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Electro Lite: A Compact 3-Wheeler Electric Trolley for Rural Utility

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ABSTRACT :

This project shows how "Electro Lite," a small, three-wheeled electric trolley that was carefully designed for use in rural and semi-urban areas, was created. The main goal is to make a utility vehicle that is cheap, long-lasting, and very useful for rural areas that need to move things around and transport people. The car has a rechargeable battery and an electric motor that is quiet and doesn't pollute the air. This is better for the environment and costs less to run than cars and trucks that use internal combustion engines. The "Electro Lite" is light but strong, and its three-wheeled design makes it easy to drive on narrow paths, dirt roads, and all kinds of terrain. A separate cargo bed makes it easier to move farm goods, tools, and other important materials, which makes it more useful. The "Electro Lite" is a simple and low-maintenance tool that is meant to help small-scale farmers, local vendors, and rural entrepreneurs work harder and become more financially independent. Not only does this project make the area cleaner and quieter, but it also helps connect remote areas to the rest of the world, bringing producers and markets together and making rural lives more modern and sustainable.

Keywords— bldc motor, controller, lithium-ion battery, lithium- ion battery charger, throttle, chain sprocket

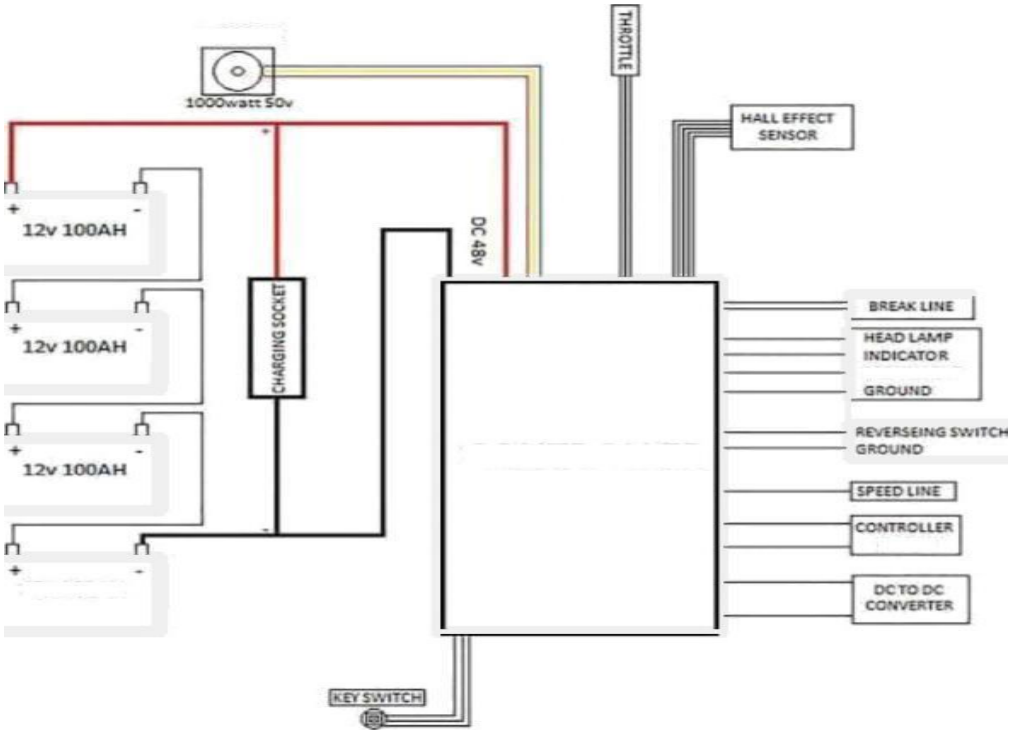
Introduction:

The "Electro Lite" is a new, small, three-wheeled electric trolley that will change how people get around and do their daily tasks in rural and semi-urban areas. This car was made to deal with the unique problems that come up on dirt roads, narrow lanes, and places where regular fuel is hard to find. It's a way to do a lot of different things that lasts a long time and works well. The trolley's design is mostly about being useful and not costing too much to run. It has an electric motor and a battery system that can be charged, which makes it better for the environment than cars that run on fossil fuels. It also makes less noise and is cheaper to run. The three-wheeled design makes it easy to move and stable, even on rough ground. It can also fit into places that bigger trucks or vans can't because it's small. The Electro Lite is a helpful tool for small farms, local businesses, and community services. You can use it to move things, carry farming tools, take things to local markets, or just get around. People and small businesses that want to work more efficiently and leave a smaller environmental footprint will find it useful and dependable because it is well-made and easy to use. This kind of vehicle is a big step toward modernizing rural infrastructure and helping sustainable development. As gas prices go up and worries about the environment grow, electric vehicles (EVs) are becoming the future of transportation. Electric mobility is a clean, quiet, and efficient way to get around that doesn't use gas or diesel.

Objectives:

The "Electro Lite" is a new, small, three-wheeled electric trolley that will change how people get around and do their daily tasks in rural and semi-urban areas. This car was made to deal with the unique problems that come up on dirt roads, narrow lanes, and places where regular fuel is hard to find. It's a way to do a lot of different things that lasts a long time and works well. The trolley's design is mostly about being useful and not costing too much to run. It has an electric motor and a battery system that can be charged, which makes it better for the environment than cars that run on fossil fuels. It also makes less noise and is cheaper to run. The three-wheeled design makes it easy to move and stable, even on rough ground. It can also fit into places that bigger trucks or vans can't because it's small. The Electro Lite is a helpful tool for small farms, local businesses, and community services. You can use it to move things, carry farming tools, take things to local markets, or just get around. People and small businesses that want to work more efficiently and leave a smaller environmental footprint will find it useful and dependable because it is well-made and easy to use. This kind of vehicle is a big step toward modernizing rural infrastructure and helping sustainable development. As gas prices go up and worries about the environment grow, electric vehicles (EVs) are becoming the future of transportation. Electric mobility is a clean, quiet, and efficient way to get around that doesn't use gas or diesel.

Circuit Diagram

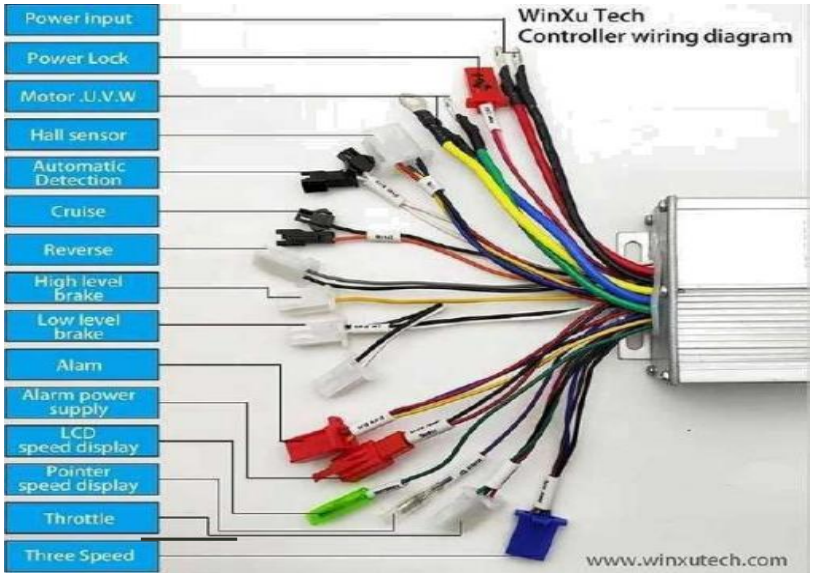


Components

BLDC Motor

A Brushless DC (BLDC) motor is an electric motor that runs on direct current (DC) power but doesn't have the brushes and commutator that other DC motors do. It uses an electronic controller to switch the current to the motor windings instead of brushes. This creates a magnetic field that moves a rotor with a permanent magnet.

Controller



A controller is a device that tells another device or system what to do or how to do it. In engineering and technology, a controller takes an input, compares it to a setpoint (the desired value), and then makes an output to change the system so that it is closer to the setpoint. This process is often part of a closed-loop control system that gets feedback all the time. .

Lithium-Ion Battery

A lithium-ion battery (Li-ion battery) is a rechargeable battery that stores and releases energy by moving lithium ions back and forth between its electrodes. They are an important part of modern technology because they have a lot of energy, work well, and last a long time.
\ When the battery is discharging (powering a device), lithium ions move from the anode to the cathode through the electrolyte. Electrons also leave the anode and travel through an external circuit (your device) to the cathode. The flow of electrons gives the device power.
When the battery is charging, this process works in the opposite direction. An outside power source pushes the lithium ions and electrons back from the cathode to the anode, where they stay until the next discharge cycle.

Lithium- Ion Battery Charger

A lithium-ion battery charger is an electronic device that charges lithium-ion batteries quickly and safely. These chargers are not just regular power adapters; they are advanced voltage-limiting devices that have their own control circuits. Overcharging lithium-ion batteries can hurt them, shorten their life, or even cause dangerous thermal runaway events.

Throttle

A throttle on an electric vehicle is not a mechanical part; it's an electronic part. It doesn't control the flow of air and fuel in a gasoline engine. Instead, it sends a message to the motor controller, which then decides how much power goes from the battery to the electric motor.

Results

The designed and fabricated Mini Electric 3-Wheeler Trolley was successfully tested under real operating conditions. The following outcomes were observed:

- The 48V 750W geared BLDC motor efficiently powered the vehicle, providing a smooth and noiseless ride.
- The tro11ey was able to carry a load of 400-500 kg or up to 4 passengers without significant performance drop.
- The 48V 18Ah lithium phosphate battery delivered a mileage of 40—50 km per charge, with a full recharge time of approximately 6 hours using a 48V 3A charger.
- All components such as throttle, differential, DC—DC converter, battery meter, and conti'ol1er worked in synchrony, ensuring safe and efficient vehicle operation.
- The DC—DC converter supplied a stable 12V to auxiliary devices (headlights, indicators, horn), keeping them isolated from the main traction system.
- The total power system proved to be cost-effective, eco-friendly, and suitable for local transport, goods delivery, and short-distance commuting.

Conclusions

In the end, the "Electro Lite" is more than just a car; it's a way to move forward. By focusing on affordability, sustainability, and usefulness, its design directly solves the problems with traditional transportation in rural areas. It gives farmers a cheap and dependable way to move people and goods, which helps them work harder, helps local businesses get more customers, and makes life better for everyone who lives there.

Using these kinds of vehicles is part of a bigger trend toward cleaner transportation and a cleaner environment. Governments are still pushing for more electric vehicles (EVs) by giving people money and building the infrastructure they need. The "Electro Lite" will be an important part of making these benefits available to a group of people who haven't been able to take advantage of the electric vehicle revolution yet. It is a smart way to improve rural areas because it uses new technology and a deep understanding of what people in those areas need.

Future Scope

The "Electro Lite: A Compact 3-Wheeler Electric Trolley for Rural Utility" has a very bright future. This is because technology has gotten better, government policies have changed, and the needs of rural communities have changed. The market for electric three-wheelers is growing quickly, especially in developing countries like India. Vehicles made for certain rural uses are driving this growth. Better battery tech: The main thing that will drive growth is better battery technology. The next "Electro Lite" models will probably have batteries that are denser and charge more quickly. This will fix the main issue of "range anxiety" and let the car run longer on a single charge, making it better for a variety of difficult tasks in rural areas. A big trend is already the switch from lead-acid batteries to lithium-ion batteries, which are lighter and work better.

Working with Smart Technology: Models in the future might have some basic smart features. This could include GPS navigation to find the best route, real-time tracking for fleet management (for businesses or community-owned vehicles), and even simple diagnostic systems that let users know when their vehicles need maintenance, all of which could be accessed through a smartphone app.

Charging with solar power: In the future, the "Electro Lite" might have small solar panels built into it to charge slowly. This would be very useful in rural areas where the grid electricity is limited or unreliable because it would let the vehicle charge its battery during the day.

Better Design and Durability: As technology gets better, the chassis and parts will get stronger and be able to handle the rough roads in rural areas. New discoveries in materials science will make cars lighter and stronger, which will let them go farther and carry more.

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