A HIGH EFFICIENCY BIDIRECTIONAL BUCK BOOST CONVERTER FOR PHOTOVOLTAIC AND ENERGY STORAGE SYSTEMS

OBJECTIVE

Battery energy storage is most promising technology and it assures the dispatch able energy and we can integrate it with most of the renewable energy sources. This technology can provide spinning reserves, load level balancing, tackling of overload problems and voltage support and it can provide most efficient use of available resources with maximum achievable efficiency and assures the quality of power. In this project battery storage and bidirectional converter is proposed.

ABSTRACT

With the increase in demand for generating power using renewable energy sources, energy storage and interfacing the energy storage device with the load has become a major challenge. Energy storage using batteries is most suitable for the renewable energy sources like solar, wind etc. A bi- directional Buck Boost Converter provides the required bidirectional power flow for battery charging and discharging. The duty cycle of the converter controls charging and discharging based on the state of charge of the battery and direction of the current. In this project, a non isolated bidirectional Buck Boost Converter is designed and simulated for energy storage in battery and interfacing it with the load.

METHODOLGY

The project “A High Efficiency Bidirectional Buck Boost Converter for Photo Voltaic and Energy Storage Systems” using PIC16F872 microcontroller is exclusive project that can continuously provide the DC power for battery charging applications with the help of bidirectional Buck Boost Converter.

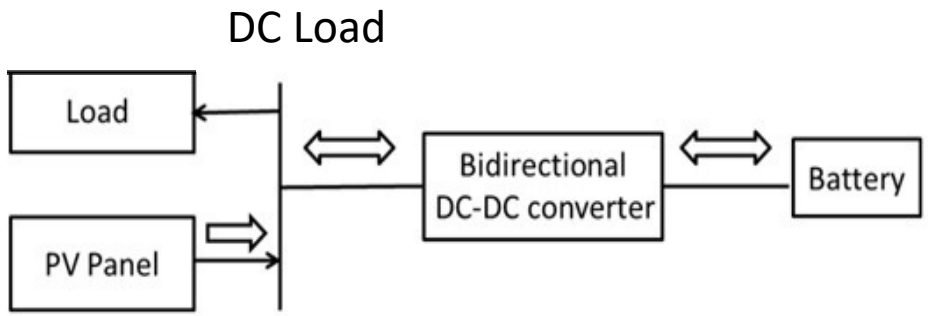
The power extracted from solar panel during the daytime is used to charge the batteries through the Buck Boost Converter operating in buck mode and when solar power is unavailable, the battery discharges to supply power to DC load through the converter operating in boost mode.

EXISTING SYSTEM

The bidirectional simple power conversion converter system with low input battery voltage for the proposed converter, only one power processing stage is needed to perform bidirectional power flow control and meet common interface standards. The current input and output of the folded network represents the power flow and the transmitted power level. It also includes power quality on the grid side.

Therefore, controlling the input and output of the folded grid current can lead to the feasibility of the proposed converter for individual power conversion.

PROPOSED SYSTEM



Connection of Bidirectional Buck Boost Converter with Load and PV Panel

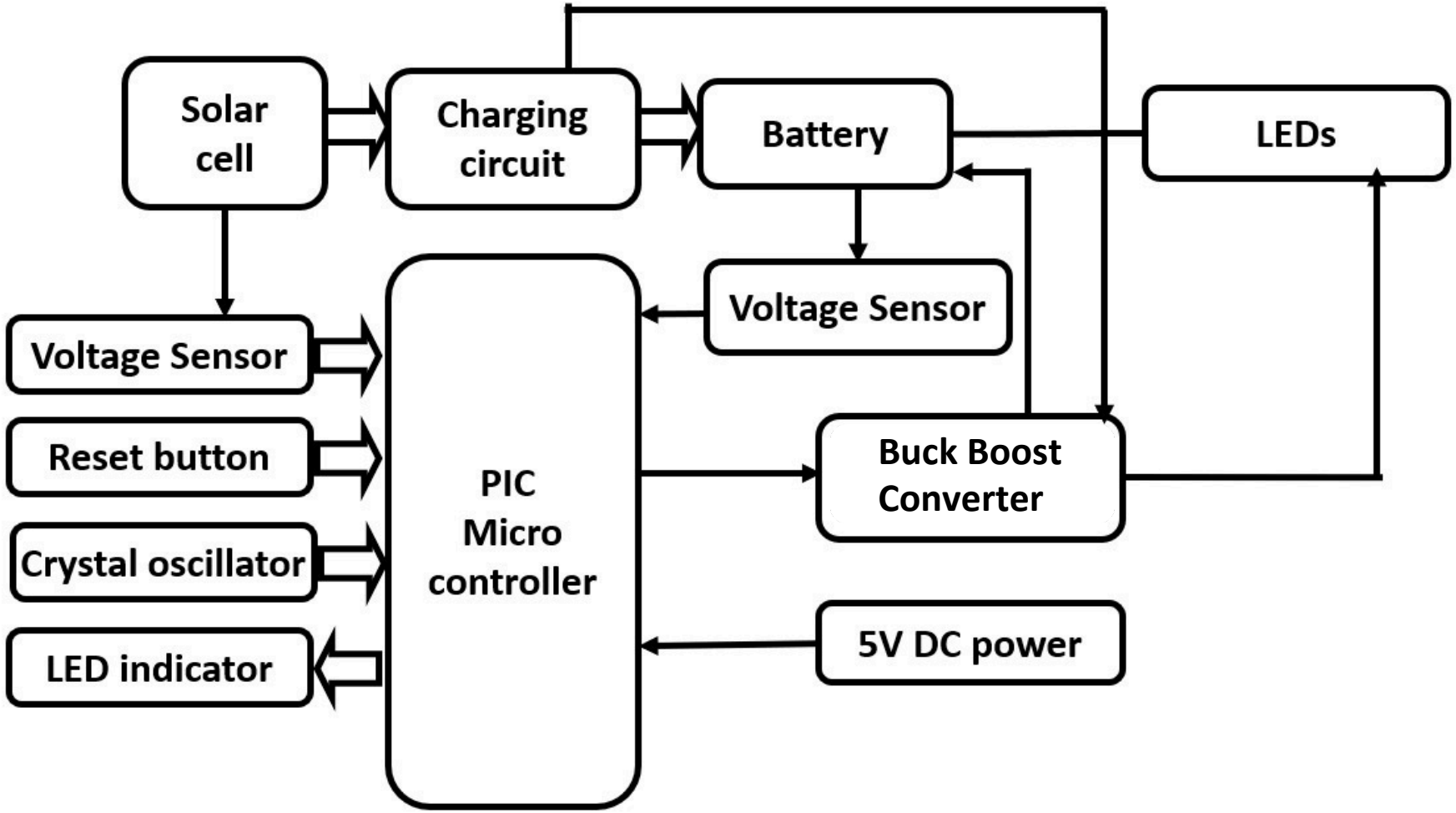
The converters can provide high step-up and step- down voltage. The basic configuration of power system The PV panel supplies power to DC load. The bidirectional converter operates in two modes; in the presence of DC load the battery is being charged, and in the absence of the DC grid, the battery supplies power to the load. It provides the required bidirectional power flow for battery charging and discharging using

COMPONENTS

HARDWARE

1. Solar panel
2. Bidirectional Buck Boost Converter
3. PIC microcontroller
4. Voltage sensors (voltage divider)
5. 12V rechargeable battery
6. LED
7. Crystal oscillator
8. Reset button

BLOCK DIAGRAM

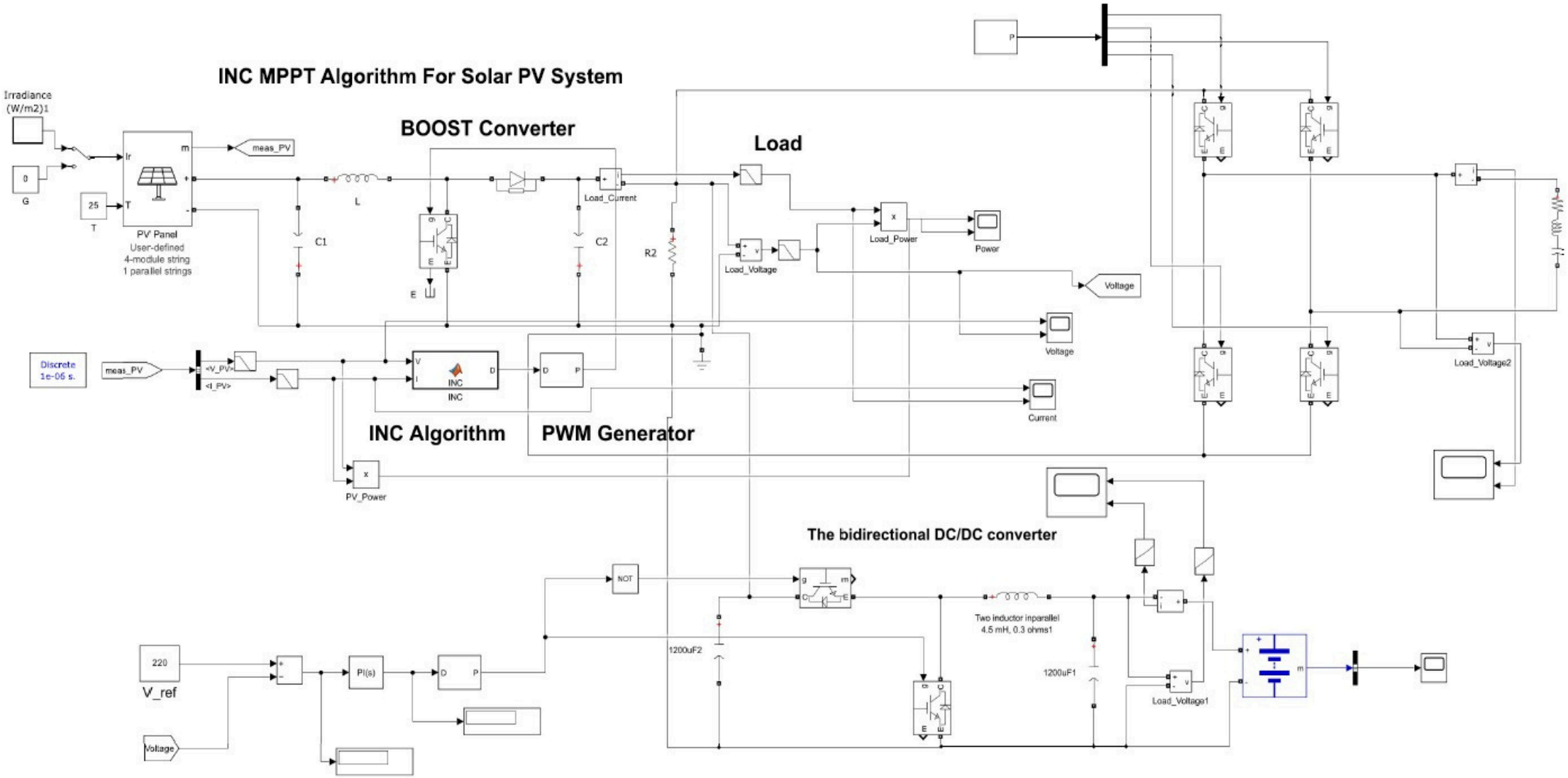


WORKING

In this solar panel and battery is connected to the microcontroller through voltage divider circuits to measure the voltage.

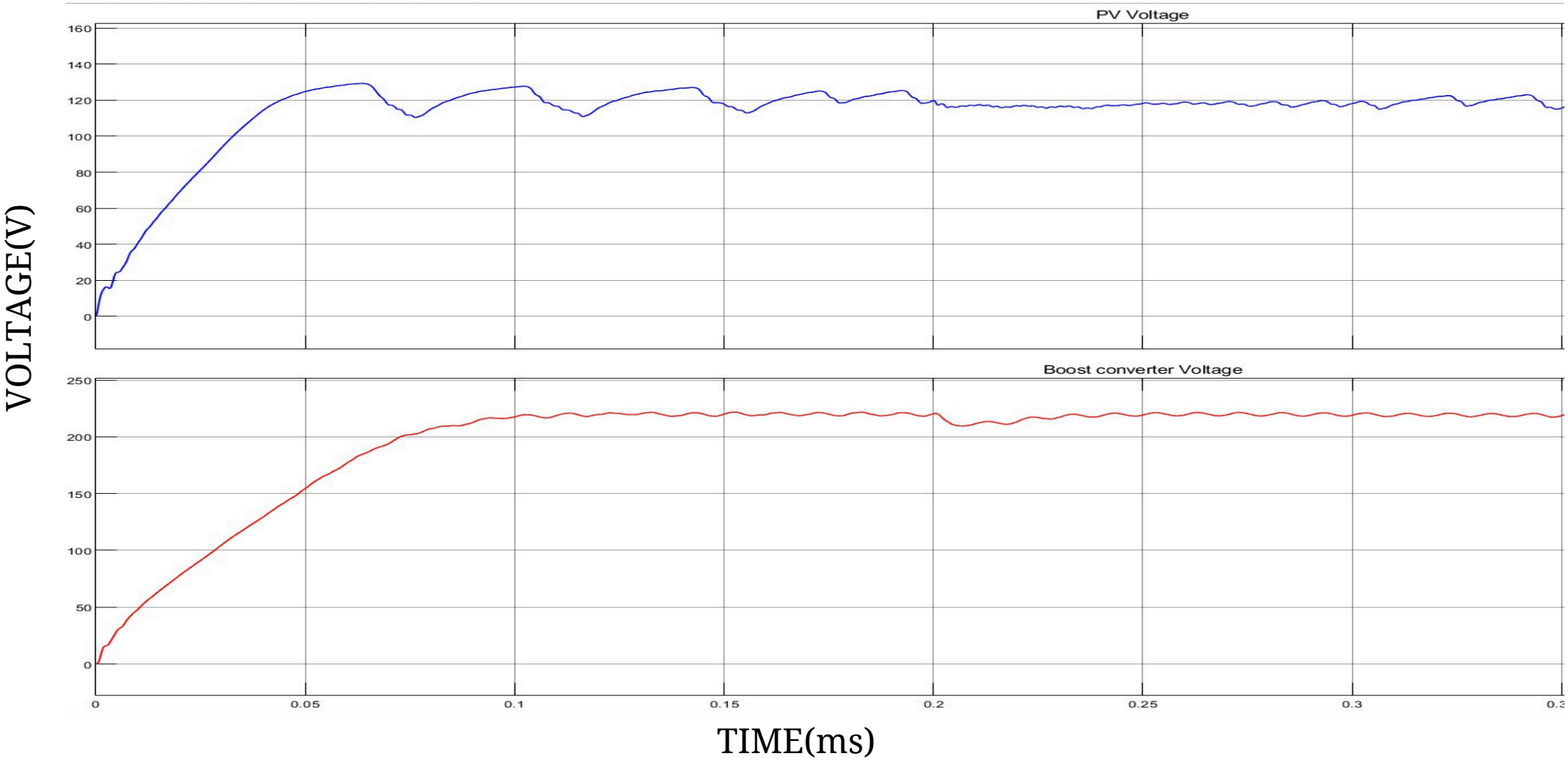
The PV panel supplies power to Load. The bidirectional converter operates in two modes; in the presence of load, the battery is being charged, and in the absence of the DC grid, the battery supplies power to the load.

SIMULATION CIRCUIT DIAGRAM

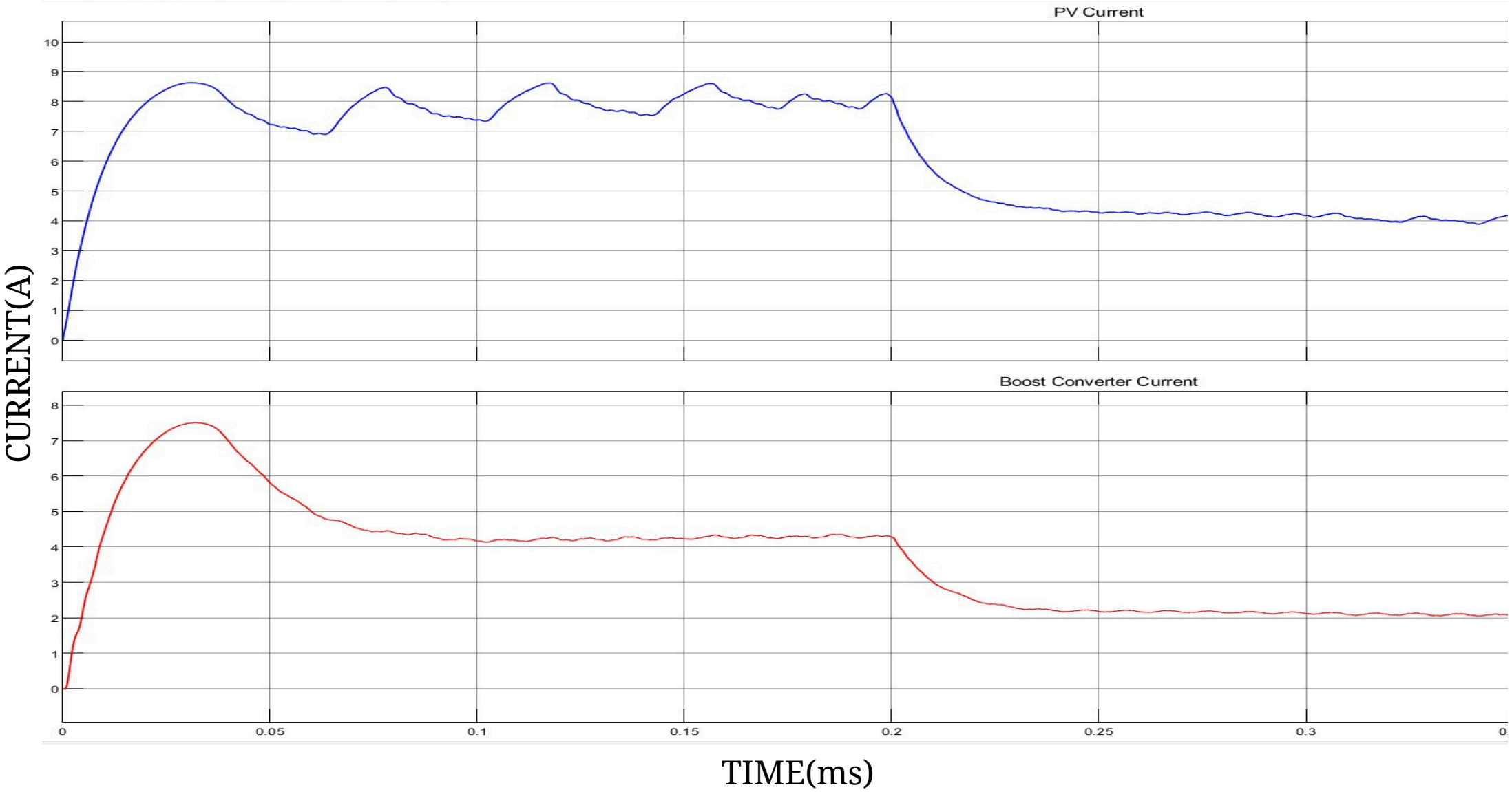


OUTPUT WAVEFORMS

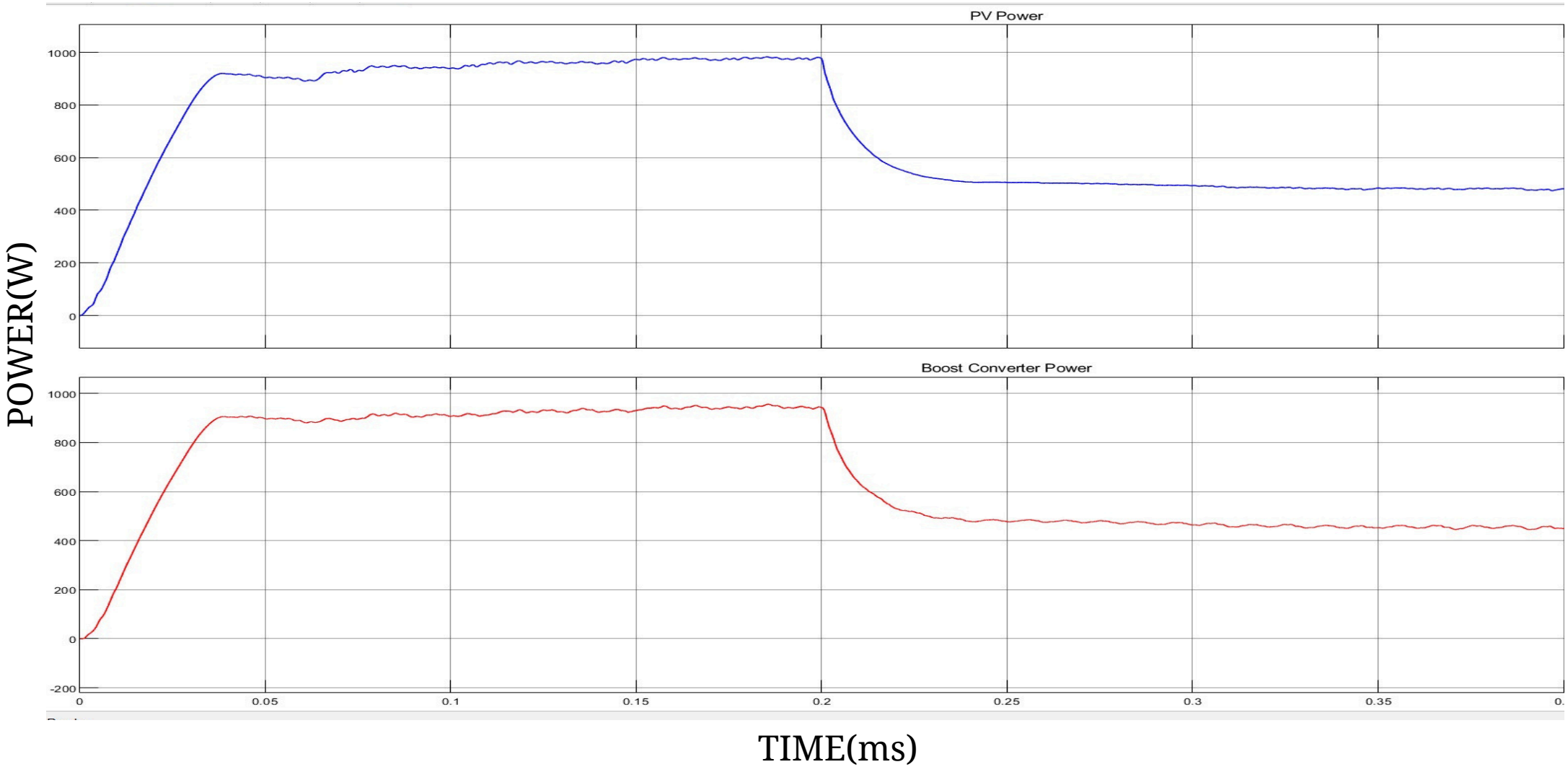
PV VOLTAGE & BOOST CONVERTER VOLTAGE



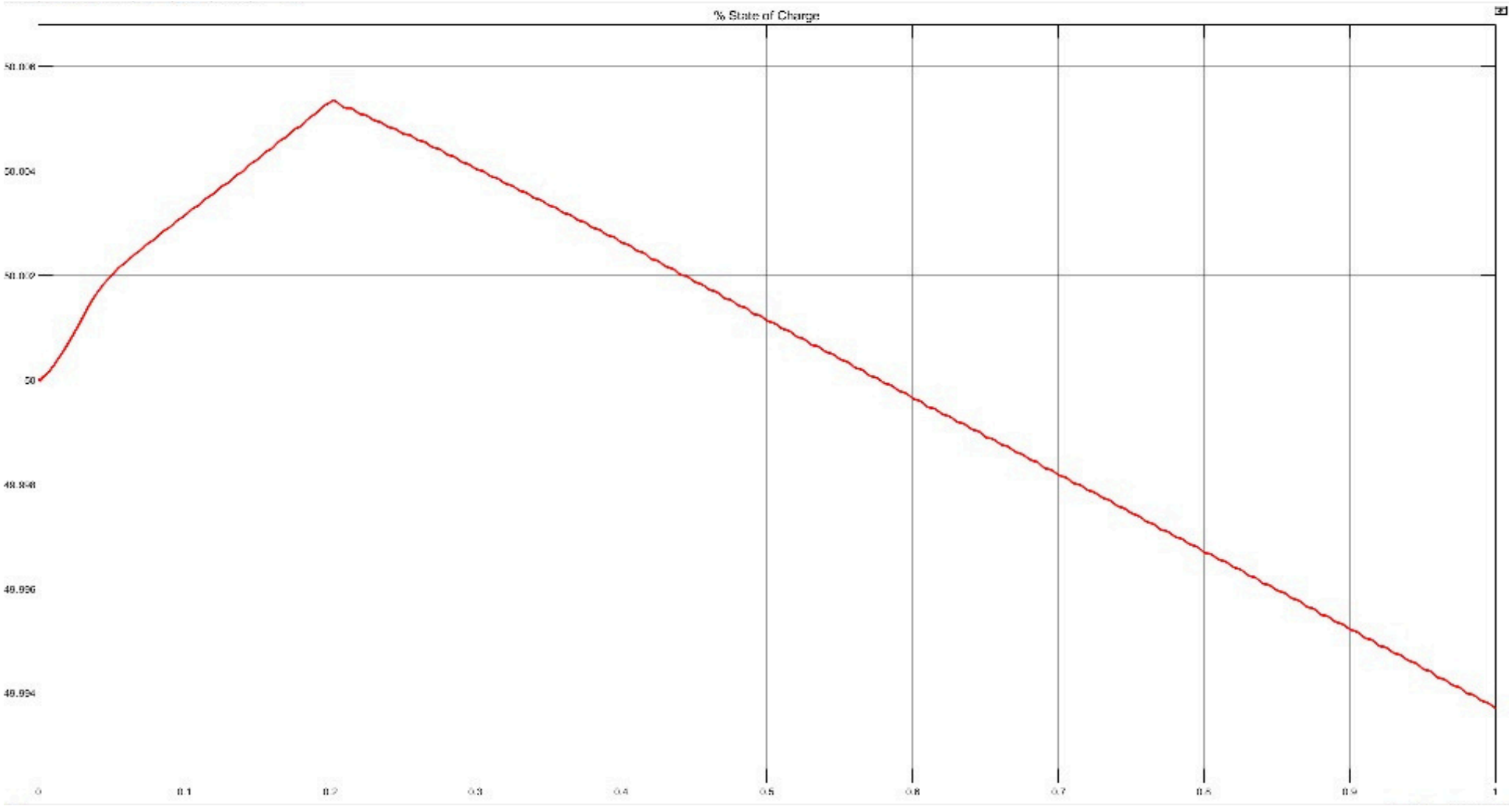
PV CURRENT & BOOST CONVERTER CURRENT



PV POWER & BOOST CONVERTER POWER



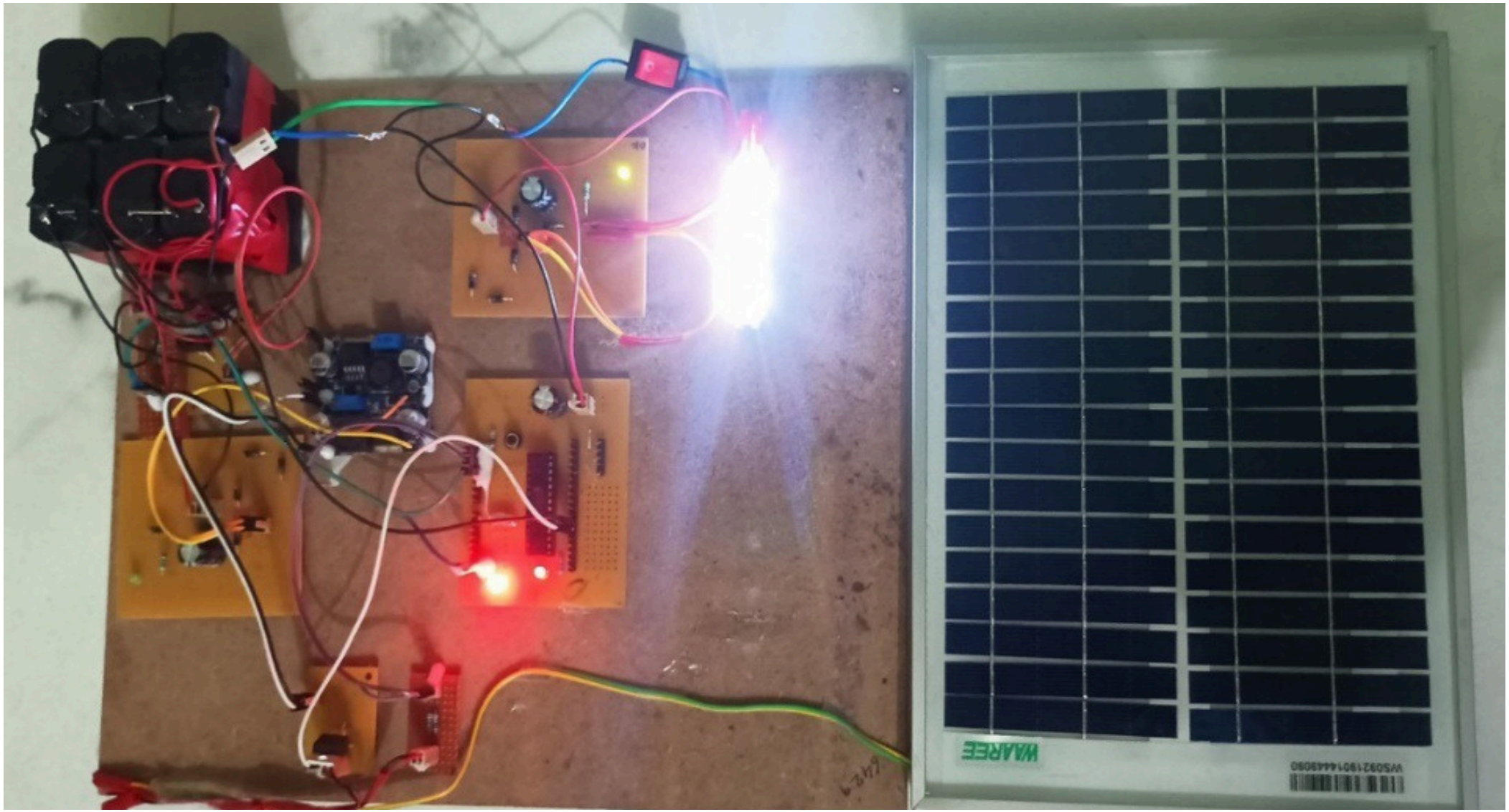
STATE OF CHARGE



VOLTAGE(V)

TIME(ms)

HARDWARE RESULTS



The reduced output current ripple enabled lower output voltage ripple and higher power conversion efficiency compared to the conventional converter. The efficiency of a Buck Boost Converter can vary depending on the specific design and components used. Generally, the efficiency can range from 80-95%, with new and more advanced designs achieving higher efficiencies.

The Project “A High Efficiency Bidirectional Buck Boost Converter for Photo Voltaic and Energy Storage Systems” was designed a bidirectional Buck Boost Converter for battery charging and discharging mode.

ADVANTAGES

- This system provides the bidirectional power flow.
- Highly efficient and user friendly design.
- Easy to operate.
- Low power consumption.
- Low cost.
- Using renewable Solar energy for battery charging.

CONCLUSION

Solar photovoltaic system with storage devices like battery can solve the present energy crisis. The power output from a solar panel can be fed to the DC load and/or can be stored in batteries for later use. In this project, a bidirectional Buck Boost Converter is designed and simulated to facilitate the energy storage at low voltage. For the grid voltage of 24 V and battery voltage of 12 V, the bidirectional converter is simulated for boost mode and buck mode. The topology provides bidirectional power flow from load to battery. The circuit structure of a bidirectional converter for a residential energy storage system is proposed.

FUTURE SCOPE

Maximum Power Point Tracking (MPPT) is a technique that grid-tie inverters, solar battery chargers and similar devices use to get the maximum possible power from one or more photovoltaic devices. Typically solar panels, through optical power transmission systems can benefit from similar technology.

Also the project can be extended by adding IOT technology and it can be applied to a transformer less grids connected photovoltaic (PV) and fuel cell power conditioning system in future applications.

The system can be used to control only DC appliances. So we can extending with inverter design which can even control the AC appliances

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Thank
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