

Design and Development of a Battery-Operated Tricycle

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ABSTRACT

The rapid growth of urbanization has resulted in increased traffic congestion, environmental pollution, and excessive dependence on fossil fuels. Electric mobility has emerged as a promising solution to these challenges. This research paper presents the design, development, and performance analysis of a battery-operated tricycle intended for sustainable urban transportation. The project focuses on system design, battery technology, motor selection, mechanical structure, and cost effectiveness. The developed prototype demonstrates reduced emissions, low operating cost, and suitability for short distance urban travel, last mile connectivity, and mobility assistance.

Keywords:- Battery operated tricycle, electric vehicle, urban mobility, DC motor, sustainable transportation

1. INTRODUCTION

Urban transportation systems are under increasing pressure due to population growth, fuel scarcity, and environmental degradation. Conventional vehicles powered by internal combustion engines contribute significantly to air pollution and greenhouse gas emissions. As a result, electric vehicles have gained importance as clean and efficient alternatives.

Battery operated tricycles offer a simple, stable, and economical solution for urban commuting. Their three-wheel configuration ensures better balance and accessibility, making them suitable for elderly users, physically challenged individuals, and goods transportation. This paper discusses the systematic development of a battery-operated tricycle with emphasis on design methodology, component selection, and operational performance.

2. SYSTEM OVERVIEW

The battery-operated tricycle consists of a battery pack, DC motor, controller, drive train, frame, wheels, and control switches. Electrical energy stored in the battery is converted into mechanical energy by the motor and transmitted to the wheels using a chain sprocket mechanism.



Fig 1: Block Diagram of Battery-Operated Tricycle

3. BATTERY SYSTEM

The battery is a critical component of the tricycle as it determines range, speed, and overall performance. In this project, a rechargeable battery system is used.

3.1 Battery Specifications

- Battery Type: Lead Acid (VRLA) / Lithium ion (as applicable)
- Voltage: 12 V
- Capacity: 7 Ah

- Charging Time: 4–5 hours
 - Weight: Approximately 2.5 kg
- Lithium ion batteries are preferred due to their high energy density, longer life cycle, and fast charging capability. The battery converts chemical energy into electrical energy through electrochemical reactions and supplies power to the DC motor.



4. WORKING PRINCIPLE

When the battery is fully charged, electrical energy is supplied to the motor through an ON–OFF control switch. The DC motor converts electrical energy into mechanical energy. The rotational motion of the motor shaft is transmitted to the rear wheel using a chain and sprocket mechanism, resulting in forward movement of the tricycle.

The speed and direction of rotation can be controlled using electrical switches. The system is designed to provide smooth operation with adequate torque for carrying load.

5. MECHANICAL DESIGN

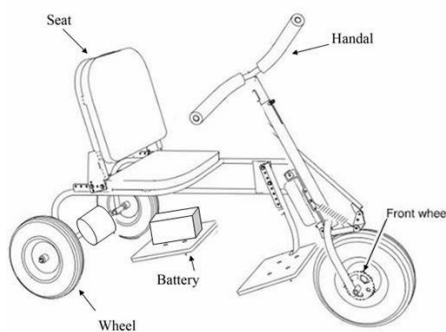
The mechanical design of the tricycle focuses on strength, stability, and user comfort.

5.1 Frame Design

The frame is fabricated using mild steel due to its high strength, durability, and low cost. The frame supports the battery, motor, rider load, and accessories.

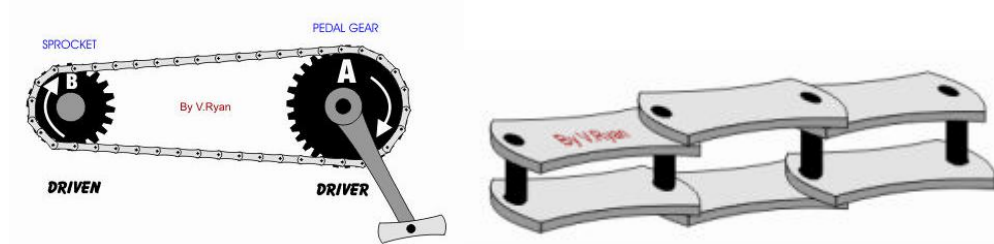
5.2 Wheel and Suspension

A three wheel configuration improves balance and safety. Proper wheel size and tire selection ensure good traction and ride comfort.



5.3 Drive train

A chain sprocket drive is used for power transmission due to its simplicity, efficiency, and ease of maintenance.



6. MOTOR SPECIFICATION

A DC wiper motor is used in the tricycle due to its high torque and reliability.

Motor Features:

- Operating Voltage: 12 V / 24 V
- Torque Capacity: 15 kg-cm
- Speed: Two speed operation
- Permanent magnet DC motor
- Low maintenance and compact size

The motor provides sufficient torque to move the tricycle under load conditions while maintaining energy efficiency.



7. FABRICATION AND WELDING

Arc welding is used for joining the frame components. The major machines used during fabrication include:

- Arc welding machine
- Drilling machine
- Grinder
- Lathe machine

Proper welding ensures structural integrity and durability of the tricycle.

8. ADVANTAGES AND DISADVANTAGES

Advantages

- Zero tailpipe emissions
- Low operating and maintenance cost
- Quiet operation
- Easy handling and stability
- Suitable for elderly and physically challenged users

Disadvantages

- Limited driving range
- Longer charging time
- Dependence on charging infrastructure
- Battery replacement cost

9. COST ESTIMATION

The total cost of the prototype is approximately ₹25,000, including frame fabrication, motor, battery, wheels, transmission system, and miscellaneous expenses. Mass production can significantly reduce the overall cost.

10. APPLICATIONS

- Urban and short distance transportation
- Passenger mobility services

- Goods and cargo delivery
- Public utility services
- Mobility assistance for elderly and disabled persons

11. CONCLUSION

The battery-operated tricycle developed in this project demonstrates a practical and eco-friendly solution for urban transportation. The prototype offers reduced emissions, low operating cost, and ease of use. With improvements in battery technology and charging infrastructure, battery operated tricycles can play a vital role in sustainable mobility systems and contribute to a cleaner and greener future.

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