

Electrical Auto-Rickshaw with Solar Charging

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ABSTRACT:

The Electric Autorickshaw with Solar Charging is an environmentally friendly transportation system designed to reduce fuel consumption and air pollution. It operates using an electric motor powered by rechargeable batteries instead of petrol or diesel. Solar panels installed on the roof of the autorickshaw capture sunlight and convert it into electrical energy, which is used to charge the battery. This solar support increases driving range and reduces dependency on grid electricity. The vehicle produces zero tailpipe emissions, operates quietly, and requires less maintenance compared to conventional autorickshaws. It is especially suitable for short-distance travel in urban and semi-urban areas. By combining electric mobility with renewable solar energy, the system promotes sustainable development, lowers operating costs, and contributes to a cleaner and greener transportation future.

Key words: Sustainable, Innovative, Eco-friendly, Cost-effective, Efficient

I. INTRODUCTION

One of the most essential necessities for human survival on Earth, and eventually on all other planets in the universe, is energy. This kind of energy is necessary for humans to meet all of their needs. Fossil fuels have been used by humans for hundreds of years to power our automobiles. The transportation sector in densely populated nations like the United States, China, and India heavily relies on fossil fuels. However, these fossil fuels' primary drawbacks are their exhaustibility and lack of environmental friendliness. Therefore, we must consider alternative solutions to address these problems, and using renewable energy is one such solution. Direct solar energy is the main source of power for the solar electric car. Solar energy is captured by photovoltaic panels, and with the aid of a photovoltaic cell, this solar energy can be readily transformed into electrical energy. With the aid of the charge controller, the PV cell gathers some of the solar energy and stores it in the car's battery. The D-C motor uses the electrical energy that has been stored in batteries to power the car continuously. The motor controller aids in regulating the motor's electrical energy input in relation to the throttle. That regulated electrical energy is used by the DC motor to propel the car. Transportation plays a vital role in daily life, but conventional autorickshaws powered by petrol, diesel, or CNG contribute significantly to air pollution, noise pollution, and rising fuel costs. With increasing environmental concerns and depletion of fossil fuels, there is a growing need for cleaner and more sustainable transportation solutions. Electric vehicles have emerged as an effective alternative due to their zero tailpipe emissions, lower operating costs, and reduced maintenance requirements.

The Electric Autorickshaw with Solar Charging is an innovative solution that combines electric vehicle technology with renewable solar energy. It operates using an electric motor powered by rechargeable batteries, while solar panels mounted on the roof generate additional electrical energy from sunlight. This solar energy can be used to charge the battery, extend the vehicle's range, and reduce dependence on grid electricity. This system is particularly suitable for short-distance travel in urban and semi-urban areas. By integrating solar power with electric mobility, the project promotes energy efficiency, environmental protection, and sustainable development, contributing to a cleaner and greener future.

II. LITERATURE SURVEY

An emerging environmentally friendly mode of transportation that aims to lessen reliance on fossil fuels and urban air pollution is the electrical autorickshaw with solar charging. According to published research, solar-assisted e-rickshaws usually use photovoltaic (PV) panels installed at solar charging stations or mounted on the roof of the vehicle to charge onboard batteries. Vehicle-mounted solar panels can only produce a limited amount of energy due to their small surface area, but they can effectively supplement battery charging and increase driving range, according to studies, including research done at the Indian Institute of Technology Madras.

It has been discovered that hybrid systems that integrate solar and grid charging are more dependable and useful. The environmental advantages, like lower CO₂ emissions and lower operating costs when compared to traditional internal

combustion engine autorickshaws, are also highlighted by research. Large-scale adoption is still hampered by issues like high upfront costs, a small capacity for solar energy harvesting, and maintenance issues. The literature comes to the general conclusion that solar-charged electric autorickshaws are a promising green mobility option, particularly in areas with high solar irradiance. However, for wider adoption, policy support and technological optimization are needed.

Key Points on Solar-Powered Electric Autorickshaws:

- Technology Overview
- Environmental Impact
- Energy Harvesting Limitations
- Hybrid Charging Systems
- Economic and Operational Benefits
- Challenges to Adoption

Widespread adoption is severely hampered by high initial capital costs, poor solar energy capture, and maintenance issues. Additionally, because of perceived complexity or ignorance of long-term benefits, car owners may be reluctant to embrace solar technology.

Summary Paragraph:

By lowering carbon emissions and dependency on fossil fuels, solar-powered electric autorickshaws present a viable sustainable transportation option. Although the vehicle's small surface area limits the amount of energy that can be harvested, these vehicles are outfitted with solar panels to charge batteries. To guarantee continuous operation, hybrid systems that integrate solar and grid charging are being utilized more frequently. Widespread adoption is hampered by the high initial investment and limited energy capture, despite the operational and environmental advantages, such as lower operating costs.

III. OBJECTIVES

- To use solar energy as a renewable charging source in order to lessen reliance on fossil fuels.
- To reduce carbon emissions and air pollution from urban transportation.
- To use free solar energy to reduce drivers' fuel and operating expenses.
- To encourage environmentally friendly and sustainable mobility options.
- To integrate solar charging systems to lessen the strain on the electrical grid.
- To increase energy efficiency through intelligent charging management and electric motors.

- To offer a reasonably priced and hygienic short-distance transportation choice.

Ultimately, the primary goal is to use solar-powered electric technology to create a transportation system that is economical, ecologically friendly, and energy-efficient.

IV. METHODOLOGY

The purpose of the electrical autorickshaw with solar charging system is to encourage environmentally friendly transportation while consuming less fuel. A BLDC motor is powered by a battery pack via a motor controller. The autorickshaw's roof is equipped with a solar panel that collects sunlight and produces electricity. To safely charge the battery, an MPPT charge controller regulates the generated solar power. Additionally, the battery has a Battery Management System (BMS) to guard against deep discharge and overcharging. The electrical components and solar panels are mounted securely through proper fabrication. Following assembly, testing is done to assess the system's overall performance, charging time, vehicle range, and solar efficiency.



Fig no. (01) Electrical

autorickshaw with solar charging.

1. Design of the System

- Create a battery-operated electric autorickshaw.
- To help charge batteries, install a solar panel on the roof.
- Principal elements:

2. Selection of Components

- Pick an appropriate BLDC motor, usually between 800W and 1500W.
- Select battery capacity (e.g., 48V, 100Ah) according to the needed range.

- Pick 300–500W monocrystalline solar panels with high efficiency.
- To improve solar efficiency, use an MPPT charge controller.

3. Development of Electrical Systems

- Attach the battery to the motor controller.
- Through throttle input, the motor controller controls speed.

Install safety gear:

- o Protection against overvoltage o Fuse o Protection against overcurrent
- o Battery Management System (BMS)

4. Fabrication & Assembly

- Fabricate frame modifications to support solar panels.
- Install wiring with proper insulation.
- Secure battery compartment with ventilation.
- Ensure waterproof connections.

5. Testing & Performance Evaluation

- Test battery charging from grid supply.
- Test solar charging efficiency.
- Measure:

Vehicle range per charge o

Charging time o Solar

contribution percentage o Power

consumption (Wh/km)

6. Analysis & Optimization

- Compare solar-assisted charging vs grid charging.
- Improve panel angle and efficiency

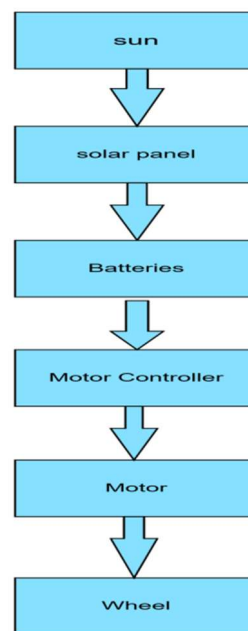


Fig no.(02)

flow chart of Electrical autorickshaw with solar charging.

V. ANALYSIS

A three-wheeled vehicle with an electric motor and rechargeable battery that has solar panels installed to facilitate charging is called an electric autorickshaw with solar charging. Electric rickshaws are already widely used for clean urban transportation, as demonstrated by vehicles like the Mahindra Treo. Sunlight is converted into electricity by panels on the roof or at a charging station in a solar-assisted system. The electricity is controlled by a charge controller and stored in a battery.

1)Technology Overview: Photovoltaic (PV) panels, which can be mounted on the vehicle or connected to specialized solar charging stations, are used to charge batteries in solar-powered electric autorickshaws. These electric-powered vehicles provide a greener substitute for autorickshaws that run on fossil fuels.

2).Environmental Impact: According to studies, solar e-rickshaws are a more environmentally friendly option than conventional autorickshaws because they can drastically cut carbon emissions. By reducing dependency on fossil fuels and grid electricity, solar energy integration helps create a cleaner urban environment.

3).Energy Harvesting Limitations: The energy collected by autorickshaws' solar panels is comparatively small because of their small surface area. Because of this, solar charging should be used in addition to grid charging rather than in place of it, particularly in areas with less sunlight or under cloudy skies.

4. Hybrid Charging Systems: Hybrid charging systems that combine grid charging and solar energy are being developed to get around energy constraints. This guarantees that there is a dependable power source for the cars, particularly in situations where solar energy is not enough. The overall viability and efficiency of solar e-rickshaws are enhanced by these systems.

5. Economic and Operational Benefits: As the need for grid power diminishes, solar charging can lower operating costs. In many situations, solar e-rickshaws are economically feasible due to long-term fuel and maintenance cost savings, even though the initial cost of installing solar panels and the electric motor is higher.

6. Challenges to Adoption: Widespread adoption is severely hampered by high initial capital costs, poor solar energy capture, and maintenance issues. Additionally, because of perceived complexity or ignorance of long-term benefits, car owners may be reluctant to embrace solar technology.

VI. CONCLUSION

Solar-powered electric autorickshaws are a very effective and environmentally friendly way to get around cities these days. By incorporating solar charging, these cars lessen their dependency on fossil fuels and traditional electricity, which lowers operating costs and carbon emissions dramatically, improving air quality in crowded cities. These vehicles can be recharged using renewable energy thanks to solar-powered charging systems, which frequently use rooftop solar panels mounted on the rickshaw or special solar charging stations. This lessens the strain on the electrical grid and offers a dependable energy source in places where the supply of electricity is erratic. Compared to conventional fuel-based rickshaws, drivers can expect significant fuel cost savings, lower maintenance costs, and a longer vehicle lifespan because of the electric drivetrain's simplicity.

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