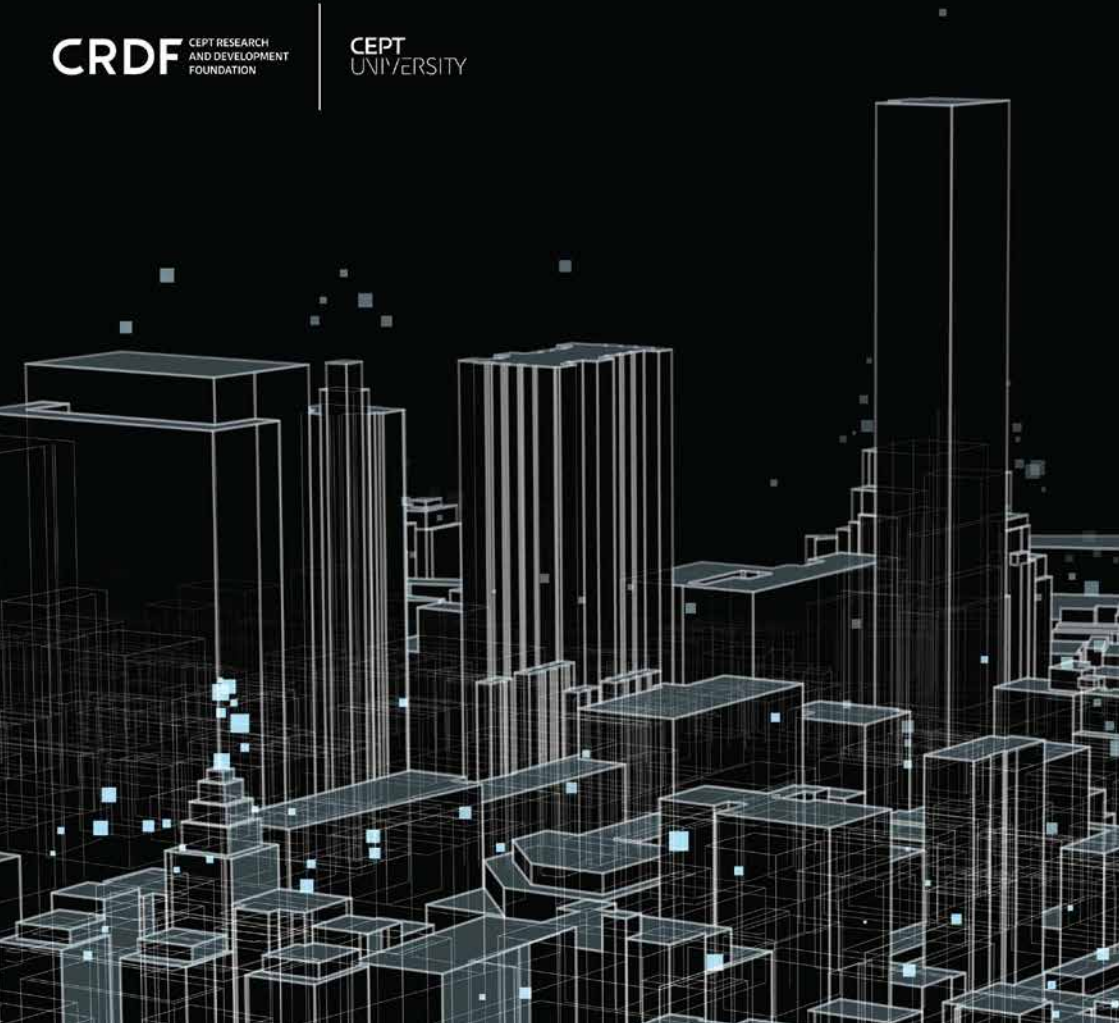
CEPT CONFERENCE

CIVIL ENGINEERING IN INDIA
GEOSPATIAL TECHNOLOGIES FOR INFRASTRUCTURE

COMPENDIUM /2024

CRDF CEPT RESEARCH AND DEVELOPMENT FOUNDATION | CEPT UNIVERSITY



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CEPT CONFERENCES

CEPT Conferences aim to promote knowledge exchange, collaboration, and interdisciplinary research in urban design, planning, and policy and management. By bringing together stakeholders from diverse backgrounds, the conferences facilitate the advancement of sustainable and equitable urban development. The platform provides a forum for unbiased discussions, advances knowledge and new ideas, influences positive change in public policy, exposes students to professionals and policymakers, and offers networking opportunities. CEPT Conferences are dedicated to working towards solutions to India's urban challenges through collaboration and collective action.

The CEPT Conferences are organised by CEPT Research and Development Foundation (CRDF), the research arm of the University, engaged in research projects, advisory assignments and capacity building initiatives aimed at solving critical problems in the built environment and human habitats.

#CEPTConferences
#TallBuildingsInIndia

ABOUT

THE CONFERENCE

The Second Edition of the CEPT Conference on Civil Engineering In India, themed Geospatial Technologies for Infrastructure!

Unlocking the Future of Infrastructure through Geospatial Innovation.

India is undergoing a massive infrastructure transformation, fueled by ambitious government initiatives like the Smart Cities Mission, Digital India, and the expansion of national highways and railways. At the heart of these developments are geospatial technologies—encompassing Geographic Information Systems (GIS), remote sensing, and satellite imagery. These technologies are revolutionising how infrastructure projects are planned, executed, and managed, offering powerful tools to optimise efficiency and sustainability.

This conference on Geospatial Technologies for Infrastructure aims to bring together key industry leaders, policymakers, academics, and technology experts. Together, they will explore the latest innovations, trends, and challenges in integrating geospatial technologies into large-scale infrastructure projects.

WELCOME ADDRESS BY AANAL SHAH

Prof. Aanal Shah, Dean – Faculty of Technology extended a warm welcome to the gathering at the Second Edition of Civil Engineering in India Conference and highlighted that this conference provides a knowledge sharing platform for practitioners, researchers and academicians. She highlighted the key role played by geospatial technologies in the planning, development and management of infrastructure projects. Further, she mentioned these technologies have immense potential to improve quality of life. After setting the context for the conference, she provided a brief introduction of distinguished speakers and subsequently provided a glimpse into the sessions and their themes along with the timings for the knowledge of audience.

WELCOME ADDRESS BY SUREN VAKIL

In his opening remarks, Suren Vakil said that the civil engineering profession has made rapid and impressive strides. As an example, he recollected his early experience in the United Kingdom, wherein the water quality monitoring project involved manual retrieval and analysis of data, which was logistically resource extensive and time-consuming process which can now be carried out through web-based real time monitoring today. He assured the audience that they would experience a stimulating day at this conference and encouraged participants to contribute to the discussions.

CONFERENCE AGENDA

26th November 2024

Venue – Balwantrai N. Brahmbhatt Lecture Hall, CEPT University, Ahmedabad

8:30 a.m. – 9:40 a.m.		**Registration and breakfast**
9:45 a.m. – 10:00 a.m.		Welcome and Opening Address by **Aanal Shah & Suren Vakil**
10:00 a.m. – 11:15 a.m.		Session 1: Session 1: Geospatial Technologies: An Overview & Applications
		Shweta Mishra **Scientist, Space Application Center (SAC)**
	(20 mins)	Role Of Geospatial Technology for Infra Projects
		Gopal BS **Senior Group Engineer GIS, ATKINS**
	(20 mins)	Unlocking Engineering Potential: The Role of Geospatial Techniques
		Bhargav Dave **Chief Executive Officer (CEO), VISIlean**
	(20 mins)	Insights on Lean-BIM-Geo Integrated Project Controls
		Q&A (15 mins)
11:15 a.m. – 11:45 a.m.		TEA BREAK
11:40 a.m. – 1:20 p.m.		Session 2: Digital Twin & Modelling
		Sanghee Shin **CEO and President, Gaia3D, South Korea**
	(20 mins)	Dreams and Dilemmas: Lessons from Korea's Urban Digital Twin
		Dr Shyju Krishnankutty, **Group Manager (Presales), Esri India**
	(20 mins)	BIM-GIS
		Shailesh Gaur **Consultant/Advisor- Digital Transformation**
	(20 mins)	Digital Twins in Urban Infrastructure
		Udit Bhatia **Assistant Professor, IIT Gandhinagar**
	(20 mins)	Integrating Spatial Network Analysis and Deep Learning for Infrastructure Resilience Against Concurrent Hazards
		Q&A (15 mins)

1:20 p.m. - 2:30 p.m.		LUNCH BREAK
2:15 p.m. – 3:45 p.m.		Session 3: Disaster Management
		Amit Anand **Principal Consulatant, PWC**
	(20 mins)	**Telecom Industry – Disaster Risk and Resilience Assessment Framework For Telecom Infrastructure Systems**
	(20 mins)	**Space-Based Technology For Geohazard Assessment**
		Bhupesh Gupta **Founder & CEO, Geonomads**
	(15 mins)	**Highway And Transportation**
		Q&A
3:45 p.m. – 4:15 pm		TEA BREAK
4:15 p.m. – 5:30 p.m.		**Panel Discussion on Construction Management And Infrastructure Monitoring With Geospatial Technologies** **Vote of Thanks – Prof Aanal Shah – Dean, Faculty of Technology – CEPT University**
		CEPT University Winter Exhibition Tour

SHWETA MISHRA

SPACE APPLICATIONS CENTRE

@Shweta Mishra

ABOUT

The Space Applications Centre (SAC) is a key center of the Indian Space Research Organisation (ISRO), focusing on the development of space-borne instruments and applications of space technology for societal use. Its work spans communication, broadcasting, navigation, disaster monitoring, meteorology, oceanography, and environmental and natural resource monitoring. SAC designs transponders for INSAT and GSAT communication satellites and sensors for IRS remote sensing satellites. It also develops ground systems for data and image processing.

Established in 1966 by Dr. Vikram Sarabhai in Ahmedabad, SAC supports its operations through advanced facilities for payload integration, testing, and image analysis. It collaborates with industries for technology development, engages with academic institutions for research, and promotes space applications through public outreach and training programs, including postgraduate courses under the Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP).

Shweta Mishra
Scientist | Space Applications Centre

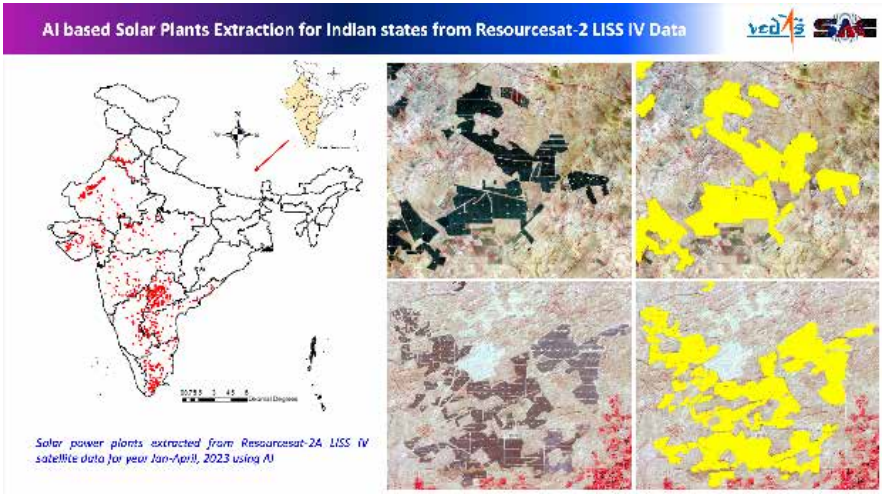
Shweta Mishra is M. Tech. in Spatial Information Technology from DAVV University, Indore. She joined Space Applications Centre (SAC), ISRO, in year 2010 and currently working as Scientist- 'SF' in VEDAS Research Group. She has special interest in applications of Geoinformatics and AI/ML for renewable energy sector.
Her current work focusses on the development of geospatial applications under –VEDAS project using advanced open source WebGIS and AI/ML technologies. Her major works include development of Renewable Energy Application, Solar Calculator for India and World, Geospatial Energy Map of India for NITI Aayog, Desertification and Land Degradation monitoring system, Urban Sprawl Information system etc. She is recipient of Young Geospatial Scientist Award for year 2016 and ISRO Team Excellence award for MOSDAC in year 2013.

ROLE OF GEOSPATIAL TECHNOLOGY FOR INFRA PROJECTS

This presentation highlights the use of geospatial technology in infrastructure:

- Visualization & Analysis: Tools for 2D/3D visualization, thematic data sharing, and web-based geo-processing across sectors like agriculture, energy, urban sprawl, and hydrology.
- Energy Mapping: A comprehensive Geospatial Energy Map of India integrating power plants, fossil fuel resources, pipelines, and renewable energy potential.
- AI Applications: AI-driven solar plant mapping using satellite data.
- Platforms: Mobile apps (e.g., VEDAS, Global Solar Calculator) and APIs for easy data access and sharing.

The session showcases how geospatial tools support effective infrastructure planning and management.



Role of Geospatial Technologies for Infrastructure Projects – Shweta Mishra

Shweta Mishra in the beginning of her talk introduced the audience about what constitutes energy infrastructure in India and how geospatial technology offers promising solutions for energy infrastructure management. She made an engaging elaboration about the use case of geospatial technology for policy making in the domain of energy infrastructure. She highlighted the efforts taken in the direction of Geospatial Energy Map of India. Earlier the data pertaining to energy infrastructure in India was fragmented across multiple organizations and there were missing details like geolocation information. The Geospatial Energy Map of India provided a one stop solution to the policy makers by providing functionalities like site selection and assessment, resource assessment, environmental impact assessment, energy infrastructure planning and performance monitoring and control. She highlighted these functionalities and analytics dashboard provides a way forward for energy infrastructure management in India.

GEOSPATIAL ENERGY MAP OF INDIA

WHY ONE SINGLE ENERGY MAP?

- Data fragmented across multiple organisations
- Available data in static form (PDF, JPG)
- Maps not updated regularly.

Examples

- Solar calculator (ISRO)
- National Power Portal (CEA)
- Online Coal Block Information System (CMPDI)
- Sub-stations, Transmission Lines of (ERLDC)

ENERGY MAP OF INDIA

Overview · Geospatial Maps · Meta Data · User guide · Disclaimer · Gallery · Imp. Links

Data provided by
- Ministry of Power
- Ministry of New & Renewable Energy
- Ministry of Coal
- Ministry of Petroleum & Natural Gases
- Dept. of Atomic Energy

Input Received in different formats

↓

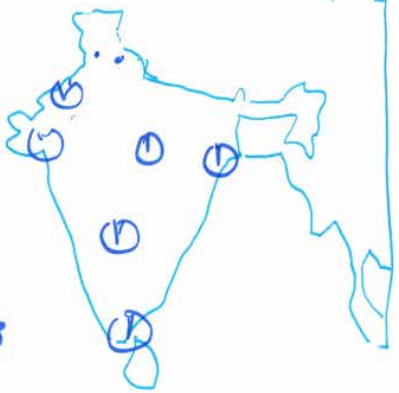
Data Cleaning / Schema mapping

↓

Data Re-Organised

↓

Energy Layers Published



GOPAL BS

ATKINSRÉALIS

@Gopal BS

ABOUT

"AtkinsRéalis is a global engineering and project management company that leverages its expertise to design and deliver infrastructure and energy solutions. The organization specializes in areas such as transportation, urban development, and energy systems, with a focus on sustainability and innovation. Through its comprehensive services, AtkinsRéalis aims to connect people, technology, and data to drive transformative change in the built environment. It operates in sectors including nuclear, transportation, and critical facilities, working on complex projects worldwide

Gopal BS
Senior Group Engineer (Lead – Geospatial) | AtkinsRéalis

"Gopal is the Geospatial Lead at AtkinsRéalis, with over 25 years of experience in GIS, CAD/BIM, LiDAR, digital photogrammetry, and mapping solutions. He joined the company in January 2018 and has since played a key role in delivering projects that leverage GIS, LiDAR, CAD/BIM, and mapping technologies.

His expertise spans a wide range of geospatial disciplines, including GIS, LiDAR, CAD/BIM, and mapping. He has a proven record in managing and building geospatial teams that specialize in GIS, LiDAR, photogrammetry, and remote sensing. Gopal has led and overseen numerous geospatial projects, ensuring adherence to industry standards across regions such as India, Europe, the Middle East, the US, the UK, Australia, and South America.

His project support covers diverse sectors, including highways, rail, transportation, airport development, building projects, transport planning, environmental studies, and water management. Gopal has contributed to several high-profile projects, such as Network Rail (UK), Ordnance Survey of Great Britain (OSGB), Ordnance Survey of Ireland (OSi), Highways England, the UK Environment Agency (EA), Heathrow Airport planning, the Oman National Spatial Strategy (ONSS), the Kuala Lumpur-Singapore High-Speed Rail project, and the Nagpur Metropolitan Area (NIT). Currently, Gopal leads the Geospatial team at AtkinsRéalis in Bengaluru. Prior to joining the company, he gained experience at Jacobs in Kuala Lumpur, Malaysia, and worked in India with COWI India and Genesys."

UNLOCKING ENGINEERING POTENTIAL: THE ROLE OF GEOSPATIAL TECHNIQUES

This presentation, titled 'Unlocking Engineering Potential: The Role of Geospatial Technology' explores the pivotal role of geospatial technology in engineering and construction. It highlights the contributions of AtkinsRéalis' global geospatial team, having over 500 experts, and showcases their innovative work in GIS technology, GIS development, and LiDAR solutions.

Key Themes:

- Integrating **geospatial technology** into the AEC (Architecture, Engineering, and Construction) industry.
- Utilizing **drones (UAS)** and **LiDAR** for precise mapping and data processing.
- Applications such as **SCAN2BIM**, drone site surveys, and GIS-based asset management.
- Promoting collaboration through **ISO BIM/GIS standards** and platforms like the **AtkinsRéalis Go Portal** for environmental data access.

The presentation highlights how advanced geospatial tools improve efficiency, accuracy, and insights in construction and engineering projects.

An illustration depicting the use of LiDAR technology, 3D digital modeling, and geospatial tools in construction and engineering. The scene features drones conducting LiDAR mapping with laser beams creating a 3D representation of the terrain, alongside a GIS interface showcasing detailed maps and data. A construction site with workers and machinery highlights the integration of advanced technologies in modern engineering.

Unlocking Engineering Potential – The role of Geospatial Technology – Gopal B S

After realizing and appreciating the role of geospatial technology for energy infrastructure in the first talk, the conference audience had the second presentation by Gopal BS explaining how engineering potential of geospatial technologies can be tapped for infrastructure management. He talked about various survey options like manned aircraft, satellite and unmanned drones. The process of collection and analysis of geospatial data was elaborated in his talk. He further went on to explain the challenges in LiDAR in terms of data integration, interoperability, accuracy and precision of data, high cost and data security and privacy. With the advent of various geospatial technologies, the volume of data is increasing rapidly. In this context, he particularly emphasized the data size, and its subsequent management is going to pose challenges in coming days to the geospatial community.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DR BHARGAV DAVE

VISILEAN

@Bhargav Dave

ABOUT

VisiLean Ltd was founded in 2015 to challenge the way of working within the construction industry. In 2010, the fundamental concepts behind VisiLean were framed.

The main drivers behind VisiLean have been to combine important elements that are based on research findings, with benefits that current technologies can deliver:

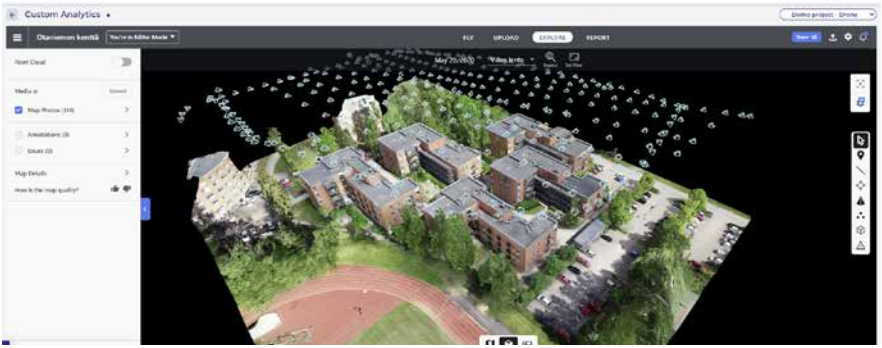
- Lean construction and collaborative planning have been proven to reduce waste in construction projects.
- The combined usage of BIM and Lean construction has an additional benefit, also shown by research.
- Mobile solutions, like apps and sensors, provide new methods for field data capture in a convenient, real-time manner.
- Usability is a fundamental building block for any successful cloud solution. VisiLean has never been a service intended for just the core experts, but for everyone from Management right down to the construction site.

Dr Bhargav Dave
Co-founder & CEO |
VisiLean Oy

Dr. Bhargav is the Co-founder and CEO of VisiLean Oy, a Finnish startup focusing on solving complex production management problems in construction with lean methods. With an early interest in computing, Bhargav started programming at the age of 11. The seeds of digitalising the construction industry were planted during his graduation in Construction Technology from CEPT University. Soon after, Bhargav's career focused on leading process improvement and lean implementation on projects. With a Masters and PhD in Digitising Construction, Bhargav's research explorations continued on in improving production on construction projects with lean construction methods aligned with information systems. During this time, he contributed to the original research behind integrating lean construction and BIM as well. As of today, Bhargav has authored over 45 publications and led several research projects in the area. Work aside, he has a keen interest in photography, reading and travelling during his spare time.

INSIGHTS ON LEAN-BIM-GEO INTEGRATED PROJECT CONTROLS

Traditional construction project management often faces challenges such as poor visibility, inefficient resource allocation, and delayed decision-making. To meet the evolving needs of today's complex projects, VisiLean's Lean-BIM-Geo integration brings a new level of clarity and control to project management. In this presentation, we will showcase how teams utilise these powerful tools to visualise tasks, track progress, and manage constraints for delivering such state-of-the-art projects. With VisiLean, users can comprehensively picture project sites, mark specific areas, and link geofences, providing real-time insights right on the map. This integrated approach helps streamline resource allocation and decision-making, enabling efficient project management that's data-driven and focused on maximising productivity.



Insights on Lean – BIM – Geo Integrated Project Controls – Bhargav Dave

Bhargav Dave gave an insightful talk focusing on the integration of three powerful concepts namely Lean, Building Information Modelling and Geo Integrated Project Controls. Firstly, he stressed the importance of adopting digital technologies in the field of civil engineering. He highlighted on the rapid pace of infrastructure development in India and the rethink required for current ways and means on infrastructure project monitoring. A novel approach involving Building Information Modelling (BIM) and Geographical Information System (GIS) integrated with lean construction management system is advocated by him for streamlining the construction processes, reduction of errors and improved project efficiency.


VisiLean Ltd. | Confidential and proprietary
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QUESTION AND ANSWER SESSION

The Q & A sessions had varied questions ranging from solar potential of Ladakh to sensor used for data collection, and platforms used for data conversion. In response to a question pertaining to solar potential, Shweta Mishra mentioned that Ladakh has high solar potential with abundant sunlight and this potential is being harnessed, which would promote sustainable development and eco-friendly tourism in that region. Subsequently, Gopal BS continued this dialogue and stated that vehicle mounted sensors can be used for site surveys and data collection like wind speed and solar radiance can be effectively done with these sensors. Dr. Bhargav Dave responded to a question pertaining to platforms for conversion of photos into 3D model using photogrammetry. In this insightful Q and A session, the audience got a glimpse of how geospatial technologies can make a difference in energy infrastructure management and how lean -BIM- GIS integration can help in effective project monitoring.


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Shweta Mishra

SANGHEE SHIN

GAIA3D, SOUTH KOREA

@SANGHEE SHIN

ABOUT

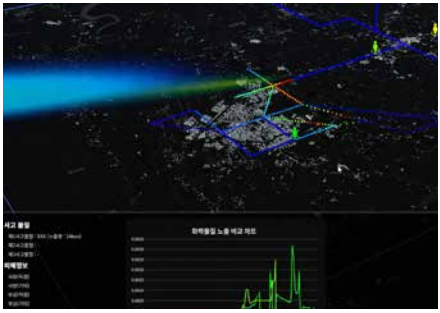
Since its establishment in 2000, Gaia3D has been dedicated to developing cutting-edge geospatial software in 3D, earth sciences, and remote sensing. Gaia3D has been recognized twice with commendations from the President of the Republic of Korea for its excellence in geospatial business development. As an open-source geospatial company, Gaia3D actively contributes to the community by sponsoring international, regional, and local FOSS4G conferences and by making its core source code available to the public. Gaia3D believes that openness and collaboration-driven technology can support the sustainability of our society.

Sangee Shin
CEO and President | Gaia3D, Inc

Sanghee Shin is the founder and CEO of Gaia3D, an geospatial software company in Korea. He studied Environmental GIS at Seoul National University and Business Administration at KAIST (Korea Advanced Institute of Science and Technology). With over 20 years of experience in global open-source initiatives, he chaired the International FOSS4G 2015 Seoul conference and served on the board of the OSGeo (Open Source Geospatial) Foundation for two years. He is a passionate advocate for open-source, open standards, and open data. He currently leads the mago3D project, a web-based digital twin platform for managing and visualizing various spatial data, simulations, and modeling results. His primary interests include open-source, GeoBIM, digital twins, and smart cities.

DREAMS AND DILEMMAS: LESSONS FROM KOREA'S URBAN DIGITAL TWIN

In this talk, I will present several urban digital twin projects developed by my company in Korea. These include BIM/GIS integration, noise propagation simulation, toxic chemical release simulation, urban flood prediction and management, and CCTV placement optimization. These are all real-world projects conducted primarily for the Korean government.



Dreams and Dilemmas: Lessons from Korea's Urban Digital Twin – Sanghee Shin

Sanghee Shin presented an impressive array of geospatial applications in Korea's Urban Digital Twin. In his interactive presentation, he presented various use cases of Urban Digital Twin like 1) location of noise barriers, 2) wind simulation modelling, 3) underground utilities management, and 4) urban flood management. After discussing these cases, he elaborated on the benefits that can be derived from utilization of urban digital twins. He further mentioned that South Korea has adopted a holistic approach involving government initiatives, private sector collaboration, and open-source technologies, and this approach serves as a model for smart city development across the globe.

DR. SHYJU KRISHNANKUTTY

ESRI INDIA

@Dr. Shyju Krishnankutty

ABOUT

Established in 1996, Esri India Technologies Pvt. Ltd. (Esri India) is an end-to-end Geographic Information Systems (GIS) solutions provider. As a market leader in geospatial technology and location intelligence, it has successfully delivered cutting-edge GIS solutions, powered by ArcGIS, to more than 6,000 customers for applications in Land management, Utilities, Water, Infrastructure, Disaster Management, Telecommunications, Urban Development, Smart Cities, Forestry, Natural Resources Management and more. For Indian customers, it has engineered a unique product called Indo ArcGIS.

Headquartered in Noida (Delhi-NCR), the company not only enjoys association with more than 6.5 lakh users across the country but has also got Great Place to Work® Certified thrice (2021-22, 2022-23 and 2023-24).

Dr. Shyju Krishnankutty
Group Manager Presales | Esri India

Dr. K. SHYJU, Group Manager in ESRI India. He is experienced in geospatial Industry for more than a decade. His worked with several State Departments across south India and Central Organizations like NRSC and NIRD. He also served as Assistant professor in Kannur University. He played a pivotal role in creating a web GIS portal for Govt of Kerala, named “Micro level Information System on Soils of Kerala”. He is also the part of Geo MGNREGA. His academic excellence is postgraduation in both Geography and Geoinformatics. Qualified UGC NET in Geography and pursue Doctoral Degree in Geography from Bharathidasan University.

BIM-GIS

This session explores the integration of Building Information Modeling (BIM) and Geographic Information Systems (GIS) in the AEC industry. It focuses on how combining BIM's detailed 3D modeling with GIS's spatial data enhances project workflows.

Key discussion points include:

- Planning: GIS-driven site selection and environmental analysis integrated with BIM models.
- Design: Accurate modeling that incorporates real-world spatial contexts.
- Construction: Improved project tracking, logistics, and resource planning.
- Sustainability: Tools for energy efficiency and environmental impact analysis.

The presentation highlights how BIM-GIS synergy supports efficient, data-driven decision-making across the project lifecycle.

LOD 1 in ArcGIS Pro

3D Road Network digitized and added elevation (Z) information

BIM – GIS – Shyju Krishnankutty

Shyju Krishnankutty began his presentation with a mention that Geographical Information System (GIS) integrates geography with science, offering a multi objective framework for understanding spatial relationships and it combines the power of data driven analytics with tools to address complex challenges across the sectors. After setting the ground for his talk, Shyju Krishnankutty discussed three key aspects of getting started with GIS: foundations in geography, leveraging powerful GIS tools and focus on data types and dimensions. While discussing various GIS tools available in the market for urban planning, environmental management and asset management, he stressed the selection of right tool for right purpose. He also suggested that beginners can start their GIS learning journey with open data to explore geography and gain hands on experience in analyzing and visualizing spatial data. With the various GIS tools, integration among different software platforms is essential. He mentioned that these software platforms are becoming more versatile allowing users to organize projects without redundant data structuring, and improved collaboration and streamline workflows. At the end of his presentation, he mentioned that the academics, researchers and practitioners need to come together for learning and exploration of GIS tools.

DR SHAILESH GAUR

NIAS

@Shailesh (V) Gaur

Dr Shailesh Gaur
Adjunct Professor | NIAS

21+ years of experience in impactful sectors like Telecom -Wireless, Digital & Mobile internet, GIS/RS, Training and Governance across diverse cultures nationally and internationally. I was proud to be part of working with Leading Indian Multinational Business Conglomerates like Bharti Airtel, IDEA which are success stories of post liberalization era. It encompasses developmental as well as business aspects for masses as well as classes.

During this journey got opportunities to sharpen leadership & communication skills apart from practicing management principles for impact on community and nation as whole. Actively participating closely in the functioning of entire ecosystem.

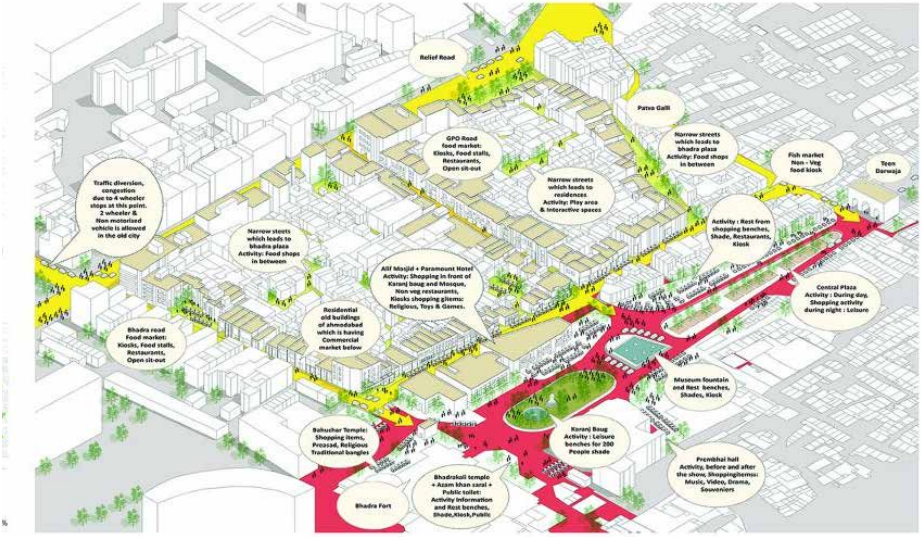
Having actively worked with multiple Government departments for projects like Smart cities, Digital India Land reforms modernization program, Defense, Agriculture, Forestry, Mining, Skill development etc. also enriched overall experience. I had equal opportunities to interact with Private sector large enterprises to solve problems thru technology was equally enriching.

During all these years was fortunate to be a change agent for digital revolution which impacts all aspects of lives of citizens and comes up with new challenges for societies in transition.

While executing Pilot projects like Mobile Money (2009), Mobile Internet (2010) for mass deployment many use cases were developed which has become a force multiplier in development. My zest for learning and solving problems is core driving force.

URBAN DESIGN AS A TOOL FOR STRATEGIC OUTCOMES

By 2036, 600 million people will be living in urban cities in India , representing 40 percent of the population & contributing to 75% of GDP as per The world bank report. This is likely to put additional pressure on the already stretched urban infrastructure and services of Indian cities – with more demand for Urban Infrastructure- Roads , Flyovers, Better sewage system, clean drinking water, reliable power supply, efficient and safe road transport , Efficient Airports amongst others. Though significant strides in improving urban infrastructure through Smartcities mission, AMRUT etc have been done , substantial challenges remain. Addressing these challenges requires a multi-pronged approach by improving governance through technological advancements like Digital Twins which is an amalgamation of various tech like GIS , Image processing, Location Intelligence, IOT, Sensors , AI and taking an integrative approach for efficient decision making .The potential to revolutionize the way cities are planned, built, and managed. By providing real-time data and insights, digital twins can help city officials make informed decisions, improve efficiency, enhance resilience, and promote sustainability. While there are challenges to implementing digital twins, the benefits outweigh the costs, and cities around the world are increasingly adopting this technology to improve urban infrastructure and enhance the quality of life for citizens.



Digital Twins in Urban Infrastructure – Shailesh Gaur

In his insightful presentation, Shailesh Gaur presented case studies of digital twins in the airport sector. To begin with, he mentioned the potential held by digital twins for improved planning, design, construction and operation of airports. The potential is in the areas like energy modelling, passenger flow simulation, facility management and so on. He highlighted that many Indian airports already have developed digital twin and tapping its potential. He interestingly conceptualized the airports as a labyrinth of various systems and it is necessary to understand these systems of system (SoS) framework for efficient management of airports. In this sense, he stressed that the digital twin could bring together these systems on a single platform and will be helpful to create value to the airport developers and users.


Gopal BS
AtkinsRéalis
Amit Anand
PWC

UDIT BHATIA

IIT GANDHINAGAR

@UDIT BHATIA

ABOUT

The Indian Institute of Technology Gandhinagar (IITGN), established in 2008, is a leading engineering institution in India. Located on the banks of the Sabarmati River in Palaj, Gujarat, the campus integrates sustainable design principles.

IITGN offers undergraduate, postgraduate, and doctoral programs in engineering, sciences, and humanities. The curriculum includes a focus on design, innovation, and entrepreneurship. The institute promotes a student-centric learning environment and engages in global academic collaborations. Its research efforts support advancements in both academic and industrial sectors.

Udit Bhatia
Assistant Professor |
IIT Gandhinagar

Udit Bhatia is an Assistant Professor at the Indian Institute of Technology Gandhinagar, affiliated with both the Civil Engineering and Computer Science and Engineering departments. His research focuses on critical infrastructure resilience of built and natural systems, physics-guided machine learning for hydrology and urban flooding, and internal climate variability and change. Dr. Bhatia has published extensively in top-tier disciplinary and interdisciplinary journals, including the Journal of Geophysical Research and Geophysical Research Letters - Atmosphere. His work also appears in prestigious Nature Portfolio journals such as Communications Earth & Environment, Communications Biology, and Scientific Data, as well as in Environmental Research Letters and the Journal of Hydrometeorology. His research has informed policymakers and stakeholders and has been widely covered in national and international media. He is the author of the widely used textbook “Critical Infrastructures Resilience: Policy and Engineering Perspectives.” Dr. Bhatia holds a U.S. patent titled “System for Networking and Analyzing Geospatial Data, Human Infrastructure, and Natural Elements.” He recently founded AIResQ ClimSol Pvt. Ltd. to scale up and deploy research solutions developed at IIT Gandhinagar.

INTEGRATING SPATIAL NETWORK ANALYSIS AND DEEP LEARNING FOR INFRASTRUCTURE RESILIENCE AGAINST CONCURRENT HAZARDS

Enhancing infrastructure resilience in India requires rigorous analysis of how concurrent hazards impact built systems. This presentation delves into our research on applying spatial network analysis and deep learning methods to assess and mitigate the effects of such hazards on infrastructure networks. Focusing on disruptions to regional road networks and national systems like the Indian Railways Network, we utilize models such as FloodResQ for predictive flood mapping and real-time risk assessment. Our work combines network science and machine learning to uncover connectivity patterns and vulnerabilities within these networks, demonstrating how extreme precipitation events can trigger prolonged disruptions. By examining structural properties and robustness under various disruption scenarios, we identify early-warning indicators and propose optimal recovery strategies based on network centrality measures. Additionally, we explore the geographical trapping of synchronous extreme rainfall events, revealing persistent hubs that influence the resilience of transportation networks. This research underscores the significant potential of integrating network science and deep learning to fortify infrastructure against complex challenges, providing actionable insights for policymakers and urban planners in developing data-driven, resilient infrastructure strategies.

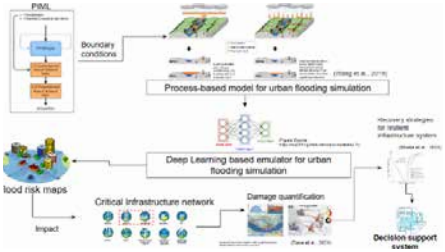


Fig 1: Schematic diagram providing the steps to integrate spatial network analysis with deep learning methods for assessing and mitigating the effects of hazard

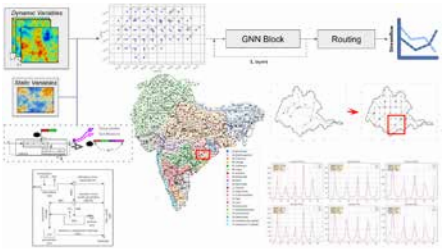


Fig 2: Schematic diagram representing the physics-guided graph neural network framework for runoff prediction

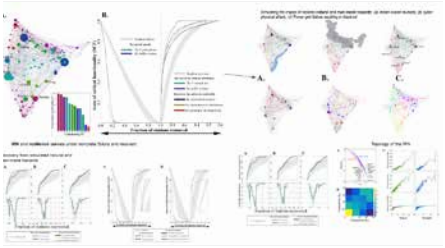


Fig 3: Indian Railway network resilience under various perturbation including (a) Tsunami, (b) Cyber physical attack and (c) Power grid failure

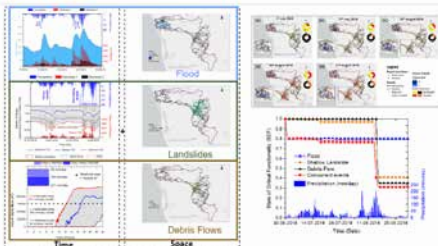


Fig 4: Prolonged Road network disruption and functionality loss by concurrent precipitation induced hazards such as (a) Fluvial flood, (b) Shallow landslides and (c) Debris flows

Integrating Spatial Network Analysis and Deep Learning for Infrastructure Resilience Against Concurrent Hazard – Udit Bhatia

Udit Bhatia in his presentation brought forth an interesting network analysis for infrastructure Resilience. He conceptualized infrastructure systems like power grids, railways, water distribution as networks, which can be modeled as network with nodes (critical points) and edges (connections). He explained how streamflow and flood inundation can be predicted using physics-guided Graph Neural Networks (GNN). He provided in depth network analysis of cases like power grid failure in India and floods in Kerala, and stressed on how network analysis can help in robust recovery and resilience strategies. This analysis can assist in understanding key focus areas for infrastructure resilience. For example, in the situation of floods, the most vulnerable road segments are often overlooked despite their criticality in maintaining connectivity. Also, he emphasized coupling hazard models with network analysis to evaluate system wide impacts of natural disasters, predicting areas which would face maximum disruption, and identify restoration priorities.


Udit Bhatia
Assistant Professor,
IIT Gandhinagar
GEOSPATIAL TECH
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CEPT RESEARCH AND DEVELOPMENT FOUNDATION
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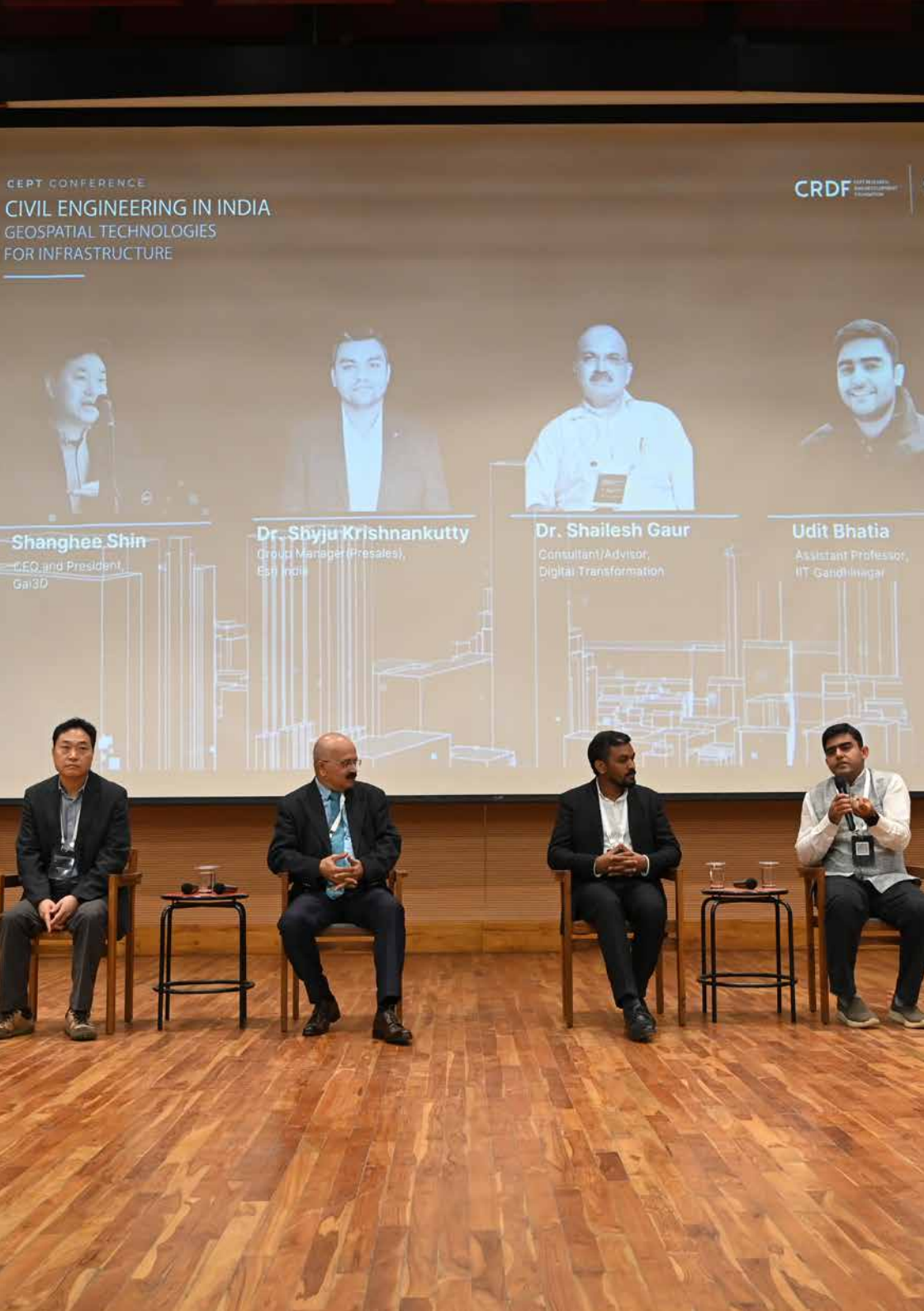
QUESTION AND ANSWER SESSION

The galaxy of speakers was brought together on a single platform for this interesting round of Q&A which had an array of questions in the areas like data collection and transfer, digital twin and integration of different platforms. In response to a question pertaining to BIM and GIS integration, Syuju mentioned that there are tools available to facilitate the data transfer between different systems. Udit Bhatia received interesting questions pertaining to specifics of nodes and edges in the network analysis models developed in his lab. All the speakers stressed the fact that digital twins, GIS and real time data capturing provides help in urban redevelopment projects, stakeholder engagement to explain projects impact and gain support and visualization of context / site. The quality of data has come into discussion wherein the speakers stressed on accurate collection of data using various instruments like sensors and drones is essential for decision making.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Group Manager (Presales),
Esri India
Dr. Shailesh Gaur
Consultant/Advisor,
Digital Transformation
Udit Bhatia
Assistant Professor,
IIT Gandhinagar

AMIT ANAND

PRICEWATERHOUSE COOPERS PRIVATE LIMITED, INDIA

@Amit Anand

ABOUT

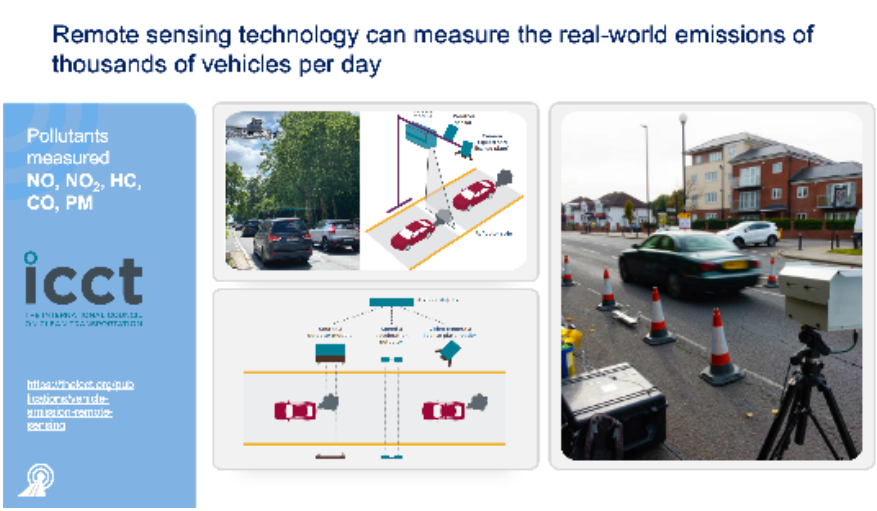
Pricewaterhouse Coopers Private Limited is one of the Big4 consulting firms with over 370,000 people committed to delivering advisory, assurance and tax services globally. Under the advisory line of services, PwC offers a range of geospatial services such as geospatial technology solutions, modeling & analytics to address the key issues of environment, industry, business and people.

Amit Anand
Principal Consultant-Climate Resilience & DRR | Pricewaterhouse Coopers Private Limited, India

Amit is a Disaster and Climate resilience professional working with Pricewaterhouse Coopers Private Limited, India. He has over 13 years of experience in disaster resilience consulting and supports numerous international agencies and regional governments at various administrative scales. His years of experience span across the areas of Infrastructure Resilience, City resilience, Climate Adaptation, Natural hazard-risk modeling & Space technology integration for DRR. Amit has successfully implemented remote sensing, GIS & Geo AI application projects in India, Netherlands, Kuwait, Vietnam, Papua New Guinea, Timor Leste, Nigeria and Lesotho. He is the alumnus of ISRO, India and is a life member of Indian Society of Remote Sensing.

DISASTER RISK AND RESILIENCE ASSESSMENT FRAMEWORK FOR TELECOM INFRASTRUCTURE SYSTEMS

Telecommunication infrastructure system is the lifeline of the nation. Disaster impacts the telecom infrastructure system in multiple ways, affecting human life, livelihood, critical information flow, and essential service delivery. The presentation comprehensively highlights the disaster risk impacts on telecom infrastructure system across all three miles and strengthen the resiliency of the sector at asset to system scale considering interdependencies and interconnectedness through a comprehensive risk and resilience assessment framework.



Telecom Industry – Disaster Risk and Resilience assessment framework for telecom infrastructure systems – Amit Anand

The world is increasingly getting connected with the development and upgradation of network infrastructure. Amit Anand focused on telecom infrastructure - one of the crucial network infrastructures. He elaborated on how the Japan Earthquake in 2011 and Odisha Cyclone in 2019 caused severe damage to the telecom infrastructure, which includes telephone exchange offices, cables, mobile station, submarine cables and so on. These disasters resulted in network outages, inconsistent access to telecom services, disruption in emergency communication and supply chain interruption. In response to these disasters and the key role played in telecom infrastructure in the times of crisis, he mentioned that the resilience of telecom infrastructure is crucial. Further to this, he mentioned a country level initiative has been undertaken to improve the resilience of telecom infrastructure which focused on last mile connectivity. As part of this initiative, extensive level of stakeholder consultations was held at national, state and district level and he mentioned that there are opportunities for researchers to investigate disaster risk and resilience of telecom infrastructure during pre-disaster, during disaster and post disaster phases. He showed case studies of multi-hazard risk mapping done for Gujarat and Assam that mapped telecom towers, landslide vulnerability, storm surge, earthquake vulnerability and cyclonic wind speeds across the state.


Amit Anand
PWC
Bhupesh Gupta
Geo Nomads

BHUPESH GUPTA

GEO-NOMADS

@Bhupesh Gupta

ABOUT

GeoNomads Consulting LLP is a Government of India recognized start-up under Startup India Program. We are specialized in remote sensing and GIS applications. We provide cutting edge solutions and services for application of geospatial technology in variety of domains. In a short span of 16 months of the establishment, the startup successfully completed multiple government and private sector assignments, some of which are pertaining to road and building infrastructure, drone mapping and high-level strategic geospatial advisory to a government department. Our commitment to excellence and sustainability drives us to continuously advance in the field of Geospatial Technology and contribute to a geospatially aware greener-world.

Bhupesh Gupta
Founder & CEO |
Geo-nomads

Mr. Bhupesh Gupta holds M. Tech. Degree in Remote Sensing/GIS and has more than 21 years' experience in the geospatial industry. He possesses vast experience in the application of remote sensing and GIS in a wide range of sectors like Traffic & Transportation, Highways, Disaster Management, Water Resources, Urban Planning, Logistics, Environment & Social. He worked on many prestigious infrastructure projects funded by multilateral funding agencies like the World Bank, the Asian Infrastructure Investment Bank (AIIB) and the Asian Development Bank (ADB). He is dedicated to promoting sustainability, open data and bringing emerging technologies to the masses. He is the founder and CEO of a startup GeoNomads Consulting LLP which provides geospatial services and solutions.

BUILDING BETTER ROADS WITH GEOSPATIAL TECHNOLOGY: EMPOWERING CIVIL ENGINEERS

This presentation explores the transformative role of geospatial technology in road planning, construction and road safety. Tailored for civil engineers, it highlights practical applications of remote sensing, GIS and drone technology for planning alignment, real-time project monitoring and asset management, showcasing how these tools enhance efficiency, safety and sustainability in modern infrastructure projects.

Highways and Transportation – Bhupesh Gupta

In his insightful presentation, Bupesh Gupta talked about integration of geospatial technologies for management of highways. He stressed data driven decision making wherein policy makers take decisions based on data collected by sensors, GPS, GIS, drones and LiDAR. The data driven decisions are more helpful in planning and management of road infrastructure. He also explained that conduct of feasibility studies in terrains like hilly roads poses challenges, hence, it required customized data collection and analysis. Based on his experience, he elaborated on the use of paper maps, GIS and drone for route analysis in these difficult terrains. In his final remarks, he mentioned that geospatial technology is a tool, but the engineering judgement and expertise remains irreplaceable, and it is necessary for the engineers to combine technical skills with geospatial tools to build smarter, safer, and sustainable road networks.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UNIVERSITY

DR. MUKTA GIRDHAR

DELHI DISASTER MANAGEMENT AUTHORITY

@MUKTAGIRDHAR

ABOUT

The Delhi Disaster Management Authority (DDMA) plays a critical role in ensuring infrastructure resilience in the National Capital Territory of Delhi. As the nodal agency for disaster management, it focuses on mitigating risks and enhancing safety through robust planning and execution.

Key objectives include retrofitting critical infrastructure to withstand disasters, conducting seismic microzonation to guide safe construction practices, and maintaining a techno-legal framework for structural safety. DDMA also coordinates emergency operations, mock drills, and capacity-building programs to integrate disaster resilience into Delhi's urban development

Mukta Girdhar
Sr. Consultant,
Delhi Disaster
Management Authority

Dr. Mukta Girdhar serves as a Senior Consultant with the Delhi Disaster Management Authority and is also the Director at the Disaster Resilient & Research Foundation since January 2016. With a strong background in geoinformatics and disaster management, she has dedicated her career to advancing strategies for resilience and effective disaster response. Dr. Girdhar combines her technical expertise with a passion for leadership and team building, contributing significantly to the environmental and disaster management sectors.

SPACE BASED TECHNOLOGY FOR GEOHAZARD ASSESSMENT

“This presentation focuses on the use of space-based technologies for assessing and managing geohazards. It covers applications of satellite imagery, remote sensing, and spatial data analytics in understanding geophysical phenomena such as landslides, earthquakes, and floods.

The session highlights methods for hazard mapping, early warning systems, and planning for infrastructure resilience. It also addresses practical challenges and the role of these technologies in disaster risk management.

The presentation provides useful insights for professionals in disaster management, urban planning, and infrastructure development.”

Location based **mobile towers** are displayed in the selected area

Space based Technology Assessment for Geohazard Assessment - Mukta Girdhar

In his insightful presentation, Bupesh Gupta talked about integration of geospatial Mukta Girdhar began her talk by urging the stakeholders to understand the disasters in more depth and systematically and further stressed on utilization of space based technologies for responding and managing the geohazards. With her vast experience in Delhi Disaster Management Authority, the example of urban floods, as a disaster, was also discussed. She meshed various space-based technologies with the examples of different disasters, for explaining how these technologies can be used for disaster management. Some of the measures elaborated by her for disaster preparedness and mitigation are SMS alert services for public relief under Emergency Response Support System (ERSS) and SACHET initiatives, emergency response kits distribution to the needy, India Disaster Resource Network (IDRN) Portal. She also mentioned that spaced based technologies need to work in tandem with overall decision making and institutional frameworks created for disaster management.

QUESTION AND ANSWER SESSION

This session started with an interesting question about the possibility of existing telecommunication technologies becoming redundant owing to technological innovations and disruptions like Elon Musk's Starlink. In response to this question, Amit Anand said that the technology selection is a difficult call to be taken by a country and an end user. It involves mulling over parameters like dependence on single technology and monopoly, the interconnectedness of new technologies with existing telecom infrastructure and resilience. Furthermore, he stressed the need of redundant telecom systems for providing communication during the times of emergency. Mukta Girdhar explained the hierarchy of communication and decision making that exists in times of emergency and disasters while answering a question related to coordination at different levels in situations like flood. A question pertaining to the use of GIS and allied technologies for road maintenance was asked to Bhupesh Gupta. Bhupesh Gupta explained that road maintenance necessitates combination of visual observations as well as automated data collection with instruments. He went on to further elaborate about the visual surveys of road length for capturing details like cracks and potholes in challenging terrains and use of network survey vehicles fitted with laser sensors, GPS and cameras. He also mentioned that post processing of collected data needs to be done diligently.

PANEL DISCUSSION – CONSTRUCTION MANAGEMENT AND INFRASTRUCTURE MONITORING WITH GEOSPATIAL TECHNOLOGIES

This interesting and engaging one day conference on geospatial technologies for infrastructure culminated with a panel discussion. This discussion touched upon a plethora of themes. The theme of educational initiatives in the Geospatial sector received diverse perspectives from the panelist. The panelists acknowledged the ongoing efforts to integrate geospatial technology into the educational curriculum and emphasized on hands on experience to be gained by the students to connect theoretical knowledge with the real-world applications of geospatial technology. This discussion further extended to the aspect of collaboration and networking in geospatial sector. The panelist echoed a need to augment industry-academia collaboration to create problem solving skills among the students and researchers and provide exposure to real world challenges in geospatial technology.

The next round of discussion revolved around the theme of Data Collection and Analysis. The panelist sounded a concern over the extensive data collection, which occasionally involved duplication and redundancy and highlighted that it culminates into increasing emery demands associated with data generation and processing. The surge in energy consumption will adversely affect emissions and climate change, especially in the times of growing concerns over sustainability. A solution like creation of centralized repositories for geospatial data to avoid data redundancy, improving collaboration and ultimately reducing energy consumption was also discussed in this panel discussion.

On a final note, the panelist deliberated over the future of geospatial technology. All panelists felt that the emerging trends in AI and machine learning would have bearing on advancement of geospatial technology. Along with this, the policy changes and community engagement also came up in this discussion as influencing parameters shaping the future. At the end of this panel discussion, Aanal Shah and Suren Vakil declared the closure of the Second Edition of Civil Engineering Conference and thanked the audience for their presence and engagement in the discussion.


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