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BOOK OF ABSTRACTS

ACADEMIC TRACK SESSION

An Assessment of Landuse changes in Gwagwalada Area Council, FCT.Abuja

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Abstract

Urban development often leads to environmental problems such as erosion, flooding, crime, urban heat islands, climate change, traffic congestion, and poor waste management systems. The loss of indigenous land, which predominantly supports farming occupations, results in a catastrophic loss of livelihoods, inflating food prices and land values. This study assesses the extent to which these changes have occurred in Gwagwalada Area Council, Abuja from 2005 to 2022 using Geographic Information System (GIS) techniques. The research utilized a mixed-methods approach, combining quantitative and qualitative data collection. Satellite imagery from 2005, 2010, and 2022 was analyzed to evaluate land use changes. GIS techniques, including remote sensing and spatial analysis, were employed to classify land use types such as vegetation, farmland, built-up areas, and bare land surfaces. Ground-truthing was conducted through field surveys and interviews with local residents and stakeholders to validate the data obtained from satellite images. The land use changes were analyzed using GIS software to generate land cover maps for each study year. The analysis involved calculating the percentage change in land use categories over the specified periods and employing statistical methods to assess the significance of these changes. Additionally, spatial analysis tools were utilized to identify patterns and trends in urban expansion and its impacts on the environment and local communities. In 2005, water bodies accounted for approximately 1.47% of the land use in Gwagwalada Area Council. There appears to be a 100% increase in land use by 2010, which has remained consistent over the study period. Vegetation in the study area initially covered 694.549 km² (68.67%) in 2005, but by 2022, this figure had significantly reduced to about 30.3432 km² (2.99%), representing a 72.61% reduction in land area covered by vegetation. Farmland accounted for 273.914 km² (27.08%) of the land use in 2005 and increased exponentially to 588.729 km² (57.98%) by 2022, reflecting an increase of approximately 39.840 km² in land use. In 2005, built-up areas in the Gwagwalada Area Council accounted for about 5.71 km² (0.56%) of the land use. By 2010, this figure had slightly increased to about 8.243 km² (0.82%). By 2022, built-up areas had expanded by 2.3% to cover 31.683 km² (3.12%). The land use associated with relief in Gwagwalada Area Council covered an area of about 21.5256 km² (2.13%) in 2005, which increased to 27.0151 km² (2.66%) by the same area council in 2022. In 2005, bare land surfaces accounted for about 0.9369 km² (0.09%) of the land use in the Area Council; by 2010, this had risen to 4.392 km² (0.43%). By 2022, bare land surfaces in the Gwagwalada Area Council had dramatically increased to 309.0362 km² (30.43%), representing the most significant increase among the land use categories identified within the area council. Three land use changes—vegetation, farmland, and bare surfaces—exhibited the most significant changes during the study period. The reduction in vegetation signifies a substantial loss of biodiversity and a notable alteration in the biogeographical characteristics of the area council. While the increase in farmland was anticipated, its extent was quite significant. However, the most concerning change over time was the rise in bare surfaces from nearly 1 km² to 309.04 km², indicating a significant loss of vegetation to activities unrelated to farming, construction, urbanization, and other factors.

keywords: Urbanization, GIS, Landuse, Gwagwalada, Climate Change



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ACADEMIC TRACK SESSION

Assessment of Geometric Consistency of the Nigerian Administrative Boundary Datasets: The Need for Data Harmony and Standardization

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Abstract

Precise administrative boundaries demarcation facilitates effective governance, policymaking, resource allocation and the delivery of public services. The delineation of administrative boundaries in Nigeria has been an ongoing challenge, with several disputes and boundary adjustments over the years. Different sources of datasets on Nigerian administrative boundaries exhibit inconsistencies, leading to discrepancies and misalignment. The aim of this study therefore is to assess the geometric consistency of the Nigerian administrative boundaries datasets from different sources. The datasets were sourced from the Office of Surveyor General of Federation (OSGoF), Geo-Referenced Infrastructure and Demographic Data for Development (GRID3), Global Administrative Areas (GADM) and Divas GIS. These datasets were analyzed in ArcGIS 10.8 for alignment and discrepancy. The findings revealed that the Global Administrative Areas datasets showed general good alignment for the Nigerian national boundary. On the contrary, the datasets from Geo-Referenced Infrastructure and Demographic Data for Development and Divas GIS have gross misalignment. Furthermore, the misalignment observed in the datasets is generally prominent in the eastern part where Nigeria shares a border with Cameroon. Significant discrepancies were observed between the datasets at all levels of boundaries from the various sources compared. The result also revealed that the Nigerian national boundary from the Office of Surveyor General of Federation is 912,153.24 km² in area, while datasets from Divas GIS is 1,991.09 km² (0.22%) higher, GADM is -1,991.09 km² (-0.22%) lower and GRID3 is 2,330.75 km² (0.26%) higher than OSGoF dataset. The study therefore concluded that these discrepancies could have a significant impact on spatial analysis, resource allocation, and decision-making processes.

Keywords: Administrative boundary, geometric consistency, data alignment, boundary demarcation



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ACADEMIC TRACK SESSION

Selection of a Right Site for a New Private Cemetery in Akinyele L.G.A of Oyo State Using Weighted Values GIS Techniques.

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Abstract

The article explores the challenges posed by urban population growth on land use planning in developing countries. It emphasizes the need to update traditional spatial planning methods with new methodologies and technologies, such as Geographic Information Systems (GIS). These tools are essential for organizing data and managing the impact of urban infrastructure on socio-economic life. The study focuses specifically on Akinyele L.G.A. Oyo State, where the placement of a new private cemetery is investigated using GIS and Analytic Hierarchy Process (AHP) techniques. The integration of these methods allows for the comparison of various criteria and factors crucial to site selection, aiming to optimize urban infrastructure management amidst increasing demands and spatial constraints. The study's focus on the distribution and characteristics of existing cemeteries in Akinyele local government area. It identifies ten cemeteries, predominantly located in peri-urban and populated areas. These cemeteries are associated with religious organizations, split evenly between Christian and Muslim affiliations. The study employs the weighted overlay technique to develop suitability maps for new cemetery sites, emphasizing the importance of prioritizing criteria through weighted values. The methodology ensures comprehensive analysis and verification to identify optimal locations that meet predefined criteria

Keywords: GIS Integration, AHP methodology, Cemeteries, Weighted Overlay Technique



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ACADEMIC TRACK SESSION

Enhancing Geospatial Data Using Unmanned Aerial Vehicle (UAV): A Case Study of Coker Adewoyin 1- Ariremake Community, Ile-ife, Nigeria.

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Abstract

Nigeria's outdated maps hinder effective decision-making, as they fail to reflect rapid development. Geospatial data is crucial for about 80% of daily decisions, and the UN emphasizes its importance for achieving Sustainable Development Goals (SDGs). The UN-GGIM program aims to address global challenges by promoting high-quality geospatial information. However, funding issues in developing countries lead to outdated data. The last base map of Osun State is outdated, necessitating an update to ensure accurate public sector decisions. Unmanned Aerial Vehicles (UAVs) offer a cost-effective solution for updating spatial data. UAVs, equipped with GPS and cameras, capture high-resolution imagery, including orthophotos and elevation models. This study uses UAVs to revise an obsolete map, establish control points, and produce digital maps. The DJI Phantom 4 pro drone was used to capture 357 images, processed with Pix4DMapper to create a high-quality orthophoto with a 2.72cm ground sampling distance and a 6.80cm root mean square error (RMSE). The orthophoto, suitable for urban planning and environmental monitoring, shows significant changes compared to the old map. The study confirms UAVs' suitability for accurate map creation, meeting American Society for Photogrammetry and Remote Sensing standards. The research highlights UAVs' potential for future mapping projects, supporting Nigeria's Geospatial Data Infrastructure Policy.

Keywords: Geospatial data, UAV, orthophoto, SDGs.



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ACADEMIC TRACK SESSION

Analyzing OpenStreetMap Community Engagement for Internally Displaced Persons (IDP) Camps in Borno State

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Abstract

OpenStreetMap (OSM) has played a significant role in the humanitarian response to crises in Borno State, particularly in mapping and managing Internally Displaced Persons (IDP) camps. This presentation explores the engagement of the OSM community in Borno State, with a special focus on how the Unique Mappers Network, the driving force of OSM community empowerment in Nigeria, has engaged local volunteers to contribute to these efforts. We analyze the surge in mapping activities driven by the increasing IDP population and highlight the correlation between the expansion of the community and the growing need for detailed, up-to-date geographic data within the camps. Through data analysis and mapping patterns, this study emphasizes both the challenges and successes in using OSM in such volatile environments. Our findings demonstrate that OSM not only delivers crucial spatial data for humanitarian purposes but also fosters local engagement and capacity-building, including among IDP residents. The talk will conclude with recommendations on how to leverage OSM for more effective humanitarian interventions and ways to sustain and expand the mapping community in order to enhance resilience in Borno State's IDP camps.

Keywords: OpenStreetMap, Borno State, IDP camps, humanitarian mapping, Unique Mappers Network.



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ACADEMIC TRACK SESSION

The Utility of Cartography and GIS in Staff Management For Public Health Care Facilities in Obudu Local Government of Cross River State.

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Abstract

This study is to harness the possibility of cartography and GIS in the management of Health care facilities in the study area. The attribute data in the course of this study were acquired from well-structured questionnaires distributed to all the public health care facilities and the second –hand information from the Department of Primary Health care Services in the study area. Spatial data were acquired using the political map, satellite imagery and other data using GIS techniques. The point locations (coordinates) of health care facilities which were collected from Obudu Local Government Area using handheld GPS, were geo- referenced in the ArcGIS environment together with imagery and map of Obudu local Government area. The geo database, data set and feature classes for the existing roads, wards administrative boundary, rivers and useful feature classes were created. The attribute data and locational data were typed into the notepad to facilitate the import into the GIS environment. Thereafter the following analyses were performed: queries or spatial search, buffering, network analysis and nearest neighbor analysis. The results were presented using tables and cartographic techniques (maps and diagrams). The study reveals that some areas within the study area were underserved in terms of the health care facilities using the walking distance of 1000m as criteria, some health care facilities lack basic amenities, conducive building, and accommodation for staff and health care personnel. Also, the distributional pattern of the health care facilities is randomly distributed. Based on the findings revealed, the government ministry of health and related agencies should site primary health care facilities in adherence to world health organization walking distance of 1000m (1 kilometer). As a Mather of urgency construction and renovation of public health care facilities. Pipe- borne water, electricity and ambulance services should be provided to enhance effective health care delivery. A doctor to the population ratio of 1:114855 is an indicator that more doctors should be employed. In the same vein, other health care personnel such as nurses, midwives, medical laboratory scientists, should be employed. The presence of only one general hospital in the study area is an indicator that more general hospitals should be established.

Keywords: Health Facilities, Cartography & GIS, Personnel, Obudu Local Government Area, Management.



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ACADEMIC TRACK SESSION

Land use Land cover Dynamics in Enugu Urban Nigeria: An Insight from Intensity Analysis and Remote Sensing Data.

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Abstract

One of the environmental crises confronting Nigerian cities today is land use land cover change. This problem is exacerbated by the recent upsurge in informal sector activities and near absence of physical planning in our cities. The attendant consequences are mixed land uses, urban sprawl, and other socio-economic malaise, which Nigerian urban areas such as Enugu is known for. In this study, we examined the dynamics of land use land cover in Enugu Urban for a time period of three decades using intensity analysis to quantify temporal changes among land use land cover categories derived from remote sensing data. Intensity analysis revealed graphically the pattern (size and intensity) of changes in each land use / land cover category of the study area. Built-up land use continually had net gain, whereas other land use lands cover particularly vegetation experiencing net losses. There was also a simultaneous transition of vegetation and water land cover to other land uses. The outcome of the study can guide proper interpretation of land use Land cover dynamics and the underlying process in Enugu Urban an emerging city South East Nigeria.

Keywords: Land use, Land cover, Dynamics, Intensity Analysis, Enugu Urban



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ACADEMIC TRACK SESSION

Pavement Condition Analysis Using GIS Techniques: A Case Study with Edge Detection, Flow Accumulation, and Curvature Data

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Abstract

Pavement condition analysis is critical for maintaining road infrastructure and ensuring public safety. This research introduces a geospatial approach to assessing pavement conditions using ArcGIS, incorporating edge detection, flow accumulation, and curvature data. Traditional pavement assessment methods often overlook the impact of environmental factors like water drainage and surface geometry, leading to inefficient maintenance planning. To address this gap, this study integrates curvature and flow accumulation analysis with edge detection to identify surface anomalies and areas prone to water-induced damage. The resulting pavement condition map provides a data-driven visualization of road infrastructure, allowing transportation agencies to prioritize maintenance efforts and predict potential failures. This applied research demonstrates the value of GIS in delivering accurate, scalable, and cost-effective solutions for infrastructure management, offering a significant improvement over traditional methods. The methodology can be further expanded for larger transportation networks, contributing to more resilient urban and rural road systems.

Keywords: GIS, Pavement Condition, Road Infrastructure



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ACADEMIC TRACK SESSION

Mapping to Reduce Poverty in Rural Area of Nigeria

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Abstract

Reducing poverty in rural areas of Nigeria involves a multi-faceted approach that includes mapping to identify key needs, resources and challenges. Poverty remains a significant challenge in rural Nigeria, where over 70% of the population lives below the poverty line. Poverty is one of the most important determinants of adverse health outcomes globally, a major cause of social instability and one of the most causes of loss of human lives. Sustainable Development Goal 1 (SDG 1) aims to end poverty in all its forms everywhere by 2030 by ensuring that all people have equal rights to economic resources and opportunities. Eradicating poverty is crucial for achieving sustainable development, as it is intricately linked to various other goals such as health, education, gender equality, and economic growth. Through targeted policies and inclusive strategies, Nigeria can make significant progress towards alleviating poverty and creating more equitable and prosperous communities for all. The target areas for reducing poverty in rural areas of Nigeria include eradicating extreme poverty, reducing the proportion of men, women, and children of all ages living in poverty, implementing social protection systems, ensuring equal rights to economic resources, and building the resilience of the poor to reduce their exposure and vulnerability to climate-related events and other economic, social, and environmental shocks. Achieving poverty reduction requires a multi-faceted approach, involving governments, international organizations, the private sector, and civil society, to create inclusive economic growth, provide social safety nets, and promote sustainable development practices. Despite various government and non-governmental efforts to address this issue, the lack of accurate data and comprehensive mapping has hindered effective interventions. This project proposes the use of Geographic Information Systems (GIS) and participatory mapping to identify key poverty drivers, resource availability, and gaps in service delivery. The goal is to develop targeted strategies that can be implemented to reduce poverty in rural areas of Nigeria.

Keywords: Poverty Reduction, GIS, Participatory Mapping, SDGs, Economic resources



BOOK OF ABSTRACTS

GENERAL TRACK/ LIGHTNING TRACK SESSION

The Transformative Power Of Youth Led Data Collection In Improving Health Care Facilities Through Electricity Planning

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Abstract

In a region where youth are often stereotyped as agents of negativity, there comes an open mapping movement that is revolutionizing the narrative by leveraging on a combination of open mapping technologies to drive change in the Health care system. Good healthcare facilities are the backbone of a healthy society, and reliable electricity is the lifeblood of these facilities. Without it, lives are lost, and communities suffer. This paper underscores the critical role of youths in mapping health facility's electricity access by utilizing a combination of tools and platforms, including OpenStreetMap (OSM), KoboCollect, Google Maps, Mapillary. By promoting a collaborative, open-source approach to mapping with a specific focus on electricity availability and its implications for healthcare in remote and semi-rural areas, this study demonstrates how youth engagement can enhance social capital, support public health initiatives, and address infrastructural challenges in underserved regions. This study emphasizes how young mappers collect spatial and attribute data on electricity availability and healthcare infrastructure. This research explores the transformative power of youth engagement in enhancing the quality of open mapping data, with a specific focus on electricity availability and its implications for healthcare in remote and semi-remote areas. The study utilizes a combination of tools and platforms, including OpenStreetMap (OSM), KoboCollect, Google Maps, Mapillary, used by young mappers to collect and analyze spatial and attribute data on electricity availability and healthcare infrastructure. The findings indicate that youth participation in open mapping significantly improves the accuracy and predictive capacity of Geographic Information Systems (GIS) in assessing the built environment's influence on heat resilience and health outcomes. The research underscores the critical role of electricity in healthcare facilities, where reliable power is essential for the operation of medical equipment and the delivery of basic health services.

Keywords: Youth engagement, Open mapping, Healthcare facilities, Electricity access, OpenStreetMap (OSM)



BOOK OF ABSTRACTS

GENERAL TRACK/ LIGHTNING TRACK SESSION

Introducing DuckDB: A peculiar but interesting Relational Database Management System with OLAP capabilities

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Abstract

This presentation will introduce Duckdb, a cutting-edge relational database management system (RDBMS) designed to address the evolving challenges of data management in today's complex environments which include online analytical processing(OLAP). Leveraging advanced data structures and algorithms, Duckdb offers enhanced performance, scalability, flexibility and reliability. We shall delve into the core features and functionalities of Duckdb, highlighting its unique architecture and innovative approaches to data storage, retrieval, and management. By showcasing real-world use cases, we will demonstrate how Duckdb outperforms traditional RDBMS solutions and provides a robust foundation for data-driven applications. DuckDB offers a comprehensive feature set including seamless embeddability, robust SQL compatibility, extension-based advanced spatial functions, and innovative query fuzzing capabilities. However, we will also candidly discuss areas where DuckDB can be improved, particularly within the Geographic Information Systems (GIS) domain, to better address the specific needs of this critical field. Keywords: DuckDB, Relational Database Management System (RDBMS), Data management, Online Analytical Processing (OLAP), Advanced data structures.

Keywords: DuckDB, OLAP, RDBMS, GIS



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GENERAL TRACK/ LIGHTNING TRACK SESSION

Introduction to AI in Mapping: Examples and Procedures

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Abstract

Artificial Intelligence (AI) is the simulation of human intelligence processes by machines, particularly computer systems. Key components of AI include machine learning, deep learning, computer vision, and natural language processing (NLP). AI algorithms enhance accuracy in mapping by analyzing large datasets and identifying patterns that humans might miss. They process vast amounts of data quickly, generating up-to-date maps in real-time or near real-time. AI can handle big data, predict future changes in landscapes, urban growth, and environmental conditions, and automate repetitive tasks, allowing human experts to focus on analysis and decision-making. Examples of applications include urban planning, disaster response, environmental monitoring, and agriculture. Machine learning is a subset of AI that enables computers to learn from data and make decisions based on patterns without explicit programming. Deep learning is a more complex subset of machine learning involving neural networks with multiple layers. Computer vision is a field of AI that enables computers to interpret and understand visual information. Natural language processing (NLP) is a branch of AI that focuses on the interaction between computers and humans through natural language. Reinforcement learning is a type of machine learning applied in autonomous navigation and path planning for drones and other unmanned systems.

Keywords: A.I, Computer Vision, Machine Language, SVM, Deep Learning



BOOK OF ABSTRACTS

GENERAL TRACK/ LIGHTNING TRACK SESSION

Revolutionizing Global Sustainability: The Power of AI-Driven GIS and Open Mapping in Achieving the SDGs

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Abstract

In the pursuit of sustainable development, the integration of community-driven open mapping initiatives with Geographic Information Systems (GIS) has emerged as a powerful approach to addressing climate change and fostering urban resilience, two critical components of the Sustainable Development Goals (SDGs). This paper explores how local communities, empowered by open-source mapping tools like OpenStreetMap (OSM), are playing a pivotal role in combating climate change (SDG 13) and building sustainable cities (SDG 11). By engaging in data collection and map creation, communities contribute invaluable local knowledge, enhancing the accuracy and relevance of geospatial data used in disaster management, urban planning, and environmental monitoring. The paper presents case studies from diverse regions where community-driven mapping has led to tangible outcomes, such as improved flood mitigation strategies in Dar es Salaam and more efficient urban planning in Kigali. The integration of AI and IoT with these mapping efforts further amplifies their impact, enabling real-time data analysis and predictive modeling. However, challenges such as data quality, accessibility, and privacy are addressed through solutions like training, simplified tools, and ethical guidelines. As cities and communities worldwide grapple with the escalating impacts of climate change, the combination of grassroots participation and advanced geospatial technologies offers a scalable and inclusive pathway to resilience. This paper advocates for greater support and investment in these initiatives to unlock their full potential in the SDG era, creating a more sustainable and equitable future for all.

Keywords: Sustainable Development, Open-Mapping, GIS, Climate change, Urban resilience



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KEYNOTE TRACK SESSION

AI-Assisted Mapping: Revolutionizing Geospatial Technologies To Achieving Sustainable Development Goals

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Abstract

AI-assisted mapping leverages Artificial Intelligence (AI) to enhance the process of creating, updating, and managing maps, map data, and products. However, mapping professionals have yet to adequately and effectively harness the integration of AI techniques with geospatial technologies for peace, prosperity, and sustainability for people and the planet. Therefore, there is a need for AI-assisted mapping and geospatial technologies to achieve part of the Sustainable Development Goals (SDGs) adopted by all United Nations Member States in 2015. This paper highlights AI as a paradigm that enables AI approaches for geomatics data acquisition techniques: interpretation, analysis, management, and implementation. The paper also explores leveraging AI for mapping research to revolutionize geospatial technologies in achieving the agenda of the SDGs. Furthermore, the paper examines real-world cases where AI is used to transform the field of mapping and discusses some of the challenges associated with using AI for geospatial mapping. Overall, AI-assisted mapping combines the strengths of AI with human expertise to create more accurate and detailed maps used in cartography, benefiting various fields from humanitarian aid to planetary science, and hence achieving the world agenda. Addressing these challenges of AI-assisted mapping involves collaboration among researchers, practitioners, and policymakers. With adequate funding, the agenda of the SDGs can be properly implemented to achieve all the mapping components of the 17 global targets of the SDGs.

Keywords: Artificial Intelligence (AI); AI-assisted mapping; Sustainable Development Goals (SDGs); Geospatial and Cartography



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KEYNOTE TRACK SESSION

The Availability, Quality and Currency of Maps and Its Implications for Achieving SDGs in Nigeria

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Abstract

The usability and functionality capacity of any map is dependent mostly on its quality, currency and availability to meet specific deployment needs and fit-for-purpose functions. Thus, in this paper, we examined the map needs objectives for achieving specific United Nations Sustainable Development Goals (SDGs). This is with particular attention to asking the 'What and the Why' questions about map needs in terms of their currency and availability both in quality and quantity for evaluating and showcasing SDGs activities and milestones. While identifying existing gaps and challenges concerning fit-for-purpose maps availability, the paper calls for the urgent need to leverage on modern geospatial technologies especially with Satellites Remote Sensing, AI and Drones-Assisted mapping, given the possibilities they offer.

Keywords: SDGs, AI, Remote Sensing, Satellite



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About Us

Unique Mappers Network aims at providing, promoting and building capacity for Open Data Development, Mobile Data Collection, OpenStreetMap, Open Source Geospatial, Information Technology, Participatory Citizen Science, Research and Humanitarian Services.

Our Mission and Mandate

Unique Mappers Network (UniqueMappersTeam) or UMT is a Nigerian registered nonprofit organization with a mandate and mission for Humanitarian Response and Community Development through:

- Open Mapping using OpenStreetMap project in Nigeria
- Mobile Data Collection & Field Surveys for Open Data Development
- Open Source Geospatial Empowerment using GeoForAll Lab
- Flying Lab/Community Drone Mapping for Open Data Development
- Participatory Citizen Science Projects for community engagement
- Gender-Equality and Youth Empowerment using Open Data & Open Geospatial
- Community Inclusive Empowerment for Sustainable Development Actions



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