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Design and Fabrication of Power Scooter

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Abstract: The concept of the model was taken from children's scooter bicycle. The complete body looks like a scooter in which platform is provided for standing and driving the power scooter. This product has a electrical motor, used for various purposes. It is economical in power consumption scooter can be driven comfortably with the help of streamline design of the body. It has compact structure and aesthetic look. At the last some efficiency tests were conducted.

Key words- Power scooter, electrical motor, efficiency, fabrication.

1. INTRODUCTION

Scooters are very popular for transportation in urban and rural areas. Some types of scooters that we will find zooming up and down the highways and city streets. The user can tread the pedal of the tread board successively to move the scooter forward. Generally, there are several types of scooter operation. High power scooter usually uses a small engine with gasoline and sometimes electrical motors.

2. IDEA BEHIND DEVELOPMENT

A power scooter is an motor-operated one-person capacity vehicle for low mobility. It is specially designed for those who having difficulty in moving or walking frequently from one place to another. A power scooter is different from a wheelchair which is motorized, and is generally used for indoor use and usually costs a great deal more.

3. CONCEPT DESIGN

Power scooters have 2 wheels powered by an electric motor which is fixed at the rear end of the scooter. A power scooter is rear wheel drive get the power from the engine by a chain drive. This scooter provides all the controls for driving it by the driver. It is provided with simple platform for standing and drives it comfortably. Some people think that power scooter is difficult to operate, so they are less worried about to purchase it. Once a person gets the feel for it, the control console makes it simple. Power scooters are also equipped with advanced brake systems, so stopping is simple, safe and comfortable. Now days, small scooter becomes popular especially during recreation time, relaxing and for human exercise. Most of the power scooters are operated by engine or motor or just using our leg to move scooter like playing skate board. The problem in most of the scooter is that they are not flexible though it is very small.

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4. TYPE OF SCOOTER

Different types of scooters are as follows:

4.1 Gas scooter

The speed of these scooters can be stepped up to levels that cannot be achieved in case of other types of scooters. These scooters are also available in different sizes and weights depending on the gas tank.

4.2 Electric Scooters

An electric scooter is a battery-operated one-person capacity vehicle. Usually, it uses DC electric motor for its operation. It may have three wheels or four and also does not create pollution.

4.3 Mobility Scooter

This is a modified version of the electric scooter and is made for special people like the disabled and the aged people. These scooters are extremely stable, as they have more than two wheels. Some even have four wheels.

4.4 Foldable Scooter

This kind of scooter made to be small space storage and easy to bring from one place to another place. Either use electric source or kick power moving.

4.5 Utility Scooter

The utility scooters are extremely handy and are used for a wide range of purposes. This variety serves multiple purposes.

4.6 Retro Scooter

Based on modification from classic scooter like Vespa. It refers to how much a design adheres to the original Vespa.

4.7 Chopper Scooter

Many scooters available come in bodywork that rests on a tubular frame. Because of this, it is relatively easy to modify and give the appearance of small Harley chopper motorcycles. Because of their appearance, it is called chopper scooters.

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5. LITERATURE SURVEY

Yefei Li[1] presents methodology on structure design based on human factors, he build a three dimensional parametric model of a scooter for ergonomic analysis. He build a three dimensional digital model of scooter in Pro/Engineer. The modeling and size specification of scooters for different children was given as example to show the whole design process. The development of human factors, computer aided design and anthropometry improves designers and manufacturers provide customer more and more suitable products to satisfy their needs. Huijuan[2] discussed the design of transmission and provided a method to modify a CVT to 4- speed manual transmission. The principle design of transmission system is found in the manufacture and experiment of the racing car. According to the design of transmission, the actual manufacture assembly is made. The result of the real vehicle test shows that the fuel economy of the transformed system is better than the original CVT system in theory and actual Performance. At the same time, the extensive use of the Computer-aided design in the design greatly reduces unnecessary steps in the actual manufacture process, which makes the real vehicle manufacture and assembly accurate and smooth. Fucai HU [3] developed a 3D finite element model of the band brake on anchor windlass is established by using PRO/E software. Temperature distributions of the brake band and the friction linings are analyzed with a finite element analysis software-MSC. Marc. He found that the highest temperature does not appear in the end, but at a certain moment before the end. For brake band, temperature rises slowly at the beginning and rises quickly later. Jianye Guo [4] introduces requirements, structures, working principle and design of the V-belt pulley absorber in the automobile engine. To generate the torsional vibration frequency response characteristics curve of the crankshaft in automobile engine, the formula has been deduced and antivibration effect have been explained by the example that are caused by the physical parameters (including rotor inertia, damping, and torsional rigidity) of rubber ring, outer ring and wheel hub, these three components constituting with the triangle groove, a belt pulley absorber. Rohan Dwivedi [5] explained the idea of adaptive suspension system, he designed the actuating suspension system for neutral jerks which are caused by speed breakers and uneven surfaces on the roads. The system designed is reconfigurable and real time. The system should be able to control engine and the braking systems is the main aim of this project. Various kinds of sensors like LASER detector, ultrasonic sensor, force sensor, accelerometer and tachometer will play main part in the Adaptive Suspension System. For controlling the suspensions and one ECU will be involved in actuating the braking and engine system, different electronic control units are also be used. The whole system can be highly useful against jerks and mountainous road where there are more possibilities of bad road conditions. The wear and tear of vehicles other parts also gets reduced due the less exertion of chassis of the vehicle. The sensors present in the vehicle also check the speed of the vehicle which reduces the risk of any accident due to bad road conditions . Based on the functional decomposition strategy, He Bin[6] presents a systematic approach to automated conceptual design of multiple input and multiple output mechanical transmission system. He also proposed transmission functional representations, and the integration of motional function matrix with mechanical transmission knowledge base. After the method of single input and single output system is proposed, multiple inputs and single output system, and single input and multiple output system are simplified into single input and single output system. Then by functional

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decomposition strategy, the multiple inputs and multiple output can be also solved. The mechanical transmission system of a robot is given as an example, which demonstrates that the methodology is obviously helpful for product innovation. This paper presents a new systematic methodology to increase opportunities for product innovation in automated MIMO mechanical transmission system conceptual design. As concerning problems of the current researches on mechanical transmission system conceptual design, a transmission functional model based on feature is built. The process of automated MIMO mechanical transmission functional is discussed in detail.

6. Electric DC motors

Electric scooters require drive systems (motor, controller, transmission) and power sources (batteries or fuel cells). Since a fuel cell scooter is essentially a battery-powered scooter with battery replaced by fuel cell plus hydrogen storage, the basic electric scooter is described first. Components are chosen for the electric scooter on the basis of technical qualifications and economic considerations. The resulting electric battery-powered vehicle is used as a base platform to develop the fuel cell scooter design. It should be noted that battery-powered scooters are currently commercially available in North America, Asia, and Europe, although they have met with only limited success.

DC motors employ a fixed current that causes the rotor to "want" to turn to line up with the poles in the stator. However, the current in the stator is commutated, often by a split-ring brush system, so that the direction of the current in the poles switches as the rotor passes by. This ensures that the rotor stays in continual motion. Multiple sets of poles are used to smooth out the rotation. In general, controllers are cheaper than for AC motors; on the other hand, the motors themselves tend to be bulkier and heavier and more expensive.4 In the basic field-wound motor described above, the stator field is provided by an electromagnet. Speed and torque are controlled by changing the current in the stator field and/or rotor windings. In a variant, permanent magnet motors use permanent magnets rather than electromagnetic windings in the stator. The presence of brushes means relatively high maintenance, but these motors tend to have higher efficiencies than other DC motors due to the lack of stator field windings.5 They have a narrow peak efficiency, so transmissions are required. With
brushless DC motors, it is the rotor that is a permanent magnet. The stator electromagnet 57 current is switched on and off at the correct frequency (instead of commutated to reverse current direction), creating a rotating magnetic field in the stator and causing rotation in the rotor. Changing the speed of the rotating magnetic field effects rotor speed control. Torque is controlled here by varying the magnitude of the magnetic flux of the stator. (The flux, in turn, is controlled by changing stator current). These motors are relatively efficient due to the absence of brushes and can achieve average efficiencies of about 84% for both motor and controller together.6 Control, however, is more complex generated by permanent magnets or by a current in an electromagnet. The stator is stationary and produces the magnetic flux, while the rotating armature or rotor contains the coils that carry the armature current. In general, motor speed is controlled by increasing the armature voltage, while torque is controlled by increasing the current flowing through the armature.

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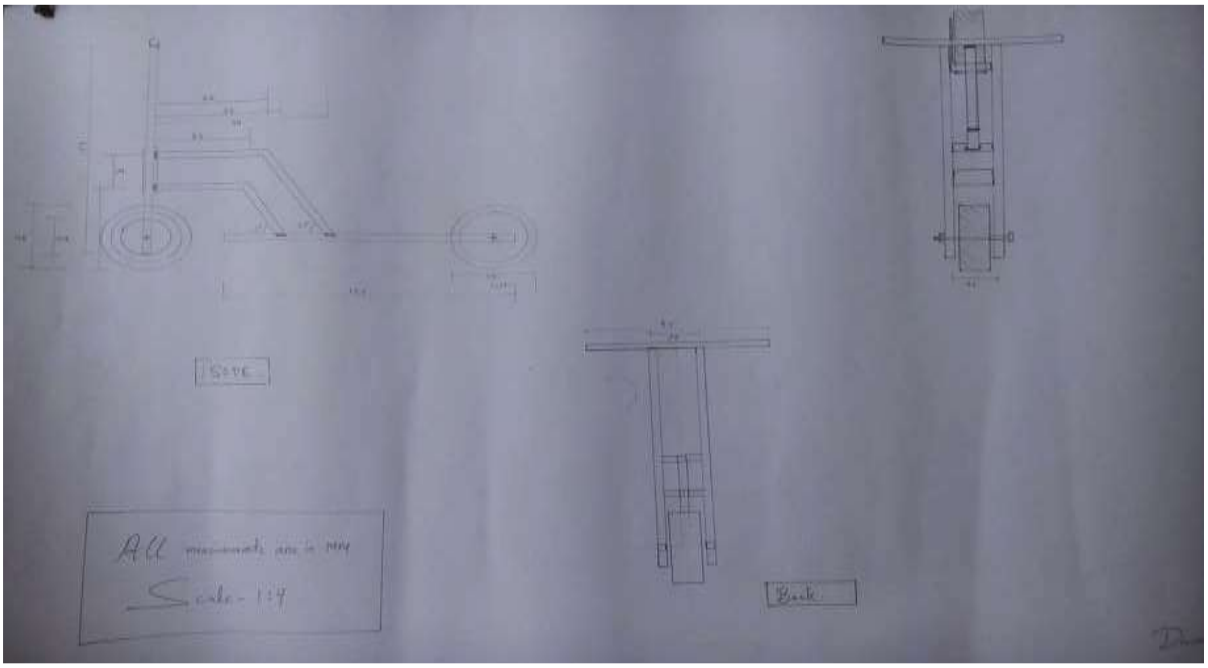
In a combustion engine, the explosions of the air/fuel mix directly produce rotation with a fixed velocitytorque relation. More flexibility can be achieved in an electric motor, where the ratio between torque and speed can be controlled independently and electronically within the motor/controller. For example, in a pulse-width-modulated system the frequency of rotation of the magnetic field governs the speed output, while the phase difference between the rotor and stator 56 fields determines torque. Transmissions are often not be necessary at all; where used, they offer optimum efficiency (since the output mechanical power can be remapped by the transmission to the higher efficiency portions of the electric motor output) for both driving and regenerative braking.3 In this study, no transmission was assumed - only a fixed final gearing between the motor output and the wheel.

8. Design of Power Scooter

The desing of the scooter is first done on a sheet by assuming the approximated length and dimensions which eventually used to fabricate a usable and economical scooter. Designing a scooter also required a lot of essential devices, such as motors, brakes etc to make it usable.



9. Chassis

Since the motor size and power is an essential design selection for the vehicle's overall performance and we do not want to waste any materials by designing, the overall weight of the vehicle will be crucial. In order to reduce the overall weight of the scooter, objective will be accomplished by designing its steel chassis with advanced, lightweight. To build a light weight scooter chassis we will need to consider a number of different parameters, such as safety, static and dynamic stability, and structural integrity. Chassis of a power scooter, consisting of the

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frame (on which the body is mounted) with the wheels and machinery. The material used in this scooter is a square pipe for the frame and steel rails for motor mounting. It has given a clearance of 5 inches from ground level.

9.1 Brake Type

The main types of brakes are disc brakes, band brakes, drum brakes, air brakes, and vacuum brakes. A brake is an apparatus used to slow or stop a moving vehicle, or, once the vehicle is stopped, to keep it from moving again. Most vehicles have wheel brakes, including automobiles, bicycles, motorcycles, and someairplanes. Wheel brakes are generally friction devices, using resistance and energy lost through heat to slow the vehicle. This is usually accomplished by pressing brake shoes either directly against the wheel or against a rotating piece of the brake attached to the wheel. In regenerative braking, the vehicle keeps this lost
energy in the car's system and reuses it later. The vacuum brake was originally devised for use on trains.
These types of brakes works by creating air pressure changes in a compartment called the brake cylinder. Inside the cylinder is a piston, which is a mechanism designed to use the force of incoming air to move a rod. The rod is attached to the brake shoes. When the brake pedal is held down, air is let into the cylinder, which causes the piston to transfer that force onto the brake rod. The brake rod moves and, in turn, the brake shoes are pressed to the side of the wheel to cause friction. The concept behind the selection of band brake is that it is simple, compact, rugged, and can generate high force with a light input force. However, band brakes are prone to grabbing or chatter and loss of brake force when hot. These problems are inherent with the design and thus limit where band brakes are a good solution

9.2 Suspension Type

Front axle telescopic type. The main advantages of the telescopic fork are that (i) it is simple in design and relatively cheap to manufacture and assemble; (ii) it is lighter than older designs using external components and linkage systems; For smooth out or damp shock impulse, and dissipate kinetic energy,

9.3 Transmission System

A belt is a loop of flexible material used to mechanically connect two or more shafts which is rotated, often they are parallel. Belts may be used as a source of motion, to track relative movement, or to transmit power efficiently. Belts are wrapped over pulleys.

9.3.1 Design of V – belt

V-belts are designed to operate in V-shaped grooves in the sheaves used for power transmission. V-belts have a major advantage over other types of belt friction drives; as the wedging effect of the belt pushing into the sheave results in lower belt take-up tension being required. For the same horsepower, sheave diameter, and sheave speeds, V-belts will operate with lower tension and, therefore, lower bearing load than other friction-type belt drives.

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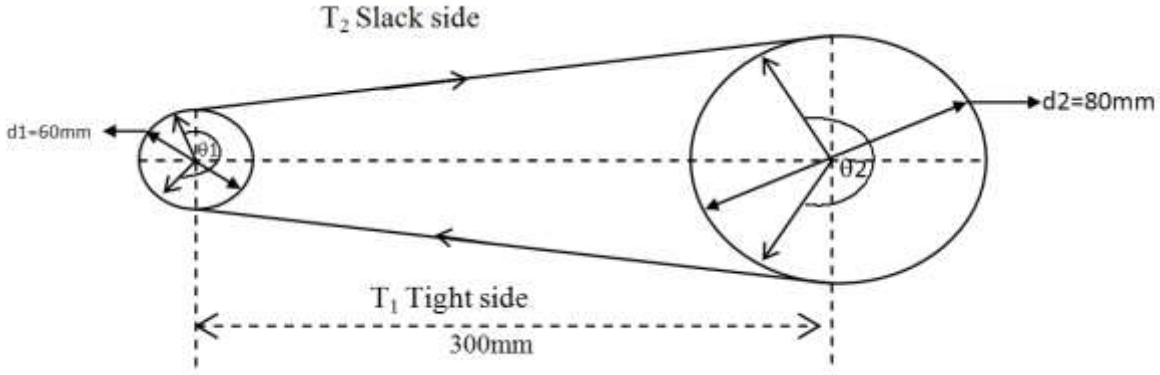

Sl. No	Parameter	Driver pulley	Driven pulley
1	Diameter	60mm	80mm
2	C.O.F	0.3	0.3
3	Speed	1000 r.p.m	1000r.p.m
4	Power transfer max	1000 watt	1000 watt
5	Angle of wrap	1 radian	1.5 radian

Table Specification of belt Drive

T1– Tension in tight side
T2 - Tension in slack side
r1 – 30 mm radius in driver pulley
Velocity is finding to determine deviations from the traditional calculations carried out with respect to tensions at different drives in a multiple pulley drive system of a conveyor. Velocity of belt is given by,
Where,
v = Velocity of belt
d= diameter of belt
N= speed

The belt moves from the tight side to the slack side and vice-versa, there is some loss of power because the length of belt continuously extends on tight side and contracts on loose side. Thus, there is relative motion between the belt and pulley due to body slip. For this purpose power transmission is to be calculated.

As per standards density of rubber ρ = 1140kg/ m Mass of belt is given by, Mass Area × length × density During rotation of belt drive, the belt is followed by a centrifugal force. The belt has mass and as it rotates along with the pulley it is subjected to centrifugal forces, no power is being transmitted and pulleys are rotating, the centrifugal force will tend to pull the belt.

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10. FABRICATION AND ASSEMBLY

As per the design calculations, the various parts are selected and assembled together to get the final product.

11. WORKING

Power scooter works on the concept of electrical DC motor running on the power of 12v battery. In this power scooter initially the person will start the scooter with the slight push and a switch in pressed positioned on the handle and the motor will start by closing the electric circuit with the help of a switch. Once power is developed the pulley start rotating by using v-belt drive which transmit power from pulley to rear axle. Axle rotates the rear wheel and scooter start running. By using accelerator we increase or decrease the speed of power scooter. And to stop the scooter we have provided the band brake on the rear axle. To start the motor battery connect electrical circuit is installed through the handle.

12. RESULT

After performing some test we find out that the running of the vehicle is smooth and can be stopped easily. With the use of good conditioned motor, battery and other essential parts the scooter can be called economical and safe to use

13. CONCLUSION

Due to the many problems of congestion, pollution and urban mobility, new modes of transportation, such as “Power scooter” personal transportation devices, increasingly seem to be an alternative to widespread automobile use. The Ergonomic evaluation also demonstrated that power scooter is easy to use in normal use situations, including situations involving obstacles, for a broad cross section of users. The devices also compare favorably with other types of vehicles, particularly in terms of stability, where they seem superior to other vehicles such as bicycles and mopeds. However, Power scooter is designed for a broader segment of the population and is meant to meet a wider variety of mobility requirements in urban communities. Power scooter would also generate transfers to alternative forms of mobility and use for short distances. The performance studies carried out in a closed environment also demonstrated that power scooter is easy to use in normal use situations as well as to get around obstacles. The survey results clearly show that a large majority of test participants found all scooter movements easy to perform. However, this device is
targeted more for young people and seems primarily intended for recreational purposes. The evaluation results suggest that power scooter use is appropriate in closed environments, such as major industrial complexes, hospitals, shopping centers and airports. The reliability and safety of this device when used in urban communities; Social acceptance of power scooters help to reduce traffic problem. In future we can use flexible sitting arrangement also we can use advance braking and suspension system. This scooter can be modified according to once interest. Non conventional fuel system can be adopted as the power source for this scooter.

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