Hybrid Bike with Solar Charging (Petrol Cum Electric)

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I. INTRODUCTION

The 20th century has seen the liquidation of all combustible matter of which the liquid and solid fuel like petrol, diesel and coal are not exception. As we know fuel will deplete in 21st century and also in a few years the fuel prices will shoot up sky high.

In today's restless world, revolution is an ominous word. The speed with which technologies become obsolete is amazing. The interest in electrical vehicle has not grown out all of a sudden. Electric vehicle has been around since before the turn of the century. The electric vehicle concept first began in the 1890's but ready availability of petroleum products made gasoline driven vehicle both faster and cheaper.

Significant factor, which stimulate the revival of the electric vehicles, are energy cost, energy independence and environmental protection. Because of the upcoming shortage of gasoline products, their cost and limitation in supply have encouraged the use of electric vehicles as a possible alternative mode of transportation.

Major reasons of the rekindling of interest in the electric vehicles are environmental considerations that electricity is superior to gasoline. The innovation in battery design will make the electric vehicle a practical means of transport in future.

The electric vehicle needs just a bit of support from both the government and public to take it to the where it truly belongings to the healthier, cleaner alternative motor vehicle. The time is not so far when no garage will be without electric vehicle. Electric vehicle transportation is more than a vision for the future.

II. COMPONENTS OF BATTERY ELECTRIC VEHICLE

There are three main components that are primary requirement for a Battery-Electric Vehicle.

1. Battery
2. Power System
3. Transmission System

A. BATTERY

Today's electric vehicles are predominantly Battery-Electric Vehicles, which utilize rechargeable batteries as a source of electric energy.In a Battery Electric Vehicle, battery does not store electrical energy in the same sense that a fuel tank stores liquid fuel.

Instead, they are essentially self-contained electro chemical reactors in which the by-products are retained within the battery housing. During recharge, these by-products are reconstituted into their original state where they are ready for another electrochemical reaction cycle.

Newer battery technologies are allowing electric vehicles to travel greater distances, recharge more quickly and require less frequent replacement. Some of the key battery and energy storage technologies include:

- Lead Acid Battery
- Nickel-Cadmium Batteries
- Lithium Ion Batteries

The most commonly used and cost effective battery of the above said is the lead acid battery because of the following reasons:

- Lead Acid Battery has the lowest initial and operating cost than any of the other type of batteries;
- Its voltage on discharge is the highest of all the reversible combinations used;
- The completely reversible chemical reactions produce little changes in plates; and
- It can operate satisfactorily over a wide range of temperature from-18 to 43 ◦c.

In construction, the battery consists of a container moulded and made of single piece construction either of hard rubber or of a bituminous material. The material has high acid proof and insulating properties with greater mechanical strength. It is divided into number of compartments or partitions or cells of two volts nominal voltage. The six cells are connected in series by lead acid battery for 12-volt battery.

Each cell in fact is a battery. It consists of two sets of plates or the electrodes on a solution of dilute sulphuric acid or electrolyte. One electrode is made of lead dioxide and other of spongy lead. As the function of cell starts, the acids react with plates to convert chemical energy into electric energy. A negative charge is built on lead plate and a positive charge on a lead peroxide plate. Bridges are formed for resting the battery plates at the bottom of each compartment. The sediments are contained in the spaces, between the bridge ribs. The plates are prevented from bridging and the short-circuiting by collecting the active material falling from the grid plates into the recess or spaces. A moulded cover with a removable plug to make the topping up and testing easy seals a cell. To allow for the escape of gases produced during the charging circuit, vent holes are provided in the plug.

The most promising near-term replacement for the Lead-acid battery appears to be the nickel-metal hydride battery. Specific energy of nickel-metal hydride battery is about double that of a lead acid battery. Looking farther into the future, the lithium couples offer the potential of a vehicle range to still increase. However, lithium based traction batteries are still in the experimental stages and much remains unknown about their ultimate performance, manufacturing costs, and service life, and consequently, their viability as an electric vehicle propulsion battery.

Battery Type	Specific Energy	Specific Power	Energy efficiency (%)
Lead-Acid	40	130	65
Al-Air	200	150	35
Zn-Air	120	120	60
Ni-Cd	56	200	65
Ni-Fe	55	130	60
NiH	80	200	65
Ni-Zn	80	150	65

B. POWER SYSTEM

The power system of an electric vehicle consists of two components: Motor that provides the power and controller that controls the application of this power. In comparison, the power system of gasoline-powered vehicles consists of a number of components such as engine carburetor, oil pump and water pump cooling system, exhaust system, etc.

C. MOTOR

Electric motors convert electric energy into mechanical energy. Two types of electric motors are used in electric vehicles to provide power to the wheels: the direct current (DC) motor and the alternating current (AC) motor.

DC electric motors have three main components:

1. A set of coils (field) that creates the magnetic forces, which provides torque;
2. A rotor or armature mounted on a bearing that turns inside the field; and
3. Communicating device that reverses the magnetic forces and makes the armature turn, thereby providing horsepower.

An electric vehicle, also referred to as an electric drive vehicle, uses one or more electric motor or traction motors for propulsion. Electric vehicles include electric cars, electric trains, electric lorries, electric aero planes, electric boats, electric motorcycles and scooters and electric spacecraft.

During the last few decades, environmental impact of the petroleum- based transportation infrastructure, along with the peak in oil prices, has led to renewed interest in an electric transportation infrastructure. Electric vehicle differs from fossil fuel-powered vehicles in which the electricity they consume can be generated from a wide range of sources, including fossil fuels, nuclear power, and renewable sources such as tidal power, solar power, and wind power or any combination of those. However it is generated, this energy is then transmitted to the vehicles through use of overhead lines, wireless energy transfer such as inductive charging,or a direct connection through an electric cable.

The electricity may then be stored on board the vehicles using a battery, flywheel, or super capacitors.

Vehicles making use of engines working on the principle of combustion can usually only derive their energy from a single or a few sources, usually non-renewable fossil fuels.

As in the DC motor, an AC motor also has a set of coils (field) and a rotor or armature; however, since there is a continuous current reversal, a commutating device is not needed.

III. CALCULATION AND RESULTS

OBSERVATION

Medium throttle speed = 240 rpm High throttle speed = 420 rpm Diameter of the wheel = 0.256 m
Radius of the wheel = 0.128 m
Mileage of the bike on petrol = 32kmpl

Distance in m	Load in kg	Time in sec
100	0	22.46
100	50	32.56
100	100	41.30

THEORETICAL RESULTS (IDLE)

N = 420 rpm
Speed = 2
Distance = v * t

1. For 22.46 seconds
   d = 2 * 3.14 * 0.128 * 420 * 1
   d = 126.379 m
2. For 32.56 seconds
   d = 183. 1882 m
3. For 41.3 seconds
   d = 232.3895 m

ERROR PERCENTAGE

Error %(load is 0) * 100 = 20.63 %

Error %(load is 100) * 100 = 56.96 %

TIME FOR COMPLETE DISCHARGE

Now,
Capacity of battery = 12Ah
Motor Power = 300W
Motor Volts = 24V

Also, P = VI;
300 = 24 X I
I = 12.5 A
Now, t = 57.6
t = 57.6 min for the complete discharge of battery.

DISTANCE TRAVELLED

Speed = 2 Distance
= v * t
Velocity = 2 X 3.14 X 0.128 X 420
V= 337.6128 m/min
Distance travelled for the full discharge of

Battery for idle condition,

d= 337.612 * 57.6 m
d = 19446.4512 m or 19.45Km
Distance travelled for the full discharge of

Battery for bike load,

d = 19.446 x
d = 15.43 Km

Distance travelled for the full discharge of battery for

50 kg,
d = 19.446 x
d = 10.61 km
Distance travelled for the full discharge of battery for

100 kg,
d = 19.446 x
d = 8.37 km

MANUAL CHARGING

Charging time of battery

T =Ah/A
A = 10% of the battery capacity
T = 12/1.2
T = 10 hrs
If we consider 10 % losses = 10 + 1 = 11 hrs.
If we consider 20 % losses = 10 + 2 = 12 hrs.
If we consider 30 % losses = 10 + 3 = 13 hrs.
If we consider 40 % losses = 10 + 4 = 14 hrs.

SOLAR CHARGING

Battery: 12 Ah x 24 V = 288 Wh
Panel : 5W x 6hrs x 0.85 = 25.5 Wh

RESULT

1. Time taken for complete discharge of battery =

57.6 min

2. Distance travelled for idle condition =19.45KM
3. Distance travelled for bike load = 15.46km
4. Distance travelled with 50 Kg load = 10.61km
5. Distance travelled with 100 Kg load = 8.37km
6. Time taken to charge manually in idle condition = 10hrs
7. Time taken to charge using solar panel = 11.29hrs

IV. CONCLUSION

The vehicle what we have is presently giving a mileage of 32 kilometers by consuming one liter of petrol as per the test rides which is merely running on a single source of energy.

By adding the electric motor to the front wheel the vehicle's mileage is excepted to increase by around 60% (idle condition), 48% (bike load), 35% (for 50 kg load),

27% (for 100 kg load).

It's very effective for city riding where we always face slow moving traffic and more traffic signals.

The electric motor is so designed that if the motor crosses its maximum rpm range, then it becomes generative type motor and the batteries get charged up during this time.

The two main benefits what we get here is the power generation at higher speeds helping to charge up the battery up to certain extent, and Initial saving of petrol at the pickup stage or in the slow moving traffics.

As everyone is aware that petrol is a non renewable resource, and is soon going to be depleted, so reducing the consumption of petrol may not stop the depletion completely but for sure will increase the life of its sustenance.

And hence the development of THE TWO WHEEL DRIVE PETROL COME ELECTRIC TWO WHEELER

REFERENCES

[1]. Electric Vehicles – Charging Stands & Infrastructure, Mark Clapper, GE Specification Engineer, 2010
[2]. A Technical Research Report: The Electric Vehicle, Rony Argueta , University of California Santa Barbara College of Engineering, 2010
[3]. Controlling of brushless DC motors in electric bicycles using electronic based circuit with 8 bit micro-controller.
[4]. V. Thiyagarajan, V. Sekar ,Assistant Prof. (Sl.Gr), Department of EEE, TRP Engineering College, Tamilnadu, India, 2012
[5]. DESIGN OF AN ELECTRICAL DRIVE FOR MOTORIZED VEHICLES, C. Boccaletti, G. Duni, P. Petrucci, E. Santini
[6]. Electric Vehicles Revisited –Costs, Subsidies and Prospects, Philippe Crist, International Transport Forum at the OECD, Paris, 2012
[7]. PERFORMANCE ANALYSIS OF TWO STROKE PETROL ENGINE, Abhishek Chakraborty, Shivamsharma, 2011