



FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRICAL ENGINEERING

FINAL YEAR PROJECT REPORT

**DESIGN AND PROTOTYPE OF A SOLAR POWERED VACCINE KIT FOR
OFFGRID COMMUNITIES: FOCUS ON ENERGY CONSERVATION.**

BY

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*A final year project report submitted to the Department of Electrical Engineering in partial
fulfilment of the requirements for the award of a Bachelor of Science degree in Electrical
Engineering*

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DECLARATION

I, the undersigned student of Busitema University hereby declare that this project report is the result of my original work, except where explicit acknowledgement has been made for the use of referenced materials. I further affirm that this report has not been previously submitted in whole or in part to Busitema University or any other institution for academic credit, funding or the fulfillment of any award or qualification.

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APPROVAL

This report is submitted in partial fulfilment of the requirements for the award of a Bachelor's Degree in Electrical Engineering at Busitema University, with full approval and endorsement of my project supervisors.

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TABLE OF CONTENTS

DECLARATION	ii
APPROVAL	iii
ACKNOWLEDGEMENT	iv
LIST OF FIGURES	vii
LIST OF TABLES	viii
LIST OF ACRONYMS	ix
ABSTRACT	x
CHAPTER ONE	1
1.1 Introduction	1
1.2 Background of study	1
1.3 Problem statement.....	3
1.4 Purpose of the study	4
1.5 Objectives.....	4
1.5.1 Main objective.....	4
1.5.2 Specific objectives	4
1.6 Research questions	4
1.7 Scope of the study	5
1.8 Significance of the study	5
1.9 Conceptual framework.....	5
1.9.1 System design	5
CHAPTER TWO: LITERATURE REVIEW	7
2.1 Introduction	7
2.2 Related works.....	8
2.2.1 Peltier-based refrigerators	8
2.2.2 Integrated cold storage solutions.....	9
2.2.3 DC refrigerators	9
2.2.4 Solar-assisted DC refrigerators	10
2.2.5 Miniature DC compressors	10
2.2.6 Efficiency improvements	10
2.2.7 Solar-powered refrigeration systems	11
2.2.8 Comparative study	12

CHAPTER THREE: METHODOLOGY.....	13
3.1 Introduction	13
3.2 Objective one	13
3.3 Objective two	14
3.4 Objective 3	20
CHAPTER FOUR: RESULTS AND DISCUSSION	25
4.1 Introduction	25
4.2 Objective 1	25
4.3 Objective 2	26
4.4 Objective 3	30
4.4.6 TESTS AND RESULTS	32
5 CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS	39
REFERENCES.....	41
6 APPENDICES	44

LIST OF FIGURES

Figure 1: System Design	6
Figure 2:control flow chart	6
Figure 3: Refrigeration cycle	14
Figure 4: Prototype images	15
Figure 5: Layout of the system	21
Figure 6: Layout 2	22
Figure 7: Temperature sensor	26
Figure 8: Results recorded by sensor	36
Figure 9: Graph showing how kit maintains temperature	38
Figure 10: Work plan	44
Figure 11: Budget.....	45
Figure 12: CAD diagrams	46
Figure 13: CAD diagrams 2	47
Figure 14: Equipment, instruments and work done	48
Figure 15: Prototype diagrams	49
Figure 16: Embedded code	52

LIST OF TABLES

Table 1:Types of Li-ion chemistries	18
Table 2:Temperature sensor accuracy table.....	35

LIST OF ACRONYMS

AC	Alternating Current
BMS	Battery Management System
CFD	Contract for Difference
COP	Coefficient of Performance
DC	Direct Current
GIZ	German Agency for International Cooperation
LCD	Liquid Crystal Display
LMICs	Low- or middle-income countries
MPPT	Maximum Power Point Tracking
PCM	Phase Changing Material
PQS	Performance, Quality and Safety
PV	Photovoltaic
SDG	Sustainable Development Goals
TB	Tuberculosis
TE	Thermoelectric
UNICEF	United Nations International Children's Emergency Fund
VVM	Vaccine Vial Monitors
WHO	World Health Organization
WHO PQS	World Health Organization's Performance, Quality and Safety

ABSTRACT

The goal of this project was to design and prototype a solar-powered vaccine carrier kit to address the critical challenge of maintaining the cold chain for vaccines in remote and off-grid communities. Access to reliable vaccine storage and transportation remains a critical challenge in remote and underserved communities, where electricity shortages hinder proper cold chain management. The project was aimed at developing a self-contained kit incorporating a solar panel, battery, and a temperature-controlled vaccine storage unit. The kit was to be designed to maintain the required cold chain temperature for vaccines even in remote locations with limited access to electricity. Through a combination of design, simulation, and field testing, this project evaluated the performance and reliability of the solar-powered vaccine kit, aiming to develop a cost-effective and sustainable solution for enhancing immunization coverage in underserved communities. The kit was designed for durability and ease of use, making it suitable for healthcare workers operating in off-grid locations. The objectives included creating a functional prototype of a solar powered vaccine kit, determining the energy conservation requirements for various components of the system, designing and sizing the essential components and integrating the solar and battery system with other essential components of the vaccine kit. The methodology involved requirement analysis, designing and sizing of components and system integration. The system was expected to be able to handle the load requirements and maintain the desired range of temperature for over 5 hours, monitor and give real-time status updates of the temperatures in the kit and energy conservation which included automated switching off/on and self-closing door. The project aligned with Sustainable Development Goals 3 (Good Health and Well-Being) and 7 (Affordable and Clean Energy).

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