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SOLAR-POWERED ROADS WITH PANTOGRAPH SYSTEM FOR ECO-FRIENDLY ELECTRIC TRANSPORT

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ABSTRACT

This research proposes an innovative concept for e-highways that utilize solar power and a pantograph mechanism to charge electric vehicles, with the main aim of reducing carbon emissions and energy consumption in the transportation sector by combining two sustainable technologies. The e-highway infrastructure comprises a solar panel system installed above the roadway to generate electricity, which is transmitted to electric vehicles through a pantograph mechanism. The study evaluates the feasibility, design, and potential advantages of this system, including a decrease in carbon emissions, better energy efficiency, and improved air quality. The findings demonstrate that solar-powered e-highways could significantly contribute to sustainable transportation and urban planning. In conclusion, the paper suggests that utilizing a pantograph mechanism with a solar-powered e-highway system has the potential to revolutionize the transportation industry, making it more environmentally friendly and sustainable.

Keywords: Pantograph,overheadlines,raspberry pico ,l293Dmotor drive.

I.INTRODUCTION

The combination of pantograph-based e-vehicles and a solar-powered base station presents a highly promising solution for sustainable transportation. By drawing power from overhead electric lines, these vehicles can significantly reduce carbon emissions and promote energy efficiency. The addition of a solar-powered base station that generates electricity from renewable sources further enhances the sustainability of this transportation solution. The solar panels convert sunlight into clean and reliable energy, which can be stored in batteries, promoting energy security and saving costs in the long term. Additionally, this technology can create jobs and stimulate economic growth in the clean energy sector. However, significant investment in infrastructure is necessary, including overhead electric lines, charging stations, and solar-powered base stations. Development of compatible vehicles that can effectively utilize the pantograph mechanism is also crucial. Maintenance costs and visual impact concerns for the overhead lines must be addressed as well. To fully realize the potential benefits of pantograph-based e-vehicles and a solar-powered base station, continued research and development are required to overcome these challenges.

II. LITERATURE SURVEY

Soham Bhadra propose a solar power hybrid electric vehicle charging station that utilizes a solar base station, combining both solar power and grid power simultaneously. This station allows for direct charging of EVs when solar energy is available, and if not, it switches to taking power supply from the grid [1].

Kamal Singh proposed a cost-effective and efficient solar photovoltaic (PV) battery charging system for light electric vehicles such as e-bikes and scooters. He developed a SEPIC system to optimize the PV array power while regulating the output voltage at the battery terminal, making it suitable for off-board charging [2].

Nan Liu proposed a pantograph-catenary dynamics model based on the CED 160D pantograph and a simple chain contact catenary using ADAMS software. The model considers the operational state of the train as the excitation load and extracts important current-receiving parameters, including contact force between the pantograph and catenary, dynamic dispatch, hard spots, and off-line rate. [3].

Tsung-Chih Lin proposed study investigates the uncertain dynamic active pantograph-catenary system and takes into account the impact of time-varying stiffness caused by uneven overhead wires to enhance current collection for light rail vehicles. The study combines a sliding mode control strategy with an adaptive fuzzy sliding mode control scheme [4].

Andrea Mariscotti research focuses on pantograph electric arcs in DC electrified railways, which not only create disturbances but also cause direct and indirect power losses due to the step change in the pantograph voltage. When the train is in traction condition, the available line voltage is reduced, and the arc itself is characterized by ohmic power losses, while the triggered oscillating transient response results in a net power loss. The study presents a model and analysis of these phenomena and provides experimental results for arcs measured on a 3KV DC line during traction and braking conditions [5].

III THE PROPOSED METHODOLOGY

The primary aim of this project is to create a transportation solution that is both cost-effective and sustainable, utilizing pantograph-based e-vehicles. The project involves the installation of a solar panel at the base station to store solar energy in a battery, which is then transferred to the overhead lines. This combination of solar power and pantograph-based charging mechanisms allows the e-vehicle to operate on renewable energy sources, significantly reducing reliance on fossil fuels and lowering carbon emissions. To achieve this, a pantograph arm is attached to the top of the e-vehicle, allowing it to draw electricity from the lines and store it in the battery while in motion. The pantograph mechanism enables continuous charging, allowing e-vehicles to operate for longer periods without requiring extended charging stops.This is shown in fig-1.

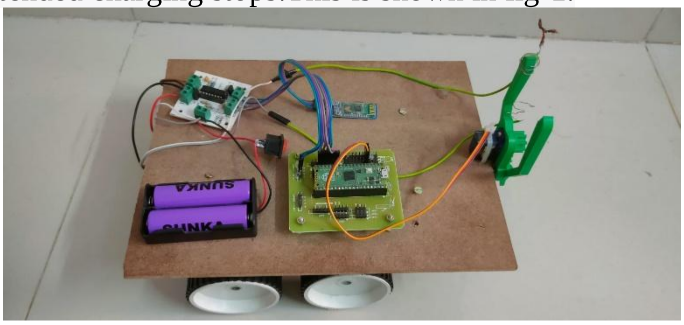

Fig.1.Prototype of the Project

A. FLOW CHART

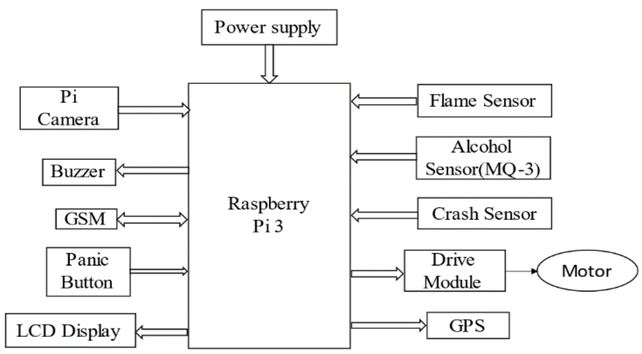

Fig. 2.. Architectural view of solar powered ev-vehicle charging

IV OBSERVATIONS AND RESULTS

The primary objective of this project is to design a solar-powered charging station that can supply energy to the overhead lines, enabling uninterrupted transportation without the need for frequent battery charging stops. The pantograph system facilitates charging while the vehicle is in motion, creating a dynamic type of transportation. Once the battery is fully charged, the vehicle can rely entirely on battery power.

Fig.3. pantograph based e-vehicle with solar power

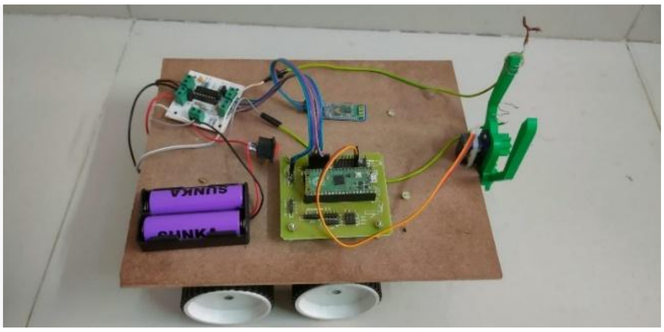

Fig. 4. Pantograph vehicle

V. CONCLUSION

In conclusion, the utilization of solar-powered e-highways featuring pantograph mechanisms for e-vehicles is an extremely promising solution to address the challenges associated with reducing carbon emissions and promoting sustainable transportation. This innovative system leverages renewable energy sources and advanced technologies to effectively reduce greenhouse gas emissions and increase the efficiency of e-vehicle operations. Moreover, this solution has the potential to minimize our reliance on non-renewable resources and promote energy security, ultimately leading to a more sustainable and resilient transportation infrastructure. By revolutionizing the way we transport goods and people, solar-powered e-highways with pantograph mechanisms represent a significant step forward in achieving a cleaner, greener, and more sustainable future.

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