FABRICATION OF E-BIKE

Mohammed Hassan Khan[1], Mohammed Habeeb Ullah Shareef[2], Md Jameel Ahmed Shakeel[3], Mohd Faiz Ahmed[4],Mohammad Umair Ansari[5]

[1,2,3,4] students, Department of Mechanical Engineering, Nawab Shah Alam Khan College of Engineering and Technology, Hyderabad, Telangana, India.
[5] Assistant professor in Mechanical Engineering, Nawab Shah Alam Khan College of Engineering and Technology, Hyderabad, Telangana, India.

Abstract - *The main keynote of this project is to give the exact view by check the Various sources of energy available to mankind.In today's modernized world travelling is very essential for human beings in order to prolong in this world.And to do so his travelling should be done in minimum Possible way and in jiffy.This project details about electric bike which runs on the battery thereby providing voltage to the motor.This Project comprises with design and fabrication of electric bike which Make 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 Connecting to a charger.The electrical power generated which is used To run the bike can give better fuel economy compared to Conventional vehicle, better performance and less pollution. By removal of engine makes a bike weight less and it can run easily,also by removal of extra unnecessary parts makes bike more weightless.It can travel about 15-25 kmph.As per the calculations.To achieve better characteristics in efficiency, energy consumption,low maintenance, good chargeability of battery in eco-friendly bike.*

1. 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 is a great variety of e-bikes available worldwide, from e-bikes that only have a small motor to assist the rider's pedal-power to somewhat more powerful e-bikes which tend closer to moped-style functionality.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).Energy crisis is one of the major concerns in today's world due to fast depleting resources of petrol, diesel and natural gas. In combination With this, environmental decay is an additional factor which is contributing to the depletion of resources which is an alarming notification. Our project proposes the solution for this above perilous problems. The system which we innovated is the electric bike.This project has various benefits both to the members of the team and External benefits thereby making awareness of using alternative modes of transport.The Electric Bike which works on the battery that is powered by the motor is the general mode of transport for a local trip. The solar panels can be alternative source for this by adding it to the system.The Electric bike which will be running on battery, the power is supplied by the motor, thereby supplying this power to drive the other gear components. The main purpose of using this E-bike is that it is user friendly, economical and relatively cheap. The efficiency of this system undeniable compared to conventional modes of transport.

Table-1: The following table shows the specification of various electric bikes used in few countries:

Country	Type of bike	Speed limit km/hrs.	Watt	Weight in kgs	Age required in yrs.
Australia	Pedal	25	250	-	-
Canada	Hand	32	500	-	Various
Germany	Pedal	30	200	20	-
Norway	Pedal	25	250	-	-
Israel	Pedal	25	250	30	14
UK	Hand	25	250	40	14
Taiwan	Hand	27	200	-	-
US	Hand	25	750	-	-
China	Pedal	30	500	-	-

2. CONSTRUCTION, WORKING, PRINCIPLE, CLASSIFICATIONS OF E-BIKE.

The Electric bike is a bike which is driven with the help of battery which is coupled to electric motor.

2.1 Main principle:

It works on the principle that the electromotive force of an A.C. motor which receives electrical energy stored in D.C. battery is converted with the help of D.C. to A.C. converter.

2.2 Construction & Working:

It consists of Hub motor, dynamo, controller,Battery, brakes, throttle, speedometer etc.

Working:

As the paddling start the real wheel start rotating and the or which the dynamo is placed which is also rotating at a same speed as of the wheel and convert the rotational or mechanical energy of wheel into an electrical energy which is stored in the battery for the further used.The stored electrical energy from the battery supply to the hub motor which is placed on the front wheel and start rotating according to the motor controller and accelerator. Controller control the speed of the hub motor with the help of accelerator which is connected to the controller and hub motor. Speedometer is also being in the system to measure the speed of the bicycle. It is analogue or digital type.

2.3 Classifications of e-bikes

Therefore very broadly e-bikes can be classed as:

•E-bikes with pedal-assist only.

•E-bikes with power-on-demand and pedal-assist.

•E-bikes with power-on-demand only.

3. E-BIKE AND IT'S COMPONENTS

3.1 Components of e-bike

- Hub motor
- Controller
- Battery
- Throttle/Accelerator
- Charger
- Speedo meter
- Speed sensor
- On/Off ignition switch

Fig: 3.1 E-bike and its component

3.2 Hub Motor

A Hub motor is incorporated inside the centre of the wheel itself and drives it direct hub working and Operation Of Hub motor:- The wheel hub motor (also called wheel motor, wheel hub drive, hub motor or in-wheel motor) is an electric motor that is incorporated into the hub of a wheel and drives it directly. In a typical DC motor, there are permanent magnets on the outside and a spinning armature on the inside. The permanent magnets are stationary, so they are called the stator. The armature rotates, so it is called the rotor.

Specification of hub motor

Rated Voltage (DCV): 36V

Rated Power: 500w

Efficiency: 83.5%

Weight: 3.2 kg

Colour: Silver

Wire Size: Long

Application: Electric Bicycle

Brake Type: Disc (Threaded Disc)

No Load RPM: 440 RPM

Fig: 3.2 Hub motor

3.3 Controller

E-bike is a motor and a battery, but it's not that simple. You also need something in the middle called a controller to dose the power to the motor. Most motors these days have hall sensors to make them run smoother, and also require a complex controller to dish out the power. The controller makes sure everything runs smoothly. Your throttle, motor, and battery all connect to your controller.

The electric bike speed controller sends signals to the bike's motor hub in various voltages. These signals detect the direction of a rotor relative to the starter coil. The proper function of a speed control depends on the employment of various mechanisms.

Specification of controller

Rated Power :- 500W

Rated Voltage :- 48V

Brake :- Low/ABS

Speed :- 3 variable

Auto Identification of the Hall Sensor :- YES

Auto Identification of the phase angle of 60 and 120 degrees:- YES

Power & Pedal assist :- YES

Over Current Protection :- YES

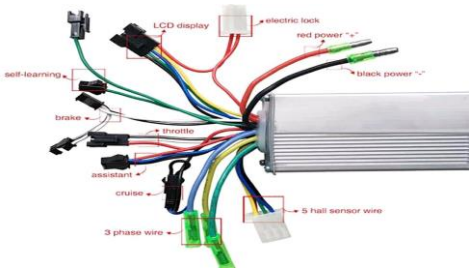

Fig: 3.3 Controller

3.4 Accelerator/Throttle

The throttle mode is similar to how a motorcycle or scooter operates. When the throttle is engaged the motor provides power and propels you and the bikeforward.

A throttle allows you to pedal or just kick back and enjoy a "free" ride! Most throttles can be fine-tuned like a volume dial between low and full power.

Fig: 3.4 Accelerator/Throttle

3.5 Li-ion Battery

The newest technology in batteries. They are pretty comparable to NiMH batteries, with the exception of two differences:

•They are little bit lighter.

•Li Ion batteries last about 800 full charge cycles before it need to be replaced. But they are little expensive than other batteries.

Specification Of Battery

Volts : 36V.

Capacity: 7.5 AH.

Weight :2.5kg.

Fig: 3.5 Li-ion Battery

3.6 Generator or alternator or dynamo.

The most and main important component in design of self power generating bike is dc generator because power generator is done by this generator. Generator is nothing but the machine that convert mechanical power into electrical power. It is based on the principle of production of dynamically (motionally)induced e.m.f (electromotiveforce).whenever a conductor cuts magnetic flux, dynamically induced e.m.f. is produce in it according to faraday's laws of electromagnetic induction. in this design I have use dc generator because dc generator having advantages over ac generator such as no conversion of supply is required from ac to dc there for it may be chap and design having low Weight .

Features & details

Epson DC 36V-Generator-High-quality-motor-1200-4200RPM...Input speed: 1200-4200RPM Output voltage: DC136V Original Japanese Generator Motor.Output diameter of axle: 2.5MM Gear attached to the Shaft is removable.

Fig: 3.6 Generator or alternator or dynamo

3.7 On/off/start switch of e-bike

An ignition switch, starter switch or start switch is a switch in the control system of a motor vehicle that activates the main electrical systems for the vehicle, including "accessories". Historically, ignition switches were key switches that requires the proper key to be inserted in order for the switch functions to be unlocked.

These mechanical switches remain common in modern vehicles, further combined with an immobiliser to only activate the switch functions when a transpondersignal in the key is detected. However, many new vehicles have been equipped with so-called "keyless" systems, which replace the key switch with a push button that also requires a transponder signal"

Fig: 3.7 On/off/start switch of e-bike

3.8 speedo meter

A speedometer or a speed meter is a gauge that measures and displays the instantaneous speed of a vehicle.

Fig: 3.8 speedo meter

3.9 speed sensor

Speed sensors let you accurately keep track of your current speed and level of support

Fig: 3.9 speed sensor

4.Design of Sprocket and Chain for Electric Bike.

There are several parameters involved in the design of an efficient hybrid power system. This system is constructed by taking the following specifications and materials.

4.1 Chain drive

Chain Drive:- A Chain is an array of links held together with each other with the help of steel pins. This type of arrangement makes a chain more enduring, long lasting and better way of transmitting rotary motion from one gear to another.

Fig: 4.1 chain drive

4.1.1 Design of Sprocket and Chain for Electric Bike

We know, TRANSMISSION RATIO = Z2 / Z1 = 19/9 = 2.1=2 For the above transmission ratio number of teeth on pinion and the number of teeth sprocket is in the range of 21 to 10, so we have to select number of teeth on pinion sprocket as 9 teeth. So, Z1 = 9 teeth.

4.2 SELECTION OF PITCH OF SPROCKET

The pitch is decided on the basis of RPM of sprocket.RPM of pinion sprocket is variable in normal condition it is = 2100 rpm For this rpm value we select pitch of sprocket as 6.35mm from table,P = 6.35mm.

4.3 Sprockets

The chain with engaging with the sprocket converts rotational power in to rotary power and vice versa. The sprocket which looks like a gear may differ in three aspects:

•Sprockets have many engaging teeth but gears have only one or two.

•The teeth of a gear touch and slip against each other but there is basically no slippage in case of sprocket.

•The shape of the teeth are different in gears and sprockets.

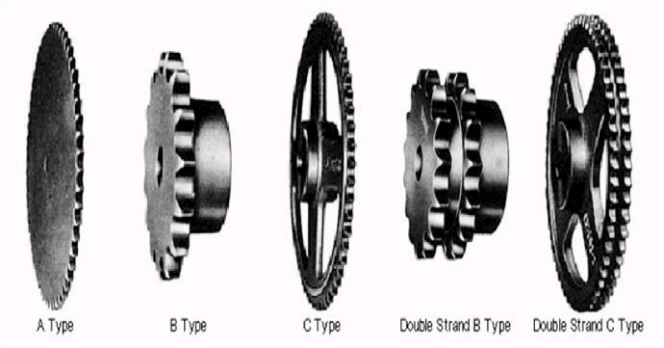

Fig:-4.3 Sprockets

4.4 Calculation of the minimum centre distance

THE TRANSMISSION RATIO = Z2 / Z1 = 19/9 = 2 which is less than 7.

Dia. of small sprocket,Periphery = π × dia. Of sprocket 9 × 6.25 = π × D

D = 9 × 6.25 / π

D = 9 × 6.25/ π

D = 37.7 mm

So from table, referred from PSG Design Data book.

The minimum center distance between the two sprocket = C' + (80 to 150 mm)

Where C' = Dc1 + Dc2/2=17.9+37.7/2=27.8mm

MINIMUM CENTER DISTANCE = 27.8+ (30 to 150 mm)= 170 mm .

5. PROPOSED CALCULATIONS OF E-BIKE

5.1 Calculation of power required accelerating the e-bike

From the start F=m*a = 140*0.842

F=117.88N

P=F*V (since V=Average speed)

V= (Vi + Vf)/2 (At starting, the velocity Vi will be zero) V=Vf/2=8.42/2=4.21m/s

P=85.54*4.21=360.12 watts

Power required=360.32 watts

5.2 Calculation of battery power

Here we have used lithium ion battery which is having 36v&10ah capacity.

Total watt power=36×10=360Wh

One watt motor burns 1Wh in one hour.

That means,360 watt motor burns

360Wh=1.02hr ~1hr

Hence from the calculation if the electric bicycle is driven at 18 km/hr, it gives a mileage of 18 km per hour (or) per battery pack.

5.3 Calculation of power generation

The generator (or) the reverse DC motor produce 36volts at 5A

In order to charge a 36V battery at 3A

Time taken=Ah/A=10Ah/5A=2hrs

It takes 2 hours to charge a 36 battery to be fully charged.

Considering the essential factors it would be ideal to Li-ion battery over the other batteries. It is not essential for Li-ion battery to charge slowly to prevent heat generation.The motor burns 360 watts in a hour for a battery rating of 350Wh.So at an average speed of 30km/hr 30 kms can be travelled for a single battery pack.

While discharging takes place simultaneously battery pack 2 gets charged from the motor 2 at a power rating of 36v and 5A. Though full charging of battery pack 2 cannot be done. More than half of the charge can be generated from the power generated from motor 2.Which can provide more mileage to the e-bike.

FIG: (A) FABRICATION OF E-BIKE

6. FUTURE SCOPE

Electric bicycles (E-Bikes) are bicycles 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 productofferings.

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 CO_2 emissions per year that is equal to the amount of CO_2 released by 25,000 New York homes peryear.

Future Developments

Fig: 6.1 Folding bike

Fig:6.2 High speed bike

Fig: 6.3 Future developments with no spokes and creative concept.

7. CONCLUSIONS

Our project may provide a solution for this existing problem since charging of the battery is done as the vehicle runs.It is very much suitable for young, aged people and caters the need of economically poor class of society.The most important feature of this e-bike is that it does not consume valuable fossil fuels thereby saving the money.

It is eco-friendly & pollution free, as it does not have any emissions.Moreover it is noiseless and can be recharged with the AC adapter in case of emergency and cloudy weather.Purchase electric bike and save our mother earth and It is you .... Who can stop population and start a revolution.

The issues associated with electric bicycles may be addressed by custom- designed drives that are most efficient over a given operating bike.These include city e-bikes, hill e-bikes, distance e-bikes, and speedy e-bikes.

The results of the studies listed here can serve as a platform to improve electric bike performance if new drive systems are designed around key parameters that will result in improvement of the system performance.

Further more, they can be used for comparison of existing drives in a systematical, comprehensive, and technical way.

8. ACKNOWLEDGEMENT

A deep sense gratitude to project guide Asst prof. Mohammad umair ansari whose overall direction and guidance has been responsible for the successful completion of this project.We would like to thank all the faculty of mechanical engineering department who motivated throughout in spite of their schedules and commitments.Our sincere thanks to Dr.syed mujahid hussaini head of the department,mechanical engineering for the encouragement and guidance provided.Special note of thanks to Dr.syed abdul sattar,Principal,nsakcet and management of nsakcet for providing facilities for project.And also we thank almighty for bestowing upon us all his blessings for compilation of this project. We would like to express our depth of gratitude to our parents for supporting us and motivating toward studies.

9. REFERENCES

1. K. Schleinitz , T. Petzoldt , L. Franke-Bartholdt , J. Krems , T. Gehlert, The German Naturalistic Cycling Study – Comparing cycling speed of riders of different e-bikes and conventional bicycles, ScienceDirect-Ekseveir July- 2015.

2. Automobile, Rimac. "Greyp Bikes." Greyp Bikes. Greyp Bikes, 2013. Web. 10 <http://www.greyp-bikes.com>.

3. BillC. "Transformer." 1 January 2006. Wikipedia, the free encyclopedia. Digital Image. 7 March 2014.<http://en.wikipedia.org/wiki/File:Transforme r3d_col3.svg>.

4. Chetan Mahadik , Sumit Mahindrakar , Professor Jayshree Deka , An Improved & Efficient Electric Bicycle System With The Power Of Real-time Information Sharing, Multidisciplinary Journal of Research in Engineering and

Technology, www.mjret.in ,ISSN:2348-6953 , M15-1-2-7-2014

5. Rahul Sindhwani , Punj L. Singh , Anjum Badar , Ankur Rathi , Design Of Electric Bike With Higher Efficiency , International Journal of Advance Research and Innovation Volume 2, Issue 1 (2014) 247-251 ISSN 2347 - 3258

6. Rajendra Beedu, Ankit, MOHAMMED Asif Shaik, Sushant Jain, Design, Fabrication And Performance Analysis Of Solar Power Bicycle, International Journal of Renewable Energy and Environmental Engineering IS Akshay, N. Khonde, Aditya R. Ughade, Kapil D. Warghane, Rajat R. Vidhale Students, Performance Evaluation of Electric Bicycles, IARJSET ISSN (Online) 2393-8021 ISSN (Print) 2394-1588 International Advanced Research Journal in Science, Engineering and Technology, Agni-Pankh 16-Jawaharlal Darda Institute of Engineering and Technology, Yavatmal-Vol. 4, Special Issue 3, January 2017.

BIOGRAPHIES

1st Author: MOHAMMED HASSAN KHAN He is pursuing B-tech final year in Mechanical Engineering from Nawab Shah Alam Khan College of Engineering and Technology, (JNTUH) Telangana, India & recognized by AICTE, accredited by NAAC. He completed his Intermediate in MPC from Agarwal Jr. College (TSBIE) Telangana, India.

2nd Author: MOHAMMED HABEEB ULLAH SHAREEF
He is pursuing B-tech final year in Mechanical Engineering from Nawab Shah Alam Khan College of Engineering and Technology, (JNTUH) Telangana, India & recognized by AICTE, accredited by NAAC. He completed his Intermediate in MPC from M.S Jr. College (TSBIE) Telangana, India.

3rd Author: MD JAMEEL AHMED SHAKEEL
He is pursuing B-tech final year in Mechanical Engineering from Nawab Shah Alam Khan College of Engineering and Technology, (JNTUH) Telangana, India & recognized by AICTE, accredited by NAAC. He completed his Intermediate in MPC from sri chandra Jr. College (TSBIE) Telangana, India.

4th Author: MOHD FAIZ AHMED
He is pursuing B-tech final year in Mechanical Engineering from Nawab Shah Alam Khan College of Engineering and Technology, (JNTUH) Telangana, India & recognized by AICTE, accredited by NAAC. He completed his Intermediate in MPC from Narayana Jr. College (TSBIE) Telangana, India.

5th Author: MOHAMMAD UMAIR ANSARI
He is working as an assistant professor and lab in charge of mechanical dept.'s lab as well as co-ordinator of B.tech final year students in nawab shah alam khan college of engineering and technology since 3 years. He Completed M-tech in production engineering and also he supervise B.tech students, internship and research/project work. He also published Journal in ijsrd. He also attended 2-day's 2-international conference one at nsakcet in n 2016 and other one in mjcet 2017.