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Pedelecs (Pedal Electric Cycle)

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ABSTRACT: In this paper we present a traction system designed for an Electric Vehicle (EV) for use. Our system incorporates two power sources; batteries and a dynamo. This technical solution allows us to efficiently integrate and utilize both energy storage systems within the traction system. The dynamo functions, as an energy storage element, which can be tapped into for energy retrieval. By considering the characteristics of EVs and analyzing a standard routing profile we determine the energy consumption of our system. We provide a description of the components involved in our design including the battery, dynamo, power converters and control strategy implementation.
Additionally, we. Discuss a control strategy that optimally manages energy within the system to enhance the vehicles performance and increase its autonomy.

I. INTRODUCTION

In today's fast-paced world, the growing demand for mobility often leads to an increase in the number of vehicles on our roads. However, amidst these concerns about our environment, there's a promising and eco-friendly solution in the form of electric bicycles. These electric bikes offer a cleaner and more sustainable way to get around our urban landscapes, reducing our dependence on oil and gas.

One of the fantastic things about electric bikes is that they don't rely on traditional fuel or coolants like conventional vehicles. Instead, they harness the power of electricity to propel you forward, and the best part is that it's essentially free to use once you've made the initial investment. This not only makes them cost-effective but also reduces your carbon footprint, as electric bikes produce no harmful emissions that can pollute our atmosphere.

Choosing the right electric motor was the crucial first step in crafting the perfect electric bicycle. These bikes use a clever combination of electric motors, alternators, and batteries. When you pedal the bicycle, the generated electricity is stored in a battery, which can then be used to power your ride. It's an ingenious system that allows you to travel effortlessly while knowing you're making a positive impact on the environment.

Electric bicycles are incredibly versatile and can serve a variety of purposes. Initially, we experimented with small DC motors that were cleverly arranged to turn a sprocket. This sprocket, in turn, transferred the rotational energy between two shafts, propelling the bike forward. It's all about finding new and innovative alternatives to traditional internal combustion engines, and electric propulsion seems to be a particularly exciting one.

In essence, the electric bicycle represents an opportunity to promote cleaner and more sustainable development while reducing our dependence on oil. These bikes run on clean electric power, and the ability to recharge the battery means that every ride contributes to a greener and more efficient planet. It's our chance to be part of a positive change and create a more eco-friendly world for ourselves and future generations.

II. LITERATURE SURVEY

In 1989, Michael Kutter, the founder of 'Dolphin E-bikes' done the first initiation in commercially producing e-bikes in the market. After his attempt, a well-known motorbike company from Japan 'Yamaha' took the leap in

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developing commercial ebikes, producing a large number of e-bikes in the year 1994, giving the name 'Power Assist'.

The earlier version of e-bikes or technically low quality e-bikes operated mostly on less effective lead acid batteries, which has less sturdiness to give full power to the motor, besides they are heavy and bulky, but in newer models there have been mostly selected NiMH, NiCad and Lithium-ion batteries, because they are light, powerful, and dense in their capacity, giving possibility to drive long and fast, giving maximum durability in terms of power and performance.

The words associated with e-bikes which are in the range of bicycles are called by many different names like 'Pedelec', 'pedalassisted', 'power-assisted' and simply 'power bike', whereas in bigger powered ebikes they are termed as (electric motorbike or e-motorbike), having high range in speed and distance, almost can make around 80 km/h.

Design and fabrication of electric bike

The main gist of this paper is to give the exact view by bridling the various sources of energy available to mankind. In today's modernized world travelling is very essential for human beings in order to protract in this world. And to do so his travelling should be done in minimum possible way and in jiffy. This paper details about the Electric Bike which runs on the battery thereby providing voltage to the motor. This paper compromises with design and fabrication of Electric Bike which makes use of Electric energy as the primary source and solar energy if possible by attaching solar panels. It also highlights on the design aspects of the bike. There is a provision for a charging the battery by ejecting it from the main system. The electrical power generated which is used to run the bike can give better fuel economy compared to conventional vehicle, better performance and also causes less pollution

1. Technologies Used

1. Your trusty bicycle is powered by a 24volt DC motor with a 250-watt capacity. It's like having a little helper to make your rides more effortless.
2. The battery is like the heart of the operation. It's connected to a controller that keeps everything in check, ensuring a smooth flow of power as you cruise along.
3. Want to speed up or slow down? No problem! There's a nifty throttle connected to the controller that lets you control the speed of the motor, much like how you would adjust your car's accelerator.
4. And when it's time to give your battery some love, it gets charged up using a 24-volt DC dynamo. Think of it as a way to replenish your bicycle's energy reserves.
5. To keep that dynamo spinning fast and smoothly, there's a handy flywheel in play. It's like a well-oiled machine that helps maintain the dynamo's rotation even when you're pedaling and driving the bicycle.
6. To connect the dynamo to the rear wheel of your bike, we use a chain drive and freewheel.

It's sort of like how your bicycle chain links everything together, so that when you pedal, you're also keeping the dynamo turning and recharging your battery for more adventures ahead.

2. Methodology

To achieve the above stated objectives, the following methodologies are to be used:-

1. To get the ball rolling, we'll create a mathematical model for our electric two-wheeler and then run simulations using MULTISIM. This will help us figure out how much power and energy our hybrid bike needs for different types of riding.
2. We'll develop a smart control strategy that's just right for navigating the bustling streets of Indian cities. This strategy is all about using as little fuel as possible, which means fewer emissions and a cleaner environment.
3. Next up, we'll give a regular two-wheeler a futuristic makeover by turning it into a plug-in hybrid electric bike. How? By fitting a special hub motor into the front wheel.
4. We're going to conduct some real-world experiments to see just how much power and torque our engine and electric hub motor need in different situations. It's all about fine-tuning our bike for peak performance.
5. It's time to dive deep into the battery side of things. We'll thoroughly investigate how much energy and power our battery needs in various conditions to make sure we're always charged up and ready to roll.
6. We'll crunch the numbers and do some serious math to figure out the cost of our battery pack and how long it'll take to pay itself off. Let's make sure our eco-friendly ride makes financial sense too.
7. We're also going to look into the big picture. How much gas can we save, and how many greenhouse gas emissions can we reduce in the next decade in India by using our eco-friendly

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twowheelers? It's all about making a significant positive impact.
8. The brain of our setup, the controller, is powered by batteries stored in a control box. It's like the control center of our bike.
9. The controller does the heavy lifting, connecting the essential components like the throttle and electric brake assembly, as well as the hub motor. The throttle talks to the controller, and based on those signals, the controller tells the hub motor what to do.
10. We started by fitting the hub motor onto the wheel rim using spokes. It's a bit like giving your bike a high-tech boost.
11. When it came to building our bike, we made sure it could handle a heavy load. We want it to be strong and reliable, no matter where the road takes us.
12. We went through various steps to create the different parts we needed, like crafting a work of art, piece by piece.
13. Finally, we put everything together, making sure all the parts fit like a puzzle. It's like building a unique and efficient machine that's ready to hit the streets.

3. Advantages

1. In our daily lives, we've all noticed how the prices of traditional fuels are skyrocketing. It's getting tougher for the average person to afford fuel-powered bikes in just a few years.
2. We're all about making smart financial choices, and that includes saving money on transportation costs and conserving precious fuel resources.
3. We're also passionate about protecting our environment, so we want to do our part to promote a greener way of getting around.
4. One of our goals is to cut down on transportation expenses because we know how costly it can be to travel.
5. We want to ensure that everyone can enjoy a comfortable ride, no matter their age or physical ability.
6. Pollution is a big concern for us, and we're determined to reduce it as much as possible.
7. Low maintenance costs mean less money out of our pockets and more peace of mind.
8. Parking can be a real headache, but with our solution, parking is easy and often free.
9. Our vehicles are lighter compared to traditional motorbikes, making them more accessible and manageable for a wider range of people.
10. We're working on creating an electronic system that can be added to your current setup, making it more convenient for you to charge and extending the life of your battery.
11. Our solution is versatile and can be used in various settings - from industrial sites for inspections to hospitals, airports, shopping malls, and more. It's about making life more efficient.
12. Our vehicles are lightweight and easy to handle, so you don't need to be an expert to use them.
13. Safety is a top priority. We've designed our vehicles to have controlled speeds to keep riders secure.
14. We believe our solution can be used by people of all ages, including the elderly, because it's designed with simplicity and safety in mind.
15. With our on-site charging option, you can forget about visiting gas stations. It's all about making your life more convenient and hasslefree.

4. Disadvantages

Of course, let's make these technical limitations more relatable:

1. Just like how we can't keep running at full speed without getting tired, the motor in our electric bike can also get overheated if it runs for too many hours non-stop. It needs a little break to cool down.
2. Our electric bike has a weight limit, just like how a regular bike can't carry more than one or two passengers. It's all about safety and making sure the ride is comfortable.
3. While our electric bikes are fantastic for getting around, they might not have the lightning-fast speed you'd find in a petrol engine. But, hey, we're all about enjoying a smooth and eco-friendly ride, not racing through the streets!

BILL OF MATERIALS

Cycle	2000
24v DC Motor	4,500
Controller 350W	700
Throttle	350
WheelHub	1000
24V DC Dynamo	1,500
Flywheel	270
Crank	220
Batteries	1,500

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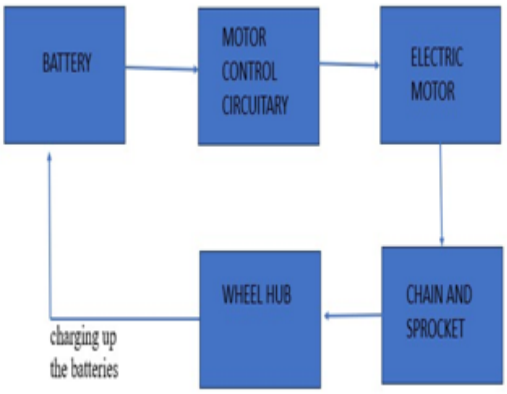
Lathe work	1000
TOTAL	13,040

BLOCK DIAGRAM



- A motor is like an electrical magician. It's a machine that takes electrical energy, the kind of energy that flows through wires, and turns it into a different kind of energy called mechanical energy. Mechanical energy is what makes things move, like the wheels on your bike.
- Now, let's talk about how a specific type of motor called a DC motor works. DC stands for Direct Current, which is a type of electricity that flows steadily in one direction, like the current from a battery.
- The trick behind a DC motor is this: When you put a wire that carries this Direct Current into a magnetic field (imagine a kind of invisible magnetic force all around), something really cool happens. The wire feels a push or a mechanical force, like a gentle nudge.
- Here's where it gets exciting for your electric bike. You know the spinning wheels on your bicycle? Well, they can do more than just move you forward.
- When you start pedaling your bike or when you're coasting downhill, the wheels are turning, right? And as they turn, they can make the electric motor in the hub (that's the central part of the wheel) work in reverse.
- Instead of the motor making your bike move, now it's acting like a magical battery charger. It's taking some of that mechanical energy from your wheels turning and turning it back into electrical energy.
- This electrical energy is used to charge up the batteries on your bike. So, while you're cruising along, you're also filling up your battery reserves for later rides.
- Think of it as a cycle of energy: from electrical energy to mechanical energy when you pedal, and then back to electrical energy as your bike stores up power for the future. It's a bit like your bike has a secret superpower, allowing you to ride and recharge at the same time!

MOTOR :

It is an 24V Dc geared motor .

Which is used to drive the cycle.

Which is controlled by controller.

And its can be accelerated by throtal.

CONTROLLER:

It is used to drive and control the motor.

It is analogous to the human brain, processing information and feeding it back to end user.

DYNAMO :

It’s use in our project to charge the battery while discharging.

When cycle is running dynamo generate dc current and charge battery’s

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When Cycle is in running position we will connect dynamo with motor.

BATTERY :

It's a 24V lithium-ion battery.

It is used to supply electricity to motor to run.

It will be charge with the help of dynamo.

OUTCOME

- A motor is an electrical machine which translates electrical energy into mechanical energy. The principle of working of a DC motor is that whenever a current carrying conductor is placed in a magnetic field, it practices a mechanical force
- If you start pedaling the bicycle or going downhill, the spinning wheels turn the electric motor in the hub in reverse and start charging up the batteries

III. CONCLUSION

In conclusion, electric bikes represent an integral part of our future by offering affordable, speedy, easy, and convenient transportation options. The increasing popularity of electric bikes can be attributed to the remarkable advancements in battery and motor technology, making them highly efficient, durable, and lightweight. What's particularly great is that you don't need to worry about external charging, thanks to the built-in dynamo that charges the battery while you ride. However, if you ever need an extra boost, you can use an adapter or eliminator for external charging, and for those who can invest, there's even the option of adding a solar panel.

One of the outstanding advantages of electric bikes is that you can hop on without any special licenses or registrations. They're not only eco-friendly but also one of the most cost-effective means of travel. Additionally, electric bike riders have the flexibility to customize their ride's difficulty level to match their individual health and fitness preferences. And here's a neat trick: if your battery ever runs out, you can switch to pedaling to keep moving, and guess what? You'll be recharging that battery as you go. Electric bikes are all about making transportation accessible, healthy, and adaptable to your needs.

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