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GPS and ITS Applications in Surveying

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Abstract:

One of the history's for the most part exciting and revolutionary developments and new uses for it are frequently being revealed is the Global Positioning structure, popularly known as GPS. The position of any object accurately on earth, any time, in any weather and anywhere will be shown by GPS. Space segment, control segment and user segment are the three parts the Global Positioning structure consists of Including the alternate of ageing satellites, the cost of maintaining the organization is just about US$ 400 million per year. Anyone with GPS beneficiary can identify transmitted signals from The GPS satellites, 24 in all, and 11000 nautical miles above the earth. We can be able to determine the location of the object with great precision usually of about several centimetres with the help of advanced technology using the receiver.

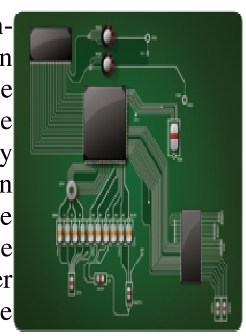
Keywords — **GPS, Survey, Its Apps.**

INTRODUCTION

Global navigation has demanded for the growth of GPS. So, GPS is frequently being used for navigation. As a part of this, it is being used in hydro graphic survey. For safe navigation, enough depth of water is essential in any port. To find out the depth accessible in the Port area, hydro graphic surveys are necessary to be conducted. The Global Positioning structure has many other applications. These days GPS is finding its way into cars, boats, planes, construction equipment, movie making , farm machinery, even laptop computers . GPS is used to resolve the routes for planes, ships, etc. GPS has lots of uses in both military and civilian life. Soon GPS will become exactly as basic as the telephone, may be a universal utility structure. GPS is an intermediate circular orbit (ICO) satellite navigation structure used for influential one's precise location and providing a greatly exact time reference almost anywhere on Earth and in Earth orbit. The GPS was considered by and is controlled by the United States Department of Defence. About three crore people approximately the world are using GPS. The utilization of this structure is increasing year by year due to increase in number of users of cell phones and vehicles. The availability of this method for utilization by all for free is leading to the expectations developments of this system.

Inside a Navigation Device

From the external a navigation device looks like nobody more than a sleek digital device, with a touch screen, though, within the shell is a host of current electronics that allows it to pick up signals from satellites orbiting thousands of miles above the earth and to calculate your precise location and speed on the planet.



Each constituent inside a direction-finding device has a specific reason and each is necessary to the execution of the device. The rechargeable lithium-ion battery provides the power for the screen and the external electronics. There are also circuits to control the present and to respond to user interface via the touch-sensitive exhibit and buttons. There are circuits too that direct the information, map and route displayed as well as to construct spoken information and camera alerts in some models. Some Navigation devices, such as the Mio Moov 580 even have Bluetooth capability.

In order to carry out its main job of locking on to the global positioning system (GPS), a direction-finding device has an aerial inside. This receives the microwave signals from the satellites in the GPS gathering. These signals are then improved and fed to the included circuits that analyze the signals and calculate your point. The circuitry uses a structure known as trilateration, which is the 3D corresponding of trilateration on a map. The trilateration method depends on the GPS machine being able to conclude the expanse to the satellites by timing the signals using its inbuilt clock. The clock itself is an electronic circuit known as an oscillator.

GPS APPLICATION

The applications of the Global Positioning System fall into five category: location, navigation, timing, mapping, and tracking. Each category contains uses for the military, industry, transportation, recreation and science.
position
This category is for location determination and is the largest part noticeable use of the Global Positioning System. GPS is the first method that can give perfect and precise capacity anytime, anywhere and under any weather situation. Some examples of applications within this category are:

1. Measuring the association of volcanoes and glaciers.
2. Measuring the expansion of mountains.
3. Measuring the location of icebergs - this is very expensive to ship captains helping them to avoid feasible disasters.
4. Storing the position of where you were - the largest part GPS receivers on the market will allow you to record a confident position. This allows you to find it again with minimal exertion and would prove constructive in a hard to pilot place such as a dense reforest.

Navigation
Navigation is the method of getting from one position to another. This was what the Global Positioning System was planned for. The GPS system allows us to find the way on water, air, or land. It allows planes to earth in the central point of mountains and helps medical emigration helicopters save precious time by pleasing the best direction.

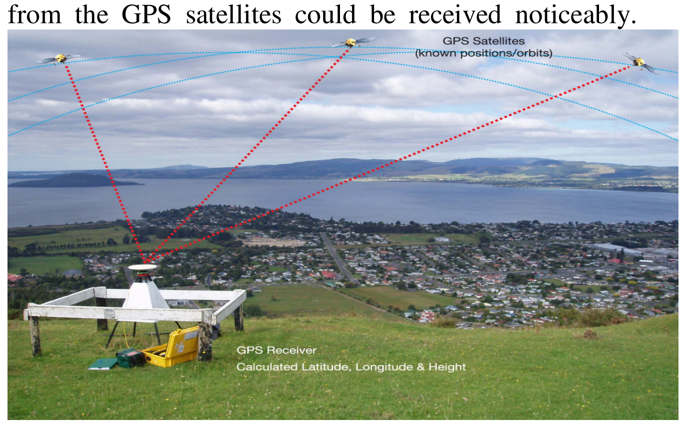
Timing
GPS brings precise timing to the us all. Each satellite is prepared with an particularly precise atomic clock. This is why we can all match our watches so well and make sure international events are in reality happening at the same time.

Mapping
This is used for creating maps by recording a series of locations. The best example is surveying where the DGPS method is applied but with a twist. Instead of making mistake correction in real time, both the stationary and moving receivers calculate their positions using the satellite signals. When the roaming receiver is through making capacity, it then takes them back to the land station which has already calculated the errors for each moment in time. At this time, the accurate measurements are obtained.

Tracking
The applications in this category are ways of monitoring people and things such as packages. This has been used along with wireless communications to keep track of some criminals. The suspect agrees to keep a GPS receiver and transmit device with him at all times. If he goes where he's not permitted to, the system will be notified. This can also be used to track animals.

SURVEYING WITH GPS

Initially developed for military use, GPS is now element of everyday life; used in mobile phones, in-car direction-finding and search and rescue tools to mention just a few. But there is a wide multiplicity of tools and techniques that can be used for surveying.
GPS was rapidly adapted for surveying, as it can give a location (Latitude, Longitude and Height) straight, without the need to measure angles and distances between intermediate points. Survey control could now be established almost anywhere and it was only necessary to have a clear view of the sky so the signal from the GPS satellites could be received noticeably.

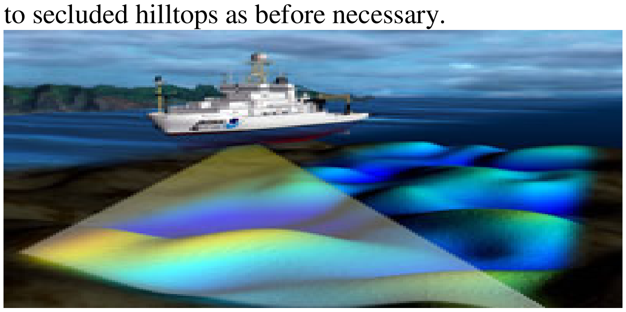


GPS is similar in several ways to the Trilateration and EDM before discussed, except that the known positions are now the GPS satellites (and their orbits) 20,000 km in space. The tools and calculations are particularly complex, but for the user the process is usually very simple.

In the frequently available receivers, the GPS receiver almost right away works out its location (Latitude, Longitude and Height) with an uncertainty of a few metres, from the data broadcast by the satellites. This data includes a report of the satellites varying location (its orbit) and the time the data was transmitted.

Geodetic GPS Receivers

Unlike square techniques, GPS surveying is not bound by constraints such as line-of-sight visibility between survey stations. The stations can be deployed at larger distances from each other and can operate anywhere with a good view of the sky, rather than person confined to secluded hilltops as before necessary.



GPS is particularly functional in surveying coasts and waterways, where there are few land-based situation points. Survey vessels combine GPS position with sonar depth investigation to make the nautical charts that alert mariners to altering water depths and underwater hazards. Bridge builders and offshore oil rigs also depend on GPS for exact hydro graphic surveys.

Land surveyors and mappers can carry GPS systems in backpacks or grow them on vehicles to allow speedy, accurate data group. Some of these systems be in touch wirelessly with reference receivers to deliver continuous, real-time, centimetre-level accuracy and extraordinary productivity gains.

To achieve the highest level of accuracy, most survey-grade receivers use two GPS radio frequencies: L1 and L2. presently, there is no fully functional civilian signal at L2, so these receivers leverage a military L2 signal using "codeless" techniques.

The ongoing GPS modernization plan is count a dedicated civil signal at L2 that supports high-accuracy positioning without the use of military signals. The GPS program is also count a third civil signal at the L5 frequency that will enhance performance even further. After 2020, the government will no longer carry codeless access to military GPS signals.

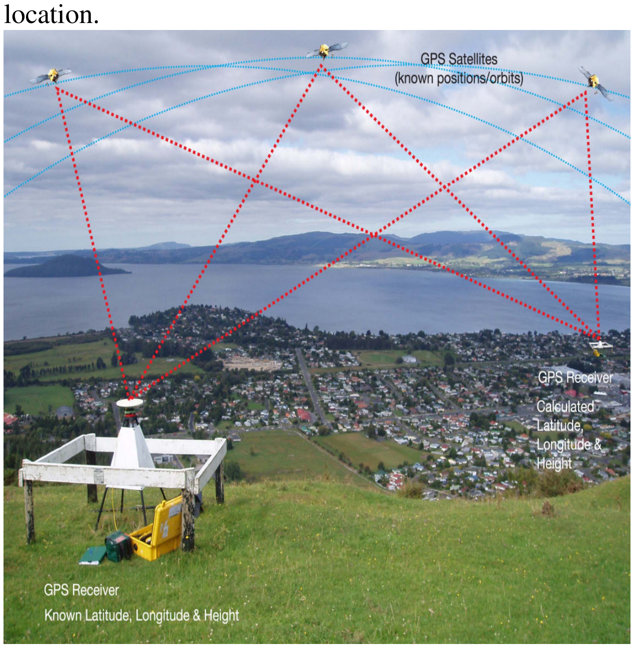
GPS Baseline

The GPS receivers used for surveying are commonly more complex and exclusive than those used in everyday life. They use the two frequencies broadcast by the GPS satellites and they use the physical characteristic of the GPS signal (the phase) and sophisticated estimate methods to really improve the exactness of the positions obtained. These receivers usually have a detach premium antenna.

A GPS baseline uses two survey-quality GPS receivers one at each end of the line to be measured. They assemble data from the equal GPS satellites at the same time. The duration of these simultaneous observations varies with the length of the line and the exactness needed, but is typically an hour or more. When the data from both points is later combined, the distinction in location (Latitude, Longitude and Height) between the two points is planned with special software. Many of the reservations of GPS position are minimized in these calculations because the difference between the explanations at each end of the baseline is used.

The precision obtained from this system depends on the length of the annotations, but is typically about 1 part per million (1 millimetre per kilometre) so a variation in location can be measured over 30 kilometres with an uncertainty of about 30 mm, or about 100 mm over a 100 kilometres. Because the GPS satellites are in a very high orbit (20,000 km) the ends of the GPS baseline can be hundreds, or even thousands of kilometres apart and still observe the equal satellites.

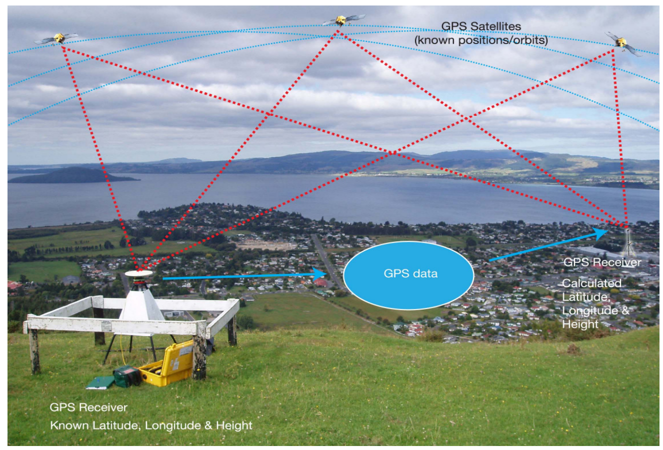
Although a single baseline from a known location is enough to give the location at the other end of the baseline, extra GPS baselines to other points are often measured to give a check on the results and a an approximation of the indecision of the calculated location.



GPS Baseline Measurement

Kinematic GPS

There are a lot of variations on this type of GPS surveying, but basically it is similar to the GPS baseline method, except that while one GPS receiver remains on a known position (Base Station), the other moves between point and it only need to be at every point for a few seconds. correction to the GPS data (based on the known Base Station position and its position computed from the GPS) may be immediately transmitted beginning the receiver on the Base position to the receiver at the other end of the line (the remote station). The location of the secluded location can then be computed and stored, all within a few seconds. Radios or mobile phones can be used to transmit the corrections. Although this system can give similar exactness to the baseline system before described, to do so this method is usually limited to a distance of about 20 kilometres.



GPS Real-Time Baseline Measurements

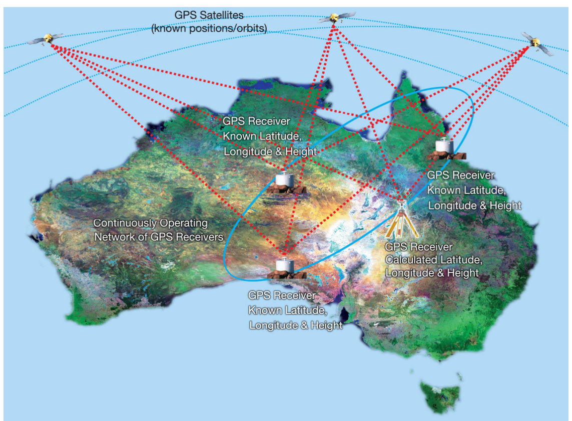
Continuously Operating Reference Stations (CORS)

A survey-quality GPS receiver may be eternally installed in a convenient position with a known location, to be used as the starting position for any GPS measurements in the district. This could be for a project such as a mine site or major engineering project, or in a town for local government use.

One or several survey excellence GPS receivers can then be used to concurrently collect GPS data at any necessary points and the data later combined with the GPS data obtained from the Continuously Operating Reference Station (CORS) to calculate the positions. If there are more than one CORS available, the unknown location can be calculated with esteem to these multiple known position, giving more confidence in the results. The period of the comments depends on the expanse from the CORS, but typically it is an hour or two.

Many countries have a CORS set of connections which covers the entire nation, allowing accurate GPS positioning anywhere in their country. CORS usually

also throw in data to global observations that make the GPS method more reliable and accurate. They also present data for technical studies such as plate tectonics and meteorology. To be useful for the learning of tectonics, the permanent marks used for the CORS stations must be geologically stable, and the observations should be constant and for a lot of years.
Australia's national CORS network, the Australian Regional GPS Network (ARGN) may be used with the on-line processing system AUSPOS that allows GPS data from a survey excellence GPS receiver to be submitted via the Internet and have the planned position emailed back, classically in a few hours. The calculations used to construct these positions use more accurate satellite orbits and within about 24 hours of observation can give a location anywhere in Australia with an uncertainty of a few centimetres.



A GPS CORS network

Heights from GPS

Because it is a three-dimensional method, GPS repeatedly gives height as well as Latitude and Longitude. But the height is above the theoretical surface of the Earth used for the calculations, known as the ellipsoid (so the height is called an ellipsoidal height) not above Mean Sea Level. The variation between an ellipsoidal height and a MSL height can be large (up to 100 metres) and irregular because of the unstable density of the earth. Fortunately it is well understood and the variation is usually applied by most GPS software. To do this, the distinction between the ellipsoid and a surface of equal severity, known as the Geoid is used.
Although the Australian Height Datum, Mean Sea stage and the Geoid may be considered the equal for mainly practical purposes, the differences are taken into account for the mainly accurate applications.

Adjustment of Surveying Measurements for Heights

Most of the surveying method described bring into being more than the least number of observations needed to calculate positions or heights. So it is possible for a location or height to be planned by a number of paths through the network of observations and get faintly different results because of the uncertainties in the survey comments. To resolve this, all details are usually combined into a mathematical process which produces the best location for each point along with an estimate of the uncertainty. This process is known as a slightest Squares adjustment.

GPS accuracy and error sources

The Global Positioning System (GPS) can present your position, altitude, and speed with near-pinpoint accuracy, but the method has intrinsic mistake sources that have to be taken into account when a receiver reads the GPS signals from the constellation of satellites in orbit.
The main GPS mistake source is due to inaccurate time-keeping by the receiver's clock. Microwave radio signals travelling at the speed of light from at least three satellites are used by the receiver's built-in computer to calculate its location, altitude and velocity.

Tiny discrepancies between the GPS receiver's onboard clock and GPS time, which synchronizes the whole global position method, mean distances calculated can drift. There are two solution to this problem. The first would be to use an infinitesimal clock in each recipient costing $100,000. The second is to use some clever statistical trickery to account for the time-keeping mistake based on how the signals from three or more satellite signals are detect by the beneficiary, which basically allows the receiver to reset its clock. The latter is the less exclusive solution used by Navigation device manufacturer.
There is also an intrinsic mistake source in GPS associated with the way the method works. GPS receivers analyze three signals early satellites in the method and work out how long it has taken every signal to get to them. This allows them to take out a trilateration estimate to pinpoint the exact position of the

receiver. The signals are transmitted by the satellites at a explicit rate.
Unfortunately, the electronic detector in standard GPS plans is accurate to just 1 precent of a bit time. This is around 10 billionths of a second (10 nanoseconds). Given that the GPS microwave signals travel at the speed of light, this equates to an error of about 3 meters. So standard GPS cannot resolve location to better than 3-metre accuracy. More sophisticated GPS receivers used by the military are ten times more accurate to 300 millimeters.
Other errors arise because of atmospheric turbulence that distort the signals before they achieve a receiver. Reflections from buildings and other large, solid objects can lead to GPS precision problems too. There may also be troubles with the time-keeping accuracy and the data onboard a particular satellite. These accuracy problems are circumvented by GPS receivers which endeavor to lock on to extra than three satellites to get consistent data.

GPS modernization

The GPS modernization plan is an ongoing, multibillion-dollar effort to promote the GPS space and organize segment with new features to recover GPS recital. These features include new civilian and military signals.
In addition to the specific new features noted above, GPS modernization is introduce modern technology throughout the liberty and control segments that will enhance overall presentation. For example, legacy computers and connections system are being replaced with a network-centric building, allowing more common and precise satellite information that will recover accuracy for everyone.

CONCLUSION

We discussed about how the surveying and mapping are done using the GPS system. We came to know the applications of GPS, what's inside a navigation device, GPS baseline, kinematic GPS, and adjustments how made in surveying measurements. Accurate positioning of physical features that can be used in maps and models the faster delivery of geographic information needed by decision makers are to be performed. And finally when Centimetre-level surveying is done and results are shown in real-time.

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