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Design and Fabrication of Solar Electric Scooter by Experimental and Simulation Approach

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ABSTRACT

Today there is a widespread scope for the vehicles working on the renewable energy especially in India. India is one of the world's largest exporter of oil. The emission from petrol and diesel leads to tremendous amount of CO2, NO2 emissions, and thereby depleting the ozone layer leading to environmental pollution. This results into respiratory diseases, eye related problems, and other comorbidity in human beings and animals. The objective of project is to fabricate solar based eco-friendly scooter to facilitate pollution-free transportation; hassle free riding experience for shorter distances. The integration of rechargeable batteries powered by solar panels in these vehicles significantly reduces emissions and diminishes reliance on human effort. The primary objective is to create a hardware model of solar electric vehicles (SEVs) to mitigate carbon emissions from traditional fossil fuel vehicles and signify a move towards environmentally conscious transportation. The modelling and simulation of the solar based scooter will be carried out by employing Solid-works as well as ANSYS software's. This endeavor involves the research to enhance solar electric bicycle technology, emphasizing carbon reduction and the promotion of sustainable transportation for a greener future.

Key Words: Solar panel, electric scooter

INTRODUCTION

Solar powered bicycles is one of the best methods of reducing our dependence on fossil fuels and minimizing environmental damage caused by carbon dioxide emissions. In this project we are going to use solar panel and DC motor. The voltage generated by the solar panel is stored in battery (48V/20AH) through charging circuit. From the battery, power will be supplied to the DC motor (48V/200W) through accelerator followed by gate switch. The purpose of gate switch is when break is applied then automatically it opens the connection between motor and accelerometer. The increasing environmental concerns and the depletion of fossil fuels have accelerated the search for sustainable and green transportation solutions. Electric scooters have emerged as a popular alternative due to their energy efficiency and lower emissions compared to traditional internal combustion engine vehicles

METHODOLOGY

Creating a solar electric bike is a multifaceted project that integrates mechanical engineering, electrical engineering, and renewable energy technologies. The process starts with conceptualization and planning, where objectives such as the bike's range, speed, weight, and usability are defined. This phase involves extensive research into existing technologies, including solar panels, batteries, and electric motors, to identify the most suitable components.

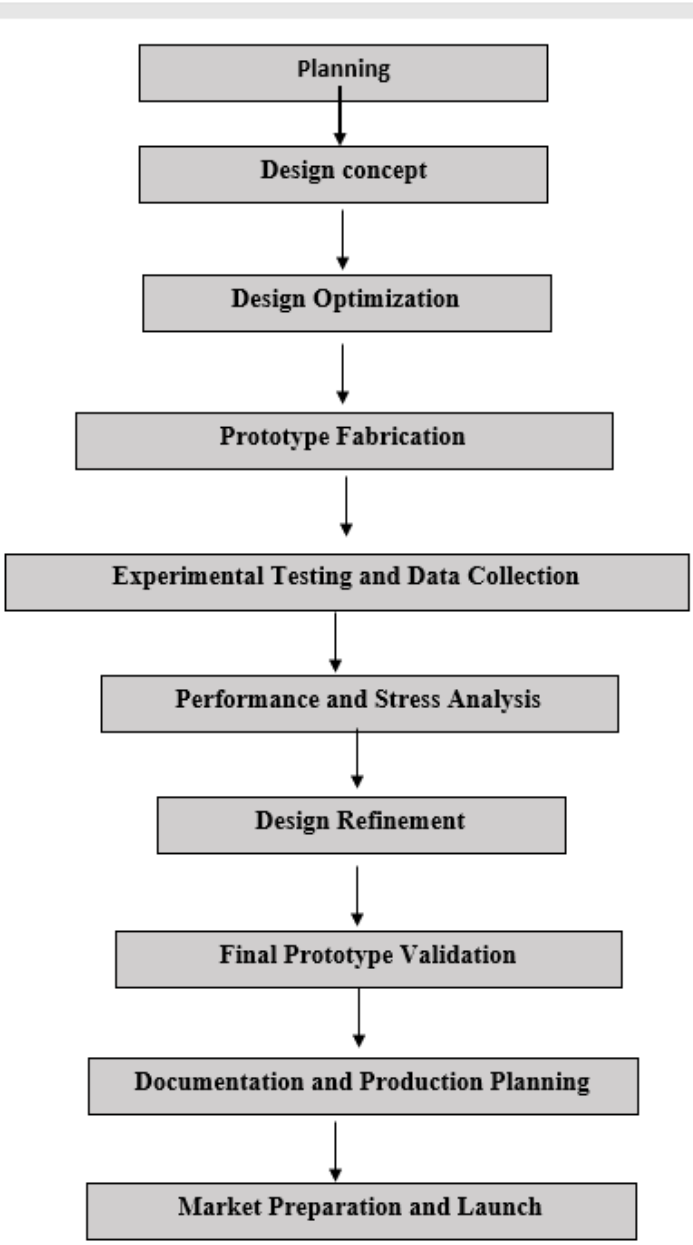

Figure Flow chart representing solar electric bike

COMPONENTS REQUIRED FOR THE PROJECT

Solar Cells: A solar cell (also called a photovoltaic cell) is an electrical device that helps in the conversion of light energy directly

into electrical energy by creating voltage when it gets exposed to light. It is a form of photoelectric cell which, when exposed to light, can produce and support an electric current without being attached to any external source of voltage, but requires an external load for power consumption

Figure. 3 solar panel

MOTORS: The working principle of a motor, whether it's an AC (alternating current) or a DC (direct current) type, revolves around the fundamental law of electromagnetism: a current-carrying conductor placed in a magnetic field experiences a force

Figure.4 Motor

Battery: Batteries are fascinating and vital components in our daily lives, powering everything from remote controls and smartphones to electric cars and backup power systems. At their core, batteries work by converting chemical energy into electrical energy through electrochemical reactions

Figure.5 Battery

Wheels: Wheels work by reducing friction and providing leverage, fundamentally transforming the way objects are moved. When an object is placed on wheels—whether it's a car, a cart, or any wheeled device—the wheels interface with the ground, allowing the object to roll. This is significantly more efficient than dragging the same object over a surface, which requires overcoming much greater friction.

Figure.6 wheels

Chain drive: Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles

Figure.7 Chain Drive

RESULTS AND DISCUSSIONS

MODILING:

A solar electric bike is an innovative form of transportation that combines solar energy technology with electric bicycle design. This integration aims to extend the bike's range, reduce reliance on grid electricity, and promote sustainable transportation.

Figure.8 solar electric bike Design

MESHING:

Meshing in SolidWorks for a solar electric bike involves simplifying the bike's geometry to create an accurate, computationally manageable model for simulations, crucial for assessing the bike's structural integrity, aerodynamics, and solar panel efficiency. The process starts with preparing the model by removing minor features unlikely to impact simulation outcomes, such as tiny fillets and holes, to reduce mesh complexity and computational demands.

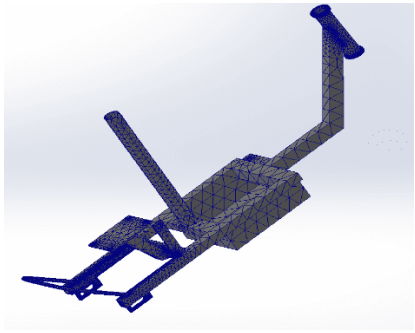

Figure.10 Meshing

STRUCTURAL ANALYSIS:

The analysis of a solar electric bike encompasses a multifaceted approach that integrates mechanical engineering principles, electrical efficiency, and sustainable energy utilization. This process evaluates the bike's structural integrity, ensuring it can withstand various stresses while remaining lightweight and durable.

Stress analysis:

The stress analysis of a solar electric bike, the evaluation further encompasses the electrical and thermal stresses on the solar power system, including the panels, battery, and electrical connections. The solar panels, often mounted on the bike's frame or a dedicated structure, must endure environmental stresses such as temperature fluctuations, humidity, and direct impact from road debris.

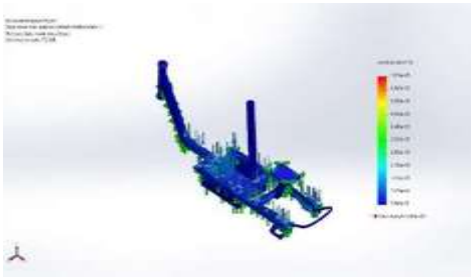

Figure 13 Stress analysis

Strain Analysis:

Strain analysis in SolidWorks for a solar electric bike offers an in-depth look into how the materials and components of the bike deform under applied forces, crucial for identifying potential points of failure or areas requiring reinforcement. This process starts with a detailed 3D model of the bike, incorporating all critical features such as the frame, wheels, solar panel mounts, and the panels themselves. After assigning accurate material properties to each part of the model—reflecting the real-life materials to be used, like carbon fiber for the frame or polycrystalline silicon for the solar panels—the next step involves defining the simulation environment.

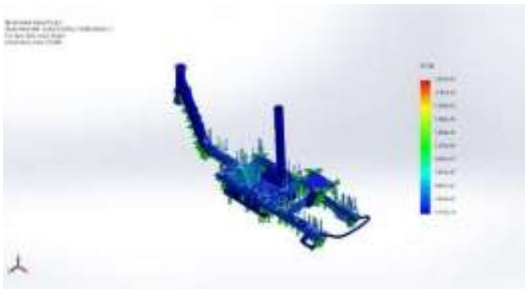

Figure.15 Strain analysis

CONCLUSION

In light of the growing concern over the dwindling availability of crude oil reserves and the pressing need to mitigate the environmental impact of conventional fossil fuel-powered vehicles, the shift towards alternative, more sustainable modes of transportation has become imperative. Electric Vehicles (EVs), encompassing electric cars, e-bikes, and electric scooters, emerge as a forefront innovation in this transition, offering a clean, pollution-free alternative to petrol and diesel vehicles. The adoption of electric vehicles is pivotal in achieving a significant reduction in air pollutants and greenhouse gas emissions, thus contributing to cleaner air quality and a healthier environment. Electric bikes and scooters, in particular, not only exemplify zero-emission transportation but also present a practical solution for reducing urban traffic congestion and enhancing the efficiency of personal mobility.

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