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RESEARCH ARTICLE

FABRICATION OF ELECTRIC BIKE

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ABSTRACT

The main purpose of this document is to explore how global research on electric bicycles is being conducted and to identify the main trends in the field. The study is based on an analysis of journals related to the topic of electric bicycles in the Scopus catalogue up to the year 2017. The keyword analysis reveals that the main focus of research is on the electrical aspect of electric bicycles, followed by battery and motor-related topics. The study also identifies six main areas of research related to electric bicycles, namely transportation environment, electrical engineering, safety, batteries, sporting goods-urban planning, and mechanical engineering.

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INTRODUCTION

In recent years, environmental problems caused by fuel vehicles and fuel economy become more and more serious. The vehicles of new energy, which is green, environmentally friendly and economical, is an important goal for economic and social development of many countries, but also the future development direction of the vehicle. EV is a vehicle with zero pollution emissions, mileage and fuel vehicles can be mutually comparable electric vehicles. Being an e-scooter the electric system plays a promising role in its designing and creation. The electric system consists of battery, motor, motor controller and other electronic equipment. The most important thing that electric system does is that it gives power to the motor which helps in the running of the scooter. This energy in form of chemical or electric energy is stored in the battery which is used by a hub motor, thus the electric or chemical energy converted to mechanical energy. A proper electric system is important to ensure driver and vehicle safety in case of collision. The brushless DC (PMDC) motor is fixed to hub of rear wheel of e bike. The reason for choosing PMDC motor is its compactness and noiseless operation. since the interest in using an electric motor drive system as electric vehicles has been increasing, there have been lots of studies on them. Related producthave begun to appear in the market. The in- wheel motor drive system that places motors adjacent to the wheel or builds motors directly in the wheels can also be applied to various transportation system such as electric bicycle, electric powered wheelchair having two wheels, and electric cars having four wheels. To survive in the market, products must meet the desired performance on the market. From the standpoint of propulsion electric motor design such as in-wheel motors, cost saving must be taken into account, along with better performances such as power density and efficiency. When considering price factors, many efforts have been made to save rare earth permanent magnet (PM) while maintaining basic properties. Researchers are working worldwide to develop more efficient electrical drive system by motor design to reduce its weight and losses in coils and magnetic core materials. These efforts are also related to reduction in operating cost.

BACKGROUND

Today if any product is developed or about to develop, then the main concern for engineers is the consequences that the product brings on the environment. But this is an obligation for automotive industry. Now people's awareness on environmental protection is getting higher and higher. Traditional fossil fuels are gradually withdrawing from people's lives. The use of electric energy is becoming more and more extensive. Motorcycles are traditional fossil fuel vehicles. So thus, all the companies investing billions in the research and development for reducing carbon footprints, how-ever many companies have already

released and some other companies about to release their electric vehicles in-to the market with-in few years.

OBJECTIVES

- To reduce running cost of vehicle
- To reduce the emissions
- To overcome the draw backs of electric vehicle
- To increase life period and efficiency of existing e -bike.

The main reason of the project is to design a smart e-bike which is be able to transport a person guaranteeing the safety of the conductor and of the citizens around them

LITERATURE SURVEY

In 1993, Kumar and Oman proposed using electric bicycles powered by nickel-metal hydride batteries to provide low-cost, pollution-free transportation in developing nations. They developed a controller for the electric bicycle's motor that varied power based on the bicycle's speed. In 1994, Morchin added electric propulsion to a conventional bicycle to create an electric bicycle. He noted that the average speed of an electric bicycle was 8 to 10 km/h faster than a pedalled bicycle, and that they did not require registration, licensing, or special operator qualifications. In 1995, Oman, Morchin, and Jamerson proposed using human power in combination with electric power to extend the range of an electric bicycle.

They calculated available travel distances based on factors like speed, grade, and battery energy content. In 2002, Lomon ova discussed the design and implementation of an electrically assisted bicycle developed by ID Bike and Technical University of Eindhoven. In 2016, Dumitrache, Carp, and Pana described how a low-power microcontroller could be used to drive a brushless DC motor in an electric bicycle, as well as manage other functions on the bike. T1lakiswaran presented a paper on the development of a battery-powered tricycle in order to create an inexpensive form of transportation. The tricycle is powered by a rechargeable battery and can be propelled by the motor alone or by pedalling.

MATERIALS

- SQUARE TUBE
- FREE WHEEL &CHAIN
- PMDC MOTOR
- CONTROLLER
- WHEEL
- BATTERY
- THROTTLE HANDLE
- BRAKE LIGHT

SQUARE TUBE

Rectangular and square HSS are also commonly called tube steel or box sections. Circular HSS are sometimes mistakenly called steel pipe, although true steel pipe is actually dimensioned and classed differently from HSS. Square tubes are generally used for maintenance and structural purposes. Some examples of applications would be building construction, railings, and sign posts. They are measured by their outside dimensions and their wall thickness. Square Steel Tube is a welded structural grade tubing that is available in either type A513 or A500 Grade B, depending on its size and wall thickness. Either grade is ideal for all structural applications, general fabrication, manufacturing and repairs.

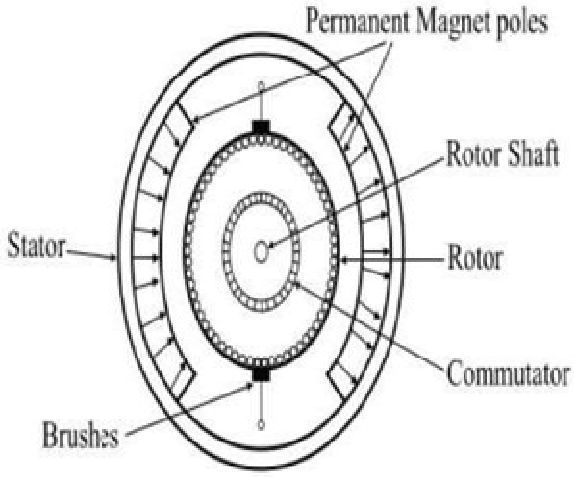
FREE WHEEL & CHAIN

A bicycle chain is a roller chain that transfers power from the pedals to the drive-wheel of a bicycle, thus propelling it. Most bicycle chains are made from plain carbon or alloy steel, but some are nickel-plated to prevent rust, or simply for aesthetics. New chains usually come in a stock length, long enough for most upright bike applications. The appropriate number of links must be removed before installation in order for the drive train to function properly. The pin connecting links can be pushed out with a chain tool to shorten, and additional links may be added to lengthen. In mechanical or automotive engineering, a freewheel or overrunning clutch is a device in a transmission that disengages the driveshaft from the driven shaft when the driven shaft rotates faster than the driveshaft. An overdrive is sometimes mistakenly called a freewheel, but is otherwise unrelated. The condition of a driven shaft spinning faster than its driveshaft exists in most bicycles when the rider stops pedalling. In a fixed gear without a freewheel, the rear wheel drives the pedals around. An analogous condition exists in an automobile with a manual transmission going downhill, or any situation where the driver takes their foot off the gas pedal, closing the throttle: the wheels drive the engine, possibly at a higher RPM. In a two-stroke engine, this can be catastrophic—as many two stroke engines depend on a fuel/oil mixture for lubrication, a shortage of fuel to the engine starves oil from the cylinders, and the pistons can soon seize, causing extensive damage.

PMDC MOTOR

A permanent magnet DC (PMDC) motor is a type of DC motor whose field poles are made up of permanent magnets. In a PMDC motor, the permanent magnet poles are radially magnetised and mounted on the inner periphery of the stator of the motor. The stator also serves as a return path for the magnetic flux. The rotor of the PMDC motor has a conventional DC armature with commutator and brushes. In a

permanent magnet DC motor, the torque is produced by the interaction between axial current carrying rotor conductors and the magnetic flux produced by the permanent magnetic poles.



- PMDC motors do not require field winding, thus, they do not have field circuit copper loss.
- the effects of corrosion, especially when used in saltwater PMDC motors have higher efficiency as compared to conventional DC motors.
- Since field winding are not used in PMDC motors, hence, these motors are compact in sized than conventional DC motors.
- As the magnetic field is created by permanent magnets, there is no need of field excitation arrangement in case of PMDC motors

WHEELS

A wheel is a circular component that is intended to rotate on an axle bearing. The wheel is one of the key components of the wheel and axle which is one of the six simple machines. Wheels, in conjunction with axles, allow heavy objects to be moved easily facilitating movement or transportation while supporting a load, or performing labour in machines. Wheels are also used for other purposes, such as a ship's wheel, steering wheel, potter's wheel and flywheel. Common examples are found in transport applications. A wheel greatly reduces friction by facilitating motion by rolling together with the use of axles. In order for wheels to rotate, a moment needs to be applied to the wheel about its axis, either by way of gravity or by the application of another external force or torque. Using the wheel, Sumerians invented a contraption that spins clay as a potter shapes it into the desired object.

BATTERY

A twenty-four-volt battery has four single cells in series producing a fully charged output voltage of 19.2V- 25.2 volts. In a series connection, there are multiple terminals and so multiple terminal connectors are used as well.

The positive battery terminals are connected to the positive terminal connectors while the negative battery terminals are connected to the negative connectors. In a lithium-ion battery, carbon is used as the anode, and lithium oxide is used as the cathode . Your 24 V battery system will power most of your basic systems like your lights and some appliances in your RV. You'll charge this battery system while plugged into shore power and draw from it while traveling or boondocking. 24V batteries are used in most vehicles because the electrical components such as the starter, lighting, and ignition systems are designed to operate on 24 volts. The 24-volt rating of a battery is the nominal voltage and it may be slightly higher or lower depending on charge. They have higher energy densities, so they can store more energy per charge than NiCad or lead acid batteries, making them more efficient at delivering power when needed. Electric bicycles powered by lithium-ion batteries offer a great way for riders to reduce their carbon footprint and benefit the environment.

THROTTLE HANDLE & BRAKE LEVER

A throttle is the mechanism by which fluid flow is managed by constriction or obstruction. An engine's power can be increased or decreased by the restriction of inlet gases (by the use of a throttle), but usually decreased. The term throttle has come to refer, informally, to any mechanism by which the power or speed of an engine is regulated, such as a car's accelerator pedal. What is often termed a throttle (in an aviation context) is also called a thrust lever, particularly for jet engine powered aircraft. For a steam locomotive, the valve which controls the steam is known as the regulator. In an internal combustion engine, the throttle is a means of controlling an engine's power by regulating the amount of fuel or air entering the engine. In a motor vehicle the control used by the driver to regulate power is sometimes called the throttle, accelerator, or gas pedal. For a gasoline engine, the throttle most commonly regulates the amount of air and fuel allowed to enter the engine.

CONTROLLER

A motor controller is a device or group of devices that can coordinate in a predetermined manner the performance of an electric motor.A motor controller might include a manual or automatic means for starting and stopping the motor, selecting forward or reverse rotation, selecting and regulating the speed, regulating or limiting the torque, and protecting against overloads and electrical faults. Motor controllers may use electromechanical switching, or may use power electronics devices to regulate the speed and direction of a motor. Motor controllers are used with both direct current and alternating current motors. A controller includes means to connect the motor to the electrical power supply, and may also include overload protection for the motor, and overcurrent protection for the motor and wiring. A motor controller may also supervise the motor's field circuit, or detect conditions such as low supply voltage, incorrect polarity or incorrect phase sequence, or high motor temperature. Some motor controllers

limit the inrush starting current, allowing the motor to accelerate itself and connected mechanical load more slowly than a direct connection. Motor controllers may be manual, requiring an operator to sequence a starting switch through steps to accelerate the load, or may be fully automatic, using internal timers or current sensors to accelerate the motor. Some types of motor controllers also allow adjustment of the speed of the electric motor. For direct-current motors, the controller may adjust the voltage applied to the motor, or adjust the current flowing in the motor's field winding. Alternating current motors may have little or no speed response to adjusting terminal voltage, so controllers for alternating current instead adjust rotor circuit resistance (for wound rotor motors) or change the frequency of the AC applied to the motor for speed control using power electronic devices or electromechanical frequency changers.

BRAKE LIGHT

The lighting system of a motor vehicle consists of lighting and signalling devices mounted or integrated at the front, rear, sides, and in some cases the top of a motor vehicle. They illuminate the roadway ahead for the driver and increase the vehicle's visibility, allowing other drivers and pedestrians to see its presence, position, size, and direction of travel, and its driver's intentions. Emergency vehicles usually have distinctive lighting equipment to warn drivers and indicate priority of movement in traffic. Brake lights are there to warn other drivers that you're slowing down. If they fail, following vehicles can charge up to your rear bumper, scaring everyone in both cars or, worse, actually rear-end you.

WORKING

Main focus of the project is to develop a low-cost Electric bicycle as compared to Electric Bike available in the market and to achieve this, the cycle is fabricated as simple as possible. Firstly, the old cycle frame is used, and a metal box is fabricated inside the frame of the bike body.

The metal box is made to keep the battery, Controller and the other wiring safe from mechanical damage which will increase the safety of the cycle and increase the life of the Electric and Electronic components used to make Electric Bicycle. The main power source of the electric Bicycle is battery which is a lead acid battery made by using a number of lithium-ion cells by connecting cells in series and parallel combination to achieve the targeted voltage and current ratting which is used to power up the components of the cycle like controller, Motor, Light, Horn, etc.

DESIGN CALCULATION

Step 1 :- Number of teeth on smaller sprocket (motor) (t1) = 9
Number of teeth on larger sprocket (bicycle) (t2) = 18 Speed on smaller sprocket(motor) (N1) = 600 rpm by using reduction ratio (9.78), speed will be reduced to 338 rpm Speed on larger sprocket (bicycle) (N2) =?

Step 2:- Using speed ratio formulae, From the law of gearing, we know that, N1/N2 = t2/t1 N1t1 = N2t2 N2 = 300 rpm

Step 3: Diameter of wheel = 650mm
Circumference of wheel = (π*D) =3.14*650 =2041mm□ 2m

Step 4 : We know that the distance travelled by a wheel in one revolution is equal to the circumference of the wheel. Therefore, the number of revolutions of the wheel per unit time multiplied by the circumference of the wheel gives the distance travelled by the vehicle per unit time, which is the speed of the vehicle. Speed of vehicle = speed of wheel X circumference of wheel
=17.25 Km/hr

REQUIRED POWER TO DRIVE BICYCLE

Step 1: - Total load act on bicycle is as follow Normal weight of person

= 65 kg =65*9.81 N
= 637.65N

Weight of bicycle = 5 kg = 5*9.81 = 49.N N
Other Miscellaneous load =5 Kg =5*9.81 = 49.05 N The total load = (637.65+49+49.04) = 735.65N

Step 2:- To find reaction on each wheel,
The above total load which is divided equally on both wheel Force (Ffw) =Force (Frw) =735.7/2 =367.8N

Step 3:

•To find torque on each wheel Total torque=Tf_W+Tr_W

To find Torque on Front Wheel
Fr_W=μ*RN
Here μ=0.1 Fr_W=0.1*343=34.3 N
T_1 = Fr_W*(D÷2) =34.3*[(0.650)/2] =11.14Nm (here D=650mm 0.650m)
T_1=T2=11.14Nm
Total torque on wheel=22.28 Nm Step **4** :-
To find power on motor P=(2πNT)/60 (2*π*300*11.14)/60= 349.97 watts Power P=349.97 watts

ADVANTAGES

- Improved physical health. Some people may think because the bike is electric and takes less effort to ride that it's not really exercise.
- Easier to ride. Pedal assist gives riders a boost.
- Better mental health.
- Great alternative to cars.
- Faster and safe.
- Deployable batteries can be taken inside house
- Cost of the unit is very low.
- Easy to carry since it is portable. Less energy consumed.

High efficiency can be obtained if inverter is used.

DISADVANTAGES: Electric Bikes May Cost More Than Traditional Bicycles. E-Bikes typically cost more to buy and maintain than traditional bikes.

Electric Bikes Can Be Hefty Electric Bike Riding Rules Aren't Always Clear. Electric Bike Batteries Can Be a Hassle.

APPLICATIONS: Transportations Local Travelling

CONCLUSION

During this semester the electric bicycle project has provided an opportunity of understanding the full possibility of what it means to Strategy a creation. This chance allowed an primary idea/goal to be understood in a team atmosphere. The idea developed as examination and several other information on the topic was acquired. The project evolved and changed as the team restrictions and financial constraints were realized. Due to a lack of funding. The initial design, of the electric supported E-Bike, conceded along with-it restrictions that had to be operated. around. The limitations were mainly economic in nature. They characterize pieces of apparatus in the design that had to be passed over from other semesters. The restrictions on the apparatus comprised of the battery, motor, and the E-Bike frame. The motor bicycle association could not be altered, mostly due to the type of growing on the motor. These limitations unsatisfactory, but did not totally limit the team's competency to proposal a "new" preparation. Once all restrictions were known, the goals for the design were clearly acknowledged. The goals were divided among the team members. In order to meet the deadline for the ending project, development was supervised weekly and different goals were get used to as needed. With communication between the group, and inflexible effort, the final objective was attained.

The proposal project provided the team with valuable involvement in design and teamwork. It allowed the team members to develop skills that will be useful in future goings-on.

FUTURE SCOPE

Electric (E-Bikes) that have a small electric motor and rechargeable batteries to assist the power provided by the rider. Electric bicycles are to witness a significant growth over the forecast period owing to new technology developments and the increasing affordability and availability of product offerings. Innovative technologies emerging in the e-bikes market is expected to drive the market growth over the forecast period. For example, throttle-control, pedal-assist models, all-in-one retrofit kits and wheels, and electric cargo bicycles. The use of these bicycles in police patrol and various other security industries has contributed to a growing market with strong potential. These bicycles emit a lot less carbon than a car would. A study from Transportation Alternatives found that if 10% of New York City commuters biked to work just once a week instead of driving or taking public transit, they could cut back on 120 million pounds of CO2 emissions per year that is equal to the amount of CO2 released by 25,000 New York homes per year.

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