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Use of Electric Bicycles to Reduce Global Warming

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ABSTRACT: Electrical vehicles are an effective alternative to all the vast fueled vehicles. They provide similar speed limits, solve many problems created by fueled vehicles, and even suggest an eco-friendly mode of transportation. In this paper, an idea enhancing the current situation regarding transportation globally through electricity and renewable sources of energy has been proposed. Along with the benefit of reducing global warming and carbon footprints on a large scale, this paper also suggests an innovative mode of transportation which solves many concerns that people have about their transportation. Furthermore, this e-bicycle uses solar panels, GPS tracking, speedometer, battery level indicator, horn, projection lights, camera, and a phone holder as accessories to better enhance the ride.

KEYWORDS: Electrical vehicles, eco-friendly, renewable sources of energy, global warming, carbon footprints.

1. INTRODUCTION

An electrical bicycle, also known as an e-bicycle is a regular bicycle which has been enhanced with an integrated electric motor and a battery which are used for propulsion. En electrical bicycle is an enhanced alternative to regular fueled vehicles. And with the vast range of fuel-based vehicles, we are only destroying our world and the environment that we live in. In other words, with the increasing amount of manufacturing of fueled vehicles, and with the constantly increasing use of these vehicles, we are quickly using up all the oil-based petrol and diesel that we have in our possession. A proposal which solves many issues worldwide, including global warming and the increasing generation of carbon footprints, is an e-bicycle. Electric bicycles are in fact a combination of bicycles as well as motorbikes; it combines their advantages together, and reduces their disadvantages. Essentially, an electrical bicycle is the revolution of modes of personal transport.

2. PROBLEMS FOCUSED

Following are the problems that we highlighted regarding our world:

1. Increasing Amounts of Pollution → Global Warming
2. Generation of Carbon Footprints
3. Transportation Issues for Physically Challenged People
4. Efforts applied by Delivery Men riding regular bicycles filled with heavy loads

It is crucial to focus on these issues, in order to improve transportation worldwide.

3. RELATED WORK

We have created a range of electric bicycles involving three various models. Each model its own advantages and they target different audiences which influences the design and overall outcome of these three individual e-bicycles. All three e-bicycles have a few common features which we provide in order to have the most effective working e-bicycle. Our range of e-bicycles travel an extent of 35-70 kilometers, with a top speed of 28 kilometers/hour. In addition to this, the charging time for the detachable battery is relatively low, only two hours until it is fully charged again.

The first of our three e-bicycles is the *XCELERATE 1.0* model. This utility bicycle targets all delivery men, including workers at *Swiggy*, *UberEats*, *Zomato* and similar food delivery systems, Lunch Box delivery men, mailmen, laundry men, and various other service providers who travel around big cities for a living. We are trying to make the transportation easier and efficient for the common man that helps us in our day-to-day lives in India. These people work really hard and we are attempting to make their lives easier.

Fig. 1 - *XCELERATE 1.0*

Our second and extremely unique e-bicycle is the *CYCLOTRIC 1.0* model. This sporty-looking e-bicycle targets teenagers and college-going students. Above all other features, this e-bicycle works on an entirely chain-less mechanism, rather it works on gears, providing the rider with a unique up and down motion, rather than the regular 360 degree motion.

Fig. 2 - *CYCLOTRIC 1.0*

Lastly, we have out *XCELERATE 2.0* model, which is an advanced version of our first model. This e-bicycle has a much more sportier look and also targets teenagers. Its distinctive white alloy wheels enhance the appearance of the e-bicycle.

Fig. 3 - Model *XCELERATE 2.0*

E-bikes have popularised and familiarised on a global level since it was first introduced in the market in 1992. Especially in Asia and Europe, the advantages rise above all else, its positive impact on the environment helped boost the expansion; it seems to have become the perfect mode of transportation for the future.

However, there are multiple unique factors in our range of e-bicycles which make them different from other electric bicycles in the market. Firstly, we have used detachable batteries which make it extremely easy to separate the battery from the body of the bicycle. Having to take the entire e-bicycle near a charging spot, or having to take it inside your house when the battery requires charge can prove to be a hassle and inconvenience. Which is why we are providing a battery which is detachable and which can then be taken inside with ease. In addition to that, we have anti-theft and anti-lock systems pre-installed in the body of the e-bicycle. The anti-theft system is such that even if the keys of the bicycle land in the hands of a thief, they wouldn't be able to start the e-bicycle without the second default key as well. This system prevents thefts in most scenarios and even provides a simple yet efficient manner to ensure safety. The anti-lock is one that when applied, would prevent action of moving forward or another direction. This system is located near the handle and breaks. It initiates a regulator on the motor, which then forces the motor to stop. Through this action, even when the accelerator is turned to the maximum level, there will be no action. With the addition of these and more features on our e-bicycle, we are eliminating issues that regular bicycles have.

4. BLOCK DIAGRAM

The following Block Diagram demonstrates the relation between the components of the e-bicycle and the energy source as well as how the workings of the product.

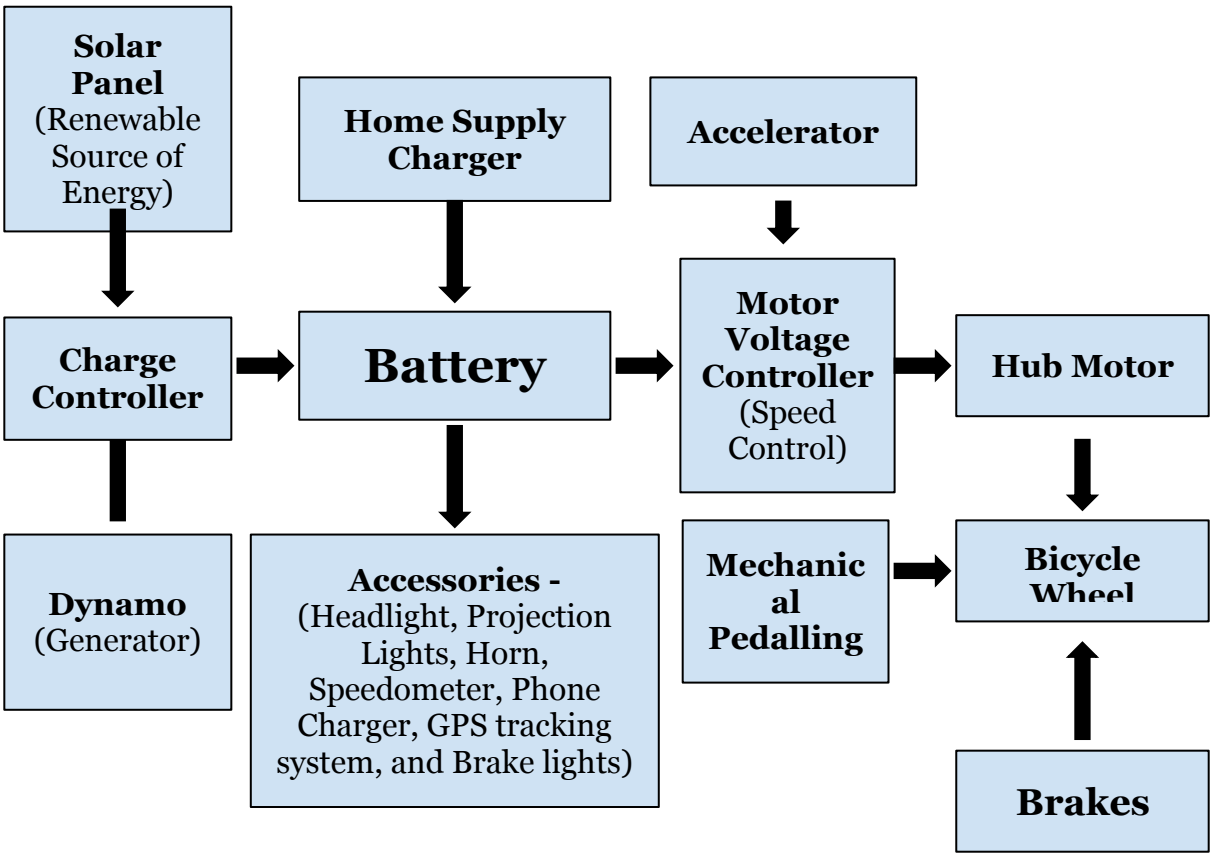

Fig. 4 - Block Diagram

5. COMPONENTS USED

Lithium Ferrous Phosphate Battery -

This Lithium Ferrous Phosphate Battery has a power rating of 250W and a voltage rating of 36V. They have an electric charging rate of 10A. Instead of using the conventional Lithium Ion Battery, we have used a Lithium Ferrous Phosphate

Battery, which is in fact a rechargeable battery made with lithium iron phosphate as the cathode material. The primary advantage includes faster charging time than other batteries. This battery also has extremely high chemical and thermal stability - meaning that the batteries do not explode at high temperatures. Even though these batteries add to the cost component, they dependability of them is extremely high. In addition to that, these batteries are incombustible, so in the event of any mishandling during charge or discharge, they are more stable under conditions such as overcharging or short circuit. In fact, they can also withstand high temperatures without decomposing. Lastly, a lithium iron phosphate based batteries are considered as safe and non-toxic material, so it does not impact the environment in a negative manner whatsoever. Rather, they have longer cycle life, and nonetheless, are economical in the long run. Figure five is an image of a battery similar to one that we have used.

Fig. 5 - Lithium Ferrous Phosphate Battery

Battery Management System –

The Lithium Ferrous Phosphate Battery is additionally fitted with an pre-installed BMS, which stands for Battery Management System. The BMS protects the battery and prevents it from operating in an unsafe situation. The BMS monitors the state of the battery, calculates secondary data such as the energy delivered to the battery since the last charge, the charge delivered, the total amount of energy delivered since the battery's first use, and much more. It additionally monitors data such as the voltage, the temperature, the battery level, the state of power, the coolant flow, and much more as well. After monitoring the conditions, the BMS controlled and balances the environment by using fan exhausts. Essentially, the BMS protects the battery from over voltage, over current, under voltage, over pressure, and ensure that the battery is being charged safely by eliminating excessive in-rush currents. Figure six is an image of the BMS that we have used in the battery.

Fig. 6 - Battery Management System (BMS)

BLDC Hub Motor –

This e-bicycle is driven by a 36V 250W BLDC Hub Motor. BLDC stands for Brushless Direct Current and it is a synchronised motor in which the magnetic field generated by the motor and the stator have the same frequency. We have used a BLDC motor rather than the conventional motor since it has many advantages. Initially, the cost of a BLDC motor is considered relatively high, however its longer life span, low maintenance, and high efficiency rates definitely make it worth the cost. This motor doesn't require any brushes, which instantly leads to a longer life span. Additionally, this also helps the motor have a higher starting torque, a higher no load speed and little to no energy loss. The motor has an efficiency rate of 83.5%, the weight is 3.10 kgs, and has a no load RPM of 447. Figure 7 is an image consisting of the BLDC Hub motor, the BMS, the throttles, the brakes, as well as the speedometer.

Fig. 7 - BLDC Hub motor, BMS, Throttles, Brakes, and Speedometer

Speedometer

The speedometer is a display unit which is extremely beneficial and informative for the rider. It displays a lot of crucial data that one might require while riding this e-bicycle. Firstly and most importantly, the speedometer displays the speed at which the e-bicycle is travelling at. It is calculated in kilometers per hour. The top speed of the hub motor has been set by us at 28 kilometers per hour. The reason behind this is that any vehicle which travels at a speed higher than 28 km/hr requires a two-wheeler license or a four-wheeler license. We are aiming to prevent such scenarios since we want to make this e-bicycle available for any and all persons. In addition to the speed, the speedometer also displays the temperature of the environment that the e-bicycle is in, using the temperature sensor located in the BMS. This is an addition that might interest any rider and is always beneficial. Furthermore, the speedometer displays the battery level indicator, which is extremely important for the rider to be informed about at all times. We have used a 36V battery, meaning that the battery level indicator should show levels from 42 to 36. Furthermore, the speedometer displays whether the GPS tracking has been switched on or not. The GPS system is located in the control box with the battery and when switched on, uses IoT to activate real-time location sharing from the component to a device. The speedometer has been displayed in figure 7.

Headlights

Right below the handles and right above the front wheel, we have attached a headlight which just makes the e-bicycle that much more road friendly. With the help of this headlight, the user can safely ride this e-bicycle even at night time or when it's dark/raining/foggy. In other words, this e-bicycle is extremely road-friendly and environmentally friendly as well. The energy source of the headlight is also the battery. Figure eight displays an image of a headlight similar to the one we have used on our e-bicycle.

Fig. 8 - Headlights

Phone Holder

A great addition to any e-bicycle is a holder for our phones. Essentially, we require our phone to reach any destination. Therefore, we have used this extremely useful phone holder. Figure nine is an image of a phone holder similar to the one we have attached to our e-bicycle.

Fig. 9 - Phone Holder

Motor Controller + Anti-Theft System

Along with the BLDC motor, we have used a motor controller. However, an addition to the motor controller is an in-built anti-theft system which (as the name suggests) comprises of an intelligent yet extremely simple burglar alarming system. This system include a two-key mechanism. Initially, you must unlock the regular key lock, however, if you do not use the

second key to unlock the motor and motor controller behind the seat, the e-bicycles immediately jerks and starting ringing and alarm system. Using IoT, a message is being sent to the owner's phone, so that they are rapidly informed and they can take action accordingly. Technically, the motor controller has a control circuit with a microcontroller, which locks the motor by generating reverse torque until the external torque is eliminated. Figure 10 is an image of a two-key system mechanism, essentially the anti-lock system.

Fig 10 - Anti-Theft System

6. FUTURE ADVANCEMENTS

There are many ways in which this e-bicycle can be advanced and enhanced to create an even more improved model in the future. Firstly, we can start a rental-based programme for the e-bicycle. Through this programme, potential customers have the option of experimenting with the e-bicycle and checking how comfortable they are with the electric vehicle. This programme would permit the rider to ride the e-bicycle anywhere they wish for a certain amount of time. The e-bicycle would have many precautionary measures taken before hand to ensure that it isn't stolen. This would include the availability of real-time location through the rigorous GPS tracking system embedded. In addition to this, there are also many more future advancements that will definitely enhance this e-bicycle further, including a dynamo generator to generate electricity as we physically peddle.

7. CONCLUSION

In conclusion, there are many issues that we are all facing worldwide. One of the most pressing issues has to be global warming, the decreasing amounts of fossil fuels and other non-renewable sources, and lastly, the increasing generation of carbon footprints world-wide. Hence, this research article suggests and highlights an efficient solution using technology, the future of our world. Additionally, it supports the idea of revolution in the modes of transportation in order to create a better world. The target of this paper is to bring light to how technology, robotics, and automation can be used to issues on a large scale. Electric bicycles are the next step in revolutionizing our world's modes of transportation.

8. REFERENCES

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