ArcIndia News

COVER STORY

GIS

Creating a Better Future

CASE STUDY
MCD Achieves More Effective Governance with ArcGIS

ARTICLE
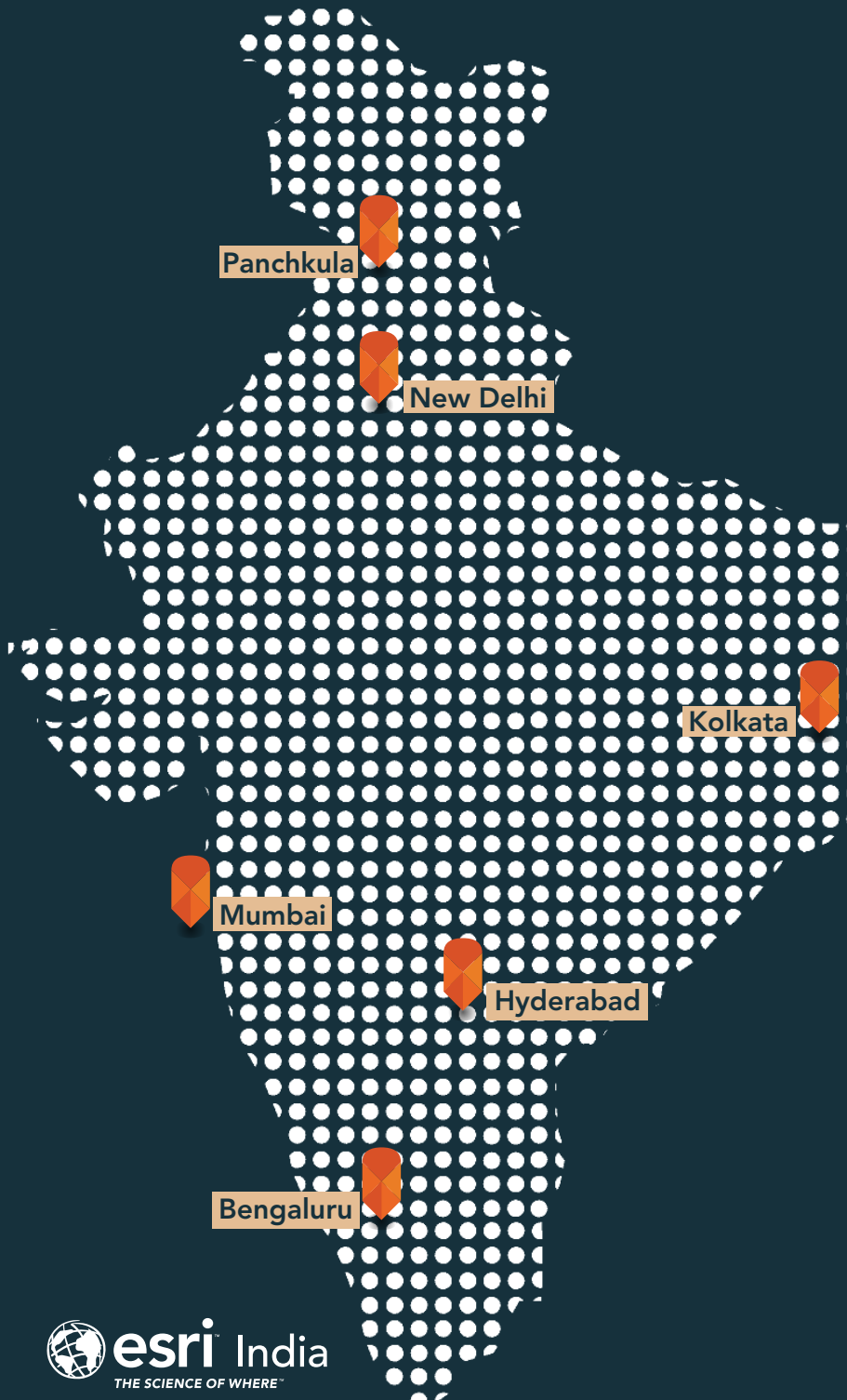Geospatial Industry: Yesterday, Today, and Tomorrow

PRODUCT REVIEW
ArcGIS Hub

ESRI INDIA LOCATIONS

DELHI NCR

Noida (Corp. Office)
10th Floor, Max Tower, Sector - 16B
Noida - 201301, Uttar Pradesh

Jasola (Regd. Office)
Plot no. 8, Elegance Tower, 5th Floor,
Unit No.505 & 506, Pocket - 1, Jasola Vihar,
New Delhi - 110025, Delhi

BENGALURU
IndiQube Gradeur 14, Walton Rd,
Shanthala Nagar, Ashok Nagar,
Bengaluru - 560001, Karnataka

HYDERABAD
Apeejay Business Center, Tresorie,
1st Floor, The PARK, 22, Raj bhavan Road,
Hyderabad - 500082, Telangana

KOLKATA
Urbanwrk Private Limited, 8th Floor, Technopolis
Building, BP Block, Sector V, Bidhannagar,
Kolkata - 700091, West Bengal

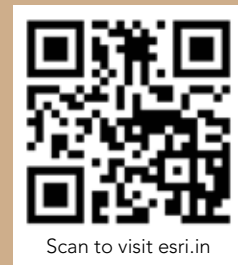**MUMBAI**
AWFIS Space Solutions Private Limited,
Auram Qparc, Building Q2, 8th Floor, TTC,
Thane-Belapur Road, Ghansoli,
Navi Mumbai - 400710, Maharashtra

PANCHKULA
3rd Floor, Plot No 16, IT Park, Sector - 22,
Panchkula - 134109

1st Floor, Plot No - 1, South Block, IT Park, Sector - 22,
Panchkula - 134109

esri India
THE SCIENCE OF WHERE

Esri India Technologies Pvt. Ltd.

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CONTENTS
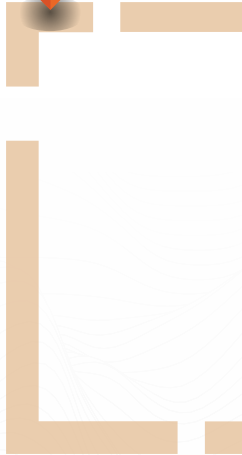
MD'S DESK
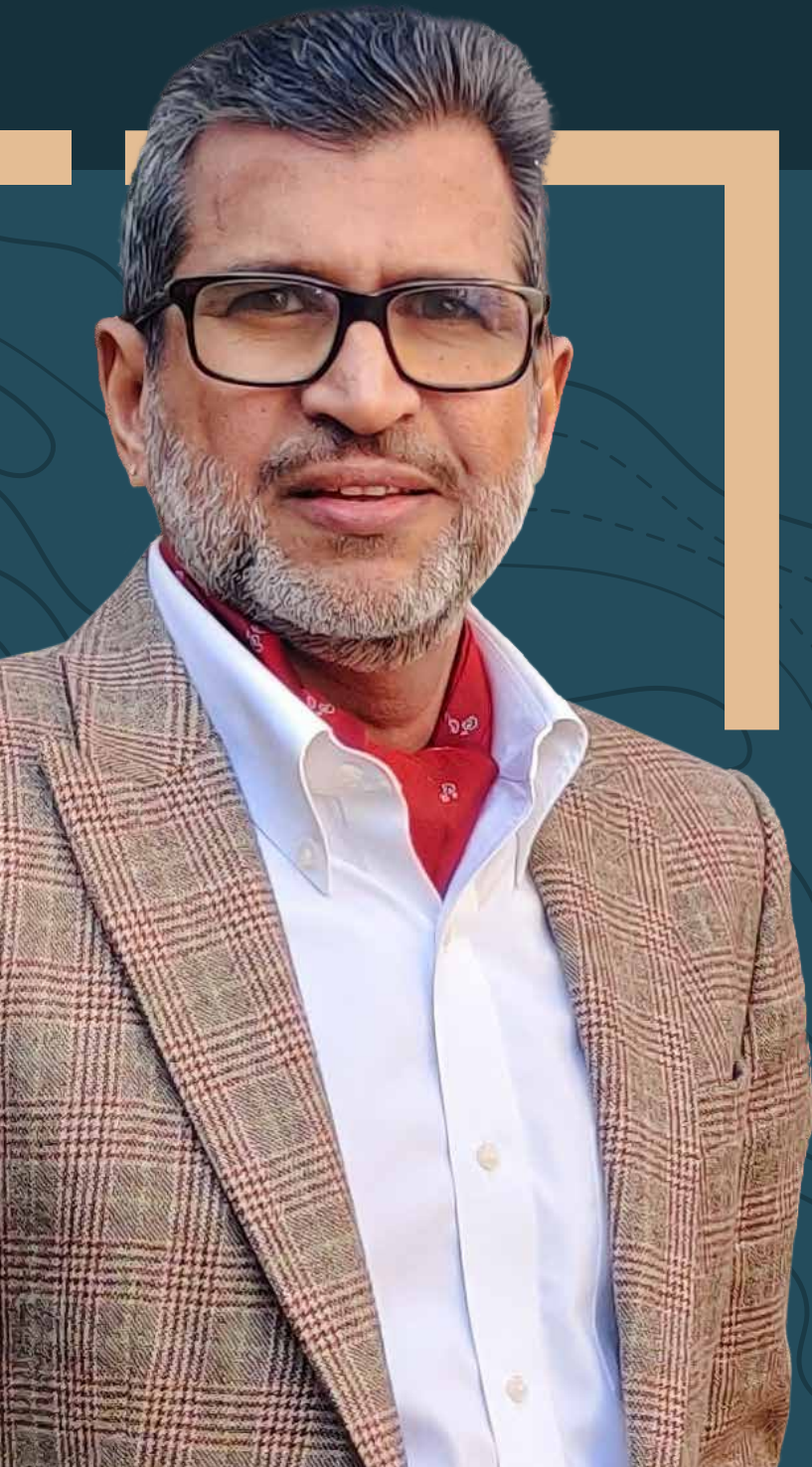
Our world is evolving rapidly, presenting us with new challenges that demand responsible innovations for a better understanding of the situation. Indo ArcGIS has powerful spatial analysis and data science capabilities. We now have over 2,000 geoprocessing tools, models, and methods for addressing some of the most pressing problems that the world is facing. Improving the availability of geospatial data is one of the key priorities for Esri India. We publish authoritative geospatial maps and datasets as 'Living Atlas of India', a part of Indo ArcGIS. Living Atlas, a dynamically growing data repository that now has more than 1000 layers of Indian content is a result of collaborative efforts with various government departments and private organizations.

As geo-technologists, we must keep on exploring diverse ways to lead and help organizations harness spatial intelligence to shape a better future. GeoAI, which is the fusion of AI and machine learning with GIS, is setting new standards in spatial analysis. To make the power of GeoAI accessible to everyone, from seasoned data scientists to those just starting their journey, Esri has integrated robust GeoAI capabilities into ArcGIS, making it easier than ever to leverage the full potential of artificial intelligence within your workflows. ArcGIS now has more than 70 GeoAI models that different industries can readily use. You can download these models to quickly get started with detecting, classifying, identifying, and extracting information from your data.

At the intersection of the Internet of Things (IoT) and location, executives are uncovering hidden reserves of business intelligence. Tools like Esri's GeoEvent Server allow organizations to connect and monitor real-time feeds and IoT data, while ArcGIS Velocity offers a managed SaaS solution for processing real-time IoT and big data analytics. This platform enhances visualization, scalability, and spatial analysis capabilities.

The advent of Industry 4.0 and IoT has accelerated the adoption of digital twin technology across various industries. Digital twins of fixed assets or real-world systems greatly benefit from integrating GIS data that reflects geographic context. GIS can not only create digital twins of both natural and built environments but also amalgamate various digital representations of the real world.

Agendra Kumar

Managing Director, Esri India

ArcGIS is foundational for any digital twin initiative. It integrates different data types and systems, creating a comprehensive view accessible throughout the entire project lifecycle. ArcGIS improves data capture and integration, enables real-time visualization, offers advanced analysis and future predictions, and facilitates information sharing and collaboration. A wide range of GIS products can be employed for digital twin applications, including ArcGIS Enterprise for integrating drone and LiDAR outputs, GeoBIM, Indoors, UNM, GeoEvent Server, and ArcGIS Urban.

Another dimension is dealing with big data, with millions or billions of records. ArcGIS GeoAnalytics Engine is designed to enhance big data workflows by delivering advanced spatial capabilities directly into your cloud analytics environment. Increasingly, big data libraries are put into cloud warehouses or data lakes. We provide more than 180 spatial functions and tools that you can run in your Spark environment to bring analysis close to these data libraries and get great performance as you process millions, and even billions of records.

Additionally, 3D and augmented reality technologies are revolutionizing our interaction with spatial data. These innovations are essential for urban planning and infrastructure development, providing immersive experiences and in-depth insights. ArcGIS Reality Studio is an advanced photogrammetry product, optimized for creating 3D digital twins.

At Esri India, we are dedicated to fostering innovations in GeoAI, IoT, and AR by delivering high-quality products, developing effective solutions, and strengthening collaboration with our customers and partners. Together, we strive for a sustainable future powered by cutting-edge technologies.

Master's Scholarships
in GIS 2024 Winners Announced

Dishita Prasad
M.Sc. Geoinformatics
Teri School of Advanced Studies, New Delhi

Praveen R
M.Sc. Agriculture

SKUAST-Kashmir

Ankur Siwach
M.Tech Geoinformatics

Punjab University

Ayushi Sharma
M.Tech Remote Sensing

IIT Bombay

Kapu Shravani
M.Sc. Geoinformatics

IIT Tirupati

Hinal Luvani
M.Plan Urban & Regional Planning

SPA, Bhopal

Jaya Prakash
M.Tech Geoinformatics

IIT Kanpur

Raihan A Khan
M.Sc. Geoinformatics

BIT Mesra

Kunal Tanwar
M.Sc. Geoinformatics

Symbiosis Institute of Geoinformatics

Himani Chaudhary
M.Plan Urban & Rural Planning

IIT Roorkee

The second year of the Master's Scholarships in GIS Program concluded at the Esri India User Conference 2024-Delhi Chapter on 5th September with the announcement of the 10 recipients of this year's Scholarship. This scholarship is available to Indian students entering their second year of postgraduate studies (M.Tech/MSc.) in Geoinformatics or related fields at accredited institutions or universities in India.

Agendra Kumar, Managing Director, Esri India said, "We introduced the Master's Scholarships in GIS Program to help students enhance their skills in and make impactful contributions toward solving the pressing social and business challenges of today. The overwhelming response we have received to the initiative for two consecutive years is very encouraging. The chosen recipients have exhibited exceptional clarity of thought, a strong drive to innovate, and a commitment to societal betterment. We are proud to announce the 10 winners of this year's scholarship and wish them a successful professional journey ahead."

Esri India received more than 250 applications for the Scholarship Program from students pursuing courses in Urban Planning, Remote Sensing, Soil Science, Environment and Water Resource Engineering, Geology, Geoinformatics, and more at varied prestigious institutes/universities across the country. After thorough rounds of assessment, 10 students, pursuing their post-graduate studies in the following colleges/universities have been selected for the prestigious Scholarship:

- **IIT Tirupati**
- **IIT Kanpur**
- **IIT Bombay**
- **IIT Roorkee**
- **Punjab University**
- **BIT Mesra**
- **Sher-e-Kashmir University**
- **TERI School of Advanced Studies**
- **Symbiosis Institute of Geoinformatics**
- **School of planning and Architecture, Bhopal**

Congratulations to all winners!

IPE GLOBAL Expanding Horizons. Enriching Lives. **and** **esri** India THE SCIENCE OF WHERE™

Release a Study on Climate Change

Over 85 percent of Indian districts are prone to flood, drought, cyclone, and heat waves, of which 45 percent are witnessing a swapping trend, according to an independent study released by IPE-Global and Esri-India. The frequency, intensity, and unpredictability of these climate extremes have also risen in recent decades by four-fold. Using a pentad-decadal analysis, the study compiles a catalogue of extreme climate events over a 50-year historical period from 1973 to 2023 by employing spatial and temporal modelling. The research provides a detailed district-level assessment, exploring the complexities and non-linear trends and patterns of these events. The study was launched at Climate Technology Summit's plenary session titled "Leveraging GIS Technology to Mitigate Climate Risks" organized by Esri-India and IPE Global.

Agendra Kumar, Managing Director, Esri India, said, "Building climate resilience requires maintaining a delicate balance of both climate adaptation and mitigation approaches. Geography is key, be it for understanding future climate projections for policy interventions or efficiently planning intervention approaches such as nature-based solutions, technological solutions, or social solutions. GIS technology, with advanced spatial analysis tools and the ability to integrate a variety of data, enables this geographic science approach. GIS technology is already the core foundation of various environmental initiatives, disaster resilience programs, infrastructure, utilities, natural resources management, and missions like smart cities, AMRUT, National Water Mission, and Clean Ganga among others. GIS-driven solutions like Climate Risk Observatory with vulnerability maps, apps, and data have the potential to help stakeholders better understand the sectoral impacts of climate change and build a more resilient future."

Abinash Mohanty, Head- Climate Change and Sustainability Practice at IPE Global and the author of the study, said, "The current trend of catastrophic climate extremes that makes 9 out 10 Indians exposed to extreme climate events are a resultant of 0.6 °C temperature rise in the last century. El Nino is gaining momentum and making its early presence felt across the globe with India facing the extreme events turbulence more

in patterns than waves. Recent Kerala landslides triggered by incessant and erratic rainfall episodes, floods in Gujarat, disappearance of Om Parvat's snow cover and the cities getting paralysed with sudden and abrupt downpour is a testament that climate is changed. Our analysis suggests that more than 1.47 billion Indians will be highly exposed to climate extremes by 2036 and these numbers peak of volumes. Embracing hyper-granular risk assessments and establish climate-risk observatories and infrastructure climate fund should become a national imperative to safeguard Indian economy especially for sensitive sectors like agriculture, industry, and large-scale infrastructural projects from the vagaries of climate change."

Ashwajit Singh, Founder and Managing Director- IPE Global, said, " While India's per capita CO2 emission is 1/3rd that of global average and a fraction of the developed nations like USA and China but it faces burnt of climate change the most. Climate is 'Code Red' and a risk multiplier that makes worse already existing challenges. With the world progress alarmingly insufficient on UN SDG index, climate change is a global emergency inextricably linked with sustainable development. India fairs very well when it comes to its compliance with SDG targets for climate change. To meet climate goals, India must shift its budget focus from mitigation to adaptation. Current practices underfund climate resilience, risking long-term sustainability. India, in particular, experienced an 8 per cent GDP loss in 2022 and a cumulative capital wealth decrease of 7.5 percent due to climate impacts. We at IPE Global realise that tackling the climate crisis requires movement-building and on-the-ground action. We are continuously striving to develop and implement strategies that convert environment risks into competitive advantage- and this study is a testament to how we can bring innovations from margins to mainstream that make India and Global South climate ready. By fostering partnerships across sectors, investing in innovation, and empowering communities, we believe that India can pave the way to become the climate solutions capital to the world" to build a sustainable future which creates harmony between people and planet."

Esri India
User Conference
Successfully Concludes in 3 Cities

The Esri India User Conference is known to create an amazing ambience of insightful discussions, unique networking opportunities, innovative showcases, and impactful knowledge-sharing sessions. **It was held on 5-6 September in Delhi, 10 September in Hyderabad, and 12 September in Kolkata.** The theme of the conference was **'GIS – Mapping a Better Future'**. As India's largest GIS conference, Esri India UC brought together GIS professionals, thought leaders, influencers, and key figures from the geospatial industry.

At the Conference, organizations from across the country demonstrated how GIS technology can fortify national

organizations are rapidly welcoming GIS to enhance every sphere of their lives. From infrastructure development to enabling rightful/responsible use of utilities, communities are transforming themselves by adopting a geographic approach. The Esri India User Conference is an empowering opportunity to stay connected to the vibrant and innovative GIS industry; and as the GIS community connects here, we strive to create a robust GIS ecosystem, that powers business decisions, supports government operations, and creates a better world."

resilience by improving preparedness, reinforcing infrastructure, advancing public health, and empowering communities to navigate environmental challenges. Powerful keynote sessions, engaging technical workshops and demos, specialized industry tracks, enriching paper presentations, and a vibrant exhibition area addressed, how GIS, in convergence with emerging technologies such as digital twins, artificial intelligence, and IoT, is helping in building solutions that can create a better future for all.

The Esri India User Conference featured a wide array of insightful discussions, including dynamic plenary sessions, focused tracks on the developments in ArcGIS technology, and user presentations showcasing the latest innovations and best practices in GIS technology adoption.

Awards were also presented to users from diverse sectors to celebrate the use of GIS in making a difference.

The Conference featured multiple industry-specific parallel tracks, where industry experts nationwide demonstrated how they are utilizing Geospatial Technology for data-driven decision-making and enhanced business operations.

Agendra Kumar, Managing Director, Esri India said, "GIS serves as a crucial enabler of the future we all want to see. With GIS technology, we can unravel complex issues such as climate change, sustainability, and social inequity—and thereby discover where to take action. Fortunately, today

The Infrastructure and GIS Summit featured ArcGIS users from around the country, as they spoke about how they are utilizing GIS to enhance the efficiency and effectiveness of their construction projects. The integration of technologies like Remote Sensing, Digital Twin, LiDar, BIM, Drones/UAVs, 3D, Augmented Reality, Big Data, and the Internet of Things (IoT) with GIS and its ability to deliver the maximum benefits to the stakeholders were also demonstrated.

The Imagery Summit showcased real-world applications of imagery across industries. The Esri India team demonstrated advanced Image Processing and Analysis capabilities within ArcGIS and ENVI and introduced the audience to a robust suite of tools for managing, analyzing, and serving imagery effectively.

As a part of the **Energy Summit**, eminent ArcGIS users and the Esri India team showcased the capabilities of GIS for empowering utilities. Various advanced tools for mapping, spatial analysis, and location intelligence were demonstrated, which are playing a key role in the transformation of the Utilities Sector.

The Water & GIS Summit showcased how the latest advancements in spatial data science and geospatial technology are aiding the transformation for integrated and collaborative water resource management. Users from across the country demonstrated how they are adopting GIS for managing key water resources, and a panel of eminent industry experts discussed the future of the Water Sector in the country.

The Esri India team took the stage during the **Digital Twin Summit** to showcase how Esri Technologies, coupled with BIM and Digital Twin, are helping industries manage construction projects more efficiently. It also discussed the varied applications of geospatial technology for enhanced operational awareness and increased collaboration.

The Climate Action Technology Summit demonstrated the tools GIS technology provides us with, that are needed to visualize, analyze and understand the complex risks posed by climate change, in turn helping build climate resilience and safeguarding our future. The panel, as a part of the Summit, featured eminent users discussing how GIS technology can be better leveraged to mitigate and address climate risks.

Esri India Launches

Indo ArcGIS®

Business Analyst

Esri India has announced the availability of 'Indo ArcGIS Business Analyst', a location intelligence solution suite designed to aid government organizations in making data-driven smart decisions. Indo ArcGIS Business Analyst for India includes a variety of location-based datasets, such as points of interest; road network; administrative boundaries at various levels like village, PIN codes, district, state, etc.; socio-economic and demographic data; and data available from the Indian edition of ArcGIS Living Atlas, while providing the flexibility to the users to add their own data.

The solution has the potential to greatly enhance the efficacy of government departments by offering precise insights into spatial and demographic factors. Using the solution, government agencies can make data-driven decisions, optimize resource distribution, and customize efforts to achieve more effective outcomes in public safety, economic development, community assessments, city development, and more. They can make a greater impact on the lives of the citizens using the available data as the developmental efforts become more targeted and reach the maximum number of beneficiaries.

Agendra Kumar, Managing Director, Esri India, said, "Location intelligence plays a crucial role in government decision-making by providing invaluable insights derived from geographic and spatial data. 'Indo ArcGIS Business Analyst' is a unique solution that provides insights into population density, demographics, site suitability, and other critical factors. Using these insights, government stakeholders can enhance the impact of their functions around socio-economic development, emergency management, healthcare, public safety, workforce development, and more. By leveraging location intelligence, government departments can make more informed, data-driven decisions that improve efficiency, responsiveness, and overall quality of life for citizens."

The power of location intelligence and analytics is being recognized all over the world. Data availability and sharing are now easier in India. With enabling policies like the National Geospatial Policy and the Geospatial Data Guidelines in place, the availability of geospatial data has improved. Being a leader in providing solutions based on geospatial technologies, Esri India has launched Indo ArcGIS Business Analyst to enable Indian government organizations to optimally utilize Indian datasets for carrying out location-specific analysis and achieve high levels of efficacy in their initiatives.

Mapping a Better Future

The Fusion of GIS and Advanced Tech

Geospatial data serves as a foundation for decision-making processes in numerous fields, including environmental management, urban planning, disaster response, business analysis, and healthcare. By leveraging geospatial data, we can tackle complex challenges such as climate change, sustainability, and social inequity, and identify actionable solutions. Esri's ArcGIS Living Atlas of the World is the foremost collection of geographic information from around the globe. It includes maps, apps, and data layers. With an intent to enable Indian users to make more informed decisions, Esri India in collaboration with various government and private data providers, has published authoritative geospatial maps and datasets as 'Indo ArcGIS Living Atlas of India'. Indo ArcGIS Living Atlas of India is a collection of curated geographic content, including ready-to-use base maps, maps, layers, apps, and tools. This is a dynamically growing dataset repository of India. Currently, there are 1000+ data layers of Indian geospatial content.

GIS provides a platform to store, manage, and analyze geospatial data to help make informed decisions in a variety of fields. Today, organizations are increasingly adopting GIS

NMCG Empowered to Clean River Ganga and Its Tributaries with PRAYAG using ArcGIS

Namami Gange is running PRAYAG (Platform for Real-time Analysis of Yamuna, Ganga & their Tributaries) for Monitoring, review, and accountability measures. PRAYAG is a collaborative Platform to access Information, Data Maps, Apps & Dashboards for Ganga Basin. The significance of PRAYAG had brought a paradigm shift in the visualization of all crucial spatial and non-spatial information of the Ganga basin to adopt accurate & transparent decisions.

The various interventions under Namami Gange have resulted in significant improvements in the water quality of river Ganga. As a result of multi-sectoral interventions, the comparison of median data of water quality parameters viz. Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) and Fecal Coliforms (FC) of years 2014 and 2023 (Jan to Sept), DO median has improved at 32 locations, BOD median has improved at 43 locations and the FC median has improved at 25 locations respectively. The stretch of River Ganga from its origin up till Haridwar has reached Class A, i.e. highest standard of water quality. Based on the water quality assessment by CPCB in 5 Ganga main stem states in 2023 (January to September), the observed water quality indicates that the median value of Dissolved Oxygen which is an indicator of river health has been found to be above the minimum acceptable limits notified for primary bathing water quality criteria and satisfactory to support the ecosystem of river for almost entire stretch of River Ganga. The median value of Biochemical Oxygen Demand (BOD) has been found less than the maximum acceptable limits of 3mg/L except a marginal exceedance (BOD: 3.2 to 4.5 mg/L) in 2 locations.

The GIS-based Web Centric Water Quality dashboard helps in visualizing the status of River Ganga Water Quality by means of "Monitoring Station wise Water quality Indicator" dashboard. It shows the water quality as reported through monitoring stations at various locations along the river Ganga. This dashboard, as its first phase; is an attempt to create a web-centric GIS-based scientific Water Quality Application by using 7 years' data (2014 to 2021) with 4 parameters DO, BOD, FC, and pH. The data from seven years were processed in a percentile-based method (90, 50 and 10 Percentile) and compliance criteria applied for individual parameters separately. The data can be filtered on the basis of States, Districts, Monitoring Stations, Station Codes, Years, etc. The portal allows users to extrapolate and make sense of trends to better identify decisions in "Nirmal Ganga".

to enhance various aspects of their operations. Whether it's advancing infrastructure development or ensuring the responsible use of utilities, communities are transforming through a geographic approach. GIS is fostering innovations in all fields from infrastructure development to utility management to water resource management to climate action. GIS is already the core foundation of various environmental, disaster resilience, and natural resources management programs like AMRUT, the National Water Mission, and Clean Ganga among others. GIS-driven solutions, powered with vulnerability maps, apps, and data have the potential to help us better understand the sectoral impacts of climate change and build a more resilient future.

GIS is helping us to solve crucial social and business challenges more effectively with its integration with new-age technologies like artificial intelligence (AI), machine learning (ML), deep learning (DL), Internet of Things (IoT), augmented reality (AR), virtual reality (VR), Big Data, Digital Twin, etc.

GeoAI: Setting Grounds for a Sustainable Future

The integration of artificial intelligence and location intelligence has given rise to a revolutionary field: geospatial artificial intelligence (GeoAI). GeoAI merges AI with geospatial data and technology to accelerate workflows, unveil valuable insights, and address spatial challenges with unprecedented speed and accuracy. Monitoring and analyzing events in real-time GeoAI enhances situational awareness and enables more informed decision-making and more effective and equitable outcomes across sectors.

GeoAI is embedded throughout ArcGIS across a wide variety of geoprocessing and exploratory analysis tools. Machine learning algorithms in ArcGIS are used in the analysis of spatial data to perform clustering, prediction (classification and regression), and spatiotemporal forecasting. Deep learning is used in ArcGIS to generate geospatial information from sensor data (including imagery and point clouds) using techniques and tools for pixel classification and image segmentation, detecting objects and extracting features, object tracking, change detection, and image simulation. Deep learning is also used to generate geospatial data from unstructured text using a variety of natural language processing (NLP) techniques. Deep learning can also be used for the analysis

of spatial data to make predictions and forecasts. **Many of our most challenging problems require bringing together GeoAI and other powerful spatial analysis techniques to both understand and effectively address these challenges.**

State and local government

By leveraging GeoAI, governments can model the impacts of urban development, understand the availability of resources to the population, forecast road and infrastructure deterioration, and identify land-use change (such as new buildings) to proactively take action.GeoAI has the potential to transform e-governance by leveraging digital technologies to improve government processes and service delivery. Integrating GeoAI into e-governance has the potential to transform how public authorities make decisions, allocate resources, and deliver services. By leveraging GeoAI, governments can analyze spatial data to reveal patterns, trends, and relationships that were once difficult or time-consuming to uncover. These insights facilitate evidence-based decision-making, resulting in more effective and targeted policies and services for citizens. The widespread availability of location-based data and advances in sensor technologies have elevated GeoAI as a key element in effective governance. By combining geographic information with AI-driven analytics, GeoAI offers a deeper understanding of spatial relationships, aiding governments in making informed decisions on various issues such as urban planning, infrastructure development, disaster management, and public health.By leveraging GeoAI, governments can model the impacts of urban development, understand the availability of resources to the population, forecast road and infrastructure deterioration, and identify land-use change (such as new buildings) to proactively take action.GeoAI has the potential to transform e-governance

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> By leveraging GeoAI, governments can analyze spatial data to reveal patterns, trends, and relationships that were once difficult or time-consuming to uncover. These insights facilitate evidence-based decision-making.

Integrating GeoAI into e-governance can enhance service delivery, increase transparency, and improve citizen engagement. Additionally, it allows for the identification of patterns and trends in spatial data, leading to more effective resource allocation and targeted interventions. GeoAI also supports predictive analytics, where algorithms use historical spatial data to forecast future trends and patterns.

National mapping agencies

GeoAI has enhanced traditional geospatial analysis and mapping, altering the methods for understanding and managing complex human–natural systems. The technology is enhancing the responsiveness, productivity, and speed of product delivery for national mapping agencies. Through automation, these organizations are scaling their internal capacities and production workflows. A national mapping department can quickly update a nation's GIS in hours, not months or days.

Earth observation spans multiple domains: air, land, and sea. One unifying technology is needed for mapping large geographic datasets in national domains. It requires a platform that is highly adaptable to support aviation, topographic mapping, and disaster response, as well as maritime charting of the ocean's bathymetry, water column, and littoral zones. Esri's ArcGIS platform utilizes GeoAI for object detection and classification from both point clouds and raster surfaces derived from remotely sensed data.

Globally, National Mapping Department and Program managers are in an exciting transition time for the implementation and scaling of GeoAI workflows within their organization. By leveraging GeoAI Geospatial organizations can quickly update the currency of a nation's foundation baseline imagery, elevation, and geospatial vector information over large geographic regions and deliver the ability of providing decision making information faster and more accurately. GeoAI with ArcGIS Production Mapping and ArcGIS Defense Mapping are the future of accelerated information production for National Mapping.

An important part of the evolution is moving beyond the desktop into enterprise environment that fosters the success of human and machine teams. These enterprise systems can leverage technology like ArcGIS Notebook Server to ensure security and proper access to shareable AI models across the organization.

Defense and intelligence

GeoAI is speeding up how organizations extract information, identify patterns, and determine changes in big data. An intelligence organization can support its activity-based intelligence efforts by automating how it analyzes information related to events, entities, surveillance video, and remotely sensed data.

Spatial machine learning algorithms and deep learning techniques have become highly advanced, thanks to unprecedented computing power. Utilizing these technologies on extensive collections of imagery or geospatial data can significantly enhance the intelligence production cycle. Applications include automatic change detection, socio-economic analysis, maritime safety, and the analysis of space and cyber events, among others.

Public Safety

GeoAI is improving public safety as it relates to traffic accidents, emergency response, and disaster management. Organizations are making communities safer by predicting where accidents are likely to occur and optimizing emergency response times. After natural disasters, assessing damage quickly is crucial for effective recovery and aid. Custom deep learning models can be trained on historical imagery to identify damaged structures from recent events. These models enable rapid damage assessment, helping responders allocate resources more efficiently and allowing insurance companies to process claims faster. With automated assessments, disaster response teams can make data-driven decisions on priority areas for aid and rebuilding.

BFSI

GeoAI empowers financial institutions by incorporating AI-driven geospatial workflows to enhance ESG (Environmental, Social, and Governance) analysis, risk assessment, and asset management. Through predictive analytics, it evaluates the influence of location-based factors on investments, aiding in the identification of market trends and the optimization of strategies. This integration promotes sustainable finance innovation and supports banks in supervisory functions, ultimately fostering a more resilient and informed financial ecosystem.

AEC

AI and GeoAI are revolutionizing how we plan, manage, and safeguard our cities. By harnessing the power of these technologies, we can build urban centers that are not only sustainable but also capable of withstanding the challenges of tomorrow. As these technologies continue to evolve, we can expect even more innovative applications that will enhance the quality of life for all city dwellers.

GeoAI is transforming the architecture, engineering, and construction (AEC) industry with its ability to extract information from imagery, which feeds a digital twin. This data allows decision-makers to improve project management, identify potential risks, and optimize building performance. As a result, architecture firms can design energy-efficient buildings. **GeoAI can analyze energy consumption patterns across different city districts. This allows for the strategic placement of renewable energy sources and optimized energy grids, promoting sustainability and reducing reliance on fossil fuels.**

Informal settlements, which are often dynamic, may not be accurately represented in census data, leading to outdated population estimates. Fine-tuning existing deep learning models to detect building footprints in informal settlements can help local governments maintain accurate population counts. By training a model with local aerial imagery and adjusting it to specific geographic parameters, governments can estimate populations more accurately and allocate resources for essential services effectively. A technology that's increasingly enabling the AEC sector to perform better is Digital Twin Technology. Digital twins are virtual representations of the real world including physical objects, processes, relationships, and behaviors. For the AEC industry, a digital twin is in the form of a built asset. Take, for example, an office building and its digital twin. At the end of design and construction, there is an exact, digital replica of the entire building, from the roof to the HVAC system and MEP. The actual, physical building is mirrored as a 'twin' in a digital, dynamic format. Unlike a digital model or a simulation, a digital twin isn't static. Just as the final, completed office building changes with use, so does the digital twin. It is responsive and continues to evolve as more data is supplied to it, such as data from artificial intelligence, sensors, or the Internet of Things. That means it can also simulate and predict informed decisions based on real-world conditions of the building.

With advancements in 3D modeling and simulations, Digital Twins are increasingly assuming greater significance in the AEC workflows. The proliferation of IoT sensors and devices is providing accurate insights for enhanced location awareness and response. Smart applications streaming real-time insights into ArcGIS enable seamless monitoring and administration of the construction processes, facility

management, and environmental monitoring. Opportunely, there is an array of GIS products that are being utilized for digital twin deployment, including ArcGIS Urban, ArcGIS Indoors, ArcGIS CityEngine, ArcGIS Velocity, and ArcGIS Reality.

> ArcGIS technology is the foundation for digital twins, providing solutions to achieve an organization's vision and its transformation objectives. Digital twins are abstracting and modeling everything. They offer a means to improve business processes, reduce risk, optimize operational efficiencies, and enhance decision-making with automation to predict future outcomes.

Business

GeoAI is accelerating smart business decisions as well, delivering insight and predictions that drive better market planning, site selection, supply chain efficiency, and customer intelligence. With these insights, a business can respond to customer behavior and determine whether a new market area is viable based on pattern and predictive analysis of market characteristics.

Managing global logistics in real-time

FedEx's global logistics operation relies on extreme precision. To keep planes and deliveries on time, FedEx uses sophisticated enterprise GIS to track its fleet. That GIS is augmented with AI's predictive capabilities to identify when a plane would need parts or maintenance, making a complex supply chain even more efficient and on schedule.

An emerging step in retail evolution is **'halo forecasting'**– a sophisticated approach that merges location data, transaction history, consumer profiles, and AI to predict sales across both physical and digital channels.

McKinsey estimates that halo forecasting can boost a store's sales by 20 to 30 percent. However, retail executives need precise predictions to capitalize on this phenomenon. Halo forecasting offers exactly that by blending AI, big data analysis, and location intelligence to project the financial impact of the halo effect with remarkable accuracy.

Halo forecasting surpasses traditional methods by analyzing vast amounts of data and accounting for numerous variables that influence sales. Unlike spreadsheets, which struggle with large data sets, halo forecasting leverages cloud computing and machine learning to handle complex interactions among thousands of factors affecting sales.

The forecasting process begins with predicting in-store sales for a new location, using machine learning to model potential areas. GIS technology then assesses these areas' proximity to potential customers based on demographics and spending habits. This initial analysis is scaled to provide comprehensive forecasts for entire markets with accuracy often exceeding 90 percent.

The final step integrates digital sales into the forecast, offering an unparalleled view of how new store locations will impact both in-store and online revenues. With halo forecasting, retail executives gain a unique edge in business planning, enabling them to identify prime locations and collaborate effectively with real estate professionals.

Halo forecasting combines consumer demographics, retailer data, and geospatial intelligence to deliver insights that were previously out of reach. In a rapidly evolving retail landscape, the ability to predict business outcomes across multiple channels provides a significant competitive advantage.

Natural Resources

GeoAI is helping us get more effective outcomes in natural resources management as well. Foresters and landowners use GeoAI to give them knowledge about the volumes and species of trees without a time-consuming on-site inspection. The technology is also revolutionizing the precision agriculture market by aiding the automated detection of invasive species. Additionally, GeoAI is helping the oil and gas industry monitor assets through automated extraction of flares, new well pads, or field access roads.

As the above discussion unfolds, the applications of GeoAI are increasing day by day. The GeoAI industry is projected to grow significantly (~16% compound annual growth rate or $550 billion USD value by 2025) in the near future. The demand for GeoAI tools and techniques from all spatial information sectors, including education and research, will continue to increase as the benefits are visibly strong.

Fusion of GIS and IoT: Making the Future More Intelligent

As IoT and GIS adoption increases and their applications mature, the future is becoming increasingly intelligent and automated. GIS and IoT technologies are connecting systems and data in new ways, which is enabling the transformation of many organizational workflows. With a firm grasp of where IoT-connected assets are, executives are turning location intelligence into better business decisions. Companies in a range of industries are leveraging the where, when, and what of the IoT to boost profits, raise revenue, and enhance customer satisfaction.

Generative AI: Taking GIS Potential Further

While traditional machine learning has already enabled AI to detect patterns and make predictions from vast datasets, GenAI takes it further by generating content, images, and natural language responses based on simple prompts. This advancement allows users to interact with complex systems like GIS software using intuitive commands, freeing technical experts to focus on tasks like quality assurance and data verification.

Integrating GenAI with GIS extends the benefits of location intelligence throughout an organization. For example, an employee could soon generate detailed maps of company assets, identify high-potential real estate opportunities, or pinpoint target demographic areas simply by describing their needs to AI-powered GIS software. Integrating GenAI into GIS allows even non-GIS specialists to quickly generate location-aware smart forms. Users can use natural-language prompts to modify descriptions, add or remove questions, and include maps or images. For instance, a business user can rapidly create a form for evaluating real estate properties or for homeowners filing insurance claims. The fusion of GenAI and GIS is set to improve communication and collaboration between professionals. **As GenAI becomes more integrated into GIS tools across enterprises, the potential for leveraging location intelligence to enhance business operations and empower employees will continue to expand. This integration promises to drive faster, more effective decision-making and improve overall efficiency in business processes.**

With most e-commerce companies moving toward same-day delivery, traditional retailers face mounting pressure to deliver to customer expectations. For years, online retailers have had an edge when it comes to measuring consumer preferences. Websites closely track how visitors navigate online shopping experiences, and e-commerce companies use that knowledge to improve margins and customer satisfaction. That might mean adjusting airfares on a site in real-time, recommending similar products for a shopping cart, or allowing one-click purchases.

Brick-and-mortar retailers fell behind with such optimization because they lacked good data on where customers spent time in their stores. Now, through IoT and location technology, that's changing. **At the intersection of the Internet of Things and location, executives have found hidden reserves of business intelligence.** Esri's GeoEvent server helps executives connect and monitor real-time feeds and IoT data. ArcGIS Velocity is a managed SaaS for processing real-time IoT and big data analytics. It enables visualization, scalability, and spatial analytics.

GIS and VR/AR: Seeing What Others Can't

3D and augmented reality technologies are reshaping our interaction with spatial data. These innovations are crucial in urban planning and infrastructure development, offering immersive experiences and detailed insights.

As augmented reality (AR) becomes increasingly common in phone, tablet, and computer applications, more developers are expected to integrate GIS services and content to fulfill practical and real-world needs. **The fusion of GIS and AR makes GIS data and analytics more interactive, real-time, and user-friendly.** A prime example of this integration is Esri's AuGeo, which exemplifies the synergy between AR and GIS. AuGeo enables users to explore the possibilities of using ArcGIS data in an augmented reality environment. Esri envisions AR applications that leverage GIS data to assist professionals on-site by providing the most current and accurate information available via mobile devices.

For example, an ecologist might see real-time overlays of historical plant growth data while examining a forest, or a geologist could visualize underground mineral compositions without taking physical samples. This not only enhances the accuracy and efficiency of data collection but also provides immersive experiences.

Field workers can use their phone's camera to view the location and orientation of buried water pipes and electric cables. An AR app can cross-reference GIS data with their location,

effectively giving them an x-ray vision to see the infrastructure beneath. In addition to visualizing hidden elements, you can have access to their attributes, view engineering diagrams, and connect to real-time sensor networks to check details like water pressure or electrical amperage. The augmented displays can also be synced with a GIS-enabled work order system for access by project managers and field crews. **The true excitement of combining AR with GIS lies not just in visualizing GIS content but in integrating that content seamlessly with other enterprise systems.** Traditional GIS maps and models, while detailed, often require specialized knowledge to interpret. AR transforms this by rendering GIS data in three dimensions and overlaying it onto our physical surroundings, making spatial information more interactive and tangible.

For instance, a city planner on a proposed development site can use AR to visualize underground utilities, potential skyscraper shadows, or historical data layers in real-time. This immersive perspective enhances decision-making and planning. Additionally, when AR is incorporated into public participatory GIS, it democratizes spatial planning. Residents can virtually experience proposed changes to their neighborhoods, leading to more informed discussions and collaborative urban planning.

AR is also revolutionizing disaster simulations for training and preparedness. Rather than relying on traditional drills or lengthy procedure manuals, first responders can engage in highly realistic AR-enhanced scenarios. Whether simulating the aftermath of an earthquake or practicing evacuation procedures during a flood, AR provides a more immersive experience.

AR and GIS seem to be a perfect match, not only for consumers but for professionals who rely on geographic information to make real-time decisions.

Orange County Public Works Using GIS and IoT to Innovate

Orange County Waste and Recycling is an agency that operates three landfills. These landfills are among the largest in California and receive more than four million tons of solid waste annually. A critical safety concern at landfills is monitoring and regulating waste stockpile temperatures. OC Public Works equipped drones with thermal imaging infrared cameras to test a way of detecting the surface temperature of stockpiles.

As the surface of stockpiles reached a specific heat threshold, staff would manually record the internal temperature of each stockpile to mitigate the risk of an internal fire that could quickly spread. Although this process helped landfill managers, it lacked real-time awareness and an active approach to internal temperature control.

The county was already familiar with pulling live data streams from its fleet vehicles into GIS to know when to provide preventative maintenance. The same concept was applied to waste stockpiles. County GIS staff inserted Raspberry Pi sensors into each stockpile, and the sensors would record the internal temperature automatically. Then, using ArcGIS Velocity, staff programmed the sensors to feed the data into a web map and show real-time temperatures within each stockpile.

 "For about $40 per device, we can deploy several sensors in different locations within a stockpile and collect precise insights 24/7," explained Cameron Smith, GIS manager at OC Public Works. "Outsourcing this to a vendor would've cost the county tens of thousands of dollars yearly."

Using ArcGIS Velocity, staff quickly set up sensors to feed maps with real-time temperatures of stockpiles. The landfill staff can click across the interactive map and retrieve the real-time temperature of each stockpile. Staff can also push alerts when internal temperatures have passed a certain threshold, putting time-sensitive information into the hands of managers and landfill personnel. In the future, county staff can integrate other sensors—such as methane or moisture sensors—to enrich their data even further.

El Jebel, Colorado, Saves Thousands Using Augmented Reality and GIS

Crawford Properties, LLC, owns and manages a residential and commercial mobile home community in El Jebel, Colorado. The company is responsible for El Jebel's 5.4 square miles of underground assets, including water, sewer, gas, and electrical infrastructure, which are needed to support this growing community just outside of Aspen, Colorado. Crawford's staff needed a faster, more accurate way to record assets and their responses to 811 requests, reduce clerical errors, and mitigate any financial exposure due to inaccurate or slow response. Using the latest in geographic information system (GIS) and augmented reality (AR) technology, staff simplified how they locate assets and saved thousands in labor costs alone.

Crawford selected Argis Solutions to help solve the problem. Argis is a Denver, Colorado-based Esri partner

focused on integrating GIS with augmented reality and mixed reality. Argis's mobile app, the Argis Lens, translates ArcGIS feature services into augmented reality in real time. Crawford moved all its GIS data to ArcGIS Online—a cloud-based mapping system for creating, analyzing, and sharing maps—to consolidate information into one dynamic system of record. Whenever new assets are placed, Crawford's locating teams visit the site and record the asset's coordinates using ArcGIS Collector, a mobile data collection app, with a Global Navigation Satellite System (GNSS) receiver via a tablet. This data is then fed directly into ArcGIS Online onto a feature layer where it is maintained.

Using a tablet, mobile workers view the collected data, which ranges from sprinkler heads to electrical wires or sewer pipes. The Argis Lens allows them to verify the data's accuracy and record images near known points and landmarks. When location requests are submitted, the location team uses the Argis Lens and ARTMS, Argis's augmented reality 811 response system, to manage the entire location request on-site in one stop. ARTMS ingests Colorado 811 marking requests and shows 811 responses directly from the field within the application. Because ARTMS is an extension of ArcGIS Workforce, team managers can also use it to track workers and tickets. Combining ARTMS with the Argis Lens keeps mobile workers safer. They are armed with visual situational awareness of surrounding systems made visible on the AR map. If the ArcGIS data requires updating, the mobile worker uses the tablet and GNSS receiver to update the data directly at the work site.

This new workflow focuses on mobile worker empowerment. It allows all GIS locating and documentation to occur at the work site. Crawford Properties is reducing postprocessing activities by two hours a day, saving $7,500 yearly in labor alone in 2021. Data quality has improved, and data is more functional and accessible. With ARTMS, Crawford has excellent documentation for 811 location response requests, verifying the full record of information provided. Better documentation minimizes Crawford's loss exposure and protects the El Jebel community, allowing it to operate as seamlessly as possible.

Conclusion

The integration of GIS with cutting-edge technologies such as AI, IoT, Digital Twins, and AR/VR is shaping a brighter future for everyone. These advancements in GIS are leading to more sustainable decision-making and uncovering the best solutions to existing challenges. The transformative power of GIS technologies is driving progress and improving our world. Innovations like Machine Learning, Artificial Intelligence, Cloud GIS, and Augmented Reality are enhancing our lives and increasing convenience.

These developments create new opportunities and are expected to significantly boost the market value of GIS in the future. Various industries and sectors have already undergone a revolution due to the swift adoption of GIS technologies.

Looking ahead, GIS is poised for a promising future, with its significance set to grow as industries and educational institutions increasingly recognize its critical role and value. As GIS technology evolves, new methods for analyzing, visualizing, and managing spatial data will continue to emerge.

MCD Achieves Effective Governance with ArcGIS

Client
Municipal Corporation of Delhi

Industry
Urban

Organization Profile
The three existing civic bodies, East Delhi Municipal Corporation (EDMC), North Delhi Municipal Corporation (NDMC), and South Delhi Municipal Corporation (SDMC) are re-unified into a single entity as Municipal Corporation of Delhi. The Municipal Corporation of Delhi is one of the largest municipal bodies in the world providing civic services to approximately 20 million citizens of Delhi. It occupies an area of 1397.3 sq. km. which is sub-divided into 12 Zones i.e. Centre, South, West, Najafgarh, Rohini, Civil Lines, Karol Bagh, SP-City, Keshavpuram, Narela, Shahdara North & Shahdara South.

Website
www.mcdonline.nic.in

Project
GIS Citizen Portal

Highlights
- Effective visualization of MCD assets and properties.
- Real-time visualization, ensuring transparency and streamlined workflow.
- Simplified information management
- Enhanced communication and decision-making
- Streamlined resource management leading to improved operational efficacy and resource optimization.

Project Summary
The MCD GIS citizen portal is a step towards better governance taken by the Municipal Corporation of Delhi to allow the citizens of Delhi to avail various services through an easy-to-use interface along with geo-referential data. The main purpose of this project is to provide a planning tool and updated information for departmental officers to design their projects/ schemes that help in delivering hassle free, transparent and efficient services to its citizens. The services include public outreach, tower location analysis, property tax, tax comparison, factory and general trade licenses, health and veterinary trade licenses, Tehbazari, birth & death registration, swatchta karamchari attendance, seasonal mosquito control monitoring, etc.

Challenges
Under the conventional system, the Municipal Corporation of Delhi (MCD) faced numerous challenges in effectively managing its widely dispersed resources and assets. Access to critical data was restrained within specific zones and wards jurisdictions, relying primarily on different computer systems, Excel files, and paper-based workflows. The absence of an efficient and consolidated monitoring mechanism contributed to an uneven distribution of resources and a fragmented understanding of the overall area. Consequently, budget allocations for the improvement of MCD's jurisdiction exhibited inconsistency, obstructing the seamless implementation of targeted developmental initiatives. Furthermore, the decision-making process suffered from siloed information and the unavailability of a structured visualization tool, resulting in limited analytical insights and hindrances in strategic planning. The constraints of the conventional system were a significant challenge to MCD's capacity to efficiently manage resources and make well-informed decisions.

Solution

Esri India's holistic solution has efficiently resolved the challenges faced by MCD through a single window-enabled GIS portal. The following measures have been taken to address the challenges:

Data Model Design: Implementation of a robust data model for structured data management and seamless integration equipped with GPL and Postgres.

Existing Data Migration: Smooth transition of existing data from the conventional system to the GIS platform, preserving critical historical records and information.

Data Preparation/Publishing: Facilitation of accurate data preparation and publishing, ensuring data reliability within the GIS framework.

Web Application Development: Creation of intuitive web applications for simplified access and visualization of geospatial data, streamlining asset monitoring and management.

Mobile App for Property Tax Survey: Integration of a mobile application for property tax surveys, enabling efficient data collection and real-time updates for accurate property tax assessments.

Capital Project Plan App: Implementation of a dedicated application for the planning and monitoring of infrastructure development projects, optimizing resource allocation, and enhancing project management efficiency.

Dashboards: Development of interactive dashboards offering stakeholders comprehensive insights and real-time updates on various operational aspects, fostering data-driven decision-making.

Scripts: Deployment of customized scripts automating complex processes, streamlining tasks, and enhancing operational efficiency within the MCD's framework. This includes the integration of various APIs through which the department is enabled to embed the data on real-time basis for quick and correct decisions.

User-Level Training on Developed Applications: Conducting comprehensive training sessions for users to ensure proficiency in utilizing the newly developed applications, fostering self-sufficiency, and promoting the widespread adoption of the GIS platform within the organization.

The solution's suite of web applications has brought about a host of additional benefits, including expanded public outreach capabilities, comprehensive analysis of tower locations, streamlined management of property tax records along with geo-tagged properties, insightful tax comparison functionalities, efficient oversight of factory and general trade licenses, improved administration of health and veterinary trade licenses, simplified processes for managing Tehbazari activities, seamless handling of birth and death registrations, enhanced monitoring of Swatchta Karamchari attendance, and effective oversight of seasonal mosquito control activities.
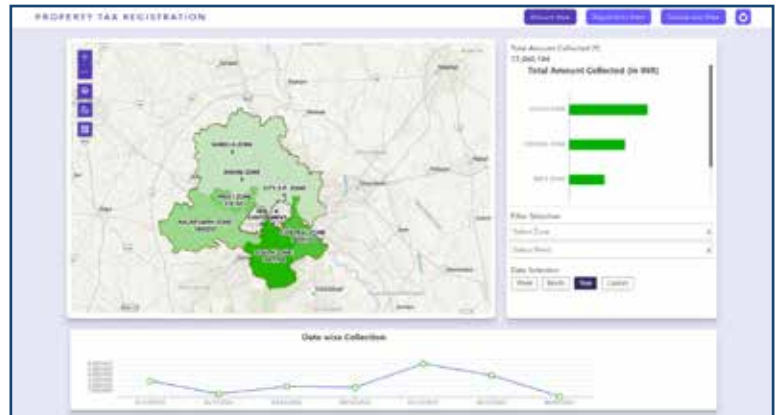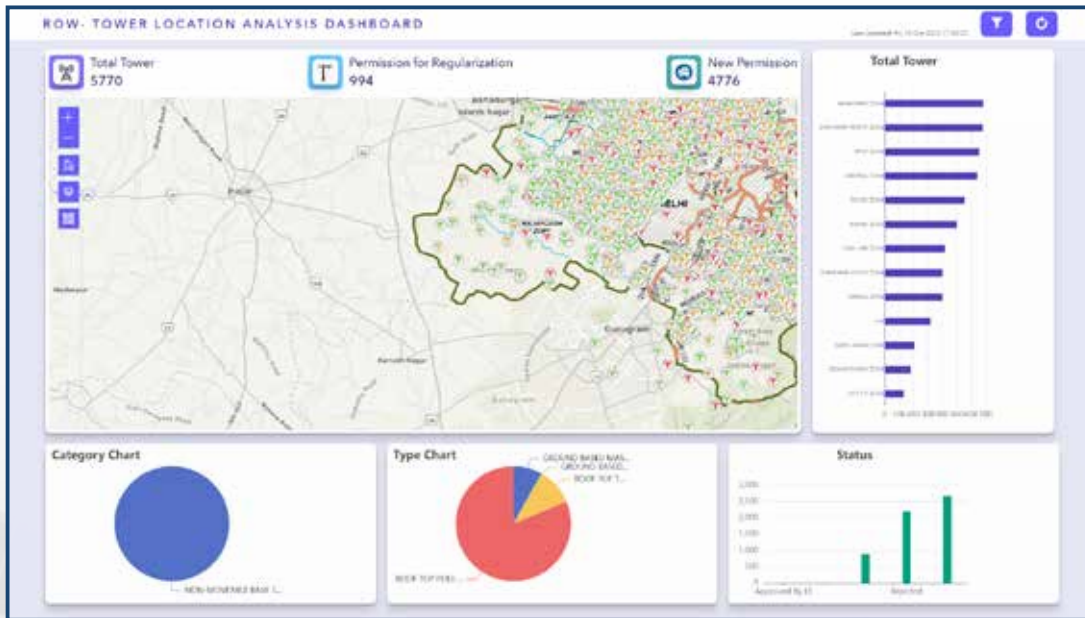
These web applications have collectively contributed to the overall efficiency and transparency of the Municipal Corporation of Delhi's operations, promoting enhanced service delivery and streamlined administrative processes.
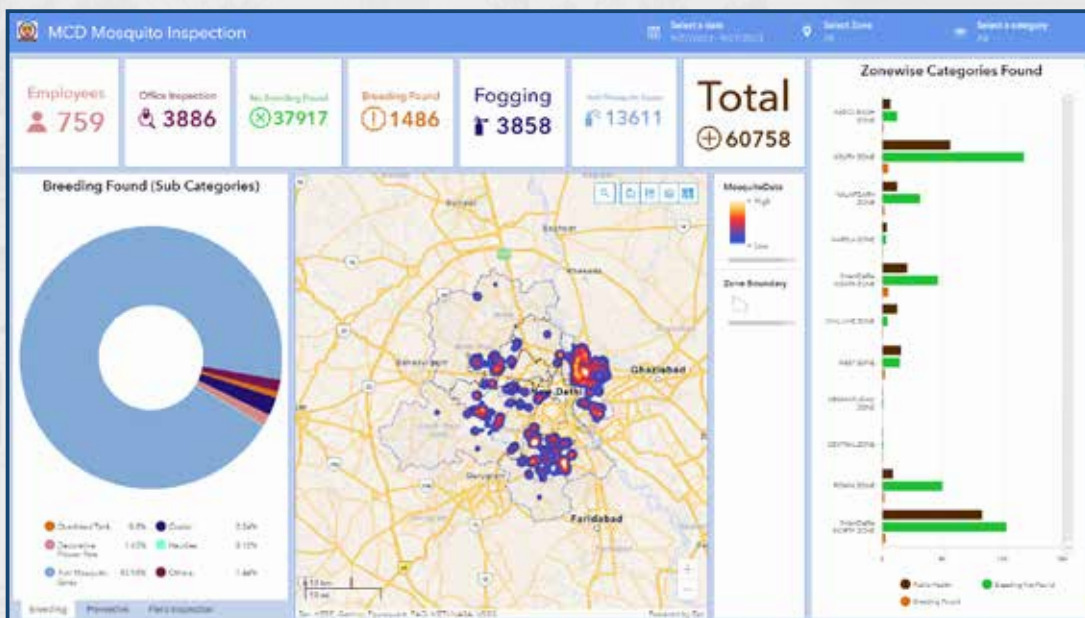
Benefits

Visualization of MCD Assets and Properties: The GIS solution enables the visualization of MCD assets and properties with metadata on a comprehensive GIS map, incorporating essential geodata for enhanced spatial analysis and informed decision-making.

Integration with Online Applications: The system's integration with various online applications enables the display of real-time visualization of thematic maps, providing updated status information for tower permission applications, property tax, licenses, and other relevant processes, ensuring transparency and streamlined workflow.

CASE STUDY

Simplified Information Management: The GIS tool simplifies the overall process of compiling, handling, manipulating, interpreting, and distributing information for the department, fostering improved data management and operational efficiency.

Enhanced Communication and Decision-Making: The strengthened communication and decision-making systems facilitated by the GIS solution promote better collaboration among stakeholders, leading to more informed and effective decision-making processes within the MCD.

Streamlined Resource Management: The sourced information through the GIS platform significantly eases day-to-day resource management, providing valuable insights for efficient resource allocation and utilization, thereby improving operational efficacy and resource optimization.

> " After implementing the new GIS solution, MCD as an organization has been able to take a leap in their service delivery. All the existing raw data integrated into the new system has enabled us to use it in various departmental activities, planning and visualization. The near real-time data integration provides daily base data updates along with analysis and comparisons on map as well as analytical charts, which further ease the monitoring capabilities of the officers. Moreover, Heat Maps generated with the help of the GIS System, are useful in identifying more prone areas falling under any schemes to provide more thrust-by-field functionalities. This system will surely reflect in the ROI outcome to MCD in the coming years.
>
> **- Mr. Durgesh Kumar, Consultant (IT), Municipal Corporation of Delhi** "

Esri India Partners with ML Infomap to Enable Suez Achieve Optimum Efficiency in Water and Sewerage Projects

Suez Group has been active in the Indian water and wastewater market since 1978 and established an Indian subsidiary in 1986. Suez uses Esri products to enable comprehensive study and planning through GIS mapping, field surveys, and door-to-door surveys to analyze water demand patterns and improve water distribution. A recent development has been the successful integration of GIS-based maps in its Android-based O&M application. ML Infomap is the long-term partner of Esri India which has supported the execution of enterprise-level collaboration with Suez. ML Infomap expertise is in multiple technologies like GIS, Cloud Computing, Machine Learning, analytics, and visualization.

integration with ArcGIS Enterprise/Online has facilitated collaboration among team members and enhanced data sharing across departments.

ArcGIS Modules Used in the Projects

- **ArcGIS Desktop:** ArcMap and ArcGIS Pro are instrumental in Suez's data analysis, visualization, and map authoring tasks. The GIS system helps them to store all information about field activities (Topographic survey, customer survey, network survey, operational activities, etc.) and effectively perform tasks such as managing topography
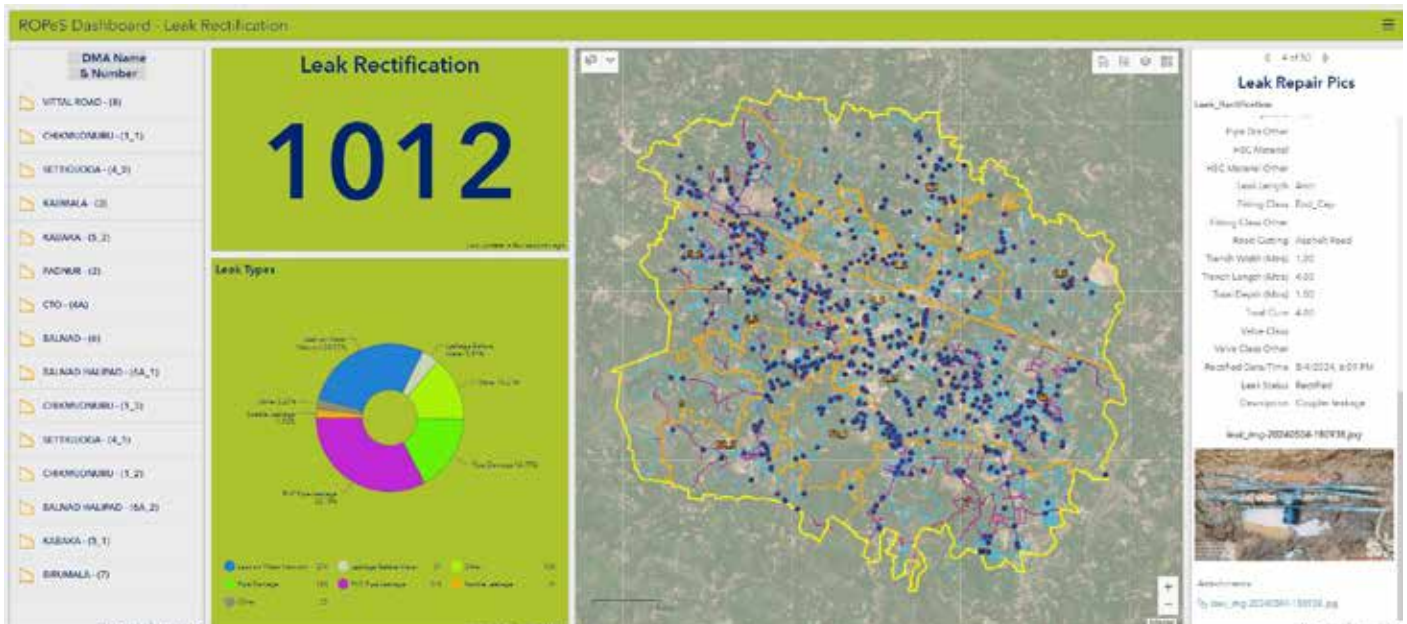
ArcGIS Dashboard to View Leak Repair Locations at Puttur

It creates IT/GIS solutions on the Esri platform. The intuitive user interface of ArcGIS Pro has significantly improved Suez's workflow efficiency, allowing it to manage the field and back-office data simultaneously. This has been achieved using ArcGIS Pro's functionality that allows users to connect to the portal and editing in portal data directly. The seamless

data, generation of contours, DEM, hydrology, etc.

- **ArcGIS Enterprise (Server/Portal):** Suez is also utilizing ArcGIS Enterprise (on-premises server) as the foundation of its GIS infrastructure that allows it to manage and share spatial data securely within the organization.

o **Web Applications:** ArcGIS web app builder provides Suez with a user-friendly platform for creating custom web applications without requiring extensive programming knowledge. It offers pre-built widgets and templates to design interactive and responsive web apps that leverage the power of GIS data.

o **ArcGIS Dashboards:** Suez uses ArcGIS Dashboards to create interactive dashboards that provide real-time insights into key performance indicators (KPIs), helping it to monitor and manage the water service status and operations effectively.

A suite of applications that are connected to the enterprise server and portal aids in field data collection, mapping, and asset management on mobile devices.

o **ArcGIS Field Map:** This mobile app (map-based app) enables field data collection and update, streamlining the workflows for asset management, inspections, and maintenance activities related to the water service infrastructure.

o **ArcGIS Survey123 Connect:** This app is designed for form-based data collection in the field using smartphones or tablets. It allows users to create customizable survey forms, collect data online /offline, and seamlessly integrate the collected data with GIS

systems for analysis and visualization. It allows media attachments or geotagged media with respective features. These can be used for any form-based survey like customer survey, marking water leaks, trail pits location, etc. Overall, Survey123 is a versatile and user-friendly mobile application.
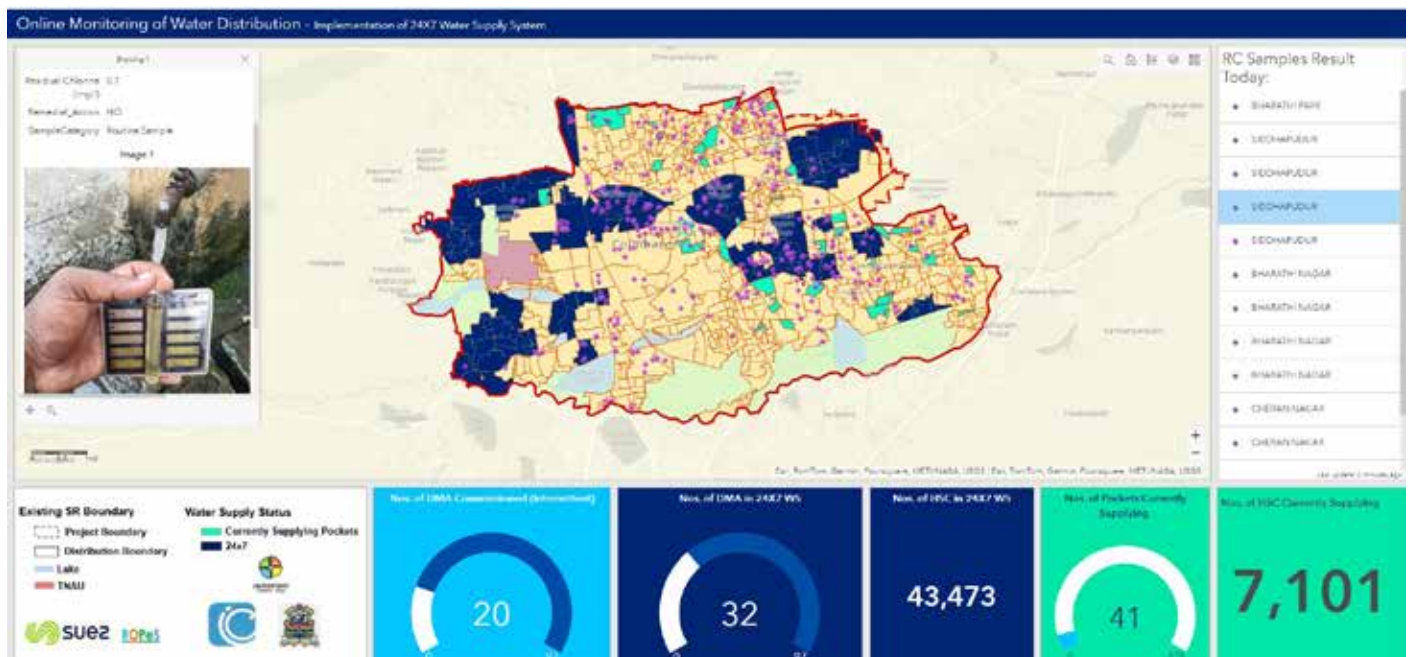
> "Suez uses Esri's products (ArcGIS Pro + ArcGIS Enterprise) to generate a complete geo-tagged asset registry at the organization. Esri's products are user-friendly and technically advanced. The impact of deploying GIS-based applications in our water and sewerage projects is truly commendable.
>
> The support and assistance provided by the Esri India team has been exceptional. Many times, we interacted with the technical support team, and we have always been impressed by their expertise, professionalism, and prompt assistance.
> - **Sriman Narayana, HOD – Digital Solutions, Water, Recycling and waste recovery Indian subcontinent, Suez Projects Private Limited**"

ArcGIS Dashboard to View Intermittent Water Supply in Coimbatore

Building a Climate Resilient Bihar with GIS

In a conversation with **Dr CN Prabhu, Joint Director, Technical, Bihar Mausam Seva Kendra**, a center under the Planning and Development Department, Government of Bihar, we explored the use of GIS in weather data visualization, prediction, and real-time decision support.

What is the mission of Bihar Mausam Seva Kendra?

The climate is changing very rapidly and will continue to do so in the future. The mission of our organization is to take weather information and advisories to the end-users in a simple and comprehensible manner.

How are you using GIS to manage changes in weather conditions?

Currently, we are using Esri's ArcGIS along with other available tools. With all the data that is coming through our research, we are using various geospatial technologies to process and create products out of these datasets. The weather information and data are spread across many regions and are available at different spatial resolutions. This makes data collection slightly complex. We always try to collect the data at the finest resolution possible. Then, the GIS technology helps us in analyzing the data and giving us a replica of the ground. The data captured in the form of tables or graphs are not of any use to us since they do not provide a spatial perspective. However, if that map is interactive and has some tools to scan the data in multiple ways, it becomes more beneficial for us.

Given the nature of our job, we cannot limit ourselves to one particular region and analyze the data we receive from there alone. The neighbouring regions are equally important. Unless we visualize what is happening in that area on a geographical platform, it's difficult to get a hold of the weather data. To manage the change in weather conditions, the collection, processing, and visualization of data in a customized way is important. This is where we use GIS.

How are you procuring the data for weather forecasting?

Our organization does not physically procure the data. Instead, we have installed a set of sensors at different geographical layers from where we collect the ground data. To be precise, we have a rain gauge in Bihar every three square kilometers, and in every 150 square kilometers, we have a weather station. The disparity between the weather station and rain gauge system is because weather conditions do not change as much as rainfall. So we have put up the weather sensors at the block level, and the rain gauge sensors at the panchayat level.

We directly take the data coming through these stations into our server through the GPRS network with other very high temporal resolutions. We collect the data every 15 minutes. For other data like remote sensing, we have collaborated with ISRO. We also collaborate with private companies, when needed, for developing tools on the GIS platform for analysis, developing custom dashboards, or creating a GIS-based application. Apart from these, most of the things we do with in-house capacity. We have scientists, and engineers that

carry out these tasks in our team of about 10-15 people, doing for the entire state.

> "GIS technology helps us in analyzing weather data and giving us a replica of the ground. The data captured in the form of tables or graphs are not of any use to us since they do not provide a spatial perspective."
> **- Dr CN Prabhu, Joint Director, Technical, Bihar Mausam Seva Kendra**

Climate change is a burning issue right now and Bihar has faced inundation for many years. Are you using geospatial data to manage the situation better?

Until recently, we had a very limited number of sensors to monitor the rain gauge. Now, with the government of Bihar investing resources and money into it, we've grown to have more sensors at the panchayat level. This gives us a clear picture of the place, intensity, and amount of rainfall at any given place.

With this information only, we are managing the flood situation in Bihar. There are different sources of water, one is water coming through river channels, streams from outside, or rainfall. Unless we measure both of them properly, we will not be able to manage the flood properly. So we are measuring the rainfall at a very fine scale, and the water coming from outside is also being measured as well as what will be the cumulative effect at any point of place down the stream. This data is fed to the GIS platform, from where we can see where it is raining and with what intensity. When the intensity is increasing, we can calculate what would be the surface runoff, depending on the land use pattern there, and whether that can lead to flood or inundation in that area. Or if not there, down the line, along this stream, anywhere in the banks.

With a lot of lead time, we will be able to caution the

downstream people. By looking at what is happening upstream, we will be able to caution the downstream when and how it is approaching. We are trying to do this in Bihar at the moment, which is going to bring a lot of change in flood management in Bihar.

Geospatial Industry: Yesterday, Today, and Tomorrow

By Rajesh Chandra Mathur, Senior Director-Strategy, Esri India

The world has come a long way from the days of using paper maps for finding places to adopting spatial intelligence in everyday decisions. The story of India is no different, although the adoption rate has been slower than desired.

Humans have long recognized the importance and value of maps in their lives. Indeed, the history of mapping can be traced back more than 5,000 years. Since then, the world has come a long way from the days of using paper maps for finding places, to adopting spatial intelligence in everyday decisions. The story of India is no different, although the adoption rate has been slower than desired.

Early adopters

As in other countries, in India as well, the early adopters of GIS were the national mapping agencies that built capacity to create geospatial data products; organizations like Survey of India, Geological Survey of India, National Atlas and Thematic Mapping Organization (NATMO), et al. Indian Space Research Organisation (ISRO), Regional Remote Sensing Centres (RRSCs), State Remote Sensing Centres, and National Informatics Centre implemented several GIS-based pilot projects across a range of domains like water resource management, forestry, urban planning, etc., to demonstrate the applications of GIS and remote sensing.

While a lot of good work was being done by the user community, the utilization of geospatial technologies was nowhere near the potential. The primary reason was lack of awareness of GIS, inadequate availability of technical manpower, spatial data availability, and limited access to solution providers who could support the users in implementing GIS.

In order to meet the growing needs of skilled geospatial manpower, several universities built GIS and remote sensing labs to create human resource capacity and also take up research projects. Soon, the availability of trained GIS manpower opened up the untapped opportunity to develop an international GIS services market for the Indian geospatial industry.

What started as low-end data development work has evolved into India becoming the preferred source for design, development and implementation of enterprise geospatial platforms for discerning global customers.

Technology evolution

Technological developments in GIS have kept pace with the emergence of new and emerging technologies in the IT space, like Internet of Things (IoT), artificial intelligence (AI), machine learning (ML), deep learning (DL), augmented reality (AR), virtual reality (VR), Big Data, Digital Twin, Web/Cloud, et al. GIS deployment on Web/Cloud enables organizations to build enterprise geo-platforms hosting data, applications, solution templates and open APIs (application programming interface) serving a variety of users.

The federated architecture based on open standards enables users to access content from multiple data servers and consume it as a service using any device, anytime and from anywhere. For instance, the geospatial infrastructure of a Smart City would enable various departments like property tax, healthcare, transportation, solid waste management, and education, among others, to share their data with other departments in a collaborative manner.

ESRI's GeoHub technology makes content available to external entities, including citizens, NGOs, academia, and start-ups that can build citizen-centric applications to leverage the data. Another example of geospatial infrastructure would be state GIS integrating data from various departments to become a single source of truth and geo-enable various state government processes and workflows.

> The geospatial ecosystem is poised for huge growth in the coming years, with the potential to be a Rs. 1 lakh crore industry by 2030. However, industry leaders, along with the government, research institutions and academia, need to remove the bottlenecks and facilitate hassle free adoption of geospatial technology.

Growth drivers

As per a survey conducted by Geospatial Media and Communications, India's geospatial economy was estimated to be Rs. 38,972 crores in 2021, employing approximately 470,000 people. It is expected to grow to Rs. 52,770 crores and provide employment to about 950,000 people by 2025. Several factors have contributed to the growth in the adoption of geospatial technologies in India. These include:

- Increased awareness of geospatial technologies among users, decision-makers and the political leadership

- Deployment of GIS in several mission critical projects of the government, like Smart Cities, Atal Mission For Rejuvenation And Urban Transformation (AMRUT), Restructured Accelerated Power Development and Reforms Programme (RAPDRP), Digital India Land Records Modernization Programme (DINLRMP), Survey of Villages and Mapping with Improvised Technology in Village Areas (SVAMITVA), to name a few.

- Technological advancements like geospatial infrastructure to expose geospatial information and services to a much larger user base.

- Integration of GIS with other enterprise platforms like Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), Supervisory Control and Data Acquisition (SCADA), et al.

- Proliferation of location intelligent devices leading to availability of real-time geospatial information.

- Easy integration of data from disparate sources.

- Geospatial data and mapping guidelines that will lead to democratization of geospatial content and unlocking of data available with various agencies.

The road ahead

- **Location enablement of digital transformation:** Disruptions caused by the pandemic have accelerated the pace of digital transformation in the past 24 months. This has made it necessary for enterprises to quickly reorganize existing business processes and workflows to adapt to the new normal. Location information is an integral part of most business processes across industries now.

- **India Geospatial Stack:** Under the Digital India Program, the Ministry of Electronics and Information Technology (MeitY) has implemented several advanced enterprise platforms like Unique Identification Authority of India (UIDAI), Direct Benefits Transfer (DBT), Unified Payments Interface (UPI), among others, often termed India Stack. Several domain specific platforms, focused on healthcare, urban development, etc., are in the process of being implemented. Location information is a critical parameter in most of these systems. Hence, it would be prudent to establish a comprehensive enterprise GIS platform that can serve the constituents of India Stack and enables them to embed location information into the system.

- **Location Intelligence for Business Analytics:** It is said that 80% of business decisions have a location dimension. Hence, commercial enterprises – manufacturing, retail, BFSI (banking, financial services and insurance sector), travel and logistics – are major users of geospatial technologies. In India, the adoption has been low

because of lack of granular demographic data. However, the Geospatial Data Guidelines 2021 should lead to significant investments in data creation, resulting in increased adoption of GIS in the commercial segment.

- **GIS for sustainable development:** India is committed to achieving the 17 SDGs (Sustainable Development Goals) identified by the member states of the United Nations. Geospatial data is one of the key components of the information needed to capture, monitor and report data on various parameters. GIS also helps in building the strategy to achieve many of the 17 SDG goals.

- **Moving up the value chain in GIS services:** Indian geospatial services companies will continue to enhance their customer engagement as they move up the value chain in service delivery. Integration of GIS with other business processes, Web/Cloud based services, managed services, would be just some of the engagement models.

- **Skill development:** While several Indian universities are offering GIS and remote sensing courses, there is a need to align them to the industry needs and also adopt current technological developments in the curriculum. There is also a need to focus on the top half of the skill pyramid like program managers, project managers, solution architects, etc.

Conclusion

The geospatial ecosystem is poised for huge growth in the coming years, with the potential to be a Rs. 1 lakh crore industry by 2030. However, industry leaders, along with the government, research institutions and academia, need to remove the bottlenecks and facilitate hassle free adoption of geospatial technology.

The government needs to establish geospatial infrastructure to host content, solution templates, applications and open APIs in order to accelerate technology adoption. The industry has to invest in data creation, application and solution template development. It also needs to support universities in the development of high caliber manpower.

A lot has been achieved with the use of GIS; however, a lot remains to be done.

Indo ArcGIS

Business Analyst

A Location Analytics Solution for
Government Organizations
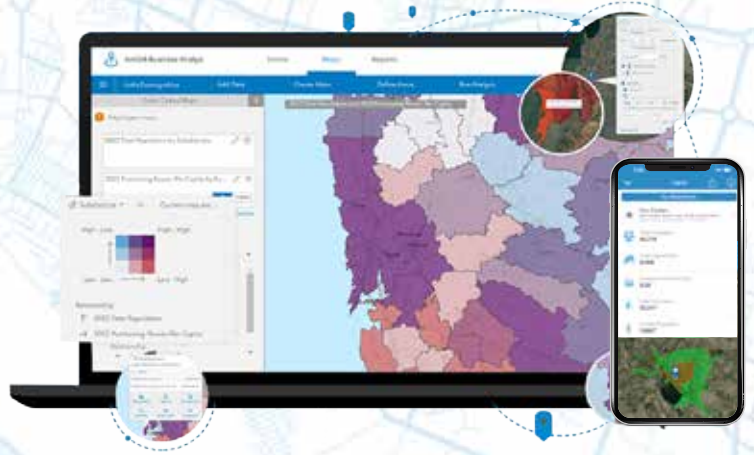
Indo ArcGIS Business Analyst is a unique location intelligence solution that provides invaluable insights derived from geographic and spatial data, aiding government organizations to make smarter, data-driven decisions. It includes a variety of location-based datasets available from ArcGIS Living Atlas of India and also provides users the flexibility to add their own data.
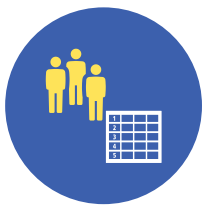
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ArcGIS Hub

ArcGIS Hub is an innovative platform developed by Esri that facilitates collaboration and engagement between organizations and their communities, providing a robust framework for sharing geospatial data and resources. It empowers users to create customizable websites that reflect their unique branding and focus on specific initiatives, making it easier to promote transparency and foster community involvement. With features such as open data portals, organizations can share datasets, maps, and applications with the public, enhancing accessibility and encouraging data-driven decision-making. The platform also includes tools for gathering community feedback through surveys and discussions, ensuring that stakeholders have a voice in relevant projects and initiatives. Furthermore, ArcGIS Hub seamlessly integrates with other ArcGIS applications, enabling users to leverage advanced data visualization and analysis capabilities. The platform offers valuable insights into user engagement and data usage, helping organizations better understand community needs and adjust their strategies accordingly. By combining powerful geospatial tools with an emphasis on public participation, ArcGIS Hub serves as a vital resource for organizations aiming to build stronger, more informed communities and drive positive change through informed decision-making.

What is the difference between the basic and premium license levels of ArcGIS Hub?

The basic license level is part of your ArcGIS Online subscription. It allows you to share open data and create open data sites and pages that can integrate, and leverage data driven visualizations and apps created with ArcGIS.

The premium license level provides added functionality and tools that make your community engagement efforts easier, including tools for creating and managing initiatives and initiative teams, an event management system, and dashboards for monitoring feedback and progress. It also provides community members with identity accounts that allow them to create a community profile to provide feedback, sign up to attend events, follow initiatives, and receive relevant updates. ArcGIS Hub administrators can also leverage included initiative templates and tools to help them manage internal and external collaboration and participation.

ArcGIS Hub offers a variety of uses that enhance community engagement and data sharing. Here are some key applications:

1. **Public Engagement:** Organizations can create initiatives that encourage community participation through surveys, feedback forms, and discussions, helping to involve citizens in decision-making processes.

2. **Open Data Portals:** Users can establish open data sites to make datasets publicly accessible, promoting transparency and allowing users to explore and utilize the data for their own projects.

3. **Project Collaboration:** Teams can collaborate on specific projects by sharing relevant maps, documents, and data, facilitating better coordination and communication.
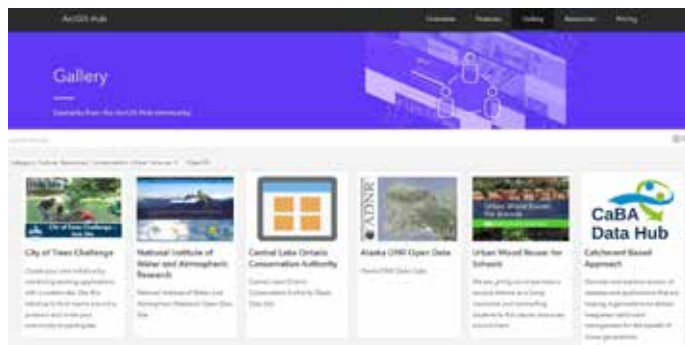
4. **Awareness Campaigns:** Organizations can use the platform to run campaigns that inform the public about initiatives, programs, or events, effectively reaching a broader audience.

5. **Resource Management:** Governments and agencies can manage and share resources related to urban planning, environmental monitoring, and public health, making critical information available to stakeholders.

6. **Data Visualization:** Users can create interactive maps and dashboards that visualize complex data, helping the community understand trends and insights more easily.

7. **Reporting and Analytics:** The platform provides tools for tracking user engagement and data usage, allowing organizations to assess the impact of their initiatives and make informed adjustments.

8. **Educational Initiatives:** Schools and educational organizations can use ArcGIS Hub to share learning resources, host workshops, and engage students in geography and data analysis.

ArcGIS Hub Advantages

ArcGIS Hub offers a multitude of advantages that significantly enhance collaboration, transparency, and community engagement for organizations across various sectors. One of its primary benefits is the facilitation of direct interaction between organizations and their communities, enabling users to collect feedback, conduct surveys, and promote public participation in decision-making processes. This engagement is further supported by the platform's emphasis on transparency; organizations can easily share datasets, maps, and other critical information, thereby building trust and accountability with the public.

Additionally, ArcGIS Hub allows users to create highly customizable platforms, enabling them to design tailored websites that reflect their branding and focus on specific initiatives, making communication more effective and targeted. The seamless integration with other ArcGIS tools enhances data visualization and analysis capabilities, streamlining workflows and ensuring that users can leverage the full potential of geospatial data. Effective data management is another key advantage, as the platform enables organizations to organize, update, and share resources efficiently, ensuring that stakeholders always have access to the most current information.

Organizations can also gain valuable insights through built-in analytics that track user engagement and data usage, helping them to understand community needs and evaluate the impact of their initiatives.

Collaboration is made easier with tools that enhance coordination among teams and stakeholders, allowing for smoother project workflows and better information sharing. Furthermore, the platform supports diverse use cases, from urban planning and environmental monitoring to crisis management and community development, making it a versatile tool for various applications. Its mobile accessibility means that users can engage with content and participate in initiatives from anywhere, broadening the reach and impact of projects.

Lastly, ArcGIS Hub serves as a valuable resource for educational institutions, allowing them to share learning materials and engage students in practical applications of GIS. Collectively, these advantages make ArcGIS Hub a powerful and essential tool for organizations aiming to foster collaboration, engage their communities, and effectively utilize geospatial data for meaningful impact.

What ArcGIS Hub can do for you?

1. **Share open data:** Data is vital to decision-making. Whether you are choosing a neighbourhood to live in, curious about city projects, or opening a new business, having the information you can trust is essential. With ArcGIS Hub, organizations can share their authoritative data so that the community can make better decisions.

2. **Create unlimited websites:** Create as many websites and web pages as you need with no coding required. Simply drag and drop components. Incorporate your organization's logos and styles to match existing websites, and share data, maps, and apps on your sites. Use the sites you make to engage your community.

3. **Organize around initiatives:** Sharing open data is the first step on the journey to effective community engagement. Give your data purpose and align it with your organization's top priorities by organizing around initiatives. Any real-world issue, mission, or project can become an initiative in your hub.

4. **Enable collaboration:** ArcGIS Hub makes it easy to create teams comprising staff, external community members, or both. You can invite trusted members of the community to collaborate with your organization, which will increase your staff's ability to solve problems.

5. **Inspire action:** Initiatives can drive engagement by giving community members a goal to rally around as well as a focused way to participate. Presenting information via charts, maps, and stories makes it easier for everyone to have a shared understanding of the goal, which can pave the way to action.

6. **Benefit from a full system:** Unlike other solutions that require piecing tools together, ArcGIS Hub comes with everything you'll need: integrated event management, surveys, and more. Work done in your hub also feeds directly back into your organization's operational systems.

ArcGIS Experience Builder

ArcGIS Experience Builder is a powerful tool that lets you create user-friendly web applications with ease. Here are some essential tips and tricks to get the most out of ArcGIS Experience Builder.

1. Use pre-configured templates

Pre-configured templates can be a great way to jumpstart your project. These templates provide layouts and functionality tailored to common workflows such as maps, dashboards, and galleries. Use these as a foundation and customize from there, saving both time and effort.

2. Make Use of the Widget Controller

Experience Builder's drag-and-drop interface is intuitive, but as your application grows, managing widgets can become complex. The widget controller is a hidden gem that allows you to efficiently manage and toggle visibility of widgets, keeping your workspace clean and organized.

3. Leverage Data-Driven Interactivity

ArcGIS Experience Builder allows you to create dynamic applications by linking widgets to your data. Use the "Data" panel to connect widgets to specific datasets, allowing for interactive elements like filters, queries, and dynamic charts. Use the "Action" feature to trigger events, such as updating charts or lists, when a user selects a feature on the map.

4.

4. Custom CSS for Advanced Styling

While Experience Builder offers a range of styling options through its visual interface, for more refined customization, adding your own CSS can help you push the limits of design. This can be particularly useful for controlling finer details like padding, margins, and hover effects.

5. Maximize Performance with Map Extent Filtering

If your app is data-heavy, performance can be an issue. To enhance loading times and improve performance, consider using map extent filtering. This feature allows you to filter data based on the visible area of the map, meaning that only the data relevant to that area will load.

6. Version Control and Collaboration

Working on a team? Use ArcGIS Enterprise to manage different versions of your Experience Builder project. With version control, you can track changes, revert to previous versions if needed, and collaborate seamlessly across multiple team members.

TIPS & TRICKS

7. Regular Updates and Learning Resources

ArcGIS Experience Builder is continually evolving, with new features and updates being released regularly. Stay updated by reviewing the official Esri blogs, participating in user forums, and watching tutorials.

By applying these tips and tricks, you can elevate your ArcGIS Experience Builder applications to the next level. Whether you're aiming for a streamlined user experience or pushing the boundaries of customization, these techniques will help you make the most out of this powerful tool.
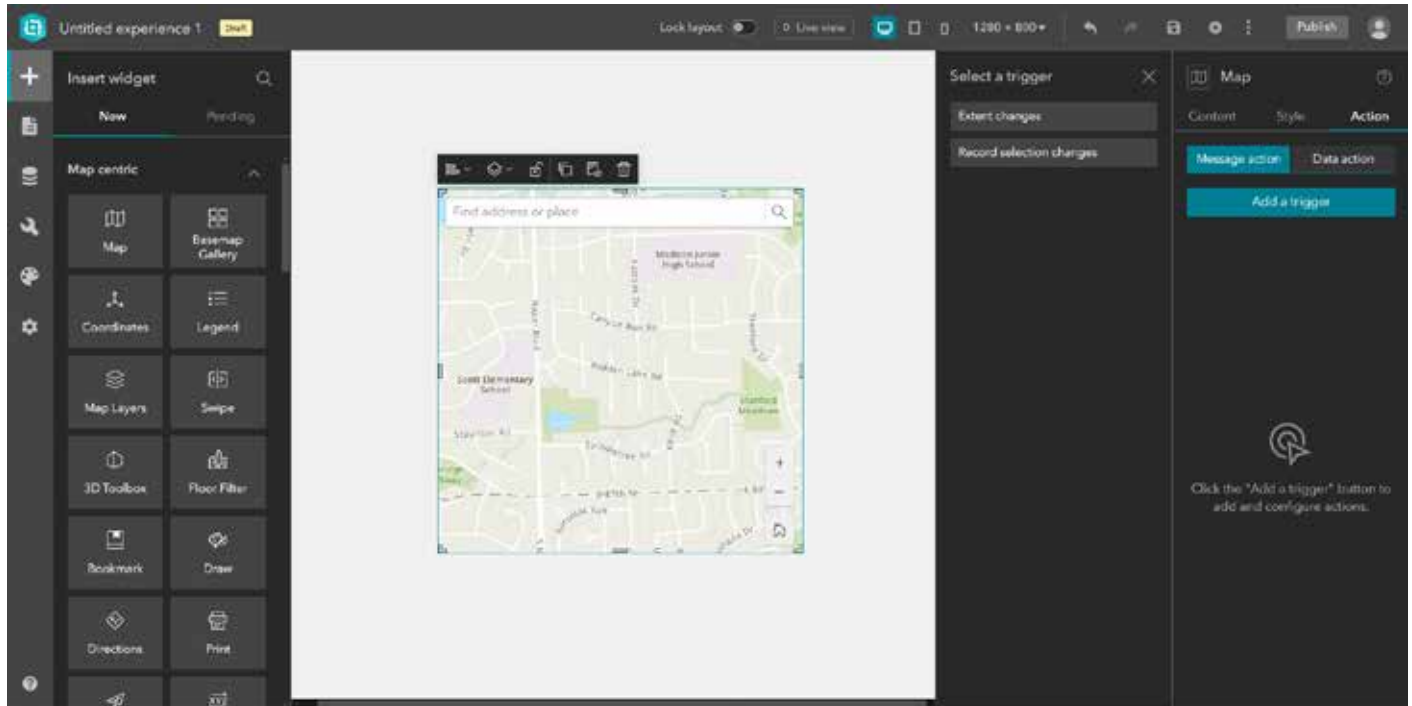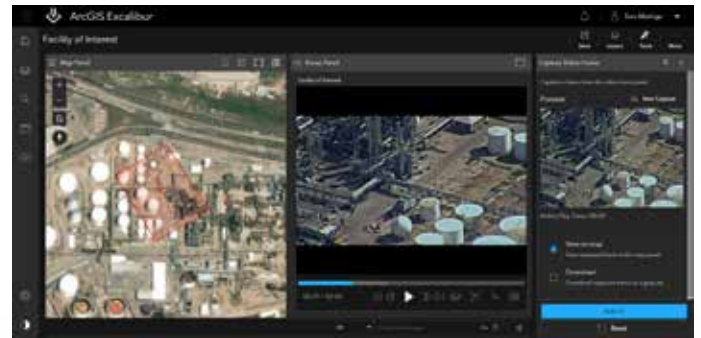
ArcGIS Excalibur

ArcGIS Excalibur is a web-based imagery application that allows users to search, discover, and work with imagery. It uses focused workflows for image analytics and exploitation. Imagery and geospatial workflows that have traditionally been separate are now seamlessly integrated and easily accessible to analysts using ArcGIS Excalibur. Results are shared as imagery-derived reports or dynamic layers with key stakeholders.

The latest release of ArcGIS Excalibur has various new improvements and features.

- Use ArcGIS Knowledge spatial entities as observation layers to collect, copy, and delete observations.

- Create fields with new field types: Time only, Date only, Timestamp offset, and Big integer.

- View a list of observation layers in the portal with the new Observation Layers List. With it, you can manage and configure observation layers outside of a project.

- View a full page of details for each layer with updated Analysis Layers.

- Run multiple searches on the same imagery with Search and Discover and build a queue list from successive queries.

- Add instructional resources to Excalibur projects to provide additional guidance, materials, and references. You can include Microsoft Word documents, Microsoft Excel spreadsheets, image files, PDFs, and Microsoft PowerPoint presentations.

- Related Information Products now shows supported item types associated with Excalibur projects. See related types such as image files, Microsoft PowerPoint presentations, ArcGIS Dashboards, ArcGIS Story Maps, and ArcGIS Experience Builder applications.

ArcGIS Excalibur introduces an Excalibur project, a dynamic way to organize required resources to complete an image or video-based task in a single location. Excalibur projects can include geospatial reference layers that provide context to your tasks and tools to streamline workflows. ArcGIS Excalibur also allows you to compile and create presentations that can be exported, used, and shared with others in your organization for reports and briefings.

ArcGIS Excalibur unifies traditional, separate geospatial, and imagery or video-based views into a single view. This new experience allows you to work with imagery and video in the collected view for maximum analytic value while allowing full integration with authoritative geospatial reference layers available across the platform.

Using the search functionality, you can perform an interactive search and selection of available imagery and video from an enterprise web service. You can also set search settings, preview imagery, view image metadata, and queue images and videos for further use.

ArcGIS Excalibur, Esri's advanced image analysis tool, has seen several significant updates recently, enhancing its functionality and user experience. Here's a look at the latest features and improvements.

## 1. Enhanced User Interface
The latest version of Excalibur features a more intuitive user interface, making it easier for users to navigate and analyze imagery. Streamlined workflows and improved layout options allow for faster access to essential tools.

2. Advanced Image Classification
Excalibur has introduced new machine learning models for image classification. These models improve accuracy and

speed, enabling users to classify land cover and other features more effectively. Users can now customize classification settings for specific projects, enhancing flexibility.
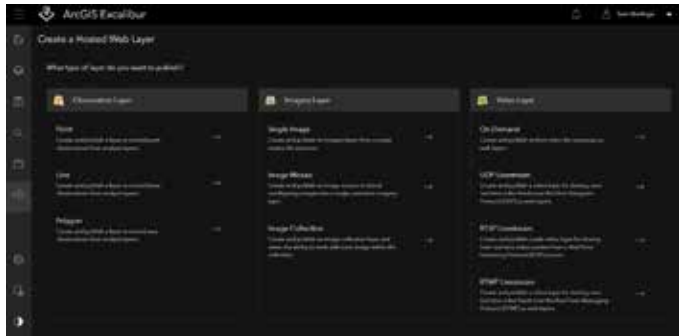
3. Integration with ArcGIS Living Atlas

Recent updates have improved the integration with ArcGIS Living Atlas, allowing users to easily access a broader range of basemaps and datasets. This integration enables more comprehensive analysis and visualization of imagery.

4. Enhanced Geospatial Analysis Tools

New geospatial analysis tools have been added, allowing users to conduct more complex analyses, such as change detection over time. These tools leverage advanced algorithms to highlight significant changes in the landscape, which is crucial for urban planning and environmental monitoring.

5. Collaboration Features

ArcGIS Excalibur now includes enhanced collaboration features, allowing multiple users to work on the same project simultaneously. Real-time editing and commenting facilitate teamwork, making it easier to share insights and findings.

6. Cloud Integration

With improved cloud capabilities, users can now store and manage their imagery in the cloud more efficiently. This update supports seamless access to high-resolution imagery from various devices, promoting a more mobile-friendly experience.

7. Improved Performance

Performance optimizations have been implemented to ensure faster processing of large datasets. Users can expect quicker load times and smoother interactions, particularly when working with high-resolution imagery.

8. Integrating with ArcGIS Knowledge

At the 3.1 release, ArcGIS Excalibur will support the knowledge graph layer directly. ArcGIS Knowledge graph layers contain spatial information through access to entity and relationship types. Excalibur will support adding graph layers directly as an observation layer within the project. This expands on the already rich ecosystem of supported layer types within the application. The observation collection workflow will be familiar in that it leverages a similar experience to other hosted feature layers.
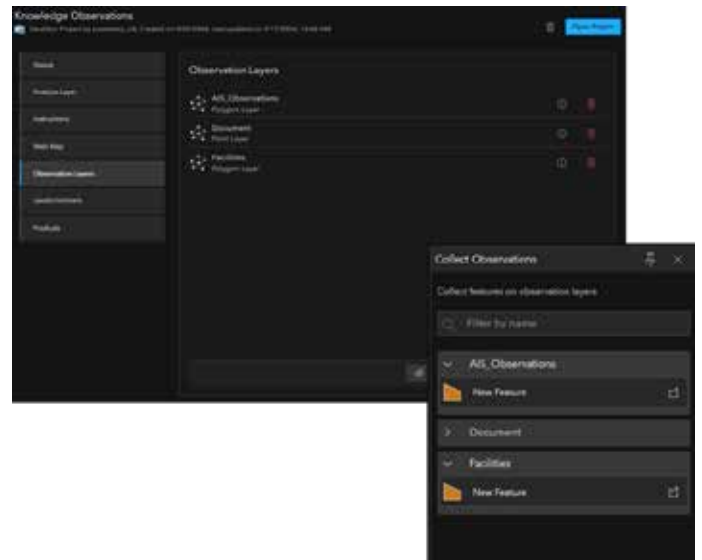
These updates make ArcGIS Excalibur an even more powerful tool for image analysis and geospatial intelligence. With enhanced user experience, advanced classification options, and improved collaboration features, Excalibur continues to support professionals in various fields, from environmental science to urban development.

esri India
THE SCIENCE OF WHERE™
and
R-CAT
Rajasthan Centre of
Advanced Technology

Elevating the Standards of Professional Education in GIS

In the heart of Rajasthan, R-CAT (Rajasthan Centre of Advanced Technology) emerges as a beacon of innovation and knowledge. Established by the Government of Rajasthan, it's not just an institute- it's a gateway to the future. As a unique IT Finishing School and a Tech Thought Leader, R-CAT engages with key stakeholders in academia, industry, government, and multilateral agencies to strengthen the IT ecosystem in the state and contribute to preparing industry-ready workforce for Rajasthan, India, and the world.

Let's understand from **Jyoti Luhadiya, Executive Director, Rajasthan Centre of Advanced Technology & Technical Director, Department of Information Technology and Communication, Government of Rajasthan**, how R-CAT, in collaboration with Esri India is diligently working towards creating avenues for the state's youth to build their GIS capabilities and be future-ready.

How is R-CAT uplifting the potential of students and young professionals?

R-CAT is dedicated to empowering students and young professionals by offering specialized training in cutting-edge technologies, including Geographic Information Systems (GIS), Big Data Analytics, Robotics, etc. Through a combination of practical and theoretical sessions, R-CAT provides an environment where students can develop critical thinking, problem-solving skills, and technical expertise. The focus is on preparing the youth to meet industry demands, enabling them to contribute meaningfully to society and enhancing their employability in a rapidly evolving job market.

What are the objectives of R-CAT's collaboration with Esri India?

The collaboration between R-CAT and Esri India aims to bridge the gap between academic knowledge and industry requirements by providing students with hands-on experience in GIS technology. This partnership is designed to enhance the technical proficiency of students, making them industry-ready. By leveraging Esri's expertise, R-CAT aims to deliver top-notch training programs that align with global standards, ensuring that students are well-prepared to tackle real-world challenges in their careers.

Why is it necessary to provide advanced learning opportunities in GIS technology to the youth?

Advanced learning opportunities in GIS technology are essential for the youth as they open doors to a multitude of

career paths in various sectors, including urban planning, environmental management, and disaster response. GIS skills are increasingly in demand as they play a pivotal role in decision-making processes across industries. By equipping the youth with these skills, R-CAT empowers them to be innovators and leaders in addressing complex local as well as global challenges, thus contributing to the development of a sustainable future.

How GIS knowledge and skills benefit the students?

Possessing GIS knowledge and skills equips students with the ability to create & analyze spatial data, identify patterns, and make informed decisions. This expertise is valuable across multiple disciplines, from urban planning to natural resource management. By mastering GIS, students gain a competitive edge in the job market, as these skills are highly sought after by employers in the government as well as the corporate sector. Moreover, GIS proficiency enables students to contribute to community development projects, enhancing their professional growth and societal impact.

> GIS skills are increasingly in demand as they play a pivotal role in decision-making processes across industries. By equipping the youth with these skills, we empower them to be innovators and leaders in addressing complex local as well as global challenges, thus contributing to the development of a sustainable future.

With GIS technology integrating with new technologies like AI, Digital Twins, IoT, etc., how do the industry-academia partnerships need to evolve?

As GIS technology converges with AI, Digital Twins, IoT, and other emerging technologies, industry-academia partnerships must evolve to foster interdisciplinary learning and research. These collaborations should focus on developing curricula that incorporate these advanced technologies, ensuring that students are well-versed in the latest industry trends. Additionally, partnerships should facilitate internships,

projects, placements and real-world problem-solving experiences, enabling students to apply their knowledge in practical settings. This approach will help produce a workforce that is adaptable, innovative, and prepared to lead in a technology-driven world.

What are the future plans of R-CAT in making the students more technology-savvy and future-ready?

R-CAT is committed to continuously updating its training programs to incorporate the latest technological advancements, including AI, GeoAI, machine learning, and big data analytics, alongside GIS. The institution plans to introduce more specialized courses and certifications that align with industry demands. R-CAT also aims to strengthen its collaborations with global technology leaders and educational institutions providing students with exposure to international best practices. By fostering a culture of continuous learning and innovation, R-CAT ensures that its students are not only technology-savvy but also future-ready, capable of leading the charge in the digital transformation of various industries.

Empowering People with Mental Disabilities like Autism with Help of GIS: A Smart Approach for a Smarter Society

Ms. Ranjana Pushkarna[1], Mr. Manish Sharma[2]

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C-56, Sector 80, Noida Phase 2

Abstract

Mental disabilities encompass a spectrum of conditions affecting cognitive, emotional, and behavioral functions, impacting millions of children worldwide each year. In India alone, the prevalence of mental disorders among children is substantial, with conditions such as autism spectrum disorders (ASD), attention-deficit/hyperactivity disorder (ADHD), and mood disorders presenting significant challenges.

In the context of smart cities, Geographic Information Systems (GIS) and Artificial Intelligence (AI) can transform urban environments to better support individuals with mental disabilities. As cities evolve, the integration of these technologies ensures that urban spaces become more inclusive, accessible, and supportive. GIS plays a critical role by providing detailed spatial analysis and mapping of city infrastructure, facilitating the design and optimization of accessible routes, public transportation, and specialized facilities. This ensures that individuals with cognitive impairments can navigate the urban landscape more easily and safely. AI, leveraging advanced machine learning algorithms, offers personalized assistance through smart devices and applications. These technologies can monitor behavior, predict needs, and provide real-time support, enhancing the independence and quality of life for people with mental disabilities. The synergy of GIS and AI in smart cities not only enhances physical accessibility but also promotes social inclusion. In conclusion, the integration of GIS and AI in smart city planning and development holds immense potential for empowering individuals with mental disabilities like autism. It paves the way for more inclusive urban ecosystems, ensuring that all citizens can benefit from the advancements in smart city technologies.
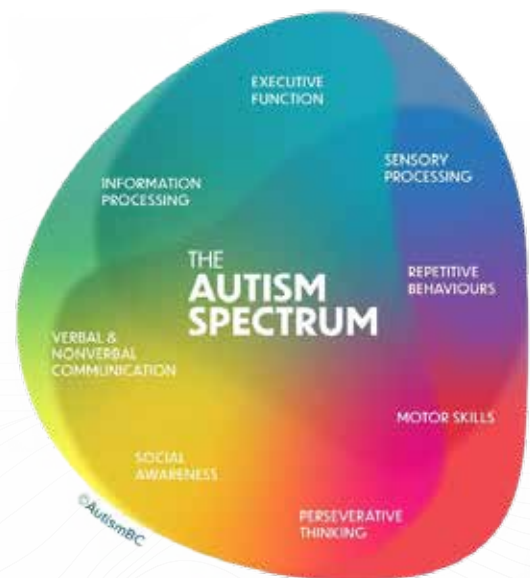
Introduction

Mental disabilities encompass a spectrum of conditions affecting cognitive, emotional, and behavioral functions, impacting millions of children worldwide each year. In India alone, the prevalence of mental disorders among children is substantial, with conditions such as autism spectrum disorders (ASD), attention-deficit/hyperactivity disorder (ADHD), and mood disorders presenting significant challenges. Autism Spectrum Disorder (ASD) is a multifaceted neurodevelopmental condition marked by challenges in social interaction, communication, and repetitive behaviors. Considering the data statistics for ASD alone, in India, ASD is estimated to affect approximately 1 in 500 children; however, due to underreporting and limited awareness,

the true prevalence might be higher. The diverse nature of mental disabilities like ASD calls for varied management and intervention strategies. Geographic Information Systems (GIS) can be instrumental in meeting these needs by offering spatial analysis, visualization, and data integration capabilities. This highlights the need for innovative solutions to support this vulnerable population.

Challenges faced by families having a child with Autism in India

Families with autistic children in India often face a range of challenges that can impact their daily lives and overall well-being. Some of the key issues include:

1. **Lack of Awareness and Understanding:** Autism is not widely understood or accepted in many parts of India. This can lead to stigma, misinformation, and social isolation for both the child and the family.

2. **Limited Access to Specialized Services:** There are often few specialized services and resources for autism, especially in rural and underserved areas. This can include a lack of trained therapists, educational resources, and medical professionals.

3. **Educational Barriers:** The education system in India may not be well-equipped to accommodate children with autism. There are limited special education facilities, and mainstream schools may lack the necessary support and resources for inclusive education.

4. **Financial Strain:** The cost of therapies, special education, and medical care can be prohibitively high, placing a significant financial burden on families. Many families may not have access to insurance or financial support for these services.

5. **Social and Cultural Stigma:** Cultural attitudes towards disability can be negative or dismissive. Families may face discrimination or judgment from their communities, which can lead to social isolation and additional stress.

6. **Navigating Systems:** Families often must deal with bureaucratic hurdles and a lack of clear guidance on how to access services and support. This can be overwhelming and confusing.

7. **Limited Research and Data:** There is relatively little research on autism specific to the Indian context, which can impact the development of effective interventions and policies.

8. **Support Systems:** There is often a lack of structured support systems, such as parent support groups or community resources, which can provide emotional support and practical advice.

9. **Government Policies:** While there have been some advancements, there is still a need for more comprehensive and effective government policies and programs to support individuals with autism and their families.

Addressing these challenges involves increasing awareness, improving access to resources, and creating supportive policies and communities to ensure that children with autism receive the care and support they need.

How GIS can Help

Geographic Information Systems (GIS) can be a powerful tool for families with autistic children in India, offering various benefits that can enhance their quality of life and access to resources. Here's how GIS can be helpful:

1. Access to Specialized Services

GIS can map out locations of specialized services such as therapy centers, special education schools, and healthcare facilities. Families can use these maps to find the nearest and most appropriate services for their child.

2.   Resource Allocation and Planning

GIS can help in identifying areas with a shortage of resources or services for autistic children. This can aid policymakers and organizations in planning and allocating resources more effectively to underserved areas.

3. Community Support Networks

By mapping community support groups, parent networks, and autism-related organizations, GIS can help families connect with local support systems and advocacy groups.

4. Educational Opportunities

GIS can assist in locating schools with specialized programs for children with autism. Families can use these maps to evaluate and choose educational institutions that offer appropriate support and facilities.

5. Healthcare Accessibility

Mapping healthcare facilities that provide autism-specific services, including pediatricians and mental health professionals, can help families easily find and access medical care.

6. Emergency Planning

GIS can be used to develop emergency plans and routes tailored to the needs of families with autistic children. This can include mapping out safe places, hospitals, and other critical resources.

7. Awareness and Advocacy

GIS can visualize data on autism prevalence, service availability, and public awareness across different regions. This can help in raising awareness and advocating for better services and support.

8. Navigational Aids

For families who need to travel to different locations for services or support, GIS can provide detailed navigational aids and help plan the best routes, considering factors like traffic and accessibility.

9. Customized Solutions

GIS can be used to analyze specific needs of families and provide customized solutions. For instance, if a family needs assistance with transportation, GIS can help identify local transportation services that cater to their needs.

In summary, GIS can offer valuable insights and tools to support families with autistic children in India, helping them navigate services, connect with resources, and advocate for better support.

How AI can help

Artificial Intelligence (AI) can offer substantial assistance to families with autistic children in India through various applications designed to support daily living, enhance educational opportunities, and improve access to resources. Here's how AI can be helpful.

1. Support for Parents and Caregivers

- **Guidance and Resources:** AI chatbots and virtual assistants can provide immediate guidance, resources, and support to parents and caregivers, answering questions and offering advice on managing daily challenges.

- **Community and Networking:** AI can help connect families with local support groups, therapists, and community resources based on their specific needs and locations.

2. Research and Development

- **Innovative Solutions:** AI can drive research and development in autism care, leading to new therapies, tools, and strategies based on data-driven insights and innovative approaches.

3. Transportation and Mobility

- **Navigation Aids:** AI can assist with personalized navigation solutions that consider the unique needs of families, such as finding accessible routes and transportation options that accommodate specific requirements.

- **Mobility Assistance:** AI-driven apps and devices can provide real-time assistance and support for managing mobility challenges, such as finding accessible locations and managing travel logistics.

4. Predictive Analytics and Resource Allocation

- **Demand Forecasting:** AI can predict demand for autism-related services and resources, helping policymakers and organizations better allocate resources and plan for future needs.

- **Optimizing Service Delivery:** AI can analyze data to optimize service delivery models, ensuring that resources are efficiently distributed to meet the needs of families and children.

Smart Cities – An Integrated Solution

Smart cities utilize cutting-edge technologies to build sustainable and efficient urban spaces. For individuals with mental disabilities like autism, these cities can greatly enhance accessibility, mobility, and overall quality of life. By incorporating GIS and AI, smart cities can deliver customized services and support systems designed to empower these individuals addressing most of the challenges, and can offer numerous benefits to families with autistic children by incorporating features and technologies that enhance accessibility, safety, and quality of life. Here's how this initiative can specifically help:

1. Accessible Infrastructure

- **Sensory-Friendly Public Spaces:** Design parks, playgrounds, and public areas with sensory-friendly features, such as quiet zones and soft lighting, to accommodate sensory sensitivities.

- **Universal Design:** Ensure public buildings and transportation are designed with accessibility in mind, including ramps, elevators, and clear signage, to make it easier for families with special needs.

2. Enhanced Safety and Security

- **Smart Surveillance:** Implement smart surveillance systems to monitor and ensure the safety of children in public spaces.

- **Emergency Response Systems:** Develop systems that can quickly alert authorities or caregivers in case of an emergency, using technologies like GPS tracking or automated notifications.

3. Assistive Technologies

- **Smart Devices:** Provide access to smart devices and applications that can aid communication, learning, and daily routines for autistic children. For example, apps that help with social skills, routines, or even sensory management.

- **Adaptive Learning Tools:** Integrate adaptive learning technologies in schools that can tailor educational content to the specific needs of autistic students.

4. Healthcare Access

- **Telemedicine:** Facilitate telemedicine services for regular consultations with specialists, making it easier for families in remote or underserved areas to access healthcare.

- **Health Data Integration:** Create integrated health records systems that can be easily accessed by multiple healthcare providers to ensure consistent and comprehensive care.

5. Community Support

- **Support Networks:** Foster community networks and support groups through digital platforms where families can connect, share resources, and get advice.

- **Inclusive Events:** Organize events and activities that are designed to be inclusive and supportive of autistic individuals, ensuring they have opportunities to participate fully in community life.

6. Public Awareness and Training

- **Awareness Campaigns:** Run awareness campaigns to educate the public about autism, reducing stigma and promoting understanding.

- **Training for Service Providers:** Offer training for educators, healthcare providers, and public service personnel to improve their understanding and support for autistic individuals.

7. Data and Research

- **Research Initiatives:** Support research on autism and its needs within smart cities, leading to better policies and interventions.

- **Feedback Mechanisms:** Establish systems for collecting feedback from families about the effectiveness of smart city features and continuously improve based on their input.

ArcGIS Application for Autistic Patients

By integrating these features into the Smart Cities initiative, urban environments can become more accommodating and supportive of families with autistic children, enhancing their quality of life and ensuring they have access to the resources they need.

ArcGIS offers various applications to support smart city initiatives:

- **ArcGIS Dashboards:** Visualize real-time data to monitor citywide metrics.

- **ArcGIS Hub:** Engage with the community to gather feedback and improve services.

- **ArcGIS Urban:** Plan and manage urban development projects with a focus on accessibility and inclusivity.

Utilizing the potential of Esri's ArcGIS, a simple yet user friendly web-based application can be created which can help families of autistic kids and governing authorities to:

- **Locate:** Nearest hospital /school/therapy center having

facilities for autistic patients to their home.

- **Navigate:** Network Analysis in ArcGIS can help them with navigation algorithms to navigate to nearest facility.

- **Plan:** To plan better considering the needs of autistic kids by looking at near real time data about areas with maximum number of autistic kids, location of existing facilities to check need of new facilities.

Conclusion

In the context of smart cities, Geographic Information Systems (GIS) and Artificial Intelligence (AI) can transform urban environments to better support individuals with mental disabilities. As cities evolve, the integration of these technologies ensures that urban spaces become more inclusive, accessible, and supportive. The synergy of GIS and AI in smart cities not only enhances physical accessibility but also promotes social inclusion. In conclusion, the integration of GIS and AI in smart city planning and development holds immense potential for empowering individuals with autism. It paves the way for more inclusive urban ecosystems, ensuring that all citizens can benefit from the advancements in smart city technologies.

GIS and Artificial Intelligence for Precise Damage Assessments

By Anthony Schultz and Jarell Perez

When wildfires ravaged Lahaina, Hawaii, the scars left behind weren't just physical but emotional and societal. The subsequent challenges of conducting a damage assessment helped underscore a pressing need for improved tools and methodologies. While traditional methods have their merits, the scale and severity of such disasters demand something more efficient. Therefore, we are excited to announce a new damage assessment deep learning model.

Historically, in the wake of a disaster, conducting a damage assessment has been a manual and time-consuming endeavor. Damage assessment teams need to cover vast areas, often under hazardous conditions, to document and assess damage. This not only elongates any potential response times but also can sometimes result in inconsistencies due to the sheer scale of the disaster.

Esri's deep learning model was designed with the primary goal of addressing these challenges. By processing high-resolution satellite and aerial imagery, the new damage assessment model can identify patterns of destruction, differentiating between damaged and undamaged structures. This automation speeds up the assessment process with surprising accuracy. This blog will provide a high-level overview of the workflow and detail where you can locate the model to start using it yourself.

Practical Application in Lahaina

In the wake of the Lahaina wildfires, we developed and put to the test a new damage assessment model. The results were outstanding. What would traditionally take hours of labor

and manual surveying was achieved in a fraction of the time with 95 percent accuracy. Rapid damage assessments with this level of accuracy revolutionize postdisaster assessment processes by providing access to previously unobtainable decision support information during initial response. For instance, with rapid and accurate damage assessments, authorities can prioritize areas for search and rescue and allocate resources to heavily affected areas immediately.

To classify damage, it is necessary to have building footprint information for the area of interest. This information allows the damage assessment model to classify buildings as damaged or undamaged by creating boundaries from which to reference and label.

Building Footprint Feature Extraction

The accuracy of the building footprint layer is also important and may vary depending on the method used to create the data. The building footprints should be accurate to the incident imagery you are planning on utilizing to run the model. If building footprints don't exist, the user needs predisaster imagery so that they can use different AI models to extract building features. To provide additional context for the buildings, the building footprint data we utilized also indicated building occupancy type. This allows the model to help quantify the number of homes and other infrastructure that may be damaged.

For help in extracting building footprints from imagery, Esri offers a high-resolution model in ArcGIS Living Atlas of the

World: Deep Learning Model to Extract Building Footprints

After obtaining building footprint information, the next step is to locate postdisaster imagery for the affected area. Postdisaster imagery can come from a variety of sources including satellites or unpiloted aerial system (UAS) technology. Obtaining postdisaster imagery from a satellite sounds difficult or prohibitively expensive. In truth, neither is the case!

A great resource for postdisaster imagery is Maxar's Open Data Program at https://www.maxar.com/open-data.

Once postdisaster imagery is obtained, it is best to refine the deep learning model. For Lahaina, we manually inspected 500 buildings from the postdisaster imagery, classifying them as either damaged or undamaged. This helped refine the model to different geographies, account for differences in building size and shape, and incorporate different extents of damage into a model's output. In short, we took our postdisaster imagery and conducted a drive-by or windshield survey to help the model classify buildings.

This image shows additional training samples the team created to help refine our preexisting damage classification model

Once the model is refined, users can use ArcGIS Pro or ArcGIS Online to run the deep learning model and produce their own damage assessments. Esri published both the results of the analysis and the deep learning model in ArcGIS Online in hopes of spurring efficient collaboration, creating new tools for incident response, and democratizing geospatial artificial intelligence (GeoAI).

The model's results can easily be placed into a web map, dashboard, or web app, depending on the user's need. In the case of the Lahaina fire, a dashboard was chosen so that the results could be visualized and organizations could use it to help guide response and recovery efforts as well as inform public outreach.

The Way Forward

The tragic wildfires in Lahaina served as a stark reminder of the vulnerabilities we face and the importance of timely and accurate postdisaster assessments. Like most artificial intelligence applications in wildland fire, deep learning is not a replacement for on-the-ground verification and expertise but rather a tool that augments human capabilities.

As wildland fire and disaster management continue to evolve, the blending of these models with traditional methods will only serve to refine our disaster response mechanisms. Regardless, as technology continues to progress, the goal remains steadfast: to support communities in their time of need, ensuring that they have the best tools at their disposal for disaster preparedness, mitigation, response, and recovery.

Anthony Schultz

Anthony Schultz is the Director of Wildland Fire Solutions at Esri. He has a background in wildland fire management and operations, having served in a variety of capacities, most recently as the Fire Management Officer (FMO) for the State of Wyoming. During his tenure in Wyoming, he served as chair of the Western State Fire Managers and was a Rocky Mountain Coordinating Group member. He has also served as an FMO with the State of North Dakota. Prior to becoming an FMO, he worked as a wildland firefighter the Bureau of Land Management, the National Park Service, and the US Fish and Wildlife Service.

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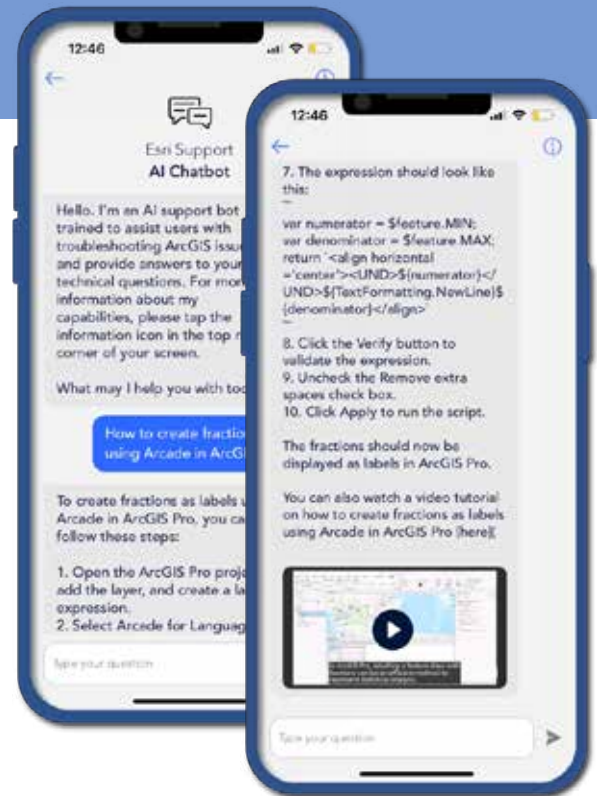
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