IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

ELECTRIC VEHICLE CHARGING SYSTEM WITH HYBRID ENERGY STORAGE SYSTEM FED FROM SOLAR STATION

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Abstract: This paper presents about the efficient range of power supply and it is highly reliable for an Electric Vehicle charging system. Battery, Solar PV source, Super capacitor plays a vital role for this extended power supply. Main source of power is battery, and is connected with super capacitor during transient phase like overloading and starting. To charge the Hybrid Electric Vehicle, the Hybrid Energy Storage System(HESS) along with super capacitor and battery is widely used for improving the charging and discharging characteristics of the battery, thus increases the instantaneous output power. For the purpose of reducing the energy loss of the Battery Super Capacitor Hybrid Energy Storage System, the bidirectional DC/DC converter with the soft switching technology is mandatory. Initially, the power received from the PV array is utilized to charge the super capacitor as well as battery. when the PV could not supply enough power to charge the EV, then the power from the battery and super capacitor can be utilized. System performance is also compared with and without using super capacitor with the help of MATLAB software.

***Index Terms* – Solar PV source, Battery, LED, Super Capacitor, Bidirectional DC/DC converter.**

Introduction

Air pollution is one of the dangerous consequences of conventional automobiles which use fossil fuels such as petrol, Diesel. Heavy traffic due to rapid urbanization, pollution becomes worse. To get pollution free environment, increasing the usage of renewable resources in vehicle system is advisable. More use of Electric Vehicle in automobile sector with pollution free emission will reduced the consumption of fossil fuels and preserving the environment. In the last few years there has been considerable interest in Electric Vehicles (EVs) and Hybrid Electric Vehicle (HEV), which could play a major role in reducing Greenhouse Gas emissions from the various transportations, and so have potential as a future alternative to internal combustion vehicle. Nowadays, to compete with gas stations, rate of charging the batteries should be as fast as possible. Renewable energy sources such as wind and solar are most available resources but due to the intermittency of the power available from these sources, Hybrid Energy Storage System is used. Hybrid Energy Storage System comprises of battery and super capacitor to increase the charging as well as discharging rate of the battery which leads to extend the life of battery. It presented interaction of solar panel and battery in such a way it can be continuously charged from solar system. This configuration represents the solar system impracticable and tends to ineffective operation. Hybridization of battery and super capacitor has been investigated. It presents an operation of photovoltaic panel - battery – super capacitor hybrid system in electric vehicles. Method for Bidirectional DC/DC converter is represented so that discharging current of battery should be with in limitation. Transients, charging, discharging mode of Super capacitor has been studied. In modified construction of an present electric vehicle, will give efficient performance along with super capacitor and battery combination. The Super capacitor are used to supply the high current required during starting and overloading, and helps in increasing the state of charge of battery. This project consists of six sections. The first section consists of proposed methodology and second section consists of Block diagram. The third section describes about the circuit topology. The fourth section gives the detailed description about simulation using MATLAB and section five gives the simulation results. section six represents conclusion and results.

I. PROPOSED METHODOLOGY

Hybrid Energy Storage System (HESS) comprised of battery and super capacitor which is connected via Bidirectional DC/DC converter. The internal energy loss of BSHESS is reduced by the efficient BDC. The most harnessed Renewable energy sources are wind and solar energy. The battery and Super capacitor is initially charged with the help of pv sources. The dc load is run through the charge of battery. The dc load uses the energy through solar pv, while battery charges goes down. When both the battery and the pv is not available Super capacitor is utilized. At the time we can charge the battery by discharging the super capacitor.

II. BLOCK DIAGRAM

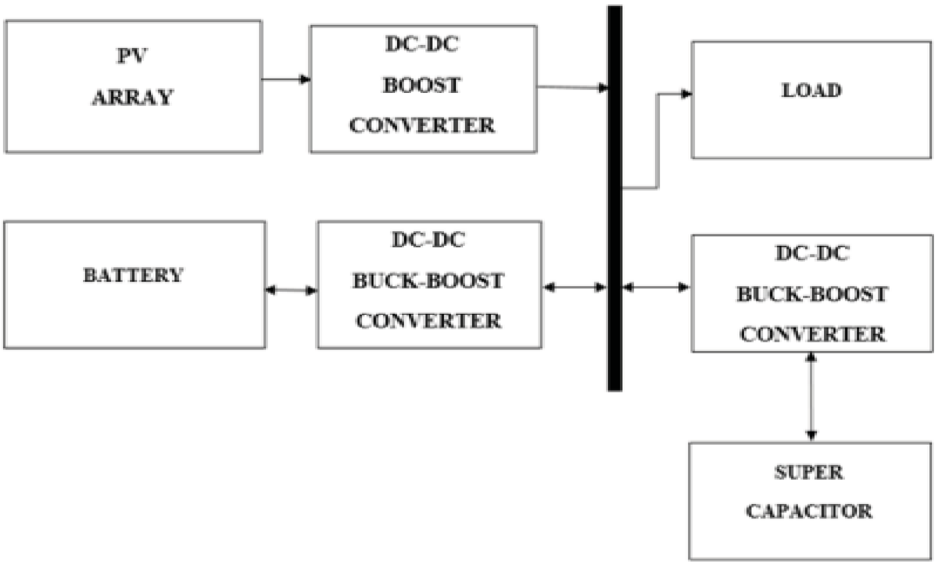
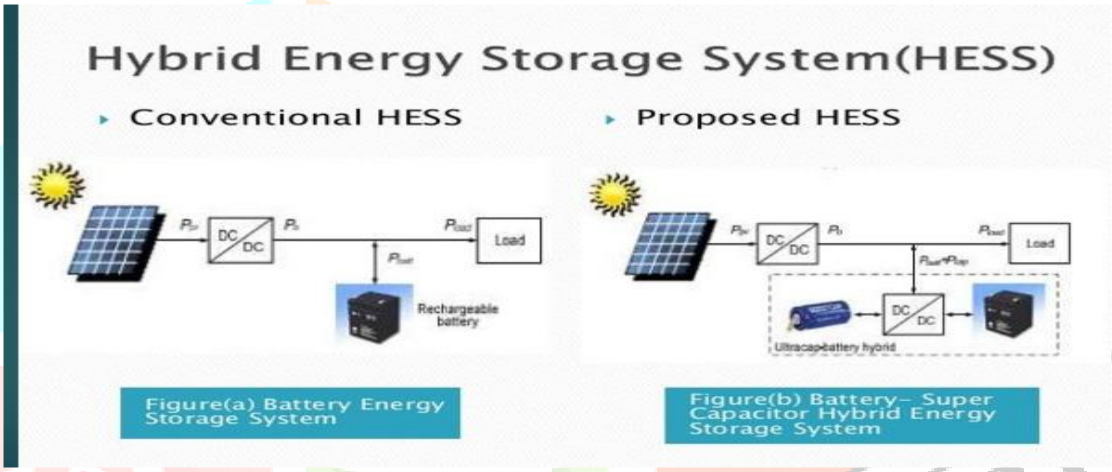


Fig.1 Block diagram of Proposed method

III. CIRCUIT TOPOLGY



IV. TYPES OF CHARGING SYSTEM

- Level 1 charging uses the same 120-volt current found in standard household outlets and can be performed using the power cord and equipment that most EVs come with.
- Making this type of charging available on your business property is as simple as installing dedicated 120 volt outlets in your company parking lot.
- Level 2 charging uses 240-volt power to enable faster regeneration of an EV's battery system. Providing this type of charging requires installation of an EVSE unit and electrical wiring capable of handling higher voltage power.
- Plug-in America's Plug Star tools offer a listing of Level 2 EVSE currently on the market. Many utilities are offering free level 2 charging equipment and/or incentives with an electric car purchase. Visit our incentives page to learn more.
- DC fast charging provides compatible vehicles with an 80% charge in 30-60 minutes by converting high voltage AC power to DC power for direct storage in EV batteries.
- Automakers currently use the same Society of Automotive Engineers (SAE) J-1772 plug for level 1 and 2 charging, with the exception of Tesla which has an adapter.
- For DC fast charging there are three plug types used by different automakers: the CHAdeMO, SAE Combined Charging System (Combo/CCS), and Tesla Supercharger.
- Nissan and Mitsubishi vehicles use CHAdeMO while current and upcoming vehicles from US and European manufacturers have SAE CCS ports
- . Tesla's Supercharger equipment is only compatible with Tesla vehicles, although they offer an adapter which allows Tesla owners to use CHAdeMO equipment.

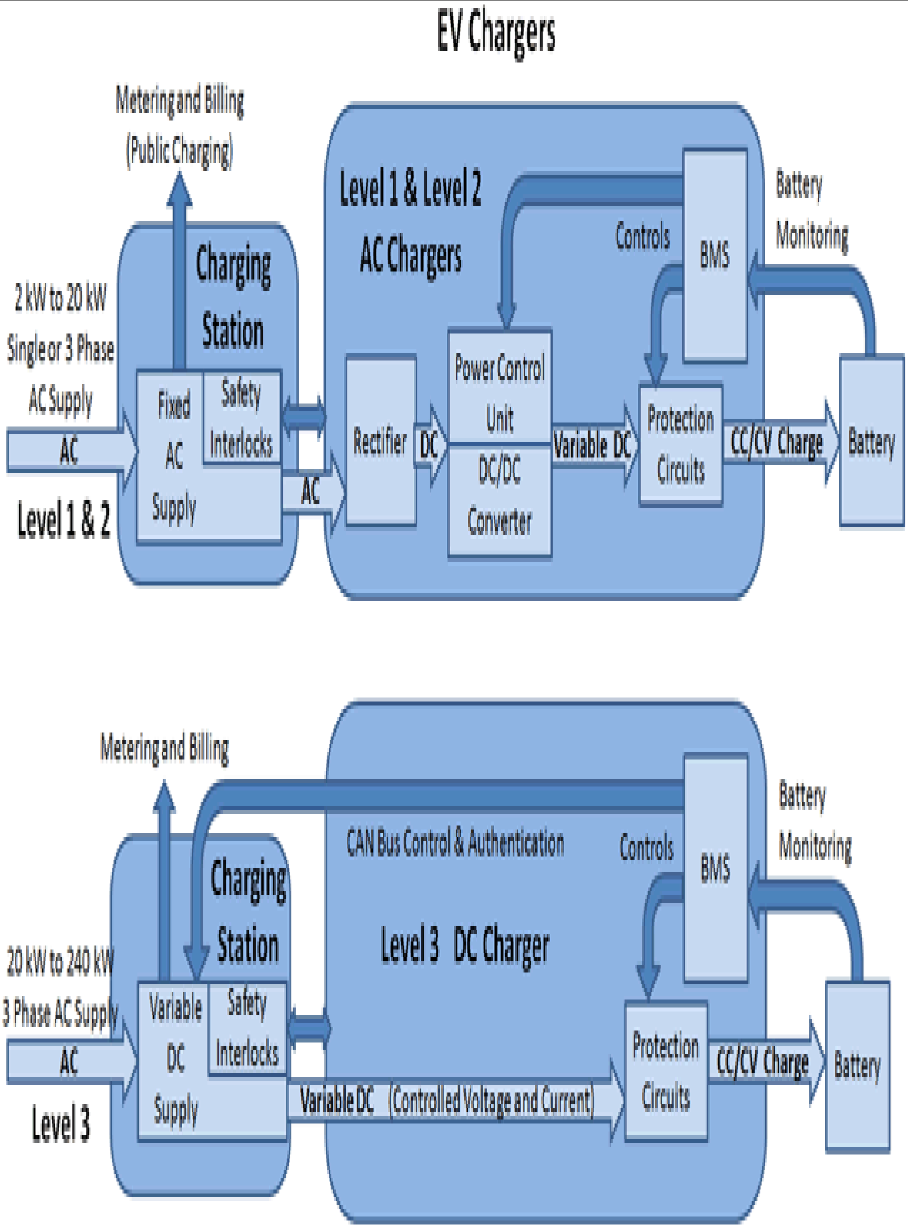


Fig. 2 Levels of charging.

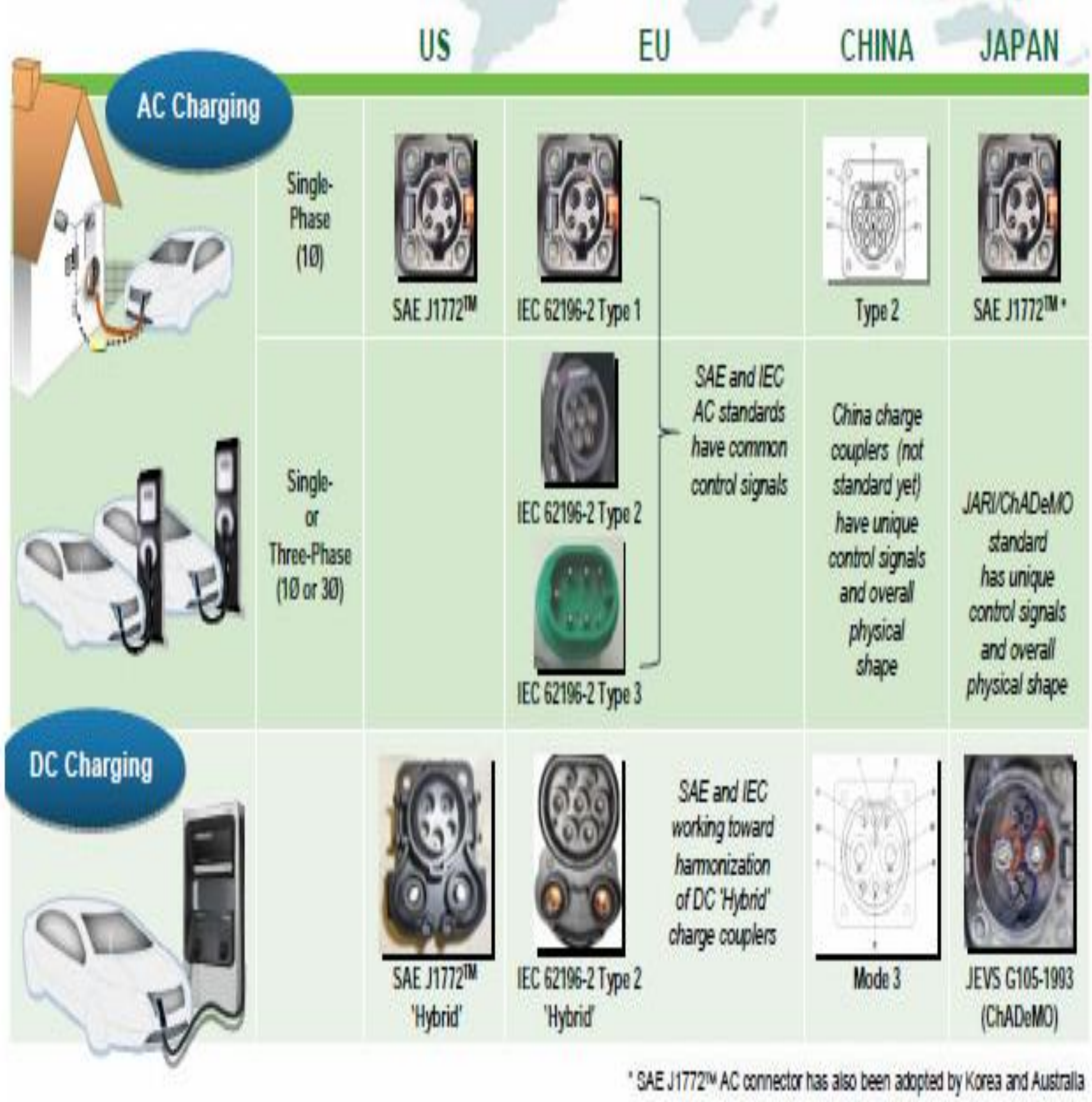


Fig. 3 The chart below shows a summary of couplers available for Level 2 and Level 3 charging

V. HARDWARE PARAMETERS

Table 1. Commonly used parameters:

Diode	IN4001
Transformer	230/12 ac volts

Table 2. Solar panel parameters:

Power	5 W
Maximum volt Vmax	12 v
Max current	0.52 A
open ckt voltage (Voc)	21.6v
Short ckt current (Isc)	0.791A

Table. 3 Power Circuit parameters:

Input capacitor	500v/1000uf
Output capacitor	500v/1000uf
Inductor	50mH
MOSFET	IRF840/500v
Load resistor	1000ohm
Battery	12 v

Table 4. MOTOR PARAMETER:

Motor used	BLDC motor
Voltage	12 v
Current	0.5 A
Power	100 W
Speed	1000 RPM

Table1, 2, 3, 4 shows the parameters of the hardware components used in the system.

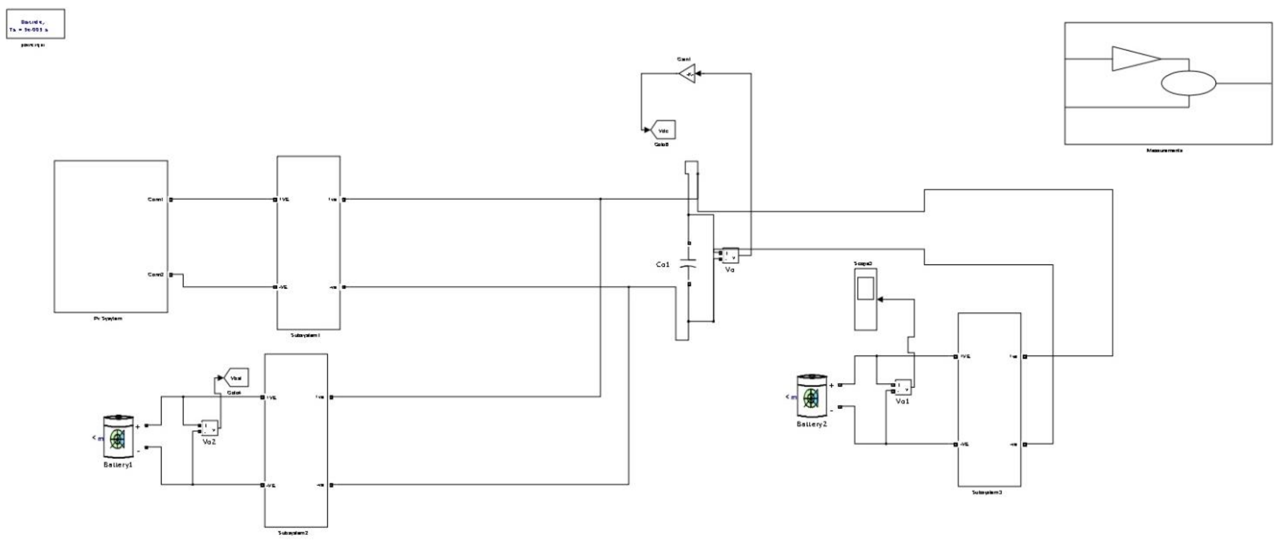
VI. MATLAB AND SIMULINK

Matlab is a high-performance language for technical computing. The name mat lab stands for matrix laboratory. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Typical uses include Math and computation Algorithm Development Data Acquisition Modeling, simulation, and prototyping Data analysis, exploration, and visualization Scientific and engineering graphics Application development, including graphical user interface building.

MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. This allows you to solve many technical computing problems, especially those with matrix and vector formulations, in a fraction of the time it would take to write a program in a scalar no interactive language such as C or FORTRAN.

Simulink is a graphical extension to MATLAB for modeling and simulation of systems. In Simulink, systems are drawn on screen as block diagrams. Many elements of block diagrams are available, such as transfer functions, summing junctions, etc., as well as virtual input and output devices such as function generators and oscilloscopes. These virtual devices will allow you to perform simulations of the models you will build. Simulink is integrated with MATLAB and data can be easily transferred between the programs. In this tutorial, we will apply Simulink to the examples of modeled systems, then build controllers, and simulate the systems.

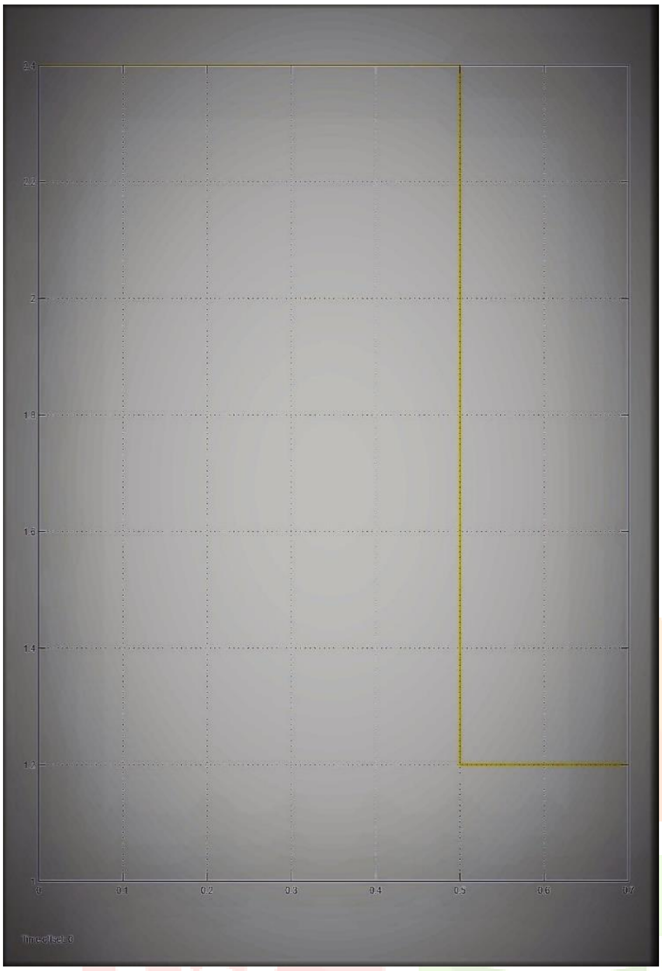
VII. SIMULATION DIAGRAM OF THE SYSTEM

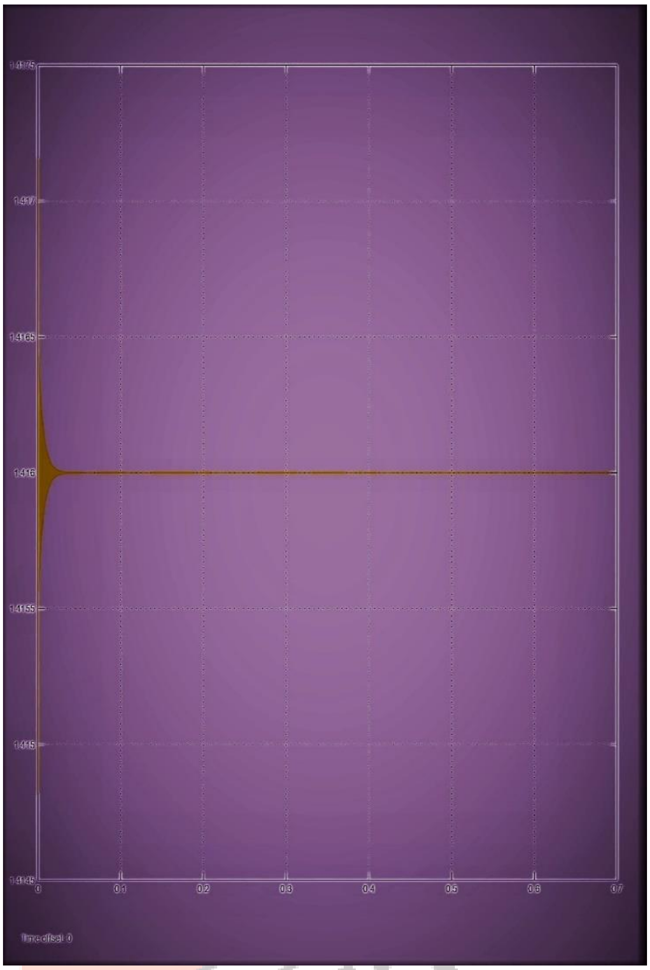


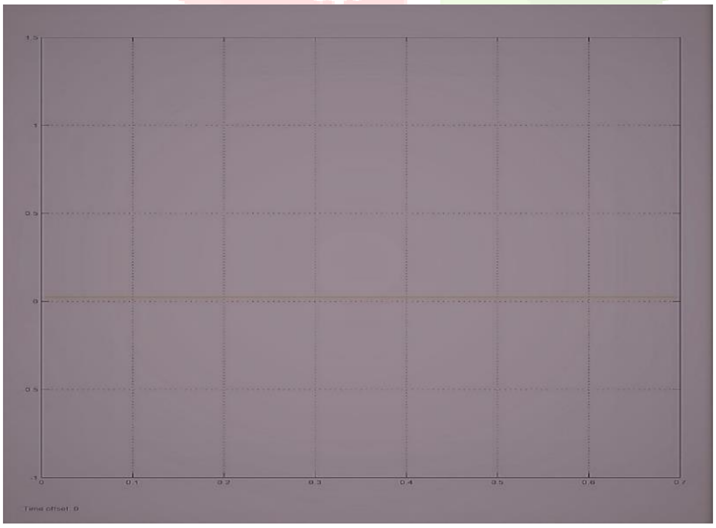
VIII. SIMULATION RESULTS

Fig. 4 PV output current

Fig 5 PV output voltage







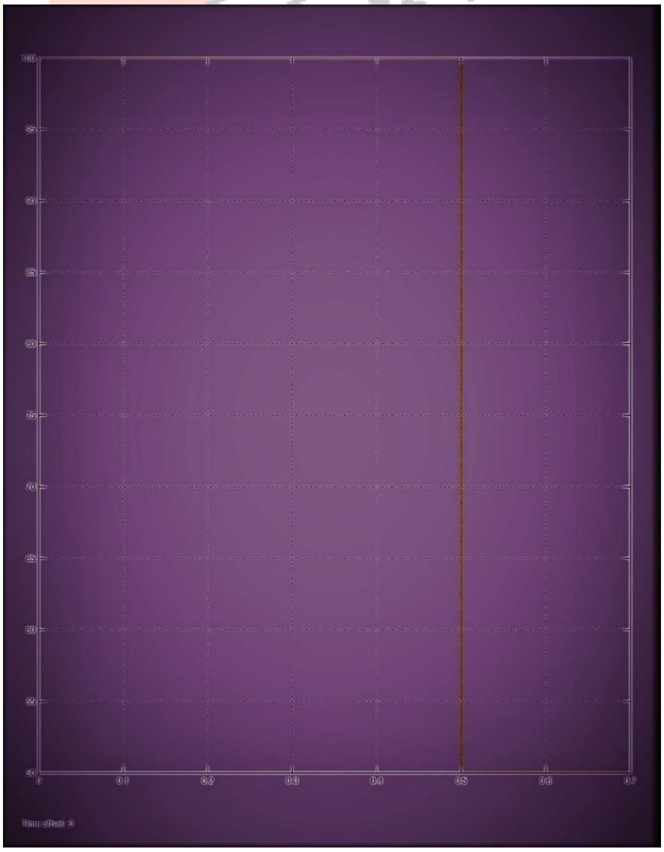


Fig.6 Product of PV output voltage and current

Fig. 7 Battery output voltage

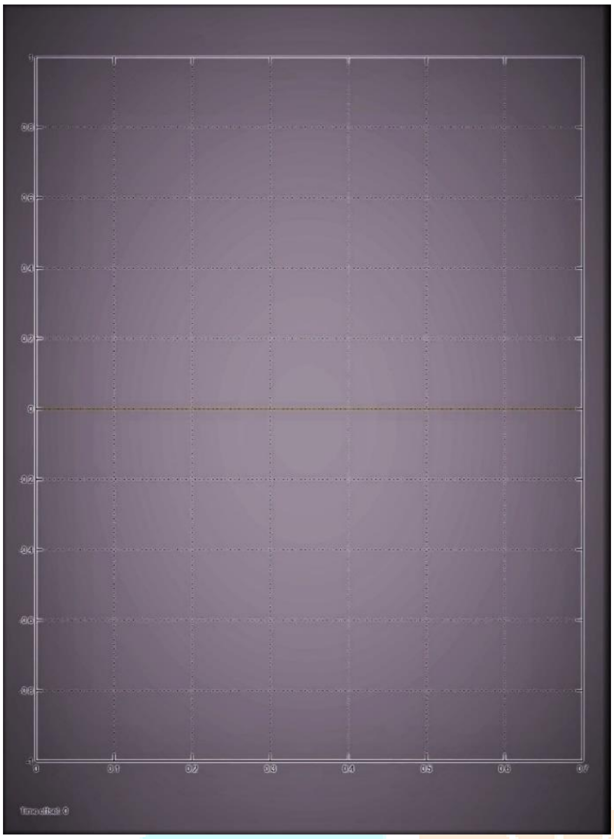


Fig. 8 output AC voltage

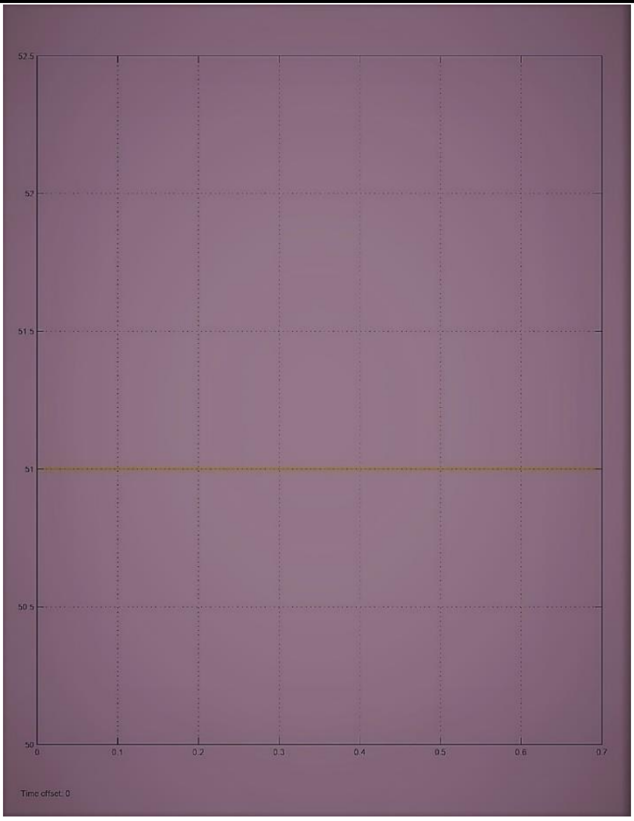


Fig. 9 Output DC voltage

IX. Result

In this prototype, we have achieved the continuity of supply for glowing the LED and also other applications by using solar energy as a renewable energy source. The solar energy from the sun falls on solar panel which has the capacity of 5V and this energy is not directly used or stored in battery banks or any other applications because the energy is in variable capacities. To use in components, we have to convert the voltage from one level to another constant level by using dc-dc converters. Now this voltage is stored in battery bank for electric vehicle charging and for glowing the LED. At times, when the solar energy is not available due to time and weather conditions, the battery acts as a source for various applications. The results and outputs of voltage, current and battery is achieved using MATLAB.

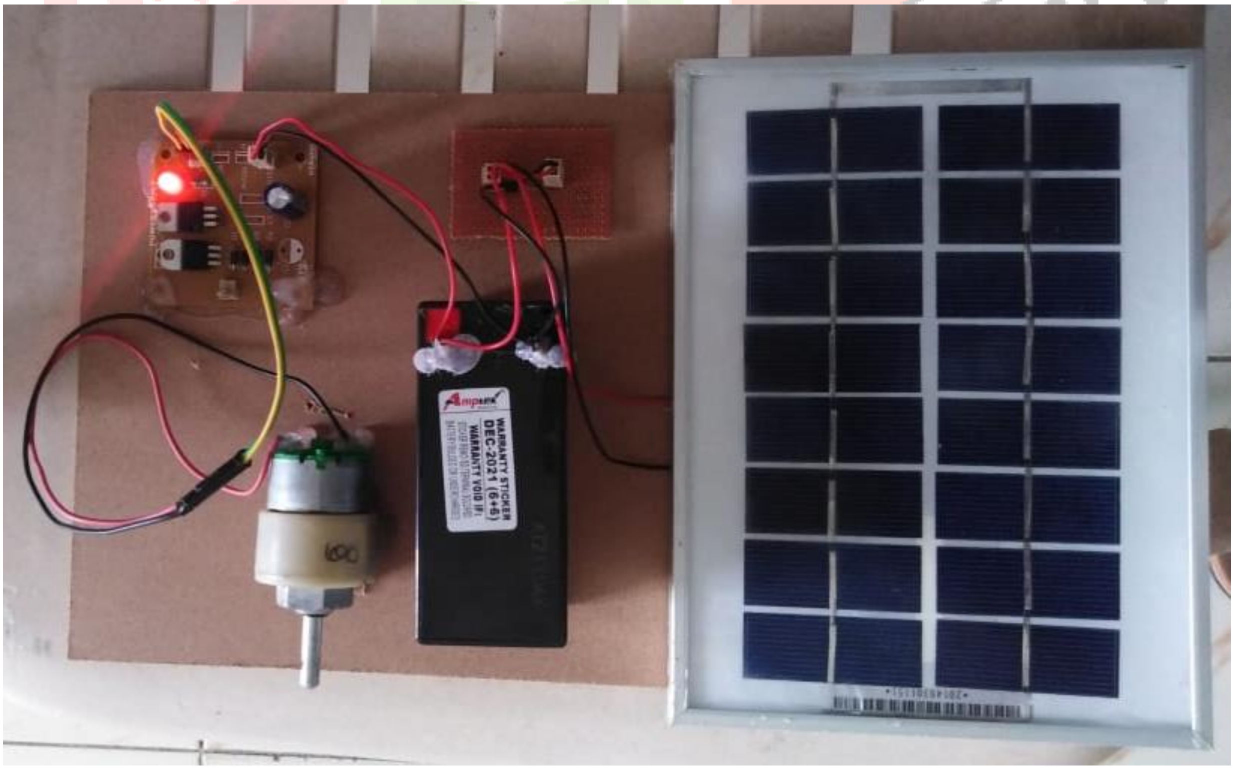


Fig. 10 Top view of kit

X. FUTURE SCOPE OF EV

The electric vehicle industry in India is picking pace with 100% FDI possible, new manufacturing hubs, and increased push to improving charging infrastructure. Federal subsidies and policy favoring deeper discounts for Indian-made electric two-wheelers as well as a boost for localized ACC battery storage production are other growth drivers for the Indian EV industry. Moreover, in September 2021, a production-linked incentive scheme for the automotive sector was approved by Cabinet to boost the manufacturing of electric vehicles and hydrogen fuel cell vehicles.

XI. CONCLUSION

This paper proposes bidirectional dc – dc converter for the Hybrid Energy Storage System applied to the Electric Vehicle. Simulations are carried out using MATLAB with detailed description. Various waveforms like, PWM signals, PV output voltage and current, Battery input voltage, super capacitor input voltage and the load voltage are obtained in the simulation. The entire system is implemented as a hardware prototype. It is found that the results obtained are to expected level. The results are obtained with proportional integral controller and with proportional resonance controller. It gives efficient system and regularity of storing energy. We obtained the results.

XII. REFERENCES

[1]-T. C. Huang, R. H. Peng, T. W. Tsai, K. H. Chen and C. L. Wey," Fast Charging and High Efficiency Switching- Based Charger with Continuous Built-In Resistance Detection and Automatic Energy Deliver Control for Portable Electronics", April 2017

[2]-Furkan. Akar, Y. Tavlasoglu, and B. Vural, "An Energy Management Strategy for a Concept Battery/Ultra capacitor Electric Vehicle with Improved Battery Life," *IEEE Transactions on Transportation Electrification,* vol. 3, pp. 191 – 200, March 2017.

[3]- L. Sun, K. Feng, C. Chapman, and N. Zhang, "An Adaptive Power Split Strategy for Battery-super capacitor Powertrain – Design, Simulation and Experiment," *IEEE Transactions on Power Electronics,* vol. 32, pp. 9364 - 9375, December 2017.

[4]- J. Shen, and A. Khaligh, "Design and Real-Time Controller Implementation for a Battery-Ultra Capacitor Hybrid Energy Storage System," *IEEE Transactions on Industrial Informatics,* vol. 12, pp. 1910 - 1918, October 2016.

[5]-Jian. Cao, and A. Emadi, "A New Battery/Ultra Capacitor Hybrid Energy Storage System for Electric, Hybrid, and Plug-In Hybrid Electric Vehicles,"*IEEE Transactions on Power Electronics,* vol. 27, pp. 122– 132, January 2012

[6]-Rajasekhar Gorthi, K. Giribabu, Dr.s. Shiva Prasad: Simulink model for Cost-effective analysis of Hybrid System: International Journal and Modern Engineering Research (Volume:4, Issue:2, Feb 2014)

[7]-Dr. Rajesh Thipparaju, Suddala Janardhan, Rajasekhar Gorthi: PV array based BLDC motor driven water pump using solar Technology: The International Journal of analytical and experimental modal analysis (Volume:12, Issue:7, July 2020)

[8]-X. Liu, P. Wang, P. C. Loh, F. Gao, and F. H. Choo, "Control of Hybrid Battery/Ultra-Capacitor Energy Storage for Stand-Alone Photovoltaic System, "Proceedings of 2010 IEEE Energy Conversion Congress and Exposition (ECCE 2010), pp. 336-341,2010.

[9]- G. Nielson and A. Emadi, "Hybrid Energy Storage Systems for High-Performance Hybrid Electric Vehicles," 2011 IEEE Vehicle Power and Propulsion Conference, pp. 1-6, Sept 2011.

[10]- Manmesha M. Patankar1, Rupesh G. Wandhare1, and Vivek Agarwal1, "A High Performance Power Supply for an Electric Vehicle with Solar PV, Battery and Ultra Capacitor Support for Extended Range and Enhanced Dynamic Response.", Photovoltaic Specialist Conference (PUSC),2014, Page(s): 3568-3573, 8-13 June 2014.