FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRICAL ENGINEERING

MPPT SOLAR CHARGE CONTROLLER WITH AUTOMATIC DC LOAD MANAGEMENT FOR STANDALONE SOLAR SYSTEMS.

FINAL YEAR PROJECT REPORT

BY;

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A final year project report submitted to the Department of Electrical Engineering in Partial Fulfillment of the Requirements for the Award of a Bachelor's Degree in Electrical Engineering of Busitema University.

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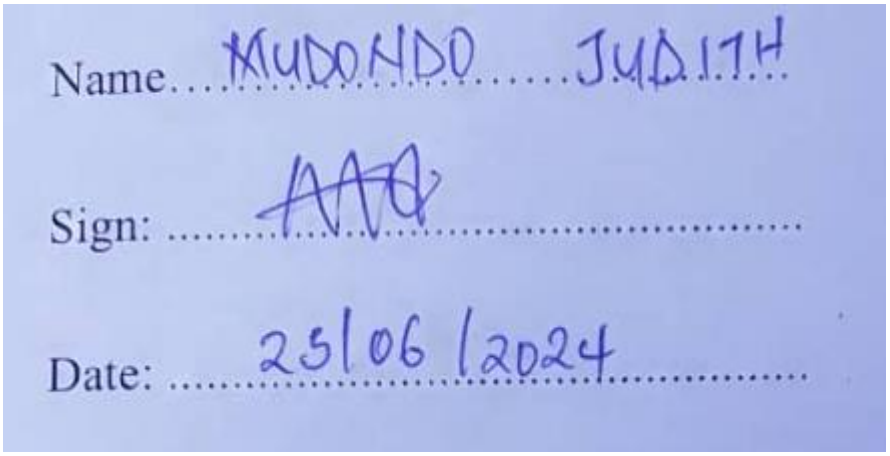
DECLARATION

I hereby declare that I carried out the work documented in this report in the Department of Electrical Engineering, Busitema University, under the supervision of Madam Lucy Nabwire and Dr Godfrey Kibalya. I solemnly declare that to the best of my knowledge; no part of this report has been submitted here or elsewhere for award of a degree. All sources of knowledge used have been duly acknowledged.



APPROVAL

I affirm that this project report, authored by MUDONDO JUDITH with Registration Number BU/UP/2020/2692, has been developed under the supervision and guidance of university advisors. It is now prepared for submission to the Department of Electrical Engineering.

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LIST OF ACRONYMS

EAGLE:	Easily Applicable Graphical Layout Editor
IncCond:	Incremental Conductance
LCD:	Liquid Crystal Display.
MPPT:	Maximum Power Point Tracking
P&O:	Perturb and Observe
SCC:	Solar Charge Controller
SDM:	Single Diode Model

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ABSTRACT

This paper presents the design and prototype of maximum power point tracking (MPPT) solar charge controller with automatic DC load control to continuously track and operate the system at maximum power from a solar panel using a DC-DC buck converter and an Arduino Nano microcontroller. The automatic DC load control involves selectively controlling the categorised loads depending on the system voltage of a 12V 7AH sealed rechargeable solar deep cycle battery using digital signals used to switch on/off the transistors and drive the load MOSFETs. The MPPT algorithm has been implemented using an Arduino Nano with the Perturb and Observe technique. To validate the proposed system, both simulation and hardware implementation are carried out in Proteus environments and laboratory set up, respectively. Protective measures against reverse polarity, under/over battery charge/discharge, short-circuit, and open circuit has been implemented using 10A fuses, IRFZ44N MOSFET, P6KE36CA diodes; both on input and output of the system. The proposed MPPT-SCC can handle the maximum current of 10A at 12V voltage.

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CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND

Rapid changes in energy sources are underway all over the globe. Exponentially growing energy demand, environmental concerns and calls for green technologies are driving this transition between fossil fuels and renewables. Renewable energy generation is expected to deliver additional 50% of total demand over the next two decades, with an existing growth rate of 2.5% per year, while fossil fuels could still provide almost 80% of overall energy needs by 2040. This gives an indication of great interest and potential of renewables as future energy demand. Solar energy is one of the top three most powerful types of renewable energy sources in terms of potential renewable energy sources, including solar electricity, wind power, Bioenergy, hydro Electricity, Geothermal Energies etc. Solar energy plays an important role as a primary source of energy, especially for rural areas. The worldwide rising level of pollution has formed a threatening situation due to our enormous reliance on traditional energy sources. The expanding demand for electricity cannot be fulfilled by conventional energy sources, so it's time to use renewable energy sources for the generation of electrical energy. Solar energy is one of the good alternatives to fossil fuel energy[1].

Among the different renewable energy resources solar energy is in the lead. This is due to the wide range of the energy supply from solar energy from a few watts to several megawatts. Solar energy is plentiful; it has the greatest availability compared to other energy sources. The amount of energy supplied to the earth in one day by the sun is sufficient to power the total energy needs of the earth for one year[2].

There are two types of solar energy utilization technologies, namely thermal solar energy and photovoltaic solar energy. Photovoltaic solar energy technology is a technology of utilizing solar energy by converting that energy into an electric current by using a semiconductor device called a solar cell[3]. Photovoltaic electricity generation offers the benefits of clean, nonpolluting energy generation, production of energy close to the consumer, very little or no maintenance requirement, and of having a very long lifetime[4][2]. However, PV power is still considered to be expensive, and the cost reduction of PV systems is subject to extensive research. From the point of view of power electronics, this goal can be approached by maximizing the energy output of a given PV array[5]. This energy with the help of an inverter is given to the load as supplement energy. There are different standards for energy storage from the solar panel. This is decided by the energy that is supplied by the backup. The standards

are the future recommendations and proposals for this research to be a flawless success.

- Can design and advanced Buck Boost converter to enable it charge multiple batteries of different voltages
- Embedding GSM in case of failure in automation for effectiveness in battery protection.

6.5 Conclusion

The developed system of MPPT solar charge controller consists of P&O algorithm with a buck converter and it was validated through simulation and experimental results and system can charge the battery in health mode without overcharging and over discharging under four different modes i.e on, off, bulk, float while displaying on LCD. The entire system was simulated in Proteus Design Suite.

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