FABRICATION OF MICRO ELECTRIC BIKE

ORANGE E-BIKE FOR TREKKING

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Abstract: The availability of fossil fuels such as Petrol, Diesel and LPG are decreasing day by day and their cost is increasing. Moreover the pollution by the IC engines causing health hazards, rising of ocean levels and natural calamities. There is an urgent need some alternative to IC engines to stop the consequences due to pollution. In this project it is intended to convert an existing bike into electric vehicle. To do this an old china made vehicle is collected from old garage and is modified to fix 250 watt electric motor and batteries. Four cells of each 12 V were chosen and are producing total 48 V. The engine position is replaced by the electric batteries. The control unit is housed under the seat and the charging socket is placed in the tank. Finally the electric driven vehicle is prepared. The vehicle is taking 2 hours of time for full charging of the battery and is consuming nearly 2KWH of electric energy. The full charging battery is giving a range of 40 km. It is found that the bike is giving a range of 40km with 14 rupees of expenditure. The total project incurred an expenditure of Rs. 25,000/-.

***IndexTerms* – Micro bike, E-bike, Trekking bike, Orange bike, Plug-in electric bike.**

I. INTRODUCTION

The electrical bike offers a cleaner environment to travel short-to-moderate distances instead of driving a Petrol / Diesel-powered automotive. The value of crude has multiplied consider over the past few years and it looks to be no turning back. The electrical bike could be a project which will promote each cleaner technology also as a lesser dependence on oil. It'll run on clean power with the flexibility to recharge the battery three separate ways: through the 230V AC wall supply, by generating power through the accelerator to the hub motor. Fashionable electrical bike integrate many inventions from technology and style, significantly within the past year.

Different electric vehicles are available in the market such as Plug in electric vehicles, Hybrid electric vehicles (Series and Parallel) etc. Electrifying an existing IC Engine vehicles are called Converted electric vehicles. In this project an old bike is equipped with an after-market electric hub motor conversion kit, with the battery pack. DC hub motor is mounted within the rear wheel. The bike itself had no gears and therefore the motor may draw up to 500 W with a 48 V battery. Four sealed lead acid batteries of each 12 V and 7.2 AH capacity were chosen as power pack.

1.1 Electric Flow Chart

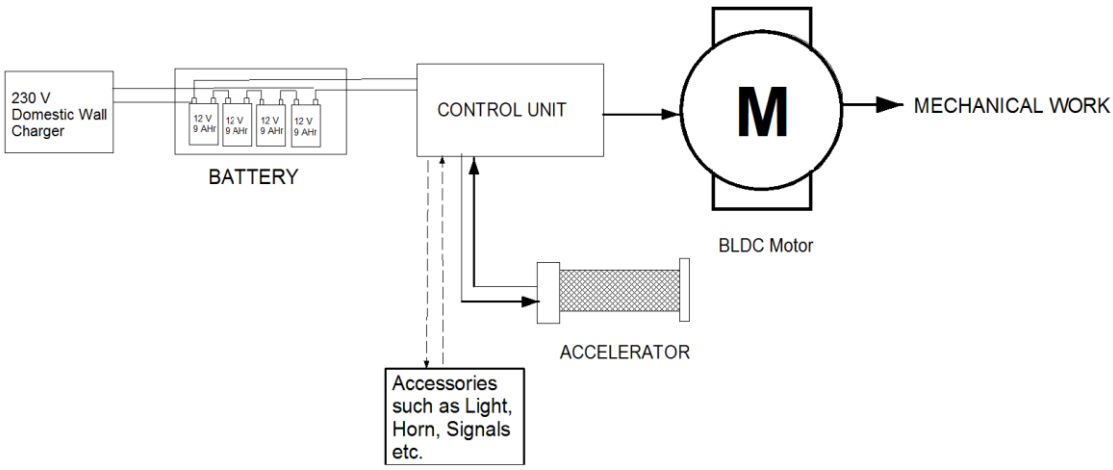

Fig. 1 Flow of power in the electric elements

There are many different components shown in Power flow diagram Fig. 1. The main components are brushless DC motor, motor controller, dry cell battery. Also throttle and extra features such as horn, speedometer, and LED signal, side stand buzzer etc. The power source for this system is given by Sealed Lead Acid battery. The output voltage of the battery is 48V. The battery can be charged by domestic current socket i.e., 230 V AC.

II. DESIGN & FABRICATION

Brushless DC (BLDC) motors are synchronous motors consisting of armature windings on the stator permanent and magnets on the rotor. The stator of a BLDC motor consists of stacked steel laminations with windings placed in the slots and these stator winding can be arranged in two patterns i.e. a star pattern or delta pattern. The major difference between the two patterns is that the star pattern gives high torque at low RPM and the delta pattern gives low torque at low RPM. There are many advantages of BLDC motor such as better speed versus torque characteristics, high dynamic response, high efficiency, long operating life, noiseless operation, higher speed ranges.

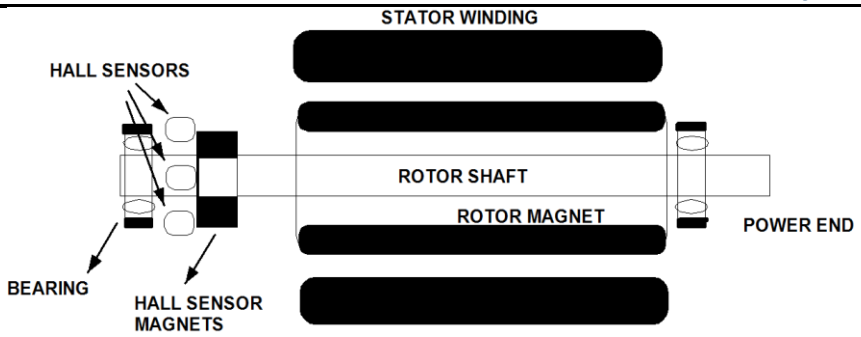

Fig. 2 Section of a BLDC motor

The rotor has alternate N and S permanent magnet s. The Hall sensors are embedded into the stationary part of the motor. Here hall sensors are connected with hall sensor magnet to detect the position of rotor. In BLDC motors the phase windings are distributed in trapezoidal fashion in order to generate the trapezoidal waveform. The commutation technique generally used is trapezoidal commutation where only two phases will be conducting at any given point of time. Typically BLDC motors have three phase windings that are wound in star or delta fashion and need a three phase inverter bridge for the electronic commutation. The brushless motors are generally controlled using a three phase power semiconductor bridge.

2.1 Motor Controller

To drive and control the BLDC motor, the use of a motor controller was implemented. The motor controller is an essential device for any motor driven device. The motor controller is analogous to the human brain, processing information and feeding it back to the end user. Of course, the applications of a motor controller vary based on the task that it will be performing. One of the simplest applications is a basic switch to supply power to the motor, thus making the motor run. As one utilizes more features in the motor, the complexity of the motor controller increases. To drive the BLDC motor, the motor controller sends rectangular/trapezoidal voltage stokes that are coupled with the position of the rotor.

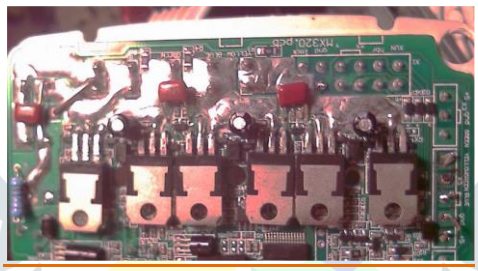

Fig. 3 Motor controller used to control the motor

The various elements used in the fabrication of this micro bike are given below.

- Frame
- Wheel assembly
- Battery casing
- Front telescopic and back mono suspension
- Seat
- Instrument panel
- Side stand buzzer

2.2 Frame

A frame includes the head tube that holds the front fork and allows it to pivot. Some motorcycle includes the battery as a load-bearing, stressed member. The rear suspension is an integral component in the design. Traditionally frames were steel, but titanium, magnesium, and Carbon-fiber, along with composites of these materials, are now used. Because of different motorcycles varying needs of cost, complexity, weight distribution, stiffness, power output and speed, there is no single ideal frame design.

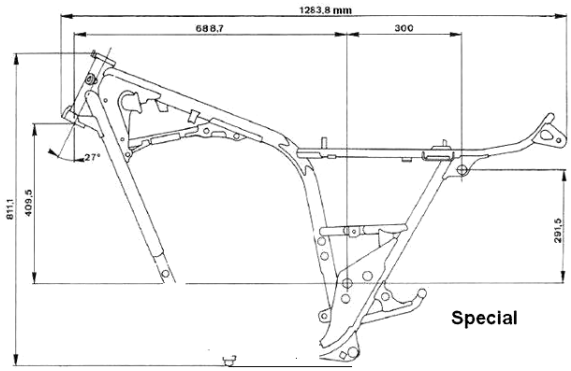

Fig. 4 Design of frame

2.3 Front Fork

A motor cycle connects a motorcycles front wheel and axle to its frame, typically via a pair of triple clamps. It typically incorporates the front suspension and front brake, and allows the front wheel to rotate about the steering axis so that the bike may be steered. Handlebars attach to the top clamp. The fork and its attachment points on the frame establish the critical geometric parameters of rake and trail, which play a major role in defining how a motorcycle handles and dives during braking.
Length: 73cm

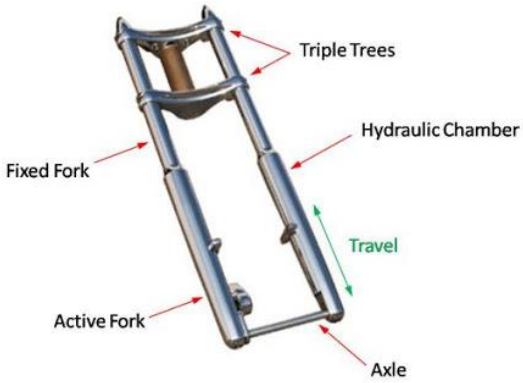

Fig. 5 Fork - Front wheel is fitted into the front axle

2.4 Handle

A Motorcycle handlebar is a tubular component of a motorcycle's steering mechanism. Handlebars provide a mounting place for controls such as brake, accelerator, horn, light switch and they may support part of the rider's weight. Even when a handlebar is a single piece it is usually referred to in the plural as handlebars
Length: 70cm

Fig. 6 Handle bar.

2.5 Frame Supporting Rod

It supports the frame to with stand weight of the bike and as well as to with stand weight of the rider.

Fig. 7 Rear suspension

2.6 Side Stand

A stand is a device on a motorcycle that allows the bike to be kept upright without leaning against another object or the aid of a person. A stand is usually a piece of metal that flips down from the frame and makes contact with the ground. It is generally located in the middle of the bike or towards the rear. Some touring bikes have two: one at the rear, and a second in the front.
Height: 33cm, Spring: 11cm, Width: 2cm

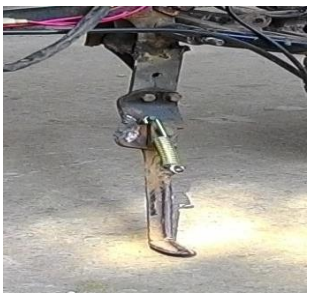

Fig. 8 Side stand

2.7 Rear Suspension Rod

Rear Suspension rod holds the rear wheel which consists hub motor and it is also supports the MONO-SUSPENSION.
Length: 26cm

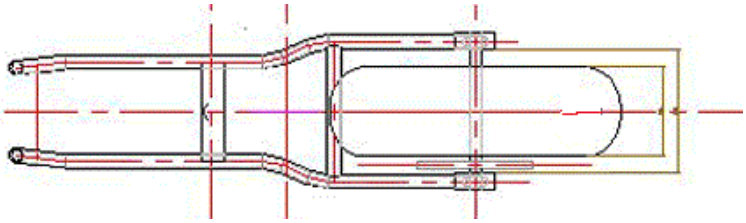

Fig. 9 Rear Suspension Rod

2.8 Assembly of Wheels

There are two wheels in this model. Front wheel is normal tire and rear wheel is consists of hub motor. Hub motors for scooters are usually positioned at the middle of a wheel and when the bike is powered off they function much like a traditional hub (connecting the tire, rim and spokes to the axle. Spokes are flexible and light weight; they absorb some shock when riding but can come out of true over time. This is of course a generalization because the technology has evolved to the point where some direct drive hub motors are quite small and lightweight. Pictured below is a 500 watt direct drive hub motor on a e-bike which does not offer regen but is still quiet, powerful and durable.

Fig. 10 Front wheel and Back hub motor wheel.

- Hub motor capacity is 500 watts.
- Wheel diameter : 41”

The bike itself had no gears and therefore the motor may draw up to 500 W with a 48 V battery.

2.9 Hub Motor

Hub motor electromagnetic fields are supplied winding of the motor. The outer part of the motor follows, or tries to follow, those fields, turning the attached wheel. In a brushed motor, energy is transferred by brushes contacting the rotating shaft of the motor. Energy is transferred in a brushless motor electronically, eliminating physical contact between stationary and moving parts. Although brushless motor technology is more expensive, most are more efficient and longer-lasting than brushed motor systems.

Fig. 11 Hub motor and its parts

2.10 Battery Casing

Angular bars are required for battery casing.4 batteries are fitted in this casing. Obtaing the casing then fitted the engine position, becasuse there no using engine in this model.By replcing the battery casing and the positioned, it can be showned given below.After compliton of this task, model look like this.
Width: 7.5cm, Length: 17.6cm, Height: 17cm

Fig. 12 Positioning to the battery casing fitting & batteries

2.11 Mono Suspension

Instead of conventional twin shock absorbers in the rear, it is incorporates a single, high performance shock absorber housed centrally below the seat and mounted on a much tougher frame. Advanced technology mono suspension coupled with advanced tough and flexible diamond frame offers superior riding comfort and excellent stability.

Length: 26cm, Diameter: 7cm

Fig. 13 Mono-Suspension

2.12 Tank

Tank was given to the bike to give ambience look to the bike and we may provide it as storage tank like charger, tool kit etc.,

Length: 35cm, Height: 24cm, Width: 22cm

Fig. 14 charging kit in fuel tank

2.13 Seat Fitting

In any bike it is required to have a seat for the purpose of comfort riding to the rider, for that purpose we have designed a seat which will fits for only single person

Length: 43cm, Height: 8cm, Width: 22cm

Fig. 15 Seat 0f the bike

2.14 Batteries

Four Sealed Lead acid maintenance free batteries of each 12 V, 7.2 AH were chosen and are producing total 48 V. The engine position is replaced by the electric batteries. The control unit is housed under the seat and the charging socket is placed in the tank. The full charging battery is giving a range of 40 km. The battery can be charged by wall supply of 230V AC domestic current.

2.15 Side Stand Buzzer

Early devices were based on an electromechanical system identical to an electric bell without the metal gong. Similarly, a relay may be connected to interrupt its own actuating current, causing the contacts to buzz. Often these units were anchored to a wall or ceiling to use it as a sounding board. The word "buzzer" comes from the rasping noise that electromechanical buzzers made.

III. RESULTS & DISCUSSION

Finally a micro electric bike of weight just 18 kg is fabricated which can be easily carried to any place and can be drive up to 40 km plus without any interruption.

Fig. 16 Final views of the e-bike 'ORANGE'

3.1 Specifications

- Height: 740 mm
- Width: 580 mm
- Length: 1220 mm
- Wheel Base: 870 mm
- Ground Clearance: 250 mm

Suspension:

- Front: Telescopic shock absorbers
- Rear: Spring loaded Hydraulic shock absorber (Mono tube)

Tyres:

- Front: 350 mm diameter
- Rear: Hub motor wheel 370 mm diameter

Brakes:

- Front: Drum type internal expanding brakes
- Rear: Drum type internal expanding brakes

Batteries:

- 12 V, 9.2Ah Lead acid battery – Total 4 no.

Hub Motor:

- Capacity: 48 V, 250 watts
- R.P.M: 260 to 350

DC Controller,
Regulator,
Electric cables.

3.2 Performance Table

Table 1 Performance of the bike

S.NO.	PARAMETER	PERFORMENCE
1	Range	46km
2	Top speed	30kmph
3	Charging time	2hrs
4	Motor	250 W
5	Battery	4 Sealed Lead acid batteries
6	Battery capacity	12 V, 7.2 Ah

Table 2 Comparison with other popular electric bikes

S. No.	*Manufacturing/ Brand*	*Model*	*Range*	*Top speed*	*Battery type*	*Wheels*	*wattage*
1	Ultra Motors	Velocity	40 km	35 km/hr	Sealed lead acid, 48V,24 AH	10”	500Watt
2	BSA	Street Rider	55 Km	25Km/hr	48V,22AH	16” x 3”	250 Watt
3	Electrotherm	YO Speed	65 km	40 km/hr	VRLA 33Ah x 4	10” x 3”	750 Watt
4	Paradise Electro Auto	myebike Classic	70 km	25 km/hr	4 x 12V-24Ah	16” x 3”	250 Watt
5	ORANGE		46 km	50 km/hr	Dry cell	16” x 2.5”	500 Watt

IV. CONCLUSIONS

Micro electric bike is developed with 500 w motor which can pull an elder person at a speed of 50 kmph for a distance of 46 kilometers with single charge. The batteries are taking 90 minutes of time for complete recharging and consuming an electric energy of 2kW. The developed micro electric bike can fulfill the dreams of those people who dare to do things differently. The developed bike can be utilized by the children as well as elders.

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