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Solar Charging Station for Electric Vehicles at work places

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Abstract : The primary goal of this project is to build and simulate an intelligent electric vehicle (EV) charging station that can accommodate DC rapid EV charging with little strain on the power grid. It is also used to improve grid security during peak loads, and the charging station's operation is controlled as if it were powered by the electrical grid or photovoltaic (PV) electricity. An electrical bus is shared by the DC/DC bidirectional converter that is connected to the grid and the PV interfaced DC/DC converter. A seamless transition from one operating mode to another demonstrates the efficacy of the control approach used. This section describes the Billing model and controls it using PI Controller, which is implemented in MATLAB Simulink. When it comes to the two-way interaction between PV and electric vehicles, simulations show how the charging terminal really works under all operational conditions. It is well-known that electric vehicles provide new opportunities for providing policy services and consumption flexibility via the variable charging power at a specific moment. Billing for electric vehicles that employ solar and grid charging is the primary emphasis of this reasoning effort. This is where I put MATLAB's embedded function from solar to grid and back to use, a relatively new tool for automation purposes. Also discussed in the study are possible monetary incentives that might encourage EV owners to actively participate in the demand response system.

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INTRODUCTION

Compared to the age-old, nonrenewable fuel-based cars, electric vehicles are gaining popularity across the world. Battery prices have recently risen sharply, making the upfront cost of electric vehicles (EVs) a potential market barrier. Customers choose EVs for a variety of reasons, including their improved performance, decreased environmental impact (no greenhouse gas emissions), and other perks. Sustainable energy relies on environmentally conscious consumers who have long-term plans to fuel their vehicles with renewable energy. New studies show that a 2% to 6% increase in renewable energy use would almost double the demand for electric vehicles. This chapter discusses the difficulties of electric car (EV) charging stations and the growing role of distributed generators in today's power grid. Image voltaic (PV) sources and battery storage systems are highlighted for their benefits. In the end, the chapter provides a quick overview of the content for the next stages and an introduction to the high-level architecture of the proposed system. Standard Electric Vehicle Payment Terminals Extensive research on EV systems is being driven by concerns about the future of fossil fuels and the urgent need to reduce greenhouse gas emissions [1]. Customer preparedness to move from using normal internal combustion engine cars to EVs as an alternate mode of transportation is a major factor influencing EV studies. Predicting the future requirement for electric vehicles is heavily influenced by this desire. According to the authors' conclusion in [2], the length of time it takes to charge an electric vehicle is a major problem in the industry. Thus, the primary goal of this dissertation is to provide new solutions that shorten the time it takes to pay for electric vehicles by making rapid charging rates more accessible.

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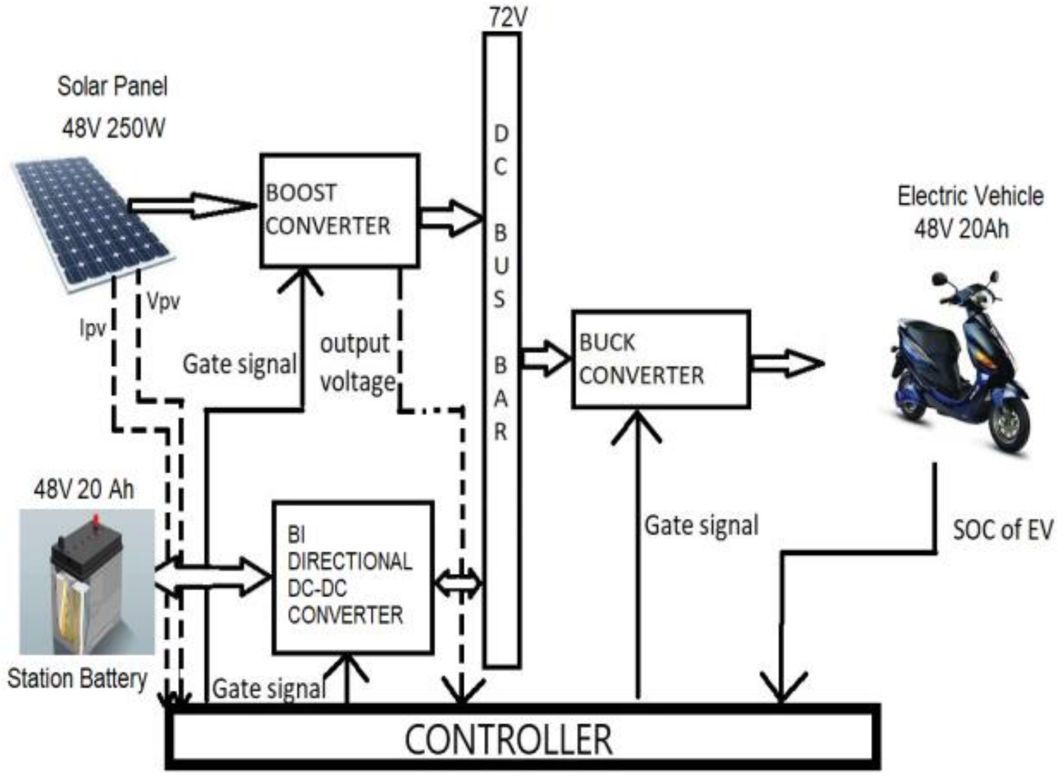

Fig : 1 block diagram

In the United States, researchers are working on three different tiers of electric vehicle charging (see Fig. 1). Power billing rates are used to categorize the EV billing degrees [3]. In level I, overnight billing takes place since the electric vehicles are hooked up to a convenient power outlet (120 V) for slow charging (1.5-2.5 kW) throughout long hours. Level I's major drawback is its long charging time; as a result, it is not recommended for long driving cycles that need more than one charging operation. In addition, from the standpoint of electric grid operation, the distribution transformers are under constant stress during the nighttime billing hours because of the large number of connected EVs in the grid system [4]. Level-II charging is the standard method of payment for most private and public venues as it needs a 240 V electrical socket. To recharge drained EV batteries, this charging level may provide power in

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the range of 4–6.6 kW for 3–6 hours. At this price point, the most significant drawback is simply the amount of time needed. Further issues with its widespread use include voltage drops and significant power losses in electrical grid systems subjected to large levels of degree II charging penetration. Reducing the negative impacts of level-II charging might be possible with level II control and coordination [5], but this would need a substantial communication infrastructure. The majority of the time, level I and level II need single phase power sources that are compatible with automobile chargers. Level III rapid charging costs (50-75 kW) use three-phase power systems with off-board battery chargers. Electric vehicles may now be fully charged in about half an hour thanks to the widespread availability of rapid charging stations. Furthermore, the EV variety anxiety problem would be eradicated with the widespread deployment of rapid EV charging stations around the city and suburbs. [6-7] However, level-III has a heavy demand on the electrical system due to the high power billing costs required over a short period of time [8-9]. The existing grid architecture is inefficient and cannot sustain the level-III pricing costs that are sought. Rapid charging rates that depend only on the power grid will need upgrades to both the charging infrastructure and the capacity of the power grid. In addition, the system cost will increase due to the fact that large amounts of power used from the electrical grid would undoubtedly increase energy prices, especially during peak hours.

Section II: The Electrical Vehicle and Its Context

Intro To get going, an electric vehicle (EV) uses one or more traction electric motors or electric motors. Some electric vehicles get their power from off-vehicle sources like a collecting agency's system, while others may run entirely on batteries, solar panels, or an electric generator that turns gasoline into energy. Vehicles on land and in the air, boats both above and below the water, electric planes and spaceships are all considered EVs. Electric Vehicle History Ten to one, electric automobiles (EVs) sold more than gasoline-powered vehicles in the late 1800s. Both the roadways and the showrooms were dominated by electric vehicles. Oldsmobile and Studebaker are two examples of successful car companies that first specialized on electric vehicles before switching to gas-powered ones. When they first opened, all of the dealerships sold electric vehicles. Due to concerns about air pollution and the OPEC oil embargo, electric vehicles had a revival in the late 1960s and early 1970s. A few of large automakers got back into making electric vehicles in the early 1990s, spurred on by California's Zero Exhaust Vehicle (ZEV) Requirement requirements. Similar to their ancestors, those EVs were mass-produced in very small numbers and were practically hand-built. Unfortunately, manufacturers ceased producing EVs as the ZEV requirement was gradually watered down over the years; in 2003, Toyota was the last major carmaker to cease EV manufacturing. Some of these production EVs narrowly avoided being crushed because of the work of DontCrush.com. Ecology of EV A battery powers an electric motor in place of a gasoline tank and an internal combustion engine in a fully electric vehicle (EV). The electrical motor is powered by the energy stored in its battery. Just like when you need to charge your phone, when the battery life of your vehicle or truck becomes low, you'll need to plug it in to use grid electrical energy to recharge it. Similarly, plug-in hybrid electric vehicles (PHEVs) include charging cables and a plug to charge the battery from the mains. These variants can still go 20-30 miles on electric power alone, despite their reduced capacity. 'Regenerative braking' is a feature that several designs use; for example, the Nissan Fallen Leaf turns off the engine when stopped and actually bills the battery while braking. You can get more done without using the gas engine thanks to this technology, which is also included in hybrid models; it helps fuel the electric motor without requiring it to be plugged in to charger. Various forms of electric vehicle Electric vehicles (EVs) may be broadly categorized into three types, each with its own level of efficiency in terms of power use. Three types of electric cars are emerging: battery electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs), and hybrid electric vehicles (HEVs). A level 3 DC rapid charge is only compatible with BEVs. Battery Electric Vehicles (BEVs) are completely electric vehicles that do not use any internal combustion engines and instead rely on rechargeable batteries for propulsion. Onboard high-capacity battery packs store electrical power in battery electric vehicles. The electrical motor and other onboard electronic gadgets are powered by their batteries. Electric vehicles do not cause pollution or other problems caused by conventional gas-powered vehicles. Electricity for BEVs comes from a power source that is located outside the vehicle. The rate of recharging an electric vehicle's battery determines the kind of charger used. Level 1, Level 2, and Level 3 (also known as DC rapid billing) are the categories. Level 1 EV charging requires an ordinary home outlet (120v) to connect to the electric car, and it takes more than 8 hours to charge an EV for around 75-80 miles. You can usually handle level one billing from the comfort of your own home or business. The majority of electric vehicles can be charged using level 1 chargers. An adapter that can provide 240 volts is needed for level 2 charging. It takes about four hours to charge a battery to 75-80 miles of capacity using a level 2 charger, which is often found at workplaces and public billing terminals. At the moment, the quickest solution available for charging electric vehicles is level 3 charging, often known as DC fast billing or just rapid charging. Dedicated EV charging stations include DC fast chargers that can top up a battery to around 90 miles of range in about 30 minutes. PHEVs, or plug-in hybrid electric vehicles, are able to recharge their batteries by a combination of regenerative braking and "connecting in" to an external electrical power source. A "common" hybrid can travel 1-2 miles before the gas engine kicks in (at moderate speeds), whereas a plug-in hybrid electric vehicle (PHEV) may go 10-40 miles before the gas engine kicks in. The term "hybrid electric vehicle" (HEV) refers to a vehicle that uses both electrical power and petrol. The electric power comes from the vehicle's own braking system, which recharges the battery. 'Regenerative braking' describes this mechanism, in which the electric motor helps slow the vehicle while also putting some of the energy that would otherwise be lost as heat into heat. When the load or speed increases, the fuel engine kicks in, but with a hybrid vehicle, the electric motor takes over first. An onboard computer controls both motors to provide the best possible economic scenario under all road conditions.

III. PROPOSED WORK

Summary and Representation of Blocks Various components such as a photovoltaic system, power grid, dc-to-dc converter, a/c-to-dc converter, charging circuit for batteries, electric vehicle charging circuit, load, and batteries make up this reasoning. A photovoltaic system's

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dc supply is further improved by the dc-to-dc converter area. The solar system and the power grid deliver electricity to the battery charging circuit. Here, an electric truck charging circuit is used to power electric vehicles. The air conditioner to dc converter section converts the power grid source from ac to dc. In the event that solar power is insufficient, the load is linked to the grid via the vehicle switching device. Power Plant: Solar Energy A power system that was built to deliver functional solar energy utilizing picture voltaics is known as a photo-voltaic system, PV system, or solar energy system. Basically, photovoltaic (PV) systems are exactly like any other electrical power producing system; the only difference is that the equipment used is different from what is often seen in regular electromechanical systems. However, a respected set of electrical standards and guidelines dictates the operating principles and how they interact with other electric systems, so nothing changes. While exposed to sunlight, a PV array may generate electricity; however, several other components are necessary for the array to operate, manage, convert, distribute, and store this energy.

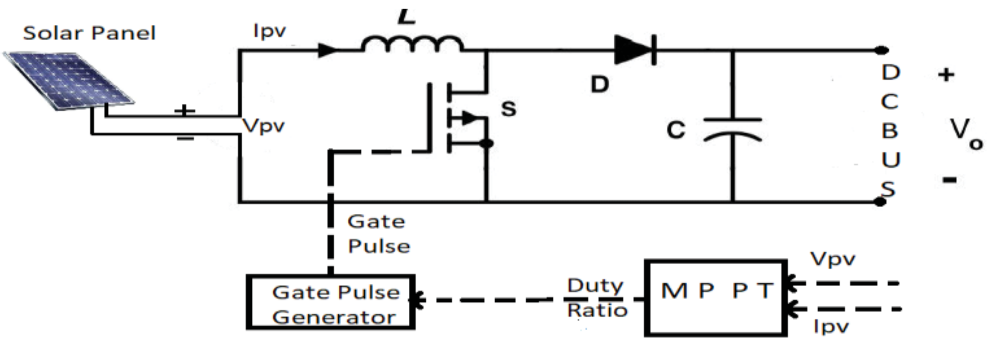

Fig : 2 solar power fed Boost converter

The term "power grid" refers to an electrical system that is controlled from a central location and consists of a network of interconnected power stations, consumers, and transmission and circulation lines. Typically, when people talk about the power "grid," they mean the system that transmits electrical energy. A direct current (DC) to direct current (DC) converter is an electronic circuit or mechanical device that changes the voltage of a direct current (DC) source. An electrical power converter, it is a kind of device. Low power (from small batteries)

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and high power (from high-voltage power transmission) are two extremes of the power spectrum.

III. Electric Vehicle Charging System Modelling

During this session, we built an electric truck model and implemented its charging system. The results and significance of the electric vehicle billing simulation system are presented in this session. The simulation model is built using MATLAB version 2014b. It offers supply from both the solar system and the grid system. It all begins with a single supply configuration, the planetary system, which provides RL Lots with an output voltage of 415 volts and an output current of 200 amps. The electric vehicle's core components are as follows: a. the planetary system Here you may find the MATLAB solar system simulation where the results are shown using the following components: MPPT voltage, irradiance constant, two converters, freewheeling diode, and range block. In Figure 3, we can see the Simulink model of the solar system, and in Figure 4, we can see the Simulink design of the battery.

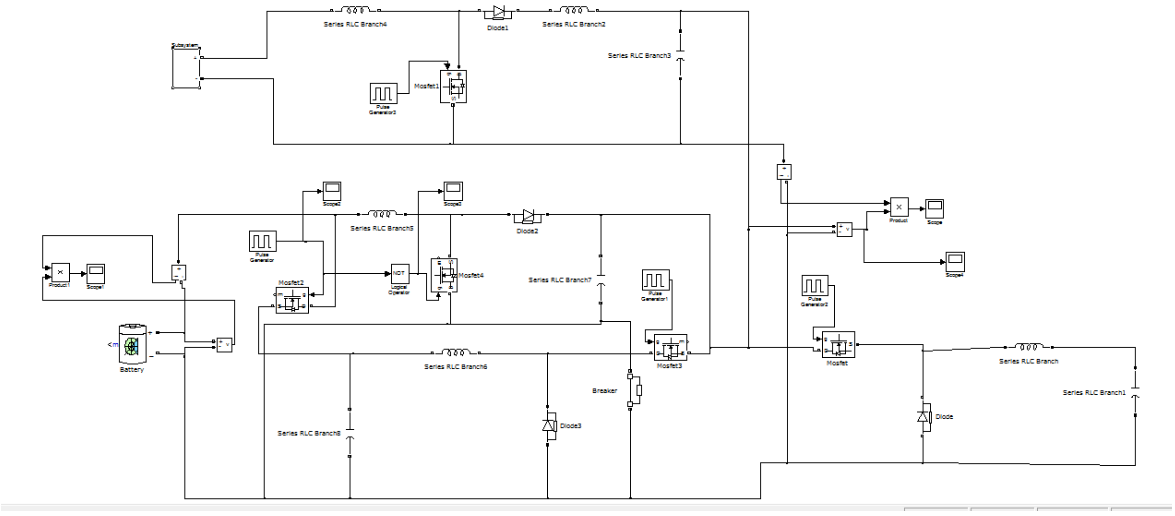

Fig :solar charger EV charging station

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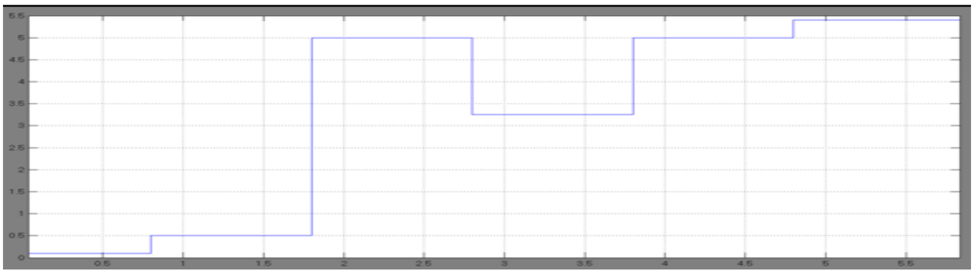

Fig : solar panel output current

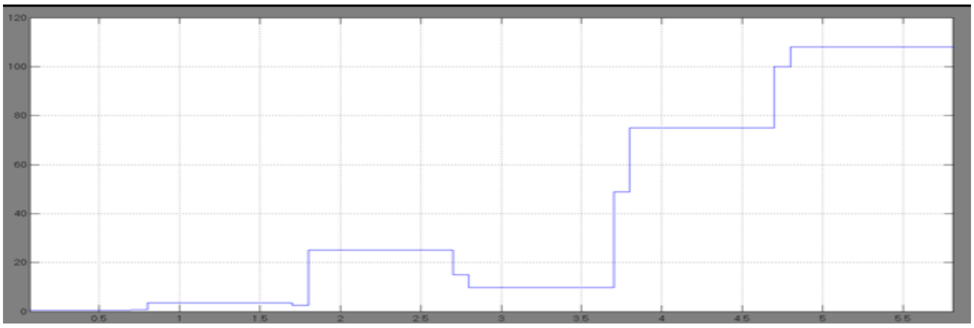

Fig : solar panel output power

Fig : DC bus voltage

By making sure all the parts are tightly coupled, we can get the target result. A boost converter, when connected across a battery, converts the DC output voltage of the battery to DC.That higher voltage is used for direct current charging.

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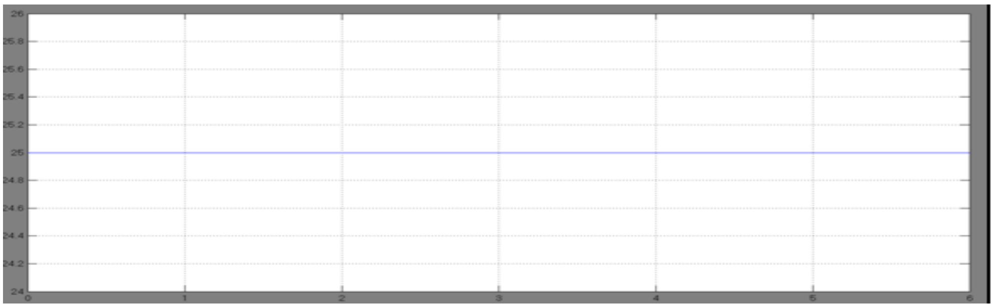

Fig : power drawn by the electric vechicle

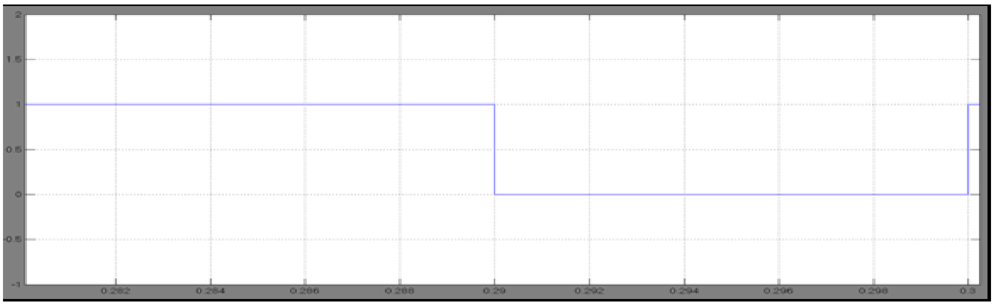

Fig : Duaty ratio to generate Gate for charging circuit IGBT of bidirectional converter.

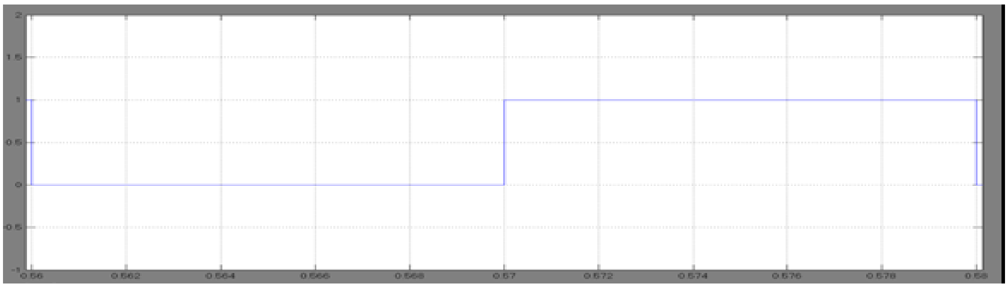

Fig : Duaty ratio to generate Gate for charging circuit IGBT of bidirectional converter

CONCLUSION

Using MATLAB and the control desk, we put the solar EV billing station controller through its paces under varying conditions of solar power production and battery power consumption. The amount of electricity that a solar panel can produce at a given temperature and irradiance is dependent on the load that is placed over it. The ability to charge the automotive batteries is ensured by the use of constant current charging. In the event that the system's solar power and station battery state of charge are both inadequate, a grid link might be included.

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