International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 9 Issue 8 ǁ 2021 ǁ PP. 50-54

Design and Development of Ecofriendly Electric Bike

Vijay Chari, *(Student), Department of Mechanical Engineering, Don Bosco College of Engineering, Fatorda, Goa.*

Dr. H.K.Amarnath *(Guide),* Professor, *Department of Mechanical Engineering, Don Bosco College of Engineering, Fatorda, Goa.*

Sharang Phaldessai, *(Student), Department of Mechanical Engineering, Don Bosco College of Engineering, Fatorda, Goa.*

Saurabh Naik, *(Student), Department of Mechanical Engineering, Don Bosco College of Engineering, Fatorda, Goa.*

Sachin Thakur, *(Student), Department of Mechanical Engineering, Don Bosco College of Engineering, Fatorda, Goa.*

Selvin Dias, *(Student), Department of Mechanical Engineering, Don Bosco College of Engineering, Fatorda, Goa.*

Abstract
The quantity of motors on the roads for the duration of the globe is increasing at a staggering charge year by means of 12 months, however the dependence on oil-based gas grows nearly unchecked. Due to this, electric motors come into the photo as an opportunity. Need for an affordable and efficient mode of transport created a developing call for Electric Bikes in India too, and this undertaking is taken as a possibility, rather a task to layout and broaden the electric bike. An electric powered motorbike is a -wheeler propelled exclusively with the aid of an electric powered motor that is powered by means of an on-board dedicated battery % offering it with the required traction energy. The electric powered motorbike has an electrical motor with a smart controller and a battery percent connected thru green cabling systems and tracking contraptions in place of an engine and different helping additives of a gasoline run motorcycle. Also, the use of electric bikes will purpose much less environmental pollution and preserve our surroundings lively. This venture gives a take a look at the design and development procedure of a better, low-cost, and more secure electric bike done by comprehensive marketplace studies, studying the prevailing alternatives to find what a purchaser dreams, the demanding situations confronted by them and benchmarking our design to fulfil industry standards

---

Date of Submission: 06-08-2021 Date of acceptance: 19-08-2021

I. INTRODUCTION

For years IC engines have dominated the auto industry. The traditional motors with IC engines offer a good overall performance and lengthy operating range. However they have precipitated and maintain to purpose critical issues of bad gasoline economic system, surroundings pollutants and human lifestyles. Due to the ever growing charges of gasoline and decreasing oil resources at an alarming charge there is want to find a trade supply of powering our vehicles. Electric powered motors provide with a higher opportunity, eliminating the possibilities of polluting the surroundings. Even though it's miles a promising alternative it comes with its very own problems. To manipulate the maximum practicable velocity of car with the right riding variety is one in all the largest worries related to those motors. With an electric powered two wheeler it's miles a as an alternative hard project to get most possible variety even as reaching a full-size speed thinking of the restrained battery %. The transmission gadget performs a vital role in offering the car with strength in order the speed and acceleration is not affected and ensuring that not a good deal strength is drawn depleting the battery strength with in small distance variety [2]. The transmission system includes an electric powered motor coupled to a sequence and sprocket pressure to transmit strength to the rear wheel. The main intention of this paper is to examine a given motorbike parameters and attempt to determine the greatest velocity and range for the town force, without affecting the motor electricity or the battery %.

The e-motorbike is an electric powered car, a sophisticated version of the pedal bicycle, powered by a chargeable battery. These motorcycles are an extraordinary opportunity for individuals who need to exchange from a vehicle for their daily shuttle. The population of India is 1.35b billion, and nearly 253 million automobiles are there on the street. In India, towns are experiencing immoderate site visitors and noise pollutants, main to inexorable air pollutants from the previous few years.

As the fuel-pushed two-wheeler sales figures elevated in the course of the overdue 20th and early twenty first century, the variety of exhaust emissions because of them also improved. These exhaust emissions from the petrol-powered inner combustion engines gave out various dangerous gases and particulate count number in the surroundings. With an extended gas consumption trend, the toxic constituents are continuously being released within the surroundings every day. The emissions led air around us to begin degrading in nice, getting polluted; drawing extensive interest to the diploma of the air pollution prompted each locally and globally.

One of the primary assets of pollutants in city regions is the 2-wheeler visitors. These exhaust emissions include various toxic additives, which are associated with extreme adverse fitness results, such as premature demise, respiration symptoms, impaired lung characteristic, and cardiovascular sicknesses. Assessing the impacts of air satisfactory control techniques in city regions is a large difficulty worldwide. Besides, global epidemiological research show a steady increase in cardiac and respiration morbidity and mortality from vehicle exhaust pollution publicity.

Due to this, there may be a right away concern about air fine degradation globally, so the want for a cleaner and energy efficient gasoline is created. It's where electric-powered two-wheelers come into the image as a appropriate alternative. Electrical energy driving the bike is a greener fuel and does not strain the give up-consumer's pocket. Also, the electric propulsion machine is much less vulnerable to put on and tear than mechanical counterparts making it extra budget friendly. Among the various economic benefits, the common jogging price of an electric motorcycle in step with kilometre travelled is much less than 0.08 rupees, which appears to be manner much less than a fuel motorcycle costing round 2 rupees in step with kilometre, taking the varying cost of the petrol into consideration. A normal electric powered bicycle with a lead-acid battery percent needs to rate in a single day, even as the Li-ion battery percent desires 1-3 hours to recharge. The average variety of an e-motorbike is 35 to 50 km at approximately 35-40 km/h making it sufficient to visit paintings, move round, and go back home on a mean day. Also, an electric bike suggests that for each 100 km, a mean of 8.5L of petrol is conserved, evading pollutants. Therefore, electric powered bikes have caused a new technique to personal mobility and worries approximately environmental degradation. This paper aims to explain levels of design and improvement of a suburban e-motorbike considering the fact that this area is exceedingly new and has much room for improvement. Our Project proposes the answer to this tough trouble. The number one cause of using this E-bike is to be person-pleasant, most economical, and comparatively reasonably-priced. The performance of this device is undeniable compared to conventional modes of delivery. The Electric Bike works on a battery-powered by way of the motor is the cutting-edge mode of transportation to move.

II. OVERVIEW OF THE PROJECT

This section introduces and offers a short description of the major components and elements with the intention to contribute to a successfully working of electric bike.

Problem definition

More than 80% of the sector's sale for fuel motorcycle is hooked up in the Asian vicinity. In the cutting-edge days, the number one situation of government is to discover a way via which we can reduce intake of fossil fuel and sell the usage of electric powered automobile in our everyday life. They may be produce air pollution resulting from fuel exhaust from bike has come a severe hassle. Recent petrol fee have hit the human beings tough economically. Also electric powered bike provide low torque at willing street for two seater.

Objective

- To convert existing conventional IC engine bike into an electric motorbike.
- To reduce the pollutants
- To growth the range consistent with fee of the electrical automobile.
- To provide the rider the identical feeling as using the IC engine powered bike.
- To provide correct quantity of torque on inclined roads.

III. METHODOLOGY

An electric motorcycle is a battery-operated vehicle that runs on the stored chemical power within the rechargeable battery packs. An electric powered bike is a pure E-bike if it completely makes use of its electric power and not any other secondary strength supply. Electric cars and motor controllers propel these motors via diverse force mechanisms (as mid-power, hub drive, and many others.), turning in the wheel's power.

Working

An electric powered motorbike works essentially the same way a Gas-powered motorbike works it's far propelled by means of an engine, and that engine requires gas. The main distinction is that the fuel in a

traditional bike is changed by using either batteries or gas cells in an electric model. The running precept of an electric powered motor is pretty similar to that of a fuel engine [1]. In each cases motorcycles are powered with the aid of mechanical energy, but best in one case are they powered through rechargeable batteries. Electric motors run on power which causes a pole into the motor to spin it. It isn't a lot a gas-powered motor but rather a battery that may journey quite a number forty to 100 miles between expenses .When the battery is ON the cutting-edge flows to the motor and the strength is transmitted to the rear wheels with the assist of chain drive shaft.

ELECTRIC POWER-TRAIN

The powertrain presents the demanded strength to the automobile to power. Electric Powertrain more often than not consists of a battery percent, DC-DC converter, Electric motor and motor controller to run the car. The electric controlling and actuation can be understood through a purposeful decomposition [4]. A practical decomposition simplifies big and complicated functionalities which makes it clean to apprehend by using breaking it into smaller, easier steps which might be obtained through considerate evaluation of the device's system.

The architecture of the powertrain is much like a natural electric motorcycle. The 48V lithium-ion battery is mid-installed and acts as the bike's strength supply connecting to all of the electronics. The motor is fitted in the rear wheel hub and connected to the battery via the motor controller. The throttle and brakes are linked to the motor controller to manipulate the strength waft. All the accessories that work at lower voltages are linked to a voltage converter for secure voltage enter.

IV. CALCULATIONS

Motor Selection
Considering Bike Speed = 60 Kmph
Kerb Weight = 110 kg
Gross Weight = 110 kg + 70 kg + 70 kg = 250 kg
Tyre Specifications = 130/70 R-17
Tyre Rim Diameter = 17*25.4 = 432 mm
Tyre Height = 130*0.70 = 91 mm
Tyre Diameter = 432+91+91 = 614 mm
Tyre Radius = 614/2 = 307 mm
Tyre Circumference = 2pr = 2*3.14*307
Tyre Circumference/ Linear Wheel Travel = 1928 mm ≈ 2 m
Bike Frontage Area = (Width*Height)*Adjusting Value [Considering Rounded Corners]
= (0.72m*1.63m)*0.70 [70% for bike]
Bike Frontage Area = 0.82 m^2
Speed 'v' = 60 Km/hr = 60*1000/3600 = 16.7 m/s
RPM Require = Speed/Wheel Travel
= 16.7*60/2
= 501 RPM
Mass 'M' = 250 kg g = 9.8 m/s^2
Velocity 'V' = 16.7 m/s
Coefficient of Rolling Resistance 'Cr' = 0.004 [Standard]
Air Density = 1.23 kg/m^3 Air Drag = 0.88 [For Bike]
Frontage Area = 0.82 m^2

13

Total Force 'Ft" = Rolling Force (Fr) + Drag Force (Fd)
Total Force 'Ft' = Fr + Fd
Fr = Rolling Force
Fr = m*g*Cr
= 250*9.8*0.004
= 9.81 kgm/s^2 [Newton]
Fd = Drag Force [Air Resistance]
Fd = 1/2*Air Density*Air Drag*Frontage Area*V^2
= ½*1.23*0.88*0.82*(16.7) ^2
Fd = 123.76 kgm/s^2 [Newton]
At Speed = 60 Kmph
Ft = Fr+ Fd Ft
= 9.81+123.76

= 133.57 kgm/s^2 [Newton]
Power 'P' = Ft*V
= 133.57*16.7
= 2230.61 watts
Motor Selection P = 2pNT/60
2230.61= 2*3.14*501*T/60 T
= 42.52 Nm
Motor Selection: BLDC Motor Standard RPM = 3000
Required RPM at Wheel = 501
Reduction Ratio = 3000/501 = 6:1
Motor Selected For 1000 watt
P = 2pNT/60 1000
= 2*3.14*1200*T/60 T
= 1000*60/2*3.14*1200
= 7.9 Nm
Torque on the Wheel
= 7.9*6
= 47.4 Nm
Battery Selection
Selected Electric Bike Motor = 1000 watt, 48 V BLDC Motor
Step 1: Find Out the current (in amps) consumed by the motor to run Power 'P' = Voltage * Current
1000 = 48*Current
Current = 1000/48
= 20.84 amps
Step 2: Find out the watt hour of the battery
To run the 1000 watt motor for 1 hour
Simply multiply [1000 watt * 1 hour] = 1000 watt hour
Considering Battery Efficiency = 80%
1000/0.80
= 1250 watt hour
Converting watt hour of the battery into amps hour of battery Power = Voltage*Current watt hour = Voltage*Current 1250 = 48* amps hour
Ampere hour = [1250/48]
= 26.04 amps hour
≈ 27 Ah
Calculations for Chain Drive
Considering: N1=3000, N2=501
Transmission Ratio 'i' = N1/N2
= 3000/501
= 6
Selecting the number of teeth on the pinion Sprocket
We know the Transmission Ratio = 6:1
For above Transmission ratio, number of teeth on the pinion sprocket is in the range from
21 to 15, so we have selected number of teeth on pinion sprocket as 15 teeth. So, Z = 15 teeth
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 3000.
For this RPM value, we select pitch of sprocket as 6.25 mm
The Transmission Ratio 'i' = 6 Diameter of the small Sprocket periphery = p* Diameter of sprocket 15*6.25 = p*D
D =15*6.25/p D =30.84 mm
Diameter of Sprocket
Periphery = p*D
90*6.25 = p*D D = 90*6.25/p
D = 165.04 mm
Minimum centre distance between two sprockets
Cmin = K1*C1
Where C1 = D01+D02/2 D01
= Diameter of smaller Sprocket D02

= Diameter of larger Sprocket
K1 = constant [minimum centre distance coefficient]
K1 = 1.5
C1 = 30.84+165.04/2
= 97.94
Cmin = 1.5* 97.94
= 145.91mm
≈146 mm

V. CONCLUSION

This motorcycle will give high speed and range per charge and good performance by using a 1000 watt motor and 48v battery pack at a low price when compared to other existing electric motorcycles [1]. With the multispeed gear reduction system the motorcycle gives better acceleration and gives better driving even at the slope area with huge load without any struggle [3]. With the petrol price rising there was a need of the bike which can save your money and also able to gibe good range to travel at longer distance. In this project we have made use of 48V, 1000 watt motor and having the rated speed of 3300 RPM. We have used a battery having specification 48V, and 27A. We have conducted the testing of this bike and we obtain result giving range of around 60 km and top speed of around 70 kmph. With this project we were able convert the existing conventional IC engine bike into an electric motorbike. We are able to reduce to the pollution which was produce by an IC engine bike. Our bike provide good amount torque and speed on inclined roads, which many of the existing electric bikes have problem with. We are also able to provide a rider with identical feeling as using the IC engine bike by making using of gearbox, which helps in proving good amount of torque and speed on inclined road, and attain great top speed.

Future Scope

- Battery Durability can be improved by using super capacitors.
- Using carbon fiber may help in reducing weight of the vehicle leading to more distance.
- Making use of higher capacity battery will increase the range of the electric bike.
- Using wireless battery charging

BIBLIOGRAPHY

[1]. International Research Journal of Engineering and Technology (IRJET) Development of smart & Regenerative Electric Bike Mopidevi Yashwanth, Kunduru Phani Teja, K sri sindhu Dept of Mechatronics Engineering, JNTU College of Engineering and technology, Telangana, India
[2]. International Research Journal of Engineering and Technology (IRJET) Electric Motorcycle with clutch less multi-speed gear reduction system Manojkumar M, Akash D, Allen Harris Prasanna J, Dr. Jose Anand Dept. of Electronics and communication Engineering, KCG College of Technology, Tamil Nadu
[3]. International Journal on Advanced Science Engineering and Information Technology Design and development of drive system integrated a continuous variable transmission (CVT) for an Electric motorbike Tuan-anh Bui, Huy-Bich Nguyen, Van Hung Pham, Manh-Toan Nguyen School of Mechanical Engineering, Hanoi University of science and Technology, Vietnam
[4]. International Journal of Power Electronics and Drive System (IJPEDS) Brushless DC Motor Speed Controller for Electric Motorbike Mohd Syakir Adli, Noor Hazrin Hany Mohamad Hanif, Siti Fauziah Toha Tohara Mechanical Department, Kulliyyah of Engineering, International Islamic University Malaysia 35 <Retrofitting and Improvisation of Conventional Bike to Electric Bike>
[5]. International Journal of Mechanical Engineering and Technology (IJMET), www.ijmet.net
[6]. American Journal of Engineering and Technology, www.ajer.org
[7]. Wikipedia
[8]. Society of automotive engineers, www.sae.org