iJRASET

International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** VII **Month of publication:** July 2024

DOI: https://doi.org/10.22214/ijraset.2024.63584

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue VII July 2024- Available at www.ijraset.com

GIS and GNSS Integration Techniques for Earth Observations

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Abstract: The term "GNSS," or global navigation satellite system, refers to any satellite navigation system with global coverage. To determine your current location, GNSS devices and receivers employ geolocation information from satellite navigation systems. Trilateration is the basis for how navigation satellites operate. An object's position on the spheroid is defined by its latitude, longitude, and altitude above mean sea level. Today, the utilisation of Global Navigation Satellite Systems (GNSS) technology is required for a wide range of uses, including engineering, cities, and defence. Geographic Information Systems (GIS) can be integrated with GPS to create powerful tools for mapping and spatial analysis. This integration allows for precise display of geographic characteristics on maps, land use planning, response to emergencies, and management of natural resources. Precision agriculture is one area where GNSS and GIS are integrated, enabling farmers to gather precise position data while operating machinery. GNSS and GIS integration can be done through position-focused and technology-focused integration. Position-focused integration uses GNSS technology to locate items or features on the earth's topography, while technology-focused integration enhances the utility and accuracy of GNSS data using GIS applications and technology. Both forms of integration provide potent solutions for various industries.

Keywords: GIS-Integration, GNSS, GPS, Earth observations satellites, Satellite Navigation and Positioning Introduction

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I. INTRODUCTION

Satellite navigation systems are increasingly included in all applications where connection plays a key role [1]. Third-generation (3G) mobile phone networks like UMTS will be built on these features. Three receivers will be as widespread in transportation systems as safety devices or airbags, and all automakers will include them as standard equipment in their entry-level models. Concerning prior advancements, GPS provided many methods, supplies, and ultimately, software and services. Real-time positioning and time synchronisation represent the pinnacle of satellite navigation. Wide-area augmentation systems should be highlighted as a result, since they permit a notable improvement in accuracy and reliability function. Such significant differences are the only ones that directly pertain to GPS and GLONASS in all phases of development. The European Galileo program's acceptance and launch are regarded as the most genuine innovations to date. Galileo's technological and political choices support the need for interoperability and integration in the upcoming years.

These problems represent the real GNSS enhancement for institutions and organisations. The advancement of GNSS will switch from the transportation field to simultaneous use, both outdoors and indoors, with the help of GNSS applications in all sectors. It is anticipated that GNSS would greatly improve position domain precision [2]. The idea of a reference system for tracking is vital since the coordinate system is connected to all GNSS applications.

The primary usage of GNSS is oriented on the capability to quickly, cheaply, and across the globe establish a location within a worldwide reference system. The use of Global Navigation Satellite Systems (GNSS) technology is now essential for a wide variety of purposes, from defence to engineering and spatial planning to cities. Public institutions all across the world have mostly adopted it. potential to expand in a nation like India as the cost of hardware, as well as software, decreases. For indoor positioning, new methods have recently been established. They provide reasonable precision for either absolute or relative positioning [3]. From the common user to experts and scientists that want a higher degree of positioning accuracy, whether static or kinematic, GNSS positioning spans a variety of user groups. The advancement of the relative positioning techniques Real Time Kinematic (RTK) as well as Differential GNSS (DGNSS), which require real-time transmission of observations or corrections to these observations from a known base station to the remote station where the coordinates are to be determined, was driven by the need for greater precision in real-time [4].

II. GIS- GPS INTEGRATION

A satellite-based navigation system called GPS (Global Positioning System) can tell you where you are on Earth and what time it is. It was established by the US Army's Department of Defense and is now widely utilised in many different fields, such as mapping, surveying, and navigation. Geographical information can be gathered, managed, analyzed, and visualised using GIS (Geographic Information Systems), a system of databases and software. GIS can be used to manage data and create maps about a variety of subjects, including land use, demography, and natural resources. It can also be used to undertake spatial analysis. It is possible to combine GPS and GIS to create potent tools for mapping and spatial analysis. The precise display of geographic characteristics on a map is made possible by the usage of georeferenced data in a GIS, which uses position data from GPS. Applications for this integration include land use planning, response to emergencies, and management of natural resources. Precision agriculture is one area where GNSS and GIS are integrated. Farmers may gather extremely precise position data while they operate thanks to the usage of GNSS-enabled machinery like tractors and combines. Then, by incorporating this data into a GIS, precise maps of fields and crops may be produced. Using this, crop health can be monitored, fertilisation and pesticide use can be optimized, and crop rotation can be planned.

III. GIS-GNSS INTEGRATION TECHNIQUES

Data from the (GIS) and the (GNSS) can be combined to use a variety of methods. They consist of

1) Precise GNSS data input into sophisticated GIS software: Precise GNSS data input into GIS software utilising data transfer protocols like NMEA, RTCM, or GPX is one method of integrating GNSS data with GIS. This enables real-time modifications and analysis of the data through the real-time incorporation of GNSS data with GIS data.
2) Post-processing of GNSS data: Before entering the data into GIS, the GNSS data can also be integrated using this technique. This may entail translating the data into another format, like a shapefile, and then importing it into a geographic information system (GIS).
3) Usage of middleware software**:** To speed up data integration and delivery between GNSS and GIS, middleware software can be employed as a middleman. Software like FME, which can transform GNSS data into a format that is usable by GIS applications, is one example of this
4) Leveraging APIs: The incorporation of GNSS data with GIS is possible through application programming interfaces (APIs). GNSS data can be retrieved and displayed in a GIS environment using web services like ArcGIS Online, and the Maps API from Google.
5) Featuring cloud-based services: GNSS data integration with GIS can also be accomplished via cloud-based programmes like ArcGIS Online or Google Earth Engine. These technologies enable teams to work together in real-time and exchange and access data from many locations.

IV. POSITION-FOCUSED AND TECHNOLOGY-FOCUSED INTEGRATION

The term "GNSS and GIS integration" describes the fusion of Geographic Information Systems (GIS) with Global Navigation Satellite System (GNSS) technology to produce an effective tool for mapping, surveying, and observing the environment. Position-focused integration is the process of using GNSS technology to locate items or features on the topography of the earth and then GIS to show the location data on a map. Technologies for this kind of integration span a wide spectrum, including asset management, mapping, and land surveying. Technology-focused integration is the process of enhancing the utility and accuracy of GNSS data using GIS applications and technology. GIS can be used, for instance, to supply extensive elevation data and to fix mistakes in GNSS data, such as those caused by air disturbances. Applications like precision agriculture, navigation, and asset tracking benefit greatly from this kind of integration. Both forms of integration are crucial and beneficial. High-accuracy location data can be obtained by position-focused integration, whereas technology-focused integration enables the correction, analysis, and improvement of that data using the knowledge and capabilities of GIS. GNSS and GIS are integrating more and more as both technologies improve, providing ever more potent solutions for a variety of industries

V. TYPES OF INTEGRATION

The blending of GNSS location-based data with the mapping and analytical tools of GIS is known as GNSS and Geographic Information Systems (GIS) integration. This makes it possible to undertake geographical analysis and modelling as well as to produce more precise and comprehensive maps. Integrating GNSS and GIS can be done in many ways, as follows [4].

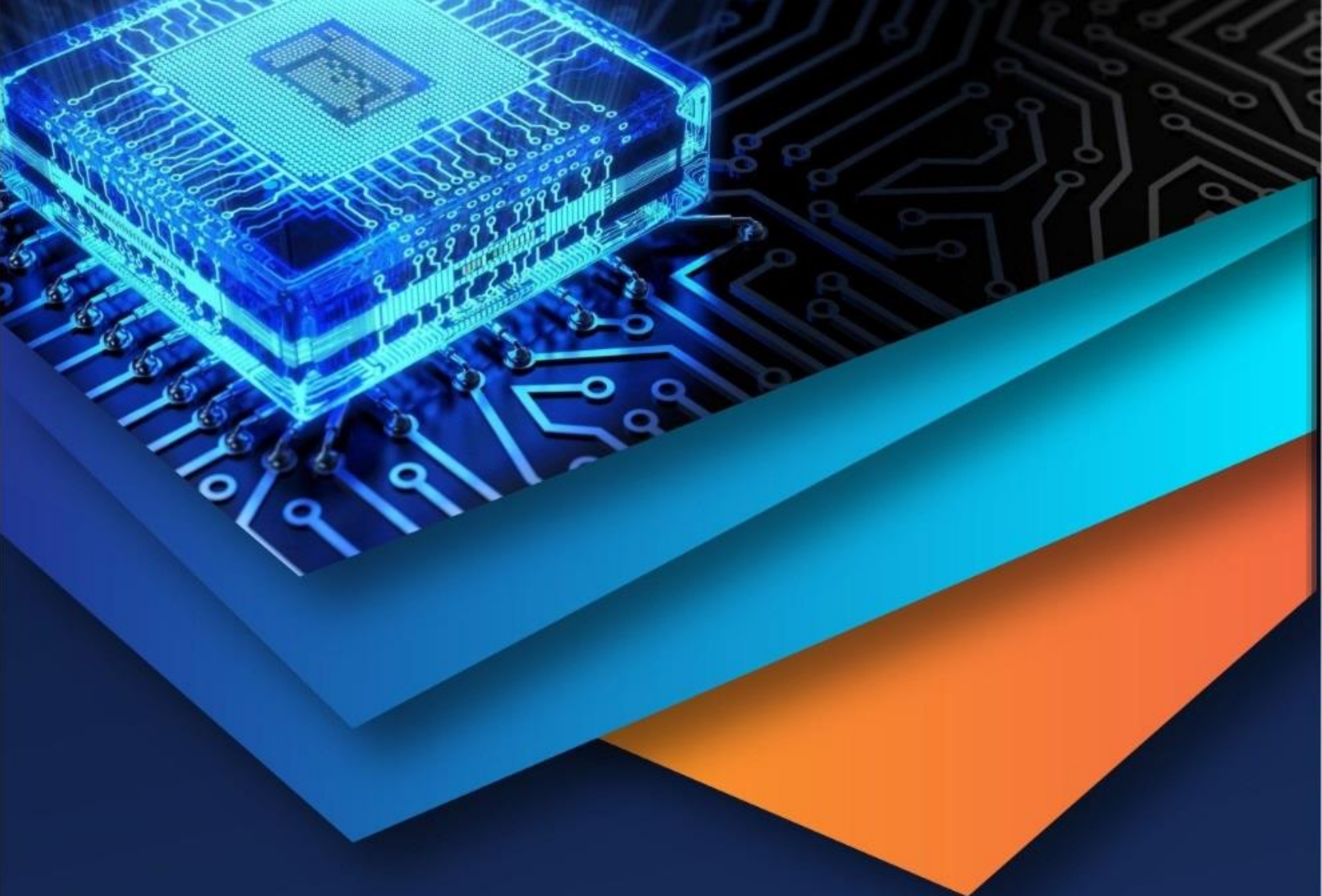
1) *Direct Integration:* In this technique, data is directly gathered utilizing a GNSS receiver and then entered into a GIS application. Maps, spatial analyses, and model creation can all be done with the data. Data collecting in the field, such as surveying the land or the mapping process, frequently uses this technique.
2) *Indirect Integration:* In this technique, data is captured utilizing a GNSS receiver, processed, saved in a different software package, and then imported into a GIS. This technique is frequently used with other sensor data, such as that from cameras or sensors, for applications like tracking the location of people or vehicles. In this technique, data is captured utilizing a GNSS receiver, processed, saved in a different software package, and then imported into a GIS. This technique is frequently used with other sensor data, such as that from cameras or sensors, for applications like tracking the location of people or vehicles.
3) *Network Integration:* Using a network-based GIS platform that can instantly integrate GNSS data is required for this technique. Applications for this include real-time tracking of asset mobility and responding to an emergency.
4) *Post-processing Integration:* By employing a GNSS receiver to gather data, this method then uses post-processing software to enhance the data's accuracy and quality before integrating it into a GIS. For operations like mapping, engineering, and construction, this technique can offer an exact 3D position and/or orientation of an object.
5) *Cloud-based Integration:* This technique involves integrating real-time GNSS data with a cloud-based GIS platform. The potential uses for this include environmental surveillance, disaster mitigation, and land use planning and mapping.

VI. CONCLUSIONS

The physical environment is brought to the desktop thanks to the integration of GPS and GIS. What might require several days to visit and analyse a certain website can now be done on your desktop. The capacity of GNSS/GIS is enormous, and there are countless and diverse applications in every field, including agriculture, environmental protection, security, natural resources, health, and business, among others. All modes of transportation, including mass transit, space stations, aviation, maritime, rail, and roads, employ GNSS. In cell phone service, aerial mapping, disaster relief, precision farming, mining, banking, scientific study, and other fields, positioning, navigation, and timing (PNT) are crucial.

REFERENCES

[1] Heinrichs G., Germany G., Winkel J., Drewes C., Maurer L., Springer A., Stuhlberger R., Wicpalek C., (2005). A Hybrid Galileo/UMTS Receiver Architecture for Mass-Market Applications, GNSS 2005, available at: http://www.gawain-receivers.com/publications/IfEN_Paper_GAWAIN_GNSS2005.pdf
[2] Lachapelle, G. M.E., Cannon, K. O'Keefe, and P. Alves (2002). How Will Galileo Improve Positioning Performance? GPS World, 2002, 13 (9): 38 – 48.
[3] Hightower J., G. Borriello, (2001). Location Systems for Ubiquitous Computing. Computer, IEEE Computer Society Press, 2001, 34(8): 57-66.
[4] Chacha SAV., Fortes LPS.,(2019). Assessment of GNSS real-time kinematic relative positioning accuracy based on NTRIP data transmitted by the Brazilian CORS Network (RBMC-IP), Coordinates https://mycoordinates.org/assessment-of-gnss-real-time-kinematic-relative-positioning-accuracy-based-on-ntrip-data-transmitted-by-the-brazilian-cors-network-rbmc-ip/
[5] Harrington, Andrew, GPS/GIS Integration: GPS Can Play a Major Role in GIS Data Maintenance? GeoWorld, Daneilson, Todd (ed.), Vol.12 No.10, Arlington Heights: Adams Business Media, October 1999.
[6] Harrington, Andrew, GPS/GIS Integration: What is GPS/GIS Integration? GeoWorld, Daneilson, Todd (ed.), Vol.12 No.12, Arlington Heights: Adams Business Media, December 1999.
[7] Harrington, Andrew, GPS/GIS Integration: Consider the Differences Among GPS Integration Technologies? GeoWorld, Daneilson, Todd (ed.), Vol.13 No.2, Arlington Heights: Adams Business Media, February 2000.



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