Research Article Impact Factor: 4.226 ISSN: 2319-507X
V Rajeev, IJPRET, 2014; Volume 3 (4): 277-284 IJPRET

INTERNATIONAL JOURNAL OF PURE AND APPLIED RESEARCH IN ENGINEERING AND TECHNOLOGY

A PATH FOR HORIZING YOUR INNOVATIVE WORK

INVESTIGATION & PERFORMANCE OF AN ELECTRIC BIKE USING 4 SPEED GEAR BOX

V. RAJEEV, S. ARUNKUMAR

Assistant Professor, Dept of Mechanical Engineering, Apollo Engineering College, Chennai, Tamilnadu, India.

Accepted Date: 22/11/2014; Published Date: 01/12/2014

Abstract: The automotive industry is currently seeking more efficient ways of increasing fuel economy. Hybrid-electric vehicles are a promising answer to this need. This project is to build upon this exciting technology to design a unique personal transportation device. Technological advances have overcome hurdles of early systems and cities throughout the globe are adopting this model of transportation service. Electric bikes have simultaneously gained popularity in many regions of the world. This paper outlines system requirement to successfully develop and deploy an electric bike sharing system, focusing on system architecture, operational concepts, and battery management. Although there is little empirical evidence, electric bike sharing could be feasible, depending on demand and battery management, and can potentially improve the utility of existing, bike sharing system. The paper presents the possibility of acceleration of two-stroke combustion engine used in motorbike. This paper deals with the method of charging and discharging electric energy main sources, electrical to mechanical energy conversion and vice versa. Basic conception comes out of combustion engine and microprocessor controlled electromotor cooperation.

Keywords: E-bike, 4 speed gear box, commuter bike, D.C motor

Corresponding Author: MR. V. RAJEEV

Access Online On:

www.ijpret.com

How to Cite This Article:

V Rajeev, IJPRET, 2014; Volume 3 (4): 277-284

PAPER-QR CODE

INTRODUCTION

Hybrid electric bike has emerged as an innovative of public transport to provide urban short distance transportation. Electric bike couples the benefits of shared ownership and expense with personal and demand responsive transportation. This model, driven by improved technology and advances in other shared vehicle platforms has filled an important opening in the transportation system of many global cites, improving sustainability of transportation services and accessibility in urban areas. Electric motorcycles are plug-in electric vehicles with two wheels that can be recharged from any external source of electricity, and the electricity is stored on board in a rechargeable battery, which powers an electric motors to attain locomotion. Electric and gasoline powered motorcycles of the same size and weight are roughly comparable in performance. In August 2013 Road and Track evaluated a high-end electric motorcycle as "faster and better handling than any conventionally powered bike." Electric machines have better 0 t4o 60 acceleration, since they develop full torque immediately, and without a clutch the torque is instantly available. Electric motorcycles suffer considerable disadvantage in range, since batteries cannot store the same amount of energy as a tank of gas. Electric machines excel as daily commuters traveling a fixed distance, but range anxiety precludes the sense of the freedom of the open road that a gas machine offers. Also electric power trades off range against speed more dramatically than gasoline power. At approximately electric machines enjoy an enormous fuel cost advantage. Electric vehicles are far quieter than gas powered. In January 2013, the Indian government announced a plan to provide subsidies for hybrid and electric vehicles. The plan will have subsidies up to 150000 for cars and 50000 on two wheelers. India aims to have seven million electric vehicles on the road by 2020.

COMPONENTS AND FABRICATION

BIKE Frame, D.C Motor, Batteries, Clutch, 4 -speed Gear box2.6, Crank shaft, Primary gear wheel, V-belt drive, Chain sprocket, Regulator, Rectifier are the components used to fabricate electronic bike.

BIKE FRAME: A structural function which means guaranteeing a rigid, secure attachment between the front suspension, the steering head, the rear suspension and the rear fork, and at the same time, holding in place.

The engine (in this project we replace engine with D.C motor); the rider, passenger and luggage; Front and rear wheels. All the auxiliaries, such as: fuel tank, batteries, lights, mirrors etc.; a geometrical functions that is, to satisfy all the requirements necessary for good biking

performance. It must allow the creation of appropriate steering head and trail angles, provide the desired stiffness, distribute the weight correctly, determine the fixed wheelbase distance, and finally, set the correct positioning of the engine sprocket and swing arm axis.. In this project we have used Suzuki max 100 bike's frame.

D.C MOTOR: A DC motor relies on the fact like magnet poles repel and unlike magnetic poles attract each other. A coil of wire with a current running through it generates a electromagnetic field aligned with the center of the coil. By switching the current on or off in a coil its magnet field can be switched on or off or by switching the direction of the current in the coil the direction of the generated magnetic field can be switched 180°. A simple DC motor typically has a stationary set of magnets in the stator and an armature with a series of two or more windings of wire wrapped in insulated stack slots around iron pole pieces (called stack teeth) with the ends of the wires terminating on a commutator. The armature includes the mounting bearings that keep it in the center of the motor and the power shaft of the motor and the commutator connections. The winding in the armature continues to loop all the way around the armature and uses either single or parallel conductors (wires), and can circle several times around the stack teeth. The total amount of current sent to the coil, the coil's size and what it's wrapped around dictate the strength of the electromagnetic field created. The sequence of turning a particular coil on or off dictates what direction the effective electromagnetic fields are pointed. By turning on and off coils in sequence a rotating magnetic field can be created. These rotating magnetic fields interact with the magnetic fields of the magnets (permanent or electromagnets) in the stationary part of the motor (stator) to create a force on the armature which causes it to rotate. In some DC motor designs the stator fields use electromagnets to create their magnetic fields which allow greater control over the motor. At high power levels, DC motors are almost always cooled using forced air. There are 2 types of D.C motors,

1) Brushed D.C electric motor

2) Brushless D.C electric motor

Brushed DC electric motor: The brushed DC electric motor generates torque directly from DC power supplied to the motor by using internal commutation, stationary magnets (permanent or electromagnets), and rotating electrical magnets. Advantages of a brushed DC motor include low initial cost, high reliability, and simple control of motor speed.

Brushless DC electric motor: Typical brushless DC motors use a rotating permanent magnet in the rotor, and stationary electrical current/coil magnets on the motor housing for the stator, but the symmetrical opposite is also possible. A motor controller converts DC to AC. This design

is simpler than that of brushed motors because it eliminates the complication of transferring power from outside the motor to the spinning rotor. Advantages of brushless motors include long life span, little or no maintenance, and high efficiency. In this project we have used brushless 4 H.P, D.C electric motor which rotates at 3000 rpm.

BATTERIES: Lithium-Ion Batteries are quickly becoming an efficient energy choice used to power the hybrid electric vehicles**.** Lithium batteries are disposable (primary) batteries that have lithium metal or lithium compounds as an anode. They stand apart from other batteries in their high charge density (long life) and high cost per unit. Depending on the design and chemical compounds used, lithium cells can produce voltages from 1.5 V (comparable to a zinc–carbon or alkaline battery) to about 3.7 V. By comparison lithium-ion batteries are rechargeable batteries in which lithium ions move between the anode and the cathode, using an intercalated lithium compound as the electrode material instead of the metallic lithium used in lithium batteries. Here we use 2, 16 Amp lithium-ion batteries for storage of energy. Since we use 2 individual batteries, we can instantly charge and discharge the batteries individually. Battery gives power to D.C motor and gets discharged and instantly gets charged by rectifier. On almost every motorcycle you will find a battery, used for providing power for starting the bike and for buffering an amount of electric energy. The battery itself is charged by a generator driven by the engine (here we use motor), and as long as the engine (motor) is running there will be a current flowing through the battery.

CLUTCH: "A clutch is a mechanical device that provides for the transmission of power from one component (the driving member) to another (the driven member) when engaged, but can be disengaged". "In the simplest application, clutches connect and disconnect two rotating shafts (drive shafts or line shafts). In these devices, one shaft is typically attached to a motor or other power unit (the driving member) while the other shaft (the driven member) provides output power for work". "A motorcycle clutch is part of the drive train. When engaged the engine drives the gearbox via the clutch and in turn the rear wheel. When the clutch is disengaged, the engine is disconnected from the rear wheel".

MULTI-PLATE WET CLUTCH: Multi-plate clutches are used in heavy vehicles with cars and motorcycles for transmitting high torque. As compared to single plate clutch, these are smoother and easier to operate due to their assembly of friction surface contact. They may be used where space is very limited. As the number of clutch plates is friction surface obviously increasing increases the capacity of the clutch to transmit more torque for the same size. If the friction plates are immersed in oil it is called wet clutch. Their construction is similar to that of the dry type. But the clutch plates always wetted by oil circulations.

GEAR BOX: The set of gears enclosed in a metal box is called gear box. This set of gear is used for transmission. This box is provided between the clutch and propeller shaft. Even the vehicle moves at low speed, it permits the engine to run at high speed. It gives required turning effort to the wheel. It gives high torque, during starting, hill climbing. It is used to reverse the vehicle. It may be used to disconnect the engine with the transmission parts.

CONSTANT MESH GEARBOX: Here we use 4-speed constant mesh gearbox. In this type, all the gear on main shaft is inconstant mesh with the corresponding gears on lay shaft. Two dog clutches are provided on the main shaft – one between the clutch gear and secondary gear. The main shaft is spilled and all the gear is free on it.

CRANK SHAFT: Crank shaft converts the reciprocating motion of the piston and connecting rod into rotary motion. Big end of the connecting rod is connected to crank shaft. It will be single crank type for single cylinder engines. The crank shaft is held in position by the main bearings. There are two bearings provided to support the crankshaft. The material of the crankshaft should be strong enough to resist heavy impact force of the piston.

PRIMARY GEAR DRIVE: All engines require a gear reduction system that is used to transfer the power from the crankshaft to the transmission and then from the transmission to the rear wheel. The gear reduction system used for transferring the power from the crankshaft to the clutch is called the primary drive. As we now understand, gear reduction is necessary to allow the engine to remain in the appropriate range of rpm while maintaining various speeds at the rear wheel.

V-BELT-DRIVE: Most motorcycles use a gear-drive this drive system may utilize spur, offset spur, or helical gears to transfer power from the crankshaft to the clutch system. Here we used v-belt, which connects the upper pulley and a primary drive, upper pulley is fixed on the output shaft of the motor .rotation of the upper pulley is transmitted to primary drive. Diameter of upper pulley is 30mm lower pulley is 115mm. This makes the clutch turn in the opposite direction of the crank shaft.

CHAIN SPROCKET: A sprocket or sprocket-wheel is a profiled wheel with teeth, even sprockets that mesh with a chain, track or other perforated or indented material. The name "sprocket" applies generally to any wheel upon which are radial projections that engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth. Sprockets are used in bicycles, motorcycles, cars, and other machinery either to transmit rotary motion between two shafts where gears are unsuitable or to impart linear motion to a track, tape etc. Perhaps the

most common form of sprocket may be found in the bicycle, in which the pedal shaft carries a large sprocket-wheel, which drives a chain, which, in turn, drives a small sprocket on the axle of the rear wheel. Early automobiles were also largely driven by sprocket and chain mechanism, a practice largely copied from bicycles.

Sprockets are of various designs, a maximum of efficiency being claimed for each by its originator. Sprockets typically do not have a flange. Some sprockets used with timing belts have flanges to keep the timing belt centered. Sprockets and chains are also used for power transmission from one shaft to another where slippage is not admissible, sprocket chains being used instead of belts or ropes and sprocket-wheels instead of pulleys. They can be run at high speed and some forms of chain are so constructed as to be noiseless even at high speed.

REGULATOR: The Voltage Regulator is an important component of the electrical charging system, and keeps your motorcycle battery from being overcharged and damaged. This section has information on common regulator types and troubleshooting information.

RECTIFIER: A rectifier is a type of equipment that is used to control electrical current. The job of a rectifier is to change the electrical current from alternating current, or AC, to direct current, or DC.

REMOVING ACTUAL WORKING SYSTEM: In two stroke engine we removed the fuel supply like air filter, carburetor, and fuel tank. We have removed the firing system spark plug, power coil, cdi unit. Then we removed the mechanical system of the engine.

REPLACING MODIFIED WORKING SYSTEM: Here a pulley is fixed in the motor output shaft and it is connected to the magnet, from the magnet the power is transmitted to the crankshaft. Motor is fixed in the bed and it is locked with the engine housing. Battery is placed in the side cover. Regulator & Rectifier are fixed above the battery connection.

WORKING

E-BIKES also works similar to the petrol engine bike, the main difference is some of the parts like fuel tank, engine, carburetor, etc are replaced by battery, electric D.C motor, regulator etc. The motor gets the power from the battery, then the motor system controls with the help of the regulator which acts as the accelerator of the bike. The motor runs at 3000 rpm, we convert this 3000 rpm into 4500 by the help of helical gear connected to the crank shaft, then the power transmitted to the primary gear wheel. The primary gear wheel transports the power to the clutch bell, by the use of clutch plate it transmit the power to the gear box, the clutch is used to engage and disengage the power from motor to gear box, the gear box converts the

power of motor 4500 rpm into 5500 rpm by changing the gear ratio, then it is sent to driver gear, this power is transmitted to the back wheel through the chain to the driven sprocket fixed with the sprocket hub. The sprocket hub meshed with the wheel drum, in between the sprocket hub and wheel drum we use crush rubber. Then we use break drum and brake shoe for braking system.

CONCLUSION

In the end we were very proud of the achievements that we were able to make. We were capable of completing the intended improvements to the frame and attached the electric drive train components. We were able to achieve our objectives we are confident that we completed the objective as well. We have done a detailed investigation on an electric bike and successfully increased the performance of an electric bike using 4 speed gear box. And its application best to use as commuter type bike can be better used for single person travel.

REFERENCES

1. Chunho Kim, Eok NamGoong, "Fuel Economy Optimization for Parallel Hybrid Vehicles with CVT" 1999.

2. Robert C. Green , Lingfeng Wang, "The impact of plug-in hybrid electric vehicles on distribution networks: A review and outlook" 2011.

3. Rosanna Garcia and Roger Calantone, "Product Innovation Management" 2003

4. John M. Miller "Propulsion Systems for Hybrid Vehicles" 2004

5. Iqbal Husain, "Electric and Hybrid Vehicles: Design Fundamentals" 2005.

6. Jean-Jacques Chanaron, Julius Teske, "Hybrid vehicles: a temporary step" 2007

7. Constantine Samaras and Kyle Meisterling, "Life Cycle Assessment of Greenhouse Gas Emissions from Plug-in Hybrid Vehicles: Implications for Policy" 2008.

8. Allen Fuhs.E "Hybrid Vehicles: and the Future of Personal Transportatio" 2008

9. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, (Power Electronics and Applications Series)" 2009.