



Sustainable Developments of Smart Car



Abdulraoof M., Nabaa D., Husaam J., Alfarouk G.

Supervised by

Dr. Ahmed Suhail and Dr. Ibtisam Yahya Abdullah

College of Science, Mosul university, Iraq



Abstract: In the face of increasing environmental challenges and rising carbon emissions, the need for sustainable transportation solutions is becoming more urgent. Solar-powered electric vehicles represent a leading innovation aimed at reshaping the transportation landscape. These vehicles utilize advanced technology to convert solar energy into electricity, reducing the reliance on fossil fuels and contributing to environmental protection. This study focuses on the design of a solar-powered electric vehicle utilizing an Arduino MEGA2560 microcontroller, ultrasonic sensors for collision avoidance, and Bluetooth modules for wireless control. The vehicle is powered by rechargeable batteries, which are charged through solar cells. A charge controller regulates the charging process, enhancing efficiency and battery life. The results of the project demonstrate that solar-powered vehicles can be both practical and efficient for daily use in areas with ample sunlight. Despite challenges such as high manufacturing costs and solar cell efficiency, the project is an important step toward developing sustainable transportation solutions that reduce emissions and improve air quality.

Background

The need for sustainable transportation solutions is increasing due to growing environmental challenges and rising carbon emissions. In this context, solar-powered electric vehicles stand out as one of the leading innovations seeking to reshape the transportation landscape. These vehicles rely on advanced technology to convert solar energy into electricity, reducing reliance on fossil fuels and contributing to environmental protection. Research indicates that using solar energy in electric vehicles not only helps reduce operational costs but also provides a long-term sustainable solution. Studies have shown that solar cars have lower maintenance costs compared to traditional vehicles, making them an attractive option for consumers.

This project aims to design and build a small electric car that relies on solar panels as the primary power source for charging, along with a traditional Type-C charger, which enhances flexibility and efficiency of use. The project represents a practical application that highlights the integration between smart control systems and renewable energy.

Research Motivations

Solar-powered electric vehicles are a promising option for sustainable transportation, but they face several challenges that hinder their widespread adoption and use. Among these challenges are:

- ❑ Solar cell efficiency: Despite advances in solar cell technology, their efficiency in converting solar energy into electricity remains limited.
- ❑ High manufacturing costs: The manufacturing costs of solar-powered vehicles present a significant obstacle.
- ❑ Charging infrastructure: Existing infrastructure for charging electric vehicles is still inadequate.
- ❑ Climate and environment: The effectiveness of solar-powered vehicles depends greatly on weather conditions.
- ❑ Public awareness and acceptance: There is still a lack of public awareness regarding solar-powered vehicles.

Methodology

In this project, the Arduino MEGA2560 is the main controller, connected to an HC-SR04 sensor to avoid collisions and a remote-controlled Bluetooth module. The vehicle is powered by electric motors controlled through the L298N motor driver, which regulates speed and direction. The system is powered by lithium batteries, which are charged using solar panels. The TP4056 module manages the charging process to protect the batteries from overcharging. Figure 1 shows the device connection diagram, and Figure 2 displays the vehicle model, illustrating the layout of the components. The vehicle is equipped with an On/Off switch for easy system control.

Results

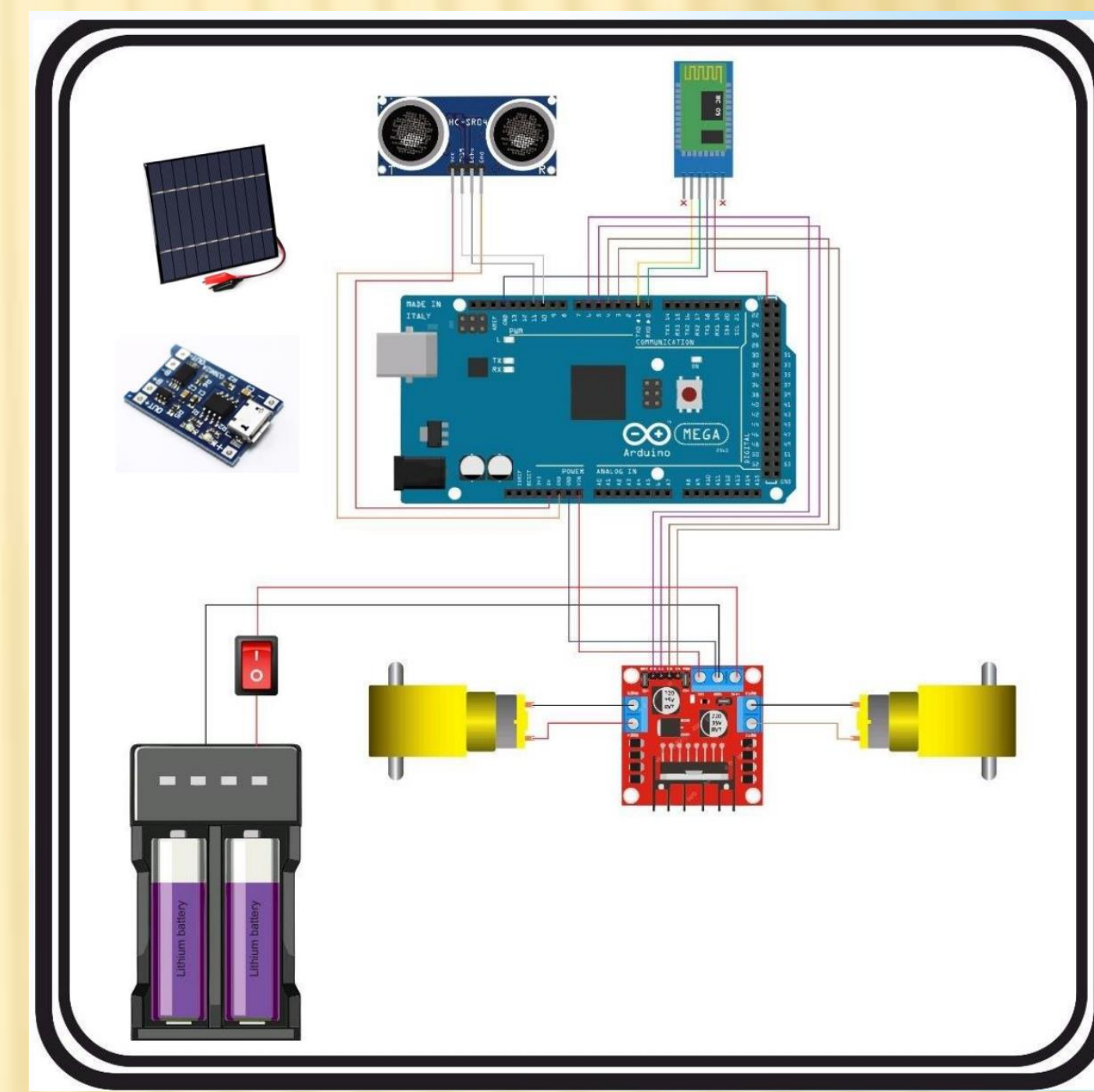


Figure 1. Components of smart car system



Figure 2. View of vehicle model

Discussion

- 1- A new design system was introduced.
- 2- The Sustainable Development Goal of Affordable and Clean Energy (SDG 7) is achieved in this work.
- 3- The smart car is powered by solar cells.
- 4- This car is useful within army applications.

Acknowledgments

This work was supported by the College of Science and Teesside University in collaboration with the British council.

References

- 1-R. B. S. Rao, D. Pandey, B. Pandit, S. R. B. B, and Y. Yesodharan, "Solar Car 2018 IJLERA – All Right Reserved," no. May, pp. 3–9, 2018.
- 2- A. Arulious Jora, D. Earlina, D. Harish, P. Sakthi Priya, A. Inba Remy, and J. S. Nancy Mary, "Design of solar powered electric vehicle," J. Phys. Conf. Ser., vol. 2070, no. 1, 2021, doi: 10.1088/1742-6596/2070/1/012105.
- 3- Y. Fang, S. M. , Wei Wei, Feng Liu, L. Chen, and J. Li, "Improving solar power usage with electric vehicles: Analyzing a public-private partnership cooperation scheme based on evolutionary game theory," J. Clean. Prod., vol. 233, p. Pages 1284-1297,