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Unlimited Battery E-Bike Using Solar & Wind Power

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Abstract:

There is growing demand for Electric Motor Bicycle in India as there will be less air pollution, lower maintenance cost and reduced noise using Electric Motor Bicycle. The motive of this research work is to design a simple, cost-effective model of Electric Motor Bicycle with intelligent controller. The Electric Motor Bicycle is consisting of motor, battery and controller. In this BLDC motor is fixed in the rim of the rare wheel. The controller is connected to the motor and battery to control speed of motor and current. The Electric Motor Bicycle can be run with battery charge and also by pedalling. ELECTRIC BIKE SIMULATOR was used to generate the simulation results. The results of the experiments are also shown in a hardware assembly kit.
This project introduces an Arduino-controlled e-bike that utilizes solar and wind energy to extend battery life and reduce dependence on grid charging.
The "Unlimited Battery E-Bike" integrates solar panels and a compact wind turbine with an Arduino-based energy management system, enabling efficient charging of the e-bike's battery both while stationary and in motion.
Solar panels mounted on the bike harness sunlight, while the wind turbine generates additional power at higher speeds.
The Arduino microcontroller continuously monitors battery status and dynamically allocates energy from the solar, wind, and battery sources, optimizing power use and charging efficiency.
This setup not only increases ride time but also serves as a sustainable, eco-friendly solution.

1.INTRODUCTION

GENERAL INTRODUCTION:

The term "electric vehicle" refers to a vehicle that is propelled by one or more electric motors or traction motors (EV). A self-contained electric vehicle can convert gasoline to energy using a battery, solar panels, fuel cells, or an electric generator, or it can be powered by electricity from off-vehicle sources using a collector system. E- Cycle is an electric and power-assisted bicycle that is one of the bicycle industry's fastest-growing technologies. This bicycle has an electric motor to assist you in moving forward. As a result, you can ride it like a regular bicycle while exerting less effort. An E-Cycle motor works by turning on automatically when you peddle or throttle. There are two main types of E-Cycle.

- Throttle assist.
- Pedal assist

2.LITERATURE SURVEY

CLASSIFICATION OF ELECTRIC BICYCLE

TYPE 1 E-Bike
An electric bicycle with Pedal Assist requires you to pedal in order to run the motor. It looks like an ordinary bicycle except that it contains a motor that recognises when you're pedalling and assists you. It's as though you've always had a strong tailwind behind you. This class/type of E-bike may or may not have a throttle.

TYPE 2 E-Bike
Throttle Only is a throttle-controlled electric bicycle. These electrics do not require pedalling to benefit from the motor. You'll be on your way in no time if you simply push the throttle. Accelerating in the middle of a corner will allow you to gain more traction. Naturally, the less you cycle, the faster the battery drains.

TYPE 3 E-Bike
With Pedal Assist, you can go up to 28 mph. This Class/Type is the fastest "legal" E-bike, with a top speed of 28 mph. It is still deemed a "bicycle," and no driver's license, licence plate, or other documentation is required. It's technically a bicycle, and it's a lot of fun! Helmets are required by law. This category is best for someone who rides their bike to work.

3. PROPOSED METHODOLOGY

The proposed hybrid electric bicycle system integrates solar power and wind power, presenting a sustainable transportation solution.
As depicted in,the system's energy flow and control signals are organized through distinct components.
Solar panels positioned at the top capture sunlight and convert it into electrical energy. Wind turbine is placed in front of the bicycle for the wind energy and convert into electric energy,stores in battery.
This energy is then directed to a solar & wind charge controller, which regulates voltage and current to optimize battery charging.
The battery serves as the energy reservoir, supplying power to the e-bike controller, the system's central processing unit.

Advantages:
An E-bike is a bicycle that is environmentally friendly. It's the same as our regular bicycle. E-Cycle, on the other hand, is powered by electricity rather than gasoline. No harmful emissions are emitted into the atmosphere. For the same reason, electric bikes don't produce any additional noise.4
Electric bicycles, in general, do not require any maintenance. Lubricate the drive system and inspect the chain and wheels on a regular basis to keep it clean.
Riding an electric bike is fashionable and popular right now. It's also the most efficient approach to cut down on pollution.

4. EXPERIMENTAL ANALYSIS

DC HUB MOTOR (BLDC)

A brushless DC (BLDC) motor with permanent magnets is used in this system. In a BLDC motor, which is

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a type of synchronous motor, the magnetic fields generated by the stator and rotor have the same frequency. The BLDC motor lasts longer since it does not require brushes. It also boasts a high starting torque, a fast no-load speed, and low energy losses. Three phase motors are the most common and commonly utilised in e-bikes out of a variety of layouts. Because the motor replaces the wheel hub, the system is chosen with a hub motor. Coupling loss is decreased, and mounting is simple without the use of chains or belts, resulting in a smaller and lighter e-bike.

Most electric vehicles (cars, bicycles, and wheelchairs) are powered by onboard batteries and a single, very basic electric motor that drives two or four wheels. However, some of the most recent electric cars and electric bicycles operate in a different manner. Instead of using gears or chains to power all of the wheels, they integrated a motor into the hub of each one, thereby merging the motors and wheels. A hub motor is exactly what it sounds like.

Fig 1: Hub motor.

Specifications

BLDC HUB MOTOR RARE WHEEL 36v, 250W

- Voltage:36 V
- Maximum current:10 A
- Maximum efficiency:85 %
- Torque:45 Nm
- Nominal power:250 W
- Peak power:350 W
- Maximum speed:30 Km/h

Hub motors are brushless motors (also known as brushless direct current motors or BLDCs), which have a half-dozen or more independent coils and an electronic circuit in place of the commutator and brushes. The circuit turns on and off the power in the coils, creating forces in each one that cause the motor to spin. Brushes press on the axle of a regular motor, causing friction, slowing it down, producing some noise, and wasting energy. Brushless motors are more efficient because of this, especially at low speeds. Getting rid of the brushes also eliminates the need to replace them when friction wears them down.

In a typical motor, the inner coil (named the rotor) rotates while the outside magnet (called the stator) remains stationary. The roles are inverted in this motor: the inner section with the coils is static, while the grey magnet spins around it. Now take a look inside to see how it all works: The grey outer shell (which is a magnet split into several portions and bent round into a circle) spins around the copper coils and circuit board as the electronic circuit transmits power to each of the nine copper coils in turn (which remain static).

However, between some of the coils are numerous tiny magnetic field sensors (also known as Hall-effect sensors). As the permanent magnets on the outer rotor sweep past them, the Hall-effect sensors figure out where the rotor's north and south magnetic poles are and which coils to activate to keep it spinning. The problem is that this necessitates the use of an electronic circuit to operate the motor, which is not required for a standard DC motor In the case of electric vehicles, the advantages are more clear. A normal car's metal weight (including the engine, transmission, and chassis) is roughly ten times that of its occupants, which is one of the reasons why cars are so inefficient. When the hefty engine and transmission are replaced with hub motors and batteries, the car becomes much lighter and more energy efficient. The engine compartment's removal also creates a lot of space for passengers and their luggage; the batteries may be placed beneath the backseat.

Hub motor vehicles are much simpler (mechanically speaking) than conventional vehicles. Assume you wish to go backwards. All you have to do is reverse the electric current instead of employing complicated gear setups. Backwards the motor spins, and backwards you go. On many cars, this is an expensive alternative because it necessitates extra gears and complicated driveshafts, but it's extremely simple to solve.

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Fig 2: Bicycle

5. CONCLUSION

From this project we have done the conversion of scrap cycle to a good condition E-cycle which has almost every feature compared to every cycle in market. It is cost efficient and follows all the 3Rs of the eco system. We got a good lithium-ion battery which gives the range 40km (or even more, depends on the driving conditions.) and a top speed of 30 km/h.

FUTURE SCOPE

In future this cycle can be developed and can add additional feature like bi- directional controller which can regenerate battery power by peddling. Since our project has single directional converter but it can't be recharged while riding. So, the regenerative braking system won't be available. We can change to bidirectional converter and add that feature. We can even make an attempt to convert other vehicles like handicapped tricycle and cycle rickshaws.

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