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PV BASED FAST CHARGING STATION FOR ELECTRIC VEHICLES USING MPPT

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Abstract— *Electric vehicles (EV) are more popular now a day as a reliable substitute to conventional vehicles. Till date to charge the EV the grid-based technology has been used. However, an interesting opportunity has emerged which utilized the solar powered chargers to charge EV. EV charging strategies to reduce the impact on the power system. However, the charging stations powered by solar and which is grid isolated is not considered. Here, we present an approach to apportioning solar energy to cars such that it maximizes both solar utilization and user satisfaction The electricity produced by PV sources is primarily for EV charging. Storage is an additional energy source to supply the EVs or to absorb excessive energy produced by PV sources. The public grid is used as a back-up source, which allows PV sources to sell excessive energy. If PV power is lower than the power demanded by the EVs, the additional power needed to charge EVs is provided primarily by the storage and then by the publicgrid.*

Keywords— Electric vehicle, energy, PV, grid, source.

I. INTRODUCTION

Nowadays looking for the conventional powered vehicles we are moving ahead to have a credible alternative to it i.e Electric Vehicle which are growing in popularity. But it is essential that EV requires their batteries to be fuelled up for operation. Whereas, the EV charging has typically been grid-based so due to that the best of solar powering chargers has emerging as an very interesting opportunity. The solar chargers brings clean electricity to be electric-powered cars that is themselves is Eco friendly and resulting for positive environment effect. Electric Vehicle charging strategies to eliminate the impact on power system. Although it does not consider as a grid-isolated solar powered charging station in the car scenario[1].So that we are presenting an approach to get opportunity for solar based energy cars so due that it will maximize both the solar utilization & conservation satisfaction respectively the electricity generated by the PV sources are primarily for EV charging. Storage of power is an additional energy to besupplied to EV or in order to absorb the excessive energy generated by PV sources. The grid supply is used as a backup sources to sell the excessive energy[1][3].If the power supply is lower than the power demanding by Electric Vehicle, the extra power will be needed to charge EV &so as to provided primarily by the storage & further by the public grid.

The charging principle of lithium-ion batteries for Electric Vehicle is constant current or constant voltage (CC/CV) process respectively[2]. At the CC time, the charging current will remains constant until then the voltage rises to a cut out voltage. Meanwhile at the time of CV mode, the voltage remains constant whereas the current is dropped. Although this CC or CV procedure is supposed to be control by the battery operational system which is emerged into the EV battery system. So the Photo voltaic system can now operate for maximum power point tracking (MPPT)[12][13]. Mode of operation & is powered- constrained , though the power grid could operate under the power constraints which is obtained by the public grid operator . Thus this storage system can operate under the power capacity constraints to be protected from the overcharging and over discharging for the long-life purpose. When the Electric Vehicle gets charging then EV battery potential difference is nearly low thus the charging current is not constant but the battery life-cycle & the charger life span gets shortened. When the is almost fully charged then the method goes into the constant voltage phase interval which resulting to prevent the battery from the overcharging. It is further assumed that the three charging modes i.e fast mode, average mode and the slow mode. The charging mode and the demanded maximum charging power must be fulfilled[3][5][6].

Maximum power point trackers (MPPTs) play a vital role in photovoltaic (PV) systems because they increase the efficiency of the solar photo voltaic system by increasing the power output[1][2]. Maximum power tracking algorithms are used to match the load resistance to the source input resistance to increase the power delivered from the photo voltaic system[2][3].

The solar PV power, the battery status, the EV charging load, and the grid status to manage power flow between different components depending on the status of the system[4]. The control strategy for maximizing PV energy used for EV charging and reducing grid peak power demand has been developed[2]. According to the availability of grid power, grid tied operating and stand-alone operating modes have been designed for the charging station.

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II. MATHEMATICAL MODELLING

A. PVArray

The PV Array block uses an array of PV modules which is made up of modules which are interconnected.

The PV Array block is a five-parameter model used to represent the irradiance- and temperature-dependent I-V characteristics of the modules.

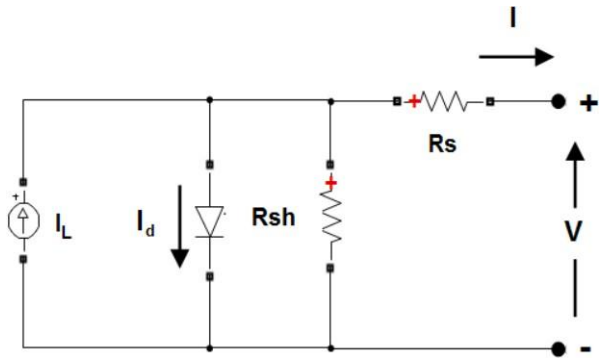

Figure 1: PV Array block consisting of 5 parameters- light-generated current source (IL), diode, series resistance (Rs), and shunt resistance (Rsh).

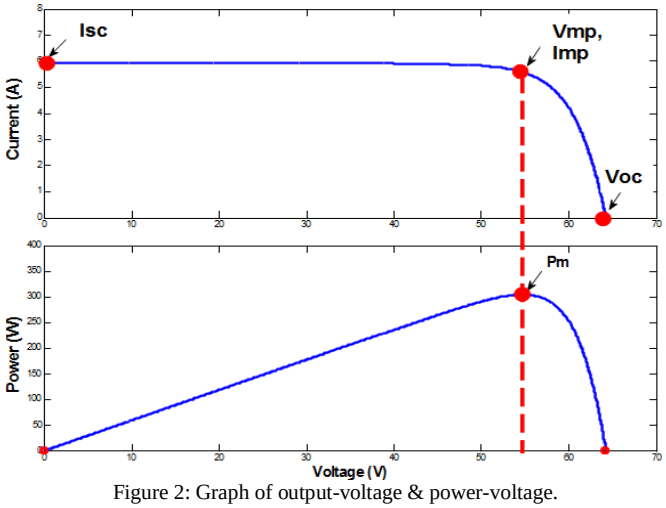

Figure 2: Graph of output-voltage & power-voltage.

The following equation gives the V-I characteristics of the diode.

$$Id=I0[exp(VdVT)-1]$$
$$VT=kTq\times nI\times Ncell$$

where

Id	Diode current(A)
Vd	Diode voltage(V)
I0	Diode saturation current(A)
nI	Diode ideality factor, a number close to1.0
k	Boltzman constant = 1.3806e-23 J.K-1
q	Electron charge = 1.6022e-19C
T	Cell temperature(K)
Ncell	Number of cells connected in series in amodule
Ir	Control signal defining Irradiance applied to solar panels,W/m2 scalar in the range [0, 1000]
T	Control signal defining temperature of cells, degrees Celsius

B. MPPTAlgorithm

Maximum power point tracking (MPPT) algorithm is implemented in PV inverters. The MPPT algorithms are used adjust Z continuously to keep the PV system operating the peak powerpoint.

The MPPT algorithms are used in controller designs to maximize the power generated by photovoltaic systems. It ensures that the system works at maximum power.

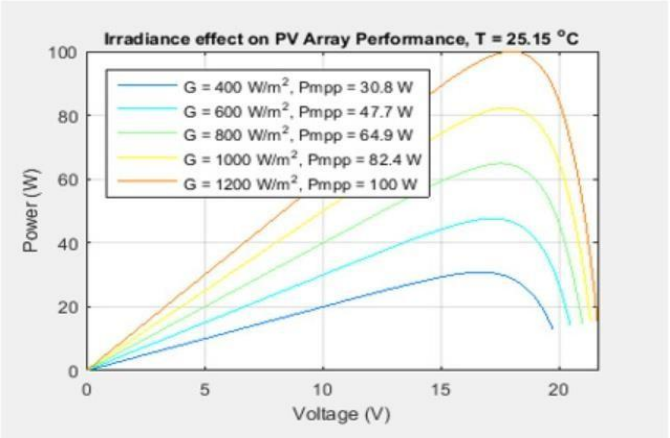

Figure 3: Power voltage curve with I-V and P-V characteristics of a photovoltaic system.

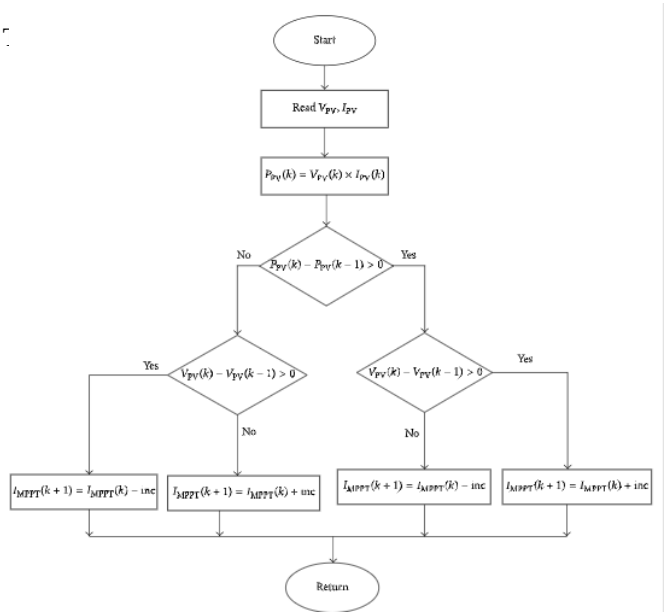

Figure 4: Flowchart of perturbation and observation.

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2. Incrementalconductance

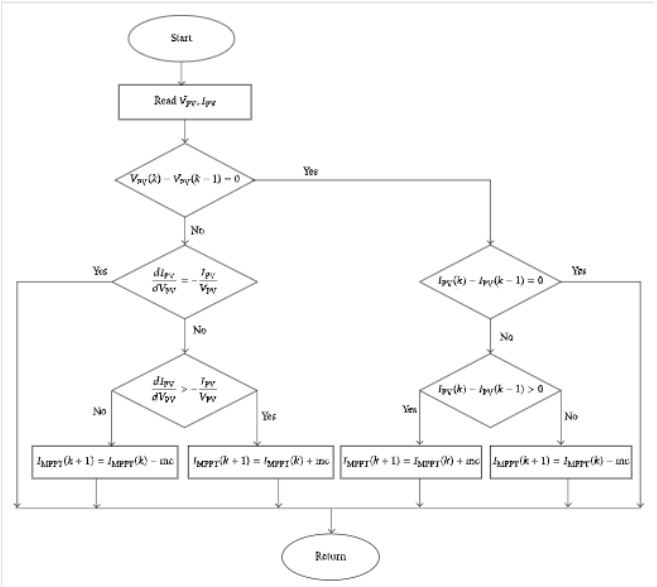

Figure 5: Flowchart of incremental conductance algorithm.

3. Ripple correlation MPPTalgorithm

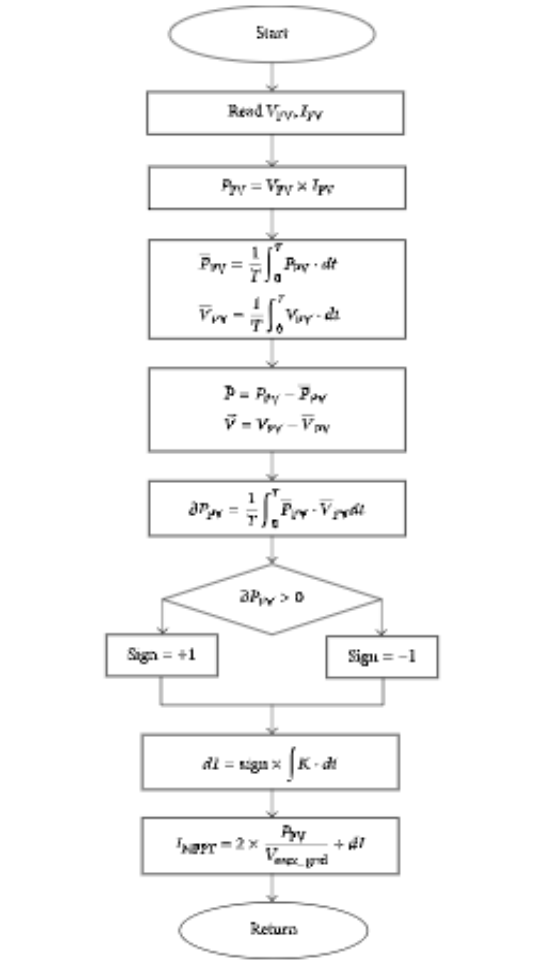

Figure 6: Flowchart of Ripple correlation MPPT algorithm.

III. PROPOSEDAPPROACH

An off-grid PV system while operating at nigh utilizes the batteries to supply loads. Even though the completely charged battery gives voltage close to the PV panel's MPP voltage, it becomes quite improbable at daytime as the battery becomes partially discharged [7]. Hence, the charging process may initiate at a matching lower voltage below the PV panel MPP voltage.

At the point when the batteries in an off-lattice framework are completely energized and PV creation surpasses nearby loads, a MPPT can no longer work the board at its greatest force point as the overabundance power has no heap to ingest it. The MPPT should then move the PV board working point away from the MPP until creation precisely coordinates request. (An elective methodology regularly utilized in rocket is to redirect surplus PV power into a resistive burden, permitting the board to work ceaselessly at its MPP so as to keep the board cooler however much as could be expected.)

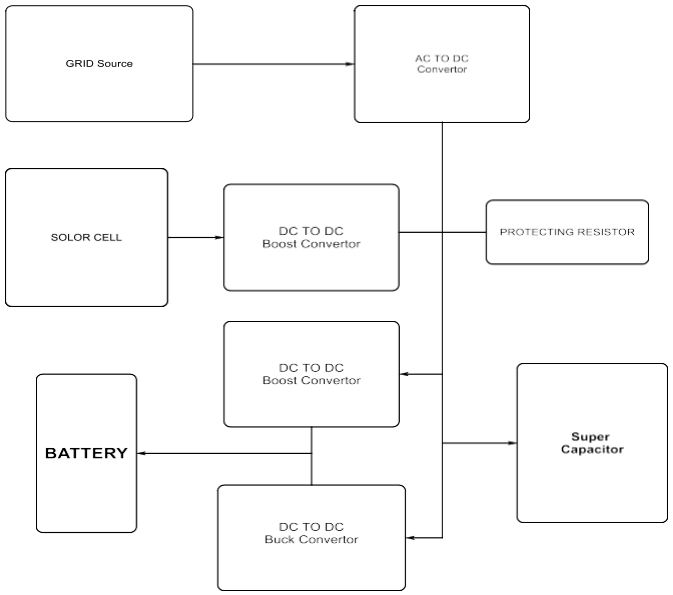

Figure 7: Block diagram of working of MPPT based fast charging station.

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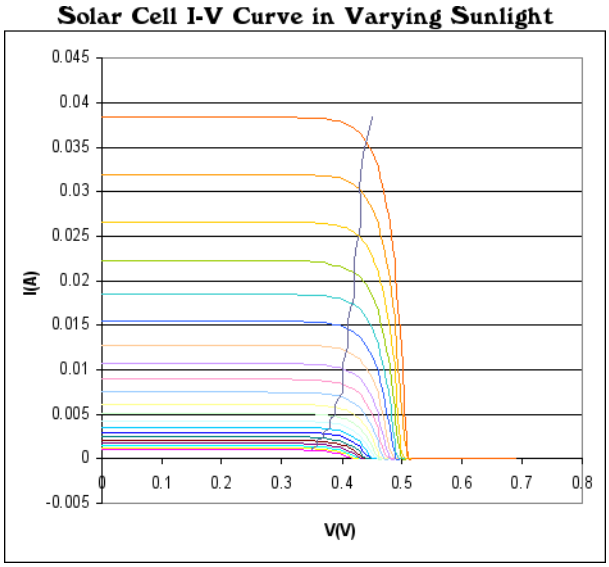

Figure 8: Graph of I-V curve.

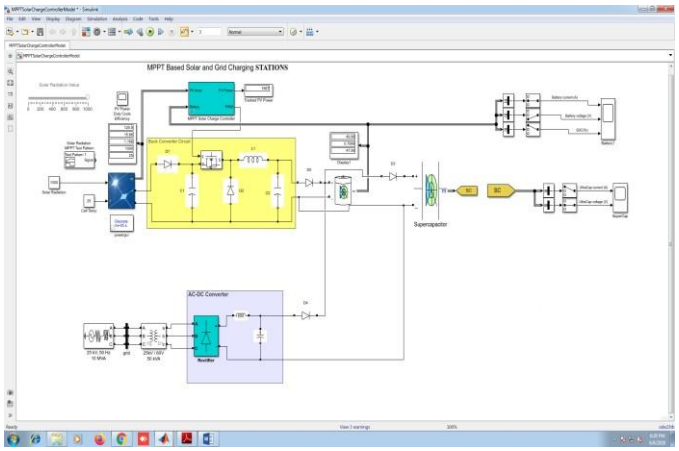

Figure. 9: MATLAB simulink representation of MPPT fast charging station.

The costing variable of the PV based quick charging station over other charging station is firmly concentrated in the perceptions. As per the information base of the past review that has been made shows the financial matters that various

Conventional Car As sumptions	Electric Vehicle Assumptions	Electric Vehicle + Solar
12,000 miles per year	12,000 miles per year	12,000 miles per year
25 miles per gallon	3,0000 kWh per year	3,000 kWh per year
$3 per gallon	$0.21 per kWh	$0.12 per kWh
$0.12 per mile	$0.05 per mile	$0.03 per mile
$1,445 per year (INR108,938.55)	$630 per year (INR47,495.7)	$360 per year (INR 27,140.4)

organizations has power utilization for charging the vehicle is more costly. Because of that customer needs to pay morefor charging the vehicle at station however in the event of PV based charging station its has advantageous factor for buyer. Despite the fact that the sun based quick charging station is more dependable ,productive, practical and eco-accommodating as well. So this is the key factor for PV based quick charging station. In the diagram above indicated Figure (4) the distinctive size of batteries are utilized by the power utilization with the Average expense every day separately and it is higher these days.

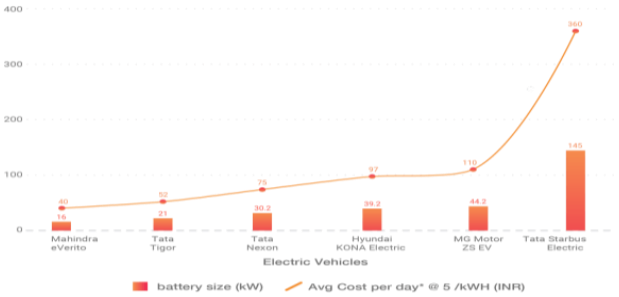

Figure 10: Electricity consumption vs. cost estimation.

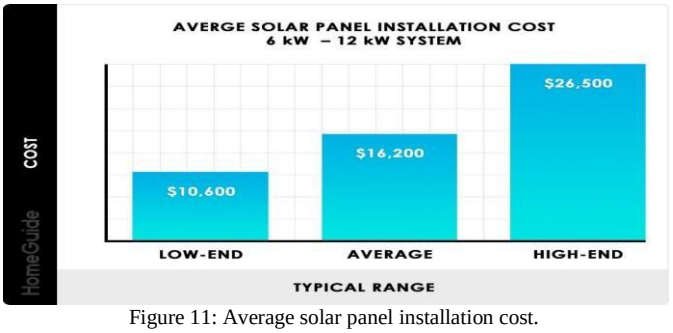

Figure 11: Average solar panel installation cost.

The separation of financial matters between thepower charging stations and the PV based charging is appeared above in two graphical portrayal. The sun oriented board establishment is a lot of conservative and eco-accommodating. As the investigation shows that this sun oriented board establishment is done one time and further it tends to be worked at wide way and furthermore it is requested by the purchaser at profoundly transmitted sun based district. Here the Low end cost is extremely less expensive for one time establishment after then the moderate range for the charging station is normal range separately. Furthermore, the top of the line scope of costing is normally not actualized at this point. As per the usage of the PV based charging station it is chosen further where the best possible scope of establishment is required. Other than that we have to examine the financial matters of the charging station and its usage which can be advantageous up until thispoint.

Table 1: Comparison of assumptions for conventional car/EV/EV (including solar).

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IV. MATLAB SIMULATIONMODEL

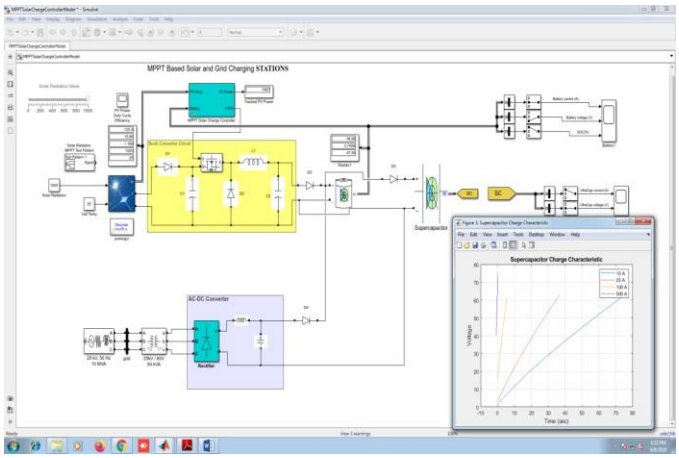

Figure12: MPPT charge controller efficiency vs. PV power.

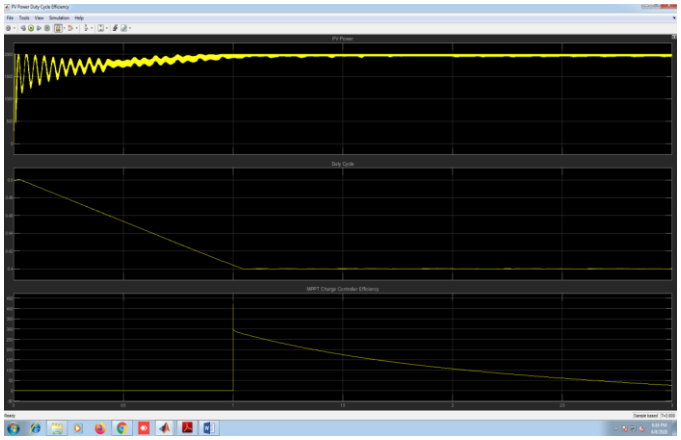

Figure13: MPPT charge controller efficiency vs. PV power.

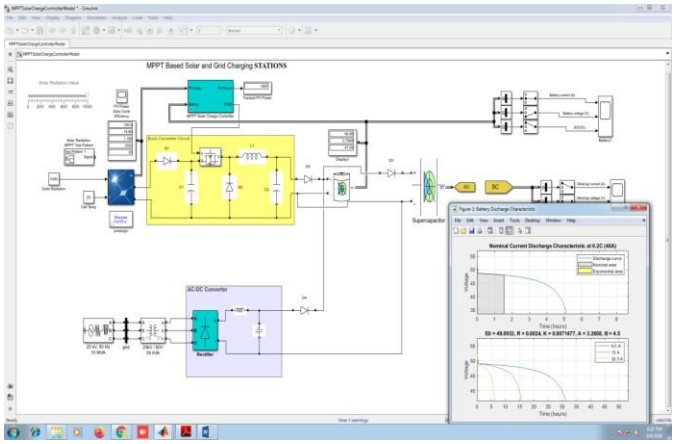

Figure 14: Battery current and voltage vs. SOC(%).

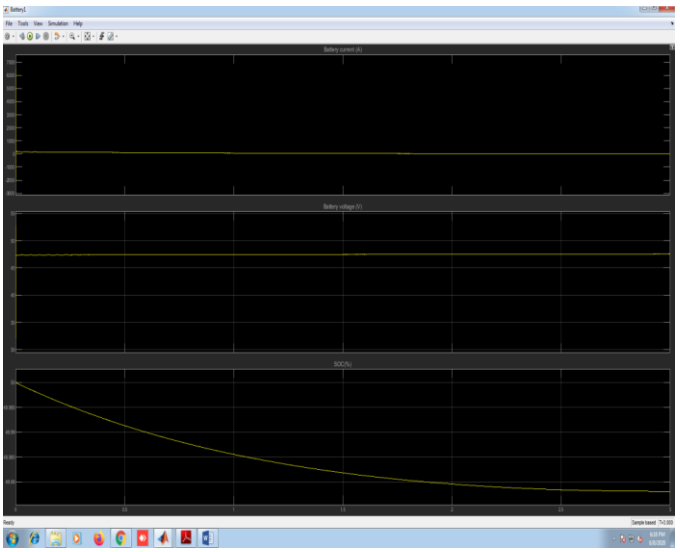

Figure 15: Battery current and voltage vs. SOC(%).

In the result shown above Figure. 14 the super charging capacitor characteristics is observed such that it varies the graph with having voltage across the solar panel with respect to time. As the constant current and constant voltage requirement is fulfilled with the help of these advanced technology that is MPPT. The constant voltage is required throughout the sunrise to sunset with respect to constant current also together it forms full efficiency resulting the output to be constant for fast charging ofvehicle.

In accord of the MPPT conductor productivity is differing concerning the PV Power yield appeared in the chart Figure 14. This paper introduced an exhaustive audit on EVs regarding charging innovation, different EV impacts and ideal CS arrangement and estimating. Charging innovation assumes a significant part in energy move for an EV battery. To give upgraded understanding about this innovation, this examination introduced distinctive energy move modes, charging levels, and methods notwithstanding the norms right now being used for EV charging around the world. In this paper presents the various methodologies and procedures for electric vehicle charging techniques. This paper will be valuable for future exploration researcher and understudies those intrigued for working in the field of solar based PV based quick charging station for electric vehicle plan. Hence, this work will help give generally applicable and noteworthy data about existing examinations. It will likewise give a chance to explore further on battery execution enhancement and insight frameworks identified with the mix of multi-power sources, steadiness, dependability examination of dissemination organizations, and area and estimating improvement of CSs regarding power qualityissues.

V. CONCLUSIONANDSCOPEFORFUTUREWORK

In this paper, an energy management system is proposed to reduce grid peak power demand and maximize PV electricity for EV charging. MPPT Algorithms is best implementation for

Solar PV based EV Charging Station. Charging innovation assumes a significant part in energy move for an EV battery. To give upgraded understanding about this innovation, this investigation introduced distinctive energy move modes. This paper presents the various methodologies and strategies for electric vehicle charging techniques. In this way it results the procedures are quick accusing station of joining of sun based PV framework, prescient regulators based charging station, PV-helped EV quick chargingstations.

To understand the impact of the solar PV system and EV charging on utility grids, the solar PV powered EV charging systems with a buffer battery will be simulate. Energy management will proposed to reduce grid peak power demand and maximize PV electricity for EV charging. The battery target will optimize base on the estimated PV electricity and the projected EV charging load. This paper will be useful for future research scholar and students those interested for working in the field of solar pv based fast charging station for electric vehicle design. Therefore, this work will help provide most relevant and significant information about existing studies. It will likewise give a chance to explore further on battery execution streamlining and knowledge frameworks identified with the mix of multipower sources, soundness, dependability examination of appropriation organizations, and area and estimating enhancement of CSs regarding power quality issues.

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