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DELTAFLEE – (Three Wheeled Segway)

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Abstract – *This is deals with new design, investigation and assembly of an electrically powered stand up scooter called (DELTAFLEE) three-wheel Segway which has higher degree of freedom than normal vehicles and can be used as a personal transporter in malls, college campus, warehouses, and industrial sites. Most commonly used Segway is the two-wheel self- balancing Segway, which is known for its zero turn radius, and zero pollution. The three- wheel version can move just like the two wheeled one. The only difference is that, it replaces complex electronics like accelerometer and gyroscope with a simple third wheel on the front making it more stable, economical and fail-safe. This vehicle has three wheels, one on the front wheel and two rear wheels. The front wheel consist of a hub motor and braking mechanism, the rear wheels fixed on bearing which is free two rotate.*

***Key Words*: *DELTAFLEE*- Three wheeled Segway, Gyroscopic stabilization, Hub motor, Pollution free, short turning radius.**

1. INTRODUCTION

There are many variants available in Segway. However, the most popular and commonly used ones are the two wheeled Segway, known as the Segway PT. It is an electric, self-esteem human transporter with a gyroscopic stabilization and control system. The device is footing on two parallel wheels and is managed by emotive body weight. The three-wheel version can move just like the two wheeled one. The only difference is that, it replaces complex electronics like accelerometer and gyroscope with a simple third wheel on the front making it more stable, economical and fail-safe. This vehicle has three wheels, one on the front wheel and two rear wheels. The front wheel consist of a hub motor and braking mechanism, the rear wheels fixed on bearing which is free two rotate.

1.1 Segway

This research is about the planning and development of a cost- effective, compact and eco- friendly electric vehicle for the big campuses where walking consumes plenty of your time. It's a front wheel drive battery operated vehicle, specially designed for indoor mobility in large campuses. It's a front wheel drive with In-wheel hub motor mounted on front of the vehicle. Project is primarily designed for green mobility thus it'll also help to regulate the pollution which is one amongst the most important crises nowadays because the present era of giant modernization and competition, associated with new advanced techniques in several sector of engineering. So we've got tried to feature some new trends in it. As we all know that, the sources of non-renewable energy are came to fade therefore the prices of fuels like petrol, diesel and other fuels are rapidly increasing. As well as, due to heavy industrialization and also number of vehicles on road in India increases. So due to that, pollution rate is additionally increases. From the exhaust gas of vehicles, numerous hazardous gases like N2, O2, CO etc. get exhausted into atmosphere causing the pollution which adversely effect on kinsfolk, plants still as on animal life. Hence, in our project, here built a 3-wheeler personal transport vehicle called three wheeled Segway. During this vehicle, balancing is completed by extra 3rd wheel rather than balancing circuit. Because the balancing circuit is kind of complicated and expensive so we decided to affix the 3rd wheel to create it economical. In multinational companies and large scale organizations, the space between departments to department is kind of long. Then it's going to become troublesome for human to travel from one place to a different for number of times by walking. Then shuttle vehicle are often used as a choice to recover from these difficulties. It also can be used for patrolling for police, security purpose in malls

2. METHODOLOGY

Like all automobiles prototype also required a frame work. The framework is important since it is very basic components of an automobile. Frame is the structure that supports the entire load applied on the vehicle. So a frame must be design in order to carry the load demands of the prototype. The most important part in frame design is the selection of the prototype. For this prototype we are using a simple frame design. The design of the same has been shown below. The frame is made up of solid steel tube. As per the requirement of the project the vehicle prototype must carry the weight of the battery, DC motor controller, Wiring, steering system, and Hub motor for propelling. This frame can handle external load about 65 kg and kerb weight of 50 kg

2.1 Design

After reviewing and studying finally came to understand that what would be design. The aim is to create a lightweight weight and ergonomic design. The entire vehicle is intended on AUTOCAD. First created an element modeling of components like frame structure ,steering column, foot platform, front and rear wheels, rear axle and battery cage .After it all parts are assembled in assembly modeling.

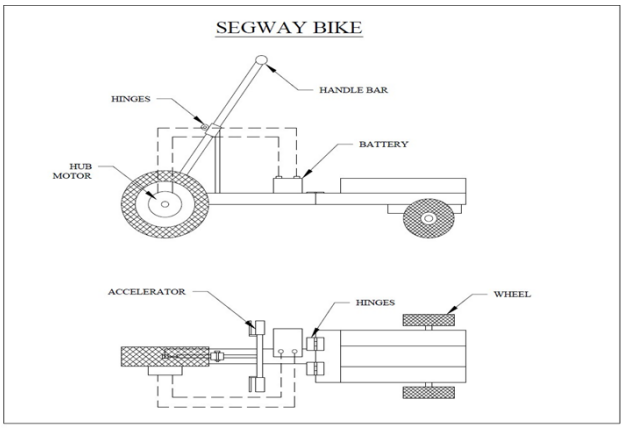

Fig -1: Design layout

Hub motor-250watts
Batteries Used-4 batteries each (12v 20ah) Total 48v 20ah
Load carrying capacity: Max. 200 kg
Speed: 40 km/hr. max
Full charge time: 4-5 hrs.
Full charge capacity: 50-55 km Weight: 56.8 kg
Ground clearance: 95 mm.
There are two types of wheels are used in this projects. They are

Back wheel	-	10" Dia. Polymer wheel
Front Wheel	-	12" Dia. Nylon Wheel

2.2 Material

The material used for prototype must be carefully selected. Any increase in the weight than the assumed level could result a motor overload. The motor overload may damage the windings thus results in a failure. So as to reduce the weight we have used mild steel tube and rectangular steel bar for the frame work. The mild steel tubes and rectangular bars provide a decent amount of strength in order to withstand the load of the battery, hub motor, dc motor controller, wiring system. 80% of the frame was done using this mild rectangular steel bars and mild steel tubes. The materials were welded together by metal inert gas it uses a shielding gas along the wire electrode, which heats up the two metals to be joined.

2.3 Components

The physical setup of this project are given below and it's been explained as follows; frame stand, chassis, platform, DC Hub motor, mechanical Drum brakes, DC motor controller, battery, bearing with bearing cap and wheels arrangement.

Frame- First of all, we fabricated the frame. A frame is created from soft-cast steel pipe of 38 mm diameter. Compare to other available frame structures such Solid bar section, square section, I section the hollow pipe structure has minimum weight and enough strength. Following image shows the fabricated frame. Battery cage is united below the plane so that more flooring space available. This arrangement also helps in lowering the Centre of gravity which is advantageous while fast turning. Frame material is steel.

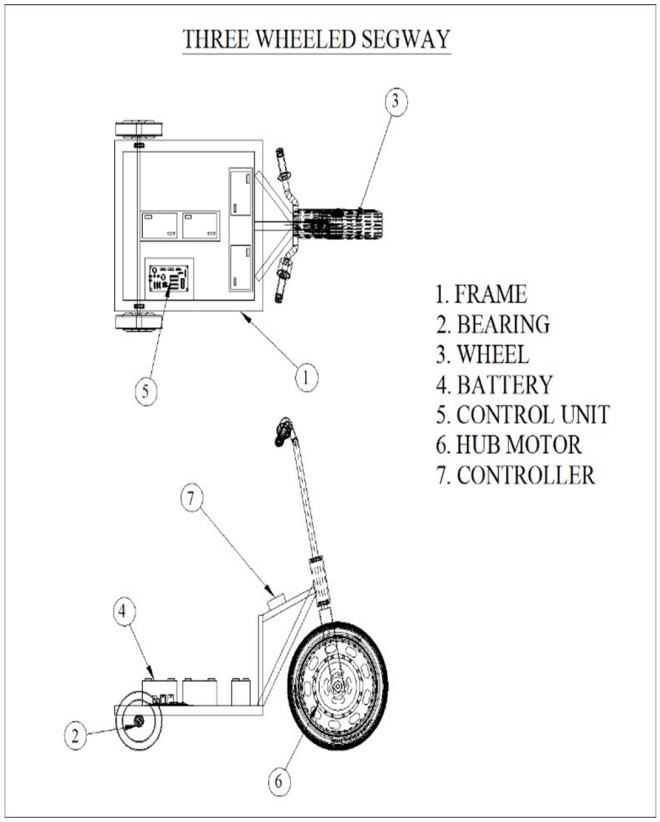

Fig -2: Components of three wheeled Segway

Chassis- The fabric used for chassis of the vehicle is steel. While creating this chassis we examined following elements; stress concentration, aerodynamic shape, caster angle, compact size and short turning radius. When all parts are ready the following step was to assembling the chassis. As shown within the front and rear wheels are mounted, batteries are placed inside the battery cage at middle. The battery supply is connected to front hub wheel motor makes it front wheel drive.

Platform- A platform consists of two components. First one is 15 mm thick wooden sheet and second is 4 mm mild steel sheet. A wooden sheet is mounted between M.S. sheet and frame. This arrangement insulates steel plates and motor wiring and ensures that they are doing not touch one another.

DC hub motor- The front wheel is Brushless DC-hub motor and also an influence source to drive the vehicle. It's also called as an In-wheel motor during which the motor assembly is comes inside the wheel itself. So there's no need of additional chain sprocket mechanism as motor is inside the wheel. This fashion arrangement reduces space for power drive mechanism and makes it more compact and lightweight weight. It connects the central, normally rotating axle to the static frame of a bicycle or the chassis of a car. Once you turn on the facility, the outer a part of the motor rotates, becoming a wheel that powers the vehicle forward

Drum brake- Within the mechanical Drum brake system like in two-wheeler & auto rickshaw, the brake shoes are actuated by a cam, which is attached to the brake linkage & pedal. Once you press the foot (brake) pedal, the cam turns. Thus, it causes the brake shoes to push outwards and rub the drum. The friction between the brake linings and therefore the drum causes the drum to prevent rotating, thereby the wheel to stop. Once you release the foot (brake) pedal, the retracting springs bring the brake shoes back to their original position. This ends up in a niche between them and therefore the drum and to again spin it freely.

DC motor controller- The prime function of a DC motor controller is to periodically read the throttle arranging and adjust this being supplied to the motor. It does this with a way called pulse width modulation or PWM. Other functions of the controller include: Low-voltage Cut-off: monitor the battery voltage and finish off the motor if the battery voltage is just too low. This protects the battery from over-discharge. Over-temperature cut-off: monitor the temperature of the FET power transistors and finish off the motor if they become too hot.

Battery- The battery which we used for our Segway could be a 12v and 7.5amph current lead acid batteries and these batteries are rechargeable. The batteries are connected in parallel and are connected to the control unit from which the power source is transferred to the motors. The whole charging time are going to be some 2-3 hours.

Bearing with bearing cap- The bearings are pressed smoothly to suit into the shafts because if hammered the bearing may develop cracks. In this project, the 6202 bearing with bearing cap is fitted. The bearings are pressed smoothly to suit into the shafts because if hammered the bearing may develop cracks. Bearing is created from steel material and bearing cap is MS.

3. RESULT AND DISCUSSION

3.1 Construction

The construction of Segway vehicle consists of a frame which is employed for mounting the components like hub motor and Battery. The front and back wheels are fitted within the base of the frame. The front wheel is hinged by the bolt and nut. The rear wheel is fitted with the assistance of shaft, bearings and bearing cap. The hub motor is not to mention this front wheel with proper welding. Battery is fixed at the highest of the vehicle by suitable arrangement. The power for driving the motor is taken from the battery source. The battery is charged through separate charging system.

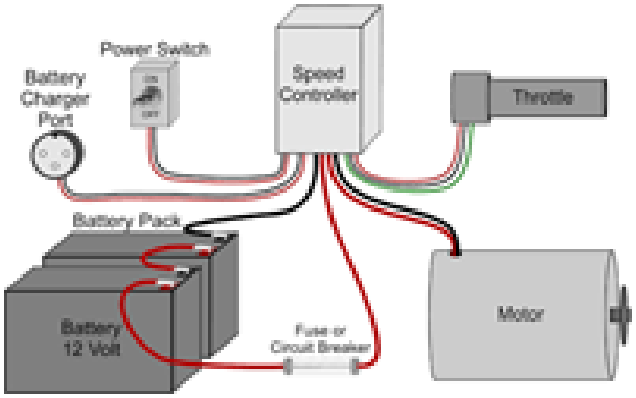

Fig -2: Circuit diagram

The circuit diagram for three wheeled Segway which consists of battery, charging port, power switch, speed controller, circuit breaker, throttle and hub motor.

3.2 Working

Anyone who ever ridden a bicycle with a dynamo light should get a concept of how electric bikes work. With a dynamo light the motion energy of the spinning tyres turns the dynamo, transferring energy and ultimately powering the light source (sun shine). Electric bikes work oppositely. A dynamo, during this case a battery, succeeded energy that moves to motion energy within the tyres and advances them forwards. A typical battery in an electrical bike will have approximately a 1/4 of the facility of a toaster, 200-350W. The batteries must be ready to store the maximum amount of power as possible, and for this reason lithium-ion batteries (like those in your mobile phone and computer) are most ordinarily used. They will often be taken out of the bike and recharged by being plugged into a typical mains plug socket, and most bikes will give upwards of 80km (50-miles) of battery-assisted riding. The battery source powers the motor, which is able to increase the speed by about double what the rider is performing, up to a top speed of 32kph (although the legal limit for an electrical powered bicycle is about 30kph, or 15mph). The motor can provide separate

power controlled by a throttle on the handlebar. The batteries of our vehicle are often recharged by external source available in houses. The facility from the batteries is given to motor through the controller. Once we accelerate the lever, then the availability from batteries is given to motor through controller in controlled manner as per the acceleration. Once we fully accelerate the lever the utmost supply is given to motor and vehicle runs at its maximum speed. For operating the accessories it's necessary to scale back the voltage, for avoiding the damages of accessories like overheating and blowing off. Hence here we use a converter. Converter acts as a voltage reducer, which converts the availability given by the batteries i.e. 48 volts into 12 volts. This current is supplied to accessories of automobile such as headlights, horns etc.

3.3 Advantages

Zero pollution, since it is battery operated there is no, cheap when compare with conventional Segway PT Short turning radius, faster than walking, alternative for short distance travel, less space for parking, no balancing issues due to the third wheel, eco-friendly, Easley manure able and no riding skill required.

4. CONCLUSION

From this paper it can conclude that this vehicle is kind of suitable for nearly all the humans. By touching on above advantages, the vehicle is affordable to social class person also, because the value of vehicle is optimum because the current the increasing volume of car transportation rising the ill health further as environmental issues, hence this vehicle focus the technology that permits the manufacturing, launching and sustainable implementation of three wheel battery operated shuttle vehicle in Indian market. Within the course of this project, the work and fabrication of two wheeled was done. The try to change the prevailing design of hi-tech Segway was successfully completed. This project was implemented with an inspiration to search out an effective solution to transportation problem. The most objective is to attain space utilization and minimize the fuel consumption especially for commuting over shortest distance. As we are well-known that the sources of fossil fuels are visiting be vanish in next few decades, hence the electrical bike will experience the amount of boom. supported the factor like stability and value, three wheels Segway is found to be an honest alternative for 2-wheels Segway is found to be an honest alternative for the 2-wheeled version. Moreover, the fail safe feature during this vehicle makes it more reliable than the 2-wheeled Segway.

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