

## Investigation of User Position Accuracy for Stand-Alone and Hybrid Modes of the Indian Navigation with Indian Constellation Satellite System

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**Abstract :** Satellite Navigation System such as the United States Global Positioning System (GPS) plays a significant role in determining the user position. Similar to that of GPS, Indian Regional Navigation Satellite System (IRNSS) is a Satellite Navigation System indigenously developed by Indian Space Research Organization (ISRO), India, to meet the country's navigation applications. This system is also known as Navigation with Indian Constellation (NavIC). The NavIC system's main objective, is to offer Positioning, Navigation and Timing (PNT) services to users in its two service areas i.e., covering the Indian landmass and the Indian Ocean. Six NavIC satellites are already deployed in the space and their receivers are in the performance evaluation stage. Four NavIC dual frequency receivers are installed in the 'Advanced GNSS Research Laboratory' (AGRL) in the Department of Electronics and Communication Engineering, University College of Engineering, Osmania University, India. The NavIC receivers can be operated in two positioning modes: Stand-alone IRNSS and Hybrid (IRNSS+GPS) modes. In this paper, analysis of various parameters such as Dilution of Precision (DoP), three Dimension (3D) Root Mean Square (RMS) Position Error and Horizontal Position Error with respect to Visibility of Satellites is being carried out using the real-time IRNSS data, obtained by operating the receiver in both positioning modes. Two typical days (6th July 2017 and 7th July 2017) are considered for Hyderabad (Latitude-17°24'28.07'N, Longitude-78°31'4.26'E) station are analyzed. It is found that with respect to the considered parameters, the Hybrid mode operation of NavIC receiver is giving better results than that of the standalone positioning mode. This work finds application in development of NavIC receivers for civilian navigation applications.

**Keywords :** DoP, GPS, IRNSS, GNSS, position error, satellite visibility

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