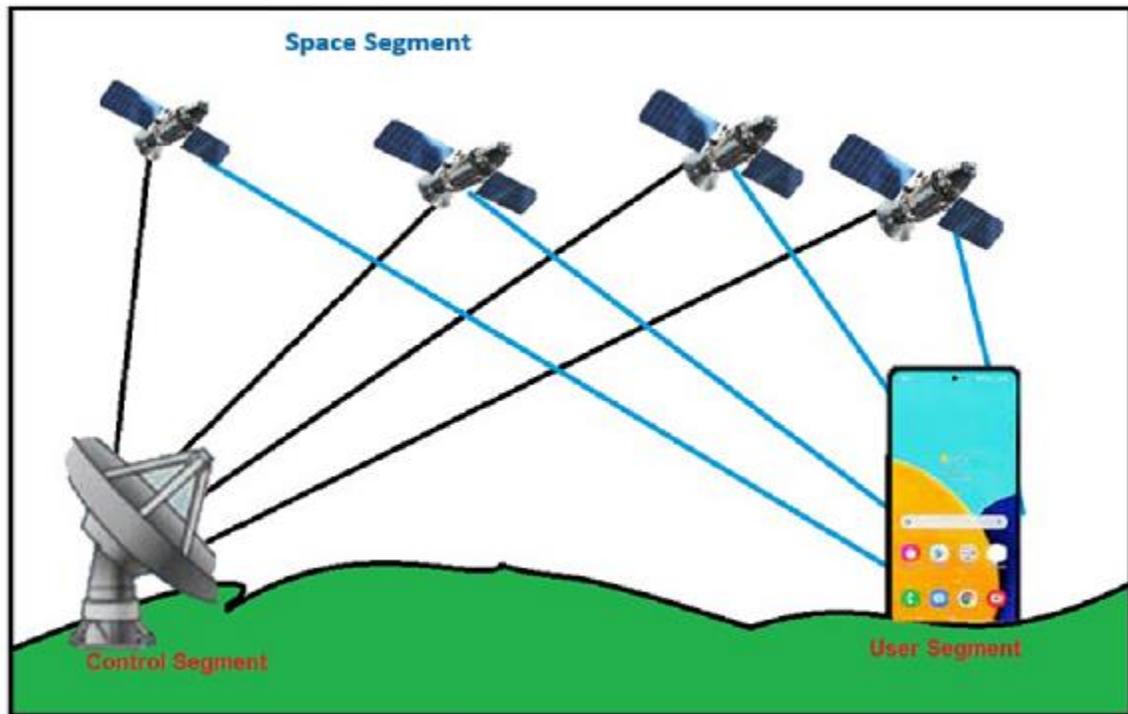


# Global Positioning System

**GPS** stands for **Global Positioning System**. GPS is a satellite-based navigation system that allows ground users to provide their exact location, velocity, and time 24 hours a day, in all weather conditions, all over the world. GPS developed by the U.S. Department of Défense. It was basically designed to assist soldiers and military

vehicles but after some years it's available to anyone having a GPS receiver. GPS is a common system that most of us are using to reach from one location to Another location.

The GPS systems are a Combination of a network of satellites that are constantly sending coded information in the form of radio signals. After that receiver received the signals and interprets the transmitted information from the satellites to locate the position on earth accurately. This satellite system is congestive of 29 satellites situated at almost 20,000 kilometers above the Earth's surface. The GPS satellites are located at 6 earth-centered orbital planes and travel at a speed of 14,000 km/hr. The GPS was first time used in combat during the Gulf wars.



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## Functionality of GPS:

The GPS device will first establish a connection with 3 to 4 satellites. After that GPS satellite broadcasts a message including the location of the receiver. If the GPS receiver receives a Group of messages from different satellites to calculate the exact position using the process called **triangulation**.

GPS satellites need an unobstructed line of sight for the broadcast. Hence, this technology is not only for indoor but also for use in a wide area. There some devices use nearby cell towers and open-source Wi-Fi signals. Then technology is called LPS (Local Positioning System) and is a substitute for GPS.

## Architecture of GPS:

GPS Architecture is basically divided into three segments.

1. **Space segment:** The GPS satellites fly in circular orbits at an altitude of 20000 km and with a period of 12 hours. It's powered by Solar cells. The GPS satellite Continuously orients themselves to point their solar panels toward the sun and their antenna. Towards the earth. Orbital planes are centered on the earth. Orbits are designed so that, at least, Six satellites are always within a line of sight from any location on the Planet. The GPS System Consist of 24 satellites (in present 32) Established in near-circular orbits arranged in 6 orbitals Placed at 55 Degree Inclination to the Equator at 20200 km height and 26600 km orbital Radius. The Period of Revolution is 12 Hours. So that at least 4 Satellites are available for observations at any time throughout the year anywhere in the World.
2. **Control Segment:** The second component of GPS is the Control segment. It's further divided into three sub-components.
  - **Master Control System**
  - **Monitor Station:** The monitor station checks the exact latitude, Position, Speed, and overall health of the orbiting satellites. The control segment ensures that the GPS and Clocks remain within acceptable limits. A station can track up to 11 satellites at a time. This "check-up" is performed twice a day, By each station.
  - **Ground Antennas:** The ground Antennas monitor and track the satellites from horizon to horizon. They also transmit correction information to individual satellites. Communication with the GPS satellites for command and control purposes.

3. **User Segment:** The Master Control Station is located at Falcon Air Force base in Colorado Springs. Responsible for the overall management of remote monitoring and transmission sites. Check-up is performed twice a day, by each of the 6 stations as satellites Complete their Journey around the earth. Master Control can reposition satellites to maintain an optimal GPS Constellation.

It also includes a display for showing location and speed information to the user. A receiver is often described by its number of channels ( this signifies how many satellites it can monitor simultaneously). As of recent, receivers usually have between twelve and twenty channels. There are five stations for satellites signal Receivers:

- Colorado (Main Station)
- Hawaii
- Ascension
- Diego Garcia
- Kwajalein
- Cape Canaveral

**GPS receiver basically consists of three components:**

- An Antenna ( tuned to the frequencies transmitted by the satellites).
- Receiver processor.
- Highly Stable Clock ( Commonly a Crystal oscillator).

**Usage of GPS:**

There are five most uses of the GPS.

- **Location:-** with the help of GPS we can find the exact position of the object.
- **Navigation:-** we can navigate one location to another with the help of GPS.GPS technology is also useful for Transportation Management and breathing of Ship at docks.
- **Tracking:** -with the help of GPS we can Monitor object movement like speed, distance, position.
- **Mapping:-** GPS also helps in creating maps of the World.
- **Timing:-** GPS also provides the estimated time for reaching destination measurement its depend on speed and object movement.

For Example, GPS technology is also useful for Monitoring Vehicles and Persons. Tracking is useful in the following services:

- Mass Tracking
- Ship Tracking
- Vehicle Tracking

GPS tracking is Mostly used by Police, Ambulance, Fire Department Service, and Mass delivery man. A GPS tracking device is a portable device. GPS device allows users to monitor and track the exact location of an object. These devices are most commonly used in Ambulance, train airplane tracking systems. While tracking devices are used in-car navigation systems, then GPS navigation systems show the drivers their location on a digital map and also provide driving instructions and direction for a destination.

Advanced feature GPS trackers use GPS technology to track a vehicle's current location and trip history. We can broadcast GPS data to a computer, smartphone, or tablet.