Pedal Operated Car

Biradar Omkar Narayan[1], Natu Sambhaji Shankar[2], Chothave Sagar Vilas[3], Biradar Sarthak Sanjay[4], Prof. Mungle Nizammehadi A[5]

[1, 2, 3, 4, 5] Dept of Mechanical Engineering

[1, 2, 3, 4, 5] Vishweshrayya Abhiyantriki Padvika Mahavidyalay,Almala,Maharashtra,India.

Abstract- *The pedal-operated car is a sustainable, human-powered vehicle designed for eco-friendly urban mobility. It incorporates a mechanical pedal-drive system to convert human energy into motion, reducing reliance on fossil fuels. The car features aerodynamic bodywork, lightweight materials, and an efficient gear mechanism to enhance speed and comfort.*

The design integrates electric-assist technology, allowing users to switch to battery-powered mode when needed, making it a hybrid human-electric vehicle. It is ideal for urban commutes, fitness, and recreational use. The pedal-operated car promotes sustainability, reduced carbon emissions, and cost-effectiveness, contributing to a greener future in transportation.

Keywords- Bicycle Pedal, Sprocket, Tyre, Chain.etc.

I. INTRODUCTION

A pedal-operated car is an eco-friendly, human-powered vehicle designed for short-distance travel. This final-year project focuses on developing a compact, lightweight, and efficient transportation system that reduces carbon emissions and promotes sustainability. The vehicle operates using a simple pedal mechanism connected to a gear and chain system, similar to bicycles, ensuring smooth motion with minimal effort. This project integrates principles of mechanical engineering, ergonomics, and aerodynamics to enhance efficiency and user comfort. The design is ideal for urban commuting, recreational purposes, and areas with restricted motor vehicle access.

II. IDENTIFY, RESEARCH AND COLLECT IDEA

A. Existing Pedal Car Designs

1. IDENTIFICATION: Understanding the Project Scope

A pedal-operated car is a human-powered vehicle designed for efficient mobility, often used for eco-friendly transport, fitness, or recreation. For a mechanical engineering project**,** key factors include:

- Energy Transfer Mechanism – Chain drive, belt drive, or shaft drive.
- Frame & Body Design – Lightweight but strong materials like aluminum or carbon fiber.
- Steering & Suspension System – Optimized for stability and maneuverability.
- Braking System – Mechanical disc brakes or traditional bicycle brakes.

2. RESEARCH: Background and Existing Designs

A. Literature Review & Existing Models

- Velomobiles – Enclosed aerodynamic pedal cars.
- Recumbent Tricycles – Low-center-of-gravity pedal-powered vehicles.
- Quadri cycles – Four-wheeled pedal cars used for urban commuting.
- Pedal Rickshaws – Used in some countries for passenger transport.

B. Engineering Concepts to Study

Power Transmission – Chain vs. belt vs. shaft drive efficiency analysis.

C. Market & Applications

- Urban eco-friendly transport.
- Fitness and recreational vehicles.
- Delivery and cargo pedal cars.

3. COLLECTING IDEAS: Design & Innovation

A. Conceptual Design Considerations

- Frame Material – Aluminum for lightweight or steel for cost efficiency.
- Wheel Configuration – Three-wheel (trike) or four-wheel (quadricycle).
- Seating Position – Upright vs. recumbent seating.
- Drive Mechanism – Chain drive with derailleur gears for smooth power transmission.

4. PROJECT EXECUTION PLAN

Phase 1: Research & Conceptualization

- Literature survey on pedal-operated cars.
- Study power transmission mechanisms and materials
- Create a conceptual sketch of the vehicle.

Phase 2: Design & Simulation

- Use Solid Works or AutoCAD for 3D modeling..

Phase 3: Manufacturing & Prototyping

- Select suitable materials and fabricate the chassis.
- Assemble power transmission, steering, and braking systems.

III. AIM AND OBJECTIVE

Aim: To design and develop a pedal-operated car that serves as an eco-friendly, cost-effective, and efficient mode of transportation, suitable for short-distance travel while promoting physical fitness and reducing carbon emissions.

Objectives:

1. Design and Development: To design a lightweight and efficient pedal-powered vehicle with an ergonomic structure for comfortable operation.
2. Energy Efficiency: To optimize mechanical power transmission for smooth and effortless pedaling.
3. Eco-Friendly Solution: To promote a pollution-free mode of transportation by eliminating fuel consumption and reducing environmental impact.
4. Material Selection: To use lightweight, durable, and cost-effective materials to enhance performance and affordability.
5. Safety and Stability: To ensure a stable and safe ride by incorporating proper braking mechanisms and structural reinforcements.
6. Load Carrying Capacity: To design the vehicle with sufficient strength to carry at least one or two passengers with ease.
7. Ease of Use: To make the vehicle simple to operate for users of different age groups and fitness levels.
8. Alternative Applications: To explore the possibility of integrating auxiliary power sources such as battery-assisted pedaling or solar energy for hybrid operation.
9. Manufacturing Feasibility: To develop a prototype that can be manufactured at a low cost for potential commercial applications.
10. Performance Testing: To analyze the efficiency, speed, durability, and comfort of the pedal-operated car under different conditions

IV. PROBLEM IDENTIFICATION:

Before developing a pedal-operated car, it is essential to identify the key problems associated with traditional transportation and human-powered vehicles. The following issues highlight the need for such a project:

1. Environmental Concerns:

High dependence on fossil fuels contributes to pollution and global warming.
Conventional vehicles release harmful emissions, worsening air quality.

2. Rising Fuel Costs:

Fuel prices are increasing, making transportation expensive for daily commuters.
Maintenance costs for fuel-powered vehicles add to financial burdens.

3. Traffic Congestion in Urban Areas:

Motorized vehicles contribute to heavy traffic congestion, especially in cities.
Pedal-powered vehicles provide a space-efficient alternative for short distances.

4. Lack of Affordable, Eco-Friendly Transport Options:

Electric and hybrid vehicles are costly and not accessible to all.
Public transportation is not always reliable or convenient.

5. Limited Physical Activity in Daily Life:

Over-reliance on motor vehicles leads to a sedentary lifestyle, increasing health issues such as obesity and cardiovascular diseases.
A pedal-operated car promotes fitness while serving as a practical mode of transport.

6. Inefficiencies in Existing Human-Powered Vehicles:

Bicycles have limited carrying capacity and offer minimal protection from weather conditions.
Traditional rickshaws and tricycles require high physical effort with inefficient power transmission.
7. Safety Concerns:

Bicycles and open tricycles lack stability and safety features such as braking systems, seat belts, and proper road visibility.
A pedal-operated car needs to ensure better balance and security.

8. Durability and Material Selection Issues:

Conventional bicycles and rickshaws may not be designed for long-term durability.
Identifying lightweight yet strong materials is crucial for improving performance and longevity.

9. Limited Speed and Comfort:

Bicycles and traditional rickshaws can be tiring for long distances due to their inefficient gear systems.
The need for an ergonomic design to enhance comfort and reduce fatigue.

V. CONSTRUCTION

The construction of a pedal-operated car involves the design, selection of materials, and assembly of key mechanical components to create a functional and efficient human-powered vehicle. Below are the essential steps and components involved in the construction process:

1. Chassis Frame Construction

Material Selection: Lightweight and strong materials like mild steel (MS), aluminum, or alloy steel are used for the frame to ensure durability and weight optimization.
Frame Design: The chassis is designed as a tubular or rectangular frame to provide structural stability and support for all components.
Welding & Fabrication: The frame is cut and welded to form the base structure of the vehicle.

2. Power Transmission System

Pedals & Crankset: The pedal mechanism is attached to a crank system to convert human power into rotational motion.
Chain Drive Mechanism: A chain and sprocket system transfers power from the pedals to the rear wheels, ensuring smooth motion.

3. Wheel & Axle Assembly

Wheels: Typically, bicycle or small automobile wheels are used, depending on the design requirements.
Bearings: High-quality bearings are installed to ensure smooth wheel rotation and reduce friction.
Axles: The rear axle is connected to the drivetrain for efficient power transmission.

4. Steering Mechanism

Handlebar or Steering Wheel: Connected to the front wheels for directional control.

5. Braking System

Brake Levers & Cables: Connected to the pedals or handlebars for easy operation.

6. Seating & Ergonomics

Seat Design: Comfortable, adjustable seats are installed for better posture and reduced fatigue.

7. Body & Covering (Optional)
Storage Compartment: A small compartment can be added for carrying goods or personal items.

VI. WORKING

The pedal-operated car functions using human power, converting mechanical energy from pedaling into motion through a transmission system. The working principle involves the following key mechanisms:

1. Power Generation through Pedaling

The user applies force to the pedals, which are connected to a crankshaft.
As the pedals rotate, they turn the crank set, converting the rider's effort into rotational motion.

2. Power Transmission System

The rotational motion from the crankshaft is transmitted to the rear axle via a chain and sprocket system (similar to a bicycle mechanism).

3. Wheel Movement & Propulsion

The rear wheels receive power from the chain drive, causing them to rotate and move the vehicle forward.

Steering control allows the vehicle to change direction by turning the front wheels using handlebars or a steering wheel.

4. Braking System for Control
The brake system (such as disc or drum brakes) is applied through hand levers or foot pedals, stopping the rotation of the wheels when needed.

5. Additional Features (Optional)

If the design includes a hybrid system, an auxiliary electric motor or solar panel can assist pedaling for greater efficiency.
A suspension system (if included) helps in absorbing shocks and improving ride comfort on rough surfaces.

6. Advantages of the Working Mechanism

- Eco-Friendly: No fuel consumption, reducing carbon emissions.
- Energy Efficient: Converts direct human energy into motion with minimal losses.
- Cost-Effective: Low operational and maintenance costs.
- Health Benefits: Encourages physical activity while.

Chain And Sprocket:

Tyre:

Bracket Bearing:

MS Rod:

Steering:

VII. DISADVANTAGES

- Limited Speed & Efficiency.
- Physical Effort Required.
- Mechanical Wear & Tear.

VIII. ADVANTAGE

- Environmentally Friendly.
- Cost-Effective.
- Low Maintenance.
- Promotes Health & Fitness.
- Simple & Easy to Use

IX. CONCLUSION

The pedal-operated car final-year project successfully demonstrates a sustainable, energy-efficient, and eco-friendly alternative to conventional transportation. Through careful design, material selection, and mechanical optimization, the project achieves a lightweight, durable, and ergonomically efficient vehicle suitable for short-distance commuting, recreational use, and urban mobility.

APPENDIX:

A. List of Components

1. Frame Material – Lightweight aluminum or steel
2. Pedal Mechanism – Bicycle-style crank and chain drive
3. Gear System – Multi-speed gear mechanism for efficiency
4. Steering System – Handlebar or joystick-controlled front-wheel steering
5. Braking System – Disc or drum brakes for safety
6. Wheels & Tires – type or small car wheels for stability
7. Seat & Ergonomics – Adjustable seat for comfort and efficient pedaling

REFERENCES

[1] Wilson, D. G. (2004). *Bicycling Science* (3rd ed.). The MIT Press. – Covers the physics and mechanics of human-powered transportation.
[2] McGinnis, P. M. (2013). *Biomechanics of Sport and Exercise*. Human Kinetics. Provides insights into human power generation and efficiency.
[3] Velomobile World – www.velomobileworld.com
[4] Open Source Ecology – www.opensourceecology.org