WEARABLE SOLAR CHARGER

Yusuf KARABULUT-21828605, Ahmet Selim BAŞOK-21828217

Project Supervisor
Prof.Dr. Işık ÇADIRCI
Electrical and Electronics Engineering, Hacettepe University

Introduction

In this project, current and high voltage are obtained by using solar panels. This high voltage is reduced to the level that will power an electronic device by using a buck converter. Within the scope of this project, the power and current supplied to the device are displayed on the OLED screen.

Specification and Design Requirements

- 15-watt power support
- Voltage supports up to 50 Volts thanks to the solar panels on the clothing.
- Buck converter that allows 60 volts to drop to 30 volts.
- Load voltage can be adjusted with the 50K ohm Trimpot on the buck converter.
- Current measurement of load thanks to ACS712 module.

Display of the power and current supplied to the device to the user using the OLED screen and STM32F401RE.

Solution Methodology

In this project, a buck converter that can reduce 60 volts to the desired voltage level was designed. PCB design was made for the buck converter and STM32F4 system. 6 solar panels were used to obtain a power of 15 watts. The 50 volts obtained from the solar panels were reduced to 15 volts through the buck converter. Thus, the necessary energy was supplied to the QC3.0 fast charging module. The current delivered to the device was measured by the ACS712 module connected serially to the QC3.0 module. The power and current values were displayed to the user on the OLED screen using STM32F401RE.

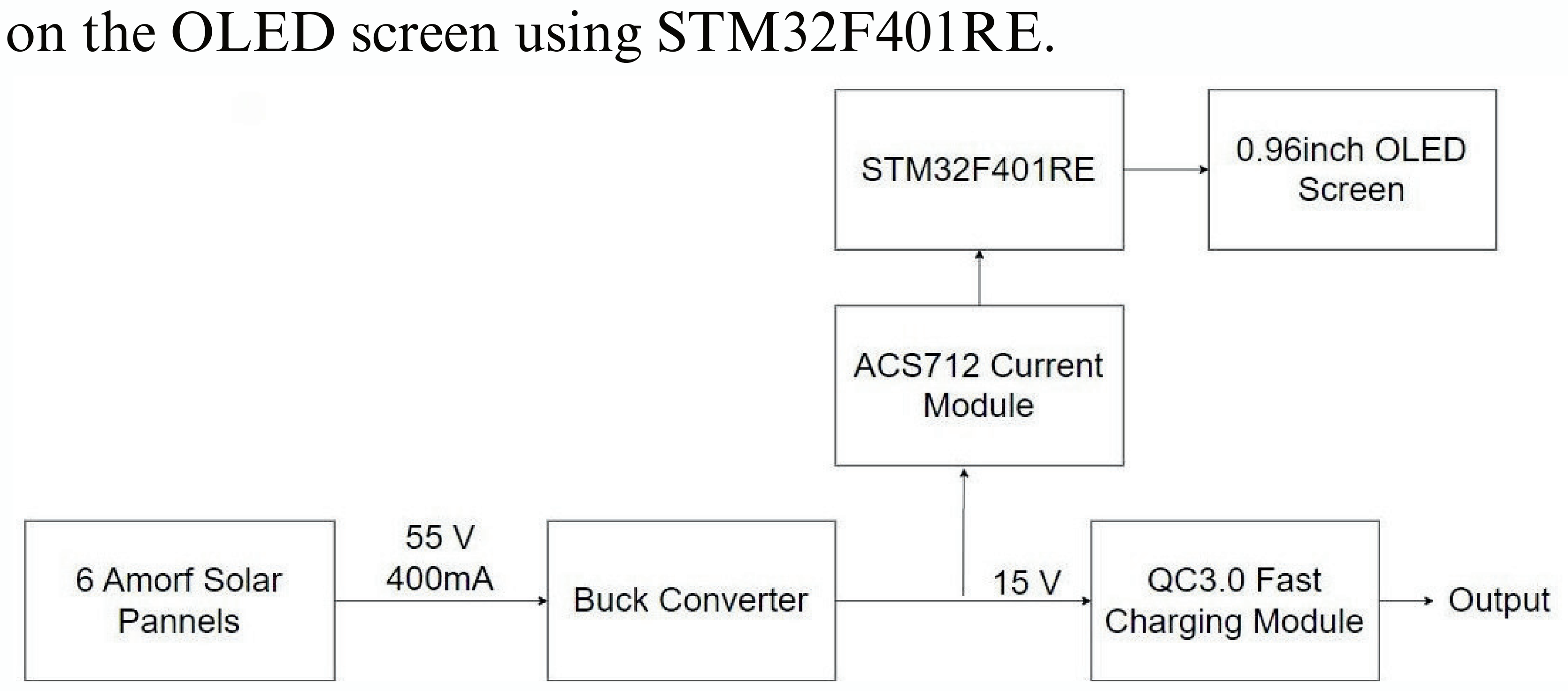

Figure 1. Schematic view of the block diagram

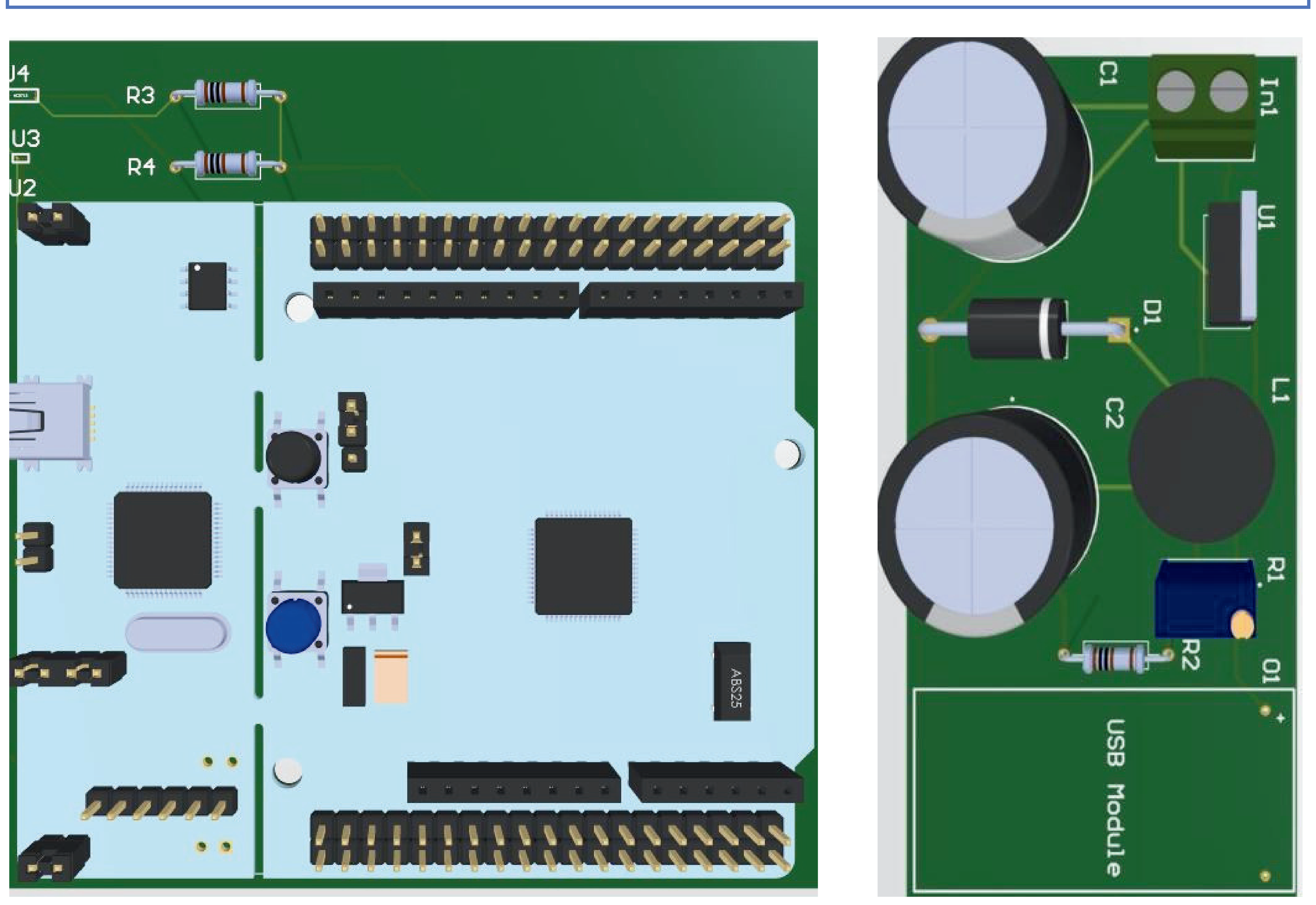

Figure 2. Overview of PCB design for STM32 and buck convertor

Application Areas

Wearable solar energy provides the energy that people need in daily life naturally, without polluting the environment. This project can be used in various areas thanks to its basic design. The high voltage obtained from solar panels is reduced to the desired voltage through the designed buck converter. In this way, it can provide benefits in various energy-requiring sectors such as Military, construction, forestry and transportation.

Results and discussion

The solar panels employed in our project demonstrated an acceptable performance by consistently supplying the required power to our circuit. In cloudy weather condition testing, we observed that even under varying environmental conditions, the solar panels reliably met the energy demands of the system, ensuring uninterrupted functionality.

Our implementation of the buck converter indicated that it is highly efficient in catering to the user's voltage requirements. With precision and reliability, it effectively reduced 60 volts to levels compatible with the circuit's specifications. It can be said that this capability enhances the adaptability and versatility of our system, accommodating diverse operational scenarios with ease.

Integrating the STM32F4 microcontroller into our design facilitated real-time monitoring of power and current parameters. Leveraging the capabilities of the STM32F4, we achieved accurate measurement and display of these significant metrics to the user interface. Our system maintained an acceptable error margin of 5%, ensuring the user receives reliable data for informed decision-making.

The design of PCBs represents a key aspect of our project's success in terms of easy transportation and integration into various power sources. These advantages ensure durability and resilience, essential for deployment in diverse environments.

With the performance of solar panels, buck converter operation, precise monitoring via STM32F4, and the versatility of PCB design, we achieved our project objectives successfully.

In conclusion, our project indicated that a robust and adaptable power supply system that develops under various environmental conditions and user demands.

Acknowledgements

This project was completed within the context of ELE401-401 Graduation Project courses in Hacettepe University, Faculty of Engineering, Department of Electrical and Electronics Engineering. We special thank Prof.Dr. Işık Çadırcı for their invaluable contributions to our project.

References

[1]. Riskiono, S. D., Oktaviani, L., Sari, F. M. (2021). Implementation of the School Solar Panel System to Support the Availability of Electricity Supply at SDN 4 Mesuji Timur. IJISCS (International Journal of Information System and Computer Science), 5(1), 34-41.

[2]. Endo, H., Yamashita, T., & Sugiura, T. (1992, June). A high-power-factor buck converter. In PESC'92 Record. 23rd Annual IEEE Power Electronics Specialists Conference (pp. 1071-1076). IEEE.

[3]. Ahmad, M., Khan, F. A., Rahman, S., & Rahman, S. (2016). Development of a Digital Multimeter: A Low-Cost Design Approach. International Journal of Engineering and Management Research (IJEMR), 6(2), 273-279.