



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

# IJIRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 5, May 2022

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

Impact Factor: 8.118

# Fabrication of Tri Wheeler Segway

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**ABSTRACT:** The aim of this project is to fabricate a tri wheeled Segway at low cost. The Segway presently in use is of high cost and a common person cannot be offered it, So it is decided to design and fabricate a tri wheeled Segway which is of low cost. The tri wheeled Segway runs by using DC motor and the motor speed is controlled by using an accelerator which is fixed in the handle. Segway has a disadvantage of the lack of stability which caused injuries to many people and this problem is chosen into serious concern and designed and developed a Segway with fail proof.

The Segway which is designed and fabricated is of low cost and higher stability and which safer operation and ensure the safety. This Segway is easy to use as it has introduced switch system to control the motion of the Segway. The tri wheeled Segway is a low cost which this kind of vehicle is interesting since it contains a lot of technology relevant to an environmentally friendly and energy transportation industry. This describes the development of similar vehicle from scratch, incorporating every phase from literature study to planning, design, vehicle construction and verification.

The main objective of this work is to build a vehicle capable of transporting a person weighing up to 80 kg for 20 minutes or to a distance of 10 kilometers, whichever comes first. The rider controls or supposed to be natural movements, leaning forward or backward in combination with tilting the handle bar sideways should be the only the rider input required to ride the vehicle.

**KEYWORDS:** Travelling, Electric bike, Electric energy, Fuel economy, Pollution free, Eco-Friendly.

## I.INTRODUCTION

### 1.1 SEGWAY OR HI-TECH SCOOTER:

At first glance, this device called the Segway (Human Transporter) doesn't seem all that remarkable it looks like a high-tech scooter. But people who have tried it out claim that it is much, much more a completely different way to get around.

- Motor-scooter like device
- Powered by electric motors
- Movement by shifting weight, turning wrist
- Turning radius zero
- Designed by inventor Dean Kamen (150 patents)
- Max speed 10.0-12.5 mph
- Maximum distance 14-17 miles (single charge)
- Device weighs 69-95 lb

Segway is the human transporter which is to move from one place to another place. with a simple operation.

Basically, Segway is a scooter like but the wheel arrangement is parallel to each other that is both the wheels are placed side by side.

## II.LITERATURE REVIEW

### 2.1 Working Mechanism

To move forward or backward on the Segway, the rider just leans slightly forward or backward. To turn left or right, the rider turns the right handlebar forward or backward. This balancing act is the most amazing thing about the Segway, and it is the key to its operation. To understand how this system works, it helps to consider Kamen's model for the device - the human body. If you stand up and lean forward, so that you are out of balance, you probably would not fall on your face. Your brain knows you are out of balance, because fluid in your inner ear shifts, so it triggers you to put your leg forward and stop the fall. If you keep leaning forward, your brain will keep putting your legs forward to keep



you upright. Instead of falling, you walk forward, one step at a time. The Segway does pretty much the same thing, except it has wheels instead of legs, a motor instead of muscles, a collection of microprocessors instead of a brain and a set of sophisticated tilt sensors instead of an inner-ear balancing system. Like your brain, the Segway knows when you are leaning forward. To maintain balance, it turns the wheels at just the right speed, so you move forward. At its most basic, the Segway is a combination of a series of sensors, a control system and a motor system. In this section, we'll look at each of these elements.

## **2.2 History of Segway:**

The Segway PT is a two-wheeled, self-balancing, battery-powered electric vehicle invented by Dean Kamen. It is produced by Segway Inc, of New Hampshire. The name Segway is derived from the word segue, meaning smooth transition. PT is an abbreviation for personal transporter.

Computers, sensors, and electric motors in the base of the Segway PT keep the device upright when powered on with balancing enabled. The rider commands the PT to go forward or backward by shifting their weight forward or backward on the platform. The PT uses gyroscopic sensors and accelerometer-based leveling sensors to detect the resulting changes in its pitch angle and, to maintain balance, it drives its wheels forward or backward as needed to return its pitch to upright.

## **III. METHODOLOGY AND WORKING**

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 designed 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 70kg.

Anyone who ever ridden a bicycle with a dynamo light should get a concept of how electric bikes work. A typical battery in an electrical bike will have approximately a 1/4 of the capacity of a toaster, 200-350Wh. 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 capacity 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.

## **IV. FRAME WORK**

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.

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: 70 kg



Ground clearance: 95 mm.

There are two types of wheels are used in this projects. They are

Back wheel – 2\*10” Dia. Polymer wheel



Fig 1: Tri Wheeler Segway

## V.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.



Fig2.Components of tri wheeler Segway.

### 5.1 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.

### **5.2 BLDC 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

### **5.3 Controller :**

The mechanism of an electric speed controller varies depending on whether you own an adaptive or purpose build electric bike. An adaptive bike includes an electric drive system installed on an ordinary bicycle. The electric bike speed controller sends signals to the bike's motor hub in various voltages. These signals detect the direction of a rotor relative to the starter coil. The proper function of a speed control depends on the employment of various mechanisms. In a purpose-built electric bike, Hall effect sensors help detect the orientation of the rotor. If your speed controller does not include such sensors and the speed controller on an adaptive bike may not the electromotive force of the undriven coil is calculated to get the rotor orientation. The analog control systems on this bike are a result of the need for user operation of the motor control elements.

### **5.4Throttle :**

The throttle mode is similar to how a motorcycle operates. When the throttle is engaged the motor provides power and propels you and the bike forward. The motor power can be increased or decreased by the restriction of current (by use of a throttle), but usually decreased. The term throttle has come to refer, informally, to any mechanism by which the power or speed of an engine or motor is regulated. A few e-bikes have a throttle, which may conjure visions of a motorcycle's twist grip, but in reality is usually just a small electric button. Pressing the throttle works just like depressing the gas pedal on your car no other action is required to accelerate or continue forward.

### **Advantages :**

- 1.They are good for the Environment and no emission of pollutants.
- 2.They have less noise pollution than an engine vehicle,whether it is rest or motion.
- 3.By using E-bikes we can save energy sources for future.
- 4.They are easy to own and maintain.
- 5.Eleminating mechanical transmission inc. gearboxes, differentials, drive, shafts, and axels provides a significant weight and manufacturing cost saving, while also decreasing the environmental impact of the project.
- 6.They can be finely controlled and provide high torque from rest, unlike internal combustion engines, and do not need multiple gears to match power curves. This removes the need for gearboxes and torque converters.

## **VI. CONCLUSION**

"From this work it may be concluded that Tri Wheeled Segway may stand for Pollution Less and Fuel Saving Technology for the Current and Future Vehicles" with even better efficiency & conservation rate are very much on the anvil in today's energy.

High Cost is still a big issue to be solved. This problem can only be eliminated by Collaboration between industries and government to lower the barriers (such as taxes) on the customer and industries to adopt these Eco-friendly Segway technologies.

Tri wheeled Segways are having a pollution-free and greener environment. Further, with their sleek aerodynamic design and ultra-light materials, these vehicles can achieve speed of approximately 30-32km/h. All in all, one can assured that electric vehicles are the vehicles of the future and will rule the automobile industry until the nextgeneration of eco-friendly and fuel-efficient cars take their place.

The substitution of Segways for conventional vehicles results in a significant reduction in greenhouse gas emissions. 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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SJIF Scientific Journal Impact Factor  
**Impact Factor: 8.118**



**ISSN** INTERNATIONAL  
STANDARD  
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