Electrical Vehicles with V2G and G2V Operating Mode By using The Bidirectional Converter

Asst. Prof. Pankaj Maskar[1], Rahul Suryawanshi[2], Shivani Bansode[3], Dimple Choudhary[4], Mrunal Satpute[5], Rasika Sarang[6].

Department of Electrical Engineering[1, 2, 3,4,5,6.]

Nanasaheb Mahadik College of Engineering Peth (Sangli).

***Abstract*-The proposed model of an electric vehicle charging station is suitable for the fast DC charging of multiple electric vehicles. The station consists of a single grid-connected inverter with a DC bus where the electric vehicles are connected. The control of the individual electric vehicle charging processes is decentralized, while a separate central control deals with the power transfer from the AC grid to the DC bus. The electric power exchange does not rely on communication links between the station and vehicles, and a smooth transition to vehicle-to grid mode is also possible. Design guidelines and modeling are explained in an educational way to support implementation in MATLAB/Simulink. Simulations are performed in MATLAB/Simulink to illustrate the behavior of the station. The results show the feasibility of the model proposed and the capability of the control system for fast DC charging and also vehicle-to-grid.**

Keywords: - Buck-Boost Converter, Electric Vehicle, On- board battery charger (OBC), Vehicle to Grid (V2G), Grid to Vehicle (G2V).

INTRODUCTION

Electric vehicles (EV) lowers the risk related to environmental pollution and it gives better performance than the normal IC-engine vehicles. Plug in hybrid electric vehicles provides technology for charging the battery of vehicles at the home or at charging station in parking time of the vehicles.

Electrical vehicles have some limitation, so all people don't use it. Its limit are: high cost as compared to the fluid based vehicles, need some more time to recharge, very much low growth in battery infrastructure. Power electronics device corrects a lot of these problems. These devices is also used for designing the charging station of electrical vehicles and afterward it charger architecture .The electrical vehicles charging station is divided as DC and AC station. In DC station the converter installed in the station. The single phase used for domestic purpose and three phase used for industrial uses. The ac source supplied to a linear and non-linear load. Nonlinear load likewise power diode, power transistor, thruster, metal oxide field effective transistor for high switching applications, isolated gate bipolar transistor (IGBT) for high voltage application based converters are hardly used in different kinds of residential and industrial equipment's.

Electric vehicles charger is connected to the charging the battery. Converting AC-DC for battery storage system require converter which is unidirectional and bidirectional. The bidirectional converter used for flow of power in both ways which is grid to vehicles and as of vehicles to grid. The 1- Øbidirectional AC-DC converter gives non-regulated DC voltage. This voltage is controlled by three-level DC-DC buck boost converter. The research activities on the interaction PEV/Grid field are spread since many years and develop by steps. The impacts on the grid and their elements were analyzed. Significant research works were conducted to lower impacts with centralized, decentralized, on-line and off-line strategies. Research of the PEV/Grid topic is now focused on Vehicle to Grid (V2G) and Vehicle-to-Home (V2H) concepts with different aims based on economical aspect. In PEVs are used to support the grid frequency thanks to V2G. In this same theme aspect, PEVs are also used to mitigate potential overloads in the distribution system and to lower charging costs during the same situation. Grid components are now most important part of the research activities.

The plug-in electric vehicle i.e., a vehicle (all electric or hybrid) that can be recharged with an electric plug (grid to vehicle, G2V), we can see as a some special residential load with the better ability to return energy to the grid (vehicle to grid, V2G). Actually, nowadays developments in PEV and residential EMS recognize the control of PEV charging and discharging operations as related issues going on to best mobility and huge optimization of energy use Charging station of PEVs is as well strategic in the near future. Here are, shows the profits by presenting a strategy allows PEVs to share their battery stored energy with each other under the coordination of an aggregator. Profit increasing in charging stations with renewable energies are applied in and battery replacement strategy in charging stations with still renewable and storage system are presented in.

LITERATURE REVIEW

Scope of Work –

In this project electrical vehicle with V2G and G2V operating mode by using bidirectional converter using to save the conventional energy sources, Save the electricity. This is electricity is used in vehicles can be store back to grid, when the vehicle is at neutral states. In today's scenario, the electrical vehicles which are been used take time for the charging process. But in this project the system we have to used take less time for charging process. So that consumer will not be able to loose or waste of time for vehicles for charging process.

BACKGROUND STUDY-

Problem Definition-

Nowadays electricity energy systems are facing a number of challenges worldwide, including the need to integrate new sources of supply. The variability of some sources of renewable- based supply and changes resulting from the increased use of Hybrid and Electric Vehicles (HEVs). The integration of HEVs in the vehicle fleet will improve deep modification and may contribute for the reduction of greenhouse gases emissions. Greenhouse gases emissions.

DESIGN OF THE PROJECT

The concept of V2G is to solve the above problems, its main idea is to use a huge amount of storage energy of electric vehicles as the buffer for power grid and renewable energies, as showninFig.1. When the network load has high amount of demand is, the energy stored in EVs will be feedback for the grid. When the network load has low demand, the power which is not used in the grid can be stored in the EVs to avoid waste. The EV users can thus buy electricity from the grid when the price is low and can sell the electricity to the grid with high price so that certain\benefits can be obtained from this trade behavior.

The plug-in hybrid electric vehicles and pure electric vehicles are slowly entering into the market. According to the official statistical data, there are about20 hours per day for the vehicles in still state, during which period it represent not good asset. If there are much amount of these vehicles, their total battery capacities can be related as a buffer for the power grid and renewable energy systems. But, the electric vehicles cannot use to the grid freely and unmanageably. It can cause serious damage to the grid with large amount of charging demand from the EVs if the gird is in peak-load periods. As for the vehicles, in importantly to provide more extra services for the grid, they should satisfy the daily routine driving requirements.

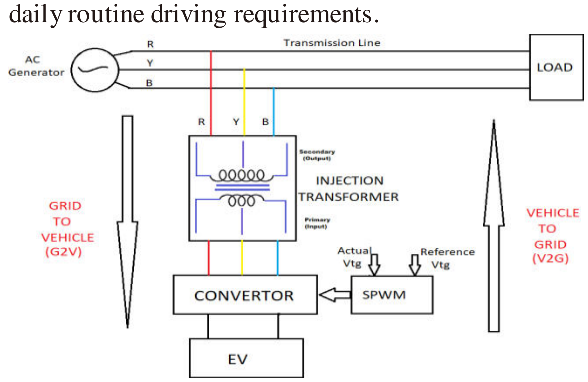

Diagram-

So, it is very important to investigate the V2G technology to coordinate the charging/discharging behaviors between vehicles and grid so that it will not affect the power grid operation and constrain the normal use of automobiles. V2G technology collect the energy flow among the EV sand grid with mutual, real-it Controllable and high speed characteristics. From the grid way, it is necessary to scattered the EVs charging load reasonably to avoid the conventional grid peak load periods so to store their impact on the power grid and other unimportant construction investment on transmission grid and distribution grid which can confirm the arrange development of electric vehicles and power grid. So EVs charging need to be regular or controlled to achieve peak shaving and valley filling due to their daily consumption demand with the application of effective economic aspect or technical aspect, which is the concept of ordered charging.

A variety of aspects necessary to understand this. When designing the circuit of the charging station. These aspects, from a technical point of view, include the following: Area made available for parking of vehicles; this influences the number of cars that can be placedandcharged.

• Estimation of the demand for fast charging slots in thelocation.

• Network parameters, i.e. nominal voltage and allowable power levels at the point of common coupling.

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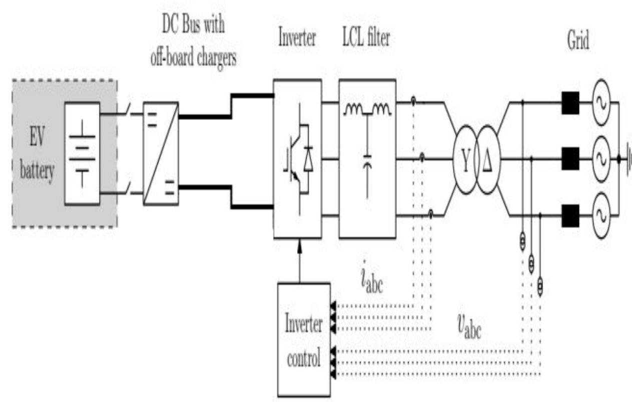
• Maximum charging power rate for individual vehicles. The proposed DC charging station configuration is shown in Fig. 1, it can be seen that the inverter is interfaced to the network through an LCL filter and a transformer; while a single DC bus feeds all individuals battery chargers. The dc capacity stratedin VA rise defined according to started= k load /VslotPEV cos*φ*.

Where cos *φ* is the power factor, *N*slot is the amount of charging slots available for individual EVs, *P*EV is the maximal power rate of an individual EV and *k* load is an overload factor for cover overloading in transients. Generally, the DC link voltage is set according to the grid voltage. In this work, the grid connection through a transformer leaves the DC bus voltage selection free from the grid voltage level. However, it has to be considered that the battery minimum voltage *V*bat min, and the battery charger minimum modulation index *m*min, where *v*dc is the DC bus nominal voltage.

1. EV (Electrical Vehicle)
2. Converter
3. Control strategy
4. Injection Transformer
5. bidirectional converter



EV Electrical Vehicle -

An electric vehicle is also known as electrics is a vehicle that used for one or more electric motors or traction motors for propulsion. An electric vehicle may be powered with collector system by electricity from off-vehicle sources, or it may be completed with a battery, solar panels, fuel cells or an electric generator to convert fuel into electricity.

EVs included, these are not limited to, road and rail vehicles, surface and underwater vessels, electric aircraft and electric spacecraft. EVs first came into existence in the mid-19th century, when electricity was among the these verified methods for motor vehicle propulsion, to providing that level of comfort and ease of operation that may not be achieved by the gasoline cars of the time. Recent new internal combustion engines have been the dominant propulsion method for motor vehicles for almost 100 years, but electric power has remained ordinary in other vehicle types, such as trains and smaller vehicles of all types.

Generally, the thing EV is used to refer to an electric car. In the 21st century, EVs have seen a renewable with technological developments, the increased focus on renewable energy and the potential minimization of transportation's impact on climate change and other environmental problems. Project shows electric vehicles as one of the 100 best solutions for describing climate changes.

Government incentives for the increasing in adoption were first introduced in the late-2000s, with the United States and the European Union, heading towards growing market for the vehicles in the 2010s. And increasing consumer interest and awareness and structural incentives, such as those being built into the green recovery from the COVID-19 pandemic, is all time expected good increase the electric vehicle market. A pre-COVID 2019 analysis, shows that Electric vehicles are intended to increase from 2% of global share in 2016 to 22% in 2030.

Mainly the market growth is expected in markets like North America and Europe; a 2020 literature review, shows that growth in use of electric vehicles, especially electric personal vehicles, now currently seems economically developed economies.

Converter

An inverter is a device that converts electrical energy of DC form into that of AC. The main objective of DC-AC inverter is to get DC power from a battery source and converts it to AC. These DC-AC inverters have been hardly used for industrial applications like not interruptible power supply (UPS), AC motor drives.

The inverters are also plays an important role in various kinds of renewable energy applications as these are used for grid connection of Wind Energy System or Photovoltaic System. In addition to this, the control strategies are used in the inverters are also same as to those in DC-DC converters.

Control Strategy

In this Control Strategy we have used Sinusoidal Pulse Width Modulation is the best technique for this. This PWM technique involves generation of a digital waveform, where the duty cycle can be converted in such a way so that the average voltage waveform matches to a pure sine wave. The normal way of producing the SPWM signal is through comparing a low power sine wave reference with a high frequency triangular wave. This SPWM signal can be used to control switches.

The term SPWM mean for “Sinusoidal pulse width modulation” it is a technique of pulse width modulation used in inverters. An inverter can generates an output of AC voltage from an input of DC with the help of changing circuits to reproduce a sine wave by generating one or more square pulses of voltage per half cycle. If the size of the pulses is adjusted, the output is said to be pulse width modulated. With this modulation, some pulses are produced per half cycle. The pulses next to the ends of the half cycle are constantly lower than the pulses near to the center of the half cycle so that the pulse widths are comparative to the equal amplitude of a sine wave at that part of the cycle. To change that kind of output voltage, the widths of all pulses are amplified or minimized while keeping the sinusoidal proportionality. With PWM, only the onetime of the pulses are changed during the amplitudes.

Sinusoidal PWM has been highly popular method applied as a part of AC engine control. This is a technique that used a triangular carrier wave modulated by a sine wave and the main intention of convergence decide the exchanging goals of the power gadgets in the inverter. on the other hand the fact that this technique can’t make fulfill utilization of the inverter’s supply voltage and the asymmetrical nature of the PWM changing characteristics delivers usually high harmonic distortion in the supply it is as yet prevalent for its effortlessness. This article shows the theory and task of SPWM must made utilizing a new modified microcontroller of 8051 families accurately connected to 3 phase inverter with 6 numbers MOSFET or IGBTs from DC got from a lonely stage or 3 stage, 50 Hz supply. The load must have star associated three stage 50 Hz, 440volt, and 0.5 to 1 HP engine. After that again starlight load will be used to see the waveform as it were.

Injection Transformer

The first state of the system is a steady one. For this, we must provide the value of state differences of system and it also the interface variables between different blocks of the model. The value of these differences can be chosen arbitrarily (within the limits of validity of models), the value of others might be already analyzed from the first through the use of relationships between differences in steady state. The definition of a first state is that choose a group of variables of the system so we can understand a value independently and that the set of all other variables in the system can be inferred.

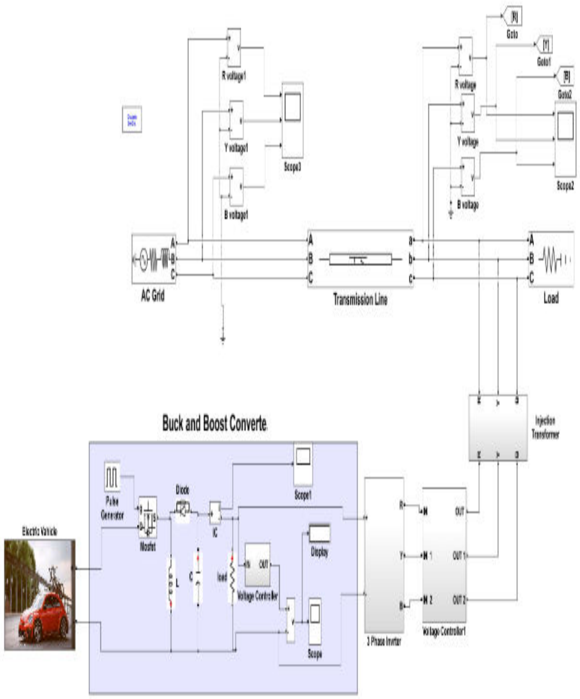
We would like to describe this later in this section the overall system initialization, that is to say the choice of independent variables and calculating the interface variable models of areas and lines. Starting within each and every component models will be presented at the same time when the description thereof. In steady state, the frequency is the same everywhere in the system. Possibility here that the first state, this frequency is the nominal frequency. We can take it as a basic option that the active production and voltage generators are given, on the other hand the active and reactive power of the charges for voltage and nominal frequency. In this scenario, in general, the active power balance is not checked.

So that, the active production of one of the generators will not be fixed (node beam). In this node, the reference phase has been fixed. Compared to the normal approach to charge flow, it is very important to make the following remarks: 1) the voltage generator is set to stator terminals of the alternator. We can assume here that the voltage is fixed to the bus bar high voltage area. If the step-up transformer of the production group is an ideal one there is a relationship of proportionality between the two. If the model of transformer including with internal impedance, the voltage all around the alternator stator is calculated from other variables, including voltage bus bar HT, as will be described later in the paragraph on the initialization of variables of the step-up transformer. For the initial situation, the voltage across the charge is not that much important the nominal voltage. If the models are including a sensitivity of active and reactive power charges in tension, it is necessary to not take granted so that the determination the powers and the initial tensions.

If the step-down transformer is an ideal transformer, the voltage across the charge is proportional to the voltage node HT, given in the initial conditions. There are the active and reactive power consumed can be calculated.

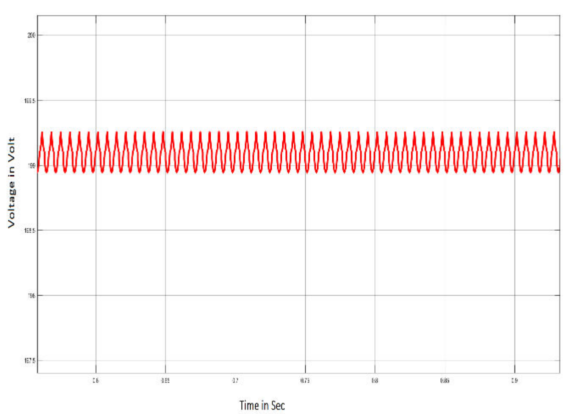
The initialization of variables relating to charges and step-down transformer will be developed in Section 2

SIMULATION

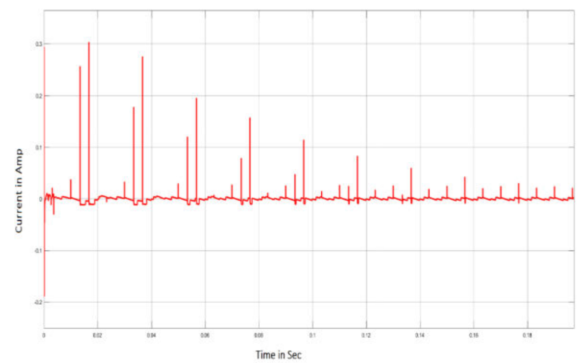


OUTPUT-

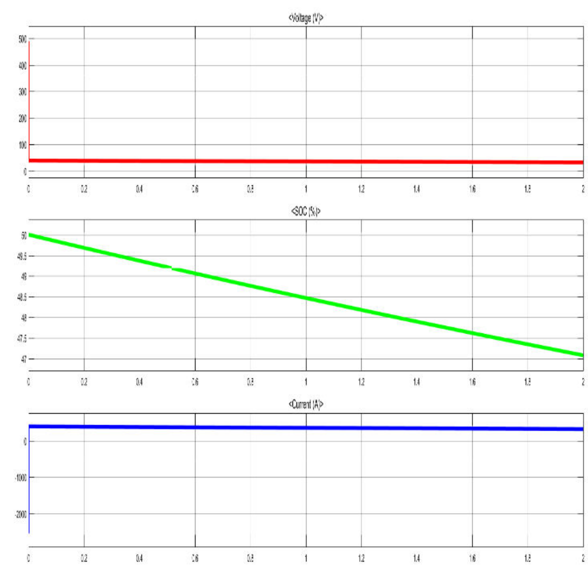
Buck- Boost converter voltage-



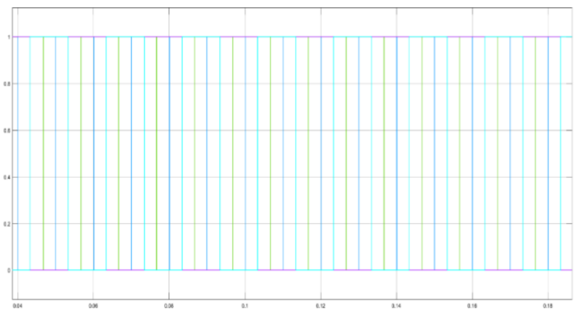
Buck-Boost converter current -



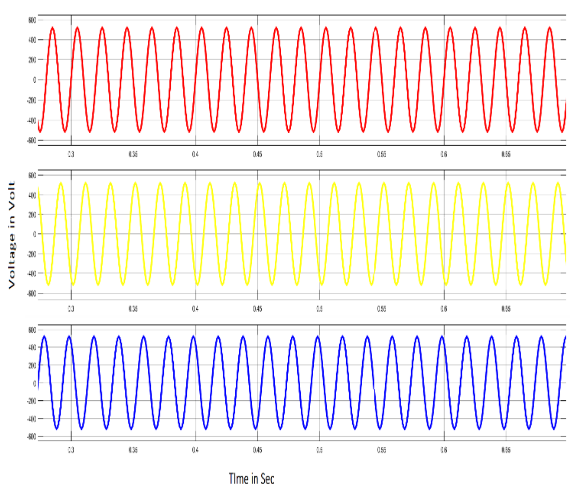
Electrical vehicle output -



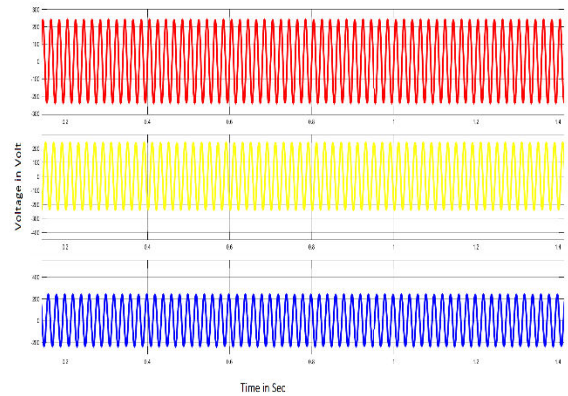
Control Output -



Input Grid voltage -



Output grid voltage-



CONCLUSION

V2G and V2H technology ensures that the reactive power is compensated by providing active power or renewable energy sources in the existing grid. The advantages of V2G and V2H technology are not only possible for the grid, but also for the owners of electrical vehicles. These systems provide vehicle owners with continuous power support at home or at work. Increasing the capacities of the existing energy sources or preparing new energy sources necessitates high costs; therefore, it is less costly to have support from V2G or V2H technologies in periods when the demands are high. These technologies increase the energy quality, reliability, and sustainability by reducing frequency regulation and harmonic distortion. The technologies are compatible with micro grid and smart grid application. Electrical vehicles provide more stable, safer, and more continuous energy backup or emergency energy support compared with solar wind and other renewable energy sources, which depend on charging.

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AUTHORS DETAILS –

[1] Mr. Pankaj M. Maskar

Asst. Prof. Department of Electrical Engineering;

Nanasaheb Mahadik College of Engineering Peth (Sangli).

[2] Mr. Rahul Sambhaji Suryawanshi

Department of Electrical Engineering;

Nanasaheb Mahadik College of Engineering Peth (Sangli).

[3] Ms. Shivani Nivas Bansode

Department of Electrical Engineering;

Nanasaheb Mahadik College of Engineering Peth (Sangli).

[4] Ms. Dimple pemaram Choudhary

Department of Electrical Engineering;

Nanasaheb Mahadik College of Engineering Peth (Sangli).

[5] Ms. Mrumal Shrikant Satpute

Department of Electrical Engineering;

Nanasaheb Mahadik College of Engineering Peth (Sangli).

[6] Ms. Rasika Balaji Sarang

Department of Electrical Engineering;

Nanasaheb Mahadik College of Engineering Peth (Sangli).