International Journal of Engineering Technology Science and Research
IJETSR
www.ijetsr.com
ISSN 2394 – 3386
Volume 4, Issue 9
September 2017

Control and Management Scheme of PV Integrated Charging Facilities for PEVs with Texas CC3200 IoT Technology

R.Vijayakumar[1], Dr.K.Malarvizhi[2], S.Divyapriya[3]
[1]SNS College of Technology, Coimbatore, Tamilnadu.
[2]Kumaraguru college of Technology, Coimbatore, Tamilnadu.
[3]Karpagam University, Karpagam Academy of Higher Education, Coimbatore, Tamilnadu.

Abstract- The progressing research in the field plug-in electric vehicles (PEVs) and the developing worldwide mindfulness for a contamination free condition, will prompt an expansion in the quantity of PEVs sooner rather than later. The expansion of these PEVs will add worry to the officially over-burden control lattice making new difficulties for the dispersion organize. To relieve this issue a few scientists have proposed charging PEVs utilizing renewable combined with brilliant charging methodologies. This paper audits the present writing on the best in class foundation proposed for PEV accusing offices incorporated of photovoltaic framework. The proposed control calculations, different keen charging procedures and distinctive power electronic topologies for photovoltaic charging offices (PCFs) are looked into. Studies evaluating the capacity of photovoltaic charging stations to limit the stacking on circulation transformers are surveyed. At last, a basic and one of a kind vitality administration calculation for a PV construct work environment charging office situated in light of dc connect voltage detecting is introduced. The power expected to charge the module electric vehicles originates from lattice associated photovoltaic (PV) era or the utility or both. The adequacy of the proposed calculation is approved through re-enactment and exploratory outcomes. This proposed work is controlled using Texas CC3200.

Keywords: Plug-in electric vehicles (PEVs) , Photovoltaic charging facility (PCF), Distribution network, Taxes CC3200.

I. INTRODUCTION

With the developing worldwide mindfulness for a contamination free condition, rising vitality costs, PEVs are being presented by numerous car producers. It is realized that if 25% of the 176 million armadas of light vehicles in U.S were changed over to PEVs, it will match the whole U.S control era limit [1]. The multiplication in PEVs requires charging stations to satisfy their battery necessities. In spite of the fact that PEVs are being showcased with the objective of limiting the contamination from vehicles, the vitality prerequisites for charging the batteries is still met by control produced by petroleum product sources. Henceforth numerous scientists have proposed charging PEVs utilizing sustainable power sources like breeze and photovoltaic. Many pilot ventures are additionally in progress to charge PEVs from sun powered photovoltaic framework [2– 5]. Charging stations in light of wind control is still in the beginning stages however few endeavours have been declared [6]. Because of the social and financial advantages, inquire about on charging stations highlighting photovoltaic framework has pulled in analysts around the globe.

Utilizing sun based energy to charge batteries is not another thought. It is a dependable hotspot for charging light obligation electric vehicles, for example, golf trucks, bikes and air terminal utility vehicles [7]. Extensive scale sending of photovoltaic chargers in a parking area is broke down in [8]. A 2.1 kW photovoltaic accusing station coordinated of the utility at Santa Monica is portrayed in [9]. A trial control methodology for electric vehicle charging framework made out of photovoltaic cluster, imitated control network and programmable dc electronic load speaking to lithium particle battery emulator is introduced in [10]. PV parking area charging and different plans of action to accuse PEVs of sun powered vitality are examined in [11]. Financial matters of PV fueled working environment charging station has been considered in [12, 13]. The investigation demonstrates the practicality of a PV based working environment parking structure with advantages to the vehicle proprietor when contrasted with home charging, to such an extent that the

International Journal of Engineering Technology Science and Research
IJETSR
www.ijetsr.com
ISSN 2394 – 3386
Volume 4, Issue 9
September 2017

carport proprietor will get the payback of establishments and upkeep cost and benefit inside the lifetime of the PV boards. As per [13] incorporating a sunlight based authority into a parking garage would bring about a considerably more quick payback-period, empowering far reaching establishment of sun powered limit. Reference [14] depicts how brilliant control methodologies can help PEVs and PV to coordinate with the present power frameworks. Co-advantages of huge scale sending of PEVs and PV frameworks has been examined in [15]. The investigation presumes that PV gives a potential wellspring of noontime era limit with respect to PEVs, while PEVs give a dispatchable load to low esteem or generally unusable PV era amid times of low request (especially in the spring).

According to the National family travel study vehicles are stopped for no less than 5 h in working environments [16]. Subsequently these spots are positive for creating charging station foundation however this would prompt genuine over-burdening issues at the dispersion level. Since overhauling of transformers is a costly choice for the utilities, this issue needs close consideration as the PEV infiltration increments. A few papers have been distributed to address the over-burdening of circulation transformers while charging the PEVs [17– 19]. All things considered, very little investigation has been accounted for to be firmly identified with the instance of diminishing the stacking on dispersion transformers utilizing a photovoltaic framework. In spite of the fact that few papers exist in the writing, they are for the most part limited to private circulation systems [20, 21]. There is a lot of stopping region in the U.S—a sensible portion of which is reasonable for PV establishment. This part surveys the present writing on the best in class framework proposed for PEV accusing offices incorporated of photovoltaic framework. The proposed control calculations, different savvy charging strategies and the financial advantages of photovoltaic charging offices (PCFs) are surveyed. Different power electronic topologies, control calculations and charging systems will be talked about. It will be demonstrated that a system of PCFs will quicken the arrangement of PEVs through financial and ecological advantages to the utilities and vehicle proprietors. The effect of matrix associated photovoltaic framework on the utility circulation systems is investigated. The reasonableness of utilizing PV control for charging PEVs is gotten to in this part.

Table 1. PV characteristics

PV type	Module price ($/Wp)	Efficiency (%)	Peak energy (Wp)	Total cost of PV ($)
Crystalline silicon	2.14	22	264	565
Polycrystalline silicon	1.74	15.5	186	324
Thin film	0.93	12	144	134

Deciding the size and sort of PV board is an essential thought for a sun powered parking space. Barely any papers [22, 23] have suggested the utilization of monocrystalline silicon as the most financially savvy sun powered cell sort for PV charging offices. Table 1 demonstrates the PV attributes of different modules, the pinnacle vitality created and the aggregate cost of the PV module. The PV board can be measured by taking the best and most exceedingly terrible months into thought. As portrayed in [24], the underlying expense of the PV board would be $20,000 when it is outlined in light of the most exceedingly terrible month of the year and $10,000 when it is planned in light of the greatest month of the year. Nonetheless, for the main case, surplus vitality can be infused into the network, to adjust the last cost.

The SimpleLink™ Wi-Fi® CC3200 LaunchPad™ improvement unit (with QFN-bundled gadget) is an assessment advancement stage for the CC3200 remote microcontroller (MCU), the industry's initially single-chip programmable MCU with worked in Wi-Fi availability. The board highlights on-board copying utilizing FTDI and incorporates sensors for a full out-of-the-case understanding. This board can be specifically associated with a PC for use with improvement instruments, for example, Code Composer Studio™ Cloud incorporated advancement condition (IDE) and IAR Embedded Workbench. This LaunchPad has driver bolster and a product improvement unit (SDK) with 40+ applications for Wi-Fi conventions, Internet applications and MCU fringe cases. Features of CC3200 are,

- CC3200 Wi-Fi remote microcontroller (MCU) in QFN bundle
- Industry's first gadgets to be Wi-Fi CERTIFIED™ at the chip level by the Wi-Fi Alliance™

International Journal of Engineering Technology Science and Research
IJETSR
www.ijetsr.com
ISSN 2394 – 3386
Volume 4, Issue 9
September 2017

- USB interface to PC for CCS/IAR utilizing FTDI USB drivers
- Streak refresh over the USB utilizing SimpleLink Programmer
- 2 20-stick connectors empowers similarity with BoosterPacks with included capacities (BoosterPack headers)
- Independent advancement stage including sensors, LEDs and push-catches
- Power from USB for the LaunchPad and in addition outer BoosterPack
- Works from 2 AA basic batteries
- On-board recieving wire and U.FL connector selectable utilizing a capacitor re-work
- Backings 4 wire JTAG and 2 Wire SWD
- GNU Debugger (GDB) bolster over Open On chip debugger (OpenOCD)

II. PROPOSED ARCHITECTURES FOR PV BASED PEV CHARGING FACILITIES

The charging units for PEVs can be either on-board or off-board. If there should arise an occurrence of an off-board charger, the charger is an outer unit while on account of an on-board charger it is a segment of the vehicle. On-board chargers are provided with air conditioning force and they comprise of an AC/DC rectifier, DC/DC support converter for control factor amendment and a DC/DC converter to charge the battery as appeared in Fig. 1. At present AC charging is being utilized to charge PEVs by methods for on-board chargers. The real disadvantage of this innovation is that it doesn't bolster quick charging as it is required to expand the power ability of the on-board charger in this manner expanding the cost and weight of the PEV. Subsequently to help quick charging of PEVs off-board chargers are proposed which specifically supply dc energy to the PEV charging channel. It is to be noticed that in the event of an off-board charger the whole power change (AC/DC) happens in an outside unit and in this way it is doable to build the appraisals of the power converters keeping in mind the end goal to help quick charging.

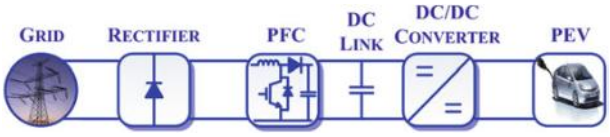

Figure 1. Conventional PEV charger

Air conditioning framework is being utilized since years for control dissemination and there are all around created foundation norms and advances. DC framework then again has many favourable circumstances, beginning with the way that general proficiency of the framework could be higher and it encourages the reconciliation of sustainable power sources with less power converters. Since PV exhibits produce dc control, a charging office including PV control encourages the charging of PEVs from a dc transport which is more viable, temperate and proficient since it doesn't include more power change stages not at all like AC charging. Different strategies have been proposed for coordinating PEV chargers inside a photovoltaic framework. A few power electronic topologies for a PCF have been proposed in the writing in view of the sort and the quantity of converters which are delegated:

A. Brought together design

B. Conveyed design

C. Single stage change with Z-converter

A. Brought together design

Itemized piece outline speaking to the concentrated design is appeared in Fig. 2. It comprises of a focal DC/DC help converter which plays out the capacity of most extreme power point following. The DC/DC chargers are coordinated with the PV charging office at the dc interface. Different PEVs can be charged by expanding the relating appraisals of PV boards and the related power converters. Each parking space must have a committed DC/DC buck converter which is associated with the dc connect. This setup is reasonable for charging stations in the scope of a few kilowatts. It is material for charging vehicles like golf trucks, grounds utility vehicles and so on which drive for short separations with low battery limits. Battery switch station fuelled by PV is a decent contender for embracing brought together engineering. In any case, this sort of arrangement does not bolster quick charging since establishment of a powerful DC/DC converter is exceptionally costly and it is helpless against single blame shutdown.

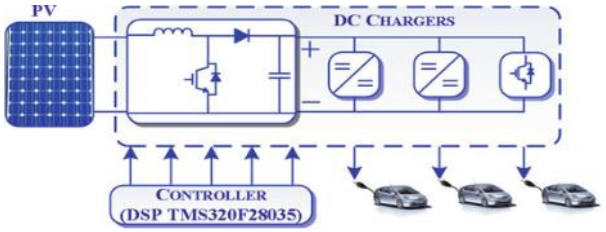

Figure 2. Centralized architecture

International Journal of Engineering Technology Science and Research
IJETSR
www.ijetsr.com
ISSN 2394 – 3386
Volume 4, Issue 9
September 2017

B. Conveyed Architecture

Nearness of DC/DC converters with high power evaluations is an imperative standard for quick charging of PEVs. This can be accomplished financially through appropriated engineering as appeared in Fig. 3. For this situation a few strings of PV boards are associated in arrangement. Each parking space has a committed PV board to help the charging of PEV and each string of PV boards is interfaced with their own DC/DC converter and offers a typical dc transport, which associates with an AC utility lattice through a bi-directional DC/AC converter. The DC/DC battery chargers are associated with the dc transport. Each parking space requires an individual DC/DC converter to charge the PEVs. The proposed design is appropriate for establishment at spots, for example, working environment, colleges, shopping centres and so forth where the request of PEVs and their length of remain in the parking garages are exceedingly probabilistic in nature. It is more dependable since the PEVs can be charged from the network amid the times of low insulation or overcast climate. Likewise, take note of that the additional vitality produced by PV can be infused into framework, which can be utilized to adjust the PV costs.

A PCF requires steady power from the PV or the network to take care of the popularity of PEVs. The unwavering quality of a PCF can be enhanced by including a vitality stockpiling unit, for example, a battery bank, ultra capacitor, energy unit and so on. For example in [35] the power created by rooftop top photovoltaic framework is put away in VRLA (valve-controlled lead-corrosive) batteries and energy components in a PEV docking station. The PEVs touching base at the docking station can be charged from two separate tracks i.e. utilizing the vitality from the VRLA batteries or the power devices. The utilization of capacity limit in PCFs has the accompanying focal points [36]:

- Efficient utilization of sustainable power sources
- Maximization of sustainable power sources commitment
- Better request and creation coordinate, better helper benefit supply and enhanced general unwavering quality

The centre thought of including an ESU (vitality stockpiling unit) is that the power request by PEVs can be either provided by the PV or the utility or through a nearby vitality stockpiling unit. Vitality got from the ESU can charge the PEVs amid specific possibilities, for example, islanding condition without the accessibility of PV control. It encourages the charging of PEVs utilizing least vitality from the framework. The charging station shows up as a dc microgrid with neighbourhood era from the PV framework, PEVs' as burdens and battery bank speaking to the capacity framework.

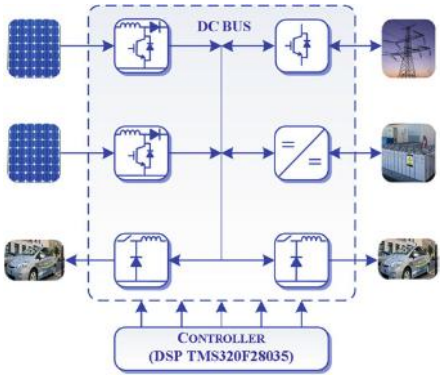

Figure 3. Distributed architecture

C. Single stage transformation with Z-converter

The twofold phase transformation portrayed in the above models is supplanted by a solitary stage utilizing a Z-converter [22] as appeared in Fig. 4. It doesn't require an extra DC/DC converter for each charging spot and a solitary DC/DC converter is utilized to give galvanic disengagement. The Z-converter has twofold tweak ability, and can shape the network current while at the same time managing PEV battery charging. The unit can be utilized for both power assimilation and infusion, with all the while controlled battery charging. This guarantees near solidarity control factor for every single working mode and power stream ways; accomplishing this with a solitary transformation stage can be viewed as a special preferred standpoint of the Z-converter. Besides, this topology has inalienable buck-help ability, permitting expanded voltage run on the PV or matrix. Notwithstanding the single transformation arrange, dependability, as opposed to proficiency or cost, is the solid purpose of the Z-topology. Likewise the single stage control handled by the Z-converter comprises of 120 Hz twofold line recurrence swell. This swell can be relieved by setting an extra decoupling capacitor over the PV source which presents conceivable deviation from consummately steady power extraction at the PV boards.

International Journal of Engineering Technology Science and Research
IJETSR
www.ijetsr.com
ISSN 2394 – 3386
Volume 4, Issue 9
September 2017

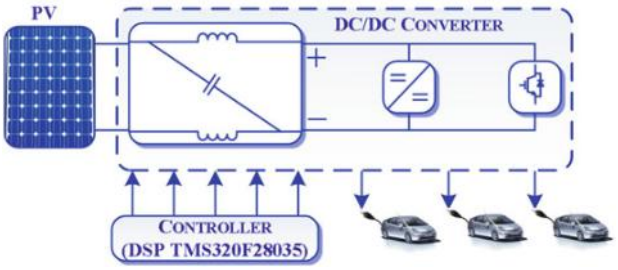

Figure 4. Single stage conversion with Z-converter

III.CONTROL STRATEGIES

Work environment based photovoltaic charging offices and private PV charging are the two accessible alternatives for charging PEVs utilizing sun oriented power. Contingent upon the sun based light, PEVs can be charged either from the photovoltaic or the conveyance network or both. The sunlight based charging station ought to circulate the power accessible at the PV boards to the PEVs viably and securely. Normally PEVs touch base at the accusing office of various State-of-Charge (SOC). More than frequently, the measure of PV control accessible to charge various PEVs is constrained. Moreover, the PV source is stochastic in nature, its energy trademark is nonlinear and the PEV batteries to be charged ought to be inside sure voltage and current breaking points. Thusly, this procedure requires smart control of the power molding unit to deal with the heading of energy stream in PV incorporated charging stations. A few calculations have been proposed in the writing which vary altogether in view of the sort and area of the PCF. The calculations likewise contrast in light of the different control parameters, for example, PV control, stack request, condition of-charge and so forth. In like manner they can be delegated takes after:

A. Private Photovoltaic Charging

B. Battery Switch Stations

C. Working environment Photovoltaic Charging

A. Private Photovoltaic Charging

Barely any creators [37– 40] have proposed a design for a matrix associated private photovoltaic framework that can be utilized to charge PEVs and additionally to supply the current family unit loads. The control calculations rely upon the power produced by the PV and the SOC of the PEV battery. Raul et al. proposed a private load coordination component to charge PEVs. Contingent upon the heap request of the circulation transformers, the PEVs can be charged utilizing sustainable power source (PV/Wind) or the power from the lattice. Every family is introduced with a housetop PV framework and a little scale wind turbine. A private microgrid made out of housetop boards and a biodiesel generator to charge PEVs and supply AC/DC family unit loads. To share the heap among the sources, master slave control technique is utilized. The operation of the private microgrid relies upon the PV control, stack request, SOC of the battery stockpiling and levy set by the utility. The vast majority of the PEVs are not accessible for charging amid daytime at private offices. Henceforth, this procedure requests for an extra part as a vitality stockpiling unit which won't not be monetarily alluring for an individual mortgage holder. Private charging is favourable for families with more than one PEV.

B. Battery Switch Stations:

A PV based battery control technique for charging numerous batteries in a sunlight based battery charging station (SBCS). The engineering of the SBCS is like the one appeared in Fig. 2.6 yet the DC/DC chargers are supplanted by bi-directional switches. The proposed control technique initially charges every individual battery until the point that they achieve a similar voltage level and afterward charges the different batteries in parallel at the same time as indicated by the battery charging period and the accessible sun powered vitality. This control system dispenses with the utilization of different DC/DC converters per battery association, making the SBCS less confounded and temperate. Despite the fact that being conservative, the proposed engineering does not consider the situations when the PV board is not creating any power or producing power in overabundance. Consequently it can't be considered for charging PEVs. The vitality trade system relies upon the battery swapping interest of the PEVs and power produced by the PV. A calculation is proposed to charge PEV batteries utilizing the most extreme vitality from PV.

C. Work environment Photovoltaic Charging

In few cases, creators have proposed embeddings a DC/DC battery charger at the dc connection of the lattice associated PV framework. By measuring the power created by the PV and the power request of the PEV, the control calculation guarantees the charging of the PEV battery from the proper source.

International Journal of Engineering Technology Science and Research
IJETSR
www.ijetsr.com
ISSN 2394 – 3386
Volume 4, Issue 9
September 2017

In view of the irregularity between the PV control and the heap request, different conceivable situations are depicted. If there should arise an occurrence of, the power stream in a PV parking area is overseen through an arrangement of PC controlled transfers. PV boards of various evaluations are interfaced with PEV chargers and the power network through PC controlled transfers. Contingent upon the light levels, the transfers guide the whole PV energy to the PEVs or the lattice or both. A few PV boards are interfaced with the dc transport through an arrangement of DC/DC converters. The DC/DC converter brilliantly controls the power stream to the PEVs in view of a specific preset points of confinement of the dc transport voltage. In light of as far as possible the vitality change unit encourages three way vitality stream among the power network, PV modules and PEVs.

The idea of dc transport flagging has been proposed by a few creators to plan energy to dc stacks in a microgrid. Maybe a couple of them have stretched out this idea to charge PEVs in a microgrid domain. The brilliant charging station can work in independent mode and network associated mode. The exchanging between different modes is encouraged by the variety in dc connect voltage levels prompted because of the change in sun oriented insulation. Amid the time of low sun based insulation and pinnacle stack on circulation transformer, the controller moves the charging of PEVs to non-top period. The proposed control calculation is straightforward as it includes just a solitary parameter i.e. dc connect voltage to deal with the course of energy stream in the charging station. It encourages the charging of PEVs utilizing least vitality from the lattice with no unfriendly effects on the dissemination transformer. The accompanying areas clarify the idea of dc connect voltage detecting and its application for control and administration of PV controlled charging offices.

IV. POWER MANAGEMENT ALGORITHM

The definite circuit design for the proposed work environment based charging office is appeared in Fig. 2.11. The engineering comprises of a few strings of PV boards interfaced to their own DC/DC converters which share a typical dc transport. The DC/DC help converter plays out the capacity of greatest power direct following (MPPT) toward encourage the operation of PV board at the most extreme power point. The vitality stockpiling unit (ESU) is associated with the dc transport by means of a bi-directional DC/DC buck-help converter. The ESU will bolster the charging of PEVs when there is no power accessible either from the lattice or the PV. The battery pack in the ESU can be charged either from the matrix amid off pinnacle hours or from the PV after all the PEVs have been charged in the charging office. DC/DC buck converter associated with the dc transport controls the charging of the PEV. The control depiction appeared for the charging office in Fig. 5 depends on the prerequisites for two PEVs. Various PEVs can be charged by having separate buck converters introduced for each charging point. The charging office is associated with the power appropriation arrange through a DC/AC bi-directional network tied converter.

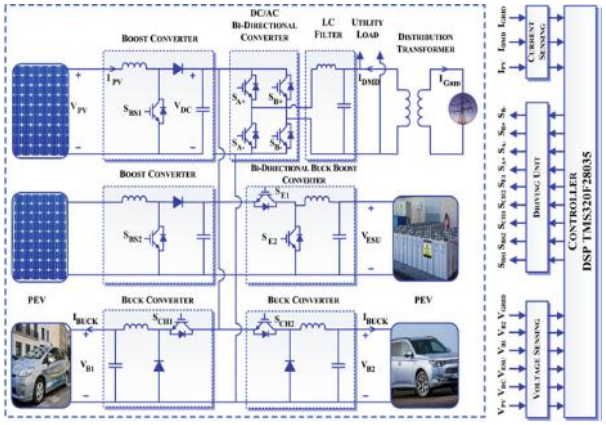

Figure 5. Detailed circuit configuration of the proposed architecture

The control unit screens and controls the power stream between the source and PEV. As appeared in Fig. 5 the control unit produces the changing signs to control the different power converters in the charging office in light of the voltage and current esteems detected by the voltage and current detecting units. V_{PV}, voltage over the PV exhibit and I_{PV}, the present spilling out of the PV cluster are utilized to execute MPPT by methods for incremental conductance calculation. V_{DC} is the greatness of the voltage at the dc transport, V_{B1} and V_{B2} are the distinguished battery voltages of the PEVs which give a measure of the condition of-charge (SOC) while VESU gives the measure of the SOC of the ESU. IDMD speaks to the stacking state of the circulation transformer, I_{grid} is the present sustained into the network by the DC/AC converter and V_{Grid} is the matrix side voltage.

International Journal of Engineering Technology Science and Research
IJETSR
www.ijetsr.com
ISSN 2394 – 3386
Volume 4, Issue 9
September 2017

V. MODES OF OPERATION

The operation of the charging station can be sorted into four modes: Mode-1 (framework associated correction), Mode-2 (PV charging and lattice associated amendment), Mode-3 (PV charging) and Mode-4 (matrix associated reversal). An arrangement of factors I_{DMD}, $I_{DMD\text{-}max}$, $V_{DC\text{-}1}$, $V_{DC\text{-}2}$, $V_{DC\text{-}3}$, V_B and V_{BH} are utilized to depict the methods of operation. I_{DMD} speaks to the appropriation transformer load and $I_{DMD\text{-}max}$ speaks to the pinnacle stack state of the transformer. VDC is the voltage at the dc transport. $V_{DC\text{-}1}$, $V_{DC\text{-}2}$ and $V_{DC\text{-}3}$ are the three picked reference voltage levels of the dc transport. V_B and V_{ESU} are the distinguished battery voltages of the PEV and the ESU. V_{BH} is the battery voltage relating to the limit estimation of the condition of-charge (TSOC). The charging of PEV ought to be ended once the battery voltage V_B is equivalent to V_{BH}. Fig. 6 demonstrates the course of energy stream amid different methods of operation of the charging station.

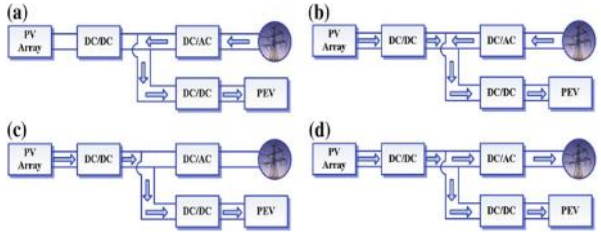

Figure 6. Direction of power flow during the operation modes

The four methods of operation are portrayed as takes after:

Mode-1: $V_{DC} < V_{DC\text{-}1}$: Grid-associated amendment

Case-1: $V_{DC} < V_{DC\text{-}1}$ and $I_{DMD} < I_{DMD\text{-}max}$

In this mode the photovoltaic framework does not create any power either because of low radiation or terrible climate conditions. The DC/DC support converter is secluded and the power required to charge the PEV is given by the framework. Whenever amid this mode if the dc interface voltage surpasses $V_{DC\text{-}1}$, the control movements to Mode-2. The DC/DC buck converter controls the yield voltage to charge the PEV. As the lattice is at off pinnacle, it keeps on providing power till the vehicle is totally charged. The controller ends the charging of PEV by handicapping the DC/DC buck converter when V_B surpasses V_{BH} and the framework supplies energy to charge the battery pack in the ESU.

Case-2: $V_{DC} < V_{DC\text{-}1}$ and $I_{DMD} \geq I_{DMD\text{-}max}$

This mode is like Case-1 yet with an expansion in neighbourhood request on the dispersion transformer. To decrease the weight on the matrix, the charging of PEV is ended briefly by de-actuating the lattice associated bi-directional DC/AC converter. As the appropriation transformer is mitigated from the extra weight of charging the PEV, it can keep providing energy to the neighbourhood loads amid the pinnacle time. Amid this period the PEV can be charged by the ESU if the put away vitality is adequate to provide food the requirements of PEV charging. Once the lattice has returned to off pinnacle condition (i.e. $I_{DMD} < I_{DMD\text{-}max}$) the charging of the PEV is re-established and the controller screens its charging.

Mode-2: $V_{DC\text{-}1} \leq V_{DC} < V_{DC\text{-}2}$: PV charging and matrix associated amendment

In this mode the power produced by the photovoltaic framework is not as much as the power required to charge the PEV. In this manner all the power created by the PV is exchanged to the PEV and the shortage is provided by the network. The dc connect voltage differs with the adjustment in illumination. This prompt change in the dc connect voltage is detected by the controller to produce an equivalent voltage at the yield of the DC/AC bi-directional converter through the procedure of amendment. On the off chance that anytime I_{DMD} surpasses $I_{DMD\text{-}max}$ the bi-directional DC/AC converter is disengaged from the lattice. The PV framework keeps charging the PEV though the lattice caters the pinnacle stack request.

Mode-3: $V_{DC\text{-}2} \leq V_{DC} < V_{DC\text{-}3}$: PV charging mode

In this mode the PV framework produces all the power required to charge the PEV. As the framework does not supply any power it is confined by the bi-directional DC/AC converter. The controller guarantees that the PEV is not over charged by ending its charging once V_B surpasses V_{BH} (voltage comparing to 95 % condition of charge of the PEV battery). This mode happens as long as the dc connect voltage is in the middle of $V_{DC\text{-}2}$ and $V_{DC\text{-}3}$.

Mode-4: V_{DC}-connect $\geq V_{DC\text{-}3}$:

PV charging mode and Grid reversal mode The PV exhibit produces abundance control once the dc connect voltage surpasses $_{VDC\text{-}3}$. This extra power created by the PV exhibit is sent to the framework through the bi-directional DC/AC converter. Once

International Journal of Engineering Technology Science and Research
IJETSR
www.ijetsr.com
ISSN 2394 – 3386
Volume 4, Issue 9
September 2017

the PEVs are charged, all the power from the PV source is sent to the matrix. The mode at that point takes after typical operation of PV era frameworks.

VI. SIMULATION STUDIES

In order to validate the proposed control calculation re-enactments were done in Matlab Simulink utilizing the simpower systems tool stash. The reference dc transport voltages i.e. V_{DC-1}, V_{DC-2} and V_{DC-3} are set at 50, 250 and 350V. The reference dc interface voltage levels are chosen in view of a preparation mode wherein the PEV stack is kept steady and the sun oriented light is permitted to fluctuate in steps. The estimations of $I_{DMD-max}$ and Tsoc are set at 80A (top to crest) and 95 %. Toyota Prius module cross breed has been picked as the PEV which has an aggregate battery limit equivalent to 4.5kWh and ostensible voltage equivalent to 48V. The rms estimation of AC network voltage is 240V. A PV board of rating 5.5kW has been displayed taking the battery limit of the PEV into thought. The reference dc transport voltages have been picked contemplating the adjustment in sun conditions from early morning to late night. As the dc transport voltage shifts, the source from which the PEV is charged likewise fluctuates as needs be. Reproduction comes about portraying the advances between different modes are demonstrated as follows.

Fig. 7 demonstrates the progress of the matrix from off crest to on crest when the charging station is working in mode 1. The stacking condition is gotten to by measuring the current (I_{DMD}) on the optional side of the dispersion transformer. At first the matrix is at off pinnacle and consequently the AC network conveys the power required to charge the PEV and other nearby loads. As appeared in Fig. 7, from 1.5 to 2.0 s the Fig. 7 Matlab simulink yields for change from mode-1 case-2. a DC transport voltage. b Current spilling out of the circulation transformer to the heaps and the PEV. c Power conveyed to the PEV (charging power). d Output voltage of the DC/DC buck converter current streaming in the auxiliary side of the circulation transformer is under 80A. With the expansion in utility load at 2.0 s, I_{DMD} surpasses 80 An ($I_{DMD-max}$). The charging of the PEV is ended when the present spilling out of the dissemination transformer, I_{DMD} surpasses $I_{DMD-max}$. This is done to diminish the anxiety being forced on the AC network amid the pinnacle time. Consequently the power devoured by the PEV lessens to zero amid the pinnacle time as appeared in the figure.

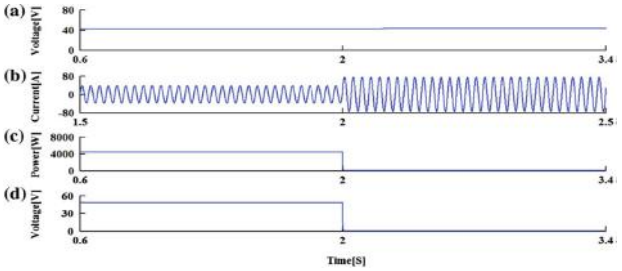

Figure 7. Matlab simulink outputs for transition from mode-1 case-2. a DC bus voltage. b Current flowing from the distribution transformer to the loads and the PEV. c Power delivered to the PEV (charging power). d Output voltage of the DC/DC buck converter

The re enactment comes about for the progress from mode 2 to mode 3 are appeared in Fig. 8. Amid the underlying stages the dc transport voltage is under 250V and framework keeps on providing the deficiency energy to charge the PEV. Once the dc transport voltage surpasses 250V, the PV framework alone provides food the charging of PEV. The power spilling out of the PV and the Power Grid is appeared in Fig. 8. As appeared in the figure, the shortfall energy of 1,000 W to charge the PEV is provided by the lattice in mode-2 and it doesn't supply any power in mode-3 as the PV alone obliges the request of the PEV.

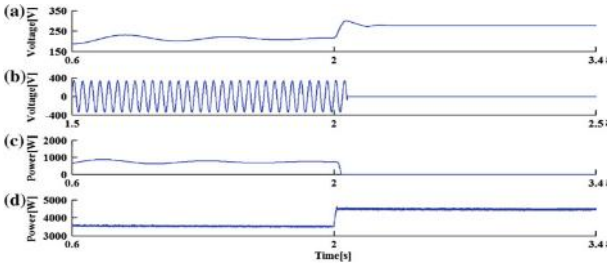

Figure 8. Matlab simulink outputs for transition from mode 2 to mode 3. a DC bus voltage. b Voltage of the grid. c Power delivered by the grid. d Power delivered by the PV array

The progress from mode 3 to mode 4 is appeared in Fig. 9. With the dc transport voltage surpassing 350V there is an expansion in control spilling out of the PV in mode 4. The PV framework bolsters this overabundance energy to the lattice notwithstanding charging the PEV. The sinusoidal yield of the DC/AC bi-directional converter demonstrates that it

International Journal of Engineering Technology Science and Research
IJETSR
www.ijetsr.com
ISSN 2394 – 3386
Volume 4, Issue 9
September 2017

goes about as an inverter for this situation. So as to keep up the vitality adjust the dc connect voltage is kept consistent at 360V. At last Fig. 10 demonstrates the end of the vehicle charging when SOC = Tsoc.

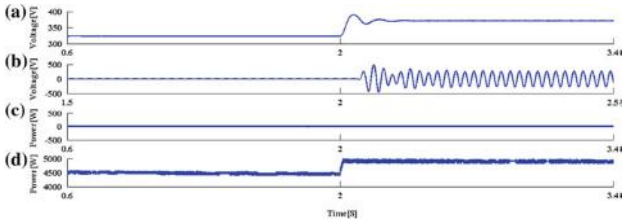

Figure 9. Matlab simulink outputs for transition from mode 3 to mode 4. a DC bus voltage. b Output voltage of the DC/AC bi-direction converted (inverter). c Power delivered by the grid. d Power delivered by the array

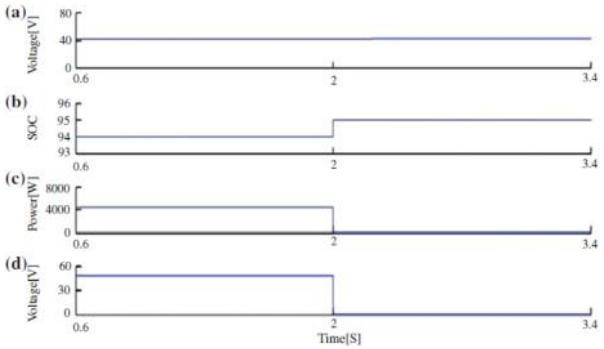

Figure 10. Matlab simulink outputs for transition in state-of-the-charge during mode-1. a DC bus voltage. b State-of-charge of the PHEV battery. c Charging power delivered to the PHEV. d Output voltage of the DC/DC buck converter

VII. CONCLUSION

To relieve the stacking on dissemination transformers because of PEV charging, savvy accusing systems coupled of sustainable power source assets are the need of great importance. This section talked about the present condition of the foundation for PV fuelled charging offices for PEVs. A few power electronic topologies are exhibited and analyzed. Control techniques are evaluated for private and working environment based photovoltaic charging. The part proposed a charging station design in view of dispersed topology. A remarkable control procedure in view of dc interface voltage detecting, which chooses the course of energy stream is displayed and the different methods of operation have been depicted. The reasonable plausibility and adequacy of the proposed control technique has been approved by recreation and test comes about. The proposed control technique in light of the adjustment in dc connect voltage level because of the adjustment in illumination of the sun, is basic and one of a kind. The vitality administration calculation encourages charging of the PEVs utilizing least vitality from the utility with a sort of interest administration to enhance the vitality productivity. Brilliant charging strategies like the one proposed in this section will cause stay away from real cost to redesign circulation transformers and other substation hardware with the expansion in PEV stacks on the dissemination framework.

REFERENCES

[1] Kempton W, Tomic J (2005) Vehicle-to-grid power implementation: from stabilizing the grid to supporting large-scale renewable energy. J Power Sources 144(1):280–294.

[2] EPRI (2012) Tennessee valley authority smart modal area recharge terminal (SMART) station project. http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000000001026583. Accessed Nov 2012.

[3] Gorton M (2011) Solar-powered electric vehicle charging stations sprout up nationally. http://www.renewableenergyworld.com/rea/news/article/2011/11/solar-powered-electric-vehicle-charging stations-sprout-up-nationally.

[4] Accessed Nov 2011 Motavalli J (2013) Here now: the world's first portable, self-contained solar EV charging station. http://www.plugincars.com/here-now-worlds-first-portable-self-contained-solar-ev-chargingstation- 128015.html. Accessed Aug 2013.

[5] Ayre J Solar-integrated EV fast charging station (eco station) gets CODA energy storage system. http://cleantechnica.com/2013/09/02/solar-integrated-ev-fast.

[6] Giges NS (2012) Wind-powered charging stations coming soon. https://www.asme.org/engineering-topics/articles/renewable-energy/wind-powered-charging-stations-coming-soon. Accessed Oct 2012.

[7] Liu K, Makaran J (2009) Design of a solar powered battery charger. In: Electrical power and energy conference (EPEC), 22–23 Oct 2009.

[8] Neumann H, Schar D, Baumgartner F (2012) The potential of photovoltaic carports to cover the energy demand of road passenger transport. Prog Photovolt Res Appl 20:639–649.

[9] Ingersoll JG, Perkins CA (1996) The 2.1 kW photovoltaic electric vehicle charging station in the city of Santa Monica, California. In: The twenty fifth IEEE photovoltaic specialists conference, 13–17 May 1996.

[10] Locment F, Sechilariu M, Forgez C (2010) Electric vehicle charging system with PV grid connected configuration. In: IEEE vehicle power and propulsion conference (VPPC), 1–3 Sept 2010.

[11] Letendre S (2009) Solar electricity as a fuel for light vehicles. In: Proceedings of the 2009 American solar energy society annual conference, Boulder, CO.

[12] Tulpule PJ, Marano V, Yurkovich S, Rizzoni G (2013) Economic and environmental impacts of a PV powered workplace parking garage charging station. J Appl Energy 108:323–332.

[13] Birnie III DP (2009) Solar-to-vehicle (S2 V) systems for powering commuters of the future. J Power Sources 186(2):539–542.

[14] Zhang Q, Tezuka T, Ishihara KN, Mclellan BC (2012) Integration of PV power into future low-carbon smart electricity systems with EV and HP in Kansai Area, Japan. J Renew Energy 44:99–108.

[15] Denholm P, Kuss M, Margolis RM (2012) Co-benefits of large scale plug-in hybrid electric vehicle and solar PV deployment. J Power Sources 236:350–356.

[16] National Houshold Travel Survey (NHTS) (2009). Summary of travel trends-2009. http://nhts.ornl.gov/2009/pub/stt.pdf. Accessed Oct 2009.

[17] Rutherford MJ, Yousefzadeh V (2011) The impact of electric vehicle battery charging on distribution transformers. In: Twenty-sixth annual IEEE applied power electronics conference and exposition (APEC), 2011.

[18] Green RC, Wang L, Alam M (2011) The impact of plug-in hybrid electric vehicles on distribution networks: a review and outlook. J Renew Sustain Energy Rev 15(1):544–553.

[19] Shao SN, Pipattanasomporn M, Rahman S (2009) Challenges of PHEV penetration to the residential distribution network. In: IEEE power and energy society general meeting, 26–30 July 2009.

[20] Zhao J, Kucuksari S, Mazhari E, Son YJ (2013) Integrated analysis of high-penetration PV and PHEV with energy storage and demand response. J Appl Energy 112:35–51.

[21] Erol-Kantarci M, Mouftah H (2011) Management of PHEV batteries in the smart grid towards a cyber-physical power infrastructure. In: IEEE workshop on design, modeling and evaluation of cyber physical systems, July 2011.

[22] Carli G, Williamson SS (2013) Technical considerations on power conversion for electric and plug-in hybrid electric vehicle battery charging in photovoltaic installations. IEEE Trans Power Electron 28(12):5784–5792.

[23] Giannouli M, Yianoulis P (2012) Study on the incorporation of photovoltaic systems as an auxiliary power source for hybrid and electric vehicles. J Sol Energy 86(1):441–451.

[24] Li X, Lopes LAC, Williamson SS (2009) On the suitability of plug-in hybrid electric vehicle (PHEV) charging infrastructures based on wind and solar energy. In: IEEE power and energy society general meeting, 26–30 July 2009.

[25] Hadley, SW (2007) Evaluating the impact of plug-in hybrid electric vehicles on regional electricity supplies. In: Bulk power system dynamics and control—VII. Revitalizing operational reliability, Aug 2007.

[26] Yan Q, Kezunovic M (2012) Impact analysis of electric vehicle charging on distribution system. In: North American power symposium (NAPS), Sept 2012.

[27] Moghe R, Kreikebaum F, Hernandez JE, Kandula RP, Divan D (2011) Mitigating distribution transformer lifetime degradation caused by grid-enabled vehicle (GEV) charging. In: IEEE energy conversion congress and exposition (ECCE), Sept 2011.

[28] Masoum AS, Deilami S, Moses PS, Abu-Siada (2010) A impacts of battery charging rates of plug-in electric vehicle on smart grid distribution systems. In: IEEE PES innovative smart grid technologies conference Europe (ISGT Europe), Oct 2010.

[29] Qian K, Zhou C, Allan M, Yuan Y (2010) Load model for prediction of electric vehicle charging demand. In: International conference on power system technology (POWERCON), Oct 2010.

[30] Papadopoulos P, Skarvelis-Kazakos S, Grau I, Cipcigan LM, Jenkins N (2010) Predicting electric vehicle impacts on residential distribution networks with distributed generation. In: IEEE vehicle power and propulsion conference (VPPC), Sept 2010.

[31] Jian L, Xue H, Xu G, Zhu X, Zhao D, Shao Z (2013) Regulated charging of plug-in hybrid electric vehicles for minimizing load variance in household smart microgrid. IEEE Trans Industr Electron 60(8):3218–3226.

[32] Osawa M, Yoshimi K, Yamashita D, Yokoyama R, Masuda T, Kondou H, Hirota T (2012) Increase the rate of utilization of residential photovoltaic generation by EV charge-discharge control. In: IEEE innovative smart grid technologies—Asia (ISGT Asia), May 2012.

[33] Chukwu UC, Mahajan SM (2014) V2G parking lot with pv rooftop for capacity enhancement of a distribution system. IEEE Trans Sustain Energy 5(1):119–127.

[34] Geiles TJ, Islam S (2013) Impact of PEV charging and rooftop PV penetration on distribution transformer life. In: IEEE power and energy society general meeting (PES), 21–25 July 2013.

[35] Robalino DM, Kumar G, Uzoechi LO, Chukwu UC, Mahajan SM (2009) Design of a docking station for solar charged electric and fuel cell vehicles. In: International conference on clean electrical power, 9–11 June 2009.

[36] Alamri BR, Alamri AR (2009) Technical review of energy storage technologies when integrated with intermittent renewable energy. In: International conference on sustainable power generation and supply, SUPERGEN, 6–7 April 2009.

[37] Gurkaynak Y, Khaligh A (2009) Control and power management of a grid connected residential photovoltaic system with plug-in hybrid electric vehicle (PHEV) load. In: Twenty-fourth annual IEEE applied power electronics conference and exposition (APEC), 15–19 Feb 2009.

[38] Nagarajan A, Shireen W (2010) Grid connected residential photovoltaic energy systems with plug-in hybrid electric vehicles (PHEV) as energy storage. In: IEEE power and energy society general meeting, 25–29 July 2010.