

ABOUT SEGWAY

It would not be farfetched to say that Segway personal transporters have revolutionized the way people travel. Segway has made the concept of personal transporters so popular and so fashionable like no other company could have done. So, what is so special about Segway and their personal transporters? Let us take a look.

Segway personal transporters, the invented by Dean Kamen in 2001 at New-York, are two wheeled electric vehicles known for their unbelievably perfect balance and powerful motors. With environmental pollution reaching epic proportions, the need for a good, reliable, and most importantly zero-emission transportation was more than ever. Out came Segway PT, which simply revolutionized the concept of personal transport.

Let us face it. Fuel costs have gone up considerably, the environment is getting dirtier by the day, and the imminent danger of global warming does not sound good either. The need of the hour is a good, safe method of personal transportation that is not only environment friendly, but also does not burn a hole in the pocket. Segway PT is simply the best choice you have.

The personal transporters from Segway are battery operated and totally wireless. They have a lean steer handlebar which make turning to your left or right incredibly easy. You can also adjust the handlebar frame height according to your needs. The most important thing about Segway PT is their incredible balance. The vehicle is fitted with gyroscopic sensors which can detect even the slightest tilting of the device and help the rider achieve perfect balance. You can go up to 12 mph with these transporters. They are slick yet sturdy so, you can take them indoors or outdoors, depending on your preference.

One of the coolest things about using Segway personal transporters is that you can customize them the way you want. There are plenty of accessories available in the market today and you can add whatever you want to your vehicle and make it look just the way you want.

Segway personal transporters are available in many different models. Some of the most famous models include Segway i2, i2 Commuter, i2 Cargo, x2, x2 Adventure, x2 Turf, and x2 Golf.

WORKING OF SEGWAY PT:

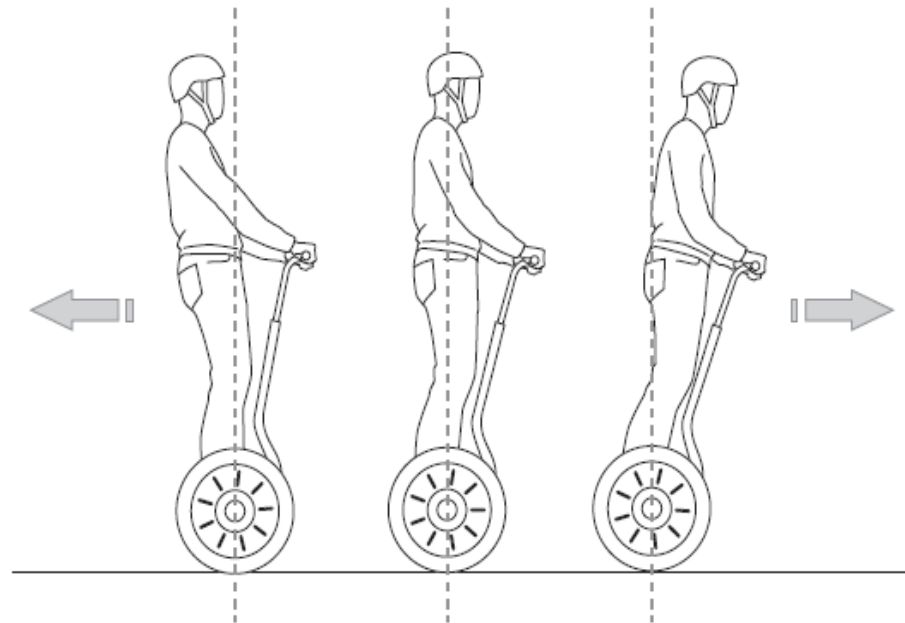


Fig.1

Computers and motors in the base of the device keep the Segway PT upright. The rider standing on an initially balanced Segway PT. when powered on with balancing enabled. A user commands the Segway to go forward by shifting their weight forward on the platform and backward by shifting their weight backward. To turn the Segway left or right the rider turns the right handlebar forward or backward. The Segway notices, as it balances, the change in its center of mass, and first establishes and then maintains a corresponding speed, forward or backward. Gyroscopic sensors and fluid-based leveling sensors are used to detect the shift of weight. To turn, the user manipulates a control on the handlebar left or right.

HOW IT SELF BALANCE



Based on the simple principles that govern the movement of the human body. When a person stands up & leans forward by shifting their weight, fluid in the inner ear shifts.

The brain to retain the balance initiates the signal which triggers the person to put their leg ahead, effectively walking forward to maintain balance.

Same principle follows by The Segway in Segway has, Wheels instead of legs, Motor instead of Muscles, Microprocessors instead of Brain and Tilt Sensors instead of Inner-ear.



Fig.2



Like your brain, the Segway knows when you are leaning forward. To maintain balance, it turns the wheels at just the right speed, moving you forward. Hence it balanced & move forward & backward.

FEATURES

- **Dynamic Stabilization:**

That's fancy speak for the tech that enables balancing. It's proprietary and full of benefits such as incredible maneuverability, a small footprint and providing a fantastically unique riding experience.

- **Electric Propulsion:**

Besides being clean and extremely efficient, electric propulsion enables fine adjustments to be made to each wheel (for turning and smoothing out the ride), and a precise, software-based approach to traction control and braking.

- **Smart battery Management**

Segway is one of the world's largest customers of large format batteries, and was at the forefront of the development of Lithium Ion batteries for transportation. We've learned a lot about the advanced sensing needed inside and applied this expertise to allow for more efficient energy use that leads to a longer battery life. Add in regenerative braking capability (being able to recharge while decelerating) and that's some smart battery tech

- **Advanced Sensing**

If there's a feeling you get when trying a Segway product, it's like it can almost read your mind. Well, it's not magic. It's the combination of propulsion, energy, inertial sensing and an incredibly intuitive user interface that enables a ride that will force you to hold back a smile. Hopefully someday you'll have a chance to try it out and feel good about your commute instead of fearing it.

SEGWAY COMPONENT

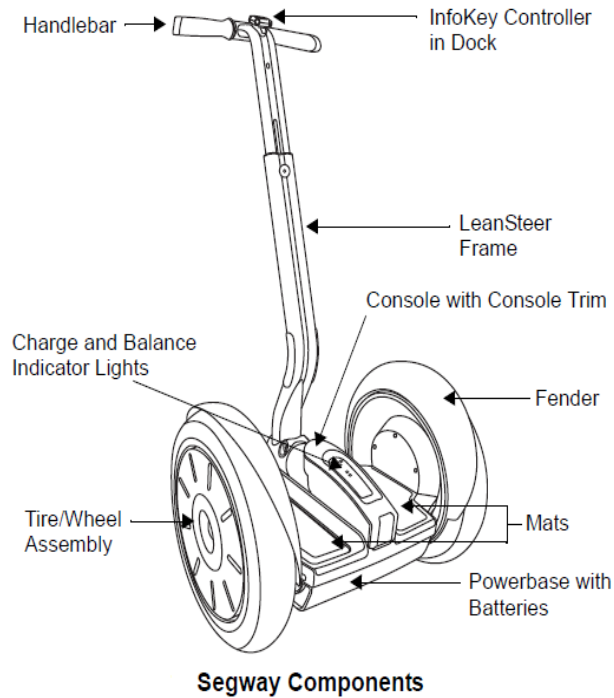


Fig.3

- **Info Key Controller:**

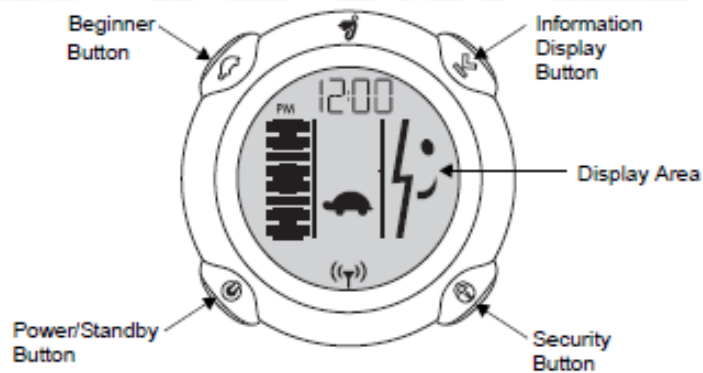


Fig.4

The Info Key Controller to operate and monitor your Segway PT. The Info Key Controller has four buttons around the outer edge and a display in the center. The Info Key Controller must be within 15-ft. (5m) in order to communicate with your Segway PT.

- **Lean Steer Frame & Handlebar Assembly:**

- ✓ The Handlebar is attached to the Lean Steer Frame.
- ✓ The Lean Steer Frame is attached to the Powerbase.
- ✓ The Handlebar is adjusted to the appropriate height.

The Lean Steer Frame pivots at the base to control left/right direction Of the Segway PT. If you lean to the left while holding the Handlebar, the Lean Steer Frame pivots and the Segway PT turns left. If you lean to the right While holding the handlebar, the Lean Steer Frame pivots and the Segway PT turns right. Always lean left or right in coordination with the Lean Steer Frame.

- **Tire/Wheel Assembly and Fenders:**

- ✓ Tires and Wheels are shipped as an assembly. Do not remove the Tire from the Wheel.
- ✓ The Fenders on the Segway PT are designed to protect the rider from debris and to safeguard the rider while leaning into turns.

- **Mats:**



Fig.5

Cushioned by thick, industrial grade rubber that absorbs shocks and jolts, the comfort mat allows you to ride on and on without getting fatigued. Two mats create one set.

- **Powerbase:**

The Powerbase consists of the following parts:

- ✓ Console
- ✓ Rider Detect Sensors
- ✓ Controller Boards
- ✓ Motors
- ✓ Balance Sensor Assembly

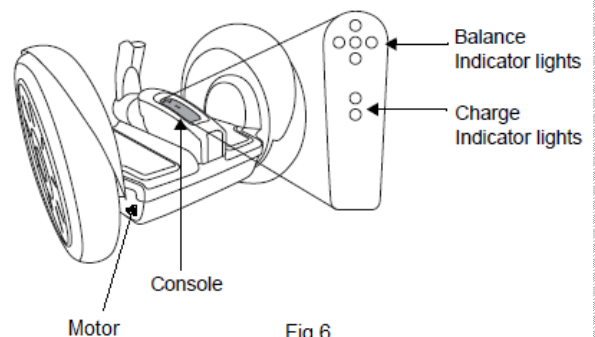


Fig.6

- **Batteries:**

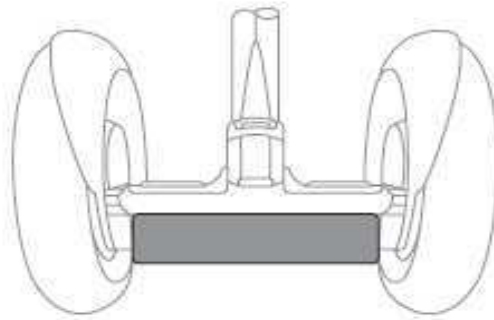


Fig.7 Location of Batteries

The two Batteries are sealed units that require no maintenance other than proper charging and storage. The Batteries are interchangeable and can each be installed in either the Front or rear of the Powerbase. For the Segway PT to operate, both Batteries must be installed, and both must be Li-ion Batteries. If one Battery fails or is depleted beyond its safe limit, the Segway PT will perform a Safety Shutdown.

BASIC OPERATION

- Primary Sensor System
 - Gyroscope Assembly
 - Tilt Sensors
- Control System
- Motor System

GYROSCOPE ASSEMBLY

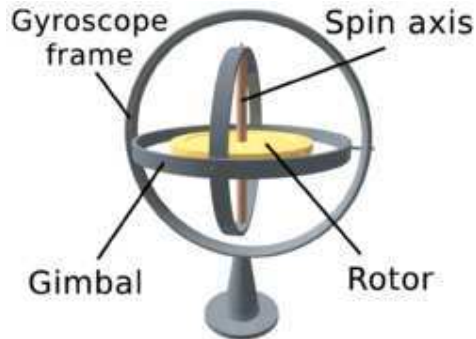


Fig.4

A Gyroscope is a device for measuring or maintaining orientation, based on the principles of angular momentum. In essence a mechanical gyroscope is a spinning wheel or disk whose axle is free to take any orientation. Although this orientation does not remain fixed, it changes in response to an external torque much less

and in a different direction than it would without the large angular momentum associated with the disk's high rate of spin and moment of inertia. Since external torque is minimized by mounting the device in gimbals, its orientation remains nearly fixed regardless of any motion of the platform on which it is mounted.

Segway's use special solid-state angular rate sensors constructed using silicon. This determines an object's rotation using the Coriolis Effect on a very small scale. These are called Solid State Silicon Gyroscopes.

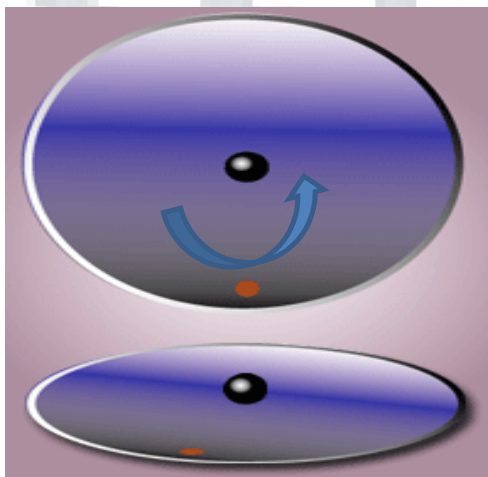


Fig.5

In physics, the Coriolis effect is a deflection of moving objects when they are viewed in a rotating reference frame. In a reference frame with clockwise rotation, the deflection is to the left of the motion of the object; in one with counter-clockwise rotation, the deflection is to the right.

TILT SENSORS

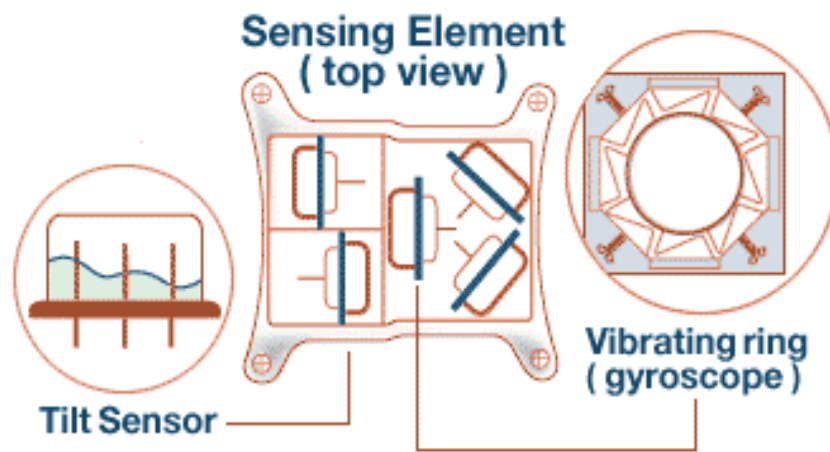
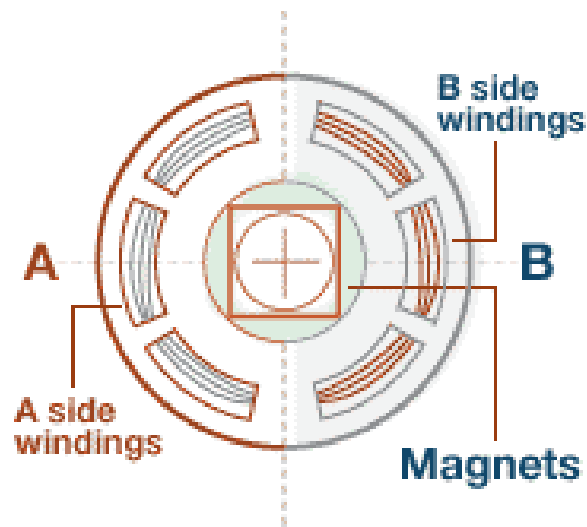


Fig.6

A tilt sensor can measure the tilting in often two axes of a reference plane in two axes. In contrast, a full motion would use at least three axes and often additional sensors. One way to measure tilt angle with reference to the earth's ground plane. The BSA, supplied by Silicon Sensing Systems, is an elegantly designed, extremely robust and incredibly sensitive piece of equipment. A small cube, 3 inches in diameter, is packed with five solid-state, vibrating-ring, angular-rate sensors ("gyroscopes") that use the Coriolis effect to measure rotation speed. These tiny rings are electromechanically vibrated in such a way that when they are rotated, a small force is generated that can be detected in the internal electronics of the sensor. Each "gyro" is placed at a unique angle that allows it to measure multiple directions. Segway's onboard computers constantly compare the data from all five gyros to determine if any of the five is supplying faulty data--in this condition, it can compensate and use data from the remaining sensors to continue balancing through a controlled safety shutdown. Two tilt sensors filled with an electrolyte fluid provide a gravity reference in the same way your inner ear does for your own sense of balance. The BSA is monitored by two independent microprocessors and is split into two independent halves for redundancy. Even the communication between sides is performed optically to avoid electrical faults on one side propagating to the other.

MOTOR



The motors use brushless servo technology, meaning there are no contacts to wear, arc, and reduce performance. The magnets are constructed of an incredibly powerful rare-earth material: neodymium-iron-boron. Each motor is constructed with two independent sets of windings, each driven by a separate board and motor. Under normal conditions, both sets of windings work in parallel, sharing the load. In the event of a failure, the motor is designed to instantly disable the faulty side and use the remaining winding to maintain control of the Segway HT until it can be brought to a stop. The motor is carefully balanced to operate up to 8,000 rpm, allowing it to produce very high power levels in a small package. Feedback from the motor back to the Segway HT is provided by redundant, noncontact analog hall sensors that sense the positions of magnets with no moving parts other than the motor shaft itself.

TYPES OF SEGWAYS

- ✓ Segway i2
- ✓ Segway commuter
- ✓ Segway i2 cargo
- ✓ Segway x2
- ✓ Segway x2 golf
- ✓ Segway x2 adventure

• SEGWAY i2

The Segway i2 is the base model Segway. Sleek and light, the i2 will keep you on the move and avoiding the congestion of traffic and the high prices of gas. The i2 includes a Wireless Info Key Controller, Siphon Lithium-ion batteries, Lean Steer frame height adjust.

i2 Specs

Weight	Tire Diameter	Footprint	Max Speed	Range
105 lbs	19in	19 x 25 in	12.5 mph	Up to 24 mi
47.7 kg	48cm	48 x 63 cm	20 kmh	Up to 38 km



- **Segway i2 Commuter:**

The i2 Commuter is an eco-friendly, convenient, easy-to-learn alternative to short-distance driving. The i2 Commuter is far less expensive to own than an automobile, saving thousands of dollars on fuel, insurance, maintenance, and parking. And recharging its Lithium-ion batteries costs about what you spend for your daily newspaper.



i2 Commuter Specs

Weight	Tire Diameter	Footprint	Max Speed	Range
105 lbs	19in	19 x 25 in	12.5 mph	Up to 24 mi
47.7 kg	48cm	48 x 63 cm	20 kmh	Up to 38 km

- **Segway i2 Cargo:**

- ✓ The i2 Cargo is based on the rugged and sleek design of the i2, but also includes high impact cargo frames and cases to ensure your gear stays safe and dry.
- ✓ The i2 Cargo includes all of the features of the i2 plus: Segway hard cases that are waterproof and lockable.
- ✓ Parking stand pivots down to offer support for quick and easy retrieval of items.



i2 Cargo Specs

Weight	Tire Diameter	Footprint	Max Speed	Range
105 lbs 47.7 kg	19in 48cm	19 x 25 in 48 x 63 cm	12.5 mph 20 kmh	Up to 24 mi Up to 38 km

- **Segway x2:**

The Segway X2 is designed for those that like to take the road less travelled. It's rugged and tough design will let you create your own path. Whether you are looking to travel on grass, gravel or dirt, the X2 can take you there. The X2 has plenty of ground clearance, a stable and smooth ride and the durability that Segway's are famous for.



x2 Specs

Weight	Tire Diameter	Footprint	Max Speed	Range
120 lbs	8 in	21x33in	12.5 mph	Up to 12 mi
54.4 kg	20 cm	53.34x83.82cm	20 kmh	19 km off-pavement

- **Segway x2 Adventure:**

- ✓ The Segway X2 Adventures takes you off road and allows you to experience the thrills of nature. Both casual and experienced riders will love the feel and handling of the X2 Adventurer.
- ✓ The specially equipped handlebar bag is great for storing tools & other equipment.
- ✓ The X2 Adventures also includes a 5W headlamp and universal cargo plates.



x2 Adventure Specs

Weight	Tire Diameter	Footprint	Max Speed	Range
120 lbs	8 in	21x33in	12.5 mph	Up to 12 mi
54.4 kg	20 cm	53.34x83.82cm	20 kmh	19 km off-pavement

- **x2 Golf**

- ✓ The x2 Golf is the effortless maneuverability on the golf course.
- ✓ Turf-friendly tires let you travel on the grass and off the cart path for a faster game, and increased height offers the best perspective on the greens. And with an easy-access bag carrier and scorecard holder included in the package, convenience is part for the course.



x2 Golf Specs

Weight	Tire Diameter	Footprint	Max Speed	Range
120 lbs	8 in	21x33in	12.5 mph	Up to 14 mi
54.4 kg	20 cm	53.34x83.82cm	20 kmh	22.52 km, up to 36 holes

APPLICATION OF SEGWAY

- **Security Applications**
 - ✓ Because of increased mobility, silent operation and portable nature, they're ideal for security patrol applications.
- **Commuting Applications**
 - ✓ Segway's provide a clean, fast and reliable alternative to traditional trucks, scooters and buses.
- **Corporate Applications**
 - ✓ Large multi-national companies are now making good use of Segway PTs in their campuses and workshops.

ENVIRONMENTAL BENEFITS

- The Segway PT has many benefits for you and the environment.
- It also reduces the impact of global warming by checking greenhouse gas output and fossil fuel consumption.
- If we are able to replace 10% of 900 million car travel to 3 mile with the Segway PT there would be:
 - ✓ 6.2 million fewer gallons of gas consumed.
 - ✓ 286 million fewer pounds of CO₂ emitted every day.

THE SEGWAY IN ACTION



Segway used by the Police



Segway used by pedestrians



Corporate Segway usage



Segway used by the Military

3.15 Conclusion:

After finishing my seminar report on “SEGWAY PT” I can say that the seminar is very important for engineering students like me. Learning knowledge is a very important in the every field. I also learn some experience about the balancing act in Segway.

REFERENCE

WWW.SEGWAY.COM

WWW.WIKIPEDIA.COM

WWW.STRICKLYSEGWAY.COM

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