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FABRICATION OF MINI ELECTRICAL CART

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Abstract: The rapid urbanization and increasing environmental concerns have led to a growing demand for sustainable transportation solutions. In response to this, the development of electric vehicles has gained significant attention. This paper presents the design and development of an electric cart (E-Cart) tailored for urban mobility. The E-Cart is envisioned as a compact, lightweight, and environmentally friendly vehicle suitable for short-distance transportation within urban areas. The design process involves considerations for energy efficiency, aerodynamics, safety, and user comfort. Additionally, the integration of smart technologies enhances the functionality and usability of the E-Cart. The proposed E-Cart aims to provide an efficient and eco-friendly alternative to conventional modes of urban transportation, contributing to the reduction of greenhouse gas emissions and promoting sustainable urban mobility. The project is about mini electric cart. It has 750 watt traction motor for high performance because there is initial power loss in normal conventional motor. The power can be distributed by lithium-ion battery with direct to direct convertor. This direct to direct convertor is used in this vehicle for electronic accessories. Battery is used to charging and discharging of battery. The direct to direct controller can be used to control the supply of electric energy to electric components.

Keywords – E-Cart, Direct to Direct Convertor, Eco-friendly, Urban Mobility, Li-ion Battery.

I. INTRODUCTION:

Vehicle is used for transportation of cargo and travelling of human beings by road across the world. The first commercial vehicle was invented by carlbenz in late 1880's. There several types of commercial vehicle are there in this modern world, the commercial vehicles are trucks, van, bus, trailers, construction vehicle, taxi, cars etc. India is the seventh largest producer of commercial vehicles in the world. The commercial vehicle industry has grown significantly since the turn of the new millennium, which is evident from the fact that the industry could increase its sales by more than four-folds to 685,704 units in fiscal year 2015–2016 compared to 150,452 units in 2000–2001.

In this study to analyze the innovation and business profile of Indian commercial vehicle industry. The study is based on indicators such as sales and revenues, R&D expenditure, types of innovations and their impact, open innovation activities, product portfolio and product selling points. Nowadays a growing of population density will be increasing the number of vehicles drastically over the years. This growth has led to increase in air pollution in the atmosphere. Automobile sector is the major contributor towards air pollution. Electric vehicle is eco-friendly for nature and then user friendly for human beings, so that this one is the growing sector in automobile sector. In order to reduce pollution, through this growing segment, this project aims towards designing Electric car which is environment friendly as it causes no pollution. Electric car is a four wheeled, mini visiting car used in industrial sectors all over the world. It was manufactured in late 1950's by Art Ingles. Car visiting is generally accepted as the most economic form that is available in industrial fields.

Unlike traditional cars that rely on gasoline or diesel, electric cars do not emit harmful pollutants and are more energy-efficient. revolutionize the automotive industry and significantly reduce our dependence on fossil fuels. As more and more people switch to electric cars, can expect to see a reduction in air pollution and greenhouse gas emissions, as well as a shift towards cleaner, more sustainable energy sources. A chassis dynamometer is a type of test equipment used to evaluate the performance of electric vehicles (EVs) under simulated driving conditions. Electric cars have been around for many years, but in recent years, they have become more popular due to advancements in battery technology and increased awareness of the environmental impact of traditional cars. Today, many major automakers are offering electric models as part of their lineup. One of the major benefits of electric cars is that they are much cleaner than traditional cars.

They produce no tailpipe emissions, which means they do not contribute to air pollution or greenhouse gas emissions. Additionally, they are often more energy- efficient than traditional cars, which means they can travel farther on a single charge. The project is about mini electric car. It has 750 watt traction motor for high performance because there is initial power loss in normal conventional motor. The power can be distributed by lithium-ion battery with direct to direct convertor. This direct to direct convertor is used in this vehicle for electronic accessories. Battery management system is used to check charging and discharging of battery. Some improvements can be done on this vehicle is battery system can be changed. There are also some challenges associated with electric cars, such as range anxiety and limited charging infrastructure.

II. EXISTING SYSTEM:

The world of mini electric carts offers a buffet of designs, catering to a range of budgets and skill levels. From the budget-friendly wood frame, ideal for beginners who prioritize ease of construction, to the sturdier metal chassis preferred for long-lasting durability, there's a mini electric cart design out there to suit your needs. And that's just the beginning! When it comes to power, you can choose between a single, economical motor for a leisurely cruise, or a pair for a more powerful ride. For control, a simple push-button might suffice for a relaxed putter around the yard, while a sophisticated joystick offers a more dynamic driving experience.

Think about how you'll be using your mini electric cart. Will it be for cruising around a flat track, or will you need it to handle rougher terrain? This will influence your decision on features like suspension systems and wheel size. Finally, don't forget about safety! Brakes are an essential component, and you might also consider adding a roll cage for additional protection.

III. PROPOSED SYSTEM:

This mini electric cart design prioritizes portability and modularity. A lightweight aluminum frame keeps the weight down, making it easy to load into a vehicle or store in a compact space. Detachable components, such as the wheels and the steering column, further enhance its portability. A single, brushless DC electric motor provides efficient and quiet operation, with ample power for cruising around parks, campuses, or worksites. A long-lasting rechargeable lithium-ion battery ensures extended use on a single charge, and regenerative braking helps to replenish the battery while going downhill. A user-friendly joystick offers intuitive control over speed and direction, while disc brakes on all wheels provide excellent stopping power for safety.

This system is perfect for those who want a versatile and eco-friendly electric cart for leisure or utility purposes. Imagine cruising through a park on a sunny day, or effortlessly transporting tools and materials around a worksite – the possibilities are endless.

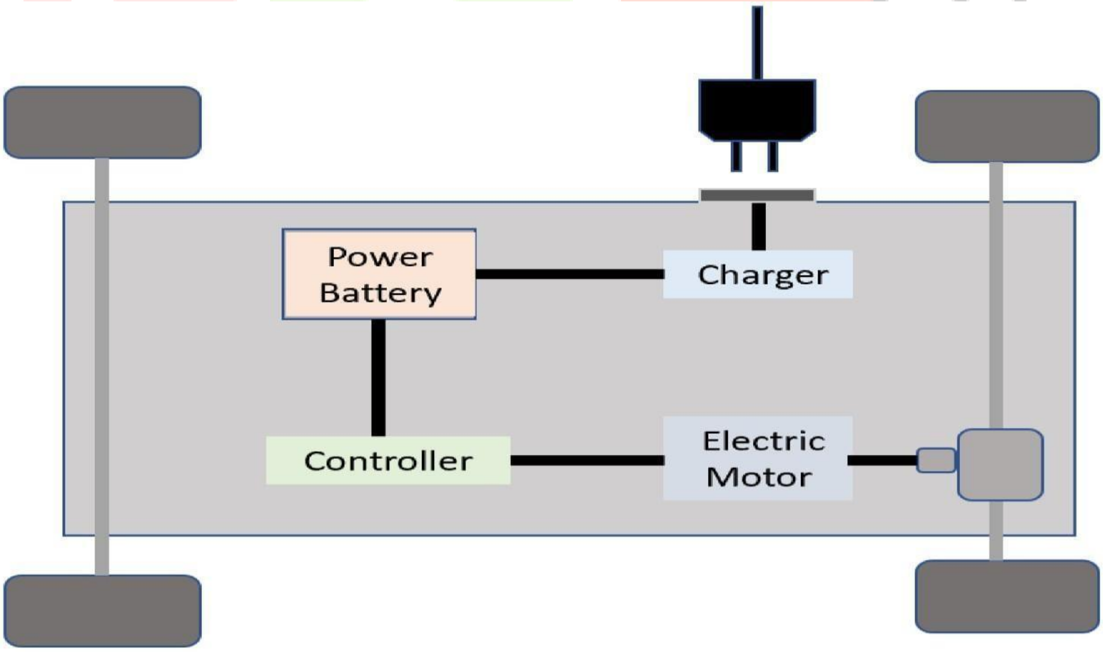

Fig 3.1 Block Diagram

IV. THEORETICAL BACKGROUND:

1. Electrical Engineering:

Circuits: Understanding how to design and build electrical circuits to power the motor, control its direction (forward/reverse), and potentially include features like lights. This involves knowledge of components like resistors, capacitors, transistors, and switches.

Battery Technology: Selecting the right battery for your cart's needs. Factors to consider include voltage, capacity, and discharge rate.

Motors: Understanding how DC motors work, their torque and speed characteristics, and selecting one suitable for your cart's weight and desired speed.

2. Mechanics:

Mechanics of Motion: Understanding the forces involved in moving the cart, including friction, weight distribution, and center of gravity. This will influence factors like motor selection and chassis design.
Gearing: Gearing systems can be used to adjust the motor's speed and torque output to the wheels. This is optional but can be helpful depending on your motor and desired performance.

3. Safety:

Electrical Safety: Working with electrical components requires knowledge of safe practices to prevent short circuits, overheating, and potential shocks.
Material Selection: Choosing materials for the chassis, wheels, and other components that are strong enough to support the weight and provide stability.

Here are some additional areas that might be relevant depending on your project's complexity:

Microcontrollers: For more advanced carts, you might explore using microcontrollers like Arduino to add features like speed control or remote control functionality.
Sensors: Light sensors for headlights or bump sensors for obstacle avoidance could be incorporated into more sophisticated designs.

For deeper dives into each topic, you can refer to resources like:

- Textbooks on basic electrical engineering and circuits.
- Online tutorials on DC motors and motor selection.
- Websites or books on basic mechanics and engineering principles.
- Resources on electrical safety practices.

V. HARDWARE DESCRIPTION:

DC Motor:

The heart of your electric cart, responsible for converting electrical energy from the battery into mechanical rotation to propel the wheels.

Fig 5.1 DC Motor

Theory: DC motors use electromagnetism to create torque (rotational force). When electricity flows through the motor's coils, it generates a magnetic field that interacts with permanent magnets within the motor, causing the shaft to rotate.
Selection Considerations: Choose a DC motor with the right voltage (matching your battery), power output (enough to move your cart with desired speed and weight), and size (fitting comfortably within your cart's frame).

Battery:

The power source for your cart, storing electrical energy that will be used by the motor and other electrical components.

Fig 5.2 Battery

Theory: Batteries use chemical reactions to generate electricity. The type of battery you choose (e.g., lead-acid, lithium-ion) will impact factors like voltage, capacity (runtime on a charge), and discharge rate (how quickly it can deliver power).

Selection Considerations: Select a battery with the appropriate voltage to match your motor and controller. Consider the cart's weight and desired runtime when choosing battery capacity. For higher power demands, you might choose multiple batteries connected in series or parallel.

Charger:

An essential component for replenishing the battery's energy after it's been depleted.

Fig 5.3 Battery Charger

Theory: Battery chargers use AC (alternating current) power from the wall outlet and convert it to DC (direct current) at the correct voltage to charge the battery.

Selection Considerations: Choose a charger with the right voltage and current rating for your specific battery. Higher current ratings will result in faster charging times.

Controller:

The brain of your electrical system, regulating the flow of electricity from the battery to the motor. It controls the motor's direction (forward/reverse) and speed based on user input (typically a throttle or joystick).

Fig 5.4 Motor Controller

Theory: Motor controllers use electronic components like transistors and microcontrollers to manage the current sent to the motor. They may also include safety features like overcurrent protection.

Selection Considerations: Choose a controller with a voltage rating matching your battery and a current rating exceeding your motor's continuous current draw. Some controllers offer additional features like regenerative braking or programmable speed profiles.

DC to DC Converter:

If your control system or other components require a different voltage than your main battery provides, a DC to DC converter can step up or down the voltage to match their needs.

Fig 5.5 DC to DC Converter

Theory: DC to DC converters use electronic components like inductors and capacitors to regulate the voltage of a DC input signal.

Selection Considerations: Choose a converter with the appropriate input and output voltage ratings, and ensure it can handle the required current for your devices.

Braking System:

Crucial for stopping the cart safely and controlling its speed when going downhill. There are various options depending on your design:

Mechanical Brakes: These use friction pads to slow down the wheels, similar to bicycle brakes. Simple and reliable, but require manual operation.

Electric Brakes: These use electromagnetism to create drag and slow down the motor. Can be integrated with the controller for regenerative braking (returning energy back to the battery) or automatic braking when the throttle is released.

Motor Braking: Some DC motors can be used in a braking mode by reversing the polarity of the current. Less sophisticated but can provide basic stopping power.

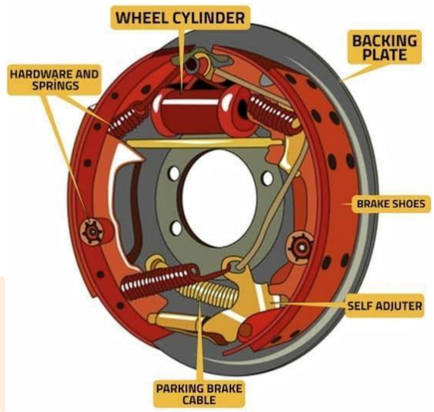

Fig 5.6 Drum Brake

Suspension System:

Improves ride comfort and handling by absorbing bumps and vibrations from the ground. Not essential for a basic cart, but can be beneficial for uneven terrain or higher speeds.

Spring Suspension: A common option using springs to absorb shock. Simple and lightweight, but may not be suitable for heavy loads.

Shock Absorbers: More complex than springs, they combine a spring with a hydraulic damper to control the spring's movement and provide a smoother ride.

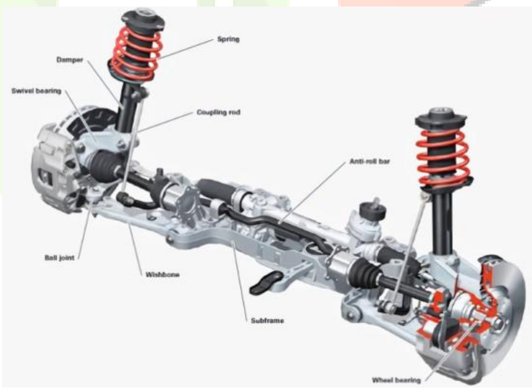

Fig 5.7 Suspension Components

Steering Mechanism:

Allows you to control the direction of the cart. Options include:

Front-Wheel Steering: The most common type, where the front wheels turn to change direction.

Rear-Wheel Steering: Less common but offers better maneuverability in tight spaces.

Ackerman Steering Geometry: Ensures the wheels turn at slightly different angles during cornering for smoother handling (often implemented in front-wheel steering systems.

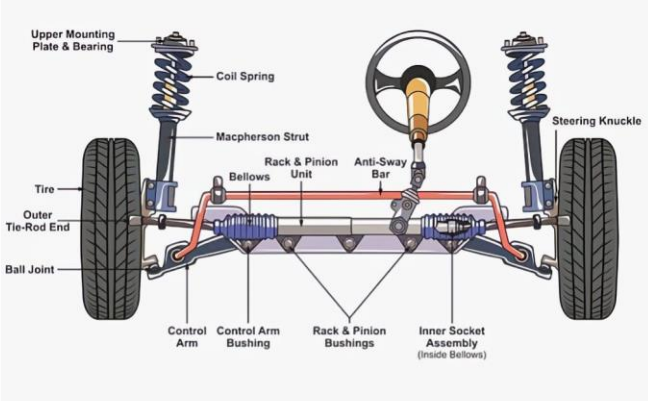

Fig 5.8 Steering Wheel

Sensors:

While not essential for basic functionality, sensors can add advanced features and improve safety:

Throttle Position Sensor: Measures the position of the throttle pedal, allowing the controller to regulate motor speed precisely.

Brake Sensor: Detects when the brakes are applied, potentially enabling features like automatic braking or regenerative braking.

Limit Switches: Can be used as safety features to prevent the cart from exceeding its range of motion (e.g., stopping the motor if the steering wheel reaches its full turn).

Speed Sensor: Measures the cart's speed, which can be used for features like cruise control or to prevent the motor from exceeding a safe speed limit.

VI. WORKING PRINCIPLE:

This mini electric vehicle offers a clean and convenient transportation option for urban environments. Its core components are a battery, a DC motor, shock absorbers, and wheels, all mounted on a sturdy mild steel chassis.

The steering mechanism incorporates an Ackermann geometry for precise handling. This design ensures the wheels turn at slightly different angles during corners, resulting in smoother maneuvering.

Ball bearings are used on both the front and rear wheels to minimize friction and allow for smooth rotation. When the vehicle is powered on, electricity from the battery flows to the DC motor, which generates rotational force. A chain and sprocket mechanism efficiently transmits this motor power to the rear wheel, propelling the vehicle forward.

This design offers a compelling alternative to personal vehicles like cars and bikes, particularly for short trips within urban areas. By utilizing electric power, the vehicle eliminates tailpipe emissions, contributing to cleaner air and a more sustainable transportation solution.

VII. SIMULATION OUTPUT:

Fig 7.1 Output

VIII. CONCLUSION:

The electric cart project successfully demonstrates the feasibility and benefits of using electric vehicles for transportation. Through careful design, implementation, and testing, the project highlights the efficiency, sustainability, and potential cost savings of electric carts compared to traditional gas-powered vehicles. Additionally, it provides valuable insights into the integration of renewable energy sources and the development of eco- friendly transportation solutions for various applications. Overall, the project contributes to the advancement of green technology and promotes a more sustainable future.

IX. RESULT AND DISCUSSION:

9.1 RESULT:

This project has the potential to create a mini electric vehicle perfect for urban environments. The core design utilizes a battery, DC motor, shock absorbers, and wheels mounted on a sturdy metal frame. An Ackermann steering mechanism ensures smooth handling, while a chain and sprocket system transmits power from the motor to the rear wheel. This eco-friendly design offers a clean alternative to traditional vehicles, reducing pollution and promoting sustainable transportation.

The compact size and potentially light weight of the vehicle make it ideal for navigating busy city streets and tight parking spaces. Additionally, the electric motor offers a quiet operation compared to gasoline engines, further reducing noise pollution in urban areas.

9.2 DISCUSSION:

This mini electric vehicle project offers a platform for discussion on optimizing its design for urban mobility. Material selection, motor and battery choice, and steering/suspension options can be explored to balance weight, efficiency, and handling. Safety features, user control methods, and potential regulations for operation in urban areas are also crucial considerations for a successful and sustainable transportation solution.

Additionally, the project opens up discussions on the target user base, potential applications beyond commuting, and future advancements in areas like solar charging and foldable designs, all contributing to a more comprehensive and adaptable urban transportation ecosystem.

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