

Global Positioning System (GPS)

GPS and its Functionality

Global Positioning System (GPS) innovated by the US Department of Defence is a system for navigation that allows one to roam easily, find locations and predict destination routes while travelling. A GPS system can be used to track location of a person and find routes to desired destinations. Many organizations use GPS based applications for different purposes. It is a network of 24 satellites orbiting the Earth at all times called Navstar and is operated by the US DoD. It revolves with a period of 12 hours (two orbits per day) at a height of about 11,500 miles traveling at 9,000mph (3.9km/s or 14,000kph).

Earth based Receivers are used to track each satellite's orbit. These satellites mutually send their location and current time details through repeated signals to receivers who use them to predict location. (PocketGPSWorld, 2013)

The position of a receiver in three dimensions can be determined when it calculates the distance to at least four GPS satellites by calculating the time taken for each signal to arrive. Because GPS operations depend on accurate signal timing therefore atomic clocks are used by satellites for timing signals as. It sends each signal as a random sequence which the receiver is aware of. This pseudo-random code or incoming signal is then compared with the receiver's own internal signal and the difference or lag in satellite signal is calculated which is used to determine travel time.



Fig 1: GPS Satellite (PocketGPSWorld, 2013)

Accuracy and Limitations of the GPS system

The accuracy of GPS systems depend on the type and location of receiver. Receivers are earth based and hence require unobstructed and clear view of the satellite.

Accuracy also depends on satellite's number and placement structure. The accuracy of most Civilian GPS Systems is around 60 to 225 feet accuracy. A technique known as Differential GPS (DGPS) is used in civilian systems to improve accuracy. It requires installation of an additional stationary receiver at a known place where data sent by satellites can be analyzed to determine precise location information up to 1m accuracy.

If triangulation is good it will result in more accurate distance measurements and precise location because if satellites are spread out in all directions with regards to a specific receiver location accurate signals will be received and correct distance calculated . Sometimes the received signal bounces off a building or reflects off an object before reaching the receiver which affects GPS accuracy. This phenomenon is called Multipath and leads to inaccurate position determination. Signal delays due to slow signal transmission in bad weather known as propagation delay and clock errors in satellites are other factors that also lead to wrong distance estimation by the receiver.

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Fig 2: Sources of GPS Signal Error (PocketGPSWorld, 2013)

Different types of GPS Applications

There are a lot of applications that use GPS Navigation System for Mapping and determining route path where the software provides directions for destination for the user. This is made possible through the use of a vector-based map for vehicles. Another type of GPS application provides Navigation tracking features with MAP image in the background. This map image shows the user location where the user has been and also enables "routes" to be preprogrammed, provide the user with a path line that he/she can take to reach their destination. Geotagging and Geocaching features are also available with this type of application where users can dynamically update locations and mark pointers along the routes for future direction determination by other users.

Google Maps is a good example of a GPS application that is platform independent and provides navigation features through a MAP that is downloaded from a remote server. Navit is also another cross platform open sourced application that uses GPS technology and is a navigation aide which can be implemented independently on a standalone system in organizations.

Recommended GPS Application

AOU can use Google Maps as a GPS application as it is a very popular application. It allows navigation tracking and mapping facilities not only on computers but also provides dynamic updating of location information through handheld devices. Google Maps can be implemented by the AOU as it will not only allow updating of current student location but navigation information of important university places as well. Portable devices like PDA's and Mobile phones also use Google Maps for dynamic updating of student location and can be used for various educational purposes apart from navigation tracking.

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