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Design and Fabrication of Eco-Friendly Foldable Scooter

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ABSTRACT

Now a days we are having the more number of two wheeler scooter. It causes the many problems in the day to day life. The major problems are pollution, traffic, depletion of non-renewable resources etc. The basic aim behind our project was to make an environmental friendly portable automobile which would be easy to handle by both the sexes and would emit 0% emission. We have used D.C motor as our main power source due to which there is no emission at all and also the problem of fuel consumption is solved. Also keeping in mind the parking problems now days, we decided to make a scooter which can be folded easily, and so after the use one can fold the scooter and can be easily carried. The design allows users to easily transport the scooter using less space when it is "folded" it becomes compact in size. This project is unique and no foldable scooter is presently available in market till now. It is a light-weight foldable electric scooter, produced on the basis of a brand new concept. This is an advantage in terms of reaching a very low weight and foldability. The maximum speed the scooter is capable to operate with is 35 km/h, and its range with a single charge is approximately 25 km (with double battery pack 40 km). It has in-wheel-motors in rare wheel (single-wheel drive). Its folding can easily be mastered. In its folded state the scooter is the size of a large trolly and it can be pulled similarly. Its weight is less than 25 kg. It requires no parking space; in a folded state it can be stored anywhere and no dirt will be released from the tires or the drum.

Keywords *- Portable, Environment Friendly, Motorized Scooter, Power, Speed, Lightweight, Foldable.*

1. INTRODUCTION

Main aim of our project was to design portable automobile which should be very easy to carry as well as easy to handle by both the sexes with equal ease. The aim was also that it should been environmental friendly and should be non-polluting. An electric scooter is a battery-operated one-person capacity vehicle that is specially designed for people with low mobility. It is generally used by those who have difficulty walking or standing for long periods of time. Scooters are available in three common designs, those intended for indoor use, those for outdoor use, and those that are used for both. An electric scooter is different from a motorized wheelchair, in that the wheelchair is generally intended for indoor use and usually costs a great deal more. An electric scooter may have three wheels or four. Since it runs on battery power, it does not create pollution. A typical electric scooter requires a pair of batteries, but the batteries are rechargeable. The length of time an electric scooter can run on each charge depends significantly on its battery's type and capacity. The most common batteries are advertised to run for about eight hours, and between 20-30 miles, before needs to be charged. Some people are a little wary of purchasing an electric scooter because they fear it will be difficult to operate. In fact, the control console makes it quite simple once a person gets the feel for it. Electric scooters are also equipped with advanced brake systems, so stopping is simple and comfortable. The brake begins to engage as soon as the operator lets off the throttle, so there is little chance for abrupt or jarring stops. Most scooters also have a parking brake to keep the electric scooter from rolling when parked.

1.1 Methodology

Literature study

Make review on other model and focusing on how to make it simple and relevance to the project title.

Conceptual design

- Sketching several type of design based on concept that being choose.

- State the dimension for all part.
- Draw the sketching model using SOLIDWORKS software

Computer Aided Engineering (CAE) analysis

- Analysis the design for strain stress structure by using ALGOR.
- Define critical point.

Fabrication model refinement

- Fabricate the scooter according to the design.
- Refinement at several part of joining and sharp edge.

Materials selection

- Selected the true material based on model design and criteria.
- Light, easy to joining and easy to manufacture.

Prototyping Development

- Assemble all the part to the design.

Testing

- Run the model

Documentation

- Preparing a report for the project.

2. LITERATURE REVIEW

Mark Jhonson Folding scooter, a folding scooter has an upright handlebar position, suitable for riding the scooter, and a folded handlebar position, suitable for storing the scooter. The folding scooter features a base, a handlebar shaft having locking hinge plates, and a base shaft having a lower locking hinge plate. The locking hinge plates of the handlebar shaft rotate with respect to the lower locking hinge plate as the handlebar shaft moves from the upright position to the folded position. A locking mechanism has a first locked position when the handlebar shaft is in the upright position and a second locked position when the handlebar shaft is in the folded position.

Ching Chiuan Chen, Scooter having a safety folding mechanism, a scooter includes a base having a rear wheel and having a block secured to the front portion. A tube is rotatable, engaged on a handlebar and includes an arm pivotally secured to the block and having one or more oblong holes for receiving a rod. A spring may bias the rod to engage with a groove of the block and to secure the handlebar to the base at an open working position. The rod may be moved along a curved surface of the block and may be forced to engage with the other groove of the block for securing the handlebar to the base at a folding position.

Paul Atherton, Andrew Graham, Kurt Walas, Powered foldable scooter A scooter has a platform on which a rider can stand, a front wheel attached to a steering system including an upstanding handle bar and rear wheel which is driven. The scooter can be folded at a hinge line across the platform so to allow it to collapse. A case for the scooter includes a front part and a rear part covering the front and rear wheels with the parts brought together by the collapsing of the platform. This folding action also uses a pivot link to move the front and rear wheels pivoted within the respective case parts to a folded position. The steering includes a headstock with the steering bar connected to the front fork by a drive coupling which converts the rotation of the steering bar about the generally vertical axis to the rotation of the fork about an inclined axis.

3. OBJECTIVE

The basic aim behind our project was to make an environmental friendly Solar Operated Eco-Friendly Scooter Using Gps Navigation System which would be easy to handle by both the sexes and would emit 0% emission. We also keeping in mind the parking problems now days, we decided to make a foldable scooter which can be folded easily, so after the use one can fold the scooter and can carry it along with him/her. Our design allows users to easily transport the scooter using less space when it is “folded” into a compact size. Our project is unique and no Solar Operated Eco-Friendly Scooter Using Gps Navigation System is available in market till now. The versatility of a folding scooter is also appropriate for air travel and inadequate storage and at places where bike theft is a significant concern.

As we see that it’s been mentioned as foldable which indicates that it been folded into three parts i.e. the handle which is been bent in such a way that the front tyre will get inside the main body region of the chassis, which becomes safe in between which is being locked using a simple lock to the alloy wheel as a notch, which holds it as a lock. Secondly second fold will be the seat i.e. the seat which the rider sit’s upon will be bent and made sit on the rare wheel. Here the seat gets stuck on the rare wheel which makes it lock at the front wheel. It does not rotate as free. Lastly when these folds are made it becomes a single line as horizontal. Now this is being

lifted as holding the handle which we ride, this can be carried as trolley and carried over. Once this mechanism is done, it need's be opened in a riding position from the folded form. Then this foldable scooter needs to accelerate as similar to other vehicles, it moves with the help of the brushless DC electric motor which is directly coupled in rare wheel hub. To run the motor we use the electric current, it can be produced by using the lithium batteries which is being placed inside the riders seat. The controlling of the motor is usually done by the throttle. This throttle is connected to a speed controller which regulates it, which is placed inside the seat. If any obstacles is seen front forth there is been brake system being implemented. This implementation is being done within the motor, which is a usually the drum brake system. The working principle of drum brake system is similar that of the brake system which is being used in other scooters.

4. DESIGN CALCULATIONS

In order to choose the required DC motor that can do the job, a theoretical study has been conducted that help us to choose the optimal type and size of DC motors. R: Incline reaction to cycle weight. Ƒx: friction force. W: cycle weight Predefined parameters, Maximum mass of cycle with person = 90 Kg This mass accounts for both the mass of the cycle approximated to be equal to 30 Kg, and the mass of a standard user which is about 60 Kg.

- g = 9.81m/s2
- Maximum angle of inclination: αmax = 37^0.
- According to the international laws for transportation the maximum slope angle should not exceed 37^0.
- Coefficient of friction: μ = 0.5 - 07, we will assume the value μmax = 0.7, to account for the worst possible conditions.
- Wheel Radius: R = 22.5cm = 0.225m
- Wheel perimeter: P wheel = πd =1.143 m
- Assuming the required acceleration: ax = 1 m/s2
- The average velocity of the cycle is:

V average = 25 km/h = 6.94 m/s

Weight of the Scooter W= M × g = 30 × 9.81 = 294.3 N

Reaction of the incline R = W cos (37^0) = 235 N

Friction force Ƒx = μmax × R = 0.7 × 235 = 164 N

Weight in the direction of the movement Wx = W sin (α) =294.3 sin (37^0) = 177.1 N

Propulsion force F = 588.6 N

Torque at the wheel,

T = F × R = 588.6× 450/2 = 1324 N.mm

Calculation of rpm,

V = 25 km/hr. = 6.94m/sec

V= πdN/60

N= 60 x v/πxd

N= 294.5 rpm T = 1324 N.mm

Available dc motor in market 240W & 1000 rpm so we have to design transmission to achieve torque of 1324 Nm at 294.5 rpm:

To find new torque "T"

T =P x 60/2πN = 240 x 60/2π x 1000

T= 2.3 N-m

T = 2291 N mm

Final torque= 2291 N-mm & new rpm = 1000/2= 500 rpm

Hence **final speed** v = π x 0.45 x 500/60 V=11.7 m/sec = 32.7 = 32.7 km/hr.

As generated torque and speed is more than required value so design of motor is safe.

Fig 1: Foldable Scooter Model.

5. RESULTS AND DISCUSSIONS

A motorized scooter is a miniature of scooter with an attached either electric motor or small internal combustion engine and used to assist the scooter to move fast in closer area. The primary function of the scooter is to aid individuals to move around from one place to another place.

The basic components of scooters nowadays are completely with two wheels, a flat deck which to put the feet, power train and handlebars to steer the front wheel. The scooter designs have made a positive impact on the ability of those who are participate in social events and physical challenges to perform their daily activities. It is also intended to be utilized as a physical assistance device that is not designed essentially for speed but can move just a little bit quicker.

Main aim of our project was to design a portable automobile which should be very easy to carry as well as easy to handle with ease. The aim was also that it should be environmental friendly and should be non-polluting.

6. CONCLUSION

From this project we can conclude that the Eco-friendly foldable has a top speed of 25 km/h (15 mph) and a range of up to 40 km (25 miles) per charge, and is folded up and ready to roll in two seconds.

This foldable scooter features twist-grip acceleration control, a 240W hub motor, and a lithium ion battery (which can be charged from a regular the outlet). There's LED lighting front, caliper brakes on each wheel and a center-mounted display on the handlebars that shows remaining charge and speed. At the end of a ride, locking mechanisms in the seat and frame are released to collapse the seat support down towards the back wheel (while raising the footrests at the same time), and allow the front wheel and handlebars to fold into the body of the scooter. When folded, it's reported to be about the size of a golf bag and tips the scales at 17kg Small stabilizing wheels at the rear come into play when the foldable scooter is being dragged behind, and also act as support when the scooter stands upright. This foldable vehicle can be used when there is traffic. As it is be dragged it can be taken anywhere were we go such as in malls, hospitals, airports etc. As it consist of brushless DC motor it an eco-friendly battery oriented running scooter which doesn't creates pollution. As mention it is foldable, it can be folded and carried easily placed in car's luggage carriers.

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