special. May God definitely bless them.

LIST OF ACRONYMS

UNES: Uganda National Electrification Strategy

PAYG: Pay as you go

ICUs: Intensive Care Units

ECMS: Electrical Control and Monitoring Systems

ESP: Espressif system

AC: Alternating Current

DC: Direct Current

V: Volts

I: Current

W: Watts

IDE: Integrated Development Environment

SDK: Software Development Kit

GND: Ground

PWM: Pulse Width modulation

LED: Light Emitting Diode

LCD: Liquid Crystal Display

EN: Enable

RTC: Real Time Clock

RDBMS: Rotational Database Management System

API: Application Program Interface

HTTP: Hyper Text Transfer Protocol

ACKNOWLEDGEMENT

I hereby express my sincere gratitude and thanks to the Almighty God, who has provided me with the steady health, wisdom, knowledge and guidance in our academic endeavors. I also want to extend my appreciation to the administration, staff and colleagues, who made this academic journey, a conducive one.

I also extend our sincere thanks to the Electrical Department and my supervisors for the final year project, for their time, guidance, knowledge and hospitality that they rendered to me.

My special thanks goes to the entire fraternity at Busitema University Department of Electrical Engineering for the knowledge, guidance and skills instilled or imparted to me. I also want to express our gratitude to my colleagues with whom I shared ideas and experiences; this did enable me to enrich our knowledge.

ABSTRACT

The increasing demand for electricity during peak hours in off-grid institutions, such as schools and hospitals, sometimes leads to overloading and potential disruptions. Manual methods of managing power usage are inefficient and unable to dynamically respond to fluctuations in energy availability. This project aims to design and implement a power load monitoring and control system specifically tailored for off-grid settings to optimize energy usage and ensure system reliability.

The main objective is to develop a system that continuously monitors energy consumption, assesses the stored power in batteries, and integrates control mechanisms to enhance energy efficiency. In situations where the available power from the generation sources is insufficient to meet peak demand, the system will prioritize essential loads, such as ICU units in hospitals, while selectively disconnecting non-essential loads. This dynamic adjustment will be based on real-time power availability, ensuring uninterrupted service to critical areas while minimizing energy consumption and promoting cost savings. The system will also optimize power usage during low generation periods from the off-grid power source, thereby improving overall efficiency and sustainability.

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