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A Detailed Study of Electrical Vehicle with Improved Applications: A Review

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ABSTRACT

Electric cars (EVs) are gaining popularity worldwide compared to regular cars with fossil fuels. Since the buying price of an EV is far more expensive, however, it may still be the main barrier to the market. For several reasons, customers prefer EVs, including lower carbon-free environmental effects, better performance, etc. Energy sustainability needs consumers with environmental consciousness and a renewable energy vision. A recent study shows that an increase of 1% in renewable energy sources will lead to an increase of about 2-6% in demand for EVs. It has been recognized that EVs bring new opportunities in terms of providing regulation services and consumption flexibility by varying the recharging power at a certain time instant. This manuscript describes the functioning, components description and improved applications of elecric vehcle with their various characteristics.

Keywords: Electric Vehicles, Battery Energy Storege System, Motors, Current, Torque, Voltage, Speed.

I. INTRODUCTION

Electric vehicles (EVs) are becoming increasingly popular around the world, outpacing traditional fossil-fuel vehicles in terms of sales. However, because to the higher cost of batteries, the EV's purchasing price may still be the main market obstacle. Customers choose EVs for many reasons, including reduced environmental impact, fewer carbon emissions, and better performance. Sustainable energy requires consumers who care about the environment and want to use renewable energy. Recent research shows that a 1% increase in renewable energy increases EV demand by 2–6%. This chapter examines the issues of EV charging stations and the growing usage of distributed generators in today's electrical system. The use of photovoltaic (PV) sources with battery storage devices is studied. The chapter ends with an overview of the proposed system's high-level design and a summary of the following chapters.

The ambient temperature and solar insolation levels have a significant impact on PV power generation. As a result, PV electricity has a day-to-day discontinuity as well as an intermittent character that can occur across small time intervals (minutes to hours). As a result, connecting the PV panels directly to the load without any additional systems has a negative impact on the linked electrical loads' performance.

Solar energy storage systems can help to stabilise the output power of solar energy. Energy storage devices, such as batteries, are advised to be integrated with PV sources in this research in order to maintain a constant power supply to linked loads regardless of PV source power fluctuations [13]. Furthermore, the grid integration of the hybrid PV-battery system allows for a greater degree of demand deregulation, which is a critical aspect in obtaining lower operating costs while achieving higher performance.

II. LITERATURE SURVEY

In this section a detailed literature rview on maximum power point techniques is illustrated as per various researchers

Gheorghe Badea et al. 2019 [1] Petrol consumption in the transportation sector has increased at a faster rate than in other sectors since mid-2010. The transportation sector accounts for 35% of overall CO2 emissions. In this framework, clean energy plans have been implemented, with electro mobility as the primary directive. The prospect of charging electric vehicle batteries with clean energy from solar autochthonous renewable resources is investigated in this research. A charging station for electric vehicles using photovoltaic panels and batteries as its main components was built, dimensioned, and simulated in operation using an isolated system. We simulated the functioning of the photovoltaic system's ideal configuration using improved Hybrid Optimization by Genetic Algorithms (iHOGA) software version 2.4. The solar energy system must be designed so that the charging station has enough electricity to feed numerous electric vehicles 24 hours a day, seven days a week. The key findings included the system's energy, environmental, and economic performance over the course of a year of operation.

M. Zeman et al. 2016 [2], This research looks into the feasibility of using solar energy to charge battery electric automobiles at work in the Netherlands. The ideal orientation of PV panels for maximum energy yield in the Netherlands is determined using data from the Dutch Meteorological Institute. The energy available for EV charging and the need for grid connection are determined by analysing the seasonal and diurnal changes in solar insolation. Due to the low solar insolation in the Netherlands, it has been established that the PV array's power rating can be enlarged by 30% in comparison to the converter's power rating. Various dynamic EV charging profiles are examined with the goal of reducing grid dependency and increasing the use of solar energy to directly charge the EV. Two situations are considered: one in which EVs must be charged exclusively on weekdays, and the other in which EVs must be charged seven days a week. A priority method is proposed to allow many EVs to be charged from a single EV–PV charger. The viability of connecting a local storage system with an EV–PV charger in order to make it grid independent is assessed. The ideal storage size for reducing grid dependency by 25% is determined.

K. Jamuna et al. 2021 [3], The charging method for electric automobiles in parking lots is described in this study. It enables us to assess a wide range of charging scenarios for Plug-in Hybrid Electric Vehicles (PHEVs) and Plug-in Electric Vehicles (PEVs), as well as the control techniques that go with them. Furthermore, this allows us to investigate various communication methods for a PHEV/PEV charging station. The Arduino board is used to monitor the charging strategy. Some vehicles are parked in office parking garages throughout the day and can be charged using solar energy using photovoltaic (PV) cell-based charging systems. Charging with solar energy reduces emissions from the power grid while also increasing charging costs. Furthermore, it provides greater flexibility in preparing for the introduction of new technologies (such as Vehicle-to-Grid, Vehicle-to-Building, and Smart Charging), which will become a reality in the near future. The simulation results show the impact of the suggested charging scenarios on voltage profiles, peak demand, and charging cost in general.

R. Seyezhaim et al. 2019 [4], Electric vehicle (EV) production relies on the use of a suitable DC-DC converter to charge the battery. To maximise battery life and performance, the DC-DC converter should be engineered. Chargers should employ a low ripple, high efficiency DC-DC converter. The Z-source converter (ZSC) and the Quasi Z-source converter are the most often utilised classical converters for charging (QZSC). As a result, the QZSC is recommended over the ZSC because it uses continuous input current, whereas the ZSC uses discontinuous input current, resulting in higher ripple content and lower converter and battery performance. Consequently, QZSC is the recommended battery charging converter, but it has the same duty ratio as a traditional buck converter. A comparison of all three converter types is made in this paper: classical buck converter, switched capacitor QZSC, and QZS buck converter (SC-QZSC). An analysis is performed on the performance characteristics, such as inductor and load ripple current and voltage, to see which one is the best fit for a certain application. The study shows that SC-QZSC is the best option because it meets the charger's specifications. In MATLAB/SIMULINK, simulations are run and results are checked.

Qi Liu at al. 2016 [5], Electric Vehicle (EV) is a clean transportation technology that replaces traditional internal-combustion vehicles, according to Qi Liu and colleagues [8]. Photovoltaic power generating is a new energy power generation trend that is environmentally friendly and green. They will be the most effective solution to the current environmental protection and energy problems, as well as ensuring that the electric car charging station is really required. Electric vehicle charging stations that use photovoltaic (p-v) as a power source must not only add energy to electric vehicles, but also to electric cars and the electric grid interface. As a result, its development is critical to the current industrialization of electric vehicles. This study suggests two realistic design strategies for photovoltaic electric vehicle charging stations. Furthermore, the simulation of the charging station's operation provides solid support for the charging station's actual construction through simulation analysis.

Siddiq Khateeb et al. 2018 [6], Electric cars (EVs) are becoming increasingly popular in various nations around the world, according to Siddiq Khateeb et al. [9]. Electric vehicles have shown to be more energy efficient and environmentally benign than internal combustion engines. However, the absence of charging facilities limits the global adoption of electric vehicles. As the popularity of electric vehicles develops, more public locations are adding charging stations. If EVs are charged using the existing utility grid, which is fueled by fossil fuel-based generating, it will have an impact on the distribution system and may not be environmentally beneficial. Because solar has such a high potential for generating electricity from PV panels, charging electric vehicles using PV panels would be a terrific option and a good environmental move. This article provides a global overview of solar PV-EV charging systems and their deployment. Analytical approaches for obtaining information regarding EV charging behaviour, charging station operation modes, and charging station users' geolocation were proposed. The methods given here was both time and money efficient, as well as extremely beneficial to the researchers.

J.A Anderson et.al. 2015 [7] discussed 99.5% efficient all-silicon three-phase seven-level hybrid active neutral point clamped inverter. In this article, the author discusses a 3.4 kW/dm3 (55.9 W/in3) all-silicon 7-level 3-ϕ inverter with an efficiency of 99.35%, setting a novel standard for ultra-effective also power-intensive converters. For this reason, another technique of the traditional FCC is adopted. The benefit is that the number of FC units is halved by using the DC-link midpoint connection. Since the capacitors need to be connected in series, it is easy to access in the hardware to endure the valued DC voltage, And has an ANPC-level front end, the front end usages a esteemed switch that is quasi of the DC bus voltage switch at the grid frequency.

Q. GUO et. al. 2010 [8] discussed a fringe pattern investigation with message passing based expectation maximization for fringe projection profilometry. In this artefact, the author discusses how to use the high correlation of unknown object surfaces to progress FPP extent presentation. The height of the body surface is regarded as a Gaussian random variable, and a first-order AR model with unidentified model constants is used to model the correlation. The question has been put into the EM framework, where height is regarded as a latent variable.

III. ELECTRIC VEHICLE TECHNOLOGY

A battery replaces the gas tank, and an electric motor replaces the internal combustion engine in an electric vehicle. The electric motor is powered by the electricity stored in the battery. When the car's battery becomes too low, it must be recharged by plugging it in to use grid electricity, just like your phone. Similarly, plug-in hybrids (PHEVs) have a plug socket and charging cables so that the battery can be charged from the power outlet. Despite their reduced capacity, these models can travel 20 to 30 miles on electricity alone.

Fig. 1 Battery electric vehicle

Many types, including the Nissan Leaf, turn off the engine when stopped and charge the battery while you brake. This is known as regenerative braking. This technology is also found in hybrid vehicles, and it helps to power the electric motor without the need to plug it in to charge, allowing you to travel further without having to use the gasoline engine. You may pre-condition the car's temperature, set the charge start and stop time, have heated seats and steering wheels, and even choose a battery percentage so that your car knows how much it needs to charge before you drive it.

But what about the feeling of driving? This is where a lot of electric vehicles truly shine. The technology behind an EV not only makes for a very intuitive car, but it also gives almost instant torque, making them faster, lighter, and ultimately more fun to drive. They're also quieter than standard cars and have a high acceleration rate, so you won't be left behind at any traffic lights.

IV. TYPES OF ELECTRIC VEHICLE

Electric vehicles (EVs) are divided into three categories based on how much electricity is used as a power source. BEVs (battery electric vehicles), PHEVs (plug-in hybrid electric cars), and HEVs (hybrid electric vehicles) are the three types of electric vehicles. Only BEVs can charge at a level 3 DC rapid charge station.

1. Battery Electric Vehicles (BEV)

BEVs (Battery Electric Vehicles) and EVs (Electric Vehicles) are entirely electric vehicles with rechargeable batteries that do not have a gasoline engine. With high-capacity battery packs, battery electric vehicles store electricity onboard. The electric motor and all onboard electronics are powered by their battery. BEVs do not produce any of the harmful emissions or risks that typical gasoline-powered vehicles do. Electricity from an external source is used to charge BEVs. Electric vehicle (EV) chargers are categorised based on how quickly they recharge an EV's battery. Level 1, Level 2, and Level 3 or DC fast charging are the classifications. Level 1 EV charging involves plugging an electric car into a typical household (120v) outlet and takes about 8 hours to charge an EV for 75-80 kilometres. Charging at level one is usually done at home or at work. Most EVs on the market can be charged using Level 1 chargers.

Level 2 charging necessitates the use of a dedicated station with 240v power. Level 2 chargers are generally available at businesses and public charging stations, and will charge a battery to 75-80 miles of range in around 4 hours. The fastest charging method for electric vehicles is currently Level 3 charging, also known as DC fast charging or just fast charging. DC fast chargers can charge a battery up to 90 miles in 30 minutes and can be found at specialist EV charging stations.

Examples of BEVs that can be charged with DC Level 3 Fast Chargers

- Model 3 Tesla
- The BMW i3
- Chevrolet Bolt
- Chevrolet Spark
- Nissan LEAF
- Ford Focus Electric Vehicle
- Hyundai Ioniq (Hyundai Ioniq)
- Revera Karma
- Kia Soul
- Mitsubishi i-MiEV (electric vehicle)
- Model S by Tesla
- Tesla Model X
- Rave Toyota
- Volkswagen e-Golf (electric vehicle)

2. Plug-in Hybrid Electric Vehicle (PHEV)

Regenerative braking and “plugging in” to an external source of electrical power can both be used to recharge the battery in plug-in hybrid electric vehicles, or PHEVs. While “standard” hybrids can go approximately 1-2 miles before the gasoline engine kicks in (at moderate speeds), PHEV vehicles may go anywhere from 10 to 40 miles before the gas engine kicks in.

Examples of plugged in hybrid vehicles are as follows-

Chevy Volt, Chrysler Pacifica, Ford C-Max, Ford Fusion, Mercedes C350e, Mercedes S550e

3. Hybrid Electric Vehicles (HEV)

Both fuel and electricity are used to power HEVs. To recharge the battery, the electric energy is generated by the car's own braking system. This is referred to as regenerative braking,' in which the electric motor assists in slowing the car and utilises some of the energy that would otherwise be converted to heat by the brakes.

HEVs begin with an electric motor, and then switch to a gasoline engine when load or speed increases. An integrated computer controls the two motors, ensuring the optimal economy for the driving conditions.

Examples of Hybrid Electric Vehicles

- Toyota Prius Hybrid
- Honda Civic Hybrid
- Toyota Camry Hybrid

V. RESULTS & DISCUSSION

The high penetration level of the PV systems as a distributed energy source into the electrical grid imposes some challenges to the stability, security, and scalability of the future power systems. Thus, it became vital to develop the PV systems to operate as virtual synchronous machines. Consequently, ancillary services (e.g. reactive power compensation, low voltage ride through, and frequency regulation) are required to be performed by the grid-tied PV systems. PV sources are incapable of solely performing all the needed services while extracting their maximum available energy at different operating conditions. This paper describes the working of electric vehicle, main components of electric vehicle and details of latest hybrid electric vehicle.

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