# Global Positioning System

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***Abstract* :- GPS (Global Positioning System) is the only system today able to show ones own position on the earth any time in any weather, anywhere. This paper addresses this satellite based navigation system at length. The different segments of GPS viz. space segment, control segment, user segment are discussed. In addition, how this amazing system GPS works, is clearly described. The various errors that degrade the performance of GPS are also included. DIFFERENTIAL GPS, which is used to improve the accuracy of measurements, is also studied. The need, working and implementation of DGPS are discussed at length. Finally, the paper ends with advanced application of GPS.**

***Keywords – Introduction, Advantage & Limitation Of Gps; Segment Of GPS; Need For Study,Working Of GPS;***

## I. INTRODUCTION

The Global Positioning System (GPS) is a satellite-based navigation system that consists of 24 orbiting satellites, each of which makes two circuits around the Earth every 24 hours. These satellites transmit three bits of information – the satellite's number, its position in space, and the time the information is sent. These signals are picked up by the GPS receiver, which uses this information to calculate the distance between it and the GPS satellites.

With signals from three or more satellites, a GPS receiver can triangulate its location on the ground (i.e., longitude and latitude) from the known position of the satellites. With four or more satellites, a GPS receiver can determine a 3D position (i.e., latitude, longitude, and elevation). In addition, a GPS receiver can provide data on your speed and direction of travel. Anyone with a GPS receiver can access the system. Because GPS provides real-time, three-dimensional positioning, navigation, and timing 24 hours a day, 7 days a week, all over the world, it is used in numerous applications, including GIS data collection, surveying, and mapping.

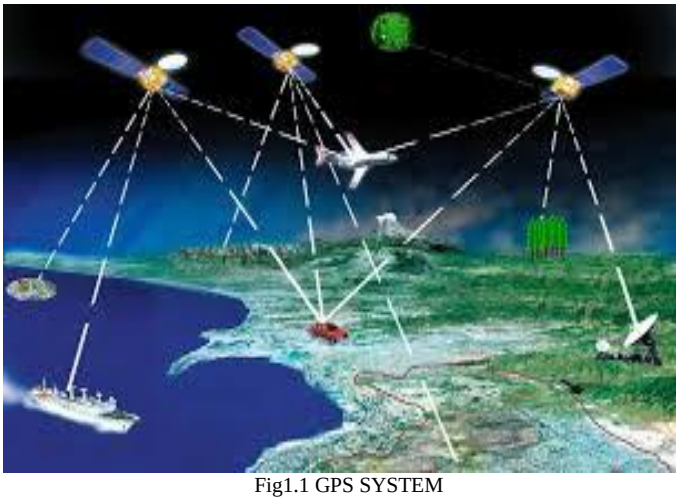

Fig1.1 GPS SYSTEM

## II.SEGMENT OF GPS

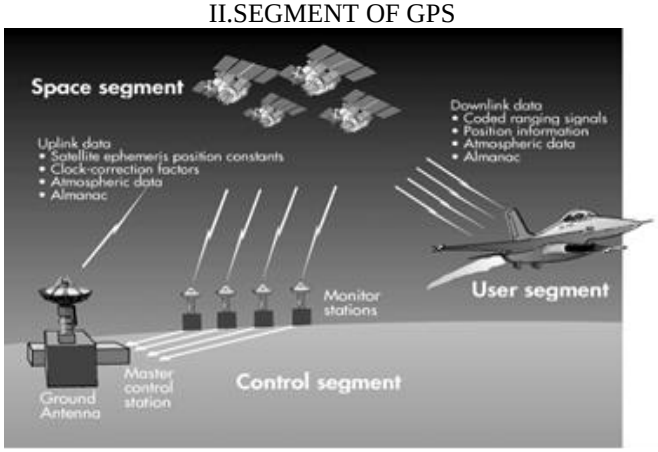


Fig1.2 GPS SEGMENTS

THREE TYPES OF GPS SEGMENTS:

- *THE SPACE SEGMENT:*

The space segment consists of 24 satellites circling the earth at 12,000 miles in altitude. This high altitude allows the signals to cover a greater area. The satellites are arranged in their orbits so a GPS receiver on earth can always receive a signal from at least four satellites at any given time. Each satellite transmits low radio signals with a unique code on different frequencies, allowing the GPS receiver to identify the signals. The main purpose of these coded signals is to allow for calculating travel time from the satellite to the GPS receiver. The travel time multiplied by the speed of light equals the distance from the satellite to the GPS receiver. Since these are low power signals and won't travel through solid objects, it is important to have a clear view of the sky.

- *THE CONTROL SEGMENT:-*

The control segment tracks the satellites and then provides them with corrected orbital and time information. The control segment consists of four unmanned control stations and one master control station. The four unmanned stations receive data from the satellites and then send that information to the master control station where it is corrected and sent back to the GPS satellites.

- *THE USER SEGMENT:-*

The user segment consists of the users and their GPS receivers. The number of simultaneous users is limitless.

## III.WORKING OF GPS

The principle behind GPS is the measurement of distance (or "range") between the receiver and the satellites. The satellites also tell us exactly where they are in their orbits above the Earth. Four satellites are required to compute the four dimensions of X, Y, Z (position) and Time. GPS receivers are used for navigation, positioning, time dissemination, and other research.

One trip around the Earth in space equals one orbit. The GPS satellites each take 12 hours to orbit the Earth. Each satellite is equipped with an accurate clock to let it broadcast signals coupled with a precise time message. The ground unit receives the satellite signal, which travels at the speed of light. Even at this speed, the signal takes a measurable amount of time to reach the receiver.

The difference of time between signal is sent and received is multiplied with speed of light which gives distance of satellite. to get accurate latitude,longitude and altitude, receiver checks total time signals took to reach receiver

*DIRECTIONS:*
The device using GPS gets location and maps of whole world. Smartphone and tablets give precise location and step by step directions from source to destination.

*AVOIDING TRAFFIC:-*
The GPS devices get real time updates, this helps to know about traffic and get to destination faster with alternative routes.
Sometimes it also shows the flow of the traffic which helps to know whether this route will be perfect or not in traffic.
The frequently updated traffic information is produced by both TomTom and Garmin models.

*CONSTRUCTION AND DEVELOPMENT:-*
Land survey is necessity before we begin construction and development. This process is very time consuming and also it is very costly because it requires lot of human resources. So to get precise results GPS has replaced traditional land survey system with federal administration so it could give accurate results.

## V. LIMITATIONS OF GPS

*MULTIPATH:-*
In any type of weather during anytime in day 24*7, GPS can provide 3-D positions in all over the world.But as like other things in world GPS also has some limitations. There should be clear "line of sight" between all satellites and the GPS antenna. It becomes difficult to get real time positions as there comes many obstacles between antennas and satellites such as buildings,overpasses and etc, due to this the antennas get weak signals from the satellites.we find such problems more into urban areas. This causes problem called multi-path as it may happen that antenna may get poor signals or signal may not reach till antennas.

*IONOSPHERE:-*

Before any signal reaches to earth it has to pass through many spheres on earth. The GPS signals also passes through many spheres among them one is ionosphere. Ionosphere has many charged particles, this particles have ability to change the speed of signals.

## VI. NEED FOR THE STUDY

GPS is a modern day technology. The importance of GPS in our daily life is undeniable. This is due to the fact that in today dynamic world, the GPS applications are increasing rapidly. It is mainly created to solve mankind's problem by making the tasks easy to execute.The application has increased into many fields today which are important to mankind like fields of Communication,Crime, Health and transportation which are part of daily life routine. Also it has entered into field of resource management things are becoming easy than before hence it will be important to see how it can contribute into the field of research and development.

## VII. CONCLUSION

Like the Internet, GPS is an essential element of the global information infrastructure and revolutionary technology that changing and operate in the various field of development. The free, open, and dependable nature of GPS has led to the development of hundreds of applications affecting every aspect of modern life. GPS technology is now in everything from cell phones and wristwatches to bulldozers, shipping containers, and ATM's. The technology of the Global Positioning System is allowing for huge changes in society. The applications using GPS are constantly growing. The cost of the receivers is dropping while at the same time the accuracy of the system is improving. This affects everyone with things such as faster Internet speed and safer plane landings. Even though the system was originally developed for military purposes, civil sales now exceed military sales (See Figure 1 below).

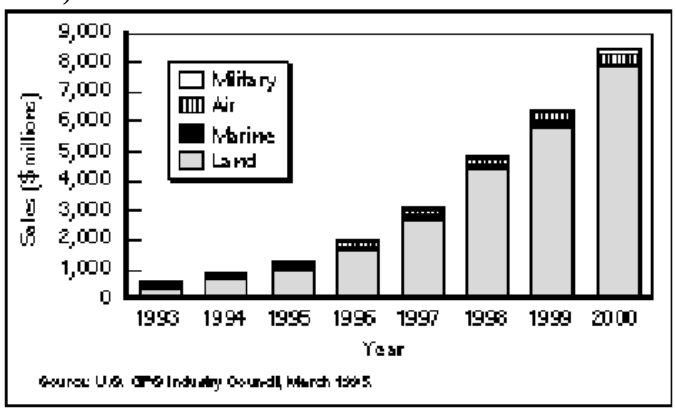


Fig1.4 SALES IN US IN MILLIONS $

On May 1, 2000 President Clinton announced that the government will no longer scramble signals from the GPS satellites. This means that civilians will be able to enjoy the

high accuracy that the military has had for years. The DGPS techniques and the equipment needed to use them will no longer be necessary to get the same effects on accuracy. The affects on society will be more reliable and accurate measurements

less costly to corporations - since the error removing equipment will no longer be needed more affordable and accessible to consumers greater incentive for the development of new uses The accuracy should increase ten-fold, from 100 meter to 10 meter accuracy. The $8 billion dollar a year GPS industry should also see a much larger than expected increase in sales.

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