NEWSLETTER

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Theme: Urban Development

ASSOCIATION OF GEOSPATIAL INDUSTRIES

In this Issue

From the President's Desk

In today's fast-paced world, urbanization is a defining global trend. With more people than ever before residing in cities, the challenges and opportunities presented by urban development have never been more significant. Here, Geospatial technologies emerge as indispensable tools for shaping sustainable and efficient urban landscapes.

These technologies empower us to capture, analyze, and leverage location-based data, providing invaluable insights that inform decision-making, optimize resource allocation, and enhance the quality of life in our cities.

From urban planning and infrastructure development to disaster management and environmental conservation, Geospatial Technologies offer innovative solutions that reshape how we design, build, and manage our urban environments. At the Association of Geospatial Industries (AGI), our members and partners have been at the forefront of pioneering projects that harness the power of geospatial data to create more innovative, resilient, and sustainable cities.

AGI's mission has always been to promote and advance the Geospatial industry in India. As a forum for exchanging ideas, techniques, approaches, and experiences by those who design, implement, and use Geospatial technology solutions, AGI dedicates this Edition of its newsletter to the theme of Urban Development and the role of Geospatial technologies in its advancement.

I extend my heartfelt gratitude to our dedicated members, partners, and contributors who continue to drive innovation and excellence in the Geospatial domain. Your unwavering support is the cornerstone of our collective success.

We hope this Edition comes across as insightful and enjoyable. Stay tuned for more insights, stories, and analyses from AGI in the coming months.

Enjoy Reading,

Warm regards,

Pramod Kaushik
President, AGI.

Geospatial technologies can help cities in data-driven decision-making by helping urban planners and policymakers make informed decisions.

"Geospatial technologies are pivotal for smart city development," *notes Prof. Inder Gopal, CEO, India Urban Data Exchange*.

Geospatial technologies provide valuable insights into urban challenges and can lead to compelling use cases for improving citizens' quality of life. Can you share some examples of successful Geospatial-based use cases facilitated by IUDX that have positively impacted major civic issues?

Many of the use cases facilitated by IUDX utilize geospatial data to improve the lives of urban citizens, and a few of them have been in operation for some time. For example, a Solid Waste Management use case has been implemented in Varanasi, where the real-time location of waste collection vehicles is tracked and combined with the location and volume of the bins to optimize waste collection routes dynamically. This has been shown to reduce garbage collection costs by about one-third.

Another successful example is Green Corridor for Emergency Vehicles, which uses geospatial tracking of emergency response vehicles and automatically manages the traffic lights to maximize their movement speed. This use case has been implemented in multiple cities, including Varanasi and Chandigarh, and recently won the Silver award at the recent ETGovt Digitech Awards 2023.

In many cases, Geospatial data has been used innovatively to improve public transportation. Two such examples were implemented in the city of Surat—an application that provides real-time arrival and occupancy for city buses and a journey planning application that enables public and private modes of transport to be combined in a single optimized journey. The latter received the Gold award at the previously mentioned ETGovt event.

Other applications that leverage geospatial data include a Personal Safety Application implemented in Pune, which helps people take the safest possible route while walking across the city. Finally, Flood Management is another use case that extensively uses Geospatial Data to understand the topography of a city and predict flooding patterns.

Breaking data silos and aggregating standardized Geospatial data can be challenging, given the diverse sources and formats of data. How does IUDX ensure the interoperability and standardization of Geospatial data from various stakeholders?

The main benefit of a data exchange such as IUDX is enabling controlled and standardized data sharing across data silos. In most public sector applications, moving data from the data owner into a central repository is not feasible or desirable. The data exchange accomplishes this federated view in three essential ways. Firstly, it provides a comprehensive catalog of all available data and annotates it with standardized meta-data for programmatic search that best matches the application's needs.

Secondly, the data exchange provides a standard way to specify and enforce sharing policies to ensure that the data owners can control who gets access to their data. This is critical to allow for a data-sharing ecosystem.

Finally, the third function is to map diverse data formats into a common representation through standard APIs. All geospatial data is mapped into standard OGC-compliant data formats and APIs, Diverse geospatial data formats (e.g., shapefiles, gpkg, gdb, etc. for vector datasets and netcdf, geotiff, zarr, and other formats for raster) are mapped using transformation techniques such as affine transforms, projection manipulations, etc.

Because of the diversity and heterogeneity of the original data, the transformation process is not entirely automated, and skilled experts are sometimes required to deal with exceptional cases. But, once the transformations are created, applications will not have to worry about the diversity of formats and can operate on all data using standard OGC formats. This dramatically reduces the burden on the application developer.

Secure collaboration is vital when dealing with sensitive Geospatial data in a digital ecosystem. What mechanisms are in place in IUDX to mitigate security risks, prevent data fraud, and maintain transparency and accountability in data-sharing?

IUDX employs a variety of mechanisms to enhance the security of geospatial data. These security measures are broadly categorized into two main areas: data security and platform security.

The foundation for Data security is a robust authentication protocol using a standard known as OpenID Connect, on which a customizable authorization system is built to maintain and enforce data access policies. This system upholds fundamental data ownership constraints for all management operations while offering a distributed plugin framework for managing data access operations. Noteworthy examples of developed plugins encompass Role-Based Access Control (RBAC), Access Control Lists (ACL), and the MeitY Electronic Consent Framework for Personally Identifiable Information (PII) datasets. To ensure security during secure operations, we use signed JSON Web Tokens.

Platform security aims to ensure the data exchange is safe from cyber-attacks. One critical aspect is a robust regimen of source code testing and scanning procedures using tools such as ZAP, Github Dependabot, and Github Vulnerabilities and Secrets Scans. These measures identify well-known vulnerabilities, insecure third-party dependencies, and emerging zero-day attacks. The code has also been scrutinized by certified cybersecurity experts, attesting to code quality and security. A vigilant monitoring system and an audit trail that records all operations have been implemented for comprehensive oversight. These logs are stored within ImmuDB to provide a comprehensive record of API request information.

IUDX, being an open-source platform, is known for its easy adoption across the digital ecosystem. What benefits does this open approach bring in terms of scalability, collaboration, and knowledge-sharing within the Geospatial community in India?

Open Source means that the source code is publicly available to all parties and usable without payment under the open-source license terms. The open-source nature of the IUDX platform indeed brings several benefits in terms of scalability, collaboration, and knowledge-sharing within the geospatial community in India. These benefits collectively contribute to a vibrant ecosystem where stakeholders work together to tackle urban challenges and create valuable geospatial solutions. As the notion of Digital Public Infrastructure has been popularized, there has been increased emphasis on ensuring that such platforms are based on open source, not proprietary vendor code.

> **The open-source nature of the IUDX platform indeed brings several benefits in terms of scalability, collaboration, and knowledge-sharing within the geospatial community in India.**

One of the most significant assets of open-source platforms is that they are not limited by licensing costs, which can often be a barrier to entry for organizations and individuals. This affordability encourages wider adoption, allowing more participants to contribute data, applications, and services to the platform. Open-source platforms thrive on transparency, enabling participants to understand the underlying architecture, algorithms, and design decisions. This encourages knowledge-sharing within the geospatial community. Organizations can build on the platform's foundation to create new solutions without reinventing the wheel.

The open-source approach also empowers developers to experiment and create novel use cases by leveraging the platform's existing capabilities. They reduce the risk of vendor lock-in. Since the source code is accessible, organizations can avoid dependency on a single vendor for updates, maintenance, and support.

Looking into the future, what critical initiatives does IUDX envision for more sustainable urban development? How do you see Geospatial technologies shaping the future of smart cities in India, and what role does IUDX play in this transformative journey?

Geospatial technologies, including Geographic Information Systems (GIS), satellite imagery, remote sensing, and location-based services, are pivotal for smart city development. These technologies provide valuable insights into urban dynamics, enabling efficient resource allocation, infrastructure planning, and sustainable growth.

Geospatial technologies can help cities in data-driven decision-making by helping urban planners and policymakers make informed decisions by visualizing patterns, trends, and potential issues. It will also assist in identifying suitable locations for infrastructure development while ensuring that new developments are integrated seamlessly into the existing urban fabric. Other key areas where Geospatial technologies are indispensable are disaster management and response, environmental sustainability, and urban mobility.

IUDX could be central to all these by facilitating data sharing among various stakeholders, ensuring that data from different sources and domains can be seamlessly integrated and used collectively. IUDX could also offer training and educational programs to enhance geospatial literacy and collaborate with policymakers to develop data-sharing policies and standards that support ethical data use, privacy, and security in the context of smart cities.

Geospatial technologies can help cities in data-driven decision-making by helping urban planners and policymakers make informed decisions.

"We want to move further ahead to developing a 3D GIS and Digital Twin of the city," *notes Shri Kaushal Raj Sharma, Chairman, Varanasi Smart City.*

Varanasi Smart City has implemented GIS-Based solutions to monitor municipal service delivery and improve overall city governance. Can you share some specific examples of how Geospatial technologies have led to more efficient service delivery in the city?

Varanasi Smart City has published a Smart Map of Varanasi, which has broadly employed GIS for digitizing property and assets like Water, Sewers, etc. These layers have been added to the Smart Map Varanasi Portal. Such details have helped the administration immensely, especially for COVID-19 management.

We mapped all resources, including hospitals, doctors, oxygen supply, ambulances, drug stores, and vaccination centers. Patient details were updated regularly on GIS maps, and various trends and patterns were identified, based on which Quarantine Zones were regularly updated. GIS enablement also helped in timely and accurate coordination between different agencies and stakeholders, eventually helping control the pandemic effectively.

Smart Map Varanasi also has several live integrations with multiple sensors, including Cameras, Traffic Signals, Waste Bin Sensors, and Environment Sensors. The Live Integration helps make decisions like the waste bins that are filled turn red color, and those which are more than 80% filled are

yellow color. This helps in optimizing waste pick-ups. We created an open Geospatial platform called 'Kashi Geo-hub' to provide a common GIS platform to all the stakeholders in the city, including citizens, administrators, civic authorities, businesspeople, startups, academia, and research.

The Smart City Project in Varanasi has made significant strides in setting up an efficient grievance redressal system. Could you elaborate on how Geospatial technologies have been integrated into this system and its impact on citizen satisfaction?

Crowdsourcing apps on the Kashi Geo-Hub provide a Geospatial-enabled Grievance Management System. The templates have been created to address the three most significant problems of the city - Waste Management, Pollution, and Traffic - with location information. Login dashboards can pinpoint problematic locations in real-time with details.

The city's focus on cleanliness and solid waste management is commendable. How have advanced technologies contributed to Varanasi's efforts to become a cleaner, more sustainable city?

Solid waste management has always been a formidable challenge for the city, generating 650 MT of waste daily. When the Kashi Integrated Command and Control Centre project was included in the Smart City Mission initiative, one of the key components was the Integrated Solid Waste Management System for the City. We have digitally linked all assets, starting from waste bins (volume sensor and GPS); collection points (CCTV camera, GPS and smell sensors), SWM vehicles (GPS, Route Tracking, Diesel consumption), SWM staff (biometric-based attendance) to the final disposal and processing Plant (CCTV, Weigh bridges) and integrated all of these together.

Image Source: Smart Map Varanasi

Image Source: Kashi GeoHub

With real-time data collection and monitoring, solid waste management has seen phenomenal change and improvement in the city.

What were the critical challenges faced by Varanasi Smart City in adopting and deploying Geospatial technologies for various projects?

We encountered multiple challenges in adopting a GIS-based transparent system for city management, including:

► Undertaking a GIS survey of properties and assets was an issue because Old Varanasi is congested, with narrow streets.

► Getting the consensus of people for undertaking the property survey was challenging.

► Integrating administrative data, POI data, Survey Data, and Sensor data on one Platform was complex, which was overcome with collaborative operations between the Smart City, MSI, Vendor, and Esri India teams without any conflict of interest.

► Integrating different live datasets through APIs on a single platform was a challenge. Esri India and subsequent vendors resolved this.

► For deploying the Open data portal on the Cloud, exposing the layers for stakeholders was an experiment because the data security might have been challenged. To overcome this, Esri India came up with a Hybrid Model. All the data resides on on-premise servers and is consumed on the cloud as services only for analytics.

> **We are appointing agencies to carry out the 3D GIS mapping using photogrammetry, drone survey, and LIDAR survey. The 3D model of the city, integrated with all attribute databases, will be a powerful tool for all civic agencies to visualize infrastructure entities in 3D view, along with associated street views, for better and quick decision-making.**

Looking ahead, what are some of the future initiatives and projects in the pipeline that you believe will further enhance the city's smart infrastructure and citizen services?

Now that we have put the conventional two-dimensional GIS to the best possible use by the city, we want to develop a 3D GIS and digital twin of the city. We are appointing agencies to carry out the 3D GIS mapping using photogrammetry, drone survey, and LIDAR survey. The 3D model of the city, integrated with all attribute databases, will be a powerful tool for all civic agencies to visualize infrastructure entities in 3D view, along with associated street views, for better and quick decision-making. We will further endeavor to develop AI-powered apps for each use case, empowering stakeholders with real-time data and analytics-based decision-making. This will be a game changer in urban planning and management for all times to come.

Geospatial technologies can help cities in data-driven decision-making by helping urban planners and policymakers make informed decisions

"Geospatial technologies are pivotal for smart city development," *notes Sreeramam GV, CEO, NeoGeoInfo Technologies.*

NeoGeoInfo Technologies recently secured a significant drone-based land parcel mapping contract from the Karnataka government. Can you share some insights into the scale and scope of this project? How will using drones and Geospatial technologies contribute to efficient land parcel mapping?

With its partner, Allterra Solutions LLP, as the lead bidder, NeoGeo has won the largest drone-based Land Parcel Mapping project through an open tender process from the Karnataka State government. The project covers an area of 68,000 SQ. KM. and ten complete districts in Karnataka – Gadag, Koppal, Kodagu, Chamarajanagar, Chikkamangaluru (Chikmagalur), Vijayapura (Bijapur), Yadgir, Raichur, Bidar, Kalaburagi (Gulbarga).

This work envisages the deployment of approximately 60 survey-grade PPK drones to capture high-resolution images to generate maps with a resolution better than 5 CM. At full scale, the fleet of drones will be mapping an approximate area of 1,75,000 acres in a single day on average. Furthermore, the SSLR department will use these Ortho-Rectified Images (ORIs) to create digital land parcel maps and print property cards. These digital maps will be critical for updating landing ownership records, ground truthing, and enabling infrastructure development across the state.

It is the world's biggest land parcel mapping project and is a leap forward in land record information digitization and management. The accuracy requirements are stringent, and we are working with the state department to deliver the project successfully. I have not seen the size of the datasets involved and the frequency at which this data needs to be delivered. Suddenly, the hundreds of GBs look very manageable. Now, it is all about tens of TB to be processed and delivered repeatedly.

Our focus is on delivering high-quality work on the first attempt. We developed a new methodology to keep teams disciplined while working remotely and meeting deadlines. Our teams have adapted well and are doing an excellent job. The value we bring to the project is substantial.

The collaboration between NeoGeoInfo Technologies and CEPT University for knowledge-sharing and research studies sounds promising. How does NeoGeoInfo plan to leverage this partnership to advance the use of Geospatial technologies and innovation in Geomatics?

NeoGeo consistently works with academic institutions to ensure the students are equipped with the right skills and experience and know real-world projects. However, most of these engagements are loosely held, and we wanted to contribute to curriculum and teaching methods to

guarantee the program's success. So when the opportunity to collaborate with CEPT came in, we took it with both hands. It paved the way to learn from their best practices and enhance the quality of academic offerings.

> **We are actively hiring people, providing internships, and engaged in providing the experience of real-world projects. But there is a lot to happen, and we have plans to co-launch a certificate course for students and professionals who want to learn/ adapt to new technologies.**

CEPT and NeoGeo are firmly committed to quality in education, applied research, and development. We are actively hiring people, providing internships, and engaged in providing the experience of real-world projects. But there is a lot to happen, and we have plans to co-launch a certificate course for students and professionals who want to learn/ adapt to new technologies. We have conceived three significant areas of collaboration:

► **Industry-academia tie-up:** Aspirations stem from students in smaller cities, and we would like to engage with the rural youth and make them ready to absorb

and conceive solutions and execute projects at scale using geospatial technology.

▶ **Drive technology transfer:** We are setting an agenda for further research since most research and technology transfer is limited to a few areas today. There are no new use cases based on the current-day projects or opportunities existing, and

▶ **Drive the academia towards Collective Social Goals:** Goals include SDGs, Climate Resilience, Disaster Management, etc., and the course correction will impact the larger society.

Property Tax Management and GIS-based Master Planning are critical aspects of Urban Governance. How has NeoGeoInfo improved property tax management and urban planning through Geospatial solutions?

Geospatial solutions have revolutionized property tax management and urban planning by providing accurate, real-time spatial data that significantly improves decision-making and overall governance. Property tax is a significant source of revenue for the ULBs, but poor or under-assessment of properties, inefficient collection, and widespread exemptions lead to revenue leakage. According to a survey, only an average of 37%∗ of probable property tax is collected across India.

The value add of Geospatial in Property Tax Management is all-pervading from Parcel Identification, Valuation/ Assessment, and Tax Collection. Geospatial solutions provide a comprehensive database of all properties within the city, along with details like property boundaries, ownership, land use, and building characteristics. It simplifies the assessment process and ensures fairness and transparency in property taxation. Such data helps identify potential tax defaulters and areas with a higher tax collection potential. By analyzing the spatial distribution of tax payments, urban authorities

can prioritize collection efforts and optimize revenue generation.

The NeoGeo team is lucky to be part of the first property project initiated in India and the latest ones happening across. We have successfully enumerated more than 45 Lakhs of Properties across 35 ULBs. NeoGeo is hand-holding individual ULBs, tied up with NIUA for platform development, and working on crowdsourcing possibilities. These property tax projects resulted in huge gains across all ULBs we were engaged in. There is a lot to be done, and with some innovative thinking, India can leapfrog on this effort, leading to a remarkable improvement in EoDB.

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Geospatial-based master planning allows for the efficient delineation of zoning regulations and land use categories. Planners can identify suitable areas for residential, commercial, industrial, and green spaces, optimizing the allocation of resources and promoting sustainable development.

Our experience in the master plan preparation helped cities identify areas lacking essential infrastructure like roads, water supply, and sewage systems. I also want to stress our vital role in urban planning for climate change resilience. By analyzing geographic data on flood-prone areas, vulnerability to natural disasters, and other environmental risks, planners can develop strategies to minimize the impact of climate-related challenges. Similarly, defining the right areas for SEZs and transport Hubs drives overall economic growth. By leveraging geospatial

technologies, urban governance can better meet the evolving needs of cities and their inhabitants.

I am happy to share that NeoGeo is a leading solution provider in Urban Governance with robust solutions, expertise, and process orientation. We have developed and leveraged a Unique Survey Technique and Equipment/ platforms (like a sophisticated platform for DDN provisioning) for faster and better results.

The Hyderabad CCTV Surveillance and Integrated Traffic Management System project significantly enhances city safety and traffic management. How have Geospatial technologies been utilized to develop this system, and what outcomes have been achieved in making Hyderabad safer and more resilient?

The Hyderabad CCTV Surveillance and Integrated Traffic Management System (HCS-ITMS) project is a prominent example of how geospatial technologies have been effectively utilized to enhance city safety and traffic management. Geospatial technologies, such as DGPS, LiDAR, GPR, Remote Sensing, and Tab based surveys, are used to create High-Resolution Spatial Data (CM level accuracy) for the Planning, Execution, and Management of safer and more resilient cities.

In this project, NeoGeo is designing a Robust, City-Wide Network for connecting 10,000 Cameras and sensors across 3000 traffic junctions within the city and Integrating. NeoGeo helped in Planning and Designing the Camera Network of the Largest Safe City Projects with the Latest Data Acquisition Techniques to provide high-resolution (CM level) Geospatial Data of the City for Planning. We worked on a LiDAR Survey for ascertaining Pole Location/ Camera FoV/ Type of Cameras, a GPR Survey for optimal path for Trenching Without Damaging the Existing Utilities, a Hands 'n Feet Survey for Collecting Hyper Local Information, and prepared ABDs for Operations and maintenance of Network.

We have created a digital database of the street network of over 7000KM that is topologically integrated, geographically encoded, and referenced, along with all "Points of Interest" data. NeoGeo produced the required Geospatial dataset, with geocoded Nodes/ Street Intersections along with characteristics of the Links and the System (e.g., Street Name, Number of lanes, Capacity & Traffic Direction) for Estimating Shortest Paths between any pair of Nodes, Routing, and Scheduling though VMBs (Virtual Messaging Boards) Capacity constraints, and Assigning Service Stations on A Network (arc/node partitioning)

All this improved Public Safety, Crime Prevention, Emergency Response, and Incident Management. We are more prepared now for Smart City/ Safe City projects with a lot of software for 3D model simulations, IoT sensors for better/ improved edge computing, and Drone-based data acquisition. NeoGeo is well poised to act as a complete system integrator to provide the entire solution, including smart poles, surveillance solutions, and analytics-ready platforms.

With a strong portfolio of successful projects in urban development and other domains, what future initiatives or announcements can we expect from NeoGeoInfo Technologies?

I am fascinated by the quote - Goals are for people who care about winning once. Systems are for people who care about winning repeatedly. And running an organization requires consistent, exceptional performance. NeoGeo is introspecting and making all efforts to create Systems.

We will continue to focus on Urban Governance and Cross-Country Infrastructure. We will consolidate our position in these two segments as a Quality Consultancy and Implementation Services Provider with Rich Experience in System Integration, Development, and Engineering Solutions. NeoGeo will invest heavily in Cognitive Technologies (AI/ Machine Learning/ Robotic Process Automation) and analytics and in developing platform-based solutions.

We are excited about the opportunities thrown in by the amalgamation of Geospatial, IoT, and Blockchain technologies. We have a few solutions in mind and are working on them seriously. A few announcements are in the offing. Our engagements in building SDI (Spatial Data Infrastructure) via establishing and maintaining the CORS networks and GIS labs across states are well appreciated, and we have a complete understanding of helping any organization monetize its spatial data.

We are also expanding our footprint beyond India. We are now operational in Canada and will also take our expertise to other markets. The coming years will be crucial and exciting, with much action. We are also looking for good, young, and enthusiastic professionals to join us so that we can grow.

Geospatial technologies are rapidly evolving, and their applications are becoming more diverse. From your perspective, what role do you see Geospatial technologies playing in addressing emerging urban challenges, such as climate change, resilience, and inclusive urban development, in the coming years?

Geospatial technologies are increasingly vital in addressing emerging urban challenges, and their applications are expected to become even more diverse in the coming years. Here are some ways in which geospatial technologies can contribute to tackling urban challenges:

Climate Change Mitigation and Adaptation: Geospatial technologies can help monitor and assess the impact of climate change on urban areas by providing real-time data on temperature, air quality, and other environmental parameters. With this information, city planners can make informed decisions to mitigate the effects of climate change and develop adaptation strategies. Additionally, geospatial tools are crucial for mapping areas vulnerable to flooding, sea-level rise, noise pollution, and other climate-related hazards, enabling better urban planning and disaster preparedness.

Smart Cities: Geospatial technologies facilitate the creation of smart and sustainable cities by analyzing spatial data in 3D to optimize urban infrastructure and transportation networks. This allows for more efficient land use, reduced energy consumption, and better urban mobility, thereby reducing the carbon footprint of cities and promoting environmentally friendly practices.

Inclusivity: I strongly advocate for Inclusive Urban Development, and geospatial technologies can help identify areas with social and economic disparities, enabling city planners to design more inclusive development plans. By mapping access to essential services, public facilities, and transportation, decision-makers can target resources to underserved neighborhoods and ensure that urban development benefits all residents, regardless of their socio-economic status.

Emergency Management: Geospatial technologies enhance urban resilience through real-time natural disasters and emergency monitoring. Using high-resolution satellite imagery, SAR remote sensing, and 3D mapping, emergency responders can quickly assess the extent of damage, identify affected areas, and coordinate relief efforts more effectively. We are working extensively in this area.

It is also essential to get the citizens into the ecosystem. After all, they are the impacted party. Through interactive map-based apps and web-based platforms, residents can provide input on proposed projects, report issues, and engage in collaborative decision-making, fostering a sense of ownership and inclusivity in urban development.

As geospatial technologies evolve, their potential to address emerging urban challenges will only increase. Governments, organizations, and city planners must embrace these tools and collaborate with experts to unlock their full potential in creating sustainable, resilient, and inclusive urban environments.

Geospatial Technologies for Inclusive Urban Growth

SPECIAL FEATURE

Sakshi Singh, AGI

According to the World Bank, urban areas are projected to absorb nearly 70% of the global population by 2050, making inclusive urban growth imperative for sustainable development. Geospatial technologies, encompassing Geographic Information Systems (GIS), satellite imagery, and mapping tools, have become indispensable in accomplishing this vision. The ability to harness spatial data and transform it into actionable insights is reshaping how cities are planned, developed, and managed.

The Foundation of Inclusive Urban Growth

Inclusive urban growth rests on the principles of equitability, accessibility, and socio-economic inclusion.

► Equitable development implies that the benefits of urban growth are distributed fairly across all population segments, regardless of socio-economic status or geographical location.

► Accessibility involves creating urban spaces that are easily navigable for all, ensuring that development benefits are not concentrated in specific areas.

► Socio-economic inclusion addresses the historical disparities in wealth and opportunities that have marginalized some communities.

The challenge lies in addressing the historical inequitable urban development patterns that have marginalized specific communities. Cities often grow in a fragmented manner, creating pockets of affluence and areas of deprivation. A report by the United Nations Development Programme (UNDP) highlights that, globally, over 50% of the urban population lives in informal settlements, facing challenges in accessing basic services and opportunities. Overcoming these historical imbalances requires a concerted effort to redefine urban development strategies, placing inclusivity at the core.

Geospatial Technologies in Urban Planning

Geospatial technologies revolutionize urban planning through precise digital mapping and analysis. Geographic Information Systems (GIS) enable planners to create layered maps integrating diverse data sets. This aids in visualizing complex urban landscapes, helping decision-makers understand spatial

relationships. For instance, GIS can overlay data on population density, infrastructure, and environmental factors, offering insights crucial for strategic decision-making.

By analyzing Geospatial data, planners can identify areas requiring specific interventions, such as infrastructure improvement, affordable housing, or green spaces. Location intelligence provides a data-driven approach to allocating resources effectively, ensuring that urban development meets the population's diverse needs. The city of Barcelona, for instance, used location intelligence to address noise pollution. By mapping noise levels across the city, officials identified areas with high noise concentrations, leading to targeted interventions like sound barriers and traffic management.

Geospatial for Inclusive Growth: Select Applications

Ensuring Equitable Infrastructure Development

The realization of inclusive urban growth is intrinsically tied to equitable infrastructure development. Geospatial tools play a pivotal role in this realm, offering urban planners and policymakers valuable insights for infrastructure planning. Geospatial technologies facilitate a granular analysis of urban areas, enabling authorities to pinpoint areas with inadequate access to essential services such as schools, healthcare facilities, and public transportation.

Social Inclusion Through Geospatial Data

Geospatial technologies contribute to data-driven policymaking by providing accurate and up-to-date information. By overlaying demographic data with socio-economic indicators, cities can identify areas with higher vulnerability or lower access to educational and economic opportunities, guiding interventions to uplift marginalized communities.

Community Engagement and Participation

Community engagement is a cornerstone of inclusive urban growth, and Geospatial technologies offer innovative ways to involve citizens in decision-making processes. From interactive mapping applications to virtual town hall meetings, Geospatial technologies empower residents to actively contribute to discussions about developing and enhancing their neighborhoods. Crowdsourced maps can highlight areas with infrastructure gaps, environmental concerns, or community initiatives, aiding authorities in tailoring interventions that align with the needs and aspirations of the residents.

For example, In cities like Barcelona and Buenos Aires, digital platforms powered by Geospatial technologies allow citizens to propose ideas for urban development, fostering a sense of ownership and participation.

Future Trends and Innovations

AI and Machine Learning (ML) in Geospatial Predictive Analytics: Predictive analytics powered by AI and ML can forecast trends in urban development, helping cities proactively address challenges. For instance, predictive models can anticipate areas susceptible to increased population density, enabling preemptive infrastructure planning.

Emerging Technologies for Enhanced Inclusivity: As technology evolves, emerging tools like Augmented Reality (AR) and Virtual Reality (VR) are finding applications in urban development. AR and VR can facilitate immersive experiences, allowing stakeholders to visualize proposed projects. This aids in more inclusive decision-making processes by providing a tangible understanding of the potential impacts of urban changes. For instance, Singapore's Virtual Singapore project employs 3D mapping and AR to create a digital twin of the city, allowing planners and citizens to interact with a detailed urban landscape model.

Global Collaborations for Inclusive Urban Development: Urban challenges often transcend borders, making global collaborations crucial for inclusive urban development. Cities worldwide can share best practices, technologies, and lessons learned. Collaborative efforts can focus on addressing common issues such as environmental sustainability, affordable housing, and equitable access to resources.

Examples from India

The following examples underscore the transformative impact of Geospatial technologies in fostering inclusive urban growth across various domains, including sanitation, housing, transportation, and overall urban planning in India.

Bhuvan - Geospatial Platform by ISRO: The Indian Space Research Organisation (ISRO) developed Bhuvan, a Geospatial platform that offers satellite imagery and maps for urban planners, government agencies, and citizens. Its detailed datasets help understand existing urban structures, plan new developments, and ensure inclusive resource access.

Swachh Bharat Mission (SBM): The Swachh Bharat Mission, a nationwide cleanliness and sanitation campaign, utilized Geospatial technologies to ensure the equitable distribution of sanitation facilities. GIS mapping played a crucial role in identifying areas without proper sanitation infrastructure. This guided the construction of public toilets in locations that lacked adequate facilities, contributing to improved sanitation accessibility.

Smart Cities Mission: The Smart Cities Mission aims to develop technologically advanced, sustainable, and inclusive cities. Geospatial technologies play a pivotal role in various projects under this

mission. In cities like Pune and Bhopal, GIS has been used to plan efficient public transportation routes, ensuring citizens from all neighborhoods can access reliable and convenient transportation services.

Pradhan Mantri Awas Yojana (PMAY): PMAY, a flagship affordable housing program, leverages Geospatial technologies to identify suitable locations for affordable housing projects. GIS mapping assists in selecting areas where housing is needed the most. This ensures that the construction of affordable homes is prioritized in areas with a high demand for housing and where vulnerable populations reside.

Traffic Management in Bengaluru: Geospatial technologies have been employed in Bengaluru to address traffic congestion, ensuring efficient transportation for all residents. The city uses real-time traffic data and smart mapping to optimize traffic signals, plan road expansions, and enhance public transportation. This inclusive approach aims to benefit all citizens by reducing commute times and improving overall mobility.

> **Geospatial technologies have been employed in Bengaluru to address traffic congestion, ensuring efficient transportation for all residents. The city uses real-time traffic data and smart mapping to optimize traffic signals, plan road expansions, and enhance public transportation.**

Recommendations for Policymakers and Urban Planners

While the examples from India showcase a gradual adoption of inclusive urban development policies, policymakers, and urban planners must take on a proactive approach along the following lines:

Integrating Geospatial Technologies into Urban Policies: Policymakers must recognize the transformative potential of Geospatial technologies and embed them into urban policies. Integrating these tools can enhance the effectiveness of infrastructure development,

transportation planning, and social inclusion policies.

Investment in Geospatial Infrastructure: Governments should allocate resources for developing and maintaining Geospatial infrastructure. This includes investing in creating and updating spatial databases, satellite imagery acquisition, and implementing advanced Geospatial analytics.

Continuous Skill Development for Urban Planners: The rapid evolution of Geospatial technologies requires continuous skill development for urban planners. Training programs should be established to equip planners with the knowledge and skills needed to leverage the latest Geospatial tools effectively.

The marriage of Geospatial technologies and urban development is a powerful alliance that can pave the way for inclusive growth. By harnessing the capabilities of these tools, cities can move towards a future where every citizen, regardless of their socio-economic background or geographical location, enjoys the benefits of urban development.

Geospatial Industry Value Chain
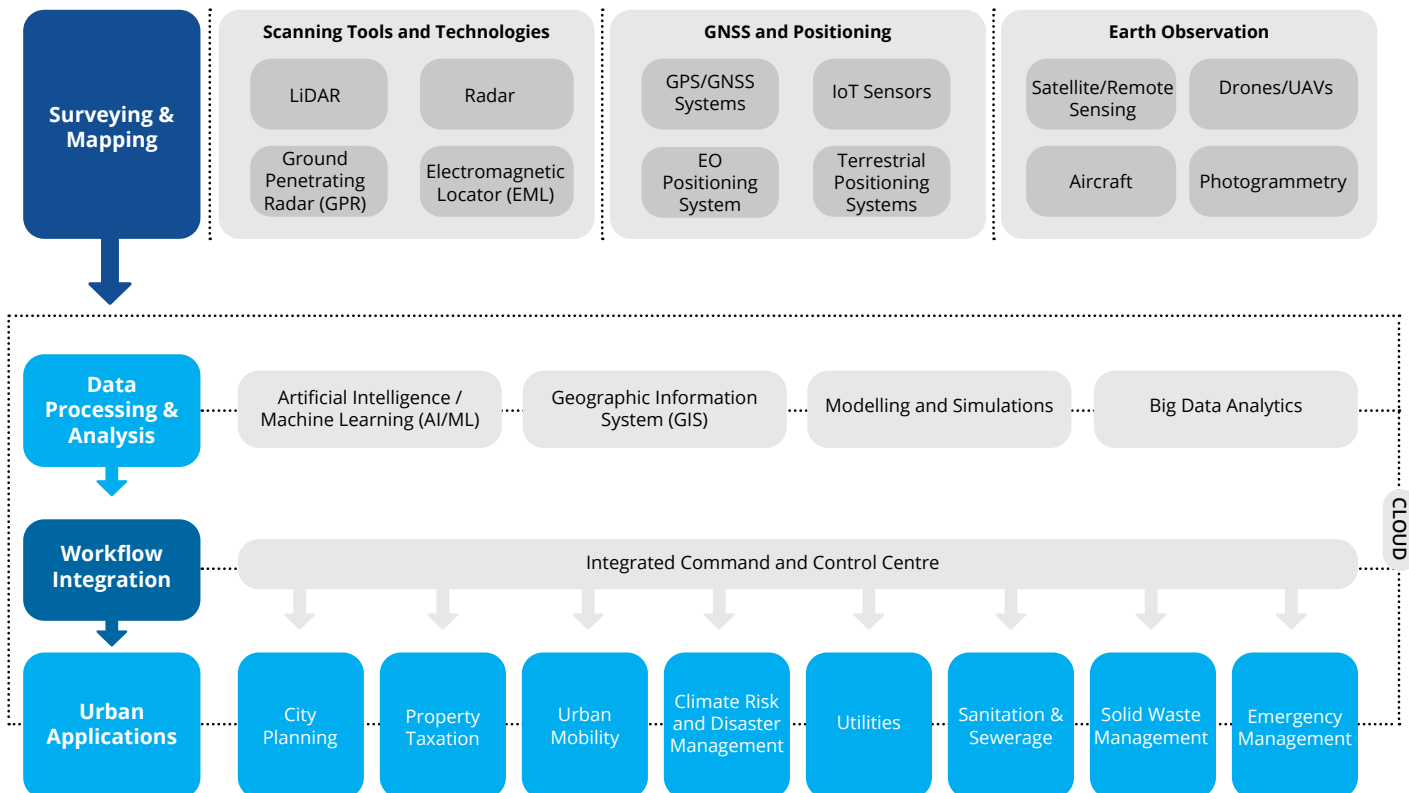
Source: AGI India Urban Affairs Report 2022

Planning Augmentation of Health Facilities under NUHM

CASE STUDY

Pixel Softek

The National Urban Health Mission (NUHM) addresses the health concerns of the urban poor population focused on setting up health facilities at suitable locations for the convenience of the listed and unlisted slums, low socio-economic populations, vulnerable populations, high-risk areas construction sites, etc. Under this program, the focus was on analyzing the adequacy and augmentation of Public Health Centers (PHCs). The program required a detailed analysis of existing facilities like the number and location of PHCs, Pulse Polio Centers, ANM Centers, and their coverage.

Geospatial Technology tools like Remote Sensing, GPS, and GIS have been adopted, providing reliable inputs for establishing new Health Facilities in many critical urban areas of Karnataka. Pixel Softek Ltd. provided such services for Chikmagalur City along these lines.

The information comprises Land Use, 2011 Census Enumeration Blocks providing information on the distribution of slums, low socio-economic and vulnerable populations in Chikmagalur City limits. Other data like locate the health units (PHCs, ANM Centres), slums, educational units, lodging and restaurants, meat stalls, vegetable/fruit shops, Swamps, waste dumps, fish markets, petty shops, entertainment units, monuments, significant landmarks, government offices, etc.

Locations for the new Urban Public Health Centre (UPHC) have been decided based on the following spatial analysis:

► Area with maximum clusters of slums
► Area covered by existing PHCs and ANM Centres
► Locations of fixed and mobile Health facilities and Health Kiosks, etc.
► Location of private health facilities

2011 Census Blocks

Health and other facilities
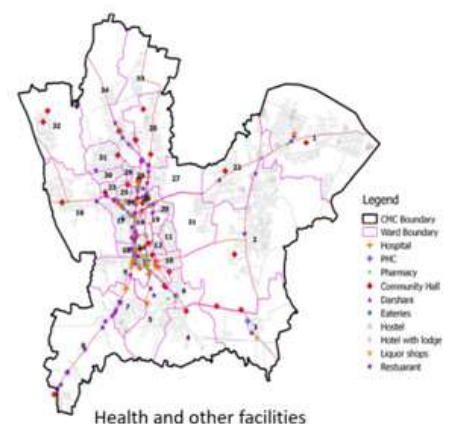
Chandrayaan 3

In News

In a historic achievement, India's lunar exploration mission, Chandrayaan-3, successfully landed on the Moon on August 23, 2023, marking a significant leap forward in India's space exploration endeavors. The landing, a collaborative effort between the Indian Space Research Organisation (ISRO) and other strategic partners, comes after meticulous planning and technological advancements.

Chandrayaan-3 is a follow-on mission to Chandrayaan-2 to demonstrate India's end-to-end capability in safe landing and wandering on the lunar surface. India's Chandrayaan-1 was the first to discover water ice in the region, which may be a source of oxygen, fuel, and water for upcoming moon missions. It may even pave the way for a more long-term lunar colony.

Roughly the size of an SUV, the Chandrayaan-3 planned to continue operating for two weeks after its historically successful landing to conduct several experiments, including a spectrometer investigation of the lunar surface's mineral composition.

Precision landing, a unique but arduous task, is at the heart of Chandrayaan 3's accomplishments. The path to a precise landing on the moon is not predetermined; instead, it is an adaptive journey fashioned by the continuous flow of geographical data. Spatial information gathered in real-time serves as the compass that directs spacecraft through the unexplored lunar terrain during lunar missions' descent and landing phases.

The spacecraft can make on-the-fly changes because of the combination of spatial data and technological prowess, ensuring the final landing is as accurate as possible. The result is before the world – a carefully planned landing that perfectly demonstrates how modern Indian technology, the ingenuity of our scientists, and their constant pursuit of accuracy come together. India has become the first country in the world to land on the moon's South Pole.

> " India's vision for global leadership was fast-forwarded with the successful landing of India's Chandrayaan on the moon. This historic event has placed India in the elite club of the top four countries that have achieved a moon landing and has taken India to one of the top-ranked countries in space technology. India is making a mark in every field, from technology to sustainability to infrastructure to space missions. Congratulations to ISRO and the scientists of India for this glorious achievement. "
>
> -Harpreet Singh, Director & Head of India Business, HERE Technologies

Initiatives

Geospatial Sector Skill Council Formation

As the Voice of the Geospatial Industry in the country, AGI has been working closely towards formation of Geospatial Skill Council since 2019. Senior industry leaders representing AGI were invited to be part of the National Committee for formation of the Geospatial Sector Skill Council. Combined with contributions from the AGI Secretariat, this committee is now spearheading a detailed proposal for sharing with relevant stakeholders.

GI's Active Role in Geospatial Sector Skill Council Formation		
2019: AGI becomes part of the Expert Committee formed for the Geospatial Sector Skill Council.	**Feb 2020:** The Expert Committee Report on the Geospatial Sector Skill Council, with AGI's active contributions, is published.	**Aug 2021:** AGI and NIGST, Survey of India, signed an MoU for Geospatial skilled training in Aug 2021.
Jan 2023: AGI met with Director NCVET to discuss and steer the formation of the Sector Skill Council.	**June 2023:** Senior industry leaders representing AGI become part of the National Committee for formation of the Skill Council.	**October 2023:** The Proposal promoters, anchored by the Department of Science & Technology, Government of India, submit a detailed proposal advocating the formation of the Geospatial Sector Skill Council in India.

## Partnerships and Engagements

The Australian High Commission

AGI is exploring multi-faceted collaborations with the Australian High Commission, focusing on fostering industry-to-industry connections in the Geospatial/Space sectors. We are collaborating on initiatives addressing future skills and capacity building, planning insightful webinars and discussions. These efforts aim to strengthen ties, promote knowledge exchange, and contribute to the growth and innovation of the geospatial industry in both India and Australia.

Business Sweden

We are actively exploring a collaboration with Business Sweden, emphasizing industry-to-industry connections and targeted stakeholder engagement, beginning with a focus on the mining sector. This collaboration aims to create meaningful partnerships, facilitate knowledge exchange, and explore diverse possibilities for mutual growth and innovation in the geospatial industry.

MoU with T-Hub

We have forged a significant collaboration with T-Hub, marked by the signing of a Memorandum of Understanding (MoU). This partnership is designed to foster innovation, entrepreneurship, and technological advancements in the geospatial sector. Several joint initiatives have been planned, including improved market access, mentorship, and networking for startups and small businesses, contribution to policy frameworks and implementation, skilling and capacity building initiatives, and recruitment drives.
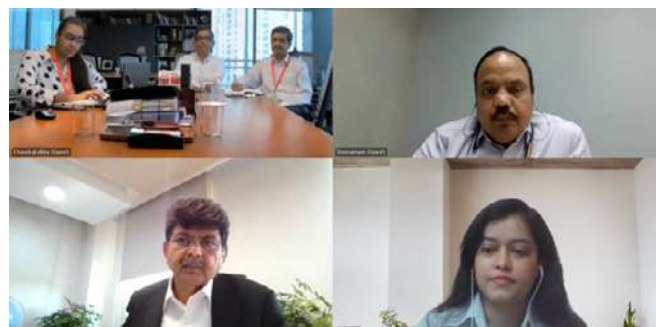
MoU with Anna University

We have entered into a collaborative partnership with Anna University, marked by the signing of a comprehensive MoU. The agreement includes provisions for capacity development initiatives, the creation of research reports, internship and recruitment channels, industry-focused competitions, and exposure to cutting-edge technologies like AI/ML and drones. The collaboration further emphasizes interdisciplinary knowledge sharing and the organization of workshops, lectures, and seminars to prepare students for dynamic careers in the geospatial domain.

Support to DST for the Manthan Workshop

AGI extended support to the Department of Science and Technology (DST) for the Manthan Workshop, a pivotal event aimed at defining the role and operational scope of DST's envisioned Geospatial innovation hub. Our assistance encompassed comprehensive agenda curation, efficient program management, mobilization of speakers and delegates, event promotion, and meticulous documentation. This collaborative effort sought to bring together diverse stakeholders from the innovation and geospatial technology sectors to collectively articulate the innovation hub's functions and operational parameters. AGI's involvement contributed to the success and effectiveness of the workshop in achieving its strategic objectives.

Partnership with BIS for TC 211 meeting in India

AGI is providing crucial support to the Bureau of Indian Standards (BIS) for organizing the ISO TC-11 meeting in India scheduled for December 2023. This support includes comprehensive assistance in agenda formulation, program management, mobilization of speakers and participants, event promotion, and detailed documentation. Our collaborative efforts aim to ensure the seamless and effective conduct of the meeting, fostering productive discussions and collaborations within the ISO TC-11 framework. AGI's involvement exemplifies our commitment to facilitating key initiatives and events in the geospatial and standards domains, contributing to the success and impactful outcomes of such crucial gatherings.

Event Partnerships

AGI has played a pivotal role in fostering collaboration and industry representation at prominent events, contributing significantly to meaningful engagements within the geospatial sector. Notably, our support and partnership extended to events such as the:

▶ Economic Times Global Sustainability Alliance

▶ Economic Times Infra Tech Summit

▶ FCC Infrastructure Today Conclave - North East

In these initiatives, AGI facilitated the mobilization of active participation and representation from the geospatial industry, ensuring a robust presence in discussions around sustainability, infrastructure focus, and regional development. These efforts underscore our commitment to enhancing the visibility and participation of the geospatial community in key thematic events across the country.

Virtual Sessions

Webinar: Mapping the Future of Geospatial: Select Insights

AGI conducted an engaging webinar that provided select insights into the future of geospatial technologies. Esteemed industry experts shared their perspectives on the evolving landscape of geospatial technology, discussing key trends, challenges, and opportunities. The webinar served as a knowledge-sharing platform, offering participants a nuanced view of the industry's trajectory and its potential impact on diverse sectors.


Webinar: GeoBIM: Current Trends and Future

AGI organized an insightful webinar on GeoBIM, bringing together industry experts to discuss current trends and future prospects in the dynamic field of GeoBIM. The webinar delved into the integration of geospatial and building information modeling (BIM), exploring the latest advancements, applications, and potential innovations. Participants gained valuable insights from expert speakers, fostering a deeper understanding of the evolving landscape and future trajectories in GeoBIM.

Interview: PRSC Director

In a virtual interview, AGI had the honor of hosting the Director of the Punjab Remote Sensing Centre (PRSC), Dr. Brijendra Pateriya. The interview delved into various aspects of geospatial technology, highlighting its role in diverse applications and the pivotal work undertaken by PRSC. The Director shared valuable perspectives on the current state and future directions of geospatial initiatives, providing unique insights into the challenges and opportunities within the geospatial domain.
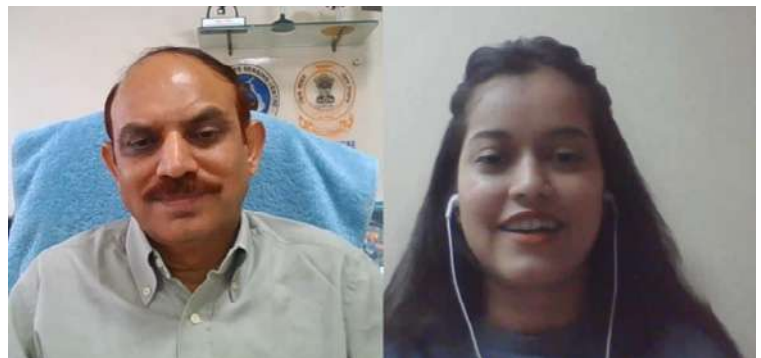
Upcoming Event

Survey of India's Inauguration of Nationwide CORS Network and Stakeholder Conference

AGI is supporting the Survey of India in the "Inauguration of Nationwide CORS Network and Stakeholder Conference on Ortho-Rectified Image (ORI) and Digital Elevation Model (DEM) Generation," where dignitaries will discuss the roadmap for better applicability of the newly established CORS network in the country, as envisaged in the National Geospatial Policy 2022. Dr. Jitendra Singh, Hon'ble Minister of Science & Technology, shall inaugurate the recently established and operationalized countrywide CORS network during the event.

| Timing: October 12, 2023 | 10:00 AM - 5:00 PM | India Habitat Centre, New Delhi |

We value your feedback

AGI seeks to explore various avenues to enhance the quantum of interaction between geospatial industry units, academia, government and various other geospatial players. Therefore, we keenly look forward to your feedback and suggestions on various issues that can help meet our objectives. Write to: sakshi.singh@agiindia.com

AGI
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