



DESIGN & IMPLEMENTATION OF EV SYSTEM BY USING RENEWABLE ENERGY SOURCE

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ABSTRACT

In the current scenario, global warming is a threat to the society. One of the major reasons is the release of carbon-di-oxide from an automobile exhaust due to the combustion of fossil fuels which pollutes the environment. One of the optimistic solutions for this problem is to use of hybrid vehicles. Generally, Hybrid vehicle involves a combination of transmission system driven through electrical, solar as well as internal combustion (IC) engine. In real life applications using solar vehicle produces zero emissions. At present, hybrid electric vehicles are being developed and launched into the market. For long distance travelling its necessary of periodic charging of their batteries, so these vehicles are depends the electrical sources also leads to increase the cost of electricity. These kinds of problems will be solved by using hybrid solar vehicle also HSV supporting to the green environment.

Keywords - global warming, fossil fuels, hybrid vehicles, hybrid solar vehicle, green environment, emissions.

I. INTRODUCTION

Electrical vehicle marked from 1890 to 1924 with peak production of electric vehicles in 1912. However, the range was limited by energy storage in the battery. After every trip, the battery required recharging. At the 1924 automobile show, no electric cars were on display. This announced the end of the Golden Age of electric-powered cars. The range of a gasoline car was far superior to that of either a steam or an electric car and dominated the automobile market from 1924 to 1960.

The gasoline car had one dominant feature; it used gasoline as a fuel. The modern period starts with the oil embargoes and the gasoline shortages during the 1970s which created long lines at gas stations. Engineers recognized that the good features of the gasoline engine could be combined with those of the electric motor to produce a superior car. A marriage of the two yields the hybrid automobile. Energy is one of the major parts of the economic infrastructure, being the basic input needed to sustain the economic growth. There exists a strong relationship between economic development and energy consumption. The more developed is a country; higher is the per capita of energy consumption and vice-versa. Human civilization relies on different sources of energy. Electric vehicles (EVs) use electricity as their primary fuel or to improve the efficiency of conventional vehicle designs.



II. LITERATURE SURVEY

"Integrating Renewable Energy Sources into Electric Vehicle Charging Stations" by Hao Luo, Weiwei Qi, and Zhaoyu Wang (2021), This paper proposes a novel EV charging system that integrates solar and wind energy sources with battery storage. It presents a control strategy that optimizes the use of renewable energy to reduce energy costs and improve the stability of the power grid.

"A Renewable Energy-Based EV Charging Station for Smart Grid Applications" by Ramin Nabizadeh, Ebrahim Babaei, and Masoud Aliakbar Golkar (2019), This paper presents a renewable energy-based EV charging station that utilizes solar and wind energy sources. It proposes a control algorithm that optimizes the charging process based on the availability of renewable energy and the electricity demand of the grid.

"Design and Analysis of a Renewable Energy-Based Electric Vehicle Charging Station" by Qingru Li, Fangcheng Liu, and Jianping Chen (2018), This paper presents a renewable energy-based EV charging station that uses solar and wind energy sources. It proposes a hybrid energy storage system that combines batteries and ultracapacitors to improve the stability of the power supply.

"Design and Implementation of a Solar-Powered Electric Vehicle Charging Station" by Mohamed El-Hadidy, Ahmed A. Elserougi, and Amr Mohamed (2015) This paper presents a solar-powered EV charging station that uses photovoltaic panels to generate electricity. It proposes a control strategy that optimizes the charging process based on the availability of solar energy and the electricity demand of the EV.

III. PROBLEM STATEMENT AND METHODOLOGY

Energy efficiency: Vehicles with similar production of energy costs can obtain, during the life of the car (operational phase), large reductions in energy costs through several measures. The most significant is by using alternative propulsion: An efficient engine that reduces the vehicle's consumption of petroleum (i.e. petroleum electric hybrid vehicle), or that uses renewable energy sources throughout its working life. Using biofuels instead of petroleum fuels. Proper maintenance of a vehicle such as engine tune-ups, oil changes, and maintaining proper tire pressure can also help. Removing unnecessary items from a vehicle reduces weight and improves fuel economy as well.



Fig3: Eco friendly Electric Vehicle

Fuel Economy: The fuel economy of medium- and heavy-duty all-electric vehicles and PHEVs is highly dependent on the load carried and the duty cycle, but in the right applications, all-electric vehicles maintain a strong fuel-to-cost advantage over their conventional counterparts. Electric vehicles can reduce fuel costs dramatically because of the high efficiency of electric-drive

components. Because all-electric vehicles and PHEVs rely in whole or part on electric power, their fuel economy is measured differently than that of conventional vehicles. Miles per gallon of gasoline equivalent (MPGe) and kilowatt-hours (kWh) per 100 miles are common metrics. Depending on how they are driven, today's light-duty all-electric vehicles (or PHEVs in electric mode) can exceed 130 MPGe and can drive 100 miles consuming only 25–40 kWh.

Methodology: In the current scenario, global warming is a threat to the society. One of the major reasons is the release of carbon-di-oxide from an automobile exhaust due to the combustion of fossil fuels which pollutes the environment. One of the optimistic solutions for this problem is to use of hybrid vehicles. Generally, Hybrid vehicle involves a combination of transmission system driven through electrical, solar as well as internal combustion (IC) engine. This work involves hybridization with solar power and conventional power IC engine. Hence it is called a Hybrid Solar Vehicle (HSV). It can be driven both on internal combustion engines as well as on solar energy assisted with electrical motor.

In real life applications using solar vehicle produces zero emissions. At present, hybrid electric vehicles are being developed and launched into the market. For long distance travelling its necessary of periodic charging of their batteries, so these vehicles are depending the electrical sources also leads to increase the cost of electricity. These kinds of problems will be solved by using hybrid solar vehicle also HSV supporting to the green environment.

The most commonly adapted hybrid vehicle has sources of a solar power assisted with

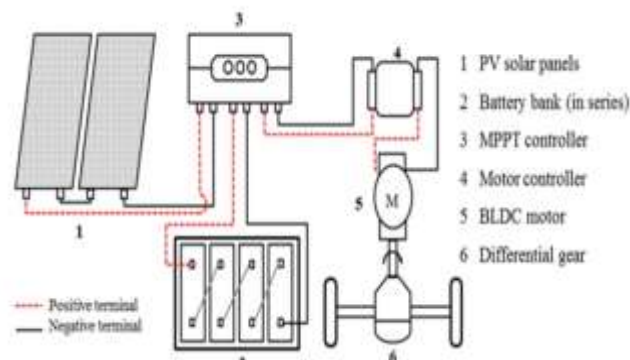


Fig 4: Design and development of Solar Powered Electric Vehicle

electric motor and an I.C. engine. In a HSV, the I.C. engine cooperates with an electric motor

which has optimal usage of the engine. Especially driving in city traffic involves frequent starts and stops of the vehicle and during idling, the engine consumes more fuel without producing useful work thus it leads to higher fuel consumption, less efficiency and unnecessary emission from the exhaust. The HSV solves those problems and also no exhaust emission from the vehicle. The parallel power train runs on both, combustion engine and electric motor. The primary drive of the vehicle from solar powered and secondary drive by the combustion. These vehicles gain maximum efficiency in city during heavy traffic conditions without producing any emissions which supports to the green environment.



EV CHARGING WITH SOLAR: The combination of solar energy and electric vehicle (EV) charging is the key in drastically reducing our dependence on fossil fuels. Electricity comes from a variety of sources and it's crucial that electric vehicles will be powered by renewables. Electric cars are becoming immensely popular and coming years we expect nearly anyone who owns a solar energy system will install a solar charging station at its home. For this to happen we'll need a fundamental change in how we think about refueling our cars and a natural evolution of our energy infrastructure.

The different methods of charging an electric vehicle:

1. TRICKLE CHARGE The slowest method of charging your EV at home, using a standard (three-prong) 220V plug. It is only recommended in urgent cases, with caution and consultation with electricity providers.

- Provides charging through a standard (three-prong) 220V plug that comes with your EV. The other end is simply plugged directly into your EV
- Doesn't require installation of additional charging equipment
- Can deliver 13 to 16 km of range per hour of charging
- Charging speed: approx. 65 km of range in 5 hours (overnight), or 200 km in 14 hours
- Using Trickle Charge is only recommended in urgent cases when you have low battery charge and cannot drive to a public station or access an AC wall box at home.

2. AC HOUSEHOLD CHARGING WITH WALLBOX Having a wall box installed lets you charge 3-4 faster using AC Household Charging. AC Public Charging is also available.

- The most common and recommendable home charging option
- Provides charging through a 230V outlet which allows charging 3 to 4 times faster than Trickle Charge – depending on the acceptance rate of your specific model and the charger
- Especially useful if you have time to top up your electric vehicle overnight: it takes around 6 hours to fully charge a 40 kWh battery car
- Requires the installation of a dedicated EV charging wall box, which should be fitted by a trained electrician

DC FAST CHARGERS: Currently the quickest way to charge an electric vehicle Provides charging power above 50kW through a voltage above 450V and current up to 125A Is capable of charging from 20 to 80% of charge in approx. 40 minutes Utilises Combo DC (CCS for Combined Charging System) Use of DC Charge should be kept to a minimum in order to help prolong high-voltage battery life.

AC Versus DC Charging:

There are two kinds of 'fuels' that can be used in electric cars. They're called alternating current (AC) and direct current (DC) power. The power that comes from the grid is always AC. However, batteries, like the one in your EV, can only store power as DC. That's why most electronic devices have a converter built into the plug. You may not realize it but every time you're charging a device such as your smartphone, the plug is actually converting AC power to DC.

SOLAR CHARGING SYSTEM FOR EV'S: Solar charging for electric vehicles is a method of using solar panels to generate electricity and charging electric vehicles with that power. The process

involves installing solar panels at a location where the vehicle is parked or on the roof of the car itself, which generate electricity from the sunlight.

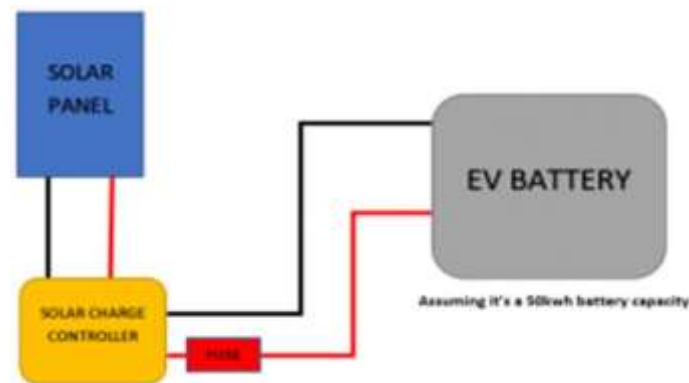


Fig 6: Block diagram of solar charging system

The generated electricity can then be stored in batteries or directly used to charge the electric vehicle. Solar charging can provide a sustainable and cost-effective way to power electric vehicles, especially in areas with abundant sunlight. There are several benefits of using solar charging for electric vehicles. Firstly, it is a clean and renewable source of energy, which reduces the dependence on non-renewable sources of energy and lowers greenhouse gas emissions. Secondly, it can help to reduce the overall cost of charging an electric vehicle, as it relies on free energy from the sun.

IV.EXPERIMENT RESULTS

Solar-friendly vehicles, also known as solar-powered vehicles, are vehicles that rely primarily on solar energy to power their propulsion systems. These vehicles can either be fully or partially powered by solar energy and are designed to reduce or eliminate the need for non-renewable energy sources. The most common types of solar-powered vehicles are solar cars, which are designed for racing and long-distance driving. These vehicles use photovoltaic cells to convert sunlight into electricity, which is then stored in batteries for later use. Solar cars are typically lightweight and aerodynamic to maximize energy efficiency, and they can travel at speeds of up to 100 km/h or more.

Temperature is a critical parameter to monitor in Electric Vehicle (EV) batteries, as it can affect the battery's performance, lifespan, and safety. The optimal operating temperature for most EV batteries is between 15-35 degrees Celsius, and any deviation from this range can affect the battery's capacity and performance.

The State of Temperature (SOT) in an EV battery refers to the battery's current temperature and its deviation from the optimal operating temperature. The SOT is monitored by temperature sensors that are placed in various locations within the battery pack.

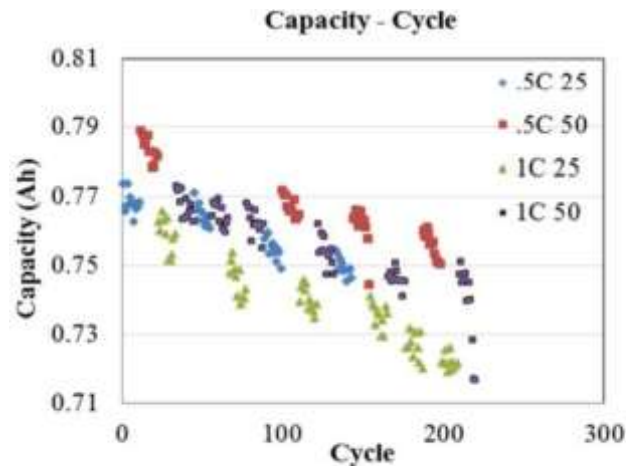


Figure 5 Discharging capability alternating at different discharge rates and at different temperatures.

When the temperature of the battery exceeds the optimal range, it can affect the battery's capacity and performance. For example, at high temperatures, the internal resistance of the battery increases, which reduces its capacity and increases its voltage drop. This can result in decreased range, reduced charging efficiency, and increased wear and tear on the battery.

Discharge Rate	Temperature
0.5C (350 mA)	25 °C
0.5C (350 mA)	50 °C
1C (700 mA)	25 °C
1C (700 mA)	50 °C



Fig 7: Designed EVSystemd model



Fig 8: EV System model under trial



V.CONCLUSION

In conclusion, Hybrid Electric Vehicles (HEVs) offer a promising solution to the environmental and economic challenges facing the transportation industry. By combining an internal combustion engine (ICE) with an electric motor and battery, HEVs provide improved fuel efficiency and reduced emissions, without sacrificing the performance and range of traditional ICE vehicles. HEVs are also becoming increasingly popular due to advancements in technology, which have led to improved battery capacity, regenerative braking systems, and advanced control algorithms. Additionally, the availability of government incentives and tax breaks has made HEVs more affordable and attractive to consumers. Overall, HEVs represent an important step towards a more sustainable and environmentally friendly transportation system. As technology continues to improve, HEVs will likely become even more efficient and cost-effective, paving the way for a cleaner and more sustainable future.

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