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PHOTOGRAMMETRIC APPROACH TO GNSS SHADOW PREDICTION USING OPEN SOURCE GIS: A CASE STUDY FOR USING HIGH RESOLUTION SPACE DATA IN DENSELY BUILT-UP AREAS

Abstract

For high precision topographic surveys the number of satellites visible to a Global Navigation Satellite System (GNSS) receiver is important. Currently GPS mission planning software solutions available in the market consider earth as a flat surface, with little or no obstructions on the horizon. However, such software is useful only for static surveys and not applicable for dynamic surveys, when the GNSS receiver is in motion. As most of the Indian cities are witnessing rapid urbanization have contributed to the trend for tall buildings and high-rise structures due to high density and smaller building footprints. Hence, there is a need to minimize GNSS outages in such areas prior to survey, by enhancing the prediction capabilities of GNSS by including high resolution digital surface models and urban 2.5D models.

There is sparse research available for GNSS shadow prediction in densely built-up areas using open source GIS, high density elevation data to extend urban 2.5D models from high-resolution, satellite data. The solution proposed in this paper is to use an open source GIS combined with freely available Global Navigation Satellite System (GNSS) prediction software to predict accurately pseudo satellite locations, incorporate urban 2.5D models of buildings derived from footprints of buildings using two different high resolution stereo optical datasets one acquired from the Indian satellite and the other high resolution data better than 50cm along with high density, elevation datasets are utilized, thus reducing efforts for full-scale survey thereby minimizing cost and save time.

The accuracy assessment of the results are done using in situ GPS data and with the widely used commercial software from ESRI ARCMAP to determine what areas shows poor GNSS visibility due to obstructions in densely built-up areas. The results indicated that using open-source GIS may be a reasonable alternative to commercial software for GNSS shadow prediction, depending on the characteristics of the study area. Further, this paper will also examine the advantages and issues of data handling and accuracy for GNSS shadow prediction in densely built-up areas using open source GIS.