VIEW POINT

MINIATURIZATION OF SENSORS FOR EFFECTIVE GIS

Abstract

The global geospatial solutions market is expected to reach $741.65 billion by 2027, increasing at a CAGR of 15.2%. The miniaturization of sensors is leading the market growth. This portable and smaller size of sensors helps collect and analyze data to makes them cost-effective, easily accessible, and user friendly. The sensors help the customers in multiple ways to collect more real-time location-based data that has made a big difference in the field of geospatial technology.

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Today, almost everyone uses a GPS-enabled smartphone, and many smartphone owners use their device to get directions to their destinations. What started initially with smartphones has now reached beyond LiDAR, Earth observation, small satellites (smallsats) to wireless connectivity is driving an explosion of the internet of things (IoT). These mobile geospatial sensor platforms greatly expand the capability of individuals, businesses, and governments in collecting volumes of remotely sensed data for diverse and mission critical purposes, including disaster response, environmental monitoring, and public safety.

Unveiling a transformative force in real-time data acquisition and analysis

Smart technologies impacting geospatial activities in the areas of data collection and generation, data analytics, infrastructure, access, and the geospatial workforce:

1. Real-time spatiotemporal data: The past few decades have witnessed an explosion of new geospatial data i.e., fused spatiotemporal data. The changes in geospatial data collection with interactive GPS/GIS applications with mobile electronic sensors, such as environmental pollutant monitors, digital cameras, bathymetric instruments, noise monitors, biometric health sensors resulting in vast amounts of new continuously georeferenced and timecoded sensor data. Real-time interactive GPS/GIS based systems has pushed location-based services (LBS) to create the navigational databases and street maps to be widely used by major Internet-map providers.

2. Small satellites (smallsat): Currently, satellite technologies are influencing the remote sensing industry in both space and airborne imaging sensors which are undergoing a dramatic transformation.

With the demand for data going up, companies are working to launch constellations of smaller, less expensive satellites in low and medium Earth orbits. Greater number of small satellites delivers larger constellations and increased opportunity for meaningful industrial monitoring. This creates new applications including insurance, land management, environmental monitoring, natural disasters response.

For defined use cases, if a spectral signature is required, small sats can be rapidly designed and deployed with orbits tailored to the mission. For instance, mining professionals often require specific spectral signatures to identify anomaly sites of mineralization. Sensors can also be 'tuned' to find crops like poppies. Hyper-spectral sensors offer thousands of spectral band combinations which helps GIS technicians to extract data.

3. Unmanned aircraft systems: Drone sizes have shrunk, and efficiency has enhanced, over the years. This increases the possibility of small business uses such as putting a near real-time aerial monitoring capability in the hands of farmers, builders, miners, and the public. For instance, pre-programmed flight plans allow farmers to capture crop data multiple times a day, and GIS assists in monitoring crop moisture and nutrient levels. Drone flight plan can also manage a use case on new open pit mines at multiple frequency that have been hidden by oversight bodies; and GIS monitors the real-time excavations/ encroachments.

Unlocking spatial data analytics with sensor platforms

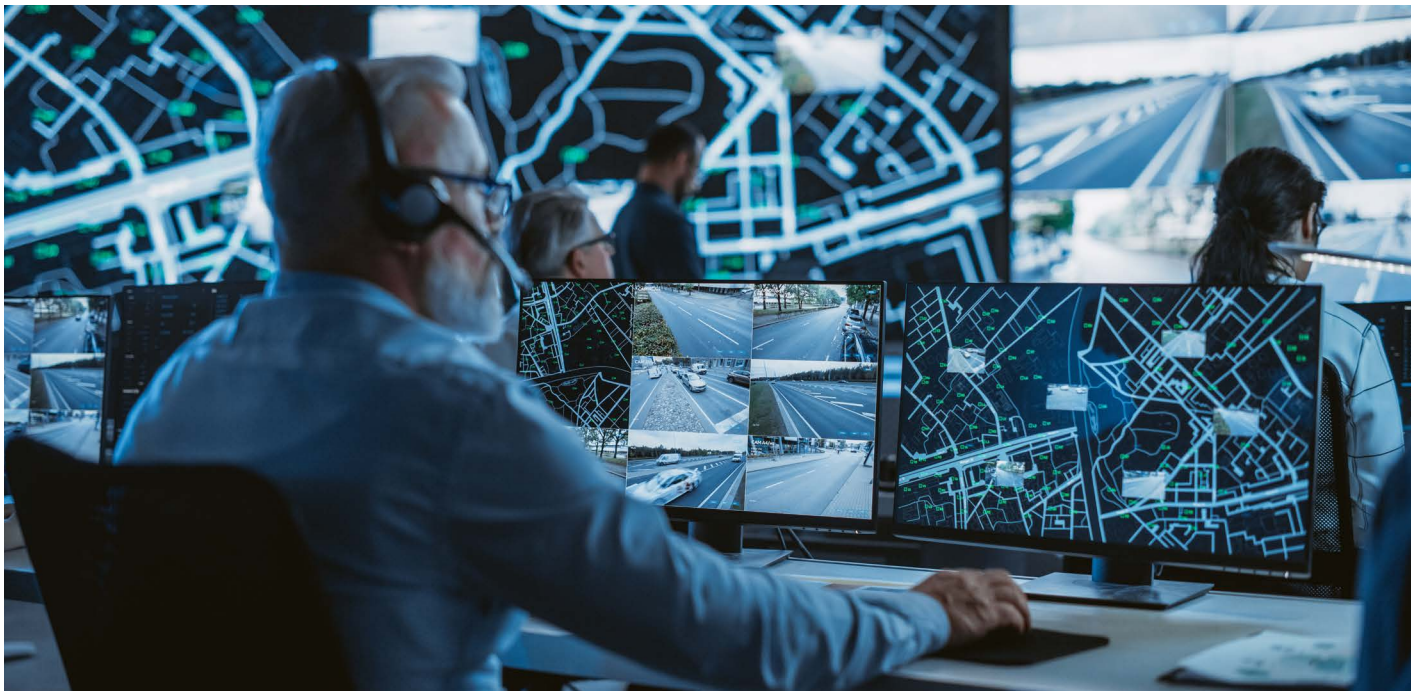
Though miniaturization of sensors has increased our capability to produce small, inexpensive devices to collect real-time data and produce geotagged messages or images, it will lead to new analytical challenges with large spatial datasets, including big data. Proliferation of spatial big data services through web technologies, cloud hosting, platform integration, smart devices, and the internet of things (IoT) will provide context of location based informed decisions, however, translating and analyzing varied big data is a challenge.

Spatial big data, including government related administrative data or humongous sensor data from IoT devices, will become more valuable with geolocation and GIS features for actionable intelligence. The hyperconnected world with automated spatial data analytics has enabled better understanding of objects, environmental situations, people, and their interactions in real-time. As the spatial-temporal data ecosystem is expanding over the time, it is creating opportunities for integrating data from billions of versatile devices that will further help in geocoding, geofencing, routing, proximity analysis that delivers business with fully geo-enriched data.

How AI can help in Spatial Analytics – as business intelligence for large sensor datasets

Generative AI embraces large language models (LLMs) that are revolutionizing the geospatial intelligence with perceive intricate patterns and generating relationships in a variety of spatial big data that continues to grow exponentially. For Example, Amazon Bedrock & Location Service provide background of how generative AI is integrated into geospatial technology, thus enable users to use high-performing models for GIS processes such as geocoding, spatial data analysis, feature visualization and routing/navigation data powering location-based services. Citing another example on generative AI that assists Gemini model with Google Maps Platform to analyzes place information and enhances the data associated with the places and areas.

AI fused with voluminous geospatial data is prevalent in market but needs more accurate models for predictive analytics. Organizations are modernizing operations to run at scale through automated data generation and approachable spatial tools and algorithms. However, it is essential to exercise caution while utilizing generative AI for creating geographic data out of such mobile geospatial sensors, as the accuracy and reliability of the generated data are critical factors that influence the validity of geospatial insights and developed applications. More accurate GIS models with cluster detections in sensor-based data, identifying changes with patterns, and forecasting outcomes with geospatial algorithms are the current framework been followed to achieve more accuracy. Thus, with this framework mentioned, AI-based predictive tools will enable business to process diverse types of GIS data, ranging from point-of-interest navigation-based sensor data to sub-surface sensors that will further assist in creating accurate, real-time modeling and analysis.



Key Takeaways

Infosys as a system integration (SI) partner and successful IT-based innovation hub continues to harness the transformative avenues of generative AI and geospatial technology for delivering its customers with next-gen spatial AI solutions for geospatial data management and a step-change towards dynamic digital twins. Public assets and its operators can gain precise, real-time data to optimize assets health pre-first maintenance recovery using geospatial sensor platforms. By leveraging generative AI with large-scale geospatial data, Infosys is poised to unlock new frontiers in decision-making and innovation, driving results in various government development activities pertaining to urban planning, public utilities maintenance, environmental conservation, and infrastructure development.

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Dr. Pradeep leads the GIS data practice in Infosys BPM. He has close to 24 years of experience in the field of GIS, telecom OSS/BSS, mobility and telematics domain, and is involved in the consulting, solution architecture, program/ project management, portfolio management for Indian and overseas clients (US/Middle East). In Infosys BPM, he is responsible for leading the GTM strategy, presales, consulting, COE accountabilities - creating/owning business modeling/framework and contribution to all lines of GIS business/new wins.

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Sudeep has over 16 years of work experience in GIS, Image processing and geospatial data management. He has delivered solutions for various industrial segments related to mineral & mining, agriculture & forestry, public utilities, land administration and property tax, urban infrastructure. Over the years he has served as GIS SME for large corporates, e-governance, large utilities across geographies in US, African & APAC regions. Immensely involved in project management and operation activities on large geospatial engagements, has functioned as techno-commercial personal and solution design professional. In his current role at Infosys BPM, he is part of solution design team responsible for pre-sales activities, developing GIS solutions with implementation of industry best practices and anchoring new digital transformation with geospatial data related automation avenues.

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