DESIGN AND DEVELOPMENT OF COST-EFFECTIVE SOLAR POWERED ELECTRIC BIKE.

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Keywords:

Solar Energy, Electric Bike, Renewable Energy, Electric Motor, Sustainable Transportation, Cost-Effective Design.

Introduction:

Transportation plays an important role in everyday life. Most of the vehicles used today depend on fossil fuels such as petrol and diesel. The continuous use of these fuels leads to problems like air pollution, increased fuel costs, and depletion of natural resources. Therefore, there is a need to develop alternative transportation systems that are economical and environmentally friendly. Solar energy is one of the most abundant and renewable sources of energy available. It can be used to generate electricity without causing pollution. By using solar energy in transportation, it is possible to reduce the dependence on fossil fuels and promote clean energy.

The design and development of a cost-effective solar powered electric bike. The system uses solar panels to convert sunlight into electrical energy, which is stored in a rechargeable battery. The Solar power Electric Bike is an eco-friendly vehicle powered by both a battery and solar energy. Traditional petrol vehicle contributes to air pollution, high fuel costs, and dependence on fossil fuels. It is designed to provide accurate-speed performance while reducing reliance on fossil fuels. By integrating solar panels on the scooter or using solar charging stations, the vehicle can extend its range and reduce electricity costs. This design enables the bike to charge for free when parked in the sun, reducing dependence on traditional charging stations. The maximum speed of the bike is 20km-25km. The charging time for the battery using electricity is 2-3 hours and using solar energy the battery takes 12-14 hours to charge.

Objectives:

1. To design and development of solar powered electric bike.
2. To provide a cost-effective solution for daily commuting.
3. To reduce daily travel cost for users through renewable, self-charging power.
4. To build a lightweight and practical bike suitable for short-distance urban and rural travel.
5. To create an electric bicycle that provides a sustainable and eco-friendly mode of transportation.

Methodology:

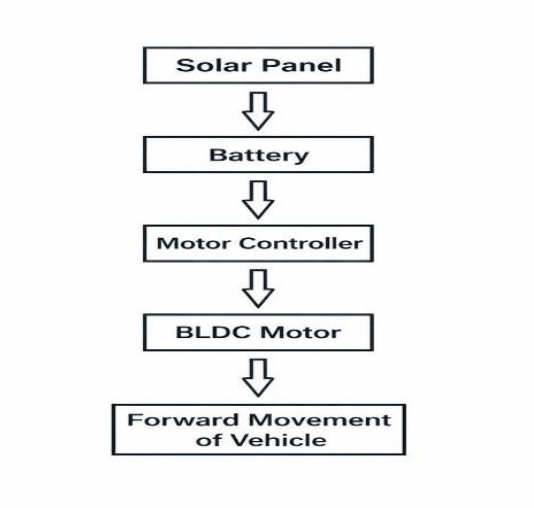

Fig.1.: Methodology

The solar panel converts sunlight into electrical energy and charges the battery. The stored energy from the battery is supplied to the motor controller, which regulates and controls the power according to the required speed. The motor controller then drives the BLDC motor, converting electrical energy into mechanical motion, resulting in the vehicle moving forward.

Component Required:

- BLDC Motor (24V)
- Battery (12V, 8Ah)
- Solar Panel (20W)
- Motor Controller (24V,250W)
- Throttle & Brake System
- Frame & Chassis
- Tyres(2)
- Light and key set

Circuit Diagram:

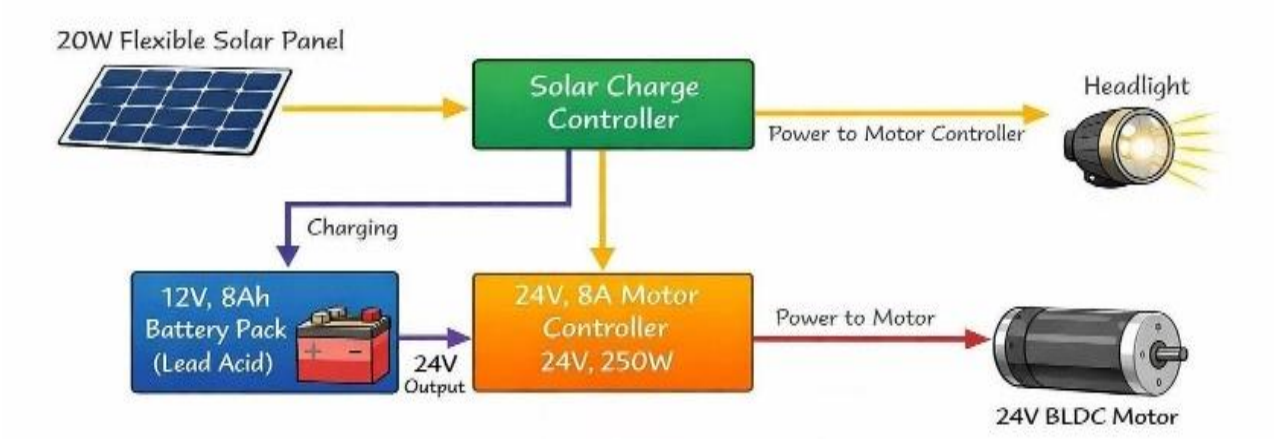

Fig.2: Circuit Diagram

The solar panel converts sunlight into electrical energy and charges the battery. The battery stores this energy and supplies power to the system. A fuse or circuit breaker is used to protect the circuit from overload. The power switch is used to turn the system ON or OFF. The speed controller regulates the power supplied to the motor and the throttle controls the speed of the bike. The motor converts electrical energy into mechanical energy, which helps the vehicle move forward.

Result and Conclusion:

A fully working of a low-cost solar-powered electric bike that can run using both battery and solar energy. Reduced dependency on grid electricity, as the bike charges itself through the mounted solar panel. Lower daily travel cost, making the bike affordable for students, workers, and rural users. Environment-friendly transportation that reduces carbon emissions**.** The motor provided sufficient torque to move the bike at a safe and stable speed. Speed control was achieved using the motor controller, allowing smooth acceleration and deceleration. The mechanical structure and frame were strong enough to support the rider's wight and ensure stability during movement.

The solar panel was able to charge the battery when exposed to sunlight, reducing dependency on external electrical charging. This proves that the system can support renewable energy usage and improve overall energy efficiency. The battery provided adequate backup power, allowing the bike to operate even when solar energy was not available. During testing, the bike showed low noise, zero exhaust emission, and reduced running cost, making it eco-friendly and suitable for short-distance transportation. The project result confirms that the proposed system is technically feasible, economical, and environmentally friendly.

Conclusion:

The design focuses on simplicity, safety, and practicality, making the system easy to understand, assemble, and maintain. This solar powered electric bike reduces dependency on fossil fuels and minimizes air and noise pollution, thereby supporting sustainable transportation. The use of renewable solar energy helps in lowering running costs and makes the bike suitable for daily short-distance travel, especially in urban and rural areas. Overall, the project demonstrates the practical application of renewable energy technology and provides a strong foundation for future improvements such as higher efficiency panels, better energy storage, and smart control systems.

Project Outcome and Industry Relevance

Project Outcome:

The project on design and development of a cost-effective solar powered electric bike results in an eco-friendly and affordable transportation solution. The system successfully integrates solar panels, battery storage, and an electric motor to run the bike efficiently. It reduces dependency on fossil fuels and lowers running costs for users. The prototype demonstrates energy efficiency by converting solar energy into usable electrical power. It is suitable for short-distance travel, especially in rural and urban areas. The project also improves knowledge in renewable energy systems, battery management, and motor control. The design focuses on low cost, making it accessible for common people. It promotes

sustainable mobility and reduces carbon emissions. Overall, the project proves that solar-powered transportation is practical and beneficial.

Industry Relevance:

This project is highly relevant to the growing electric vehicle and renewable energy industry. With increasing fuel prices and environmental concerns, industries are shifting towards clean energy solutions. The solar powered electric bike supports government initiatives like green mobility and sustainable development. It has applications in delivery services, campus transport, and rural mobility. Many companies are investing in electric vehicles, and this project aligns with current industry trends. It also opens opportunities for startups in solar mobility solutions. The design can be further improved and commercialized at a large scale. It contributes to reducing pollution and supports the future of smart transportation systems.

Learnings:

This project helped us understand the basics of solar energy and electric vehicles. We learned how to integrate components such as solar panels, batteries, and motors into a working system. It improved our practical skills in circuit design and system assembly. We also gained knowledge about energy efficiency and cost-effective design methods. Overall, the project enhanced our problem-solving ability and teamwork skills.

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Future Scope:

1. In the future, our project can be improved in many ways. A solar panel can be added to charge the battery automatically, which will reduce electricity consumption and make the system eco-friendlier. The existing battery can be replaced with a lithium-ion battery to reduce weight and increase running time.
2. User interaction and monitoring can be improved by adding an information display system. This unit can provide real-time feedback on important parameters like power status, speed, and distance covered, making the system more practical and user-friendly for daily transportation.

3. To improve vehicle control and rider comfort, a more efficient motor control system can be implemented. Features such as precise speed regulation and energy recovery during braking can significantly increase energy utilization and extend battery life.
4. The project can be further enhanced by integrating smart technologies such as IoT and mobile app connectivity. This will allow users to monitor battery status, track location, and control certain functions remotely, making the system more advanced and convenient to use.