ISSN: 2469-4134
Journal of Remote Sensing & GIS

OPEN ACCESS Freely available online

Commentary

Improvement of Helical Antennas for Navigational Applications

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DESCRIPTION

Navigation is the art of determining the position of a platform or an object on earth at any given specific time. The early navigation systems used tools like celestial objects, magnetic compass, astrolabe, back staff, octant and sextant. However, the advancements in technology have led to the use of sophisticated systems like Radio beacons, Radar, Gyroscopic compass and Satellite systems for navigation. Modern navigational systems are classified as Map based navigational systems and satellite based navigational systems. The Map based navigational systems use maps generated from physical survey or GIS data for navigation. The satellite based navigational systems are based on Medium Earth Orbit (MED) satellites positioned above earth. The satellite navigational systems are independent positioning and navigational systems unlike the map based ones which still require local references to determine the exact location. They use the signals received from multiple satellites to determine the location based on the trilateration technique. A minimum of three signals from three different satellites is required for the same. Although a satellite based navigational system provides exact location at any point on earth, seamless navigation would be possible only if this positioning data is mapped on a geographical map.

A hybrid system which uses both the map and satellite based navigational systems has become quite popular for terrestrial navigation and is widely used across the world. These systems are used in applications such as geographical surveying and mapping, navigation on air, waterways and land, tracking and automatic machine guidance and control. In recent years, the miniaturization of such hybrid systems has led to their integration with radios, laptops, cell phones. The first commercial satellite navigational system was the Navy Navigation Satellite System (NNSS), launched in 1967 to provide precise position information for shipping vessels. That system was withdrawn in 1996 in favor of the Global Positioning System (GPS) developed by the US air force. Although GPS remains the most popular navigation system worldwide till date, various countries have implemented their own satellite based navigational solutions.

The Russian navigational system called the GLONASS was deployed in 1976 and the European Union launched their system called GALILEO in 2002. The existence of multiple satellite constellations owned by countries around the world has led to the idea of leveraging the capabilities of all the constellations leading to an accurate and seamless navigation. This led to the development of interoperable satellite navigational systems which can receive and process signals from multiple satellite constellations and is generalized by the term Global Navigation Satellite Systems (GNSS).

CONCLUSION

The orbit ephemerides and the time are known to the satellites very accurately and are adjusted suitably by the ground-based control stations whenever necessary. GNSS satellites broadcast the signals containing the ephemeris, time and their status regularly towards the earth. The broadcasted signal propagates through the multiple layers of the atmosphere and reaches the user equipment. While travelling from the GNSS satellites to the receiving antennas located on the Earth, the electromagnetic wave passes through different medium resulting in the satellite clock error, the satellite orbit errors, and the ionospheric and tropospheric delays. If one of two station positions is precisely known, then the precise position of the second station can be deduced by correcting its measured signals based on the errors determined on the signals measured in the first station.

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Received: 03-Oct-2022, Manuscript No.JGRS-22-18830; **Editor assigned:** 05-Oct-2022, Pre QC No. JGRS-22-18830 (PQ); **Reviewed:** 20-Oct-2022, QC No JGRS-22-18830; **Revised:** 25-Oct-2022, Manuscript No. JGRS-22-18830 (R); **Published:** 03-Nov-2022, DOI: 10.35248/2469-4134.22.11.258.

Citation: Willi C (2022) Improvement of Helical Antennas for Navigational Applications. J Remote Sens GIS. 11:258.