

# Design and Manufacturing of E-Kick Scooter

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## ABSTRACT

This paper is based on providing a better transportation for all in a big infrastructural facility. For this, we are building an electric kick scooter suitable for teenagers and adults. In big spaces such as IT Parks, Colleges, Airports, etc., there is a transportation issue to travel between two sections of the facility.

To tackle this issue an electric kick scooter is a fun and effective way to get going. To develop our product, benchmarking was a major step, to see what is and was in the market and what they are offering to the public. With some basic features such as speed controller, dual brakes, and good ground clearance, we are adding more features like a removable seat, phone holder as an accessory, extra standing space for two adults, front and rear lighting and some styling features. After researching, we have chosen to build our product with high quality steel and recycled plastic and rubber for better strength and durability. This product is intended for public use, with that in mind, our vehicle is controlled just as a bicycle.

A good-looking product and better features are key for sales.

**Keywords:** Electric Vehicle, Personal Mobility, Kick Scooter, Eco friendly transportation

## I. INTRODUCTION

An e-kick scooter is a battery-operated one-person capacity vehicle designed for people who have difficulty in walking longer distances. There are various types of scooters according to the environment in which they are going to be used, such as outdoor use, indoor use and those which can be used in both conditions. A e-kick scooter may have two or more wheels according to need.

As an electric vehicle uses electricity, it does not pollute the environment while in use. An e-kick scooter requires rechargeable batteries on which the range and speed are dependent, which are affected by the type of battery we use.

Electric scooters are easy to use as their controls are very simple, accelerator and brakes. They are fun to drive and does not cause noise like a traditional IC engine vehicle.

## II. COMPONENTS OF A E-KICK SCOOTER

Following are the components used in an electric vehicle:

- Batteries
- Battery charger
- Motor(s)
- Motor controller
- Vehicle electronics

1. **Batteries:** Batteries are the main source of power for an electric vehicle for it to function. Since our scooter is battery powered, it requires DC charge to recharge the batteries. For this, we have two options to choose from, a lead acid battery or a lithium-ion battery.

- **Lead acid batteries:** These are formed by dipping lead peroxide plate and sponge lead plate in dil. sulfuric acid.
- **Lithium-ion batteries:** These are a family of rechargeable batteries having high density of energy and are commonly used in common electronics. Lithium-ion batteries are lighter than most kinds of rechargeable batteries of similar size. That is why they are commonly used in portable electronics.

2. **Battery Charger:** A battery charger runs on both AC and DC charges according to its type. We require DC charge to recharge our batteries which also requires a DC-DC convertor.

3. **Motor:** A motor is a device which converts electrical energy into mechanical energy and propels a shaft. The basic working principle of DC motor is based on the fact that whenever a current carrying conductor is placed inside a magnetic field, there will be a mechanical force experienced by that particular conductor. There are two types of motors,

A. **PMDC motors:** When a permanent magnet is used to generate magnetic field in a DC

motor, the motor is referred to as a PMDC (Permanent Magnet DC) motor. Most commonly used as starter motors in vehicles, wipers, HVAC systems, toys, etc.



Fig. 1: PMDC Motor

B. **BLDC motors:** These are also known as electronically commutated motors, or synchronous DC motors. These are powered by DC electricity via an inverter which produces AC current to drive each phase of the motor.



Fig. 2: BLDC Motor

4. **Motor controller:** A motor controller provides pulses of current to the motor windings that control the speed and torque of the motor.

5. **Vehicle electronics:** The electronics are one of the main components of an e-vehicle, they manage the flow of current in the right way and

helps the controller to operate the vehicle smoothly. The wiring needs to be perfect in order to make the vehicle run. Quality grade wiring must be used to ensure safety and efficiency

**6. Other components:** Subcomponents such as brackets, nuts and bolts, different hardware is also required to be fitted on the frame.

Note: All the components should meet all standards required by the authorities.

### III. DESIGN OF THE VEHICLE

The design process of our vehicle begins with what components we need and how we must arrange them. We studied different e-kick scooters on the market and benchmarked them to start with our own design. To start this, we worked on concept designs and creating a basic layout of where all the components should fit and will be ergonomically suitable for the operator.

We first had to build different components of the scooter in the software to assemble afterwards with ease.

Once the parts are individually designed/modelled, we can then assemble them and then test the structure under different loads. As you can see in the below figure 3 and figure 4.



Fig. 3: Prototype Design

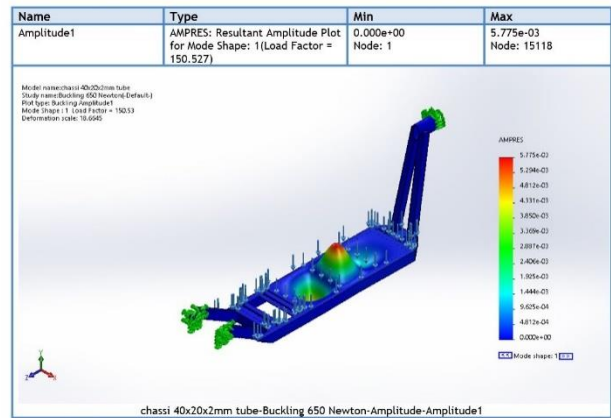


Fig. 4: Stress analysis in the frame of the scooter.

### IV. TIME PLAN FOR THE PROJECT

Months/ Activity	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
A												
B												
C												
D												
E												
F												
G												
H												
I												
J												

Where's,

Activities:

- A=Topicfinalization
- B=Literature Review
- C=FormulationofProblem
- D=Parametricanalysis
- E=Developmentof CADmodelsofsystem
- F=Purchasingofcomponents
- G=Manufacturing
- H=AssemblyandTesting
- I=ResultsandConclusion
- J=ReportWriting

### V. DESIGN CALCULATIONS

The motor readily available in market we chose are permanent magnet, self-generating motors with 200-

wattpower and 300 rpm. The motors run on 48 volts and 5 amps power source.

These motors reach a peak current during starting equal to 8 amps.

$$P = 2 \times 3.14 \times N \times T/60$$

$$= 2 \times 3.14 \times 300 \times T/60$$

$$T = 6.36 \text{ N m} = 6366 \text{ N-mm}$$

Reduction in chain drive R

$$\text{chain} = 18/18 = 1:1$$

Torque at wheel = 6366 N mm

Speed of wheel shaft = 300 rpm

**SPEED**

$$V = \pi DN/60$$

$$V = 3.12 \times 0.300 \times 300/60$$

$$V = 4.71/\text{sec} = 16.96 \text{ Km/hr}$$

**RANGE**

Motor power 200 watt

Battery power 6 V x 4-amp x 4Nos. =96 watt

$$(96/200 = 0.48)$$

$$0.48 \times 60 \text{ min} = 28.8 \text{ min}$$

## VI. ADVANTAGES AND DISADVANTAGES

**Advantages:**

- It is Eco-Friendly.
- It can easily be used for short-distance travels i.e., College tours, factory tours etc.
- The Electric Scooter has a predictable surface that is much easier to negotiate than sidewalks, curbs or trails and the risk of tripping is reduced.
- Multiple users can use the same equipment without adjusting the structure.
- It can be used at the places where is the risk of contamination due to emission.

**Disadvantages:**

- Main disadvantage of Electric Scooter is its discharging battery. Due to sudden discharge of

battery in between of travelling many problems are faced.

- Not optimal for long distance.

## VII. FUTURESCOPE AND IMPROVEMENT

**Future Scope:**

- It can be used as an indoor locomotive device infrastructure with large roof span i.e., malls, warehouse, open markets, large office spaces, etc.
- By using such product pedestrian cops can save themselves from getting exhausted.
- Pedestrians in large campuses can benefit from this product the same way.
- Can replace scooter as an energy efficient vehicle for those who cannot drive a scooter.

**Future improvement:**

- Due sudden discharge of battery in between of travelling leads to face many problems to overcome this disadvantage we can do some improvements in present model.
- To overcome this discharge problem, we can install a solar panel to the system it will recharge the battery and continuous movement of walking can be possible. Solar panel is one of the simplest ways to charge the battery.

## VIII. ACKNOWLEDGEMENTS

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