

Tecno-Economic Analysis through Innovative Design on Conventional Motor Bike to Powered Electric Vehicle

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Abstract:

In the past few decades, major researchers focus on fuel consumption and emission reduction. Due to volatile fossil fuel price and depletion, there is a growing demand for the alternative fuels. Alternative fuel like biodiesel is green energy, which is derived from vegetable oils. Utilization of green energy in more efficient manner is a need of research. This research work is about the production of biodiesel from jatropha oil. Other oils can also be used for the production, but jatropha was chosen because it is not edible therefore, it will not pose a problem to humans in terms of food competition. Before the transesterification process was carried out, some basic tests such as free fatty acid content, iodine value, and moisture content were carried out. This was done so as to ascertain quality yield of the biodiesel after the reaction. The production of the biodiesel was done with standard materials and under standard conditions which made the production a hitch-free one. The jatropha oil was heated to 60°C, and a solution of sodium methoxide (at 60°C) was added to the oil and stirred for 45 minutes using a magnetic stirrer. The mixture was then left to settle for 24 hours. The result shows that the product meets the set standard for biodiesel. The focus is to study its performance and emission characteristics of biodiesel under various engine loading conditions.

Keywords — Biodiesel Production, Jatropha Oil, Emission Reduction, Fuel Efficiency

1.1 INTRODUCTION

In recent some years, Greenhouse gas problem increases day by day and also the gasoline fuel rate increases nearly about 90 Rs/li. In daily life routine, public transportation is very important but the fuel rate, some people avoid using bikes or cars. So, many automobile manufacturer and new companies put their effort to convert the conventional vehicle into electric vehicle that provide reliable solution.

A vehicle is propelled with electric motors and draw power from onboard electric source is an electric vehicle. It is more durable and mechanically simpler than gasoline vehicle. It gives more fuel efficiency than gasoline because it does not produce

emission like internal combustion engine. However, automobile industry is not completely moving towards pure electric cars because there is inherent problem of existing batteries technology. For storing the electric energy, most common storage device used in Electric vehicle is battery.

It can store large amount of energy in a small volume and weight. The recent report shows that there were more vehicles running on a gasoline product in past few years but now the report has been changed with increasing the usage of Hybrid and Electric vehicle. Presently people are more inclined towards the Hybrid vehicle, but the future will be totally based on electrification.

The rapidly developing technology of EV design precludes the description of a definitive universal package because the substantial forces which shape the Ev market tend to cause quite sudden major changes in direction by the key players, and there are a number of different EV categories with different packages. For passenger cars, it seems that the converted standard IC-engine driven car may be giving way to a more specifically designed package either for fuel-cell electric or hybrid drive.

While the volume builders may lean towards the retention of standard platform and body shell, it seems likely that the more specialist builder will try and fill the niches for particular market segments such as the compact city car. It is thus very important to view the EV in the wider perspective of its market and the wider transportation system of which it might become a part because electric drive has a long history, quite a large number of different configurations have already been tried, albeit mostly only for particular concept designs. As many established automotive engineers, brought up in the IC engine era, now face the real possibility of fuel-cell driven production vehicles, the fundamentals of electric traction and the experience gained by past Ev builders are now of real interest to those contemplating a move to that sector. A review of the current 'state of play' in sole electric drive and associated energy storage systems is thus provided, while hybrid drive and fuel-cell applications will be considered.

1.2 ELECTRIC VEHICLE PROMOTION IN WORLD

The scenario analysis highlights the fact that it is quite possible to reach the EU 2020 targets without EVs. Meeting the longer-term targets however, i.e. in 2050 (and likely intermediary targets from 2030-2050), would prove to be very difficult without EVs, and given the massive biofuel requirements, perhaps even impossible. Hydrogen based personal vehicles could form part of the solution, but at this point in time it would appear that EVs and PHEVs will be a more cost-effective solution. In addition, the production and on-board

conversion of hydrogen also involves additional processes that increase the overall energy use for hydrogen vehicles relative to EVs. The scenarios demonstrate the likely future importance of EVs and PHEVs in the EU passenger vehicle segment. Given the lifetime of a personal vehicle, a transition to such a large segment of electrical drive trains will take time and equally important, will require technology advancement and cost reductions.

To spur this technology advancement and cost reduction it is important that EV production and utilization rates are increased in the upcoming years. The primary objective of the remainder of this report is therefore to identify and provide recommendations regarding EU level measures and incentives that can promote EV diffusion.

1.3 ELECTRIC VEHICLE PROMOTION IN INDIA

Electric Vehicles in India are still relatively new. They account for just 1 % of the total vehicle density. India unveiled the 'National Electric Mobility Mission Plan (NEMMP) 2020' in 2013 to address the issues of national energy security, vehicular pollution, and growth of domestic manufacturing capabilities.

While you might see a lot of e-rickshaws zipping across the narrow lanes of Karol Bagh in Delhi, a major shift has yet to arrive towards Electric Vehicles. Only a handful of electric cars are available in the market, and the small-vehicle market is still dominated by conventional vehicles.

"We are going to introduce electric vehicles in a very big way. We are going to make electric vehicles self-sufficient like UJALA. The idea is that by 2030, not a single petrol or diesel car should be sold in the country," Power Minister Piyush Goyal said while addressing the CII Annual Session, 2017.

1.4 REASONS FOR EV DEVELOPMENT

As modern culture and technology continue to develop, the growing presence of global warming and irreversible climate change draws increasing amounts of concern from the world's population. It has only been recently, when modern society has actually taken notice of these changes and decided

that something needs to change if the global warming process is to be stopped.

Countries around the world are working to drastically reduce CO₂ emissions as well as other harmful environmental pollutants. Amongst the most notable producers of these pollutants are automobiles, which are almost exclusively powered by internal combustion engines and spew out unhealthy emissions. According to various reports, cars and trucks are responsible for almost 25% of CO₂ emission and other major transportation methods account for another 12%.

With immense quantities of cars on the road today, pure combustion engines are quickly becoming a target of global warming blame. One potential alternative to the world's dependence on standard combustion engine vehicles are hybrid cars. Cost-effectiveness is also an important factor contributing to the development of an environment friendly transportation sector.

1.5 PURPOSE AND NEED OF ELECTRIC-BIKE

Economic conditions around the world have been very encouraging. Global growth which was 4.8% in 2005, 4.9% in 2006 and still below 5% in 2009 and is expected to hover around this level in the current year also. While the Chinese economy is growing at around 10% without any signs of slow down, the Indian economy is also continuing to grow at more than 8%. In the coming years, I am expecting that the Indian economy will be booming owing to the heavy demand on infrastructure. Energy sector is growing by leaps and bounds as it is receiving the highest attention of both the State Governments and Central Government. India has moved from an agrarian economy to a manufacturing economy. The manufacturing sector now contributes around one-fourth of the total GDP, and the industrial output has now crossed USD 65 Billion in value. Global steel production is continuing its growth and the production in 2006 crossed 1.2-billion-ton mark.

In spite of some control measures adopted by Chinese Government the crude steel registered an impressive growth and has crossed 450 million tons.

India is also witnessing a huge growth in steel production, and it is expected that steel industry will continue to grow by more than 12% per annum. Sustainable economic growth of India as well as rest of the world will depend on effective energy planning.

Nearly 40% of the world's energy comes from petroleum. Natural gas contributes to another 20% and these two natural resources account for 60% of the world's energy. The growth in consumption of oil and natural gas in the past has been such that the consumption has been doubling every 15 years. This trend is likely to continue and will lead to complete depletion of natural resources in next 30 years.

1.6 COMPONENTS OF ELECTRIC VEHICLE (EV)

There are three important components in electric vehicle namely,

1. Motor
2. Motor Controller
3. Battery

1.6.1 MOTOR

The main function of motor is to convert supplied electric energy current into mechanical energy. Brushless DC motor (BLDC) have been much focused for many motor manufacturers. These are more effective in term of System cost, size, higher in efficiency, excellent controllability and also power saving than other motor. It has only two basic main parts Rotor and stator. The rotor is rotating part which carries permanent magnet and stator is stationary part and containing stator winding. The structure of stator is similar to the induction motor. It is made up of steel lamination with axially cut for winding.

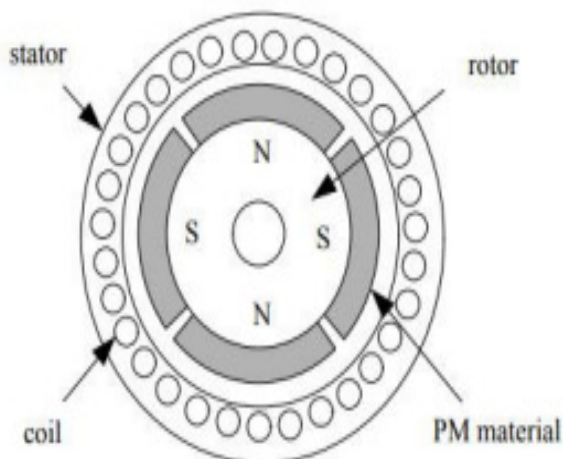


Figure 1.1 BLDC Motor

1.6.2 MOTOR CONTROLLER

In most of the electric vehicle, Brushless DC motor is used which is better than brushed DC motor, permanent magnet DC motor. Brushless DC motor does not have brush and commutator, the electric vehicle which uses brushless DC motor has to use motor controller which helps to control various properties of motor to take sufficient current and voltage applied to motor. When accelerating pedal is pressed, this linked variable resistor type controller gives signal to the motor controller to adjust speed as per our needs. The motor controller has no power when vehicle is at rest position.

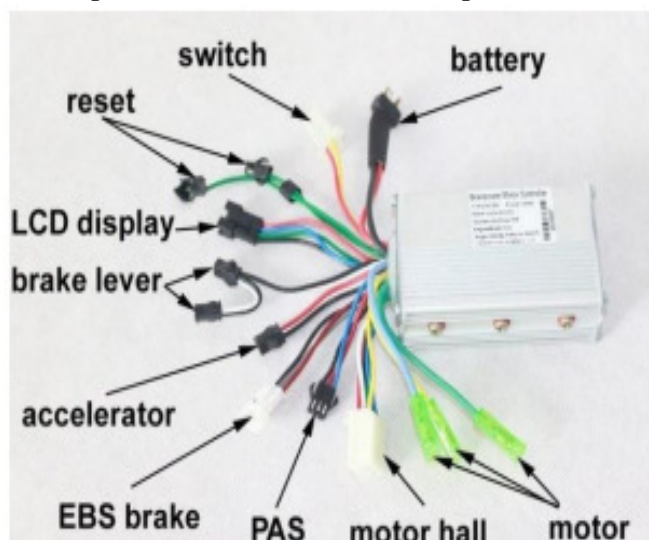


Figure 1.2 Motor controller

1.6.3 BATTERY

The main function of battery is to store electric energy. Most Hybrid and electric vehicle used lithium-ion batteries. This storage system is usually essential for hybrid electric vehicle, Plug in hybrid electric vehicle and all types of electric vehicles. Due to advancing technologies, most of automobile manufacturer uses rechargeable batteries. The different type of batteries along with their characteristics is shown in Table.

Battery type	Lead - Acid	Ni - Cd	Ni - Mh	Lithium - ion
Power density	180	150	250-1000	1800
Nominal voltage	2V	1.25V	1.25V	3.6
Energy Density	30-50	45-80	60-120	110-160
Overcharge Tolerance	High	Moderate	Low	Very low
Life cycle	200-300	1500	300-500	500-1000
Operating temperature	-20-60°C	-40-60°C	-20-60°C	-20-60°C
Self-discharge	Low	Moderate	High	Very low

Table -1.1: Types of Battery

1.6.4 Frame

The Frame is made up of M.S. along with some additional light weight components. The frame is designed to sustain the weight of the person driving the unit, the weight of load to be conveyed and also to hold the accessories like motor. Also, it should be designed to bear and overcome the stresses which may arise due to different driving and braking torques and impact loading across the obstacles. It is drilled and tapped enough to hold the support plates.

1.6.5 Platform

The Platform is designed with robust base so that it can hold the load along with the weight of the driving person uniformly. It is fabricated from Mild Steel at a specific angle in cross section and welded with a sheet of metal of specific thickness. The platform's alignment is kept horizontal irrespective

whether it is loaded or unloaded, and this is directly bolted and welded to the frame.

1.6.6 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. The major advantage of chain drive over traditional gear is that the chain drive can transmit rotary motion with the help of two gears and a chain over a distance whereas in traditional many gears must be arranged in a mesh in order to transmit motion.

1.6.7 Braking System

For the braking system it is convenient to use braking system used in band brake system which consist of spring-loaded friction- shoe mechanism, which is driven with the help of hand lever.

1.6.8 Sprockets

The chain with engaging with the sprocket converts rotational power into 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 is different in gears and sprockets.

1.7 CONSTRUCTION AND WORKING PRINCIPLE OF ELECTRIC VEHICLE

Basically, electric vehicle is necessary for saving fossil fuel. The figure shows the simple construction of electric vehicle. It consists of battery, motor controller, motor which is connected to the transmission system. Here, battery is the energy source which is charged by taking electric current from the grid (In Solar power electric vehicle, Battery is charged with the use of solar pv panel which is attached on the roof of the vehicle).



Figure 1.3 Electric vehicle (BEV) power train

These batteries are rechargeable. Most electric vehicle uses lead acid battery but in new type of electric cars, use lithium-ion batteries because it can store more energy than lead acid battery in same physical space. The efficiency and life span of battery is far better than other type of batteries, but it is costlier than lead acid battery. After that controller control the flow of energy from energy source to the motor. Motor transmits the power to the wheels of the vehicle by the use of transmission system.

1.8 TYPES OF ELECTRIC BIKE

Electric vehicles are classified as follows.

1.8.1 BATTERY ELECTRIC BIKE: MOTOR

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A battery electric vehicle (BEV) is a vehicle that is powered entirely on electric energy, typically a large electric motor and a large battery pack. Based on the type of transmission; the use of a clutch, gearbox, differential, and fixed gearing; and the number of battery packs and motors there are many variations on the BEV design. However, a basic BEV system is shown in Figure 1. Battery Motor/ Transmission Generator



Figure 1.4 battery electric vehicle (BEV) power train

1.8.2 HYBRID ELECTRIC BIKE

Unlike a BEV, a hybrid electric vehicle (HEV) relies on two energy sources, usually an internal combustion engine and an electric battery and motor/generator. A Mild Hybrid is the least electrified type of HEV. A Mild Hybrid is a conventional internal combustion engine (ICE) vehicle with an oversized starter motor that can also be used as a generator, usually called an integrated starter-generator (ISG) or a belted alternator starter (BAS), and an oversized battery that powers and is recharged by the motor.

A simple Mild Hybrid system is shown in Figure 1.4. In a Mild Hybrid, the engine must always be on while the vehicle is moving. However, the motor/generator can be used to enable idle stop in which the engine is turned off while the vehicle is at idle. The motor/generator can be used at high

loads to assist the engine and increase vehicle performance. At low loads, it increases load on the engine and recharges the electric battery. Liquid Engine Transmission Fuel Battery Motor/Generator



Figure 1.5 Hybrid ELECTRIC BIKE

1.8.3 PLUG-IN ELECTRIC

Vehicles a plug-in hybrid electric vehicle (PEV) is an EV that can be plugged-in or recharged from wall electricity. PEVs are distinguished by much larger battery packs when compared to other EVs. The size of the battery defines the vehicle's All Electric Range (AER), which is generally in the range of 30 to 50 miles.

PEVs can be of any hybrid configuration. Although no PEVs are available on the market today, a number of companies have begun to sell conversion kits and services to convert a standard EV into a PEV by adding additional battery capacity and modifying the vehicle controller and energy management system.



Figure 1.6 Plug-in Electric vehicle

E-bikes typically incorporate a battery, which can be charged at an ordinary domestic power socket, linked to an electric motor in the bicycle transmission system. The rider has the power to control the output power from the motor i.e. speed using a handlebar mounted computer display panel and controller.

E-bikes come in different styles and bike uses, and most resemble the various types of traditional bikes and functions.

Cruiser: Cruiser e-bikes are best for recreational riders who want comfort as they cruise. They're designed mostly for flat terrains like bike paths and paved roads. Cruisers have wide tires and usually feature a suspension system to reduce shock in the front fork and the seat. The handlebars are placed higher to provide a more upright ride that's easy on the back.

Commuter: A Commuter is good for running errands, commuting to work, or getting where you need to go fast, even if it's far. Commuter bikes typically have large, narrow tires built for efficiency and an upright design for comfort. They also feature comfortable seats, but the seats usually aren't as wide as cruiser seats.

Mountain: Mountain e-bikes are built for thrill-seekers who want to venture into off-roading trails and have fun as they ascend steep hills fast. They feature wide tires and flat handlebars to help riders tackle rugged terrain and dirt trails.

Road: Road e-bikes are similar to cruiser bikes in that they are designed for recreational riding on paved surfaces. The difference is they have narrow tires and drop handlebars to encourage fast riding. These lightweight bikes are designed to quench a thirst for speed.

There are three different classes of e-bikes.

Classes were created to determine how e-bikes should be used according to local e-bike laws. The classes include.

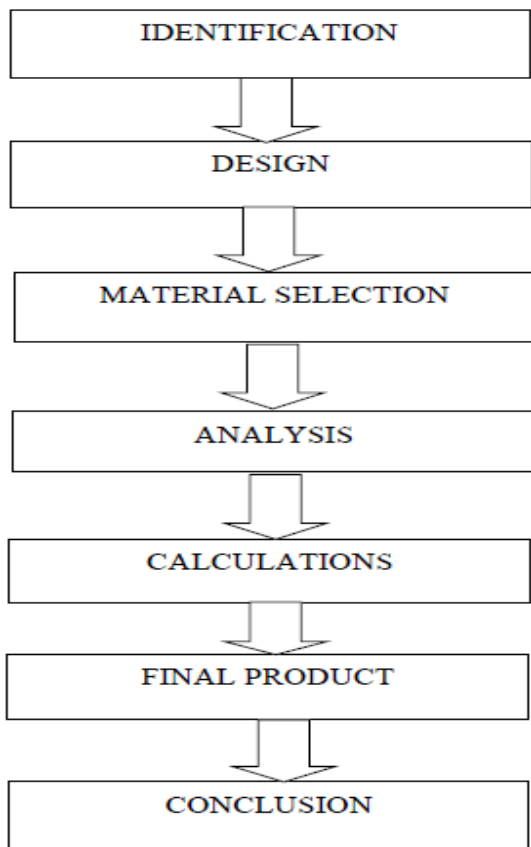
Class 1: The Class 1 e-bike provides assistance only when you pedal, and stops assisting when you reach

20 mph — great for bike lanes, bike paths, roads or anywhere you'd take a traditional bike.

Class 2: The Class 2 e-bike is equipped with a throttle which provides a boost without pedaling, and stops assisting at 20 mph.

Class 3: The Class 3 e-bike is equipped with a speedometer, and only assists until the bike reaches 28 mph — an excellent choice for commuters. The most popular bikes fit into Class 1 or Class 3 because riders still want to pedal.

II. METHODOLOGY



The invention provides exemplary electric motor assemblies, electrically assisted bicycles, and methods for their use. In one exemplary embodiment, the invention provides an electric motor assembly which comprises housing and a spindle that is disposed to rotate in the housing.

A motor is disposed within the housing and comprises a stator coupled to the housing and a rotor rotatably disposed within the stator such that the rotor is disposed about the spindle. The motor assembly further includes an output driver, and a gear system operable coupled to the rotor and the output driver to rotate the output driver upon operation of the motor.

The disposition of the motor and output driver within the housing is advantageous in that it facilitates packaging and manufacturing of the motor assembly. Preferably, the spindle is aligned with a central axis of the housing, with the rotor being concentrically disposed about the spindle, and the stator being concentrically disposed about the rotor. Such a configuration allows for a compact design to allow the motor to conveniently fit within the housing.

III. DESIGN OF ELECTRIC BIKE

3.1 ELECTRIC BIKE

Here the current from battery moves to controller where all the connections are made. When the power is given to the motor, it rotates the wheel using chain and sprocket.

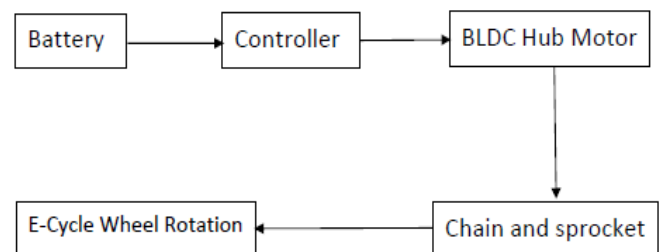


Fig.3.1 Block diagram of Electric Bike

3.2 OPERATION

Insert the key and turn on the ignition. Long press the power button in the instrument console, then the power supply will be active.

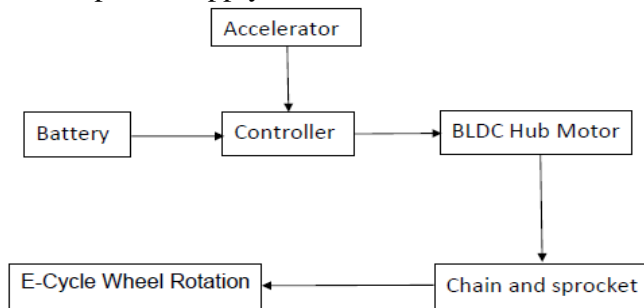


Fig.3.2 Block diagram of converting Electric Bicycle

When we rotate the accelerator to our desired amount, the controller takes the input and gives the limited power to the motor and runs accordingly.

When the brakes are applied during running/idle conditions, the controller cuts off the power supply to the motor till the brakes are engaged.

3.3 ANALYSIS

3.3.1 Speed and torque performance analysis.

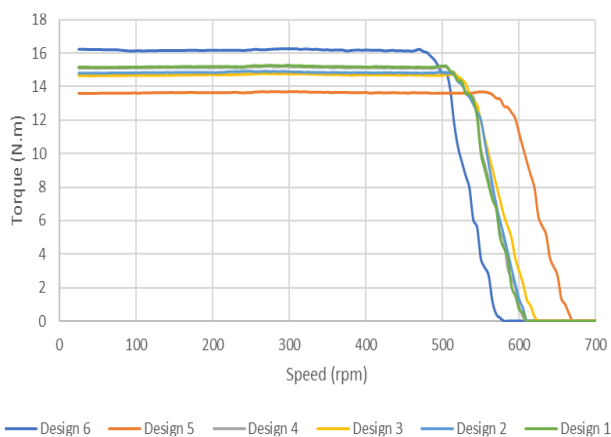


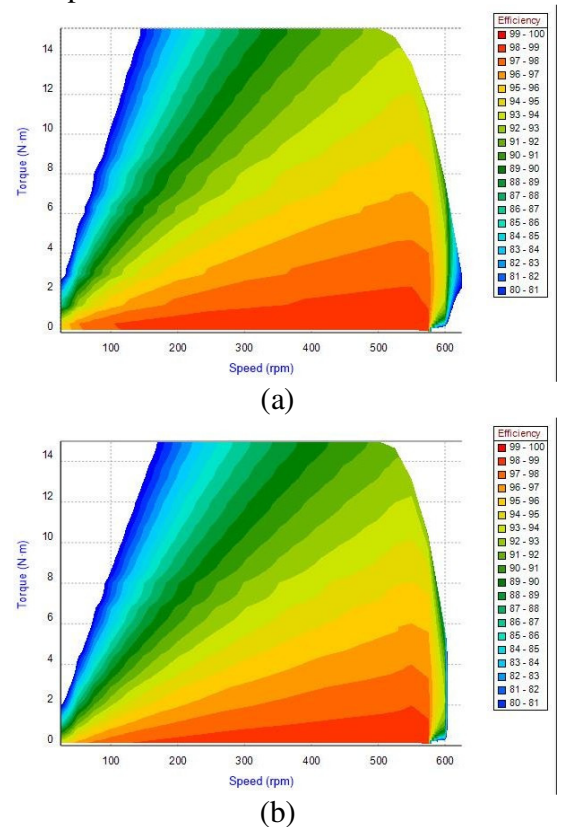
Figure 3.3 Torque and speed comparison on the outer rotor BLDC motor design

Figure 4.3 shows the comparison of torque vs speed for each BLDC SPM outer rotor motor

design. Design 6 shows a fairly good torque performance compared to other designs. Design 5 has the advantage of increasing the speed up to 600 rpm with a torque of 12 N.m. Designs 1, 2, 3, and 4 have a speed of 550 rpm when the torque is 12 N.m. Unlike the design 6 which is capable of rotating at 515 rpm at 12 N.m of torque.

3.3.2 Efficiency analysis

Figure 5 shows a comparison of the efficiency mapping for each design. Please note in detail the changes that occur in each design. Changes do not change significantly, only for designs 1 and 2 have the same characteristics, while designs 3, 4, 5, and 6 have almost the same efficient map characteristics.



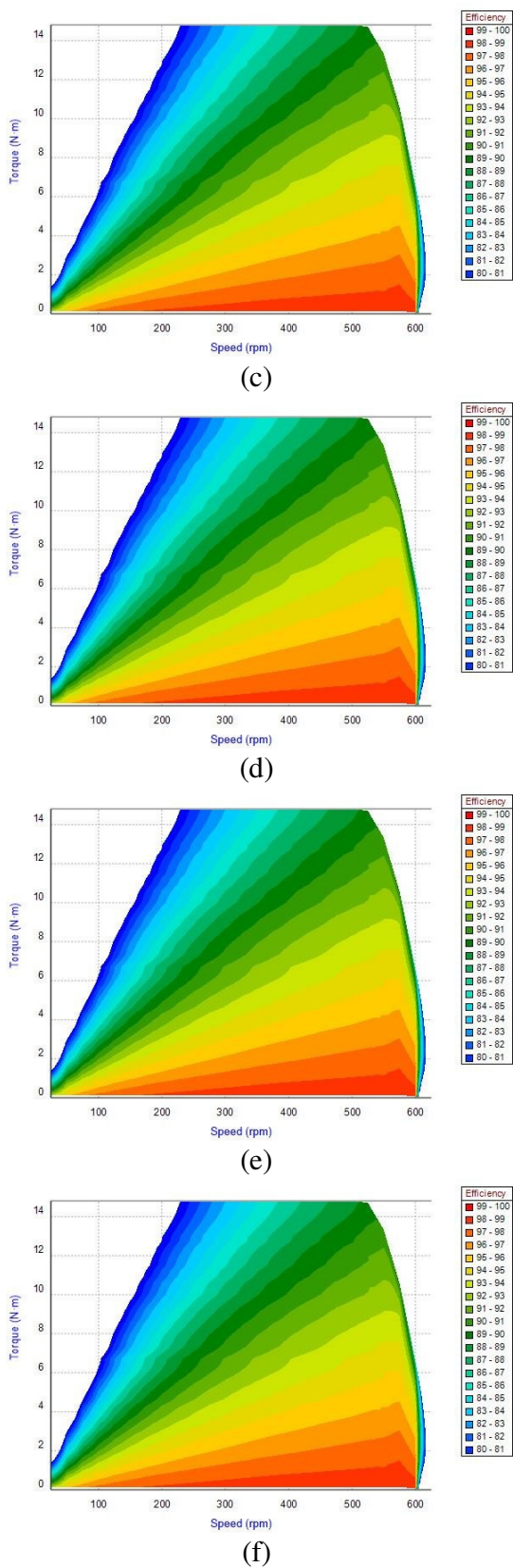


Figure 3.4 (a) efficiency map of design 1, (b) efficiency map of design 2, (c) efficiency map of design 3, (d) efficiency map of design 4, (e) efficiency map of design 5, (f) efficiency map of design 6

3.4 REQUIREMENT CALCULATIONS

3.4.1 Mass Range Calculations

2 Person Weight	= 150kg
Battery Pack	= 6kg
Motor & Controller	= 4kg
Bike weight	= 80 kg

Total = 240 kg

So, Battery & Motor are required to propel the Bike with the weight of 260kg.

3.4.2 Motor Load calculation

- F_p = Propulsion Force
- F_{wf} = Windage & Friction Drag
- F_d = Down force from Gravity

Consider the Grad @ 3.14%

$$\alpha = \tan^{-1}(\text{slope})$$

$$= \tan^{-1}(3.14/100)$$

$$= \tan^{-1}(0.0314)$$

$$\alpha = 1.8 \text{ degree}$$

3.4.3 To Finding F_d (Gradient Resistance)

$$F_d = m \times \sin \alpha$$

$$= 260 \times 9.81 \times \sin 1.8$$

$$= 81 \text{ N}$$

3.4.4 To Find F_{wf} (Aero Resistance)

C_d = Aerodynamic Area Co-efficient = 0.74

$$\rho = \text{Density} = 1.225 \text{ kg/m}^3$$

$$A = \text{Frontal Area of Bicycle} = 0.37 \text{ m}^2$$

$$V = \text{Velocity of Bicycle} = 25 \text{ km/h} \Rightarrow$$

$$6.94 \text{ m/s}$$

$$F_{wf} = \frac{1}{2} \times C_d \times \rho \times A \times V^2$$

$$= \frac{1}{2} \times 0.74 \times 1.225 \times 0.37 \times (6.94)^2$$

$$F_{wf} = 8.07 \text{ N}$$

3.4.5 To Find FR (Rolling Resistance)

CR = Rolling CO-efficient => 0.0041 (for Bike)

$$FR = CR \times mg \times \cos \alpha$$

$$= 0.0041 \times 120 \times 9.81 \times \cos 1.8$$

$$= 4.8 \text{ N}$$

3.4.6 Total Propulsion Force required, FP.

$$\begin{aligned}
 F_p &= F_d + F_{W_F} + F_R \\
 &= 81 + 8.07 + 4.8 \\
 &= 93.87 \text{ N} \\
 \text{Propulsion Power} &= F_p \times \text{Velocity} \\
 &= 93.87 \text{ N} \times 6.94 \text{ m/s} \\
 &= 651.4578 \text{ W}
 \end{aligned}$$

Thus, the Motor is to be 652 W.

3.4.7 SELECTION OF BATTERY PACK
Range required: 150 km.

Speed of bike: 50 km/hr
 50 km for 1hr
 Therefore, 150 km for 3 hr
 345W Power to be extracted for 1.2hrs, to cover 30km distance.

Therefore,

$$652 \times 3h = 1954 \text{ W-h}$$

1954 W-h battery Pack is required.

$$\begin{aligned}
 \text{Charge Rating (C)} &= 37.5 (7.5 \times 5) / 12.5 \\
 &= 3C \text{ for}
 \end{aligned}$$

Discharge

$$\begin{aligned}
 \text{Charging allowed is } 0.5C &= 0.5 \times 12.5 \\
 &= 6.25 \text{ Amps}
 \end{aligned}$$

$$\begin{aligned}
 \text{Safe current is } 0.2C &= 0.2 \times 12.5 \\
 &= 12.5 \text{ AMPS}
 \end{aligned}$$

So, 42 V 2.5A Charger needed.

3.4.8 CONTROLLER SPECIFICATIONS

$$\begin{aligned}
 36V \times I &= 350W \\
 I &= 9.7 \text{ A} \\
 9.7 < 37.5 &\quad \text{Therefore Battery is safe.}
 \end{aligned}$$

$$9.7 < 13 \quad \text{Therefore controller is safe.}$$

3.4.9 DESIGNING OF SHAFT BENDING:

The force which develops across a specific cross section of the shaft, it generates stress at that point of cross section that are subjected to maximum loading. This internal or resisting moment gives rise to the stress called as bending stresses. Torsion: When the shaft which is twisted by the couple such that the axis of that shaft and the axis of the couple harmonize, that shaft is subjected to pure torsion and the stresses generated at the point of cross section is torsion or shear stresses.

Combined Bending and Torsion: In actual practice the shaft is subjected to combination of the above two types of stresses i.e. bending and torsion. The bending stresses may occur due any one of the following reasons:

1. Weight of belt
2. Pull of belts
3. Eccentric Mounting of shafts/gears
4. Misalignment of shafts/gears on contrary, the tensional movement occurs due to direct or indirect twisting of the shaft. Hence at any given point on cross-section of the shaft, the shaft is subjected to both bending and tensional stresses simultaneously. Following stresses are taken in consideration while designing the shaft:

Shaft design

$$T = 36000 \text{ N mm}$$

$$T = 3.14 / 16 \times \sigma_s \times d^3$$

$$F_s \text{ allowable} = 80 \text{ N/mm}^2$$

$$6820 = 3.14 \times \sigma_s \times d^3 / 16$$

$$\sigma_s = 34.73 \text{ N/mm}^2$$

Material = C 45 (mild steel)

$$\sigma_{ut} = 320 \text{ N/mm}^2 \text{ ----- PSG design data book.}$$

factor of safety = 2

$$\sigma_t = \sigma_b = \sigma_{ut} / \text{fos}$$

$$= 320 / 2$$

$$= 160 \text{ N/mm}^2$$

$$\sigma_s = 0.5 \sigma_t$$

$$= 0.5 \times 160$$

$$= 80 \text{ N/mm}^2$$

σ_s is less then allowable so our shaft design is safe.

3.5 MOTORCYCLE CHASSIS



Fig 3.5 Motorcycle Chassis

The primary function of the motorcycle frame (also known as Motorcycle Chassis) is to hold the different parts together in one rigid structure and prevent it from falling apart. In other words, a motorcycle frame is its core structure or skeleton made to support the suspension, seats, handlebars, fuel tank, and engine. It also houses the steering equipment in the front with the help of a steering head tube.

Earlier, frames were commonly made from steel; however, manufacturers now also use long-lasting materials such as Titanium, Magnesium, Carbon Fiber, etc., depending upon requirements and production costs. There are various types of motorcycle chassis. In this post, we have listed a few of those.

3.6 BATTERY MANAGEMENT SYSTEM (BMS)

The battery management system is in place to keep track of each battery cell's specific performance. Rather of allowing for individual performance, the BMS assures that each battery cell drains, performs, and acts in the same way as every other cell in the battery.



Fig 3.7 Battery management System

If you have uniform cell performance, which is otherwise impossible, you will have consistent performance and full operation of your motor. The BMS also extends the life of your battery. Individual cells without a BMS can overcharge and explode, or they can drain too far and become un-rechargeable, hastening their overall deterioration.

A defective BMS in your battery is the cause of failure if your Electric Motor Bicycle battery explodes or fails out much sooner than the manufacturer claims. In fact, a defective BMS is one of the most prevalent causes of your Electric Motor Bicycle's poor performance.

Tips to Manage Your BMS System:

- Don't charge your battery with a charger that isn't rated for it.
- Never leave your battery in a hot, cold, or wet environment.
- After Long Periods of Inactivity, Refresh the BMS System

5.10 CONTROLLER

One of the most crucial components of an electric bike is the electric bike controller; it is the e-brain that controls the motor's speed, start, and stop. It's connected to everything else in the car, including the battery, motor, throttle (accelerator),

display (speedometer), PAS, and any other speed sensors.

The TA controller is made up of main chips (microcontrollers) and peripheral components (resistors, sensors, MOSFET, etc). Inside the controller, you'll find a PWM generating circuit, an AD circuit, a power circuit, a power device driver circuit, a signal acquisition and processing circuit, an over-current and under-voltage protection circuit, and a signal acquisition and processing circuit.

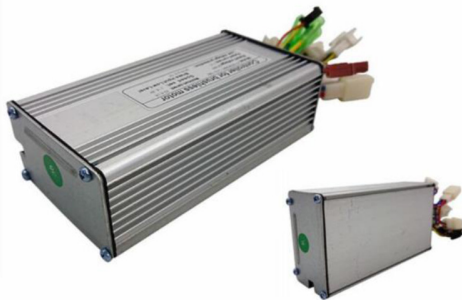


Fig.3.8 Controller

The controller supplies the working voltage to the external device, such as the switch +5V, headlamp +5V, and so on, after attaching the battery. Based on the input from the throttle or PAS, the PWM generates an appropriate pulse pattern for the MOSFET driving circuit. To control the motor speed, the MOSFET driving circuit manages the MOSFET circuit's turn-on and turn-off.

When the voltage is lower than the controller set value, the under-voltage circuit protects the battery from discharge, and the PWM circuit stops the output. The controller, battery, and motor cannot operate at greater currents because of the over-current protection circuit. The basic job of an electric bike controller is to collect all inputs from all electric components (throttle, speed sensor, display, battery, motor, and so on) and determine which signal should be returned to them (motor, battery, display).

IV. CONSTRUCTION AND WORKING PRINCIPLE

Each e-bike motor system we have on Raleigh bikes has different pedal assist parts, but the way the motor systems work in general is very similar. All our e-bikes are simply activated by pedalling. The motor will kick in when you start to

pedal - which triggers a sensor on the bike (this might be found in different places depending on your bike's system). There are two main types of e-bike sensors: cadence or torque. Each e-bike will have a chosen sensor that is ideally suited to the type of bike and its usage. The battery on the e-bike gives consistent electrical energy to the motor.



Fig 4.1 Electric bike

We understand that people still want to know a lot about e-bikes and our aim is to answer all your questions so you can make an informed decision on which electric bikes you'd like to purchase. Read more below as we answer questions about electric bikes.



Figure 4.2 Construction of Electric Bike

Users can easily disassemble the chain components of an electric bike. You can separate the

bike onto fractions without needing to remove the electric bike's frame. Chains quickly suit many bike designs than the shaft-drive system.

ADVANTAGES

- Easy to commute with low fatigue.
- Less maintenance cost.
- Normal Drag/Pedal is possible when power is not in use.
- Deployable batteries – can be taken inside house.
- Cost of the unit is very low.
- Easy to carry since it is portable.
- Less energy consumed.

V. CONCLUSION

As cities grew, so did the demand and transportation. Regular bike cannot meet the requirements and electric two-wheeler use is experiencing tremendous growth. There is an over-standard electric bike which is faster and heavier than normal electric bike. Over-standard electric bike provides an low-cost and convenient form of private mobility and is thus an attractive alternative to public transit or regular bicycling. 70% users had switched from public transport and bicycle. However, the increasing numbers of over-standard electric bike have simultaneously created some serious problems affecting future prosperity: safety and efficiency.

This paper focuses on travel characteristics. More than 500 electric two-wheeler users are interviewed to collect characteristic data. Statistical analysis is used to analyze the differences between electric bike and over standard electric bike. When over-standard electric bikes characteristics are made comparison with electric bikes, the distribution has a few changes. The use of over-standard electric bike improves the level of service of two-wheeler traffic. There are a longer travel distance and a relatively long travel time.

Over-standard electric bikes are still the dominant transport mode in both commuting trip and non-commuting trip. The main reason to choose over standard electric bike is punctuality and timesaving. If the over-standard electric bikes are

unavailable, 70 percent of the over-standard electric bike users will transfer to motorized traffic, such as transit and car.

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