Smart Electric Two Wheeler Scooter

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Abstract - *Transportation becomes an essential part ofhuman life.Day by day new design vehicles are come in market works mostly on petroleum fuel.use of these vehicles leads to drastically increase in Carbon emmersive and pollution ,causes global warning and related issue.The market for electric bikes, scooters and bicycles is growing. There are numerous brands of E-bikes emerging locally. All most all incorporate a BLDC (Brushless DC) hub motor; lithium ion battery pack, a light weight chassis, and a Bldc controller. The Vehicle achieves average speed of 30-50km/hr, range of 70km/charge. The other drawback is the long charging time of 6-8 hrs and short lifespan of battery pack i.e. around 3 years. Considering these limitations we are modifying the existing design of an electric bike which will give a better performance with the use of a brushless hub (BLDC) motor.*

Key Words: 1.E-bike 2.BLDC motor 3. Lithium ion Battery 4.Bldc Controller

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 flash functionality. E-bikes use rechargeable batteries and the lightervarieties can travel up to 55 to 60 km/hrs, depending on the laws of the country in which they are sold. While the more high-powered varieties can often do in excess of 60 km/hrs.Loss of power and efficiency in electrical and mechanical systems has been a recurring problem in automotive design. In recent years, energy regeneration has made rapid advances in the automotive world. Regenerative braking is defined by the United States Department of Energy as a system that captures the energy lost during braking by utilizing an electric motor as a generator and storing the energy captured. This extra energy is re-used during acceleration, providing the vehicle with more energy and a longer range. Energy regeneration is not only a concept that has been applied to automobiles, but also on a smaller scale to motorcycles, motorbikes and scooters. With renewable and regenerative energy remaining a relatively new and expensive model, small scale regenerative systems can be minor steps towarda more eco- friendly lifestyle. Regenerative motorbikes are not a necessarily new concept; however there is still room for improvement in their efficiency, design and adaptability. According to the Massachusetts Registry of Motor Vehicles (RMV), a motorbike can operate with or without pedals, has an automatic transmission, runs on some form of electric motor, does not operate above 30 mph and requires a minor registration and titling by an operator with a valid driver's license.

2. DESCRIPTION OF THE PROJECT

In this design the hardware components that we use are:

- Battery
- BLDC Motor
- Controller
- Converter
- LDR Circuit

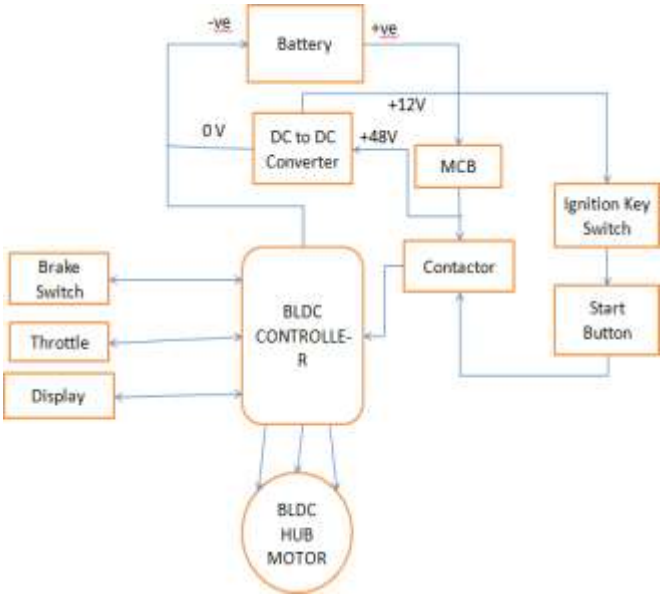

Fig -1: System block diagram

2.1 BATTERY (48V,30 AH)

Fig -2: Battery 48V, 30Ahr Li-Ion Battery

Li-ion batteries are the powerhouse for the digital electronic revolution in this modern mobile society, exclusively used in mobile phones and laptop computers. The success of commercial Li-ion batteries in the 1990s was not an overnight achievement, but a result of intensive research and contribution by many great scientists and engineers. Then much efforts have been put to further improve the performance of Li-ion batteries, achieved certain significant progress. To meet the increasing demand for energy storage, particularly from increasingly popular electric vehicles, intensified research is required to develop next-generation Li-ion batteries with dramatically improved performances, including improved specific energy and volumetric energy density, cyclability, charging rate, stability, and safety. There are still notable challenges in the development of next- generation Li-ion batteries. New battery concepts have to be further developed to go beyond Li-ion batteries in the future. In this tutorial review, the focus is to introduce the basic concepts, highlight the recent progress, and discuss the challenges regarding Li-ion batteries. Brief discussion on popularly studied "beyond Li-ion" batteries is also provided.

2.1.1 Different type of battery

A. Nickel-Metal-Hydride

Nickel-Metal hydride (Ni-MH) batteries are commonly used in today's hybrid vehicles, and in low-cost consumer applications, such as electric razors, toothbrushes, cameras and camcorders.

B. Lithium-ion (Li-ion)

Lithium-ion batteries are commonly utilized in cell phones and laptop computers and that they are getting the battery of choice for plug-in hybrids and BEVs, also as some conventional hybrids

C. Lithium Polymer (Li-poly)

Li-poly batteries are used in some hybrid vehicles, in agriculture, in automotive equipment, in communication.

D. Lead-Acid

Lead-acid batteries are used in conventionalcars and trucks for starting, ignition, lighting and other electrical functions. They are relatively inexpensive and have a high power density but a relatively low energy density.

2.2 BLDC MOTOR (1KW)

The BLDC motor is widely utilized in applications including appliances, automotive, aerospace, consumer, medical, automated industrial equipment and instrumentation.The BLDC motor is electrically commutated by power switches rather than brushes. Compared with a brushed DC motor or an induction motor, the BLDC motor has many advantages:

- Higher efficiency and reliability
- Lower acoustic noise
- Smaller and lighter
- Greater dynamic response
- Better speed versus torque characteristics
- Higher speed range
- Longer life

2.3 Controller

New trends e bike were developed with the assistance of controller. differing types of controllers utilized in e bikes. Controllers are connected with mechanical and electrical components. In these project BLDC Motor Controller are used for speed control of the scooter.

- Battery Pack Compatibility: Works with 48 Volt Battery Packs
- Motor Compatibility: Works with 1000 Watt Brushless DC Motors
- Current Limit: 30 Amps (30 Amps Maximum Current Output)
- Low Voltage Protection: 41.5 Volts Dc

2.4 Converter

A DC-DC Converter is an electronic circuit or mechanical device that converts a source aof DC from 48 volt to 12 volt. it's a kind of electrical power converter .

Specifications:

Input Voltage: 24 Volt to 60 Volt Output Voltage: 12 Volt

2.5 LDR Circuit

Fig–3: LDR Circuit

An LDR (Light Dependent Resistor) may be a device whose resistance varies with the change in amount of sunshine incident thereon . Hence this is often majorly utilized in Light Sensitive Circuits.A light dependent resistor works on the principle of photo conductivity. Photo conductivity is an physical phenomenon during which the fabric s conductivity is increased when light is absorbed by the material. When light falls i.e. when the photons fall on the device, the electrons within the valence band of the semiconductor material are excited to the conduction band. These photons within the incident light should have energy greater than the band gap of the semiconductor material to form the electrons jump from the valence band to the conduction band. Hence when light having enough energy strikes on the device, more and more electrons are excited to the conduction band which ends up in sizable amount of charge carriers. The results of this process is more and more current starts flowing throgh the device when the circuit is closed and hence it's said that the resistance of the device has been decreased. This is the foremost common working rule of LDR

3. CALCULATIONS

1) Aerodynamic drag can be calculated using the following formula.

$$F_{drag}=0.5\rho C_d A V^2$$

Where, r-Density of air Cd-Coefficient of drag

A-Frontal area of vehicle in m^2 V -Speed in m/s.

2) Rolling resistance can be calculated as follows:

$$F_{rr}=C_{rr} m g \cos\theta$$

Where, θ-Road or hill climbing angle Crr-Coefficient of rolling resistance

g-Accleration due to gravity(9.81m/s^2) m -Mass in kg.

3) Force of acceleration can be calculated as follows:

$$F_a=ma$$

Where, m-Mass in kg a-acceleration.

4) Gradient force can be calculated as follows:

$$F_g=mg\sin\theta$$

Where, m-Mass in kg

g-Acceleration due to gravity(9.81m/s^2) θ-Road or hill climbing angle

$$F_T=F_{drag}+F_{rr}+F_a+F_g$$

Where, FT-Total Force

Total power required to travel electric scooter

PT= FT*V

Where, PT- Total Power,V-Velocity (m/s)

3.1 Useful Constant Values For Power Calculation

Coefficient of drag	0.6
Rolling resistance	0.014
Mass with rider	130kg
Frontal area	0.5 m²
Density of air	1.225
Road or hill climbing angle	5°
Velociy	25kmph
Radius of tyre	6”=0.1524m

Table-1: Constants For Calculation

Fdrag=0.5*1.2*0.6*0.5*6.94²=8.85N Frr=0.014*9.81*130*cos(5)=17.78N

Fa=130*{6.94/(60*60)}=0.25N Fg=130*9.81*sin(5)=111.14N FT=8.85+17.78+0.25+111.14=138.02N

PT=138.02*6.94=957.85Watt (Approximately= 1KW)

4. CONCLUSION

Till now, we are taking step towards the pollution free energy vehicles. i.e: Electrical & Hybrid vehicles .What's next ,we took initiative to further improve performance of those electrical bikes by means of Regenerative process adoption. Yes! it is possible now to go limitless no more worries ;your bike take care of itself energy requirement. Improvement in electrical e-bike is possible in many ways.

REFERENCES

1. 2014. Digital Data. 2 March 2014.<http://www.alphacoredirect.com/contents/en-us/d185_amorphous_ccores_.html>.

2. Automobili, Rimac. "Greyp Bikes." Greyp Bikes. Greyp Bikes, 2013. Web. 10 Oct. 2013. <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. Bolton, Brent. “Is Regenerative Braking Useful on an Electric Bicycle?” Ecospeed LLC. 12 Oct. 2013. Web. <http://www.ecospeed.com/regenbraking.pdf>

5. Dillon, William E., Ph.D. "PSpice Tutorials." PSpice Tutorials. William E. Dillon, Ph.D, P.E., 17 Oct. 2007. Web. 10 Oct. 2013.

6. Ellsworth, Timmothy J. High Efficiency Motorbike. Publication no. E-project-101112- 010436. Ed. Cosme Furlong-Vazquez and Kenneth Stafford. Worcester: Worcester Polytechnic Institute, 2012. Print.

7. Erickson, R. W. "Ch15slides.ppt." 2 March 2004. Chapter 15 Transformer Design. Digital PDF Document.22February 2014. <http://ecee.colorado.edu/copec/book/slides/Ch15slides. pdf>.

8. G nen, Turan. "Chapter 6: Induction Machines." Electrical Machines with MATLAB. Boca Raton, FL: CRC, 2012. 207-66. Print.