International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-9 Issue-3, January 2020

Satellite based Navigational System Errors

A L Siridhara, D V Ratnam

Abstract: ***When two or more signals of the satellite signals arrives through a GPS antenna with different tracks it leads to multipath phenomenon. The two main classifications of multipath phenomenon are specular and diffuse multipath. In the multipath pertaining to specular phenomenon the signals of GPS are reverberated through relatively sleek surfaces resulting in unsystematic errors within both pseudorange and carrier phase measurements. In contrast, diffuse phenomenal multipath is considered when the signal of GPS is incidental along a rough exterior where the reverberated signals are dispersed in various directions and generally they are unrelated in time period domain and it is noisy in activity. The stated unsystematic in-accurateness tin to be significant and leads to misconceptions of meters in the range in regard of pseudo range and for phase measurements at a range of a few centimeters . As the positioning mechanism needs to be be precised needs the straight path betwixt the satellites and a receiver, as the phenomenon of multipath doesn't exist. The phenomenal multipath occurrences for the associated misconceptions in a GPS apparents eventually evidences for navigational misconceptions. Topical studies on GPS and its applications stimulate the necessitate for an improved multipath characterization techniques, to have an increased admiration for the spatial complexity and sequential of specific- position multipath environments.***

Keywords: Diffuse Multipath, Pseudorange, Carrier Phase, Spatial Complexity etc

I. INTRODUCTION

The satellite based navigation is visualized from early 1960 adjunct patronage of the US department of air force, however in the year 1974 the further military divisions of the US. enhanced the requires efforts. The first satellite was launched into the space in the years 1978. In April 1995, the system has been declared to be fully operational thoroughly. The satellite based navigation constellation has nearly 24 Satellites for circulating the globe with in every 12 hours of a day for providing worldwide positioning and information on time and velocity. GPS facilitates the user by precisely identifying the positions within the earth by standardizing the spatial arrangement from orbiters.

1.1 Working Methodology

When the GPS receiver it switched on, it initially downloads the orbital accumulation from all the orbiters. This activity of downloading an orbital information for the first time, can lasts for nearly 11.95 minutes, merely erstwhile if the information is obtained, it is accumulated with in the retention of a receiver for prospect activity. Even though a GPS receive makes a precise emplacement of attribute satellite has to estimate the satellite spatial arrangement of each other, for a signal which is received. The spatial arrangement is analyzed from a GPS receiver by calculating the time taken by the signal to compass to GPS receiver and with the speed of a communicated signal. The velocity is predictable and receiver approximates the speed of a radio wave, i.e velocity of light. To analyse the time factor, the GPS receivers matches the transmitting code of satellites for the self encoding and through analyzing them its how much time it takes to determine to delay its own code for matching the satellite code . When time which was delayed is correlated/multiply with speed of the light gets the distance. The satellite's atomic clock is more accurate than GPS receivers clock and hence from each one spatial arrangement dimension is to be accurate for accounting at a GPS receivers intramural errors in clock.

II. DESCRIPTION

2.1 Sources of GPS Error

The potential position errors occours at the GPS receivers due to the following sources: Typographic errors and inaccurate datum when coordinates are entered within the GPS receivers which results in inaccuracy in the range of Kilometers in range. Unintentionally depending on fewer than four satellites for formative positional synchronize will result in inaccurate location. Signal interference is also caused from the human body. Cleaving a GPS receiver very close to a body of human may block few signals of a satellite and interrupt precise location services.

If the receiver of a GPS is to be handled only hand if needed devoid of peripheral antenna which faces toward SOUTH direction which enables improve signal obstruction originated by a human body as the preponderance of GPS satellites are oriented relatively more in the Southern hemisphere of earth. User mistakes has no way to be identified and corrected at GPS receiver

2.2 Satellite clock errors: It is caused due to minor discrepancies in each satellite's atomic clocks of four. Master Control Station monitors and corrects by the errors in this context.

2.3 Tropospheric interference: The layer lowest to the earth surface is the troposphere (beneath 16 km) where the layer has credibility of changes in pressure of air, temperature and humidity correlated with the changes in weather. The error of which occours with in this layer are due to the content. However almost the different errors which were caused due to this layer are not significant and can be overcome.

2.4 Multipath interferences: When the signal from a satellite which is coming directly towards a receiver of a GPS is been interfered with a in direct path signal it leads to

Revised Manuscript Received on January 30, 2020.
***** Correspondence Author

A L Siridhara*, Research Scholar, Department of Electronics and Communication Engineering, Koneru Lakshmaiah Education Foundation, Vaddeswaram, Guntur, Andhra Pradesh, India – 522502.

D V Ratnam, Professor, Department of Electronics and Communication Engineering, Koneru Lakshmaiah Education Foundation, Vaddeswaram, Guntur, Andhra Pradesh, India – 522502.

The multipath effects are the typical phenomenons which are hard to nullify but causes huge accuracy errors. The widespread sources of multipath include huge constructions, power cables, vehicles and masses of water. When external antennas are placed/mounted on vehicles of their roof mount of vehicle may abolish interference signals mostly due to vehicle. If on dashboards the GPS receiver is placed the multipath effects are diminished.

2.6 Amplitude:

The maximum variation from the equilibrium or average value of any frequently changing quantity such as the position of a pressure, vibrating object, velocity, voltage, current and others. The sound wave amplitude is the maximum amount by which the instant sound pressure differs from the ambient pressure. Simple harmonic motion can be as below.

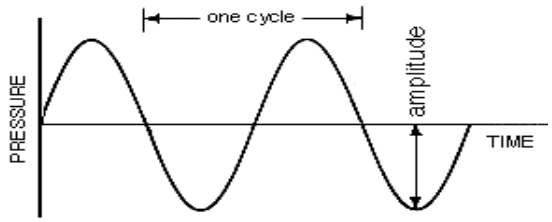


Figure1.1: Figure showing amplitude of signal

The two cycles of a sine wave shows the amplitude of the pressure variation. The variation of amplitude over time is considered as the envelope of the sound.

III. RECEIVED SIGNAL ERROR SIMULATION:

A GPS receiver was installed in STAR excellence centre of Koneru Lakshmaiah Education Foundation. The signal from a satellite is received by an array of antenna, installed on the top mount of the centre. The radio frequency electromagnetic wave is transformed to an electrical signal and sent to GPS receiver. The date from GPS receiver is in the form of RINEX, (Receiver Independent Exchange).This data is simulated by using R2K software and hence the impact of different errors on the GPS accuracy was analysed.

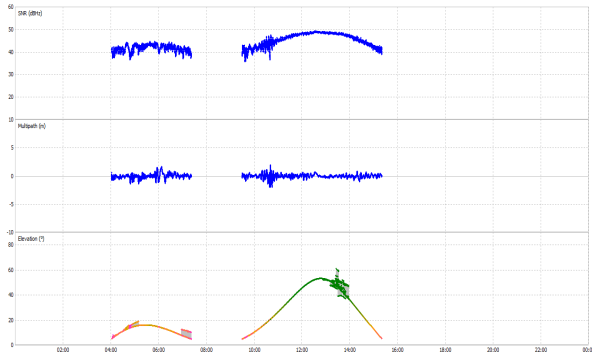
IV. RESULTS AND DISCUSSION

The tabular readings below depict the multipath component as code minus carrier (CMC) basing on the GNSS signals.

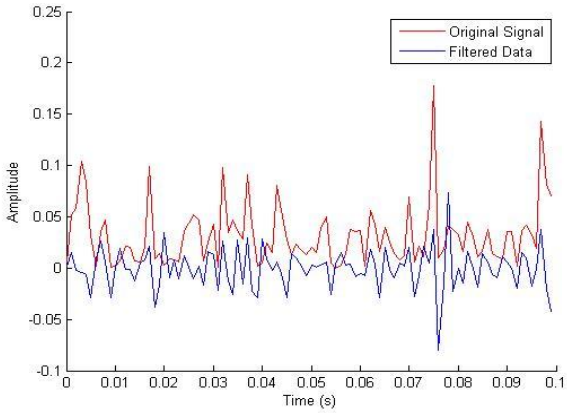
Table 1: Multipath component in GNSS signal

CMC Avg	CMC Std
-0.81	0.14
-10.754	0.223
-5.06	0.106

The RINEX data when analyzed by using R2K software, the following analysis of the GPS data made. The figure below states the visibility of a Satellite scaled in 24 hrs on 'X' axis and Signal to Noise Ratio, Multipath component & Elevation angle on 'Y-axis. It can be clearly analysed that the more the multipath fluctuation the more detoration of SNR value and hence the performance of GPS reduces.



The below figure depicts the soothed form of the original multipath affected GPS signal. However the credibility of the signal was lost which relatively stales the accuracy of GPS.



V. CONCLUSION:

From the above discussion it is vivid that multipath is the most dominant source of error in GPS limiting its accuracy. Though different filtering mechanisms are implemented to reduce the multipath affects they were not adequate to improve the performance of GPS. It was concluded that multipath mitigation mechanisms are suggestible to be introduced before the signal arrives at the receiver. As an extension work beamforming algorithms may be considered to have better mitigation of a multipath signal.

REFERENCES:

1. A L Siridhara,D V Ratnam, "Multipath mitigation in GPS receiver using Taylor Integrated Bidirectional Least Mean Square Algorithm",(October-2019),Transactions on Emerging Telecommunication Technologies by Wiley Publications, doi.org/10.1002/ett.3760
2. A L Siridhara, , Reddy, M.S., "Study of typical signal in a Global Positioning Systems receiver", (2018) Journal of Engineering and Applied Sciences, 13 (6), pp. 1523-1525
3. A L Siridhara, Ratnam, "Estimation Multipath in GPS using SNR',VOL. 11, NO. 19, OCTOBER 2016, ISSN 1819-6608, ARPN Journal of Engineering and Applied Sciences.

AUTHORS PROFILE

Mr. A L Siridhara, pursuing his Ph.D and working as a teaching faculty has published reputative journals in the communications field

Dr. Ratnam D is a renowed researcher in the field of communication has published several SCI journals. His works have contributed towards major contributions to Navigation Systems