DESIGN AND IMPLEMENTAION OF SELF CHARGING E - BICYCLE

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Introduction:

With the growing demand for sustainable and eco-friendly transportation, electric bicycles (e-bikes) have emerged as a promising alternative to conventional vehicles. However, one of the major limitations of traditional e-bikes is their dependence on external charging sources, which can be inconvenient and less efficient in remote or long-distance travel scenarios. This project focuses on the design and implementation of a self-charging electric bicycle that integrates regenerative braking and onboard energy harvesting systems to recharge the battery during operation. By converting mechanical energy generated during pedaling and braking into electrical energy for charging the battery and converting electrical energy into mechanical energy for discharging the energy to run the cycle, the system enhances the overall energy efficiency and range of the e-bike. The goal is to create a more autonomous, user-friendly, and sustainable mode of transportation that reduces reliance on the grid while promoting green mobility solutions.

Objectives:

➢ The primary objective of this flowchart is to depict the working principle of a regenerative braking system in a bicycle.

➢ The regenerative braking system in a bicycle aims to improve energy efficiency, increase range, and promote environmental sustainability by capturing and utilizing the kinetic energy generated during braking.

➢ This system aims to capture the kinetic energy of the bicycle during braking and store it as electrical energy, which can then be used to assist in pedaling or for other purposes.

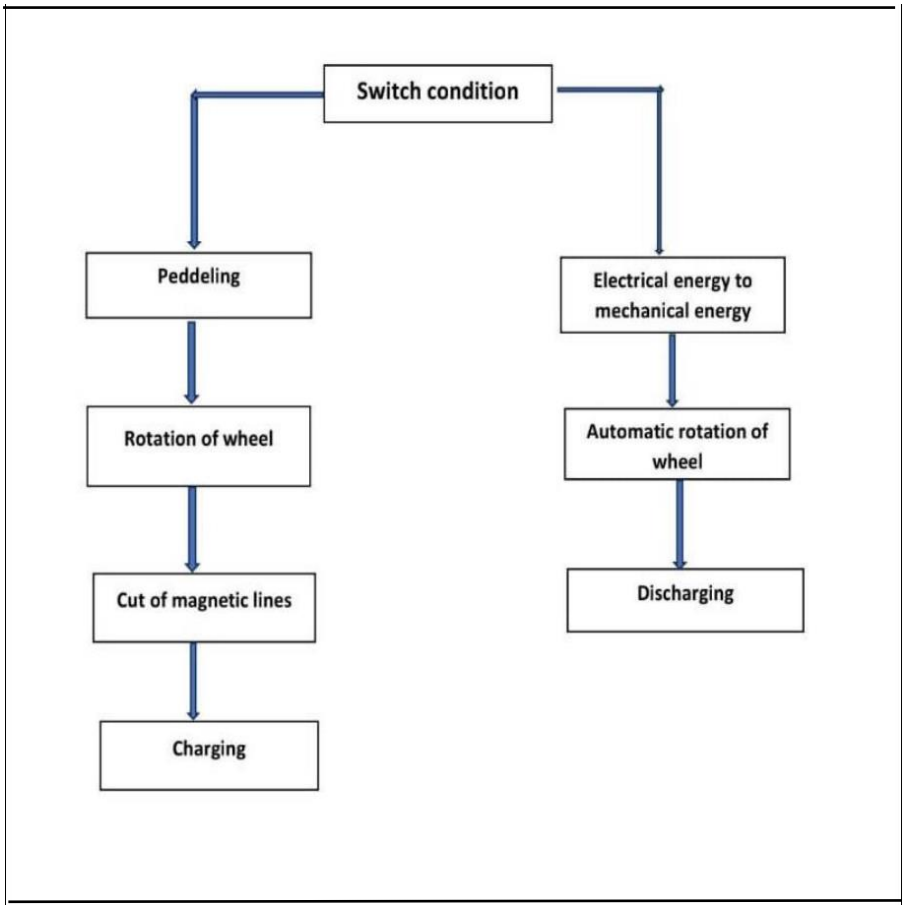
Methodology:

Switch Condition:

- Pedaling: When the cyclist pedals, the wheel rotates.
- Rotation of Wheel: This rotation cuts through magnetic lines, generating electricity.
- Charging: The generated electricity is stored in a battery, charging it.

Switch Condition:

- Electrical Energy to Mechanical Energy: When the cyclist wants to brake the stored electrical energy is converted back into mechanical energy.
- Automatic Rotation of Wheel: This mechanical energy causes the wheel to rotate, slowing down the bicycle.
- Discharging: The battery discharges as its stored energy is used for braking.
- In essence, the system captures the kinetic energy of the bicycle during braking and stores it as electrical energy, which can then be used to assist in pedaling or for other purposes.



Working Model:

- The e-bicycle uses a DC motor powered by a rechargeable battery to provide motion.
- While riding, especially during downhill motion or braking, the hub motor or dynamo switches to generator mode, converting kinetic energy back to electrical energy.
- This energy is routed through a rectifier and voltage regulator and stored in the battery.
- Optionally, pedal-powered dynamo or solar panels can be used to supplement battery charging.

Result and Conclusion:

Result:

- Charging efficiency
- Distance covered per charge
- Energy recovered via pedaling
- Battery life improvements

Conclusion:

- Self-charging e-bike is a viable and eco-friendly solution
- Effective in reducing dependency on external power
- Offers good scope for future enhancements

Future Scope:

- Integration of Solar Panels
  – Adding compact and flexible solar panels for continuous charging during daylight.

- Advanced Battery Technology

  – Use of higher-capacity and faster-charging batteries like solid-state batteries for improved range and efficiency.
- IoT - Based Monitoring System

  – Real-time tracking of battery health, charging status, and ride data through a mobile app or cloud system.
- AI-Powered Energy Management

  – Implementation of AI algorithms to optimize power distribution and regenerative braking efficiency based on riding patterns.
- Wireless Charging Capabilities

  – Development of inductive charging stations for hassle-free energy top-ups.
- Lightweight & Aerodynamic Design

  – Use of advanced materials like carbon fiber or graphene composites to reduce weight and improve performance.
- Integration with Smart City Infrastructure

  – Syncing the e-bike with traffic management systems, public transport, and digital maps for efficient urban commuting.
- Expansion into Delivery & Logistics

  – Adaptation of the self-charging e-bike for courier and last-mile delivery services to reduce operational costs and emissions.
- Scalability for Bike-Sharing Systems

  – Deployment in shared mobility platforms for public transportation in cities and campuses.
- Enhanced Safety Features

  – Incorporating smart helmets, anti-theft systems, automatic lighting, and collision detection for safer riding.