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SOLAR HYBRID E-VEHICLE

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ABSTRACT

The Solar Hybrid Electric Vehicle (HEV) is an innovative project aimed at developing a sustain able, energy-efficient transportation system that utilizes solar energy and electric power. This hybrid vehicle leverages renewable energy sources to reduce its dependence on fossil fuels. The ESP8266 microcontroller is employed to manage the energy harvesting, power distribution, and control system of the vehicle, while machine learning algorithms are implemented to optimize energy usage based on driving patterns. This project addresses pressing environmental issues such as air pollution and fossil fuel depletion, contributing toward greener transportation solutions. The integration of hybrid power sources and intelligent energy optimization makes this system more efficient and eco-friendly. The Solar Hybrid Electric Vehicle (HEV) using ESP8266 and Machine Learning is an innovative project aimed at developing a sustainable and energy-efficient solution to modern transportation challenges. With the rising concerns over environmental degradation and the depletion of fossil fuels, there is an urgent need to shift toward renewable energy sources. This project combines the principles of solar energy harvesting, electric vehicle (EV) technology, and intelligent energy management to create a hybrid vehicle that minimizes its carbon footprint while maximizing operational efficiency. The hybrid vehicle utilizes two energy sources: solar power and electric batteries. Solar panels installed on the vehicle harvest energy from the sun, which is stored in a rechargeable battery. This stored energy powers the electric motor, significantly reducing the need for traditional fuel based propulsion. By incorporating both renewable energy and electric power, the vehicle ensures continuous operation even in non-optimal weather conditions. At the core of the system is the ESP8266 microcontroller, a versatile and cost-effective device known for its Wi-Fi capabilities and efficient handling of multiple tasks.

I. INTRODUCTION

The Solar Hybrid Electric Vehicle (HEV) is an innovative project aimed at developing a sustain able, energy-efficient transportation system that utilizes solar energy and electric power. This hybrid vehicle leverages renewable energy sources to reduce its dependence on fossil fuels. The ESP8266 microcontroller is employed to manage the energy harvesting, power distribution, and control system of the vehicle, while machine learning algorithms are implemented to optimize energy usage based on driving patterns. This project addresses pressing environmental issues such as air pollution and fossil fuel depletion, contributing toward greener transportation solutions. The integration of hybrid power sources and intelligent energy optimization makes this system more efficient and eco-friendly. The Solar Hybrid Electric Vehicle (HEV) using ESP8266 and Machine Learning is an innovative project aimed at developing a sustainable and energy-efficient solution to modern transportation challenges. With the rising concerns over environmental degradation and the depletion of fossil fuels, there is an urgent need to shift toward renewable energy sources. This project combines the principles of solar energy harvesting, electric vehicle (EV) technology, and intelligent energy management to create a hybrid vehicle that minimizes its carbon footprint while maximizing operational efficiency. The hybrid vehicle utilizes two energy sources: solar power and electric batteries. Solar panels installed on the vehicle harvest energy from the sun, which is stored in a rechargeable battery. This stored energy powers the electric motor, significantly reducing the need for traditional fuel based propulsion. By incorporating both renewable energy and electric power, the vehicle ensures continuous operation even in non-optimal weather conditions. At the core of the system is the ESP8266 microcontroller, a versatile and cost-effective device known for its Wi-Fi capabilities and efficient handling of multiple tasks. The ESP8266 manages key vehicle functions, including

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monitoring solar energy output, battery charge levels, and motor control. It also enables real-time monitoring and communication, providing the vehicle with an intelligent control system that ensures optimal energy usage

II. LITERATURE REVIEW

1. Paper Name: Photovoltaic Systems for Electric Vehicles Author Name : John A. Duffie, William A .Beckman Description : Overview of photovoltaic systems for mobile electric vehicles and their energy effi ciency.

2. Paper Name : Autonomous Vehicle Navigation Author Name : Nicholas Roy, Sebastian Thrun Description : Discusses algorithms for autonomous driving and robotic car navigation

3. Paper Name : IoT-Based Control System Using ESP32 Author Name : Liang Xiao,Yanming Shen

Discription: Discusses the use of ESP32 in IoT-enabled robotic control and communication systems.

4. Paper Name : Sustainability of Solar-Powered Vehicles Author Name : Jane Smith, Robert Green Description :Examines the environmental benefits of solar-powered electric vehicles in comparison to conventional systems

III. BLOCK DIAGRAM

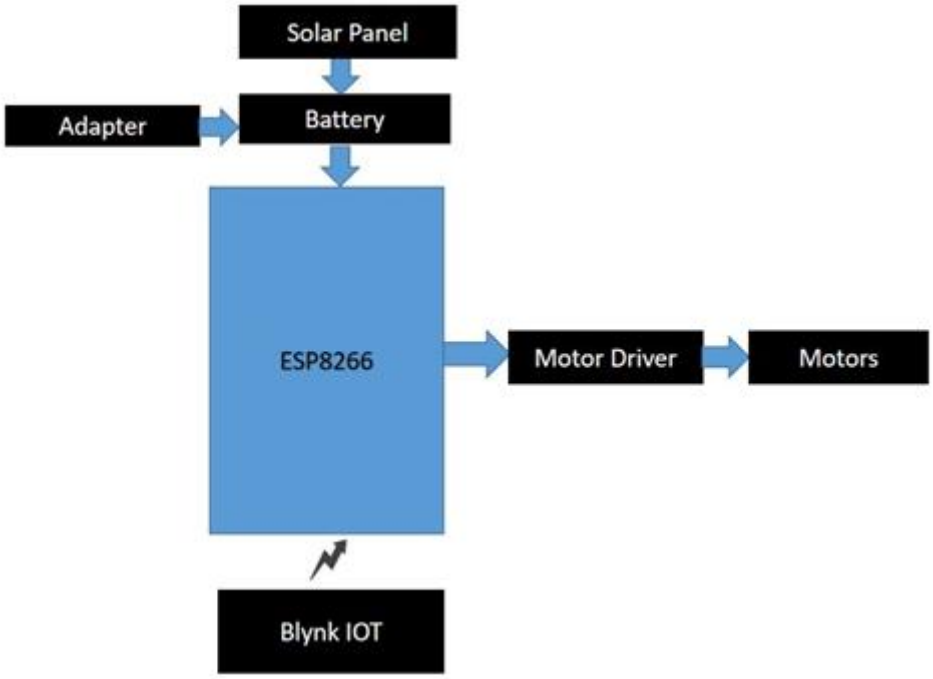

Figure 1: Block Diagram

1. Solar Panel Function: Converts solar energy into electrical energy. Connection: It charges the battery, providing a renewable energy source. Key Point: When sunlight is sufficient, the solar panel ensures the system runs on green energy without needing the adapter.

2. Battery Purpose: Stores the energy collected by the solar panel and powers the ESP8266 and motors. Function: Acts as a buffer to provide continuous power even if solar energy is unavailable (like at night or on cloudy days). Connection: Supplies power to the ESP8266 and other components. Charge Input: Can be charged either through the solar panel or the adapter when solar energy

3. Adapter Purpose: Provides an alternate power source to charge the battery. Scenario: If the solar energy is insufficient or unavailable, the adapter can charge the battery (or directly power the system). Usage: Typically an AC-DC adapter connected to the battery charging circuit, ensuring uninter rupted operation.

4. ESP8266 Microcontroller: Function: Controls the operation of the motors and communicates with the Blynk IoT platform. Key Features: Built-in Wi-Fi module for wireless communication. Handles control signals from the Blynk app, which could include instructions like ”move forward,” ”stop,” or ”change speed.” Blynk IoT Platform: Communicates via Wi-Fi for remote control and monitoring.

5. Motor Driver (e.g., L298N OR L293D) Purpose: Converts low-power control signals from the ESP8266 to higher-power signals needed by the motors. Function: Acts as an interface between the ESP8266 and motors,

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ensuring smooth operation. ESP8266 sends commands to the motor driver (e.g., direction, speed). The motor driver powers the motors according to these commands.

6. Motors: Function: Convert electrical energy into mechanical movement. Examples: DC motors that could be used for: A car that moves in different directions. Actuators for specific mechanical actions.

7. Blynk IoT Platform: Purpose: Enables remote control of the motors and monitoring of the system through a smart phone or web app

IV. COMPONENTS

- **ESP8266**

The ESP8266 is a low-cost Wi-Fi microcontroller widely used in IoT applications. It features built-in Wi-Fi capabilities, allowing for easy connectivity to wireless networks.

- **Solar Panel**

Solar panels consist of photovoltaic (PV) cells that convert sunlight into electrical energy. They are key components in renewable energy systems. Function: The solar panels in the project capture solar energy to power the vehicle and charge the battery. This integration reduces reliance on conventional power sources and minimizes the vehicle's car bon footprint.

- **Lead-Acid Battery**

Lead-acid batteries are widely used for energy storage due to their reliability and cost-effectiveness. They consist of lead dioxide and sponge lead plates submerged in sulfuric acid electrolyte.

In this project, the lead-acid battery stores energy generated by the solar panels and supplies power to the electric motor when needed.

- **L298 Motor Driver**

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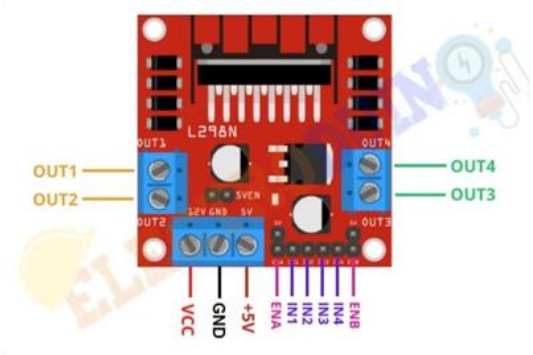
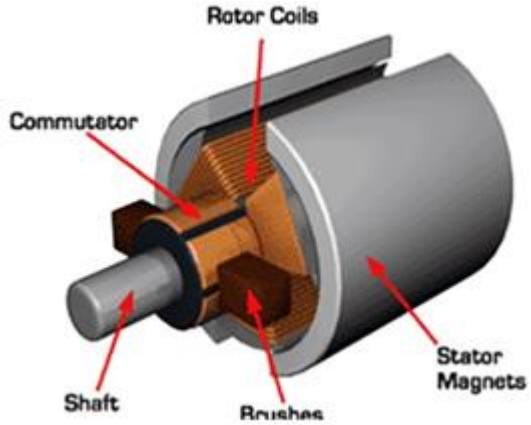


Lead-acid batteries are widely used for energy storage due to their reliability and stepper motors.

It allows the ESP8266 to control the direction and speed of the DC motors by managing the power supplied to them

- **DC Motors:**



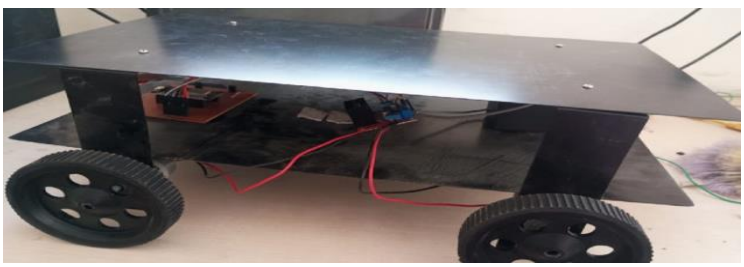
DCmotors convert electrical energy into mechanical energy, providing the propulsion required for vehicle movement. Function: The 12V DC motors drive the wheels of the hybrid vehicle, powered by the lead-acid battery.

Power Rating: Varies by application; typically ranges from 20W to 100W. RPM: Usually between 1000 to 3000 RPM, depending on design. The motor operates at 12 volts of direct current. Speed (No-Load RPM): 60 RPM

- **Blynk IOT Platform:**

Blynk is a popular IoT platform that allows users to build applications for controlling and moni toring IoT devices remotely. The Blynk platform will be used to create a user-friendly interface for real-time monitoring of vehicle performance metrics, battery status, and energy consumption. It enables users to interact with the vehicle remotely

- **Chassis**



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The chassis provides the structural framework for the vehicle, supporting all components and providing stability. Function: It houses the solar panels, battery, motors, and other components while ensuring durability and lightweight design for better performance

- **Wires/Adapter:**

The adapter is a device used to convert one form of electrical power to another, facilitating the connection between different components in the vehicle's electrical system. It is essential for integrating various power sources and ensuring compatibility between components. Power Conversion: It converts the voltage from the lead-acid battery or solar panels to the appropriate levels required by the microcontroller (ESP8266), motor driver (L298), and other electronic components.

V. ALGORITHM

Step 1: Initialization of the system.

Step 2: Continuously monitor battery levels.

Step 3: Checking of solar energy availability.

Step 4: If available then charge through solar energy.

Step 5: If not available charge through adapter.

Step 6: Shutdown the system

VI. CONCLUSION

A solar-powered hybrid electric vehicle is an eco-friendly way of transportation that uses sunlight to power car, reducing fuel use and pollution. The hybrid design ensures it works even without sunlight by using a regular battery.

It's a cost-effective and sustainable solution that can also provide power to other vehicles when needed. This project shows how renewable energy can make transportation cleaner and more efficient for the future **.**

ACKNOWLEDGEMENTS

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