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Solar and Kinetic Energy for E-Vehicle Charging

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ABSTRACT: This project explores the use of regenerative braking systems in electric vehicles to generate both solar and kinetic energy for charging purposes. The regenerative braking system harnesses the energy generated by the braking process and converts it into electricity, which is stored in the vehicle's battery for later use. The addition of solar panels further increases the charging potential by converting sunlight into electrical energy. By combining these two technologies, the project aims to develop an efficient and sustainable method for charging electric vehicles, reducing their environmental impact while increasing their range and reliability.

KEYWORDS: Solar and Kinetic Energy for E-vehicle Charging(SKEEVC), Solar Energy, Kinetic Energy, Regenerative Braking System, Solar Panels, Charging, Electrical Energy.

I.INTRODUCTION

The transportation sector is responsible for a significant portion of global greenhouse gas emissions, making the shift towards electric vehicles (EVs) a critical step towards achieving sustainable transportation. The EVs still face challenges such as limited range and lengthy charging times, which can be a deterrent to potential buyers. In response to these challenges, various technologies are being developed to increase the efficiency and sustainability of EV charging. A technology that shows great promise is the regenerative braking system, which captures the kinetic energy generated during braking and transforms it into electric energy that can be stored in the battery of the vehicle. This system not only reduces the amount of energy wasted during braking but also extends the driving range of EVs. However, the regenerative braking system alone may not be sufficient for meeting the energy demands of EVs, particularly in areas with limited charging infrastructure.

In this regard, solar energy can play a vital role. Solar panels installed on either the roof of electric vehicles or charging stations can harvest the sun's energy and convert it into electrical energy. When combined with regenerative braking, this dual system can maximize the energy generated and significantly reduce the charging time for EVs. Additionally, it can also reduce the reliance on the grid, making EVs more independent and sustainable. The proposed project aims to develop a system that integrates solar energy and regenerative braking technology to charge EVs.

The system will consist of solar panels on the roof of the EVs or charging stations, a regenerative braking system, and a battery storage system. The system will be designed to capture and store energy generated by both solar panels and regenerative braking, allowing for more efficient and sustainable charging of EVs. Overall, this project has

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the potential to improve the performance and sustainability of EVs, making them more attractive to potential buyers and accelerating the transition towards a greener transportation sector.

II. RELATED WORK**[1]. Development of a Solar-Powered Electric Vehicle with a Regenerative Braking System**

Presents the development of a solar-powered electric vehicle that utilizes a regenerative braking system. The system captures the kinetic energy produced when braking and transforms it into electric energy, which is then stored in the battery. The vehicle also includes a solar panel to generate additional energy and extend the driving range.

[2]. A Review on Regenerative Braking Technologies for Electric and Hybrid Electric Vehicles

This discusses various regenerative braking technologies used in electric and hybrid electric vehicles. The authors highlight the importance of regenerative braking in improving the energy efficiency and range of electric vehicles and discuss future research directions in this field.

[3]. Energy Management Strategy of Regenerative Braking and Solar Power for Electric Vehicle Charging Station"

outlines an energy management approach for electric vehicle charging stations that integrates both regenerative braking and solar power.

This study introduces an energy management plan for an electric vehicle charging station that combines the use of regenerative braking and solar power. The proposed charging system includes a battery energy storage system (BESS) that stores and controls the energy produced by regenerative braking and solar power sources.

[4]. Optimization of a Solar-Regenerative Braking Energy System for Electric Vehicle Charging

This Presents an optimization approach for a solar-regenerative braking energy system to improve the efficiency of electric vehicle charging. The study proposes a charging system that integrates a solar panel, regenerative braking system, and battery energy storage system (BESS) to optimize the use of renewable energy sources.

[5]. Solar-Powered Electric Vehicles A Review of Recent Developments

This Describes various aspects of solar-powered electric vehicles, including solar cell technologies, charging infrastructure, and battery technologies. Furthermore, the authors address the difficulties linked with the integration of solar power into electric vehicles, including the restricted surface area accessible for installing solar panels on the vehicle and the irregularity of solar power generation.

III. EXISTING METHOD

Charging electric vehicles was primarily done through fixed charging stations that were connected to the electrical grid. These charging stations typically used AC power, which was converted to DC power to charge the batteries in electric vehicles. Before the implementation of a solar and kinetic energy charging system for e-vehicles, the existing system for charging e-vehicles mainly relied on the electrical grid. This means that e-vehicles would be charged using electricity generated from power plants and distributed through the electrical grid.

IV. PROPOSED SYSTEM

The proposed system aims to utilize both solar and kinetic energy to power electric vehicles through a regenerative braking system. The system will consist of solar panels mounted on the top of the E-Vehicle, which will capture solar energy and store it in a battery bank. Subsequently, the battery bank will be utilized to supply power to the electric vehicle. Apart from relying solely on solar energy, the system will also harness the kinetic energy produced when the vehicle's brake. This will be achieved through the implementation of a regenerative braking system, which will capture the energy produced during braking and transform it into electrical energy. The electrical energy will then be

stored in a battery bank for later use, thus providing an additional source of power for electric vehicles.. The system will also feature a smart charging algorithm that will ensure efficient use of the stored energy. The algorithm will monitor the energy levels in the battery bank and adjust the charging rate accordingly. This will ensure that the charging station operates at maximum efficiency while minimizing energy waste. A smoke sensor is included, whether a battery is exceeded its limit, and if any damage to the battery the smoke sensor will be activated. Overall, the proposed system will provide an eco-friendly and sustainable solution for charging electric vehicles, while also reducing the reliance on fossil fuels.

V. BLOCK DIAGRAM

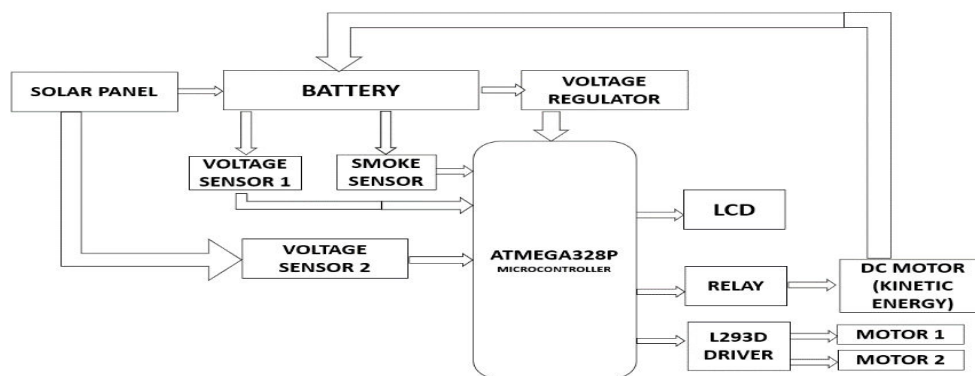


Fig1 Block diagram of SKEEVC Architecture

The system consists of a solar panel, a battery, voltage sensors, a voltage regulator, an ATMEGA328P microcontroller, an LCD, a relay, a DC motor, an L293D driver, and a smoke sensor. The solar panel charges the battery through the voltage regulator while the microcontroller monitors the voltage levels of the battery and the solar panel. The LCD displays the voltage levels, and the smoke sensor detects any potential fire hazards. In the event of a fire hazard, the smoke sensor sends a signal to the microcontroller, which activates the relay to cut off the power supply to the battery. This helps prevent any potential damage or accidents caused by the battery overheating. The L293D driver is linked to the DC motor and controlled by the relay. Additionally, any surplus power from the solar panel is used to operate the car once the battery has reached its maximum charge capacity. The regenerative braking system works by capturing the kinetic energy produced during the vehicle's movement and transforming it into electrical energy, which is then stored in the battery.

VI. EXPERIMENTAL RESULTS

According to the experimental findings, the regenerative braking system was capable of capturing and transforming the kinetic energy produced by the vehicle's movement into electrical energy. This electrical energy was then stored in the battery, which was connected to the solar panel. When the battery was fully charged, the surplus electricity generated by the solar panel was used to charge the battery. The voltage sensors and the ATMEGA328P microcontroller were able to monitor the voltage levels of the battery and the solar panel, ensuring that the battery was not overcharged or undercharged. The LCD display showed the voltage levels of the battery and the solar panel, and the relay was able to control the DC motor. Overall, the system worked efficiently to generate and store energy from both the solar panel and the car's kinetic energy, making it more energy-efficient and environmentally friendly.

PARAMETER	DESCRIPTION
SolarPanel (SV)	2.63v
Regenerative braking (RB)	0.29v
Battery (BV)	12.63v
Smoke Sensor (SL, SH)	100%

Table 1 Experimental Output



Fig 2 Image view of Experimental Output

VII. FUTURE SCOPE

One potential future scope for this project is to incorporate AI technologies for advanced control and optimization of the system. One possible application is the utilization of machine learning algorithms to anticipate the energy requirements of the vehicle and regulate the power supply from the solar panel and battery accordingly. This approach has the potential to enhance the overall efficiency of the system. AI could be used to develop predictive maintenance algorithms for the battery, allowing for early detection of potential problems and reducing the risk of battery failure. This could be particularly useful in extending the lifespan of the battery and reducing the need for frequent replacements. By incorporating AI-powered sensors and algorithms, the car could be capable of navigating and adapting to various road and traffic conditions, optimizing energy usage and reducing the overall carbon footprint of the vehicle.

VIII. CONCLUSION

Solar and kinetic energy are two potential sources of energy that can be used to power e-vehicles. Solar energy can be collected through photovoltaic panels and used to charge the vehicle's battery, while kinetic energy can be captured through regenerative braking systems and converted into electrical energy for storage in the battery. Although each of these energy sources has its own strengths and weaknesses, combining them can lead to a more efficient and sustainable e-vehicle. Utilizing solar panels during the day to charge the battery and regenerative braking systems during braking to capture kinetic energy can make e-vehicles even more environmentally friendly and cost-effective. With the current focus on reducing emissions, the implementation of electric vehicles is becoming increasingly important. Government policies and benefits to manufacturers and users need to be reviewed to enhance the electric vehicle market. The successful hardware implementation of the hybrid system demonstrates encouraging electrical parameters and

potential for future development. With further modifications, the hybrid charging system can be scaled up to achieve a higher range and power rating.

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