



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 6, June 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118

9940 572 462

6381 907 438

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Single Wheel Electric Skateboard

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ABSTRACT- A Electric Skateboard is a self-balancing personal transporter consisting of two motorized wheels with a typical system. Emissions from internal combustion vehicles are on the rise every day. Urban vehicular traffic has increased tremendously over the years. Traffic congestion leads to higher vehicle emissions and lower ambient air quality. There can be no immediate solution to this issue, but another solution for conventional personal transport is Electric Skateboard. So the Electric Skateboards are becoming more popular day by day. But the complex electronics like accelerometer and gyroscope make it too expensive. This project involves the design, analysis, and fabrication of an electric three-wheeled hovercraft. The system moves back and forth using the DPDT switch. A small wheel is used to balance the vehicle such that a gyroscope is not needed for balancing purposes. This project work aims to build a low-cost and efficient Skateboard.

KEYWORDS: Single wheel, DPDT Switch, speed controller, low cost, efficient.

I. INTRODUCTION

Air pollution is a major environmental problem in cities where most people are exposed to poor air quality. Rapid urbanization in India has led to significant growth in the number of ICE vehicles. As vehicle traffic continues to grow and congestion increases, vehicles have become the primary source of air pollution in urban India. These include improving fuel quality, drafting the necessary legislation and applying vehicle emission standards, improving traffic planning and management, etc. Shortage of fossil fuel and the expansion of pollution and fuel rate makes electric vehicles (EV) more popular on transportation. Compact electric vehicles are gaining some attention from the urban public, personal transporters include all types of bicycles, Skateboard, Electric Skateboard, e-scooter, e-bikes, etc... are widely used. But the main disadvantage of these electric vehicles is their high cost. A Electric Skateboard with single wheel, which is powered engines mounted as part of the Electric Skateboard.

The DPDT switches control the board's direction and movement. The vehicle has battery-operated electric motors. It is balanced through a small bearing wheel. No micro-controller, gyroscope, or sensor is used. The rider accelerates or decelerates by using Speed governor.

II. LITERATURE SURVEY

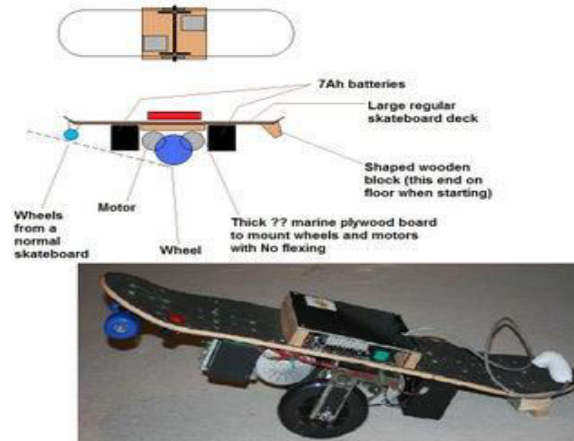
Controller and Controlling System- The use of Controller with IMU Sensor for an elevated wheeled-platform was justified. Robinson AP (2013) [1]. A. Dinesh Kumar (2017) [1]. The design and fabrication of wooden hoverboard wheeler. The Self balancing two wheeler is based on the principle of Segway. Reilly R., and Andrie (2016) [2].

Design and Development of a Prototype- The use of motor for traction purpose, instead of the traditional motor is justified in this paper. The paper deals of equipping a skateboard with a Motor and Batteries. Pravin Kumar (2011) [3].

On the other hand, we can say that we have to know the battery behavior that it is fully charged, in the middle means 50% state of charge or completely discharge. Agus Purwadi (2013) [4]. The battery test system based on with a

consistent power source was created and used to know the battery limit and the battery charging and discharging time for its various charges. In a dynamic load, the battery. Nana Heryana (2011) [5].

BLOCK DIAGRAM



The Electric Skateboard contains two wheels, two BLDC motors, two DPDT switches, a Speed governor, battery source, and a display. The main power supply is the battery. The two motors used here will drive the wheels. DPDT switches are used to drive the Electric Skateboard. The speed governor will help to control the speed of the motors. The display provided in the system will help to know the charge left in the battery. Here we are using two batteries and those are connected in parallel.

III. METHODS USED TO DESIGN THIS PROJECT

Frame



It is the main part of the Electric Skateboard. It is made of rectangular wood material. It is designed to ensure the safety of the driver and a robust standing platform and to protect the electrical system and components.

Motor



Here we are using two 24V, 6.25A, 150W BLDC motors. Since BLDC motors are used, there is no need for brushes commutators. Thereby, avoid the spark and provide the stable operation.

Battery



We will use two batteries of 12V and 9 Ah each connected in series to power 2 motors with DC. They are lead-acid batteries.

DPDT Switch



Double Pole Double Throw (DPDT) switch. This serves to guide the direction of rotation of the Electric Skateboard. By operating the switch the direction of the vehicle can be controlled. The connector wires connect the switch to the motor.

Speed controller



The DC motor speed controller can control the direction of a DC motor using a DC voltage modulated in pulse width.

6. Wheel- Tyre are designed to support the weight of the vehicle, convey traction, torque, and braking forces to the road surface, and maintain and alter the direction of travel. And these are places just after the motor.

Supporting wheel



The purpose of a small supporting wheel is to balance properly; there is no need for a gyroscope for the balancing purpose. This will help to eliminate the complex electronic components from the board.

Chain drive



A chain arrangement is an endless chain coiled around two pinions. The C Plates chain consists of several links linked by spindle joints while the sprockets are gear wheels with a special profile for the teeth. The chain runs between the belt and the gearbox. For all automobiles especially two-wheelers the chain drive is used for transmission power generated by the engine to the rear wheel.

CALCULATION

Weight to be carried = 80-100kg

Diameter of the tyre = 0.1651m

Radius of the tyre = 0.08255m

Required speed = 12kmph(normal speed of a hub rotor Electric Skateboard is 6 to 7 miles/hour)[7 miles = 11.2654 km](max: speed of hover board is 10 miles/hour)

[10 miles = 16.0934 km]

Total reaction on each tyre normal reaction of each tyre = $W/2$

$W = \text{Weight} = 100/2 = 50 \text{ kg}$

$= 50 \times 9.81 = 490.5 \text{ N}$

Static friction, Considering it as u ,

$u = 0.025$

Dynamic friction $v = 0.002$

then, Static frictional force, $F(u) = 0.025 \times 490.5$

$= 12.2025 \text{ N}$



Dynamic frictional force, $F(v) = 0.002 \times 490.5$

$$= 0.981 \text{ N}$$

Torque required in static friction,

$$T = F \times r \quad F = \text{force, } r = \text{radius of wheel}$$

$$T = 12.2025 \times 0.08255 = 1.0122 \text{ Nm}$$

Torque required in dynamic friction,

$$T = F \times r$$

$$T = 0.981 \times 0.08255 = 0.0809 \text{ Nm}$$

Internal force required for the motion,

$$F = ma$$

$$m = 100 \text{ Kg}$$

$$a = dv/dt = [(16000/3600) / 10]$$

$$= 0.444 \text{ m/s}$$

$$F = 100 \times 0.444 = 44.4 \text{ N}$$

Torque required for moving the vehicle,

$$T = F \times r$$

$$= 44.4 \times 0.08255 = 3.665 \text{ Nm}$$

Total power required to move the vehicle,

$$P = T \times \omega$$

$$T = \text{Torque}$$

$$\omega = \text{Angular velocity}$$

$$= 2 \text{ rps}$$

$$60 \times \text{rpm} = \text{rps, } 16 \text{ kmph} = 514.1286$$

from reference 1 rpm = 6 (angular velocity)

$$\text{So, } \omega = 514.1286 \times 6$$

$$= 3084.7716$$

Power required to move vehicle,

$$P = T \times \omega$$

$$\text{Rad/sec to degree} = 53.839 \text{ rad / seC}$$

$$P = 3.665 \times 53.839 = 197.3199 = 198.$$



IV. CONCLUSION

The hardware is performing the balancing function in a hassle-free manner with the user standing on it. The PID algorithm's response is just perfect and is intuitive enough for any new user to perceive the how-to for this hardware. The skateboard posture provides more aerodynamic and grip advantage over the current two-wheel-hover-boards available in the market. The inbuilt battery level indicator displays accurate readings of the charge remaining in the battery. Personal electric vehicles are technically possible now. The price of a personal electric vehicle that is available on the market is very higher for its range, it uses cutting-edge technologies which has increased the price. In this project, fabrication methods are changed. For balancing purpose a gyroscope sensor is used in the Electric Skateboards available on the market, but in this project, a support wheel is used to balance the vehicle. The charging time is higher in this project because a strong battery is preferable to lower the cost. Thus, the feasibility of a personal electric vehicle depends on reducing the cost and making it available for every person and in every place.

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SJIF Scientific Journal Impact Factor
Impact Factor: 8.118



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