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DEPARTEMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

OPTION OF ELECTRICAL TECHNOLOGY

FINAL YEAR PROJECT:

**TITLE: DESIGN AND IMPLEMENTATION OF SOLAR POWER
UPS**

Submitted in Partial Fulfillment of the Academic Requirements for the Award of an Advanced Diploma (A1) in Electrical Technology

Presented by:

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Lastly, thanks to all those who have contributed directly or indirectly to the success of this project.

DECLARATION

Me, **KAGAZO JONATHAN Giovani** with roll number **202150431** respectively, I hereby declare that I carried out the work presented in this report title **DESIGN AND IMPLEMENTATION OF SOLAR POWER UPS**, presented for the award of advanced diploma in Electrical Technology at **ULK POLYTECHNIC INSTITUTE** is my contribution to the best of my knowledge, no part of this report has been submitted here or elsewhere in a previous application for the award of an academic qualification

KAGAZO JONATHAN GIOVANI

Date.../.../2024

ABSTRACT

This paper presents a comprehensive approach to the design and implementation of a solar power uninterruptible power supply (UPS) system, aimed at providing reliable and sustainable power backup solutions.

And as we know, the law of conservation of energy states that energy can neither be created nor destroyed. But it can be transformed from one form to another.

The system architecture involves the integration of photovoltaic (PV) panels of 12W for solar energy capture, charge controllers for regulating the charging of batteries, battery storage of 12 V for energy storage, and an inverter for converting stored DC power into AC power for load consumption which is 220 V.

CHAPTER 1: GENERAL INTRODUCTION

1.1 Background of study

The term “solar power UPS (Uninterruptible power supply) is a system that combines solar photovoltaic (PV) technology with energy storage capabilities to provide backup power during grid outages or periods of low electricity generation.

A solar power UPS system combines two crucial technologies: typically, batteries, Solar PV panels convert sunlight into electricity through the photovoltaic effect, while batteries store this generated electricity for later use. The integration of these technologies forms a reliable power backup solution that can operate independently of the grid, making it particularly useful in remote locations or during grid outages.

1.2 Problem statement

In many regions frequent power outages, grid instabilities, and unreliable electricity supply pose significant challenges to businesses, households, and critical infrastructure.

Conventional uninterruptible power supply (UPS) systems, often reliant on fossil fuels or grid electricity, are not only susceptible to supply disruptions but also contribute to environmental degradation. To address these issues, there's a pressing need for sustainable and resilient energy solutions that can ensure uninterruptible power supply while minimizing reliance on traditional energy sources.

1.3. Research objective

1.3.1. Main objective.

Designing and implementing a solar power Ups (Uninterruptible Power Supply) of such system is to provide uninterrupted power backup using renewable energy sources like solar power.

1.3.2 Specific objectives

- To design and implement a system that will utilize solar panels to exploit renewable energy, store excess power in batteries, and ensure an uninterrupted power supply during outages.
- To integrate solar panels for energy generation, batteries for energy storage, and an intelligent inverter to manage energy flow.
- To achieve high energy efficiency, maximize battery lifespan, and ensure seamless transition during power outages.

1.4. Research questions and hypothesis

- This research seeks to explore the latest technologies and methodologies for maximizing the energy conversion from solar panels to stored battery power and subsequently to usable AC power.
- This research investigates the practical challenges and solutions for integrating solar-powered UPS systems into current electrical grids or standalone applications, ensuring uninterrupted power supply and ease of deployment.
- This research aims to identify the best practices in selecting and integrating various system components, such as PV panels, batteries, charge controllers, and inverters, to balance performance with cost considerations.

1.5. Scope and limitations

According to the national institute of Research of Rwanda advocate essays that for the adoption of solar power UPS systems for residential house installations as a sustainable solution to address energy challenges in the country. With abundant sunlight throughout the year.

Rwanda possesses significant renewable energy potential. In particular in solar photovoltaic technology. By leveraging solar power UPS systems, residential households can achieve energy independence, reduce reliance on the national grid, and mitigate the impact of frequent power outages. Additionally, solar power UPS installations align with Rwanda's commitment to sustainability and environmental conservation.

Dependency on fossil fuels: Conventional UPS systems powered by diesel generators contribute to carbon emissions, air pollution, and dependency on finite fossil fuel resources. Moreover, fluctuating fuel prices add uncertainty to operational costs.

Grid Dependency: UPS systems connected to the grid are vulnerable to grid failures and outages, undermining their reliability during critical situations such as natural disasters or infrastructure failures.

Environmental Impact: The environmental footprint of conventional UPS systems, including emissions from fuel combustion and the disposal of lead-acid batteries, poses sustainability challenges and contributes to climate change.

Cost and efficiency: Traditional UPS systems require significant upfront investments in equipment and ongoing operational expenses, including fuel procurement, maintenance, and replacements of consumables such as batteries.

1.6 Project Significance

One could ask, why research and implementation of a Solar Power UPS instead of buying ready-made one?

My answer is simply my motivation to contribute to the emergence of a strong technological industry in my continent.

Being able to conceive and manufacture Solar power UPS is a solid step in the emancipation of our people especially as Africa is still lagging and is still relying heavily on imports of crucial technologies.

1.7 Organization of the study

According to my topic chosen I prefer to conduct my research of final year project design and implementation solar power UPS with 4 chapters.