Numerical Simulation and Design Analysis Survey of a Solar-Powered Electric Vehicle

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***Abstract*—** The introduction of the Tesla in 2008 demonstrated the possibility of public electric vehicles to reduce fuel consumption and greenhouse gas emissions in the transportation industry. It catapulted electric vehicles into the spotlight around the world when, due to growing demand and fossil fuel prices, they reached unanticipatedly high levels at a time when emerging countries required significant economic growth. Electric automobiles' energy storage capacity, as well as the grid's expected erratic discharge and loading, provide significant operational and maintenance issues. For large numbers of vehicles to be integrated with the smart grid and electric vehicles, optimal preparation approaches are critical. Greenhouse gas emissions are one of the most serious environmental issues, and their rates are increasing rapidly as the world becomes more industrialised. Solar energy for transportation can help to solve this problem. The goal of the proposed effort is to include a green energy-supporting technology; imagine a situation in which we can utilise photovoltaic energy to charge vehicles that are integrated into the vehicle. The research highlights the functional aspects of electric vehicles and provides an illustrated literature analysis on recent breakthroughs in the field. The main components of an electric car with a solar photovoltaic system are also explained in the research report. The study is beneficial in gaining a better grasp of the properties and issues in the realm of electric vehicles.
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Index term: Electrical Vehicle, DC-DC power converters, photovoltaic cells, maximum power point tracker, multilevel and single-phase inverter, Wind Energy, Solar PV, Grid Connected Energy System

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I. INTRODUCTION

An increase in anthropogenic greenhouse gas (GHG) emissions has had a substantial impact on global warming practises. Natural disasters have increased in intensity and frequency, mainly as a result of the extreme weather imperative demonstrated by global warming, forcing countries to cut GHG emissions and pollution indices. Furthermore, fossil fuel reserves, such as coal, petroleum, and gas, are limited, putting constraints on global economic expansion and raising concerns about the environment due to carbon combustion fuels. All of these difficulties necessitate the development of new renewable and non-emitting energy sources, as well as increased energy and socialisation. Transport is a substantial contributor to GHG emissions and a large consumer of fossil fuels globally (Ipakchi, Albuyeh 2009). Worldwide. However, successful electric vehicle (EV) marketing can change this scenario. EV inventions, which began in the early nineteenth century, have a long history of evolution. Tesla has made a technological breakthrough in the last few years, and it was reached with the Roadster and Model for technical integration. EVs were popular because of their environmentally friendly attributes. Post EVs (Koyanagi and Uriu) sorts and typical styles with detailed EV powertrains and battery numbers Chan and Wong (2004), Chan (2007), and Chan (2009) are all examples of Chan and Wong's work (2007). From a grid standpoint, EVs can be classified as pure battery. Plug-in hybrid electric vehicles (BEVs) and gas cars (PHEV). A battery is used to recharge a BEV. PHEVs use a battery as the primary power source and a fuel-powered internal engine to expand the range of the vehicle. The range of motor vehicles and PHEVs is normally battery-based, while internal combustion in PHEVs is dependent on both Motor. Battery capacity can range from over 80kWh to less than 10kWh. For this reason, both are referred to as electric plug-in (PEV) vehicles. Tesla and other electric vehicles, such as the Nissan Leaf and Toyota Prius, are new to the market. According to the automotive industry, the BMW i3 is a revolutionary vehicle. Investing heavily in and believing in the demand for electrical transmission and the future of EVs. Due to the battery's low power, there are a few technical issues, the most serious of which being the EV's range. But here's the thing: there's a catch. Proceedings of the 19th World Congress. Some of the reasons for the energy requirements have become a necessity for cars that use other sources. Advances in electric motor technology are focusing on high-efficiency batteries. [1]. A number of corporations throughout the world have begun to take advertisements more seriously and are developing electric vehicles (EV). Automobiles are close to being efficient. Combustion engines. Hybrid vehicles combine features to improve performance. When the internal combustion engine is running well, electrical traction engines produce quick EV output. Constant speeds are maintained. (2), (3). Currently, most electric vehicles are powered by an external generator that feeds a bank of batteries. Vehicle-saved chemical energy is one of the energy collection technologies. Batteries. -Batteries. Low density and a shorter cycle life are two of the electrochemical battery's disadvantages. Solar cells, high-performance batteries, and the usage of power electronic technology electronic power systems are all examples of new energy storage technologies that represent a huge step forward. Using the energy consumption metre for the battery bank Reduces the amount of time it takes for the battery to discharge and increases the amount of time it takes for the Many colleges in Mexico have developed electric automobiles. [4] In order to meet several worldwide quality standards, the UNAM Engineering Faculty has developed the "Kalani," a threewheeled steel frame vehicle with fibreglass. It weighs 50 kilogrammes and stands 220 centimetres tall, 80 centimetres tall, and 220 centimetres long. Typically, 1000 watts of lithium cells are used, with a range of 14 kilometres on a single charge. Furthermore, the National Polytechnic School of Mechanical and Computer Engineering The Mexican Institute adapted a sedan car for Volkswagen in order to develop an electric vehicle that operates between 36 and 92 volts. Six 8 V leadacid depth cycles make up the battery bank. The Toluca Campus of the Monterrey Technology Institute, a study and research institute of technology higher education, is now working on commercial electric vehicles. This EV will be used by their products in cities, and the Mexican Energy Agency has agreed to collaborate. A differing speed EV battery's full use of available resources must be optimised. The most crucial aspect is A PID controller is used to control battery energy. The conventional PID controller necessitates a dynamically rapid and appropriate adjustment. To acquire a rapid change answer that dynamically adapts to the mode in PID, a precise change is required. Operational amplifiers are used to calculate the parameters. The most significant disadvantage of circuits is their linear model, which causes time and temperature degradation.

II. REVIEW OF LITERATURE

Grid Services can also be delivered by PEV fleets in the form of energy storage and auxiliary services to the grid (V2 G). The grid and hence PEVs are complementary in terms of controlling energy storage and transmission (alternatively, Kempton and Tomi) (2005a, b). New Wind and Wave Generation's unpredictability and interference may function as distributed as optimal scheduling output and storage of energy for demand using PEVs. As a result, it's V2 G grid control and service support (Leemput et al., 2011); Su et al., 2011). (2012). (2012), (2012); Foley et al. (2012a, b); (2012), (2012). V2 G can be done in addition to smart grid support infrastructure for structures and electric vehicles, according to Bessa and Matos (2012). (EVSE) Techniques for scheduling that are both robust and intelligent are required. Optimal PEV charging schemes are necessary for seamless power system integration. Investigators looked into several techniques and simple recommended approaches for PEV charging preparation. A PEV can charge a battery up to 85 kWh, giving it a total range of 300 miles. If a number of PEVs are charged at the same time in a specific c time Load, which includes the initial load and the additional load Test engines, the PEV load can grow by up to 20 kWh (2013)). When charging several PEVs, however, if the original load falls proactively, it is possible to charge the complete load. The plug-in can detect and monitor the PEV load once. Customers will have certain uncritical but high loads turned on by a dryer, such as water heaters or garments. A short period centre control to reduce base load and assist the PHV charge. However, balancing a domestic load with current infrastructure and user actions is difficult. By dividing the overall power demand into a longer load, the sudden load spike can be mitigated. For instance, Vandael et al. (2011) offered two ways for reactive and constructive strategies. The reactive technique initially delays the peak and then activates all loaders until the battery is fully charged by the time limit by turning certain chargers and saving the necessary charging power to maintain a load balance as long as possible. The constructive strategy puts the vow to avoid overloading the charging scenario's prospective day forward load and averages to the test. The last form suggests a faster charging time, but it may create a dramatic spike during the quick charging stage, whereas the latter averages the risk of difference but takes longer. Methods by Vandael et al. (2009) and et al. Shao. In the loading and control phase, load-keeping scenarios are followed (2011). If the charge power can be monitored, the charge rate can be calculated by dividing the actual charging power by the massive power cap. To balance the aggregate load, strategists can assign each PEV a variable charge rate. Two methods of monitoring charging speeds are proposed by Cappuccino and Amoroso (2011). The first is the highest priority maximum energy, which sets as much of all energy demands as possible for the charging capacity and is known as priority spreading energy, which calculates the rate by dividing the total energy required by the total time span available. It's important noting the methods for analytical charging. In the simple phases, stay still. The gross outcomes are excellent, but they are unable to achieve optimal preparation results. Furthermore, the majority of methodological procedures are focused on a specific topic. Assumptions that all PEVs will begin charging at the same time—for example, the plan could be separated from the facts at the same time over a period of time. Finally, whereas essential considerations such as energy and waste disposal, GHG emissions, cost avoidance and optimization, and other factors are vital, the foregoing charging policies primarily take care of overload prevention measures. Fix these flaws and develop more intelligent mathematical optimization methods and approaches (Hajimiragha et al., 2011), (2010); optimization is a critical and difficult process. There are a number of traditional numerical optimization methodologies that can be used to solve problems with PEV integration scheduling. Non-linear programming (Sundstrom and Linking (2010) (NP) (Bazaraa et al. (2013)), dynamic programming (DP) (Han et al. (2010)), and other techniques, such as PHEVs, can be used as queuing theory in the loading (CD) mode and loading. Some of them have been tested in the field of investment. PEV charging is tigated using linear programming (LP). Supporting method (CS). In CD mode, the vehicle is primarily powered by an electric power consumption engine. The electricity grid is operational. When the CS mode is on, the vehicle's SOC retains intermittent driving charges at a set value, extending the battery's working life. When the car arrives at its destination, the external power grid battery can be reloaded (Germany et al., 2012). PHEVs can use better gasoline. HEVs as a company. Such key PHEV fields have been widely examined in past study, such as Energy Efficiency and Battery Power Strategy (Li L et al., 2016, Sun C et al., 2016; Xiong R et al., 2018., 2017). Driving cycles are one of the most important fuel variables in PHEV economics (Khayyer et al., 2012). Plug-in Most hybrid vehicle energy management techniques, such as the Path-based Energy Management Strategy Acknowledgements (Chen Z et al., 2016; Denis et al., 2016), have been established based on driving cycles in recent studies (Sun C et al., 2015; Chen Z et al . , 2016). a. a. a. a. a. a. The ideal control approach is influenced by the driving cycles (Tulpule et al, 2011). The mechanism of the influence of driving cycles on energy, on the other hand, is rarely used to determine PHEV consumption characteristics. The influence process aids in defining the CD-CS control plan flaw as well as providing a theoretical framework for more practical energy management solutions.

III. OVERVIEW OF THE SYSTEM

The PHEV in this study is configured simultaneously. The configuration of the drive mechanism is shown in Figure 1. The Integrated Starter Generator (ISG) and power sources drive a motor. The engine, to be precise. The engine and ISG are coaxial to establish dynamic coupling, and the master clutch, the engine, and the ISG are all positioned. A double buckle DCT is also used to meet the transmission criteria of various speed and torque driving times. The PHEV's motor powertrain system can operate in one of five modes: mode drive and charge, motor drive mode, electric mode, hybrid mode, and regenerative braking mode. Furthermore, function modes are adjusted by changing the status of the master seizure and double seizures. The basic parameters of the PHEV are listed in Table 1. The efficiency of the inverter and DcT are modelled as the powertrain system's fixed values and modelling in our earlier research (Liu Y and al., 2017, SPEV consists of 500watt inlayed solar panels for recharging). Approved detection vehicle with RFID authentication, a tachometer for measuring rotation speed, a brushless DC controller SPEV motor, and a 24V motor.

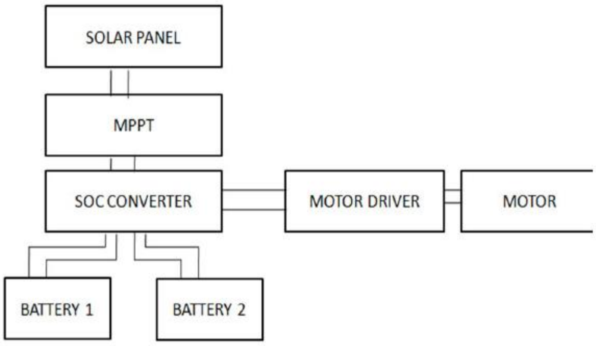

Figure 1. Block diagram of interconnection of Solar Powered Electrical Vehicle

Figure 1 shows a block diagram of a solar-powered electric car. Solar energy is clearly driven by a photovoltaic system connected to an MPPT controller that is combined with a SOC converter that serves as a central processing unit and is coupled to the motor drive and the battery system, as shown in the diagram. The vehicle is responsible for running the battery charging module, which is accessible through the solar panel. Because of its processing, polycrystalline solar panels are employed, which are simpler and more cost-effective. Polycrystalline solar panels have a lower heat resistance than monocrystalline solar panels if they are equal. Figure 2 depicts a view of the solar panel projection. The vehicle's side view has 80 watts, the front view has 20 watts, and the top view has 400 watts. As a result, a total of 500 watts of solar panels were added, making the SPEV completely functional. There are horizontal panels as well as other 30 degree slanting position panels. Built-in solar power generates 500 watts of power. Vehicle panels in bright sunlight. Projection view[2] ensures the description of the 500watt panel SPEV design configurations.

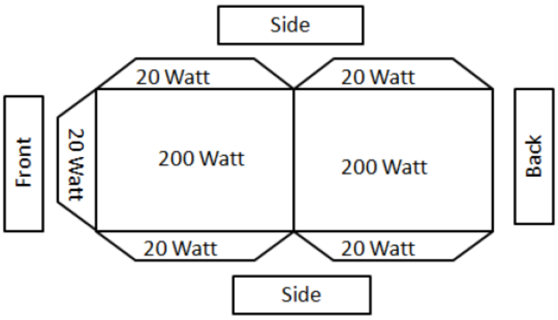

Figure 2. Arrangement of solar panels in electrical vehicle

As a result, the polycrystalline solar panel is accountable for 500 watts of direct sunlight harvesting capacity. Calculate the amount of energy that can be charged by a solar panel using an electronic converter. As a result, the load controller analyses the panels' output and compares it to the battery voltage. As a result, the DC output voltage is reduced to the lower voltage required to charge the battery. It is transformed by the most powerful force it can muster. Mppt systems are installed at voltage to ensure that the battery receives full amperage. Modern MPPTs, for example, have a conversion rate of roughly 93-97 percent. In the winter, it gains 20 to 45 percent of its power, and in the summer, it gains 10-15 percent. The true benefit varies significantly depending on the weather, temperature, battery charge state, and non-charging status (SOC) factors: This is an important parameter. Hybrid automobiles are being considered. It is determined by the state of the SOC after the battery has been charged and discharged. SOC flow diagram for data acquisition We used the battery's open circuit voltage mechanism to get the SOC, which is significantly simpler and more precise with lead acid batteries. The embedded SOC microcontroller comparator evaluates the SOC standards of both batteries, and

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the appropriate SOC level relay is activated. A battery with a higher SOC is linked to the charge connection between the battery and the load. Relay is a solar panel battery with a lower state of charge (SOC). PV is relayed. The SOC data is processed on a regular basis. The time intervals and the accompanying SOC batteries were compared [3]. Figure 3 compares battery compliance and shows the gathering of SOC data and associated flow map. 4) Audi A4: Acid batteries are utilised since they are less expensive @ 24 Volt 25Ah. The car must run for 6 hours, thus the total power available is 600 Watts per hour. The flow chart and functioning system of the SOC data acquisition system are depicted in Figure 3. The control system for electric vehicles should be reliable, responsive, and efficient. The integration of the PID controller and other control system components improves the system's overall productivity and efficiency. The battery management and charging control of solar-powered electric vehicles is clearly an important topic of research.

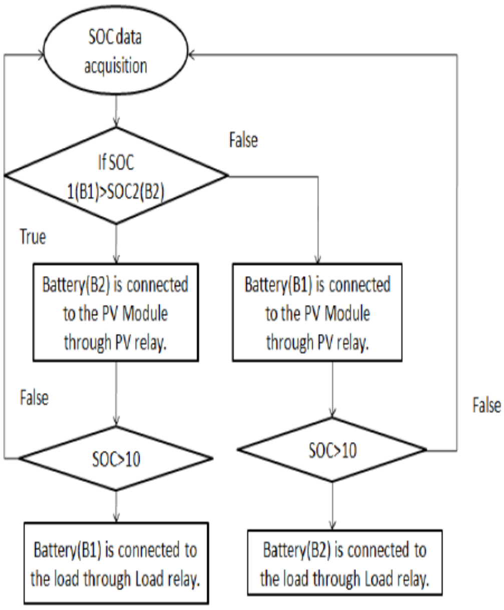

Figure 3. SOC Data Acquistition system Overview

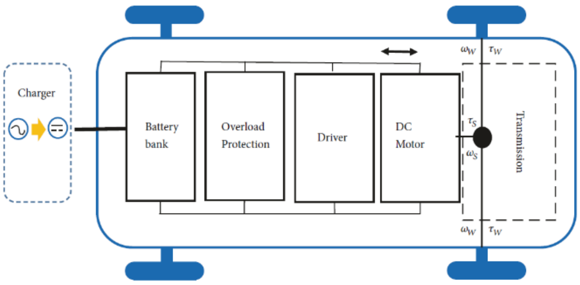

Figure 4. Interconnection of charging circuit and motor drive

Figure 4 depicts the connections of charging circuits and electric vehicle motor drive. As can be seen from the figure, the battery bank is connected to the charger and is protected by overload. Brushless DC motors are connected to the driver circuit, which is coupled to the axle through the shaft. The operation of an electric vehicle is a complicated control system with many inputs and multiple outputs.

Obviously, integrating PEVs into energy systems is a difficult task that involves many aspects of the power system, generation, transmission, and distribution systems, as well as the optimization of economic dispatch and electricity management and control. The company says that the electric engine can achieve speeds of more than 100 km/h; nevertheless, the user's reach is not safe. Because of the type of battery utilised, the speed reduces. As a result of the wear, the bushings should be checked on a regular basis. An overview is a viable option for completing this research. The noise and temperature of the engine. There is a bushing over its typical condition wear if the engine starts to display temperature or noise increases. The engine's data sheet contains no information on these parameters The operating restrictions had to be defined based on the vehicle's user experience. Timely replacement and repair of worn elements in the medium where the engine's internal components are tested Cost overruns will be avoided, as will greater vehicle efficiency and a longer service life. The current battery production capacity is clearly insufficient. Because of the low and medium power density, efficiency is often between 70 and 75 percent.

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Table-1 Detailed Speofocation of Planned Deign	
Per Hour Power /hr	420 W
Total Operating Hours per day	7 hours
Total Energy Consumed(7*420)	2940 Watt Hour
Power generated by Solar Panel in Direct sunlight	500
Average fall of direct Sunlight per day	7
Total energy generated	3500 Watt Hour

IV. CONCLUSION

An SPEV requires less transportation and produces less non-standard energy waste. End users such as industries, universities, and amusement parks will profit from the SPEV. The notion for autonomous driving mode will benefit people with physical impairments. It is self-evident that PEV integration in power systems SPEV contributes to Green Transport is a difficult topic that has a lot to do with power systems, generation, transmission, and distribution. The standard CD-CS control strategy's main flaw is its low energy efficiency in the CS mode. The CS mode uses a lot less energy than the CD mode. PHEVs, in contrast to traditional HEVs, which maintain a high-efficiency engine area, are considerably more important for maximising the use of energy for power. The engine-on/off control rule has been shown to be as significant as engine torque control in the PHEV energy management method.

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