

Fabrication of battery powered Long-Board as Alternative Transportation

Anil Kumar¹, Anil Baliram Ghubade², Mahipal Singh³, Hitesh Arrora⁴, Nikita Jain⁵, Aditya Mishra⁶

^{1,2,3,4}Assistant Professor, School of Mechanical Engineering, Lovely Professional University, Phagwara, Punjab-144411, India.

^{5,6}Assistant Professor, School of Mechanical Engineering, Career Point University, Kota, Rajasthan-324005, India.

Abstract:

Due to technological advances and an increased focus on renewable energy, Electric vehicles saw revolutionary technology in the 21st century. It is known that there is the steepest rise in the various fuel prices including petrol. Similarly, pollution in urban and rural cities is constantly growing due to vehicles. To provide a solution, a better alternative is being searched towards the transportation method by using a different energy source. Sadly, purchasing of two-wheelers like scooters/motorcycles or four-wheelers for everyone in society is not affordable either. Hence, there was an ongoing quest for finding a better solution to make environmental supportive. An electric longboard maybe that alternative to the above said problem. The electric longboard can runs on battery-powered DC motor or manually. A battery must charge the electric power supply when the electric longboard is idle. A DC motor in an electric longboard can generate power around 250W which can produce about 25-30 km per hour speed.

Keywords: DC Motor, Electric Long Board, sensors.

Literature Review and Theory

It is said that the first stake board was invented around the 40's or '50s. But it is not confirmed that who is an inventor and who gave an idea for it. Although it is sure that another similar option seen, name as "sidewalk surfers" which have been verified that it developed by California wave riders. They used to surf on land when waves slowed.

Later skateboards fabricated by using roller skates (metal) to planks of wood. It certainly made more stylish. It can be good and personal transport vehicles which may be comparative more.

Skateboarding alone can be quite an exciting experience for riders as they cross the street, take off on an all-terrain coaster, or participate in the incredible kiteboarding experience. It has been observed that electric skateboard has become popular with board enthusiasts because it is a cheaper, efficient, and eco-friendly transportation system for urban.

Introduction of Electric longboard:

An electric longboard can be an alternative transport medium that is similar to the stake board. Overall control can be handled with hand by using throttle or weight sensor controls. Direction can be changed manually by adjusting the man's weight either left or right side.

Previously, the batteries which were used in electric skateboard found sealed lead-acid batteries but they had various drawbacks, such as limited power, less powerful and having much weight. After some time, lithium-ion batteries have been introduced which found to be of less weight in small sizes and with high output power. A typical electric long-board has a maximum speed of about 25-40 kmph.



Fig 1: Electric longboard

Scope of the longboard:

As with the advent of the growing technology, the electric longboard has been drastically improved. Old types of batteries were based on lead-acid and could not produce more power. It also needs a recharge on a regular basis. Hence more powerfull batteries are required and it available know as lithium-ion batteries. These new batteries have more power and less frequent recharging is required and also has less weight comparatively.

The longboard has been recognized as a good medium for personal transportation which can be used for the shorter distance. However, more distance can be covered but it required more battery back-up and reduced size of the longboard.

The various researcher has stated that weight sensors and remote controller can be easily attached which can make electric longboard easy control in various aspects.

Objective of electric longboard:

The main objective of this project is to reduce the physical force used by people for traveling a distance and to make a portable and fast transportation reducing paddling effort. The wheels are guided by handheld throttle the direction of the wheels could be by tilting on one side or the other for turning or handle could be used for manual turning limiting body motion or easing it for comfort turning.

This is a new future for an electric longboard with a remote controller having a throttle push button and buttons to stop the board without any use of kicktail. These are for personal transportation with compact batteries quickly charged for long-distance travel. These electric longboards with no pollution will be good for the environment and could be fun for the people and even be used for short-distance travel. The longboard is been used in many countries like Norway, USA, Spain, Japan and other countries.

- Eco –friendly and pollution-free for environment
- Reduce physical effort by people
- Simple to ride
- Fast transportation
- No physical effort to achieve high speeds

Methodology:

The purpose of this project is to render the longboard platform, hence the owner of longboard users can use the motorized kit. After fully mounting of it below of the previous board they can make or turn it into an electric longboard.

It consists of a microcontroller, a transceiver for the receiver, a brushless DC motor also batteries that are required to provide power to the motor.



Fig 2: Electric skateboard

Table 1: List of Components with applications

Sr. No	Component	Application
1	Rear-wheel	Driving wheel
2	Sprocket	Power transmission
3	Motor	Power generation
4	Battery	Power source
5	Board	Supporting unit
6	Chain drive	Transmission unit
7	Push button	On/off
8	Wiring	To complete circuit
9	Front wheels	Stability and steering
10	Nut and bolt	Fitting

Major Components used for the Project:

The project contains the following major components are:-

- Rear Wheel
- Small wheels
- Battery
- Sprockets
- Wooden board
- Fixture
- Chain
- Frame
- Motor
- Switch
- Nut bolts

The brief explanation of a few components are given below:

Rear Wheel:

The longboard has three-wheel drive, the rear-wheel-drive the longboard. The smaller dimension wheel used in the front side like used in the normal skateboard. The motor supply power to the sprocket then power is transmitted to the rear wheel so the rear wheel is driven by the motor. The diameter of the wheel varies as per usage we are using a 19-inch wheel that could be found in bi-cycles and smaller diameter wheel is used if we use bigger diameter wheel will be increased so battery required for the motor will take much space and the longboard will be not compact as per requirement.



Fig 3: Rear-wheel

Front wheels:

On the front side, we use the trucks that connect the smaller wheel of the diameter of 4 inches. We use the smaller diameter of wheels in front because smaller wheels have less inertia to overcome to get spinning, in the rear side we used bigger wheels as compared to normal skateboard because when we are in bigger wheels it can roll much faster over the rough surface. Smaller wheels are more maneuverable.



Fig 4. Front-wheel (caster wheel)

Wooden Board:

The wooden board is a building block of the electric longboard .basically it works as a frame of any automobile which can support the chassis components and body of that vehicle. Board tends to be 45 to 55 inches long. This length provides the **best stability and maneuverability**. These boards tend to have a low deck height for stability. A slight flex in the deck offers a smoother ride. The material for the deck would vary as per need and application of load. Things to look on board are **thickness, length, width, and flexibility**.

The thicker the board is, the less flexibility it offers. As we said, longer boards provide more stability but less maneuverability while shorter boards offer less stability but more maneuverability. More and more companies are changing the design according to the evolution of modern technology.

The material we used in our project is hardwood. The wheels are fitted to the deck by the use of fixtures.



Fig 5: wooden board

Sprocket:

Sprocket is similar to gear which makes fixing with chain and used to transmit power via shaft. It is generally being used in two, three and four-wheelers including bicycle. Hence, sprocket transmits the power generated in the motor to the wheels.

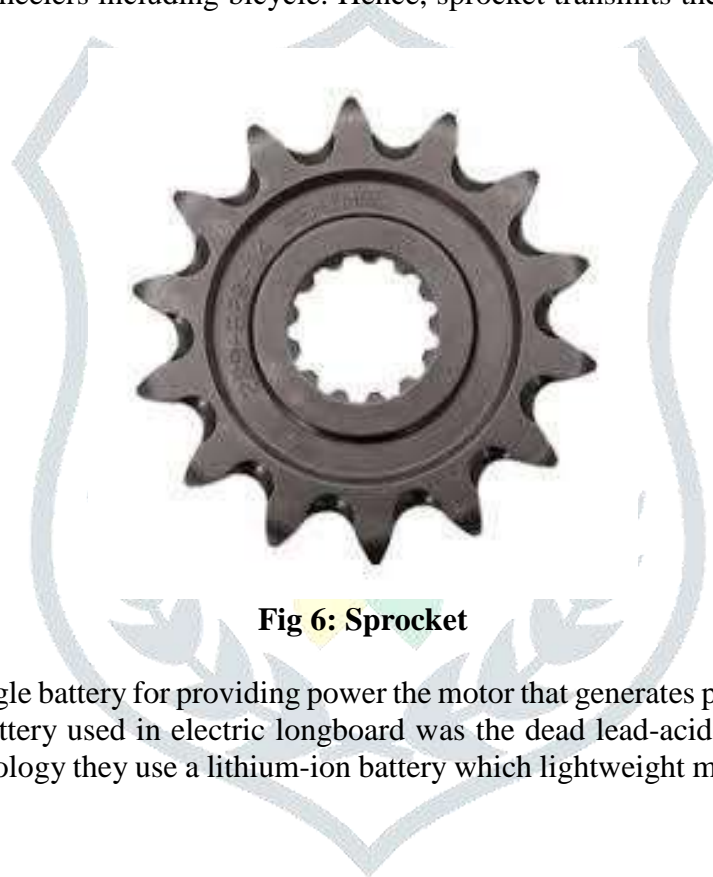


Fig 6: Sprocket

Batteries

The authors used a 24-volt single battery for providing power the motor that generates power and the sprocket transmit it to the wheel. Earlier the battery used in electric longboard was the dead lead-acid battery which was heavy less power as improving the technology they use a lithium-ion battery which lightweight more power. Two battery of 12v each and 13 ampere/hr.



Fig 7: Battery

We are using a 3 wheel drive longboard that is been controlled by the controller, the frame is constructed as per dimension for the rear wheel and sprocket fixtures are connected to frame by bolts and the nuts motor is connected to the sprocket and the sprocket transmit the power to the wheels. The 24v battery is connected to the controller terminal and the motor is connected to the controller help in discharge by the mean of accelerating and deaccelerate.

The two batteries were tested by hooking them up to a multi-meter. The battery powering the motor should be 22.2V \pm 10% and they were measured to be 24.04V.

Specifications of Battery:

- Type of battery – dead lead acid battery
- Size(l*b*h)--150*60*90
- No. of batteries –2
- Voltage 12.02V(each)
- Amp Hr. 7.2 Ah(each)

The body of the switch is made of non-conducting plastic.



Fig 8. Push-button, wire cover and wire

Table 2: Bill of material

S.No	Component	Specification	Quantity
1	Rear Wheel	19 inch dia	1
2	Small Wheels	6 inch dia	2
3	Fixture	10cm*8cm	2
4	Frame	148cm*46 cm	1
5	Board	120 cm*46 cm	1
6	Sprocket 1	30 teeth	1
7	Sprocket 2	24 teeth	1
8	chain drive	60 cm	1
9	Battery	7.20 AH ,12 v	2
10	Nut and bolt	M10	20
11	Motor	24 v ,480 rmp	1

Motor specifications:

- Rated power: 250W
- Rated voltage: 24V
- Base motor RPM: 480RPM
- Actual speed: 142.39RPM
- Full load current: 26.7A
- Rated Torque: 120.72Nm
- Gear ratio: 1:8
- Motor Weight: 4.80 kg

Motor Calculation:

Diameter of rear wheel	= 19 inch = (48.26cm)
Total weight	= 85 kg.
Rolling coefficient (miu)	= 0.3(assumed).
Rated power of motor	= 250W
Angular frequency	= w
Torque on sprocket	= T
Rpm with load	= N
Velocity	= 15 km/hr
Resisting force	= m*g*u = 85*9.81*0.3 = 250.15N
Torque required on wheel	= force*displacement = 250.15*48.26 = 120.72 Nm

$$\text{Power} = T * w.$$

$$\text{Power}/w = T$$

$$w = 2 * 3.14 * N / 60$$

$$V = 3.14 * D * N / 60$$

$$N = V * 60 / 3.14 * D$$

$$N = 142.39 \text{rpm}$$

Use the rpm with load to find angular frequency

$$w = 2 * 3.14 * 142.39 / 60$$

$$= 14.90$$

Substitute the value of angular frequency to find the torque on sprocket

$$\text{Power}/w = T$$

Table 3: Cost Analysis

S.No	Component	Cost (in Rupees)
1	Rear Wheel	600
2	Small Wheels	480
3	Fixture	50
4	Frame	500
5	Board	200
6	Sprocket 1	200
7	Sprocket 2	150
8	chain drive	300
9	Battery	2400
10	Nut bolt	300
11	Motor	3500
12	Wire and switch	120
13	Miscellaneous	1000
	Total	Rs 9800/-

Results and Outcomes of The Project:

Results:

The results were found satisfactory and this fabricated electric longboard met with all the initial objectives. Speed and power made it successful project and riders were found satisfied as it is motorized instead manual where less manual control and human efforts are required.

Application of the project:

The electric longboard can be used for traveling a shorter distance without affecting the environment. The electric longboard could be an effective means of transportation with some modifications.

Conclusion:

The electric longboard could be helpful for personal transporter can be used in day to day life traveling to school or nearby places. It is portable and could be carried for vacation as it is electric there is no contribution to the pollution, the electric longboard is one wheel drive power is provided to the rear wheel the acceleration is controlled by the motor controller.

The electric longboard could be the replacement for short-distance use of bikes, eco-friendly and the battery could be recharged easily as the lithium-ion battery is used, it could be used for personal transportation for kids as well as adults and it is portable could be carried around trips.

Future Scope:

With the help of artificial intelligence, the project will enter the advance level in that it is known as a smart longboard. To make it smart we have to use Arduino along with the motor controller and two dc motor for the front wheels. This system helps us to properly steering.

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