

HYBRID CAR

**Mr. Shanwar Tejas Sham^{*1}, Mr. Khairnar Mayur Vikram^{*2}, Mr. Pawar Krupal Anil^{*3},
Mr. Ahire Vinod Sahebrao^{*4}, Mr. Khairnar Yogesh Supadu^{*5}**

^{*1,2,3,4}Student, Mechanical Engineering, Matoshri Institute Of Technology, Yeola, Maharashtra, India.

^{*5}Lecturers, Department Of Mechanical Engineering, Matoshri Institute Of Technology, Yeola,
Maharashtra, India.

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ABSTRACT

Hybrid cars that utilize both solar and electric energy are a groundbreaking step towards sustainable transportation. These vehicles harness solar energy through photovoltaic panels, converting sunlight into electricity to power the motor or charge the battery. Additionally, they rely on stored electric energy, which is supplied through external charging sources. This dual-energy system enhances efficiency, reduces dependence on fossil fuels, and lowers carbon emissions. Despite their environmental benefits, challenges such as energy storage limitations and high production costs remain. Continuous research and technological advancements are crucial for making solar-electric hybrid cars more practical and widely accessible.

I. INTRODUCTION

Hybrid cars that utilize both solar and electric energy are a groundbreaking step towards sustainable transportation. These vehicles harness solar energy through photovoltaic panels, converting sunlight into electricity to power the motor or charge the battery. Additionally, they rely on stored electric energy, which is supplied through external charging sources. This dual-energy system enhances efficiency, reduces dependence on fossil fuels, and lowers carbon emissions. Despite their environmental benefits, challenges such as energy storage limitations and high production costs remain. Continuous research and technological advancements are crucial for making solar-electric hybrid cars more practical and widely accessible.

II. LITERATURE REVIEW

The initial phase involves an extensive review of existing research and technologies related to solar-electric hybrid vehicle systems. This review helps identify relevant theories, previous systems, and technological gaps in the current market. The literature review covers:

- Study of photovoltaic (PV) energy conversion, efficiency, and applications in hybrid vehicles.
- Exploration of electric battery storage and its role in vehicle performance.
- Investigation into hybrid energy systems combining solar and electric power sources.
- Review of current limitations and challenges in hybrid vehicle energy systems.

III. METHODOLOGY

The development of solar-electric hybrid cars involves integrating photovoltaic panels with an advanced electric powertrain. The photovoltaic cells convert solar radiation into electricity, which is either used immediately or stored in a rechargeable battery. Additionally, the vehicle's battery can be charged through external power sources. Energy management systems regulate power distribution, optimizing efficiency. Testing includes evaluating solar panel efficiency, battery performance, and overall vehicle range. Challenges such as energy storage capacity and cost-effectiveness are analyzed. Continuous improvements in solar technology and battery advancements are essential for enhancing hybrid vehicle performance and sustainability. The approach consists of the following key steps:

1. Data Gathering

In this phase, relevant information is collected to support the project concept. This data is obtained through direct industrial visits, where we assess real-world system dimensions, operational mechanisms, time efficiency, and identify existing shortcomings or inefficiencies in the current system.

3. System Design

The system design phase involves the development of a mechanism capable of performing the intended function efficiently. This stage focuses on determining the necessary system components, their arrangement, dimensions, and functional attributes. The components required for this phase are carefully selected to ensure optimal compatibility and efficiency in the overall system.

4. Mechanical Design

Each component undergoes a thorough stress and strain analysis under specified load conditions to determine precise dimensions and structural integrity. Standardized parts are selected based on reference data from the CBS Design Handbook, ensuring compatibility, durability, and reliability within the system.

5. Creation of Production Drawing

To ensure accuracy in fabrication, detailed production drawings are generated using Creo and Auto-CAD. These drawings incorporate dimensional precision, geometric tolerances, and technical specifications. Additionally, raw material specifications for each part are established to maintain consistency in quality and manufacturability.

6. Material Acquisition & Process Planning

Raw materials are sourced based on predefined specifications and required quantities. A structured process plan is developed to outline the manufacturing sequence while identifying suitable machinery and techniques for efficient production.

7. Manufacturing

The fabrication process follows the production drawings, ensuring each component is manufactured according to design requirements. Various machining processes such as turning on a lathe, drilling, cutting, and welding are carried out in the workshop to produce the necessary parts. Quality control measures are implemented at each stage to ensure accuracy, durability, and functionality of the final components.

8. Assembly

The assembly process involves connecting all components to form a functional system. Initially, each part is inspected for accuracy and quality. The flywheel, spring, shafts, and other mechanical elements are then carefully aligned and secured in place. Proper alignment is ensured to reduce friction and enhance efficiency. Once assembled, the system undergoes basic functional testing to confirm that all parts work together as intended.

9. Analysis

The system's performance and efficiency are assessed through various tests. Key parameters such as energy storage capacity, output efficiency, and mechanical durability are measured. Any misalignments, energy losses, or structural weaknesses are identified and rectified. Finally, necessary improvements are made to optimize the system's overall functionality and reliability.

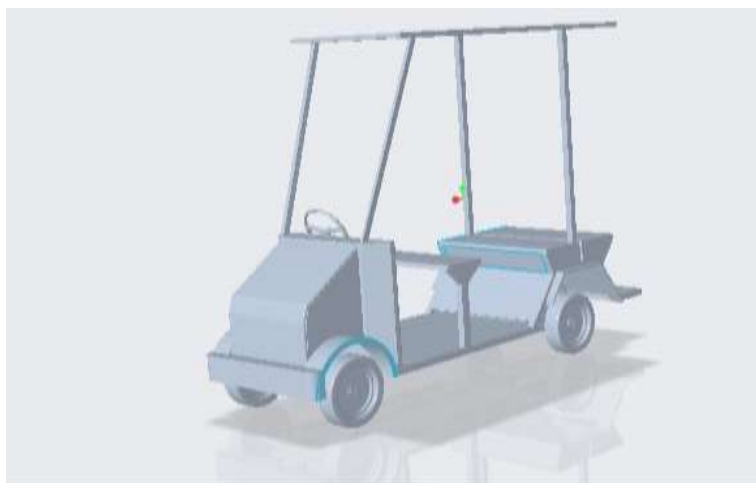
IV. MODELING AND ANALYSIS

Figure 1: 3D view of Hybrid Car.

V. RESULTS AND DISCUSSION

The results indicate that solar-electric hybrid cars enhance energy efficiency by integrating photovoltaic panels with an electric powertrain. Solar panels contribute additional power, extending battery life and reducing reliance on external charging sources. However, challenges such as limited solar energy availability, battery storage constraints, and high production costs impact overall performance. The efficiency of solar panels varies based on weather conditions, affecting energy generation. Advancements in battery storage and solar panel efficiency are necessary for improving these vehicles. Further research and technological improvements will be crucial in making solar-electric hybrid cars a more practical and sustainable transportation solution.

Key findings include:

1. Enhanced Energy Efficiency: The combination of solar and electric power improves overall vehicle efficiency.
2. Reduced Fossil Fuel Dependence: Solar integration minimizes reliance on conventional fuels.
3. Supplementary Power Source: Solar panels provide additional energy, reducing the need for external charging.
4. Regenerative Braking Benefits: Captures and reuses energy, improving battery life and efficiency.
5. Challenges in Implementation: High initial costs and solar panel efficiency limitations require further research.

VI. CONCLUSION

The adoption of hybrid vehicles presents a significant advancement in sustainable transportation by reducing dependence on fossil fuels and minimizing carbon emissions. The integration of photovoltaic panels with an electric powertrain enhances energy efficiency, yet challenges such as high initial costs and energy storage limitations persist. Continuous research and technological advancements are essential to improving solar panel efficiency, battery storage, and cost-effectiveness for widespread adoption in the future.

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