

GPS stands for the **Global Positioning System**. It is a satellite-based navigation system owned by the U.S. government that provides accurate location, velocity, and time information to a GPS receiver anywhere on or near the Earth, in all weather conditions, and with no subscription fees.

## How GPS Works

The system is comprised of three segments that work in unison:

- **Space Segment:** A constellation of at least 24 operational satellites orbit the Earth, continuously broadcasting signals with their location and the exact time.
- **Control Segment:** Ground-based monitor stations and a master control station track the satellites, ensure their orbits are correct, and synchronize their onboard atomic clocks.
- **User Segment:** Devices like smartphones, car navigation systems, and dedicated GPS units contain receivers that listen for these signals.

A GPS receiver calculates its position through a process called **trilateration**. By measuring the time it takes for signals from multiple satellites to reach it, the receiver can determine its distance from each satellite. To determine a 2D position (latitude and longitude), a minimum of three satellites is required. For a precise 3D position (latitude, longitude, and altitude), signals from four or more satellites are needed.

## Common Uses

GPS has become an integral part of modern life with countless applications, including:

- **Navigation:** Providing turn-by-turn directions in cars, on phones, and for marine and aviation transport.
- **Tracking:** Monitoring the movement of vehicles, shipments, or people.
- **Mapping & Surveying:** Creating accurate maps and performing land surveys.
- **Emergency Services:** Aiding in emergency response and search and rescue operations.
- **Timing:** Providing precise time synchronization for critical infrastructure like banking and power grids.

# **Types of GPS**

## **1. A-GPS**

Assisted GPS (A-GPS) is a type of GPS that allows receivers to get information from local network sources, which helps in the location of satellites. Assisted GPS is usually used in areas where satellite signals cannot easily reach, probably due to trees or tall buildings. However, there must be cellular networks for A-GPS to work.

## **2. S-GPS**

Simultaneous GPS (S-GPS) is a modification of GPS that allows both voice data and GPS signaling to be transmitted from a phone simultaneously. Both data types are sent simultaneously rather than alternating the SPS signal and the reception for the telephone call, and there is better sensitivity. This is particularly useful in emergencies to allow service providers such as ambulances, fire stations, etc., to locate the source of a call even as the call is ongoing.

## **3. D-GPS**

Differential GPS (D-GPS) is a correction technique used to increase the accuracy of location data obtained from a traditional GPS receiver. D-GPS is an enhancement to GPS, providing a better sense of the actual location of an object or person.