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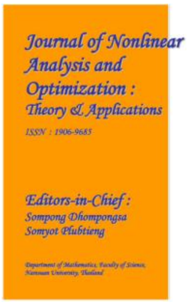

PV-EV CHARGING STSTIONS BASED ENERGY MANAGEMENT STRATEGY

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ABSTRACT

The use of solar-powered charging facilities for electric vehicles has increased. This study examines and analyses a grid-connected electric car charging station that is powered by a photovoltaic solar system and a battery pack for storage. The direct current bus voltage is the most crucial characteristic for system supervision. To keep the bus voltage at such level, the electric car charging station may be supplied by the grid or an energy storage system. By modelling the charging system under various irradiance circumstances and accounting for the cost of energy transfer and battery state of charge, this oversight is tested. The results confirm the effectiveness of the suggested energy management strategy and the appropriate functioning of the electric car charging station.

INTRODUCTION

A photovoltaic (PV) electric vehicle (EV) charging station is a type of charging station that uses solar energy to charge electric vehicles. The station consists of PV panels that convert sunlight into electricity, which is then used to charge the EVs. The main advantage of using PV charging stations is that they are eco-friendly, as they do not emit any harmful gases or pollutants into the environment.

However, the challenge with using PV charging stations is that the amount of energy generated by the PV panels varies depending on the weather conditions and the time of day. To overcome this challenge, an energy management strategy is required to ensure that the EVs are charged efficiently and effectively, while also maximizing the use of renewable energy sources.

The energy management strategy of a PV EV charging station involves several key components, including energy storage, load management, and grid interaction. Energy storage systems, such as batteries or capacitors, can be used to store excess energy generated by the PV panels during times of high sunlight intensity, which can then be used to charge EVs during periods of low sunlight intensity or at night.

Load management involves balancing the charging of multiple EVs to ensure that the available energy is used efficiently and effectively. This can be achieved through the use of intelligent charging systems that prioritize charging for EVs that require more energy or have longer charging times, while also taking into account the energy requirements of other EVs that are connected to the station.

Grid interaction involves the connection of the PV EV charging station to the electrical grid, which allows for the exchange of energy between the station and the grid. This can be beneficial in situations where the PV panels are not generating enough energy to meet the charging demands of the EVs, as energy can be drawn from the grid to supplement the energy generated by the PV panels.

In summary, an effective energy management strategy is essential for the efficient and effective operation of a PV EV charging station. This involves the use of energy storage systems, load management techniques, and grid interaction to ensure that the charging of EVs is optimized while also maximizing the use of renewable energy sources.

LITERATURE SURVEY

Xuan Hieu Nguyen, Minh Phuong Nguyen; Background Photovoltaic (PV) array which is composed of modules is considered as the fundamental power conversion unit of a PV generator system. The PV array has nonlinear characteristicsand it is quite expensive and takes much time to get the

operating curves of PVarrayunder varying operating conditions. In order to overcome these obstacles, commonandsimple models of solar panel have been developed and integrated to many engineeringsoftware including Matlab/Simulink. However, these models are not adequatefor application involving hybrid energy system since they need a flexible tuning of someparameters in the system and not easily understandable for readers to use by themselves. Therefore, this paper presents a step- by-step procedure for the simulation of PVcells/modules/arrays with Tag tools in Matlab/ Simulink. A DS-100Msolar panel isused as reference model.
Ellen De Schepper, Steven Van Passel and Sebastien Lizin; The operationcharacteristics of PV array are also investigated at a wide range of operating conditionsand physical parameters.Result The output characteristics curves of the model matchthecharacteristics of DS-100M solar panel. The output power, current and voltage decreaseswhen the solar irradiation reduces from 1000 to 100 W/m2. When the temperaturedecreases, the output power and voltage increases marginally whereas the output current almost keeps constant. Shunt resistance has significant effect on the operating curves ofsolar PV array as low power output is recorded if the value of shunt resistance variesfrom 1000 ohms to 0.1 ohms.Conclusion The proposed procedure provides an accurate, reliable and easy-to-tune model of photovoltaic array. Furthermore, it alsorobust advantageous in investigating the solar PV array operation fromdifferent physical parameters (series, shunt resistance, ideality factor, etc.) and working condition varyingtemperature, irradiation and especially partial shadow effect aspects.BackgroundPhotovoltaic (PV) array which is composed of modules is considered as the fundamental power conversion unit of a PV generator system. The PV array has nonlinearcharacteristics and it is quite expensive.

PROPOSED SYSTEM

An electric vehicle charging station, also called EV charging station, electricrecharging point, charging point, charge point, electronic charging station (ECS), and electric vehicle supply equipment (EVSE), is an element in an infrastructurethat supplies electric energy for the recharging of plug-in electric vehicles—includingelectriccars, neighborhood electric vehicles and plug-in hybrids. For charging at home or work, some electric vehicles have converters on boardthat can plug into a standard electrical outlet or a high-capacity appliance outlet. Others eitherrequire or can use a charging station that provides electrical conversion, monitoring, orsafety functionality. These stations are also needed when traveling, and manysupport faster charging at higher voltages and currents than are available fromresidential EVSEs. Public charging stations are typically on-street facilities provided by electric utilitycompanies or located at retail shopping centers, restaurants and parking places, operatedby a range of private companies. Charging stations provide a range of heavy duty or special connectors that conformtothe variety of standards. For common DC rapid charging, multi-standard chargersequipped with two or three of the Combined Charging System (CCS), CHAdeMO, andAC fast charging has become the de facto market standard in many regions. Charging stations fall into four basic categories:
1. Residential charging stations: An EV owner plugs into a standard receptacle(suchas NEMA connector in the US) when he or she returns home, andthecarrecharges overnight. A home charging station usually has no user authentication, no separate metering, but may require wiring a dedicated circuit to havefastercharging. Some portable chargers can also be wall mounted as charging stations.
2. Charging while parked (including public charging stations) – a privateorcommercial venture for a fee or free, sometimes offered in partnershipwiththeowners of the parking lot. This charging may be slow or high speed andoftenencourages EV owners to recharge their cars while they take advantage of nearbyfacilities.
3. It can include parking for an organization's own employees, parking atshoppingmalls, small centers, and public transit stations. Typically, ACType1/ Type2 plugs are used.
4. Fast charging at public charging stations >40 kW, capable of delivering over 60-mile (97 km) of range in 10–30 minutes. These chargers may be at rest stopstoallow for longer distance trips. They may also be used regularly by commutersinmetropolitan areas, and for charging while parked for shorter or longer periods. Common examples are J1772, Type 2 connector, Combined chargingsystem, CHAdeMO, and Tesla Superchargers.

5. Battery swaps or charges in under 15 minutes. A specified target for CARB credits for a zero-emission vehicle is adding 200 miles (approx. 320 km) to its range in under 15 minutes. In 2014, this was not possibleforcharging electric vehicles, but it is achievable with EV battery swaps. It intendstomatch the refueling expectations of regular drivers and give crane mobile support for discharged vehicles where there is no charging station.

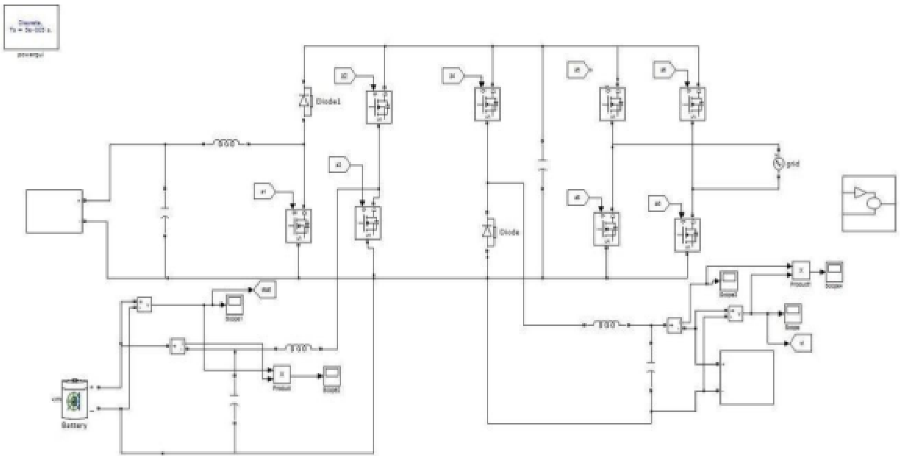
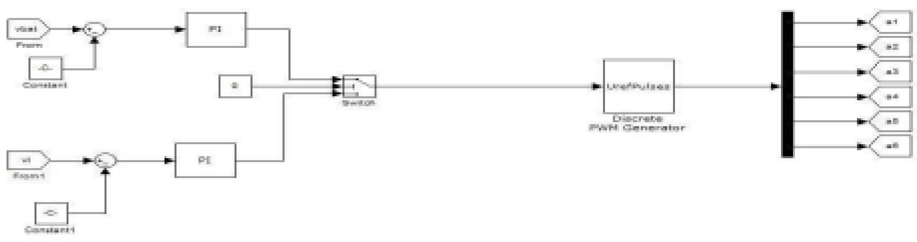


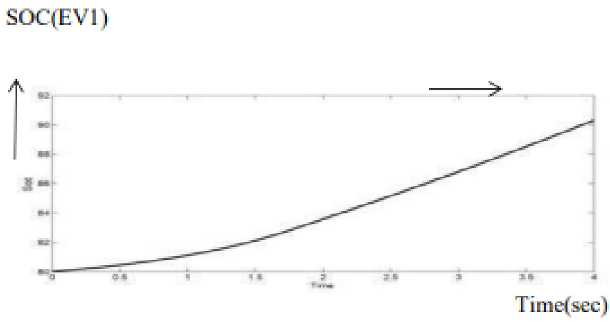
Fig.1: proposed simulation circuit

SIMULATION RESULTS

Battery capacity and the capability of handling faster charging are both increasing, and methods of charging have needed to change and improve. Newoptions havealsobeen introduced (on a small scale, including mobile charging stations and chargingvia inductive charging mats). The differing needs and solutions of various manufacturershas slowed the emergence of standard charging methods, and in 2015, there is a strongrecognition of the need for standardization. The charging time depends on the battery capacity and the charging power. Insimpleterms, the time rate of charge depends on the charging level used, and the charginglevel depends on the voltage handling of the batteries and charger electronics in the car.TheU.S.-based SAE International defines Level 1 (household 120V AC) as theslowest, Level 2 (upgraded household 240 VAC) in the middle and Level 3 (supercharging, 480VDCorhigher) as the fastest. Level 3 charge time can be as fast as 30 minutes for an 80%charge. Although there has been serious industry competition about whose standard shouldbewidely adopted. Charge time can be calculated using the formula: Charging Time[h] =Battery Capacity [kWh] / Charging Power [kW]



proposed controller



: *SOC EV1 Graph*

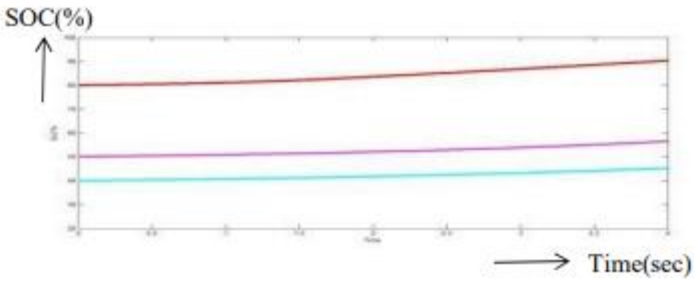
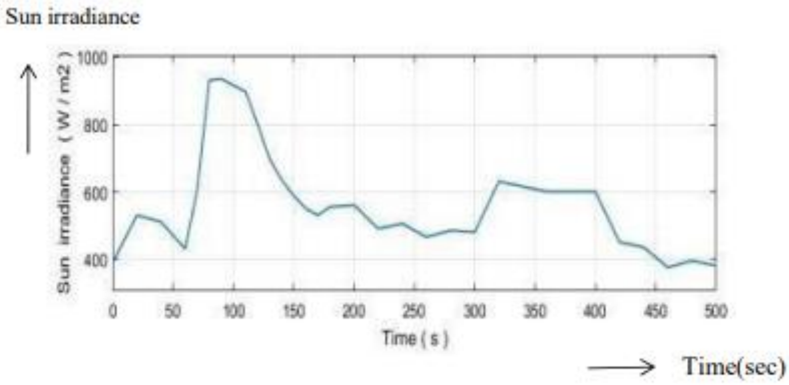
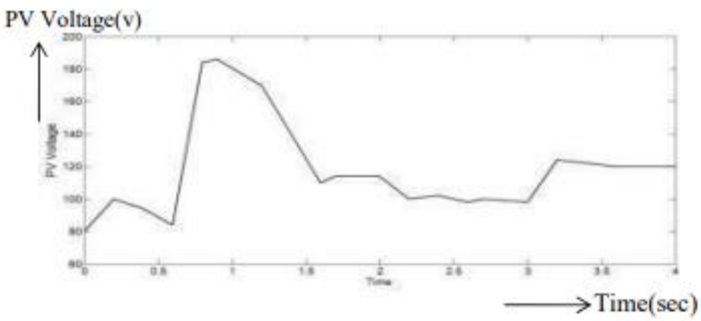


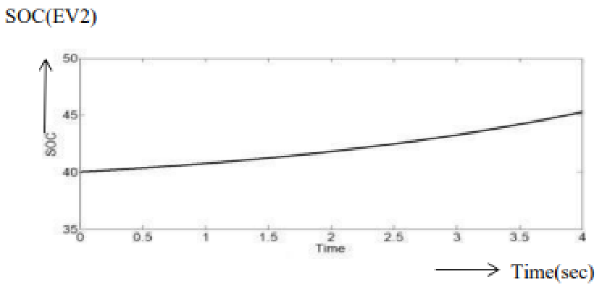
Fig.2: Electric vehicle's SOC



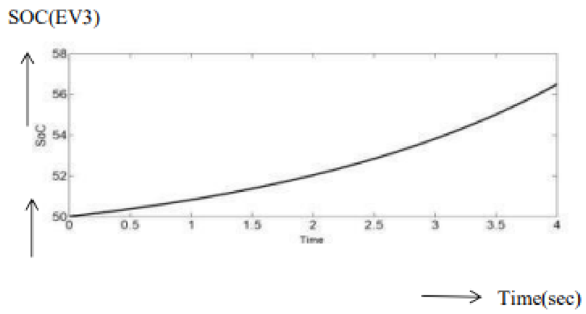
sun irradiance profile



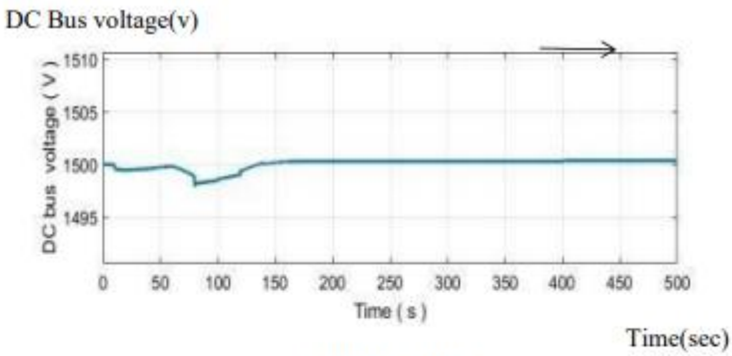
pv voltage



SOC EV2 Graph



SOC EV3 Graph



DC bus voltage

CONCLUSION

A suggested EV charging station with PV and BES is built on a multiport converter. The purpose of the ABES controller is to reduce voltage sag and balance the power supply between solar, wind, and electric vehicle charging demands. When wind and PV production are inadequate for local EV charging, the proposed control system causes the BES to discharge. When wind and PV generation are excess, or the power grid is experiencing low demand, as at night, the BES begins to charge. As a consequence, the power grid's stability and dependability are improved by the combination of EV charging, PV production, and BE. Following an investigation into the advantages of various operating modes, MATLAB simulation and thermal models of the multiport converter-based EV charging stations and their suggested SiC equivalent are created.

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