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Design and Fabrication of E-Cycle

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ABSTRACT: This project presents the design and development of an E-Cycle (Electric Bicycle) as a sustainable, costeffective, and eco-friendly mode of personal transportation. The E-Cycle integrates a brushless DC motor (BLDC), a rechargeable lithium-ion battery, and a standard bicycle frame to create a hybrid system that allows both manual pedaling and electric-powered mobility. Designed to reduce urban pollution and promote green commuting, the E-Cycle provides an efficient alternative to fuel-based vehicles, particularly for short-distance travel..

KEYWORDS: 1.Travelling, 2.Electric bike, 3.Electric energy, 4.Fuel economy, 5.Pollution, 6.Ecofriendly, 7.Transmission

I. INTRODUCTION

In recent years, electric bicycles (e-bicycles) have emerged as a sustainable and efficient solution for urban mobility, combining the environmental benefits of traditional bicycles with the convenience of electric propulsion. As concerns over traffic congestion, air pollution, and fossil fuel dependency continue to grow, e-bicycles offer a compelling alternative for short- to medium-distance transportation. This report presents the final outcomes of the e-bicycle project, which was initiated to design, develop, and evaluate a functional and user-friendly electric bicycle prototype.

The primary objective of the project was to integrate electrical and mechanical systems to produce a reliable e-bicycle that meets performance, safety, and efficiency standards. Key areas of focus included battery selection and management, motor integration, frame design, and user interface features. Through iterative design and testing, the project aimed to address the technical challenges associated with e-bicycle development while considering cost-effectiveness and user accessibility.

PROBLEM STATEMENT:

With rapid urbanization and increasing vehicular traffic, cities around the world are facing critical challenges related to air pollution, fuel consumption, and traffic congestion. Traditional vehicles, especially those relying on fossil fuels, contribute significantly to environmental degradation and rising transportation costs. At the same time, there is a growing need for affordable, efficient, and sustainable modes of personal transport, especially for short to medium distances.

II. LITERATURE REVIEW

1. Pucher, J., & Buehler, R. (2012). "Cycling for Everyone: Promoting a Healthier and More Sustainable Transport System." Summary: This paper discusses the potential of cycling, particularly e-bikes, to address urban mobility challenges. The authors highlight how e-bikes can promote healthier, more sustainable transport options in cities while encouraging people who would typically be unable to cycle due to age or physical limitations to take up cycling. Findings: E-bikes provide a solution for increasing cycling participation and contribute to sustainable urban transport by reducing traffic congestion and carbon emissions.

2. Cherry, C., & Cervero, R. (2007). "Use of Electric Bicycles in China: Implications for Transport and the Environment." Summary: This study focuses on the rapid adoption of electric bicycles in China, a leading market for e-



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bikes. The authors analyze how the integration of e-bikes into urban transportation systems in China has led to environmental benefits and improved mobility in congested cities. Findings: E-bikes have the potential to significantly reduce carbon emissions and traffic congestion in crowded urban centers, offering a more sustainable alternative to traditional vehicles.

3. Xu, H., & Li, X. (2016). "Performance Evaluation of Electric Bicycles for Urban Commuting." Summary: This research evaluates the performance of e-bikes in urban commuting contexts, focusing on energy consumption, speed, range, and user comfort. The study uses simulation models to estimate e-bike performance in real-world urban environments. Findings: The study concludes that e-bikes provide a highly efficient alternative for short-to-medium distance commuting, with low energy consumption and good overall performance in mixed traffic environments.

III. PROBLEM DEFINITION

With increasing fuel prices, rising environmental pollution, and the need for sustainable modes of transport, conventional gasoline-powered vehicles are becoming less viable, especially for short-distance urban commutes. Traditional bicycles, while eco-friendly, require significant physical effort and are not always practical for all age groups or terrains. There is a growing demand for a lightweight, eco-friendly, and cost-effective transportation alternative that combines the efficiency of a motorized vehicle with the simplicity of a bicycle. The current market options for electric bicycles are often expensive or not optimized for local conditions. Therefore, there is a need to design and fabricate an affordable, energy-efficient, and user-friendly Electric Bicycle (E-Cycle) that meets basic transportation needs while being environmentally sustainable.

IV. FUTURE SCOPE

- 1. Selection and integration of a suitable electric motor (preferably BLDC) for smooth and efficient propulsion.
- 2. Design and installation of a rechargeable battery system with appropriate capacity and safety features.
- 3. Development of a basic control system for speed regulation, throttle response, and battery monitoring.
- 4. Mechanical modifications to the bicycle frame to support electrical components while maintaining balance and safety.
- 5. Evaluation of the e-cycle's performance in terms of speed, range, charging time, and user comfort.
- 6. Emphasis on low-cost design using easily available components to ensure affordability and scalability.

V. OBJECTIVE

- 1. To design an efficient and lightweight e-cycle that combines mechanical and electrical systems seamlessly.
- 2. To select and integrate a suitable electric motor (such as a BLDC hub motor) that provides adequate power for assisted cycling.
- 3. To choose a reliable battery system (preferably lithium-ion) with optimal capacity for extended range and reduced charging time.
- 4. To develop a basic electrical control system for speed regulation, motor control, and battery monitoring.
- 5. To ensure safety and stability of the e-cycle through proper frame design and component placement.

VI. METHODOLOGY

METHODOLOGY

Problem Identification and Requirement Analysis

- Studied the need for sustainable and cost-effective transportation.
- Defined the basic requirements such as range, speed, weight, and power output.

Literature Review

- Reviewed existing e-cycle designs, motor technologies, battery systems, and control mechanisms.
- Identified best practices and potential challenges based on previous studies.

Component Selection

• Motor: Selected a suitable BLDC hub motor for efficient propulsion and low maintenance.



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• Battery: Chose a lithium-ion battery for its high energy density, lightweight, and rechargeability.

• Controller & Throttle: Selected a compatible controller and throttle system for speed control and motor management.

• Frame: Chose a standard bicycle frame with enough strength to support added components.

Design and Planning

- Created a basic design layout for the electrical system integration.
- Planned the placement of battery, motor, and control units on the cycle to ensure balance and safety.

Assembly and Integration

- Installed the motor onto the rear or front wheel hub.
- Mounted the battery pack securely on the frame (typically on the rear carrier or down tube).
- Connected the controller to the battery, throttle, and motor using proper wiring and connectors.
- Ensured all electrical components were insulated and waterproofed as needed.

Testing and Evaluation

- Conducted initial tests to verify system functionality (motor response, throttle, braking).
- Measured key performance indicators such as speed, range, charging time, and battery life under different conditions.
- Made adjustments for efficiency, safety, and ride comfort based on test results.

Final Tuning and Documentation

- Fine-tuned the system for smoother operation.
- Documented all technical specifications, wiring diagrams, and test results.
- Prepared the final report outlining the complete process, findings, and future scope.

VII. FABRICATION WORK

FABRICATION WORK

1. Frame Preparation

Selection of Frame: A lightweight yet strong bicycle frame was selected, typically made from materials such as aluminum or steel, ensuring durability while keeping the overall weight manageable.

2. Scrap Cycle

- 3. Rust Protection
 - Material Used: Mild Steel (MS), Stainless Steel, or Aluminum
- 4. Motor Installation
- 5. Battery Pack Assembly
- 6. Controller and Wiring Setup

7. Testing and Quality Checks

- Solar panel output test under sunlight.
- Battery charging/discharging test.

VIII. RESULTS

RESULTS

A Trip To The College And Final Finish

We went to college for showing our work to college staffs and asked for the review. Every one review on the performance of the cycle and gave it good comment. They asked us to change the battery placement. So according their review we have changed as per their needs. Finally, we painted it for final finish and added some sticker for enhancement of the looks. We enjoy the ride to college that every one in our batch raided the Bicycle and share their feeling with others. Even the other also ride the Bicycle and share their feeling. Then the faculty members raided the Bicycle and check the performance of the Bicycle. The acceleration speed was good enough that it can pickup the top speed as soon the throttle is twisted. It was a best moment while the facultymembers raiding the bicycle it makes us happy.



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APPLICATIONS

- 1. Urban Commuting
- 2. Delivery and Logistics
- 3. Recreational Cycling.

IX. CONCLUSION

The electric cycle (e-cycle) represents a significant advancement in personal transportation, combining the simplicity and efficiency of a traditional bicycle with the added benefits of an electric motor for assisted pedaling. Throughout this report, various aspects of e-cycles, including their design, components, performance, applications, and advantages, have been examined in detail.

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