The Role of GNSS-RTN in Transportation Applications

Subjects: Transportation

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The Global Navigation Satellite System—Real-Time Network (GNSS-RTN) is a satellite-based positioning system using a network of ground receivers (also called continuously operating reference stations (CORSs)) and a central processing center that provides highly accurate location services to the users in real-time over a broader geographic region. Such systems can provide geospatial location data with centimeter-level accuracy anywhere within the network. Geospatial location services are not only used in measuring ground distances and mapping topography; they have also become vital in many other fields such as aerospace, aviation, natural disaster management, and agriculture, to name but a few. The innovative and multi-disciplinary applications of geospatial data drive technological advancement towards precise and accurate location services available in real-time. Although GNSS-RTN technology is currently utilized in a few industries such as precision farming, construction industry, and land surveying, the implications of precise real-time location services would be far-reaching and more critical to many advanced transportation applications. The GNSS-RTN technology is promising in meeting the needs of automation in most advanced transportation applications. This article presents an overview of the GNSS-RTN technology, its current applications in transportation-related fields, and a perspective on the future use of this technology in advanced transportation applications.

Keywords: GNSS-RTN ; real-time network ; highly accurate geospatial data ; transportation

In the past few decades, significant technological advances have been made in global navigation satellite systems (GNSS), which include the Global Positioning System (GPS) (U.S. GNSS) and its counterparts: Globalnaya Navigazionnaya Sputnikovaya Sistema (GLONASS, Russia), Galileo (Europe), Quasi-Zenith Satellite System (QZSS, Japan), and BeiDou (China) [1]. The GNSS has become one of the fastest-growing emerging technologies delivering location services to various industries. Geospatial data are not only used in measuring ground distances and mapping topography [2], but they have also found significant applications in other fields such as agriculture, construction, mining, bridge health monitoring, natural disaster management [3], and accurate navigation [4]. Among all these fields, geospatial technology plays a remarkable role in the transportation sector and has the potential to play an even more critical role in future autonomous transportation systems. This article sheds light on the major existing GNSS-RTN transportation applications and provides an outlook on the future role this technology plays in advanced transportation systems. In this article, the GPS is occasionally used to refer to the GNSS technology in the broader sense and not necessarily in reference to the U.S. constellation of navigation satellites. In these instances, the use of GPS is deemed more appropriate, as it involves the use of globally accepted technical terminologies.

This article aims to compile and synthesize the literature on the use of GNSS-RTN geospatial data in transportation applications. It provides a concise high-level overview to engineers and professionals working in the transportation industry.

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