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Design and Implementation of solar powered Electric Go-kart

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ABSTRACT: The " Design and Implementation of Solar Powered Electric Go-kart " project aims to revolutionize the go-karting experience by leveraging solar power for electric propulsion. This abstract outline the key components and objectives of the project. The primary goal of Solar go kart is to design and construct a solar-powered electric go-kart that showcases the integration of renewable energy and sustainable transportation. The project focuses on three main aspects: solar integration, electric propulsion, and performance optimization. Solar integration involves the careful selection and placement of high-efficiency solar panels on the go-kart's surface to maximize energy capture while maintaining aerodynamic efficiency. These solar panels will charge a battery storage system, providing continuous power to the electric propulsion system. The electric propulsion system comprises a lightweight chassis equipped with an electric motor and drivetrain optimized for efficiency and performance. Regenerative braking technology will be implemented to recover energy during deceleration, further enhancing the kart's energy efficiency. Performance optimization will be a key aspect of the project, balancing speed, endurance, and handling characteristics. Extensive testing and iterative refinement will be conducted to achieve the optimal balance between power output, energy consumption, and overall performance. Most countries are dependent on thermal power plant which uses coal for generation of electricity. Intern rising in pollution of electricity. So, to resolve this problem the paper proposes the design of renewable energy base solar cycle. in from the manufacturing industry a simple, reliable, eco-friendly, safety, and less costly product. Due to increasing population and leads to One of them is electric vehicles.

KEYWORDS: Solar panel, MPPT, Boost converter, Battery, Charge controller, PID controller

I.INTRODUCTION

In the future, the rapid development of electric vehicle (EV) manufacturing and production becomes more and more appealing in terms of environmental, technological, and economical potential. The contribution of carbon dioxide (CO₂) derived from fossil fuels to climate change is currently one of the most significant issues. Another issue with using battery banks for storage in automobile systems is the related budgetary burden. Technology wise, renewable energy sources are seen as a potential choice for the EV and transportation sectors. The EV's batteries have a longer lifespan and are more reliable because they are partially charged by renewable resources. Using renewable energy sources instead of a conventional electrical grid to power an electric vehicle (EV) aims to improve system efficiency overall and reduce harmful emissions. Photovoltaic panels are becoming recognized as competitive energy source technologies for electric car charging when compared to other renewable resources. PV systems have recently been employed as the major energy source for charging batteries due to several advantages, such as decreased maintenance and operating costs, a decrease in greenhouse gas emissions, and the possibility to be energy independent. Solar energy has been utilized in large-scale research and technology recently to charge electric automobiles. Many countries have issued installation guidelines and design standards for PV charging stations. The writers talked about how EV adoption is going right now and the obstacles facing the infrastructure needed for charging. They also looked at the challenging issues that have lately come up because EVs are being used widely and have different worldwide standards and charging codes. Depending on a variety of conditions and applications, PV's charging station charges batteries when the EV is parked in the lot during the day. This topology has many benefits, including lower expenses, load demand shifting, and less CO₂ emissions. In, the energy management strategy and the design of a closed-loop system controller were looked at. The authors did not discuss how various charging techniques affect a battery's behavior. Tiano et al. evaluated the viability of mounting solar photovoltaic panels on a car body. The study disregarded the collection of data. The study focused only on mathematical models and the effects of temperature, ignoring the collection of data on solar resources.

II.SYSTEM MODEL AND ASSUMPTIONS

The PV motor system's optimal performance is significantly impacted by the choice of an appropriate DC-DC converter for maximum power transfer. It is possible for this converter to have high-frequency transformer isolation or not. When a high voltage conversion ratio is needed, an isolated DC-DC converter is usually preferred because it reduces additional conduction loss caused by energy transfer from the primary winding to the secondary winding. When a low voltage conversion ratio is needed, a non-isolated DC-DC converter can be used. The best DC-DC converter among its many topologies is chosen by carefully weighing the benefits and drawbacks of each one in terms of its MPPT operating region, input and output current quality, and gate-drive circuitry. The presented schematic diagram represents the suggested topology. Between the VSI and the PV array is a Cuk converter. A VSI supplies power to the BLDC motor- pump. By using an electronic commutation, the three built-in Hall sensors are used to generate the gating signals for VSI. By using a decoder to commutate the currents flowing through the BLDC motor's windings in a predetermined sequence, a symmetrical direct current is drawn for 120° from the DC bus of VSI and put in phase with the back electromotive force E_b . This process is known as electronic commutation. Additionally, an incremental conductance MPPT technique is used to operate the Cuk converter to control the SPV array. It forces the PV array to run at peak power by gradually. Phase current sensors are eliminated in the proposed BLDC motor drive. Therefore, the phase currents have no bearing on speed control; instead, the speed is solely controlled by a variable DC bus voltage of VSI. The output voltage of VSI, or the motor's input voltage, varies when the DC bus voltage varies, which in turn affects the motor speed. The duty ratio of the Cuk converter increases as the operating point is moved towards MPP by the MPPT algorithm, which causes the DC bus voltage to build up. The BLDC motor rotates as a result, reaching specific speed in line with the DC voltage that is being applied. The sole purpose of the VSI switch is to commutate the currents flowing through the BLDC motor's windings using so-called electronic commutation.

III.RELEVANCE

As previously said, additional methods are required to monitor and increase solar panel efficiency. The most popular method is Maximum Power Point Tracking, or MPPT. To make sure the solar panel is always working at its maximum capacity, MPPT measures the power of the panel at regular intervals. Following a measurement from the solar panel, the power is calculated. After a predefined period, another measurement is taken. These two measurements will be compared, and adjustments made within the solar panel, to ensure that the measurement with the highest current will yield the highest power. MPPT is not a new concept. Some companies have been working on solar sensor development for years. Most of the solar trackers move in accordance with the sun's inclination rather than continuously calculating power. For example, two different solar tracking devices that Link offers both use integrated control actuators. The suggested solar panels have dual access for tilting in all directions and single- plane rotation for 180 degrees.

IV.METHODOLOGY

- 1.A 750W permanent magnet brushless direct current motor is the kind of motor. It operates at 450 rpm when linked to a 48-volt battery and 450 rpm when linked to a 48-volt source. This motor can produce a maximum torque of 10.02 Nm.
2. The motor has an efficiency of about 80%. 750W motor controller that operates at 48 or 60 volts is the motor controller that is used.
- 3.A lithium-ion battery with a 12 volt and 28 ah power rating is the type of battery that is used. Our car uses four batteries to achieve a 48-volt voltage. The battery weighs 36 kg (9 kg each).
4. Train to drive Chain drive is the mode of drive used to connect the motor to the rear axle. The driven sprocket has a pitch circle diameter of 290mm, while the driver sprocket has a diameter of 65mm. The chain has a thickness of 13.92 mm.
- 5.The ratio of gears is 4.5:1. The solar panel type is silicon polycrystalline. The solar panel has an open circuit voltage of 46 volts and a power rating of 300 W. The inverter's maximum solar open circuit voltage is 56 volts. The inverter's maximum charger efficiency is 95%.

6. The chassis is made of mild steel, specifically AISI 1018. It has a 370 MPa tensile strength 440 MPa is the ultimate tensile strength. 205 GPA is the modulus of elasticity.

7. A rack and the brakes utilized are disc brakes. The vehicle has a stopping distance of about 4.487 meters.

The EV's system consists of PV panels, a DC/DC converter with a charge controller, battery banks, and a DC motor load. With a conventional golf cart system, the battery banks are charged using a conventional AC/DC electric charger that is connected to the main plug. The developed model extends the life of the deep-cycle battery and improves sustainability by using photovoltaic panels as its primary energy source. A monocrystalline solar PV panel is the main energy source for this system. The sun's irradiance and the regular fluctuations in the outside temperature may influence energy efficiency.

V. RESULT AND DISCUSSION

In the fig 1, it shows the Hardware model of the existing system.



Fig. 1 Hardware of System

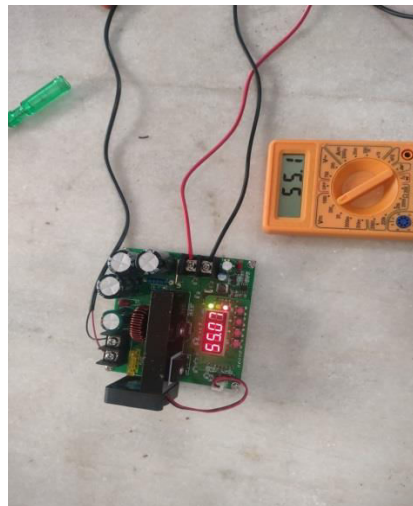


Fig. 2 MPPT Bost charger output.

In the fig 2, it shows the output of charger which is powered by solar panel and connected to the battery pack.

VI. CONCLUSION

The solar system includes three deep-cycle battery banks, a PV panel, and a DC/DC charge controller with MPPT capabilities. When analyzing metrological data, temperature and solar radiation at the intended site are considered. The dynamic performance of the modified EV with experimental applications is simulated using MATLAB/Simulink. An examination of three case studies confirmed the system's dynamic performance. The top of the upgraded EV is outfitted with a 335 W photovoltaic panel that charges a 48 V battery. Through experimental applications, MATLAB/Simulink is used to simulate the performance of the modified EV. An examination of three case studies confirmed the system's dynamic performance. A 350 W photovoltaic panel mounted atop the electric vehicle charges three deep-cycle battery banks with a combined rating of 3.6 kWh. The analysis's conclusions show that the EV's photovoltaic system can produce enough electricity to power the car under a range of weather conditions. The PV system can also limit the charging intervals and increase the moving range. It also increases overall sustainability and prolongs battery life. The environmental results show that the PV system can cut greenhouse CO₂ emissions by 420 kg since it doesn't need an external charge from fossil fuels. In conclusion, the modified EV is technically possible, dependable, and environmentally friendly.

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