



INTRODUCTION

Global Positioning System, is a global navigation satellite system that provides location, velocity and time synchronization. It is a navigation system using satellites, a receiver and algorithms to synchronize location, velocity and time data for air, sea and land travel. The satellite system consists of a constellation of 24 satellites in six Earth-centered orbital planes, each with four satellites, orbiting at 13,000 miles (20,000 km) above Earth and traveling at a speed of 8,700 mph (14,000 km/h). While we only need three satellites to produce a location on earth's surface, a fourth satellite is often used to validate the information from the other three. The fourth satellite also moves us into the third-dimension and allows us to calculate the altitude of a device.

MAIN ELEMENTS OF GPS

GPS is made up of three different components, called segments, that work together to provide location information.

The three segments of GPS are:

- **Space (Satellites)** — The satellites circling the Earth, transmitting signals to users on geographical position and time of day.
- **Ground control** — The Control Segment is made up of Earth-based monitor stations, master control stations and ground antenna. Control activities include tracking and operating the satellites in space and monitoring transmissions. There are monitoring stations on almost every continent in the world, including North and South America, Africa, Europe, Asia and Australia.
- **User equipment** — GPS receivers and transmitters including items like watches, smartphones and telematic devices.

WORKING

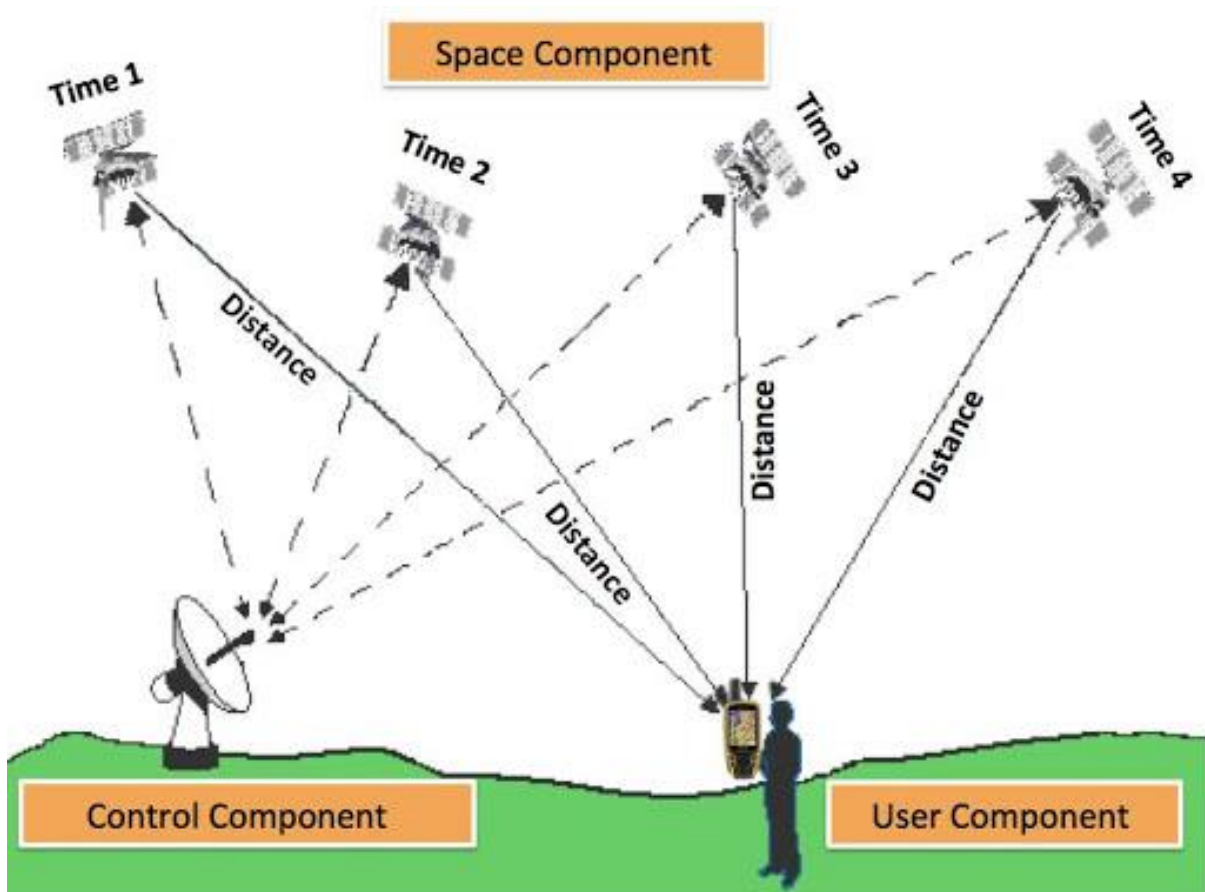
GPS works through a technique called trilateration. It is used to calculate location, velocity and elevation. Trilateration collects signals from satellites to output location information. Satellites orbiting the earth send signals to be read and interpreted by a GPS device, situated on or near the earth's surface. To calculate location, a GPS device must be able to read the signal from at least four satellites. Each satellite in the network circles the earth twice a day, and each satellite sends a unique signal, orbital parameters and time. At



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any given moment, a GPS device can read the signals from six or more satellites. A single satellite broadcasts a microwave signal which is picked up by a GPS device and used to calculate the distance from the GPS device to the satellite. Since a GPS device only gives information about the distance from a satellite, a single satellite cannot provide much location information. Satellites do not give off information about angles, so the location of a GPS device could be anywhere on a sphere's surface area. When a satellite sends a signal, it creates a circle with a radius measured from the GPS device to the satellite. When we add a second satellite, it creates a second circle, and the location is narrowed down to one of two points where the circles intersect. With a third satellite, the device's location can finally be determined, as the device is at the intersection of all three circles. That said, we live in a three-dimensional world, which means that each satellite produces a sphere, not a circle. The intersection of three spheres produces two points of intersection, so the point nearest Earth is chosen. As a device moves, the radius (distance to the satellite) changes. When the radius changes, new spheres are produced, giving us a new position. We can use that data, combined with the time from the satellite, to determine velocity, calculate the distance to our destination.





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USES OF GPS

- Location - Determining a position.
- Navigation - Getting from one location to another.
- Tracking - Monitoring object or personal movement.
- Mapping - Creating maps of the world.
- Timing - Making it possible to take precise time measurements.

ADVANTAGES OF GPS

- GPS satellite-based navigation system is an important tool for military, civil and commercial, users.
- Vehicle tracking systems GPS-based navigation systems can provide us with turn by turn directions.
- Very high speed.

DISADVANTAGES OF GPS

- GPS satellite signals are too weak when compared to phone signals, so it doesn't work as well indoors, underwater, under trees, etc.
- The highest accuracy requires line-of-sight from the receiver to the satellite, this is why GPS doesn't work very well in an urban environment.