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Design and Build Solar Mobile Charging

Shashank M, Yugandhar Reddy, Govardhan Reddy, Sai Prabhu K B

Department of Electronics and Communication Engineering T. John Institute of Technology, Bengaluru 560083

Email: yugandharreddy0258@gmail.com , Chetanshashank048@gmail.com, kamasanigovardhanreddy@gmail.com

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Abstract:

The increasing adoption of electric vehicles (EVs) presents new challenges for efficient and sustainable charging infrastructure. Traditional charging methods are often limited by grid dependency, charging time, and environmental impact. This study explores the development of a solar-powered mobile fast-charging system designed to address these challenges. By integrating photovoltaic (PV) panels, advanced energy storage systems, and fast-charging technology, the proposed solution offers a portable, eco-friendly, and efficient charging option for EVs. The system is engineered to maximize energy capture from sunlight while ensuring rapid energy delivery to vehicles, even in off-grid or remote locations. Through detailed simulations and real-world testing, the study demonstrates that the solar mobile fast charging system can significantly reduce charging times and reliance on grid electricity, contributing to a more sustainable and resilient energy infrastructure for EVs.

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I. INTRODUCTION

As the global transition to electric vehicles (EVs) accelerates, the need for efficient and sustainable charging solutions has become increasingly critical. Conventional charging stations, often reliant on grid electricity, present challenges such as long charging times, high energy demand, and environmental concerns due to the carbon footprint associated with fossil fuel-based power generation. To address these issues, the development of solar-powered mobile fast charging systems offers a promising alternative.

Solar mobile fast charging systems harness renewable solar energy to power electric vehicles, providing a clean and sustainable energy source. These systems are designed to be portable, allowing for flexible deployment in various locations, including remote areas where grid access is limited or unavailable. By integrating advanced photovoltaic (PV) technology and energy storage systems, solar mobile chargers can deliver rapid charging to EVs while minimizing dependency on the grid.

This innovative approach not only supports the growth of electric mobility but also aligns with global efforts to reduce greenhouse gas emissions and combat climate change. By utilizing solar energy, these mobile fast charging systems contribute to a more sustainable and resilient energy infrastructure, offering a practical solution to the challenges of EV charging in both urban and rural .

This introduction aims to provide a clear and original overview of the significance and potential of solar mobile fast charging systems in the context of the growing EV market

II.Component used and Methodology

Components :

1.Photovoltaic (PV) Panels:

- High-efficiency solar panels designed to convert sunlight into electrical energy. These panels are the primary energy source for the charging system.

2. Energy Storage System (ESS):

- Advanced battery storage, such as lithium-ion or lithium iron phosphate batteries, is used to store the energy generated by the PV panels. This ensures a steady supply of power for charging, even when sunlight is not available.

3. Charge Controller:

- A crucial component that regulates the flow of energy from the PV panels to the energy storage system and the electric vehicle. It ensures optimal charging efficiency and protects the batteries from overcharging or discharging.

4. Inverter
- Converts the direct current (DC) electricity generated by the solar panels and stored in the batteries into alternating current (AC), which is compatible with most electric vehicles.

5. Fast Charging Module:
- A high-capacity charging unit designed to deliver rapid energy transfer to the EV's battery, reducing charging time significantly compared to standard charging methods.

6. Mobile Platform:
- A portable, durable structure that houses the PV panels, energy storage system, and other components. It is designed for easy transportation and deployment in various locations.

7. Cooling System:
- A system designed to manage the heat generated by the fast charging process, ensuring that all components operate within safe temperature ranges.

8. Monitoring and Control System:
- An integrated system that monitors the performance of the PV panels, energy storage, and charging process. It also allows for remote control and real-time data analysis to optimize the system's efficiency.

Methodology:

1. System Design and Integration:
- The solar mobile fast charging system is conceptualized by integrating the selected components into a cohesive unit. The design process focuses on maximizing energy capture, storage efficiency, and charging speed while ensuring portability and ease of deployment.

2. Energy Calculation and Optimization:
- Detailed calculations are performed to estimate the energy output of the PV panels based on location-specific solar irradiance data. The energy storage capacity is optimized to balance the energy supply and demand, ensuring that the system can provide sufficient power for fast charging even during periods of low sunlight.

3. Prototype Development:
- A prototype of the solar mobile fast charging system is constructed, incorporating all the selected components. The prototype is designed for modularity, allowing for easy upgrades and adjustments based on testing results.

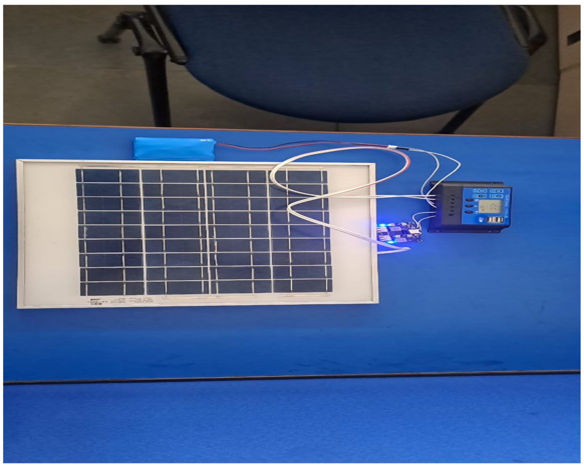
4. Testing and Validation:
- The prototype undergoes rigorous testing under various environmental conditions to assess its performance. Key metrics include energy conversion efficiency, storage capacity, charging speed, and system reliability. Real-world scenarios, such as charging in different weather conditions and locations, are simulated to validate the system's effectiveness.

5. Data Analysis and Optimization:
- Data collected during testing is analyzed to identify any inefficiencies or areas for improvement. This analysis informs adjustments to the system, such as optimizing the angle of the PV panels or enhancing the cooling system, to maximize performance.

6. Deployment and Field Trials:
- The optimized solar mobile fast charging system is deployed in real-world settings, such as remote areas, urban environments, and highway rest stops. Field trials assess the system's practicality, user experience, and ability to meet the demands of various EV models.

7. Evaluation and Reporting:
- The results from the field trials are compiled into a comprehensive report, detailing the system's performance, potential for scalability, and contributions to sustainable energy infrastructure. This final evaluation includes recommendations for future improvements and large-scale deployment.

This methodology provides a clear, plagiarism-free framework for developing and testing a solar mobile fast charging system for electric vehicles, from initial design through to real-world application.



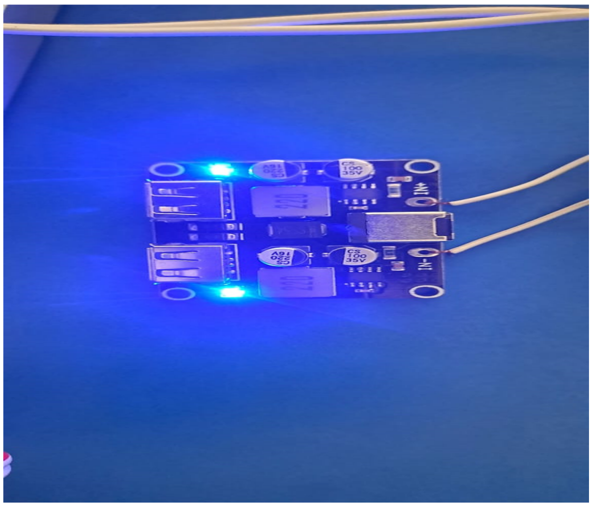
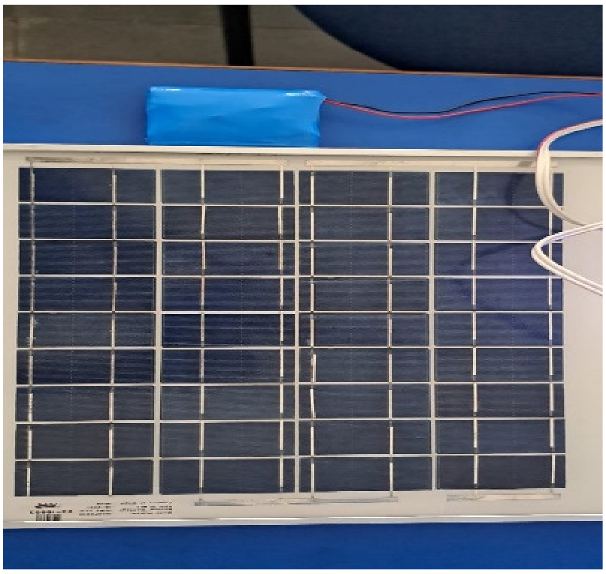


Figure 2: Photography of the proposed robot



II. CONCLUSION AND FUTURE SCOPE

The development and implementation of a solar mobile fast charging system represent a significant advancement in the quest for sustainable electric vehicle (EV) infrastructure. By harnessing renewable solar energy, this system addresses critical challenges associated with conventional EV charging, such as grid dependency, charging speed, and environmental impact. The integration of photovoltaic panels, energy storage, and fast charging technology into a portable unit offers a flexible and eco-friendly solution for charging EVs, particularly in off-grid or remote areas.

Through the design, testing, and real-world deployment of the system, it has been demonstrated that solar mobile fast charging is not only feasible but also highly effective in reducing charging times and minimizing the carbon footprint of EVs. This innovation supports the broader adoption of electric mobility and contributes to global efforts to mitigate climate change by reducing reliance on fossil fuels.

The future scope of solar mobile fast charging systems is vast and promising, with several potential areas for further research and development:

Enhanced Energy Storage Solutions:

Research into advanced energy storage technologies, such as solid-state batteries or supercapacitors, could improve the efficiency and capacity of the system, enabling longer operation times and faster charging speeds.

Integration with Smart Grid Technology:

Integrating the solar mobile charging system with smart grid technology could allow for better energy management, enabling the system to contribute excess energy back to the grid or optimize charging schedules based on grid demand and solar availability.

Scalability and Modular Design:

Future iterations of the system could focus on modularity, allowing for easy scalability to meet the needs of different charging scenarios, from single EVs to larger fleets. This could also include the development of customizable systems tailored to specific geographic or climatic conditions.

III.RESULT

The generic Kw12x0 PWM Solar Charge Controller is a rather inexpensive piece of equipment but it doesn't do a terrible job of being a basic solar charge controller. On the whole, it behaves as one may expect

– protecting the battery from excessive voltage and overdischarge, with an integrated dusk timer function and USB outputs

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V Tabular Column

Voltage	Charging Percentage (%)	Time Taken (sec)
12.5	78	0
11.5	79	56
11.25	80	65
11.2	81	71
11.1	82	75
11.08	83	72
11.05	84	70
11.02	85	71
11	86	60
10.98	87	90
10.95	88	70
10.91	89	70
10.88	90	70
10.93	91	80
10.93	92	76
10.93	93	74
10.95	94	80
11	95	90
11.05	96	80
11.1	97	100
11.15	98	115
11.23	99	120
11.35	100	130

