Journal of Advanced Research in Geo Sciences & Remote Sensing
Volume 7, Issue 3&4 - 2020, Pg. No. 1-3
Peer Reviewed Journal

Article

Advancements in Global Positioning System Technology

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How to cite this article:
Choudhary AR, Chaudhary N, Sharma MK. Advancements in Global Positioning System Technology. *J Adv Res Geo Sci Rem Sens* 2020; 7(3&4): 1-3.

Date of Submission: 2020-08-08
Date of Acceptance: 2020-09-16

A B S T R A C T

The Global Positioning System which is also known as NAVSTAR GPS. It is a satellite dependent radio navigation system which is controlled by U.S government and operated by U.S space force. Major work of this Global Navigation Satellite System (GNSS) is to give the information about geolocation and time information to any operator on earth or in range of the line sight of four or more GPS satellites. The obstacles such as mountains and buildings block the radio signals from satellite.

Keywords: History, Enhancement, Basic Concept, Applications

Introduction

In earlier days to check the location of nearby areas we have to earlier check the direction of sun and in night time we tracked stars and moon.

That was too difficult for a common man to read all these directions so as the technology progressed the systems of radio detection were used. Thereafter in late 19th century the development of GPS was a milestone that was a game changer step in this direction. The GPS was earlier used by only the US defence forces but later in the year 2000 it was opened to civilian usage but with certain limitations.

Today we all use GPS in our pockets that are our cellular phones so now it is in reach of everyone and anywhere on planet. The GPS trackers are available easily in market and are now cheaper than the one available about ten years from now.

History

The GPS project was started by US department of defence in year 1973, they launched their prototype satellite in year 1978 and by the year 1993 they made the constellations of 24 satellites. Originally only the US military was allowed to use this technology but later in 1990s the use for civilian was also encouraged.

With the advances in technology this led to the various changes and can say improvement in the field of GPS technology.

The modernisation of GPS was initiated by the year 1998 and the orders were passed by US president from White House.

Indian military was denied to access the GPS service by US government during the fierce war of Kargil in year 1999. Due to this several other countries like China, Russia, and European countries are processing to set up their navigation

systems. Here are few of GPS like system developed by various countries:

- Russia -GLONASS
- China -Baidoo Navigation Satellite System
- European Union- Galileo Positioning System
- India- NAVIC

Enhancement of GPS Technology

- In year 1972 the U.S Air force conducted a test using four prototype satellites in the Y configuration at the white sands range.
- The first experimental Block-I GPS was launched in 1978.
- After the success of this project they made launch of ten more such satellites.
- The Gulf war of years 1990 and 1991 was the first time where military used the GPS technology at a wider range.
- The older GPS receivers were of 16 kg and that were later replaced by the 1.25 kg receivers in year 1991.
- The full satellite constellation of about W4 satellites was developed till the year 1993 and it provided the standard positioning service.

Basic Concept of Global Positioning System

- The concept perceived by the GPS technology is nothing but the set of very stable atomic clocks that are synchronised with one another and with ground clocks.
- If there is any deviation from the time then the time on ground is corrected daily. In the same manner the locations of satellites are tracked by great precision. The GPS receivers also consist of clocks but they are not so precise and stable.
- The data containing current time and location is transmitted by satellite in form of Radio wave signals.
- As we know that the speed of radio wave is constant and independent of speed of satellite so there will be surely the time delay between satellite and ground and those us directly proportional to the distance between satellite and the planet.
- The multiple satellites are monitored by the GPS monitors and respectively the solutions of equations to get the accurate position and time. For the equation at least four satellites are to be monitored.

Applications of the GPS

There are two kinds of uses of GPS like:

- Civilian usage
- Civilian restricted usage

Civilian usage

The civilian uses consists the applications we perform independently and under law freely. These activities include:

- Astronomical uses by getting accurate location of positions and time
- Modern vehicles consists this for safe and quick navigation
- It is often used for cellular tracking and determination of electronic devices
- Many emergency services also depend on GPS for the positions and accurate timings
- The GPS is also very important for the climate forecasting and other atmospheric quantities
- It is also used in robotics as self-navigating and auto calculation of time, speed and latitudinal and longitudinal coordinates
- It is further also used for daily navigation, sports and mines etc.

Civilian Restricted usage

All the GPS receivers that function above 18 km of sea level and 1000 mph or are designed to modify the weapon systems and military based missiles and other defence applications.

- Target tracking: Various military weapons systems use GPS to track potential ground and air targets before Navigation: Soldiers use GPS to find objectives, even in the dark or in unfamiliar territory, and to coordinate troop and supply movement. In the United States armed forces, commanders use the Commander's Digital Assistant and lower ranks use the Soldier Digital Assistant.
- Target tracking: Various military weapons systems use GPS to track potential ground and air targets before flagging them as hostile.[citation needed] These weapon systems pass target coordinates to precision-guided munitions to allow them to engage targets accurately. Military aircraft, particularly in air-to-ground roles, use GPS to find targets.
- Missile and projectile guidance: GPS allows accurate targeting of various military weapons including ICBMs, cruise missiles, precision-guided munitions and artillery shells. Embedded GPS receivers able to withstand accelerations of 12,000 g or about 118 km/s^2 (260,000 mph/s) have been developed for use in 155-millimeter howitzer shells.
- Search and rescue.
- Reconnaissance: Patrol movement can be managed more closely.
- GPS satellites carry a set of nuclear detonation detectors consisting of an optical sensor called a bhang meter, an X-ray sensor, a dosimeter, and an electromagnetic pulse (EMP) sensor (W-sensor), that form a major portion of the United States Nuclear Detonation Detection System. General William Shelton has stated that future

satellites may drop this feature to save money. Electro-magnetic Pulse (EMP) sensor (W-sensor), that form a major portion of the United States Nuclear Detonation Detection System. General William Shelton has stated that future satellites may drop this feature to save money.

Conclusion

The GPS technology is very crucial in the modern times due to the feature of easiness in the navigation field as well as easy access to the remote areas.

The GPS technology has the limited usage available for the civilians and that is under the range of 15 km and above this range is taken over by the military and defence departments.

The GPS technology has modernised after the availability made by private sector and introduced new gadgets.

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