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Fabrication of Hoverboard- A Personal Electric Vehicle for low distance transportation

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***Abstract*— In this study, the method and methods utilised to design and construct an electric hoverboard are discussed. A hoverboard is a self-balancing mobile transporter with two powered wheels and a gyroscopic stabilising mechanism. Internal combustion vehicle emissions are increasing every day. The amount of traffic in cities has increased dramatically over time. Traffic congestion results in increased car emissions and poorer air quality. Although there is no quick answer to this problem, another option for traditional personal transportation is the hoverboard. As a result, hoverboards are gaining in popularity. However, complicated electronics, such as the accelerometer and gyroscope, make it prohibitively expensive. The design, analysis, and manufacture of an electric three-wheeled hovercraft are all part of this project. The speed can be controlled by a potentiometer and moves back and forth using a DPDT switch. A small wheel is utilised to balance the vehicle, eliminating the requirement for a gyroscope. The purpose of this research is to develop a hoverboard that is both inexpensive and efficient.**

1.INTRODUCTION

In cities, where most people are exposed to poor air quality, air pollution is a serious environmental issue. The number of ICE vehicles in the world has increased dramatically due to rapid urbanisation. Vehicles have emerged as the dominant cause of air pollution in urban areas as traffic continues to grow and congestion worsens. Several steps have been done by the governments to improve city quality. These include things like improving fuel quality, developing and implementing relevant legislation, enhancing traffic planning and management, and so on.

The main idea behind a hoverboard is to produce a means of transportation that is in contact with the ground. However, the initial concept was to build a hoverboard that does not touch the ground. Hover board will be powered by rechargeable batteries, much like any other vehicle. And, in most cases, electricity to charge the batteries is readily available. The components necessary, how each component works, the technique, and finally a discussion of how the Hover board would work are all discussed in this paper. A conclusion is given as to what we have accomplished and what more can be done in this area.

2. COMPONENTS USED

Throughout the Hover board, we want to keep two things in mind. Firstly, the whole system needs to run on such energy that is feasible to obtain at low cost and secondly, it needs to be portable by being as light as possible. The majority of the weight adds up by the use of Plywood frame and the battery which is responsible to power up motors, however, the power generated is enough to rotate those two motors when the load is applied plus the weight of an average human, riding the board. The essential components involved are listed as follows with their minimum specification.

i. Plywood Frame

The rectangular platform was necessary because the device would require two motorised wheels. The dimensions chosen were 15”x12”. The 15” width allowed the user to comfortably lay their feet on the platform, with their heels together and their feet pointed slightly outward. Simple plywood was chosen as the material because of its excellent strength and resistance to cracking and bending. Its modest weight was also advantageous because it reduced the load on the wheels. The plywood height was chosen to be 23/32”.

ii. Brushless DC Motor
The right motor for the job was determined by the device's anticipated speed and the load the motorised wheels would carry. Walking speed would be a reasonable velocity. This speed was estimated to be between 8 and 10 kilometres per hour. A 400 RPM brushless motor was selected with a rated voltage of 12 VDC. Brushes and commutators are not required because BLDC motors are installed. As a result, the spark will be avoided, and the operation will be stable.

iii. LITHIUM ION Battery
The selected motor's rated voltage was 12VDC, so a battery capable of producing 24V was required. A Lithium ion type battery was deemed to be appropriate for the device seeing as the motor did not require a high amp load. The battery is rechargeable.

iv. SPST Switch – Single Pass Single Throw
An SPST switch is a switch that has only one input and can only be connected to one output. That is, there is only one input and output port. The one-way switch acts as an on / off switch for the circuit. When the switch is closed electricity is supplied. This switch is used to connect the battery to the motor via an electric dimmer.

v. Pushbutton Switches
These switches are momentary switches, The switches were default on, momentary off in order for the user to press down with their fingers in order to stop. Two of these switches were attached on either side, one for each motor.

vi. Wheels
Two tyres are used on both the sides of the wodden ply. Tyres are able to support the weight of vehicle upon load; conveys traction, braking forces to the road surface, torque and maintain the direction of travel. These wheel are attached to motor shaft with a M6 Grub screw which holds the motor shaft without slipping off from the specially designed hub with Iron EN8 material.

vii. Supporting wheel
A 3Inch diameter swivel casters were selected. The caster was directly attached to the underside of the platform by screwing the attached to the plywood in the front side. The wheel is not driven by the motor; can swivel 360 degrees which is good to take turns.

viii. A Electric Dimmer
Dimmers are devices that are linked to a light fixture and are used to reduce light brightness. The intensity of the light output can be reduced by changing the voltage waveform applied to the bulb. By applying the same, we are lowering the speed of the motor.

3. EXPERIMENTAL SETUP AND METHODOLOGY

The main thing is the wooden ply, which is more of a protective casing, which goes on the top and serves the purpose of a platform for the person to stand. Beneath the deck we have the motors on either side. The motors attached to the wooden ply using clamps. Tires are attached to the motors using Iron EN8 hub with a grub screw. A 3inch diameter support wheel is chosen as it should provide an inclined angle so that weight will be distributed between main tyres and support wheel. The support wheel is mounted on to another rectangular ply strip on the bottom side of main wooden ply. Over the support wheel on the top side of wooden ply a handle is attached to support the rider from falling. A display which indicates speed and battery percentage is also mounted on the handle. Moreover, the dimmer is attached to vertical shaft of handle. At the intersection of vertical and horizontal shaft of handle a main SPST switch is mounted. Push button switches are approximately place at the two sides of handle where rider will place the thumb finger. Battery is placed on the top of the wooden ply i.e., it will be in between rider's legs and a protective sheet is used to protect the battery from water and dirt. There are extra two ply wood attachments to ensure the riders safety from ground obstacles.

Figure 1: Final Prototype

4. COMPONENTS SPECIFICATIONS

S.NO	Name of the COMPONENT	SPECIFICATIONS	QUANTITY	AVAILABILITY
1.	Wooden Ply -1	Length – 17cm Width – 43.5 cm Thickness – 1.6cm	1	EASY
2.	Wooden Ply - 2	Length – 32cm Width – 6.8cm Thickness – 1.6cm	1	Easy
3.	BLDC MOTORS	12 VDC, 6.5 AMP, 400 RPM	2	MODERATE
4.	BATTERY	24V 8Ah Sealed lithium-ion battery	1	easy
5.	SPST Switch		1	easy
6.	Push button switch		2	easy
7.	Tires	7inch diameter 1.5inch width	2	easy
8.	Support caster wheel	2 inch diameter	1	moderate
9.	Handle and control shaft	Height – 96cm Diameter – 1.6cm Length – 36cm	1	easy
10.	dimmer	DC 12-24 V . 8A	1	Easy

TABLE 1: COMPONENT SPECIFICATIONS

5. CIRCUIT DIAGRAM

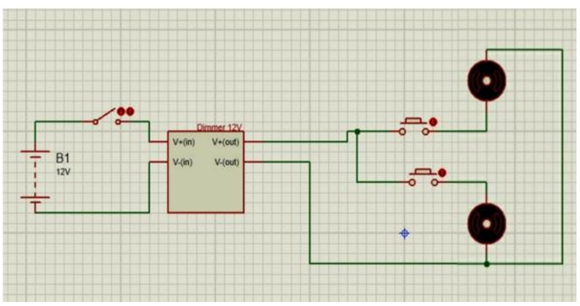

Figure 2: Circuit Diagram

6. WORKING

Supplying the necessary amount of electricity is a vital process which we achieved through a electric circuit drawn from a power source. The challenge now is to direct the power in such a way that it could actually make the Hover board move front and back. For this, the location of each switch has been strategically chosen to be closer to the front side at the rider's finger tips. This is done so that when the operator closes the circuit, the current is utilised by the motors through which the tyres rotate and it moves the hoverboard in the specified direction. For moving the Hoverboard sideways, we are using the basic steering principle, if one wheel is made to stop then the body will rotate at the axis of rotation of the stationary wheel. When the push switches are made open and close the circuit then the power supply to the motor is paused and the rotation takes place concerning the stationary wheel. The speed can be controlled by the dimmer which also acts as a brake.

7. OBSERVATIONS AND RESULT

During initial testing, it was observed that the device did not function as well as it should have. It was difficult to stand and control the vehicle to turn left and right directions, but after a few trials, it was not a big challenge. The left motor will frequently stop for no reason which makes the vehicle turn left disturbing the pathway direction. The device was quiet at the start of the journey increasing in sound has been observed after a few minutes of working. The motors are heating up after the increase in the sound of the motors. The battery's problem couldn't get understood sometimes it is working well as expected whereas it doesn't work sometimes even though it is fully charged. The wheels collected any dust and tiny items on the ground. As a result, the equipment was unable to perform to its full potential. Due to the debris and random dust that accumulated on the casters, they were more hesitant to swivel.

8. CONCLUSION

In general, this research was successful in achieving the goal and producing a satisfactory result. The primary purpose of this project was to create a workable two-wheel and one-supporting-wheel transporter, which was achieved. A number of test drives were used to evaluate the vehicle's general operation and performance. A variety of weights have been used to test the vehicle. This project is being implemented with the goal of finding a viable solution to the transportation challenge.

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