Electric Bicycle

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ABSTRACT:-Increasing demand for non-polluting mechanized transportation has revived the interest in the use of electric power for personal transportation and also reduced reliance on automobiles. A low cost alternative to an automobile is a bicycle. However, the use of bicycles has been limited to very short trips or as a recreational activity. This report describes the design of an electric assisted bicycle that will extend the range of a typical rider. The rate of improvements in technologies is at an exponential level despite that the electric bicycle is a concept that has been very feasible for years but has not been fully explored. The human electric bicycle is designed to provide electromagnetic propulsions to a bicycle therefore relieving the user of having to produce the energy required to run the bicycle. The system design is based on mechanically coupling a dc motor as the primary power source to drive the bicycle and electrically wiring the motor together with a dc rechargeable battery and efficient transmission from the source to the motor.

Key words:-Pedelec, traction battery, electric vehicle (EV), hybrid electric vehicle (HEV), Powertrain

I. Introduction

An **electric bicycle**, also known as an **e-bike** or **booster bike**, is a bicycle with an integrated electric motor which can be used for propulsion. There are a great variety of e-bikes available worldwide, from e-bikes that only have a small motor to assist the rider's pedal-power (i.e., pedelecs) to somewhat more powerful e-bikes which tend closer to moped-style functionality: all, however, retain the ability to be pedalled by the rider and are therefore not electric motorcycles. E-bikes use rechargeable batteries and the lighter varieties can travel up to 25 to 32 km/h (16 to 20 mph), depending on the laws of the country in which they are sold, while the more high-powered varieties can often do in excess of 45 km/h (28 mph). In some markets, such as Germany, they are gaining in popularity and taking some market share away from conventional bicycles, while in others, such as China, they are replacing fossil fuel-powered mopeds and small motorcycles. A key advantage of hybrid or plug-in electric vehicles is regenerative braking due to their capability to recover energy normally lost during braking as electricity is stored in the on-board battery



(Fig.1-A mountain bike styled e-bicycle)

II. LITERATURE REVIEW

In **1999,AVL Company** proposed a hybrid system that used a 50 cccarburetted lean-burn two-stroke engine with a 0.75 kW electric motor mounted on the engine crankshaft mainly to provide increased torque during acceleration.[1]

Su-Hau et al (2004) focused on the highly efficient energy usage of the battery energy and proposed an integrated management system for electric motor.[2]

David and **Sheng-Chung** (2004) proposed new parallel-type hybrid-electric-power system comprises an engine's energy distribution and a torque-integrated mechanism (specifically including an engine, a motor/alternator, a CVT device, and PCM as well as a 3-helical gear set).[3]

Wenguang et al (2005) presented an approach to control powertrain of series hybrid electric vehicles. A formulation of the system equations and controller design procedure were proposed by them. They also proposed a new switching algorithm for the power converter for motor torque and motor flux control.[4]

Daniel (2007) designed, developed and implemented a series hybrid electric vehicle. Though he proposed the architecture as hybrid electric vehicle architecture, he showed that the vehicle runs well in the electric mode and left the hybrid conversion as future expansion.[5]

Lukic et al (2007) tried to develop a driving cycle of the auto rickshaw in a typical large Indian city, in their case, Delhi. First, they considered the existing driving cycles used in India are considered as candidates. Since these data were not applicable, GPS data collected at various times of the day were applied to the analysis. They derived the new driving cycle from the gathered information via GPS data as well as surveys of auto rickshaw drivers in India, which helped to get the entire picture for the driving cycle.[6]

'Investigation of an electric assisted bicycle and determination of performance characteristics' paper examines and realizes an alternative design for a front wheel hub direct drive, which utilizes a three-phase brushless PM motor.[7]

III. What is an electric vehicle?

An electric vehicle (EV), also referred to as an electric drive vehicle, uses one or more electric motors or traction motors for propulsion. An electric vehicle may be powered through a collector system by electricity from off-vehicle sources, or may be selfcontained with a battery or generator to convert fuel to electricity. EVs include road and rail vehicles, surface and underwater vessels, electric aircraft and electric spacecraft. Electric vehicles are different from fossil fuel-powered vehicles in that they can receive their power from a wide range of sources, including fossil fuels, nuclear power, and renewable sources such as tidal power, solar power, and wind power or any combination of those. However it is generated, this energy is then transmitted to the vehicle through use of overhead lines, wireless energy transfer such as inductive charging, or a direct connection through an electrical cable. In an electric vehicle (EV), a battery or other energy storage device is used to store the electricity that powers the motor. EV batteries must be replenished by plugging in the vehicle to a power source. Some electric vehicles have onboard chargers; others plug into a charger located outside the vehicle. Both types, however, use electricity that comes from the power grid. Although electricity production may contribute to air pollution, EVs are considered zero-emission vehicles because their motors produce no exhaust or emissions. In a parallel hybrid motorized bicycle, such as the aforementioned 1897 invention by Hosea W. Libbey, human and motor inputs are mechanically coupled either in the bottom bracket, the rear or the front wheel, whereas in a (mechanical) series hybrid cycle, the human and motor inputs are coupled through differential gearing. In an (electronic) series hybrid cycle, human power is converted into electricity and is fed directly into the motor and mostly additional electricity is supplied from a battery. The electricity may then be stored on board the vehicle using a battery, flywheel, orsupercapacitors. Vehicles making use of engines working on the principle of combustion can usually only derive their energy from a single or a few sources, usually non-renewable fossil fuels. A key advantage of hybrid or plug-in electric vehicles is regenerative braking due to their capability to recover energy normally lost during braking as electricity is stored in the onboard battery.

IV.Electricity sources

4.1.Connection to generator plants

- Direct connection to generation plants as is common among electric trains, trolley buses, and trolley trucks.
- Online Electric Vehicle collects power from electric power strips buried under the road surface through electromagnetic induction

4.2. Onboard generators and hybrid EVs

- generated on-board using a diesel engine: diesel-electric locomotive
- generated on-board using a fuel cell: fuel cell vehicle
- generated on-board using nuclear energy: nuclear submarines and aircraft carriers
- renewable sources such as solar power: solar vehicle

It is also possible to have hybrid EVs that derive electricity from multiple sources. Such as:

- on-board Rechargeable Electricity Storage System (RESS) and a direct continuous connection to land-based generation
 plants for purposes of on-highway recharging with unrestricted highway range
- on-board rechargeable electricity storage system and a fueled propulsion power source (internal combustion engine): plug-in hybrid

V. Lithium-ion battery

Most electric vehicles use lithium ion batteries. Lithium ion batteries have higher energy density, longer life span and higher power densitythan most other practical batteries. Complicating factors include safety, durability, thermal breakdown and cost. Li-ion batteries should be used within safe temperature and voltage ranges in order to operate safely and

efficiently.Increasing the battery's lifespan decreases effective costs. One technique is to operate a subset of the battery cells at a time and switching these subsets.

V.I. Electric motor

The power of a vehicle electric motor, as in other vehicles, is measured in kilowatts (kW). 100 kW is roughly equivalent to 134 horsepower, although electric motors can deliver their full torque over a wide RPM range, so the performance is not equivalent, and far exceeds a 134 horsepower (100 kW) fuel-powered motor, which has a limited torque curve.Usually, direct current (DC) electricity is fed into a DC/AC inverter where it is converted to alternating current (AC) electricity and this AC electricity is connected to a 3-phase AC motor.

V.II. Hybrid EVs

A hybrid electric vehicle combines a conventional (usually fossil fuel-powered) powertrain with some form of electric propulsion. As of April 2016, over 11 million hybrid electric vehicles have been sold worldwide since their inception in 1997. Japan is the market leader with more than 5 million hybrids sold, followed by the United States with cumulative sales of over 4 million units since 1999, and Europe with about 1.5 million hybrids delivered since 2000. Japan has the world's highest hybrid market penetration. By 2013 the hybrid market share accounted for more than 30% of new standard passenger car sold, and about 20% new passenger vehicle sales including kei cars.

V.III. On- and off-road EVs

EVs are on the road in many functions, including electric cars, electric trolleybuses, electric buses, battery electric buses, electric trucks, electric bicycles, electric motorcycles and scooters, neighborhood electric vehicles, golf carts, milk floats, and forklifts. Off-road vehicles include electrified all-terrain vehicles and tractors.

V.IV. Energy and motors

In the systems above motion is provided by a rotary electric motor. However, it is possible to "unroll" the motor to drive directly against a special matched track. In addition to the high-performance control systems needed, switching and curving of the tracks becomes difficult with linear motors, which to date has restricted their operations to high-speed point to point services.

VI.Components

The type of battery, the type of traction motor and the motor controller design vary according to the size, power and proposed application, which can be as small as a motorized shopping cart or wheelchair, through pedelecs, electric motorcycles and scooters, neighborhood electric vehicles, industrial fork-lift trucks and including many hybrid vehicles.

VII.Energy sources

Although EVs have few direct emissions, all rely on energy created through electricity generation, and will usually emit pollution and generate waste, unless it is generated by renewable source power plants. Since EVs use whatever electricity is delivered by their electrical utility/grid operator, EVs can be made more or less efficient, polluting and expensive to run, by modifying the electrical generating stations. This would be done by an electrical utility under a government energy policy, in a timescale negotiated between utilities and government.

VIII. Issues with batteries

An **electric vehicle battery** (EVB) or **traction battery** is a battery used to power the propulsion of battery electric vehicles (BEVs). Vehicle batteries are usually a secondary (rechargeable) battery. Traction batteries are used in forklifts, electric Golf carts, riding floor scrubbers, electric motorcycles, full-size electric cars, trucks, and vans, and other electric vehicles.

IX. Efficiency

Because of the different methods of charging possible, the emissions produced have been quantified in different ways. Plug-in allelectric and hybrid vehicles also have different consumption characteristics.

X.Charging

If a large proportion of private vehicles were to convert to grid electricity it would increase the demand for generation and transmission, and consequent emissions. However, overall energy consumption and emissions would diminish because of the higher efficiency of EVs over the entire cycle. A recharging system that avoids the need for a cable is Curb Connect, patented in 2012 by Dr. Gordon Dower. In this system, electrical contacts are fitted into curbs, such as angle parking spaces on city streets. When a suitably authorized vehicle is parked so that its front end overhangs the curb, the curb contacts become energized and charging occurs.

XI. Battery swapping

Instead of recharging EVs from electric socket, batteries could be mechanically replaced on special stations in a couple of minutes (battery swapping).Batteries with greatest energy density such as metal-air fuel cells usually cannot be recharged in purely electric way. Instead, some kind of metallurgical process is needed, such as aluminum smelting and similar.Silicon-air,

aluminum-air and other metal-air fuel cells look promising candidates for swap batteries. Any source of energy, renewable or non-renewable, could be used to remake used metal-air fuel cells with relatively high efficiency.

XII. The Advantages of Electric vehicles

XIII.I Save Your Money On Gas

Driving a car that runs solely on gasoline can become an extremely expensive thing. Gas prices are unpredictable and have reached some very high peaks in the past decade. Electricity is much cheaper than gas in the long run so driving an electric car can same you a countless amount of money.

XIII.II. You're Saving TheWorld

Gas powered vehicles emit a large amount of carbon emissions into the air that cause damage to the atmosphere and contribute to environmental problems such as global warming. Electric vehicles have absolutely no emissions from them, which is a wonderful thing for the environment because no further damage is being done.

XIII.III. Less Maintenance Is Required

Electric cars have motors that run solely on electricity, which makes them much different than a gasoline powered car. Gas cars have engines and many intricate parts that have to remain sufficiently lubricated in order to run properly, and this work has to be done pretty often. With electric cars, while some maintenance is needed of course, it is much cheaper and much less frequent than it is with gas powered vehicles.

XIII.IV. Energy efficiency

Energy is not consumed while the vehicle is stationary, unlike internal combustion engines which consume fuel while idling. However, looking at the well-to-wheel efficiency of EVs, their total emissions, while still lower, are closer to an efficient gasoline or diesel in most countries where electricity generation relies on fossil fuels.

XIII.V. Future work of electric bicycle

The following materials will be needed for designing of an electric bicycle.

- a bicycle
- a cordless drill (any voltage will work but the bigger the better)
- lots of zip-ties (how many you will use depends on your type of bike and/or drill)
- a piece of small wood (this will support the drills' battery)
- a bicycle hand brake (this is for the throttle system)
- bicycle cable (this also for the throttle system and goes into the hand brake)

Step 1: Adding the drill

First of all we have to take a drill and make such an arrangement that will help to run the bicycle. Here are some of the pictures that will help us how to make the arrangement.



(Fig.2-A cycle and drill setup)

Step 2: Zip-tieing the drill down

Now begin to zip-tie the drill onto the bicycle frame. Make sure that the drills' chuck always stays on the side of the tire. Try to keep the drill in line with the tire. Get the drill as snug **AS POSSIBLE** against the side of the tire. The more friction you have the better the drill will grip the tire.



(Fig.3- drill tied to cycle)

Step 3: Adding the throttle system

Combine the hand brake and the cable and the slide the hand brake on to the handlebars of the bicycle. This will probably require removing the handlebar grips. Finally, tighten down the hand brake.



(Fig.4 - Different views of throttle cable arrangement)

Step 4: Attaching the throttle cable

Beware this is the hardest part of the instructable. Take the bicycle cable and lead it down to the side of the drill where the trigger is. Zip-tie the end of the black part of the cable to the SIDE of the drill. Wrap the metal part of the cable around the trigger and back to the side of the drill. Zip-tie the black part of the cable and the end of the metal section of the cable together. Make sure that the cable does not pull on the trigger. It should only pull on it when you pull on the brake handle. You can skip this step and just pull the drills trigger with your hand. However you have to drive with one hand.

Step 5: You are done!!!!!

You are done!!!!!!! However this bicycle doesn't have a whole lot of economical value it only goes about as fast as a rather drained barbie jeep. It is more just for fun. Or it can be used for riding around the block and laughing maniacally and scaring little children all at the same time!! Or looking cool. Just remember to use a drill that you don't use a lot.

XIV. Conclusions

China has experienced an explosive growth of sales of non-assisted e-bikes including scooter type, with annual sales jumping from 56,000 units in 1998 to over 21 million in 2008, and reaching an estimated fleet of 120 million e-bikes as of early 2010. This boom was triggered by Chinese local governments' efforts to restrict motorcycles in city centers to avoid traffic disruption and accidents.Users began replacing traditional bicycles and motorcycles and, in e-bike became an alternative to commuting by car.Nevertheless, road safety concerns continue as around 2,500 e-bike related deaths were registered in 2007. China is the world's leading manufacturer of e-bikes, with 22.2 million units produced in 2009. Production is concentrated in five regions, Tianjin, Zhejiang, Jiangsu, Shandong, and Shanghai. China exported 370,000 e-bikes in 2009. The issues associated with electric bicycles may be addressed by custom-designed drives that are most efficient over a given operating cycle. These include city bicycles, hill bicycles, distance bicycles, and speedy bicycles.

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