DESIGN AND FABRICATION OF A COMPACT , LIGHT WEIGHT AND HIGH EFFICIENT ELECTRIC VEHICLE WITH SOLAR POWER BACKUP

A MINI PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project report "**DESIGN AND FABRICATION OF A COMPACT , LIGHT WEIGHT AND HIGH EFFICIENT ELECTRIC VEHICLE WITH SOLAR POWER BACKUP**" is the bonafide Work of "**AKASH M (111420114001), HEMASHANKARAN M (111420114008), KAREM AKASH (111420114010)** " who carried out the project work under my supervision.

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ABSTRACT

The project aims to develop an electric vehicle (EV) that incorporates a solar power backup system, enabling the use of renewable energy for sustainable transportation. By integrating solar panels onto the vehicle's roof or body, advanced photovoltaic technology converts solar energy into electrical power, reducing reliance on grid charging and increasing the environmental friendliness of the EV. The project involves the design and implementation of a solar power backup system that supplements the primary battery pack of the vehicle. Intelligent charging algorithms and power management systems optimize the utilization of solar power, grid power, and the main battery based on factors such as solar irradiation, battery charge level, and energy demand.

The objectives of this project include extending the EV's overall range, reducing greenhouse gas emissions, promoting renewable energy adoption, and improving energy efficiency. Implementation of this project will contribute significantly to sustainable transportation, reducing dependence on fossil fuels and mitigating the environmental impact associated with conventional vehicles. In summary, the electric vehicle with solar power backup project represents an innovative and practical solution to achieve greener and more self-sustaining transportation. It aligns with the global goal of transitioning to a sustainable energy future.

Keywords: electric vehicle, solar power backup, renewable energy, sustainable transportation, solar panels, photovoltaic technology, energy efficiency.

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1.1 Introduction

The introduction of electric vehicles (EVs) has revolutionized the transportation industry by offering a cleaner and more sustainable alternative to traditional internal combustion engine vehicles. However, EVs still face challenges such as limited range and reliance on grid-based charging infrastructure. To address these challenges and further enhance the environmental friendliness of EVs, the integration of solar power backup systems has emerged as a promising solution.

Solar power, as a renewable energy source, presents an opportunity to power EVs with clean energy directly from the sun. By incorporating solar panels onto the vehicle's surface, advanced photovoltaic technology enables the conversion of sunlight into electricity, supplementing the primary battery pack of the EV. This solar power backup system offers several advantages, including reduced dependence on conventional grid charging and a decrease in greenhouse gas emissions.

Intelligent charging algorithms and power management systems play a vital role in optimizing the utilization of solar power in conjunction with grid power and the primary battery. These algorithms dynamically manage the energy flow based on factors such as solar irradiation, battery state of charge, and energy demand. By intelligently switching between energy sources, the system maximizes the use of solar energy, thereby extending the range of the electric vehicle.

To ensure the efficient storage and utilization of excess solar energy, an energy storage system is integrated into the vehicle. This system captures and stores surplus solar energy generated during periods of high solar irradiation, which can be utilized during low solar irradiation periods or in emergency situations. The energy storage system enhances the EV's reliability and reduces the impact of intermittent solar availability.

The primary objectives of this project are to enhance the overall range of electric vehicles, promote the adoption of renewable energy sources, reduce greenhouse gas emissions, and improve energy efficiency. By combining the benefits of electric propulsion and solar power backup, this innovative solution contributes to a more sustainable and self-sustaining transportation ecosystem.

In conclusion, the integration of solar power backup systems in electric vehicles represents a significant step towards achieving sustainable transportation. By harnessing the power of the sun, these systems offer the potential for increased range, reduced environmental impact, and greater energy independence. The following sections will delve into the technical aspects and implementation strategies of the electric vehicle with solar power backup project.

1.2 Problem Statement

The problem at hand is to overcome the limited driving range and dependence on grid charging infrastructure in electric vehicles (EVs), by developing an efficient and practical solution that integrates a solar power backup system.

1.3 Objectives of the Project

1. Extend Driving Range: Develop a system that effectively increases the driving range of electric vehicles by integrating a solar power backup system, enabling them to operate for longer distances without frequent recharging.

2. Reduce Grid Dependency: Reduce reliance on grid-based charging infrastructure by utilizing solar power as an auxiliary energy source for electric vehicles, thereby promoting energy independence and reducing the environmental impact associated with conventional electricity generation.

3. Enhance Sustainability: Promote the use of renewable energy sources by integrating solar panels into EVs, contributing to a more sustainable transportation system and reducing greenhouse gas emissions.

4. Optimize Energy Management: Develop intelligent charging algorithms and power management systems that optimize the utilization of solar energy, grid power, and the vehicle's primary battery, ensuring efficient energy flow and maximizing the use of available resources.

5. Improve Energy Efficiency: Increase the overall energy efficiency of electric vehicles by effectively harnessing and storing solar energy, minimizing energy losses, and optimizing the charging process to reduce energy waste.

6. Demonstrate Feasibility: Conduct practical demonstrations and tests to validate the feasibility and effectiveness of the integrated electric vehicle and solar power backup system, assessing its performance, reliability, and economic viability.

1.4 Scope of the Project

The scope of the project "Electric Vehicle with Solar Power Backup" includes the design, development, and integration of a solar power backup system into an electric vehicle. This involves the installation of solar panels onto the vehicle's structure to capture and convert solar energy into electrical power. The project also encompasses the implementation of an energy storage system capable of efficiently storing the excess solar energy generated by the panels. The system will be designed to seamlessly integrate with the vehicle's existing components and infrastructure.

The focus will be on optimizing the charging process, developing intelligent algorithms for energy management, and ensuring the overall efficiency and reliability of the integrated system. The project's scope will also involve performance evaluation through rigorous testing and real-world demonstrations to validate the feasibility and practicality of the electric vehicle with solar power backup concept.

1.5 Methodology

The methodology for the project "Electric Vehicle with Solar Power Backup" involves the following steps:

1. Requirement Analysis: Identify the specific requirements and objectives of the project, considering factors such as desired range extension, energy storage capacity, and charging efficiency.

2. System Design: Based on the requirements and research findings, design the solar power backup system architecture. Determine the optimal placement and orientation of solar panels on the electric vehicle, considering factors such as aerodynamics, available space, and solar irradiation.

3.Component Selection and Procurement: Select high-quality solar panels, energy storage devices, power management units, and other necessary components. Ensure compatibility, efficiency, and reliability of the selected components. Procure the components from trusted suppliers or manufacturers.

4.System Integration: Integrate the solar panels onto the electric vehicle's structure, ensuring secure mounting and efficient electrical connections. Connect the energy storage system, power management unit, and charging system to create a fully functional integrated system. Ensure proper insulation, protection, and safety measures are implemented.

5.Testing and Validation: Conduct rigorous testing and validation of the integrated system. Evaluate its performance in different scenarios, including varying solar irradiation levels and driving conditions. Measure parameters suchas charging efficiency, range extension, and energy utilization to ensure the system meets the desired objectives.

6.Performance Optimization: Analyze the test results, identify areas for improvement, and refine the system design and algorithms accordingly. Optimize the performance of the solar power backup system to achieve maximum efficiency and reliability.

CHAPTER 2

COMPONENTS

1.hc-05 Bluetooth module

2.L298N motor driver

3.Arduino uno

4.YX850 power failure automatic switching battery module

5.Solar panel

6. 4.2V 18650 Li ion battery

7.Battery holder

8.Single shaft BO motor

9. 65 mm motor wheel

1.hc-05 Bluetooth module

The HC-05 Bluetooth module is a widely used wireless communication module that facilitates Bluetooth connectivity between electronic devices. With its Bluetooth 2.0 support, it operates as a serial transceiver, allowing transparent bidirectional communication over Bluetooth. The module can be configured as a master or slave device, enabling connections with other Bluetooth-enabled devices, making it ideal for projects requiring wireless data transmission and communication between microcontrollers and other devices within a range of approximately 10 meters. Its simplicity and versatility have made the HC-05 Bluetooth module a popular choice for numerous applications.

2. L298N motor driver

The L298N motor driver is a versatile integrated circuit commonly used for controlling and driving DC motors and stepper motors. It offers a compact and efficient solution for controlling motor speed and direction in various applications, including robotics, automation, and motor control systems. With

its built-in H-bridge circuits, the L298N can handle bidirectional control and support two motors independently or a single stepper motor. Its wide voltageinput range and robust design make it a popular choice among electronics enthusiasts and professionals seeking reliable motor control capabilities.

3.Arduino uno

The Arduino Uno is a widely recognized and versatile microcontroller board that serves as the foundation for countless electronics projects. It features the ATmega328P microcontroller, providing a user-friendly platform for programming and interacting with various sensors, actuators, and other electronic components. With its extensive range of input/output pins, built-in USB connectivity, and a supportive community, the Arduino Uno offers a beginner-friendly yet powerful platform for makers, hobbyists, and professionals alike to bring their creative ideas to life and explore the world of electronics and programming.

4.YX850 power failure automatic switching battery module

The YX850 power failure automatic switching battery module is a dedicated module designed to ensure uninterrupted power supply during power outages. It is widely used in applications where a continuous and reliable power source is essential, such as backup power systems, emergency lighting, security systems, and industrial equipment. The module automatically switches to battery power when the main power source fails, providing a seamless transition to backup power and preventing disruptions. It offers a convenient and reliable solution for maintaining power stability and ensuring the uninterrupted operation of critical devices and systems.

5.Solar panel

Solar panels, also known as photovoltaic (PV) panels, are essential components in the harnessing of solar energy for electricity generation. Composed of interconnected solar cells, these panels convert sunlight into direct current (DC) electricity through the photovoltaic effect. The generated electricity can then be converted into usable alternating current (AC) electricity through an inverter. Solar panels have become popular due to their ability to provide clean, renewable energy without producing greenhouse gas emissions.

6.4.2V 18650 Li ion battery

A 4.2V 18650 Li-ion battery is a rechargeable lithium-ion battery that provides a nominal voltage of 3.7V and a fully charged voltage of 4.2V. With a standardized size of approximately 18mm in diameter and 65mm in length, these batteries are commonly used in various electronic devices. They offer a high energy density, allowing for extended runtimes, and have a long cycle life, making them durable and cost-effective. The 4.2V voltage represents the upper limit of the battery's charging capacity, ensuring optimal performance and safety. Whether in portable electronics or electric vehicles, 4.2V 18650 Li-ion batteries provide a reliable power source for numerous applications.

7.Battery holder

A battery holder is a device designed to securely hold and connect batteries in electronic devices. Typically made of non-conductive materials such as plastic,the holder features slots or compartments that snugly accommodate the batteries. It often includes metal contacts or springs that establish electrical connections with the battery terminals, ensuring proper power transfer to the connected circuit. Battery holders are widely used in a variety of electronic devices, ranging from toys and remote controls to flashlights and portable electronics. They provide a convenient and reliable solution for battery installation and replacement, ensuring stable connections and facilitating efficient power supply management.

8.Single shaft BO motor

A single shaft BO (Brushed DC) motor is a common type of electric motor that utilizes direct current and features a single rotating shaft. These motors operate using brushes and a commutator system, which allow for the continuous flow and reversal of electrical current in the armature windings, resulting in the rotation of the motor's shaft. Single shaft BO motors find wide application in various industries, ranging from small appliances and toys to automotive systems. They are favored for their affordability, simplicity, and compact design. However, they do have some drawbacks, including lower efficiency compared to other motor types and limited brush and commutator lifespan. Nonetheless, single shaft BO motors remain a popular choice for applications that require cost-effective and reliable rotational motion.

9. 65 mm motor wheel

A 65 mm motor wheel is a compact wheel assembly that incorporates a motor within its hub and has a diameter of 65 millimeters. This integrated design eliminates the need for separate motor components, such as gears or belts, resulting in a streamlined and space-efficient solution. The motor wheel is commonly used in various applications, such as robotics, small vehicles, and automation systems, where compact size and direct motor-driven motion are desired. With its convenient integration and compact design, the 65 mm motor wheel provides an efficient and versatile solution for rotational motion requirements.

CHAPTER 3

DESIGN OF ELECTRIC VEHICLE

An electric vehicle (EV) is a car that runs on electricity instead of gasoline, and its design encompasses several key elements. First, the shape and size of an EV can vary, ranging from compact models ideal for urban commuting to larger vehicles suitable for families or commercial use. The exterior design of an EV often prioritizes aerodynamics, featuring sleek lines and curves to minimize air resistance and improve energy efficiency. Additionally, EVs may incorporate lightweight materials such as aluminum or carbon fiber to reduce weight and enhance overall efficiency.

The interior design of an EV offers a comfortable and spacious cabin for passengers, with modern features and technology. The placement and layout of components, such as the battery pack and electric motor, are optimized to maximize interior space while ensuring optimal weight distribution for stability. Overall, the design of an electric vehicle aims to combine efficient performance, eco-friendliness, and a user-friendly experience, providing an attractive and sustainable transportation option for the future.

SYSTEM OF ELECTRIC VEHICLE

The system of an electric vehicle with solar power backup integrates solar energy generation with an electric vehicle to enhance its sustainability and efficiency. This system typically consists of the following components:

1.Solar Panels: Photovoltaic (PV) panels are installed on the exterior surfaces of the vehicle, such as the roof or hood, to capture sunlight and convert it into electrical energy. These solar panels are designed to withstand the outdoor environment and generate electricity when exposed to sunlight.

2. Charge Controller: A charge controller manages the flow of electricity from the solar panels to the vehicle's battery. It regulates the voltage and current to ensure safe and efficient charging, preventing overcharging or damage to the battery.

3.Battery Storage: The electric vehicle is equipped with a high-capacity battery that stores the electrical energy generated by the solar panels. This battery serves as an energy reservoir, allowing the vehicle to utilize solar power even when sunlight is not available or during nighttime.

4.Power Management System: A power management system coordinates the flow of energy between the solar panels, battery storage, and the vehicle's electrical components. It optimizes the use of solar power, prioritizing it for charging the vehicle and powering auxiliary systems, such as air conditioning, infotainment, or lighting.

5.Grid Charging Integration: In addition to solar power, the electric vehicle can also be charged from the electric grid when needed. The system allows for seamless integration between solar power and grid charging, maximizing the use of renewable energy while providing flexibility in charging options.