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Cost Efficient and Eco-Friendly Electric Vehicle

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ABSTRACT: There are three main stages in the EV's history. In the early days of mechanic traction, until the beginning of 1900s, steam, internal combustion (IC), and electric motors had equivalent market penetration. The IC motor has been recently developed. Steam automobiles were dangerous, dirty, and expensive to maintain. EVs had many technical advantages.

In the next 50 years, the global population will increase from 6 billion to 10 billion and the number of vehicles will increase from 700 million to 2.5 billion. If all these vehicles are propelled by internal combustion engines, where will the oil come from? And where should the emissions be disseminated? The gloomy answers to these questions compel people to strive for sustainable road transportation for the 21st century. EVs addressed these issues positively. Concerning the environment issues, EVs can provide emission-free urban transportation. Even taking into account the emissions from the power plants needed to fuel the vehicles, the use of EVs can still significantly reduce global air pollution.

Application of solar energy to electrical energy for running a bike with motor mounted on the rear wheel. This electrically powered bicycle is known as e-bike and as it is supported by a solar energy it is more efficient as it charges the electrical battery even in diffused sunlight.

By studying the market and after meeting with some authorize electric vehicle dealers it is clear to understand different specification of recent electric bikes. We found specification of current electric bikes & compared it with customer feedback then started collection of data regarding the torque of and battery life of electric bike, then we got to know that there must be increase in starting torque & also there should be alternative source for battery.

KEYWORDS: ECONOMIC , UTILITY, ENVIRONMENTAL FRIENDLY.

I. INTRODUCTION

There are three main stages in the EV's history. In the early days of mechanic traction, until the beginning of 1900s, steam, internal combustion (IC), and electric motors had equivalent market penetration. The IC motor has been recently developed. Steam automobiles were dangerous, dirty, and expensive to maintain. EVs had many technical advantages. The short range of EVs was less of a limitation as only big cities were properly paved, i.e., long journeys were infrequent. However, the expansion of modern road systems. Since the appearance of the internal combustion engine towards the end of the 19th century and specifically its installation and use in wheeled automobiles, motorcars have been creating pollution as a result of their emissions to the environment. The degree of this pollution has been increasing over time with more and more automobiles appearing on the roads through the years. It was only in the early 1950's when air pollution and automobiles were first linked by a California researcher who determined that vehicle traffic was the cause for the smoggy skies over the city of Los Angeles.

II. NEED OF PROJECT

In the next 50 years, the global population will increase from 6 billion to 10 billion and the number of vehicles will increase from 700 million to 2.5 billion. If all these vehicles are propelled by internal combustion engines, where will the oil come from? And where should the emissions be disseminated? The gloomy answers to these questions compel people to strive for sustainable road transportation for the 21st century. EVs addressed these issues positively. Concerning the environment issues, EVs can provide emission-free urban transportation. Even taking into account the emissions from the power plants needed to fuel the vehicles, the use of EVs can still significantly reduce global air

pollution. From the energy aspect, EV is an off era secure, comprehensive and balanced energy option that is efficient and environmentally friendly, such as the utilization of various kinds of the renewable energies. One of the primary reasons for the introduction of electric bike into the market is the concern over greenhouse gas emissions and their contribution to global warming. The purpose of creating electric bike that reduced or eliminated exhaust emissions was to help combat this issue. India also needs to cut its stronger reliance on coal to produce electricity as the benefits of having EVs would be largely nullified if they are charged using thermal power. "It is because of pressure owing to energy security and rising pollution, electric vehicles have taken greater importance.

III. OBJECTIVES OF PROJECT

- TO INCREASE GRADIENT TORQUE OF ELECTRIC BIKE
- TO MAKE ELECTRIC BIKE RELIABLE & CONVENIENT TO USE
- To reduce cost of electric bike with eco-friendly design.

IV. WHAT IS ELECTRIC BIKE

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

Types of E-bike:

- a) Battery electric vehicles (BEV)
- b) Hybrid electric vehicle (HEV)
- c) Fuel cell electric vehicle (FCEV)

Components used in Bike:

1. Motor:



Fig:1 Motor

An electric motor is a device converting electrical energy into mechanical energy (usually a torque). This conversion is usually obtained through the generation of a magnetic field by means of a current flowing into one or more coils.

Types of Motors:

- DC Motor
- AC Motor
- Brushless

2. Motor Controller:



Fig:2 Motor Control

The controller enables speed and breaking control by the lever based on the Hall sensor. It has also regenerative braking function which enables charging the battery during deceleration what increases an overall range of the vehicle. Furthermore, it is equipped with the extensive

Diagnostic system and the several protections such as: over current, overload, too high temperature, too high or too low voltage or accidental handle lock.

3. Battery:

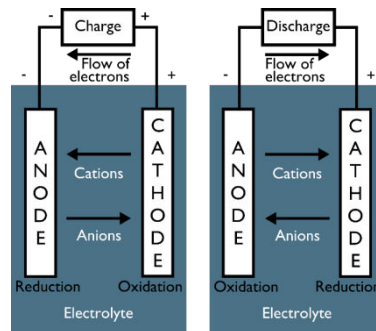


Fig:3 Battery

Vehicle battery is a main component that acts as the power source for propulsion of electric vehicle. Rechargeable batteries which are secondary batteries act as the source of energy for electric vehicle.

Different battery technologies are being used based on the advantages, applications, and cost. Range of the vehicle depends mainly on the capacity of battery. Size and cost of the vehicle increase as more battery is added to the vehicle. Cost of electric vehicle battery shows a decrement in last few years and it will further decrease since automotive industries focus on economical high efficiency, high capacity battery development.

Common Electric Vehicle Batteries:

a. Lead acid battery:

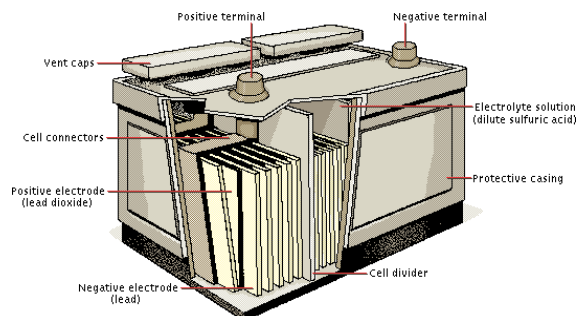


Fig:3(a) Lead acid battery

Traditionally electric vehicle have used Lead acid battery due to their matured technology and low cost. But life of deep cycle lead acid battery is lower than that of other battery types. Life span of lead acid battery is around 2 to 3years.

b. Nickel metal hydride battery:

Nickel metal hydride batteries are long life batteries compared to lead acid battery. They are considered as a matured battery technology now. Energy density is more in Nickel metal hydride batteries. Even though the charging and discharging efficiency is lower than that of lead acid battery, Nickel metal hydride batteries position at the top with their long life and energy density suitable for electric and hybrid electric vehicles.

c. Lithium Ion battery:

Fig:3.1(c).Lithium Ion battery

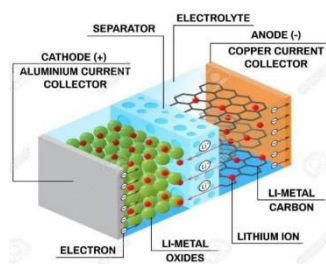


Fig:3.2(c)Lithium Ion battery



Lithium ion batteries are the most common batteries used in recent electric vehicles. High energy density, power density and charging efficiency are the advantages of Lithium ion battery. Energy density of 200 Wh/kg and more than 85% of charge/discharge efficiency makes Lithium ion battery suitable for electric vehicle. Weight of the vehicle significantly reduces due to the above-mentioned advantages of battery. But life of lithium ion battery is not that impressive. It ranges to a few 1000 charging cycles.

General parameters of the Electric Battery component:

Battery	Application	Wh/kg	W/kg	\$/kWh
Lead acid				150
Panasonic	HEV	26,3	389	
Panasonic	EV	34,2	250	
Nickel Metal				1500
Panasonic	HEV	46	1093	
Panasonic	EV	68	240	
Ovonic	HEV	45	1000	
Ovonic	EV	68	200	
Lithium ion				2000
Saft	HEV	77	1550	
Saft	EV	140	476	
Shin-Kobe	HEV	56	3920	
Shin-Kobe	EV	105	1344	

4. Chain Drive:

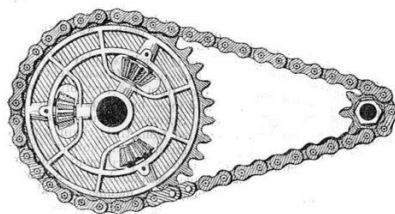


Fig:4Chain Drive

A chain can be defined as a series of links connected by pin joints. Chain drive, Device widely used for the transmission of power where shafts are separated at distances greater

Chain drive Than that for which gears are practical. In such cases, sprockets (wheels with teeth shaped to mesh with a chain) take the place of gears and drive one another by means of a chain passing over the sprocket teeth. The chains used in conveyor belts are commonly block chains, and consist of solid or laminated blocks connected by side plates and pins. The blocks engage with teeth on sprocket wheels. Depending on the material being moved, buckets, hooks, or other devices are connected to the blocks.

5. Brakes:

A brake is a mechanical device that inhibits motion by absorbing energy from a moving system. It is used for slowing or stopping a moving vehicle, wheel, axle, or to prevent its motion, most often accomplished by means of friction.

Types of brakes:

a. Simple Drum brake:



Fig:5(a)Simple Drum brake

It is the most traditional braking concept and also most commonly used. It is used in commuter motorcycles and scooters. There are two circular brake shoe which is encased in a drum-like circular casing. To this brake shoe, there is a piston attached which is operated by an actuating lever. On applying pressure to actuating lever by a foot, the piston pushes the brake shoe towards the drum and resist its motion which ultimately stops the wheel. It is limited to stop the vehicle having a speed of 50-55 kmph.

b. Simple Disc brakes:

These brakes are used for high-speed braking in sports motorcycles. Disc brakes are in great demand these days as it provides more braking power than drum or combined braking system. The key components for disc brakes are the rotor, piston, caliper, and brake pads. When brakes are applied by the rider, the piston moves which pushes the brake pads towards the rotor. The rotor is connected to the wheel and resistance of motion of rotor results into stopping of the wheel.

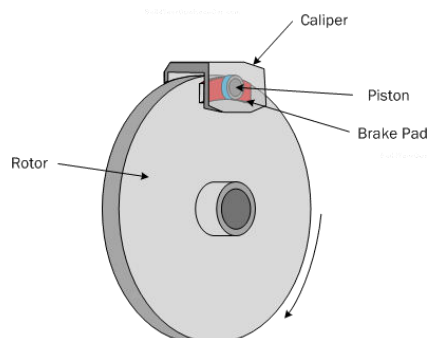


Fig:5(b)Simple Disc brakes

6. Switches:

- Ignition Switch
- Panel Switch
- Indicator Switch
- Control Switch

7. Charger :



Fig:7Charger

48Volt6Amp (48V6A) electric scooter / bike Constant Current battery charger. Universal 180265 VAC power input. Two-color LED indicator lamp glows orange when charging and green when charging is complete. This is an automatic battery charger which stops charging and goes into float mode when the charging cycle is complete to prevent over charging. Weight 1.5KG. Works with electric scooters and bikes that have four 12 Volt batteries or one 48 Volt battery.

Design of Vehicle:

a. Material Selection

The main materials used for making cars, parts and components, along with future trends, are Steel, aluminum, magnesium, copper, plastics and carbon fibers.

Need of material selection:

1. To design an existing product for better performance, lower cost, increasing reliability and reduced weight.
2. To select a material for a new product.
3. Need for higher fuel efficiency
4. Weight minimization

The most important criteria that a material should meet are:

1. Light weight, this criterion is the most important one for an automotive company, in the context of the high emphasis on greenhouse gas reductions, reduction of emissions and improving fuel efficiency.
2. Economic effectiveness, having in view that one of the most important consumer driven factors in automotive industry is the cost, that determines whether any new material has an opportunity to be selected for a vehicle component;
3. Safety, which criterion have in view the ability to absorb impact energy through controlled failure modes and mechanisms and be survivable for the passengers.
4. Recyclability of their products and lifecycle considerations, having in view that the most important concerns in automotive industries are the protection of resources and the recycling possibilities, including strategies on research and development targeted on recycling techniques and the development of more easily recyclable materials and their incorporation into the vehicle and its constituent components

Selection of Motor:

The torque calculation of motor is follows:

In torque calculation mass of vehicle and acceleration are main factor.

Sample calculation of torque required to overcome is as shown:

**Calculations:****1. RPM Calculations:**

The factors to be considered for rpm are wheel diameter, circumference, and speed required. The rpm obtained here is no load rpm. On inserting load, the rpm decreases gradually. The motor rpm to be selected should be on higher side than theoretically obtained rpm.

Sample calculation of RPM is as shown below:

- Wheel Circumference= $3.14 \times \text{wheel diameter}$
- RPS=Speed Required/wheel circumference
- RPM=RPS*60

2. Torque Calculation:

$$\text{Power, } P = T \times \omega$$

$$N = V \times 60 / \pi D$$

$$T = P / N$$

3. Battery charging time:

$$\text{Battery charging Time} = \text{Battery AH} / \text{Charging current}$$

4. Battery Discharging Time:

$$\text{Battery Discharging Time} = \text{Battery Ah} / \text{Applied Load}$$

Calculation Summary:

Component	Name	Quantity	Specification
Battery	Lead acid battery	4	12v
Motor	BLDC	2	1Hp & 1/2HP
Solar panel	Solar	1	Area : 5.97m^2

Battery selection:**Motor Selection:**

Battery	Lead acid battery	capacity=25a h charging time=4.166hr battery discharging time=1.5hrs
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Motor	DC Brushless Permanent Magnetic Motor.	RPM =288.2857934 HP=1
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V. RESULT

An attempt to test the motorbike was made. Current levels to the relay contact in the motor control circuit reached critical ampacity and destroyed the relay, and rendered the motor control circuitry inoperable. Immediately before the relay was destroyed, the motorbike did jerk forward slightly, proving that power was sent through the drive train to the rear wheel. A redesign of motor control circuit would be necessary to restore functionality to the bike. The challenge set forth by this MQP team was met with a pragmatic appreciation of the project's broad scope. There were numerous facets that determined success in this MQP, and overcoming those obstacles developed the team's understanding of the multidisciplinary and deeply varied challenges inherent to this type of engineering project.

Future scope:

Electric bike sales will likely continue to grow as more people look for alternatives to using gasoline-powered vehicles for their morning commute. As technology continues to evolve, we may see even more applications for these e-bikes, from off-roading to grocery shopping and everything in between.

In loner ride e-bike are not suitable as they require frequent charging station, from this we understood that there should be some alternate source of battery for that we think for solar powered vehicle in future to give continuous charging source.

VI. 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. As per our project problem statement we designed & developed E-Bike with Better Gradient Torque.

It is possible now to Manufacture E-bike with minimum cost & Eco-friendly design. We can Develop reliable & Convenient E-bike. Also, we have satisfied project objectives by designing & developing E-Bike with minimum cost & also with better Gradient torque.

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