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## **Challenges and Solutions in Developing Solar Boats: A Comprehensive Review**

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Abstract: This paper explores the innovative strides in solar-powered boat technology, emphasizing its pivotal role in fostering sustainable maritime transportation. The paper delves into the design, efficiency, and environmental benefits of solar boats, highlighting the integration of photovoltaic panels to harness solar energy for propulsion. The study also examines the challenges faced in the development of solar boats and proposes potential solutions to enhance their viability. By investigating the current state of solar boat technology, this paper contributes valuable insights into the future of eco-friendly maritime transportation and its potential to reduce carbon emissions in the water transport sector. Solar boats, also known as solar-powered boats, harness the power of the sun to propel themselves through water, offering a sustainable and eco-friendly alternative to traditional fuel-powered vessels. The development of solar boats involves a combination of specialized tools, techniques, and coding languages. Design and simulation tools, such as CAD (Computer-Aided Design) software, are crucial for modeling the boat's structure and optimizing its aerodynamics and hydrodynamics to maximize solar energy conversion. Solar panels, the heart of these vessels, require advanced photovoltaic technology for efficient energy capture. Electrical and electronic components, including batteries and power management systems, are integrated using programming languages like  $C^{++}$  or Python to control and optimize energy usage, storage, and distribution on the boat. Additionally, real-time monitoring and control systems may employ sensors and IOT (Internet of Things) technologies, enhancing the boat's overall performance and safety. The development of solar boats is a multidisciplinary effort, incorporating engineering, computer science, and renewable energy technologies to create sustainable and efficient waterborne transportation solutions

**Keywords:** Solar-Powered Boats, Photovoltaic Systems, Energy Management Systems, Marine Renewable Energy

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