AFRICA GEOSPATIAL MAGAZINE

AGM IS A MAGAZINE FOR GEOSPATIAL INDUSTRY IN AFRICA

ISSUE 01 >> 01 VOLUME >> 06 JAN - APR 2025

Technology for a connected world



BUILDING BRIDGES FOR LIFE!

A SPATIAL PERSPECTIVE

1. Dongo Kundu Bridge in Kenya
2. Magufuli Bridge in Tanzania

Geospatial Technologies in Kenya? >>Pg. 6

Quantifying Flood Risk with GIS Data & AI >>Pg. 14

Using DataPlotly QGIS Plugin >>Pg. 28

Battle for Space: SpaceX vs Blue Origin >>Pg. 36

AFRICA GEOSPATIAL MAGAZINE

Africa Geospatial Magazine (**AGM**) is published quarterly by Orbital Africa Limited, Kenya for the Geospatial Community. The magazine provides an effective and reliable platform for overviews and news for the Geospatial Industry from Africa and around the world.

Editor-in-Chief: Edison Majoji - magazine@orbital.co.ke
Manager: Catherine Aroni - magazine@orbital.co.ke

Contributing Editors

Felix Orina
Catherine Aroni
Mashford Mahute
Dr. Anne Olawale
Ann Coholic
Steve Jacobs
David Njoroge
Dishant Shah

Material to be Published

All submissions will be handled with reasonable care, but the publishers assume no responsibility for safety of photographs or documents. Every precaution is taken to ensure accuracy, but publishers cannot accept responsibility for the accuracy of information published or for any opinion expressed.

Reprints

The reprints of all AGM articles are available at: www.orbital.co.ke or call +254 719 672296

Advertising

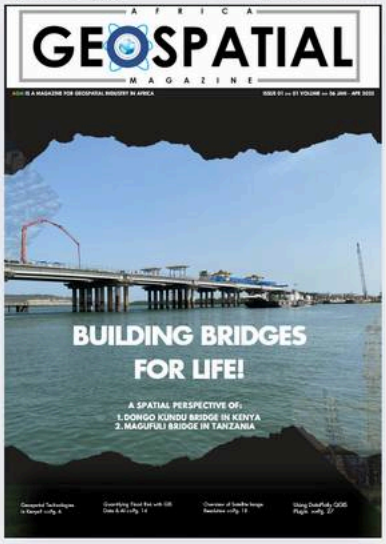
Information about advertisement is available on: AGM Media Pack

Contact Details

Africa Geospatial Magazine
1st Flr, African Creative Centre,
Karen Village, Nairobi.
Cell: +254 719 67 22 96
E-mail: geo@orbital.co.ke
web: magazine.orbital.co.ke

COVER PAGE

We dive into the major infrastructure projects being undertaken in Africa particular the Dongo Kundu and Magufuli Bridges in Kenya and Tanzania respectively.



CONTENTS

P. 06 Utilization of Geospatial technologies in Kenya

Kenya has been at the forefront in adopting the latest geospatial technologies. We discuss how the select organizations in Kenya are utilizing GIS, drones, LiDAR and GPR technology among others.



P. 11 GIS Training of Telesom Engineers in Hargeisa, Somaliland

The visit to Hargeisa for QGIS training was quite glamorous and memorable. How is Somaliland? We dive into the dos and dont's in self-declared Republic of Somaliland.



P. 14 Quantifying Flood Risk with Geospatial Data

The recent flooding in Valencia city has reminded us of the devastating social, environmental as well as economic impacts that flooding can cause. The flood quantification can be done using Geospatial data



P. 18 Building Bridges for Life in Kenya and Tanzania

The ongoing road infrastructure projects in Kenya and Tanzania among other E. African countries reflect the region's commitment to enhancing its connectivity through transportation infra-structure, promoting economic growth.



P. 24 Forest Carbon Estimates with GIS and Remote Sensing Methods

Forest carbon refers to the carbon stored in forest ecosystems i.e. trees, soil and vegetation. Forests play a critical role in the global carbon cycle thus acting as carbon sinks by absorbing the Carbon dioxide.



P. 30 Evolution of Mobile Mapping: How AI is Driving the Technology

Mobile mapping is a method of mapping using a data collection system and a moving vehicle, mostly a car or van fitted with a GNSS, INS, Camera and a LiDAR System



P. 06-07 News

P. 28 Training Catalogue

FOLLOW US ON SOCIAL MEDIA

@OrbitalLtd
Orbital Africa
/@orbital.africa
/Orbital.Africa.Ltd
Orbital Africa
/orbital.africa

To subscribe, share an article or place an advert, e-mail us at:

magazine@orbital.co.ke

Welcome!



Happy new year 2025!

Greetings to all our esteemed readers, the technology enthusiasts, customers, innovators, and commentators! It is with great honour and excitement that I welcome you to this issue of AGM, the 6th edition. AGM is your gateway to the cutting edge Geospatial technology, news, insights, and trends shaping our world.

As we start the year, I'd like to remind you that many Geospatial events have been planned this year. We have documented the events in this magazine. Therefore, it is my singular hope that AGM will enrich your ideas, unlock complex developments in AI and MM technology. As well, you shall get acquainted with the latest developments in Geo world. And as we move deeper into the digital age, this magazine serves as a beacon, guiding you through the transformative Geospatial, mapping and ICT technologies that define the modern era of information age.

Geospatial technology is very dynamic. It has been and will always be the catalyst that reshapes societies, re-imagines industries, and redefines what is possible. In every page of this publication, you will find ideas of ingenuity and resilience showcasing how various organizations are leveraging innovation to solve complex challenges.

From breakthroughs in artificial intelligence and carbon credits to the marvels of space exploration. Talk of Elon Musk's SpaceX, we just bring you the pulse of progress. Indeed, behind every groundbreaking invention is a story of determination, resilience and vision.

Our team of writers, analysts, and contributors have meticulously curated the engaging content that goes beyond the headlines to explore the people and ideas driving change across the Africa and the world at large. We aim to inspire curiosity, spark dialogue and provoke thought as we navigate the possibilities ahead.

The theme of this issue, "Building Bridges for Life: Technology for a Connected World," reflects our commitment to exploring how innovation can unite rather than divide. In a rapidly evolving world, ensuring equitable access to technology is crucial. We delve into the initiatives that are breaking down barriers, connecting the communities and making technology inclusive for all.

As AGM editorial team, I am honored to lead a team dedicated to excellence and creativity. Our mission is to inform and empower our readers with content that resonates, inspires, and equips you to engage with technology in meaningful ways. Thank you for choosing AGM. Lastly, I take this opportunity to wish you a prosperous new year!

Warm Regards!

Mr. Edison Majoji

Chief Editor-AGM

AGM

AFRICA GEOSPATIAL MAGAZINE



- Accurate
- Un-biased
- Non-political
- Up-to-date
- Global

Grab your copy today!

AFRICA GEOSPATIAL MAGAZINE 2025

magazine@orbital.co.ke
+254-719-672296

Advertise with us!



Media Pack 2025

Submit an article today!

agm.orbital.co.ke



UTILIZATION OF GEOSPATIAL TECHNOLOGIES IN KENYA

A review of various organizations in Kenya

By: Felix Orina



Kenya has been at the forefront in adopting the latest geospatial technologies. These technologies have continued to revolutionize key sectors such as infrastructure, agriculture, urban planning and environmental management.

GIS, Remote sensing and mapping tools have become integral to Kenya's national development plans. The adoption of these technologies has expanded in the infrastructure projects especially in mapping transport networks such as the Nairobi Expressway and the Lamu Port-South Sudan-Ethiopia Transport (LAPSSET) corridor.

Land survey practices in Kenya have also witnessed significant advancements especially with the integration of digital tools. This progress also aligns with the government's push to digitize land records under the National Land Information Management System (NLIMS) i.e. Ardhisasa. **Ardhisasa** is an online platform that allows citizens, other stakeholders and interested parties to interact with the land information and processes held in a centralized repository. Over time, Ardhisasa has led to seamless land transactions.

Drone mapping has also emerged as a transformative technology since it is widely applied in agriculture for precision farming, mapping of farmlands as well as crop health monitoring. Further, drone images are extensively used in urban, spatial and landuse planning including real estate development.

On the other hand, GIS has become a bedrock and engine driving public service delivery in Kenya. It has been utilized in the utilities management by various water utility companies in mapping the location of water pipelines network and customers.

Kenya power has employed GIS in mapping of electricity grids, meters, customers and other assets. The County governments such as Nairobi, Mombasa, Kisumu, Nakuru have adopted GIS to enhance urban planning, disaster management and resource allocation. For instance, GIS tools have been instrumental in monitoring the implementation of the government' affordable housing projects.

In disaster preparedness and risk management, geospatial technologies have been critical in addressing the predicaments like flooding in the Lake Victoria Basin and drought menace in the Arid and Semi-Arid Lands (ASALs).

As we usher in new year 2025, Geospatial realm has and is still witnessing myriad of developments with ever-increasing fusion with AI especially in satellite and drone image classification and analysis.

What are we supposed to do then in 2025? Continuous training and capacity development is key in unlocking Geo-AI insights. Indeed, Kenya has recognized the need for skilled Geo professionals with the knowledge and experience in realms of IT, programming, data science and web apps creation.

Orbital Geospatial College (OGC) including universities such as the University of Nairobi and Jomo Kenyatta University of Agriculture & Technology (JKUAT) offer these specialized courses in GIS, IT, programming and remote sensing.

For us to reap big as a country, we should tap into the increase in internet penetration, adoption of cloud-based GIS platforms to make geospatial data more accessible and scalable. Indeed, there are limitless possibilities in the realm of Geospatial technology. So, lets keep discovering the emerging trends and applications in this field!

LOCAL NEWS

A metallic fragment of a space object falls in Mukuku Village, Makueni County

A massive piece of metal believed to be a space junk recently fell from the skies into a Mukuku village in Makueni County, Kenya. The 500 Kg ring of metal object likely came from a rocket, though its exact origins are still unknown, Kenya Space Agency (KSA) officials say. Read their press release here.

According to livescience.com, Low-earth orbit is getting increasingly congested. There are currently more than 170 million pieces of debris wider than 0.004 inches (1 mm) from rockets, space shuttles, defunct satellites and other space operations orbiting our planet. Some of that space junk simply burns up in Earth's atmosphere. But the pieces that don't burn are beginning to pose serious environmental problems.

Nuclear Authority investigates possible radioactive elements in metallic ring site

The Kenya Nuclear Regulatory Authority (KNRA) on Friday, 3rd January 2025 took control of the site in Nduluku, Mbooni, in Makueni county where a separation ring from a rocket fell few days ago.

The body which deals with matters radiation protection, nuclear safety, nuclear security and nuclear safeguards will be collecting samples from the scene for analysis, according to the authority sources. The body pleaded for calmness from the locals to be patient as further studies will be conducted at advanced levels.



Building permits lead as Nairobi revenue source, overtaking the parking fees

Nairobi county generated 22% of its own source revenue from the fees paid from building permits and inspections, Controller of Budget's latest report shows.



East Africa expects drier-than-usual conditions from January to March

The East Africa region is likely to experience drier-than-usual conditions between the months of January to March 2025, the Climate Prediction and Applications Center of the Intergovernmental Autho-rity on Development (Igad), said on Monday, 30th December 2024.

The centre said in a forecast that the drier conditions will affect mainly Ethiopia, Uganda, Rwanda, Kenya, Burundi, and Tanzania. The region will also record considerably warmer-than-usual temperatures during the said period. However, normal temperatures are likely to be recorded in a few areas of northern Uganda and western Sudan.

Traffic traffic snarl-ups along Nairobi-Nakuru highway, a cause of concern, say residents



Many Kenyans who were traveling upcountry for Christmas festivities were stranded for hours following traffic snarl-ups stretching for kilometres along Nairobi-Nakuru highway. As at 10.00 pm on 23rd December, motorists had also spent several hours at Ahero on Kisumu-Kericho Road due to heavy traffic jams stretching several kilometres. The residents have urged the government to expedite dualling of Nairobi-Nakuru-Eldoret (A8) Highway in order to address the traffic challenges. This will also reduce accidents and delays.

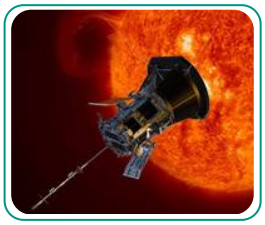


Looming water crisis as forests are cut down for development, the experts warn

Kenya may face a critical water crisis, with over 21 million people at a threat of lacking basic access to safe water, UNESCO's World Water Development Report of 2023 states. This is driven by urbanisation, competition for resources and excision of the forests.

GLOBAL NEWS

NASA's Mission to Understand the Sun with the Parker Solar Probe is a success



On the new year's day, NASA's Parker Solar Probe added to the festive cheer by sending home more good news about its record-breaking closest-ever approach to the sun. The latest telemetry transmission also confirms the Parker Solar Probe successfully carried out the commands programmed into its flight computers and that its science instruments were functioning during the flyby, according to the statement. That means the spacecraft collected valuable data about our star as it swooped to within 3.8 million miles (6.1 million kilometers) of the sun's surface — the closest yet a spacecraft has ever gotten to our star.

Source: space.com

Why Elon Musk's Starship rocket is beating NASA in the space race



The SpaceX chief's powerful new system is set to slash the cost of missions, leaving NASA in the dust! It was one of the most striking technological events of the year. On 13th October 2024, Starship, the world's largest and most powerful rocket, blasted into space from a launchpad in Texas. Its main booster reached an altitude of more than 65km before it began to hurtle back to Earth at a velocity greater than speed of sound.

A crash was averted when the rocket – built by Elon Musk's SpaceX company – reignited its engines and slowed down until it hovered tantilisingly over the tower from which it had been fired aloft only seven minutes earlier. Source: theguardian.com

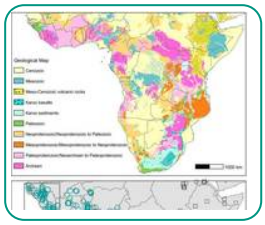
Togo launches Open Data platforms to promote Transparency and Development



Togo's government has launched Open Data and Geoportal platforms, offering public and private geospatial data on sectors like health, agriculture, education, utility and infrastructure.

The Open Data platform provides insights into key sectors, including health, agriculture, and education. The health section features data on health indicators and global challenges, while the agriculture category addresses rural development and food security. Education data highlights human development and other critical indicators. Source: techafricanews.com

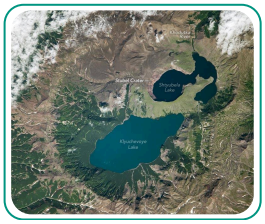
Strontium isotope map of Sub-Saharan Africa: A powerful tool for archaeology, forensics



A team of researchers led by UC Santa Cruz recently released a sophisticated new map that reveals, for the first time, the unique "geologic fingerprints" for most of the African continent. The map will help archaeologists, conservation scientists, and forensics experts match artifacts and plant, animal, and human remains found at locations around the world back to their most likely region of origin within Africa.

The Researchers also mapped predicted bioavailable strontium isotope ratios across most of the African continent. Source: phys.org

Astronaut captures breathtaking image of Russian Volcano's Nested Calderas and Craters



A breathtaking image from the ISS shows Ksudach volcano with its vibrant landscape, shaped by volcanic forces, resulting in mesmerizing lakes and contrasting colors that narrate the story of Earth's raw power. Traces of **snow** fill valleys within and outside the volcano's caldera complex. These snow-covered areas highlight the drainage patterns from higher to lower elevations. Source: scitechdaily.com

◆◆ SPONSORED ◆◆

Explore Vacation Packages to Popular Destinations

Mombasa | Mahebourg | Bali | Malindi | **Zanzibar**



The Neela Boutique Hotel Stone Town + Flight
Zanzibar Town

4 stars - 9.8/10 Exceptional (29)

Nairobi (NBO) - Zanzibar (ZNZ)

$722 off

$1,389 ⓘ ~~$2,111~~

per traveler

Sat, Jan 18 - Sun, Jan 26 (8 nights)



Hotel Riu Palace Zanzibar - All Inclusive - Adults Only + Flight
Nungwi

5 stars - 9.2/10 Wonderful (620)

Nairobi (NBO) - Zanzibar (ZNZ)

$963 off

$2,222 ⓘ ~~$3,185~~

per traveler

Sat, Jan 18 - Sun, Jan 26 (8 nights)



Hotel Riu Jambo + Flight
Nungwi

4 stars - 9/10 Wonderful (264)

Nairobi (NBO) - Zanzibar (ZNZ)

$728 off

$1,703 ⓘ ~~$2,431~~

per traveler

Mon, Feb 10 - Sat, Feb 15 (5 nights)



Kobe Suite Resort + Flight
Watamu

4.5 stars - 9.8/10 Exceptional (18)

Nairobi (NBO) - Malindi (MYD)

$141 off

$622 ⓘ ~~$763~~

per traveler

Fri, Jan 24 - Mon, Jan 27 (3 nights)



AHG Lion Beach Resort + Flight
Watamu

4 stars - 7.6/10 Good (5)

Nairobi (NBO) - Malindi (MYD)

$88 off

$418 ⓘ ~~$506~~

per traveler

Fri, Jan 24 - Mon, Jan 27 (3 nights)



Ndoto Boutique Hotel + Flight
Malindi

3 stars - 10/10 Exceptional (1)

Nairobi (NBO) - Malindi (MYD)

$89 off

$420 ⓘ ~~$509~~

per traveler

Fri, Jan 24 - Mon, Jan 27 (3 nights)

Expedia

Seito

Start the year with exciting deals today!

Scan me for more details >>

https://bit.ly/3W1eiDd

Overview of Satellite imagery Resolution...

Comparing Spatial, Temporal and Spectral resolution



Mashford Mahute

Mashford is a GIS and Remote Sensing specialist focusing on transforming Businesses with GIS & Remote Sensing technologies. He's ESG, Sustainability & ISO 14001, 45001, 9001 Competent. He enjoys writing articles on GIS and RS realms.
Author: LinkedIn Page

Remotely sensed data is the core of modern geospatial analysis. It enables the users to monitor, understand and interpret the Earth's ever-changing and dynamic processes. The satellite imagery resolution plays a critical role in determining the quality, detail and utility of the data collected from the satellite sensors in space.

Our focus is the three main types of resolution in satellite imagery i.e. the **spatial**, **temporal** and **spectral** resolution. Each describes a different aspect of the satellite's sensor imaging capabilities. Whilst they are interrelated, they address unique dimensions of satellite functionality as well as it applications. Indeed, understanding the concepts of imagery resolutions allow geospatial professionals to optimize the satellite data sources for specific applications thus improve the decision-making processes.

Spatial resolution refers to the size of the smallest object that can be resolved by a satellite sensor. It is measured in meters and indicates the dimensions of one pixel in an image. It determines the level of detail visible on the Earth's surface.

Satellite images with higher spatial resolution have smaller cells or pixels, which implies they can capture more detail from the real world. The satellites such as WorldView-3 has a spatial resolution of 0.3 meters. It allows for detailed imagery in identifying objects such as vehicles, roads, and buildings among others.

Temporal resolution describes the frequency of satellite revisits period and capturing imagery of the same location on the surface of the Earth. The interval depends on the satellite's orbit and the imaging sensor's design. High temporal resolution satellites e.g. Sentinel-2 has a revisit period of 5 days. Its images are applied in monitoring dynamic phenomena such as crop growth, deforestation, urban sprawl, wildfires, and disasters such as flooding or drought. The imagery from satellites with lower temporal resolution are utilized in long-term geological and environmental studies.

Spectral resolution is the ability of a sensor to distinguish fine wavelength intervals. It's defined by the number and width of spectral bands a sensor can record. The narrower the wavelength range for a given band, the finer the spectral resolution (*nasa.gov*). For instance, Landsat 8 sensors have moderate spectral resolution. They capture visible, near-infrared and shortwave-infrared bands. In contrast, the EO-1 Hyperion is an example of the Hyperspectral sensors. These sensors offer images with high spectral resolution with hundreds of narrow bands. This is ideal for detailed analysis of materials, vegetation health, or water quality.

This comparison infographic below highlights the key attributes, applications and limitations of these three resolutions to help you make informed choices when executing remote sensing projects.

By Mashford Mahute	Spatial Resolution	Temporal Resolution	Spectral Resolution
Definition	• Smallest ground unit a pixel represents.	• Frequency of data capture for the same area.	• Ability to distinguish different wavelengths.
Unit of Measure	• Meters or kilometers per pixel.	• Time intervals (e.g., days).	• Wavelength intervals (nm) or number of bands.
Determined By	• Sensor pixel size and satellite altitude.	• Sensor revisit period or data acquisition frequency.	• Number and width of spectral bands.
Importance	• Indicates ground detail level.	• Indicates frequency of monitoring changes.	• Indicates ability to identify material spectral signatures.
Example	• 10 m resolution = one pixel covers 10 x 10 m.	• 5-day resolution = data captured every 5 days.	• 10 nm resolution = distinguish 10 nm apart wavelengths.
Applications	• Urban mapping, land cover, infrastructure monitoring.	• Monitoring vegetation growth, disasters, urban expansion.	• Mineral exploration, vegetation health, water quality.
Trade-Offs	• High spatial = lower spectral or smaller area.	• High temporal = lower spatial or smaller area.	• High spectral = lower spatial, larger file size.
Sensor Examples	• Sentinel-2 (10 m), Landsat-8 (30 m), WorldView-3 (0.31 m).	• GOES (15 min), Sentinel-2 (5 days), Landsat-8 (16 days).	• Hyperion (220 bands), Sentinel-2 (13 bands), Landsat-8 (11 bands).
File Size Impact	• High spatial = larger file size.	• Minimal impact unless paired with high spatial resolution.	• High spectral = larger file size due to multiple bands.
Data Analysis Focus	• Geometry and precise location of features.	• Change detection and event monitoring over time.	• Material identification and classification.
Sensor Platform	• Satellites, drones, or aircraft with high-resolution cameras.	• Satellites with frequent revisits (e.g., GOES, MODIS.	• Hyperspectral or multispectral sensors.
Key Limitations	• Limited area coverage at high resolution.	• Limited frequency in capturing rapidly changing events.	• Limited ability to detect features without strong spectral contrast.
Technology Trends	• Advances in very high-resolution sensors (e.g., <1 m).	• Increasing revisit times with constellations (e.g., Planet Labs).	• Improved hyperspectral imaging and spectral unmixing techniques.

Follow me for more. Mashford Mahute.

Trip to Hargeisa city in Somaliland

GIS training of Telesom Telecomms engineers



Cate Kerubo

Catherine Kerubo is a project management professional with over 10 years of experience. Currently, she is the Business Development Director at Orbital Africa Ltd overseeing the sourcing of projects as well as execution thereof. She is passionate about GIS, Drone technology and mapping.

In December 2024, we had an opportunity to travel to Hargeisa in Somaliland for GIS training services to a group of 5 engineers from **Telesom** - a leading Telecommunication company in Somaliland.

The customized QGIS training course on the applications of GIS in telecommunications industry was conducted within 2 weeks. This is a beginner to advanced course which provided a well detailed introduction to GIS, spatial data analysis and mapping using QGIS - a free yet powerful open-source GIS software. Generally, this course is often designed for professionals, students and researchers keen on advancing and enhancing their Geo skills.

The training was conducted at Telesom premises in Hargeisa city, in the self-declared Republic of Somaliland. Hargeisa serves as political, economic, and cultural hub of Somaliland. Hargeisa is the capital and largest city of Somaliland.

Somaliland: It is one of the safest and peaceful places in what the rest of the world still considers to be Somalia! According to 2023 estimates, Hargeisa city has more than 1.2 million inhabitants. The city is a also peaceful with friendly people. For a successful visit, you require some adequate planning prior to visiting.

Although **Hargeisa airport** has undergone significant renovations in recent years, the availability of modern amenities remains limited. The passengers may find fewer options for restaurants, shops, and waiting areas compared to other larger international airports such as JKIA. Whilst Somaliland issues visas on arrival for many nationalities, the process is inefficient since it requires additional time for approval and verification of documents. Sometimes also expect some delays at the airport!

The Global GIS market in the telecommunication industry is one of the fastest-growing markets worldwide. The GIS mapping can revitalize telecom companies by reducing costs and enhancing better capital planning.

The 2-week GIS training course was designed to cover the evolution and the basic concepts of GIS and its application in the telecommunication industry. Upon successful completion of the training, the participants were be able to:



Hargeisa City

- Understand the evolution of GIS & application in telecommunication industry.
- Create GIS maps, infographs, reports, and other statistical presentations and for visualizing the wide range of telecommunications data.
- Use smartphone technology to capture and store telecomms spatial data in Geoserver cloud.
- Solve spatial problems in telecommunications industry such as locating the underground fiber optic cables, towers, manholes etc.
- Use various GIS tools and plugins to evaluate the strength and weaknesses of GIS in telecommunications data handling, analysis as well as presentation thereof.
- Integrate and incorporate GIS techniques and workflows into the current activities of Telesom telecommunication industry.
- Design and produce high customized maps using QGIS inbuilt cartography tools.
- Perform spatial analysis using Model Designer.



Issuance of certificates to participants

Scan me for more details

https://bit.ly/4fRPiW5



ORBITAL GEOSPATIAL COLLEGE

SPONSORED

Enroll today and get huge discounts

Geospatial training courses



Prioritize your professional growth today!

Call us : **254-719-672296** to schedule a meeting with us or book on: **study@ogc.or.ke**

Self-paced courses

Allowing participants to learn at their own pace, accommodating varying schedules, learning styles, and skill levels.

Online training platform

Learn anytime, anywhere, on your schedule...balancing learning with work or personal commitments. You Reduce expenses on travel, accomodation etc.

PhD. level trainers

Elevates learning by bringing in a wealth of expertise, experience, deep subject knowledge, and research-based insights to training and education.

New year discounts

An excellent time to invest in personal or professional development, as our training model flexible deals to kick off the year!



Access a wide range of courses on-the-go

- Basic
- Advanced
- Certificate
- Catalogue

www.ogc.or.ke

You have the potential to unlock the power of GIS technology today!

254-719-672296
study@ogc.or.ke
@ogc.africa
www.ogc.or.ke
www.orbital.co.ke

GEOSPATIAL EVENTS 2025

Event: Africa GeoExpo
Dates: 23-24 Oct. 2025
Location: Boma Hotel
Country: Nairobi, Kenya

Event: Uganda W&E Week
Dates: 17-21 Mar. 2025
Location: Kampala
Country: Kampala, Uganda

Event: ISK AGM Meeting
Dates: TBD
Location: TBD
Country: Nairobi, Kenya

Event: INTERGEO
Dates: 7-9 Oct. 2025
Location: Frankfurt
Country: Germany

Event: GWF
Dates: 23-24 Oct. 2025
Location: Virtual
Country: Nairobi, Kenya

Event: Geo Connect Asia
Dates: 9-10 Apr. 2025
Location: SE & CC
Country: Singapore

Event: GEOINT Symposium
Dates: 18-21 May. 2025
Location: ACCC
Country: St. Louis, MO. USA

Event: GEO Business
Dates: 4-5 Jun. 2025
Location: Excel London
Country: UK

Event: Managing Facilities and
Dates: 23-24 Oct. 2025
Location: Virtual
Country: Nairobi, Kenya

Quantifying flood risk with Geospatial data and AI

By: Ann Coholic

The recent flooding in Valencia has reminded us of the devastating social, environmental as well as economic impacts that flooding can cause. This catastrophic event saw many parts of Valencia experience up to 500 millimeters of rain in just eight hours, resulting in major flash floods that caused widespread destruction across the city.

The European Environment Agency (EEA) predicts that both flash floods and coastal flooding—which is caused by storm surges and high tides that inundate typically dry land—will become more frequent in the coming decades due to rising sea levels. This shift poses an increasing threat to the populations, infrastructure, and ecosystems. Specifically, the EEA forecasts that what was once considered a 1-in-100-year coastal flood could occur up to 10 times more often by 2050 along many locations on the Mediterranean and Atlantic coasts.

With nearly half of the European Union's population living within 50 km of the coast primarily in urban areas, the potential impact of these events is significant. This serves as a powerful reminder of how increasingly extreme weather patterns are straining and negatively affecting the urban systems. Therefore, there is urgent need for improved flood management strategies and resilient infrastructure to mitigate any future risks.

High-precision land cover data for flood risk analysis

When heavy rainfall occurs, impervious surfaces (roads, buildings, parking, sidewalks, pavement) can contribute to excess runoff which can overwhelm infrastructure and intensify flooding. High-precision geospatial data helps identify impervious areas and evaluate their contribution to flood risks, allowing cities to take proactive measures such as enhancing drainage systems or implementing green infrastructure to better absorb and manage excess water.

Traditionally, obtaining high-precision land cover data has been a challenge for communities, as many have relied on manual digitization processes, which is resource-intensive and time-consuming, reducing how frequently you can create and maintain these layers.

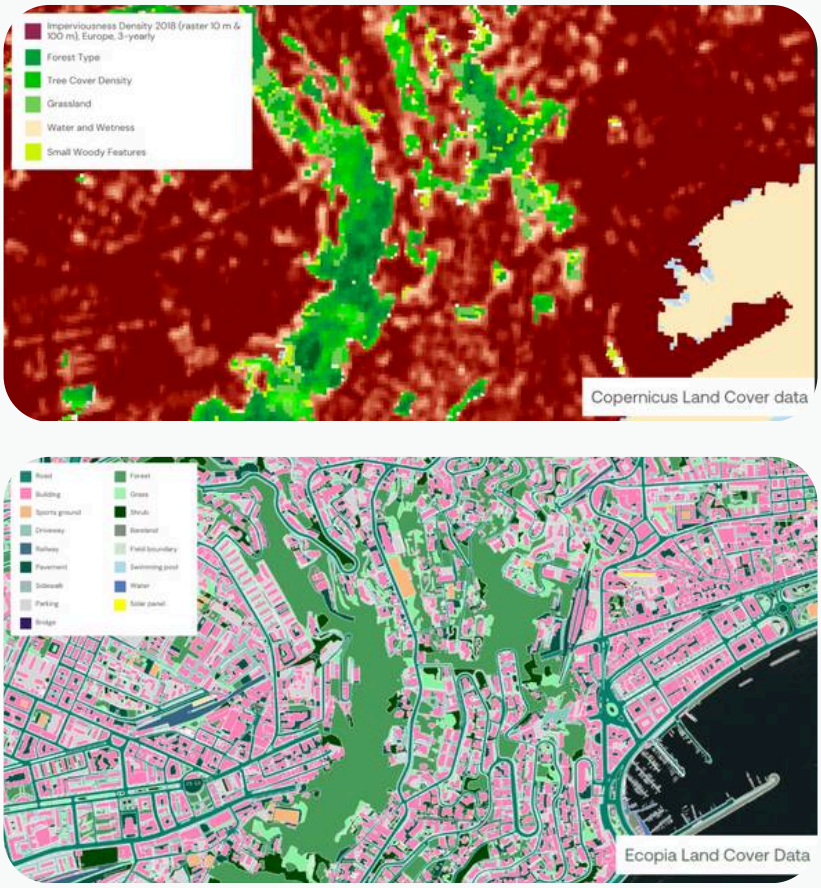
Other alternatives, like open data do provide valuable insights, but Ecopia's high-precision datasets offer a level of detail and freshness that is not available in openly accessible datasets.



A sample of Copernicus satellite imagery data

As you can see, Ecopia's AI-based mapping systems provide you with the intricate details of how your city (or country) is configured and how different infrastructure assets interact with each other. Whether you need to accurately model where water is going to sit and ultimately flood, or how you want to evacuate your citizens when conditions become hazardous, this level of detail becomes a necessity.

Through our extensive partner network, we gain access to the latest satellite imagery data, enabling us to deliver the most comprehensive, accurate, and current data to support climate resilience initiatives. Our robust AI-based mapping system delivers your client's data in just weeks, while maintaining the same level of accuracy and quality of the outputs as a trained GIS professional. This includes but not limited to the mapping 3.5 million km2 of 30cm land cover vectors across all of the Coastal US in under 6 months!



A sample of impervious and pervious land cover data extracted by Ecopia AI in Naples, Italy.

Quantification Process

Quantifying flood risk with geospatial data entails integrating spatial and temporal information to analyze the likelihood and impact of flooding in a given area. The combination of remote sensing, Geographical Information Systems (GIS), and hydrological modeling is key in achieving this objective. The spatial data enables mapping of flood-prone zones, assessment of vulnerable assets, and simulation of potential flood scenarios as well as providing valuable insights for risk reduction and planning.

The first step is **hazard assessment**. This entails identifying areas likely to experience flooding. This requires analyzing topographical data e.g. Digital Elevation Models (DEMs) to understand the terrain features and drainage patterns in the specific area.

Remote sensing tools e.g. freely available satellite imagery from Landsat or Sentinel-1 provide the additional information on land cover and location of water bodies. The historical rainfall and river discharge data are integrated into hydrological models to estimate flood recurrence intervals and potential water depths.

The **Exposure analysis** evaluates the elements at risk. For instance, the infrastructure, buildings, and general ecosystems. GIS/AI tools are used to overlay hazard maps with data on buildings, roads, and agricultural land, highlighting the areas where assets and activities intersect with flood zones. This spatial analysis helps in hotspots identification of the vulnerability and prioritize regions for intervention.

The **vulnerability assessment** is done to measure the susceptibility of exposed elements to damage. This entails evaluating the resilience of buildings, infrastructure, and households to flood impacts.

The combination of hazard, exposure, and vulnerability data results in a comprehensive **flood risk assessment**. The outputs are often presented as risk maps which provide visualizations of areas with the highest flood risk. These maps inform urban planning, disaster preparedness as well as policy-making.

Geospatial data-driven flood risk quantification has myriad of benefits e.g. improving accuracy of predictions and enabling proactive flooding risk mitigation and management strategies.



About Ecopia: Ecopia's mission is to digitize the world using AI. Ecopia specializes in extracting insight from geospatial big data. Their intelligent systems leverage groundbreaking advancements in artificial intelligence to convert high-resolution imagery of our earth into HD vector maps, which are embedded into critical applications around the world.

Since 2013, they've been leveraging this technology to build a digital twin of the world layer by layer of insight required to solve the world's most complex problems.

Ann Coholic is the Senior Director of Channel Partnerships at the Ecopia AI, a technology company that was founded with the core mission of digitizing the whole world using AI.
Web: www.ecopiatech.com



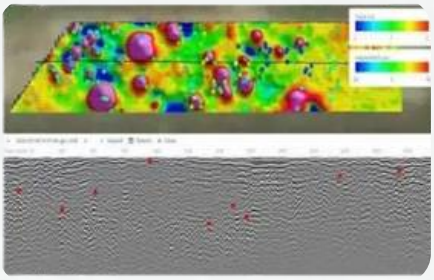
Ann Coholic

Recent Geospatial articles

By: Orbital Africa



iPhones and Android users can now use satellites to make calls >>



GPR utility scanning project in Mogadishu, Somalia >>



Six (6) Best GIS web and online or Cloud Mapping platforms >>



Surveyors call for a transition to Fixed Boundaries surveys >>



Online GIS course: Mobile data collection with Epicollect5 >>



Do you want to live in Mars? NASA has a Plan for you! >>

Read all articles here: https://bit.ly/3W9goBd

Dramatic scenes as wildfires sweep through west LA, California



Thick smoke engulfed huge areas of LA city

A wildfire that started in the Pacific Palisades area of Los Angeles on Tuesday morning has spread across the west of the city at an alarming rate throughout Tuesday, 7th Jan. 2025 and overnight.

High winds and very dry conditions further fueled the flames, causing the blaze to rip through neighborhoods at alarming speeds. The fires reportedly spread from a size of 10 acres to nearly 3,000 in a matter of hours. Firefighters had battled the flames throughout the night as residents were forced to flee amid evacuation orders affecting tens of thousands of people.

The photographers captured the dramatic scenes across the west of the city as firefighters worked to control the fires.

Drones were employed by firefighters to aid in combating the spread of the fires.

Source: BBC

SPONSORED

PROFESSIONAL GEOSPATIAL COURSES

Learners Today, Leaders Tomorrow!

ORBITAL GEOSPATIAL COLLEGE

Beginner Courses

- Introduction to GIS Course
- Web and Online Mapping
- Building the GIS Databases
- GIS Mobile Data Collection
- Remote Sensing & Drone Mapping
- Introduction to Cartography
- GIS Programming with Python
- Remote Sensing & Drone Mapping

Advanced Courses

- GIS for Land Administration
- GIS for Geology and Mining
- GIS for Monitoring and Evaluation
- Google Earth Engine Course
- Design with MicroSurvey CAD
- GIS for Spatial/Land use Planning
- Intelligent Urban Transport Systems
- Land Information Systems Course











Contact Us:

+254-719-672296
Karen Village, Nairobi
www.orbital.co.ke

Building Bridges for life

Key lessons learnt from Kenya and Tanzania



Felix Orina

Felix Orina is a Geospatial Engineer & Technology consultant with over 15 years of experience. He has executed projects in a number of African countries including Kenya, Tanzania, Somalia, Rwanda, Ethiopia etc. He's passionate about the emerging trends in the realms of Geospatial, technology, AI and construction.

The **Dongo Kundu** Bypass is a key infrastructure project aimed at easing traffic congestion and improving transportation efficiency along the coastal region of Kenya, specifically between the city of Mombasa and south coast region. The Bypass is part of the larger vision aiming at connecting the various transport corridors - especially the Northern Corridor of East Africa thus fostering regional economic integration. The highway is significant as it bypasses the busy Mombasa city centre, offering a direct route between the northern and southern parts of Mombasa city as well as the surrounding areas. The project began in earnest in August 2015. This marked the start of construction works. It was intended to alleviate the chronic traffic jams that were severely affecting the flow of goods and passengers through the city of Mombasa, especially considering the city's strategic role as Kenya's main port and a gateway to East and Central Africa region.



Mteza Bridge along Dongo Kundu Bypass

The 17.5 km bypass is also part of the Mombasa Port Area Road Development which also includes other major road networks meant to enhance the port access and traffic movement.

It starts at the Mombasa Southern Bypass and extends to the south thus connecting with the Mombasa-Nairobi Highway at the Dongo Kundu area. Indeed, this bypass is crucial as it reduces the travel time for motorists between the southern parts of the region and Mombasa, allowing them to bypass the city's congested areas. Therefore, the road provides an alternative route to the main highway, thereby alleviating pressure on the old Mombasa town roads.

The project was estimated at around KSh 30 billion (approximately USD 250 million), with the bulk of the funding sourced from the Kenyan government and loans from Japan International Cooperation Agency (JICA). This reflects Kenya's ongoing partnership with Japan in the infrastructure development.

The significant portions of the bypass run through wetland areas and residential zones, meaning that some people had to be relocated, compensated and environmental measures were adequately taken to mitigate any adverse effects during and after the project execution.

The Dongo Kundu Bypass project was constructed in three phases. The project was completed and opened to the public in August 2024.

Phase 1: Miritini-Kipevu section

This phase was completed in June 2018, its cost was approximately KSh 11 billion. The road stretches about 10.1 km from Miritini to Kipevu.

Phase 2: Mwache-Tsunza-Mteza section

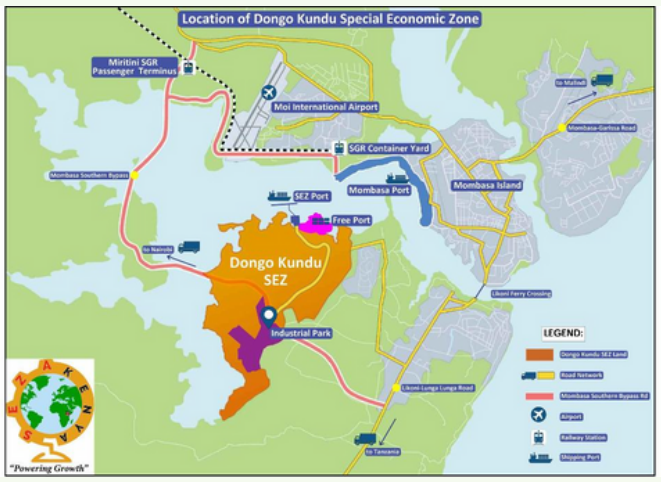
It was completed in 2024, and its cost was KSh 24.2 billion. It built a 8.9 km stretch from Mwache Junction to Mteza. This phase included the construction of the Mwache Bridge, Tsunza Viaduct, and Mteza Bridge. The Mwache-Tsunza-Mteza section of the bypass falls under phase two of the whole project. The Government also compensated land owners who had to be relocated at a cost of about KSh 2 billion.

Phase 3: Mteza-Kibundani section

This phase was planned to build a 6.9 km road from Mteza to Kibundani, connecting the bypass with the Likoni-Lunga Lunga Road section. It is now complete.



Construction of Mteza Bridge section



Source: Special Economic Zones Authority

As a result of the construction of Dongo Kundu bypass, the Kenya Ferry Services will likely see a drop in traffic since it's projected that many motorists traveling from Nairobi to south coast will opt to use the road for convenience. Juma Bakari, a resident of Ukunda, told AGM team this will ease traffic at Likoni crossing channel, which currently serves over 350,000 people and 6,800 cars daily.

Economic Benefits of the Bypass

The bypass is expected to immensely boost economic activities in the region. It facilitates access to the Port of Mombasa which is the largest in East Africa thereby supporting regional trade. Furthermore, improved road infrastructure is likely to attract investments in industries including logistics, tourism and manufacturing along the bypass corridor and its environs.

For decades, the ferry crossing at Likoni Channel has been a major predicament. There are long queues and delays affecting commuters and cargo transport. The Dongo Kundu Bypass provides an alternative route reducing the over-reliance on the ferry system thus improving efficiency of transportation in Mombasa.

The bypass opens up previously inaccessible areas for tourism development. The coastal destinations such as the famous Diani Beach (one of Africa's premier beach resorts) are now more accessible. Additionally, the road facilitates travel to major tourist sites such as the Tsavo National Park and other inland attractions further promoting overall Kenya's tourism sector.

Whilst the bypass offers numerous benefits, it has raised a lot of concerns about the environmental impacts. The construction activities had affected mangrove forests and other sensitive ecosystems in the coastal region. To address these challenges, the mitigation measures including the reforestation and the establishment of the environmental conservation programs, have been incorporated into the project.

The bypass has created numerous job opportunities, both during its construction phase and in related industries such as logistics and hospitality. Local communities have benefited from employment in construction projects and ancillary services thus fostering the economic empowerment in the region.

By enhancing connectivity within coast region, the Dongo Kundu Bypass plays a significant role in regional integration. It links Kenya to Tanzania as well as other countries in the East African Community (EAC) thereby facilitating the movement of goods and people across the borders; and supporting initiatives aimed at improving the regional trade and cooperation.

The Bypass is also expected to transform the transportation landscape in Kenya's coastal region. It will enhance the efficiency of the Port of Mombasa, reduce logistical costs, and improve the quality of life for residents. As well, it sets a precedent for future infrastructure projects aimed at boosting economic growth and sustainability in Kenya and Africa at large.

Magufuli Bridge in Tanzania

The Magufuli Bridge which is named after the late Tanzanian President John Pombe Magufuli is a remarkable infrastructure project that connects the regions of Kigoma and Geita across Lake Victoria. It was officially inaugurated in 2022. The bridge stands as one of the longest in East Africa and a symbol of Tanzania's commitment to regional integration as well as the economic growth.

The Magufuli Bridge spans 3.2 kilometers long and 28.5 meters wide. Its design incorporates modern engineering techniques to ensure durability and resilience against the environmental challenges such as high winds and water currents from Lake Victoria.

The project was constructed by China Civil Engineering Construction Group (CCECG) and the China Railway. Its cost was TZS 700 billion (approximately $300 million) and was entirely funded by the Tanzanian government and named in honour of the late President John Pombe Magufuli. Best known for championing infrastructure projects, Magufuli's legacy continues through this vital addition to the country's transport network, reflecting Tanzania's commitment to development and modernization.



Construction of Magufuli Bridge



Construction Phases

Planning and Feasibility Studies: Before construction began, comprehensive feasibility studies were conducted to assess the technical, economic and environmental viability of the project. Ground surveys were carried out to determine the best location for the bridge, considering factors like water depth, wind speeds, and soil stability.

Design Phase: The bridge's design was developed by a team of local and international engineers. The design incorporated modern engineering principles to ensure the bridge could withstand the environmental conditions of Lake Victoria, such as strong winds, high water levels, and fluctuating temperatures. It also included features like durable steel-reinforced concrete and expansion joints for flexibility.

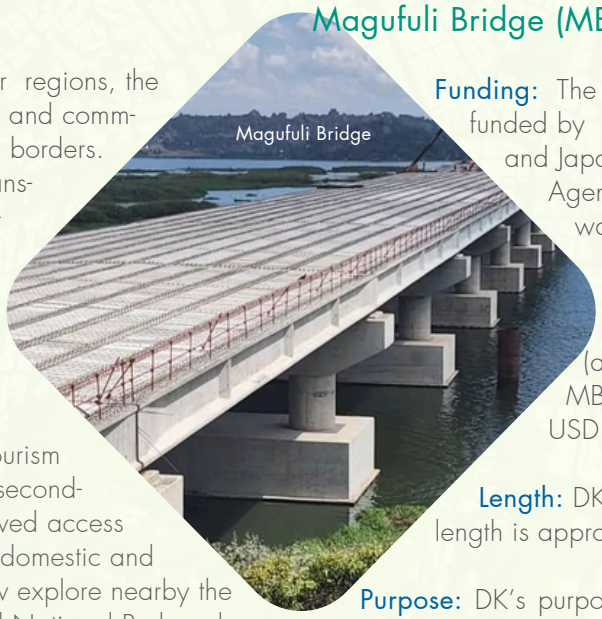
Foundation Construction: The foundation work was one of the most challenging aspects of the project. Deep-sea drilling rigs were used to install piles into the lake-bed. These piles serve as the main support for the bridge's piers.

Construction of Piers and Supports: The Massive piers were constructed to support the bridge deck. These piers were built using reinforced concrete, which was cast on-site and transported using barges.

Key Benefits of Magufuli Bridge

Regional Connectivity
The bridge significantly enhances connectivity between Kigoma and Geita, the two key regions in Tanzania. Previously, travelers relied on ferries which were often time-consuming and unreliable. The bridge facilitates seamless transportation reducing the travel time and improving the movement of goods and people.

Trade and Commerce
By connecting Tanzania's interior regions, the Magufuli Bridge promotes trade and commerce within the country and across borders. It provides an efficient route for transporting agricultural products, minerals, including manufactured goods thereby enhancing the access to markets and reducing the logistical costs.


Magufuli Bridge

Tourism Potential in the Region
The bridge is expected to boost tourism around Lake Victoria, the world's second-largest freshwater lake. The improved access makes the area more attractive to domestic and international tourists, who can now explore nearby the attractions such as Rubondo Island National Park and cultural heritage sites with ease.

Employment Opportunities
The construction of the bridge generated thousands of jobs which benefited the local communities in Kigoma and Geita. The project created jobs for over 1,200 local engineers and skilled workers.

In addition to direct employment, the project stimulated ancillary industries such as construction materials supply, hospitality, and transportation.

Regional Integration
The Magufuli Bridge is a vital link in Tanzania's broader infrastructure network. It contributes to the development of trade corridors within the East African Community (EAC). Thus, it supports the free movement of goods and people; it fosters the regional economic integration and cooperation.

Comparison: Dongo Kundu (DK) Bypass and Magufuli Bridge (MB)

Funding: The Dongo Kundu project was funded by the Government of Kenya in and Japan International Cooperation Agency (JICA). Magufuli Bridge was fully funded primarily by Government of Tanzania.

Cost: DK cost KES 30 billion (about USD 250 million) while MB cost TZS 700 billion (about USD 300 million).

Length: DK span 17.5 km while MB's length is approximately 3.2 km.

Purpose: DK's purpose was to ease congestion in Mombasa by providing an alternative to the Likoni ferry. The aim of MB is to improve the regional connectivity between Kigoma and Geita whilst enhancing the transportation across Lake Victoria.

Engineering and Design: DK bypass includes several bridges and viaducts, as well as multi-lane road sections to accommodate increasing traffic volumes. MB features steel-reinforced concrete and advanced engineering techniques to withstand environmental challenges, such as strong winds and water currents.

Major Road Projects in East Africa region


A section of TanZam Highway

1. Mombasa – Mtwapa – Kilifi Road (Kenya)
2. The Lamu Port-South Sudan-Ethiopia-Transport (LAPSSET) Corridor (Kenya)
3. Kigongo–Busisi Bridge (Tanzania)
4. Tanzania-Zambia Highway Project Rehabilitation (Tanzania/Zambia).
5. Arusha – Namanga – Athi River Road Project.
6. The Bus Rapid Transit (BRT) System (Tanzania).
7. Kampala Northern Bypass (Uganda)
8. Kampala–Entebbe Expressway in Uganda.

The above are some of the ongoing and completed road projects in East Africa region. These projects reflect East Africa's commitment to enhancing its connectivity through transportation infrastructure, promoting economic growth hence facilitating the regional integration under EAC Umbrella.

Africa is on the Move!



Dishant Shah

Shah is a partner at Legion Exim company Manufacturer-Merchant. He's Exporter of Refractories, Submersible Pumps & Diverse Engineering Products from India to Africa. He's an International Business Development with expertise in sourcing, procurement and International Logistics.

A highway network stretching across the entire continent. That's the vision of the African Trans-Continental Highway (ATH) project. It's about connecting people, businesses, and opportunities. The ATH aims to link Cairo to CapeTown, Dakar to Djibouti, and everything in between.The African Trans-Continental Highway is one of the most ambitious infrastructure projects in the world.

Spanning over 60,000 kilometers and 9 major corridors, it aims to connect Africa like never before. The idea is simple yet powerful: build a network of highways linking major cities and regions across the continent. This highway system has the potential to redefine trade, travel, and economic growth in Africa.

Africa has long struggled with infrastructure gaps. Poor road connectivity has made it difficult for businesses to transport goods efficiently. Farmers can't always get their produce to markets on time. Traders face higher costs due to poor logistics.

This is where the Trans-Continental Highway could change everything. Improving the road networks could boost intra-African trade and make businesses more competitive globally. The highway is a lifeline for landlocked countries. It links them to ports and markets, opening doors to international trade.

The countries like Uganda, Mali, and Zambia could see major economic transformations as they gain better access to global supply chains.

However, building the highway isn't easy. The challenges like funding, political cooperation and environmental concerns are significant. Some sections of the highway already exist, but others are still in the planning phase. Different countries have different priorities, which can slow down the progress. Corruption and inefficiencies in infrastructure development also remain concerns. Yet, the potential benefits far outweigh the challenges by far.

The estimates suggest that the African Continental Free Trade Area (AfCFTA), which works hand-in-hand with the highway project, could increase intra-African trade by over 50%. That's a huge leap for a continent with immense untapped potential.

Better roads mean fewer transport emissions if they reduce congestion and promote efficient routes. However, environmental considerations will need to be balanced with development goals.

The African Trans-Continental Highway is a vision of a connected, prosperous and united Africa. It shows what can be achieved when countries come together to tackle the shared challenges.

While there's still a long road ahead—literally and figuratively—the journey is undoubtedly worth it.

What are your thoughts on the potential impact of this highway? Could this be the infrastructure revolution Africa needs?



Graphic by: Dishant Shah

SPONSORED

AGE

Orbital Geospatial Services

Seito



AFRICA GEOSPATIAL EXPO

2025

23RD - 24TH OCTOBER

THE BOMA HOTEL, NAIROBI KENYA

REGISTER NOW!!

age.orbital.co.ke/register

Forest Carbon

Carbon estimates with Remote Sensing and GIS



Dr. Anne Olawale

Dr Anne Olawale is an IT Manager and Cybersecurity Analyst with a BSc and MSc in Information Technology from Southern Illinois University. She manages large-scale ICT environments and security protocols. She is skilled in implementing robust IT tools and strategies. Her passion is in IT and emerging trends in GeoICT and remote sensing realms.

Forest carbon refers to the carbon stored in forest ecosystems i.e. trees, soil and vegetation. Forests play a critical role in the global carbon cycle thus acting as carbon sinks by absorbing the carbon dioxide (CO_2) from the atmosphere during photosynthesis. The absorbed CO_2 is stored in the **biomass** (trunks, branches, leaves as well roots) and soil. This makes the forests a critical and essential natural solution for mitigating the climate change. Therefore, there is a need to grow more trees through afforestation and reforestation. Forests play an important role in absorbing the huge quantities of CO_2. However, high-fidelity estimates of the carbon they store are often costly and impractical at large scale.

Mapping and monitoring carbon stocks in forested regions of the world particularly along the tropics has recently attracted great attention as deforestation and forest degradation account for up to 30-35% of anthropogenic carbon emissions. They are now included in climate change negotiations.

Estimations of Forest Carbon

Carbon estimation and quantification entails measuring the amount of carbon stored in ecosystems i.e. soils, forests and wetlands. Estimation of carbon emissions from activities like deforestation and land-use changes is also crucial. These measurements inform on the appropriate policies for carbon trading, conservation of environment and climate action.

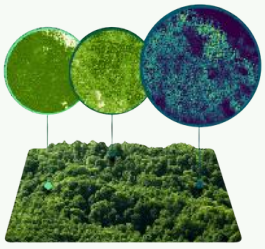
Remote sensing employs satellite, aerial and drone-based sensors to map and collect data on land cover, vegetation health and biomass. The technology such as Light Detection And Ranging (LiDAR), Radio Detection And Ranging (RADAR) and multispectral sensors provide more insights into forest structure, canopy density and vegetation types. All these are critical parameters for estimating the above-ground biomass and carbon storage.

On the other hand, GIS complements remote sensing by capturing, organizing, analyzing and visualizing spatial data. GIS integrates datasets including land cover maps, climate data, and soil information to create detailed **carbon maps.** GIS-based models can also simulate carbon fluxes and precisely predict the impacts of land-use changes on carbon stocks.

The forests act as major **carbon sinks.** A carbon sink is a system that absorbs more carbon from the atmosphere than it releases (clientearth.org). Their biomass is directly related to carbon storage. Remote sensing tools such as NASA's Global Ecosystem Dynamics Investigation (GEDI) provide open data on forest canopy height and density. Why GIS? In essence, GIS integrates this data with land cover classifications to estimate the total forest carbon stocks and identify areas at risk of deforestation.

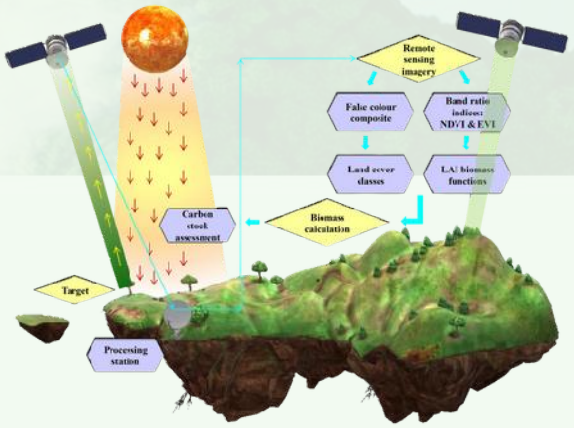
Soil organic carbon (SOC) is a crucial carbon pool often overlooked due to its measurement challenges. Remote sensing proxies such as vegetation cover and moisture indices are used alongside GIS to map SOC. Thus, combining soil samples with GIS tools allows the creation of detailed spatial distributions maps of SOC across diverse landscapes.

The wetlands, mangroves and seagrass beds store substantial amounts of "**blue carbon**." Remote sensing tools monitor these ecosystems through high-resolution imagery whilst GIS analyzes their spatial extent and carbon sequestration potential. (Source: BMC)



Estimating forest carbon with GIS and remote sensing techniques

Source: planet.com



Carbon stock estimation in forest ecosystem (Source: springer.com)

GIS and Remote sensing technologies have proved to be vital in monitoring of carbon emissions from wildfires, deforestation and urbanization. Whereas the thermal sensors detects the wildfire hotspots, the multi-spectral imagery tracks the loss in vegetation. The GIS datasets combined with land-use maps can estimate the emissions and model future scenarios.

Carbon estimation models: They are used in assessment of the amount of carbon stored in the ecosystems including forests, soils and wetlands. They estimates the carbon fluxes as a result of natural processes or human activities. Robust remote sensing and GIS models integrate the spatial data and processing techniques to provide insights into the spatial-temporal dynamics of the carbon storage as well as the emissions.

Data sources: The main data sources include: satellite imagery, drone or aerial data on land cover, vegetation health and biomass. The satellite platforms like Sentinel, Landsat and NASA's GEDI provide important datasets on the canopy height, forest density including the vegetation indices.

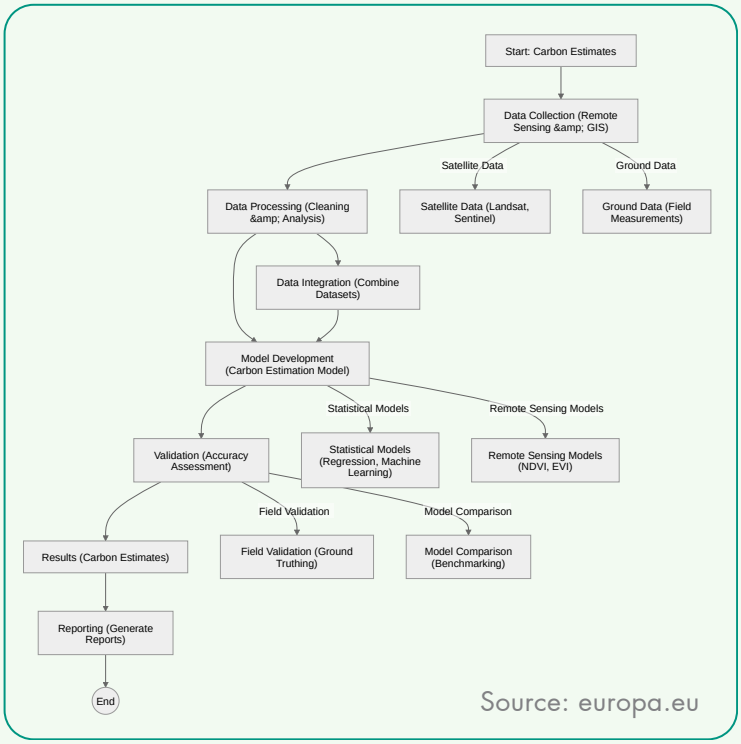
Pre-processing and model calibration: Prior to analysis, the raw data from remote sensing often undergoes pre-processing incorporating atmospheric correction, noise reduction and georeferencing. This ensures that spatial and temporal accuracy of the data is maintained.

Above-ground carbon estimation: It is mainly stored in the vegetation biomass making it a major focus on the carbon quantification models. The LiDAR and RADAR is used to capture detailed information about the tree height, canopy structure and forest density.

Below-ground carbon estimation: The carbon which is stored in the soils is also a significant component of the carbon cycle. SOC is estimated using vegetation cover, land use data and soil moisture derived from remote sensing. Consequently, GIS spatial tools model the SOC by integrating these datasets with field measurements and climatic factors. As a result, detailed maps of soil carbon distribution are created.

Blue carbon ecosystems: The coastal and marine ecosystems encompassing mangroves, tidal marshes and sea-grasses store substantial amounts of carbon, often referred to as the blue carbon. High-resolution satellite imagery and multispectral sensors are employed to monitor these ecosystems. With GIS, the extent of ecosystems is mapped. Overlaying this information with ecological and carbon stock data to estimate their carbon sequestration capacity is done.

Carbon emissions monitoring: Time-series analysis of satellite imagery can detect changes in land cover and forest loss or urbanization. The use of GIS comes in handy as it integrates these data with emission factors for specific land-use types to estimate the carbon emissions is a given locality.



Future scenarios: The advancements in remote sensing technology in areas such as hyper-spectral imaging and AI integration, promise to enhance the accuracy and efficiency of carbon estimation and quantification models. Recently, increased access to high-resolution satellite data and cloud computing capabilities makes the models easily accessible to governments, researchers and conservation organizations.

Carbon credit accreditation bodies (CCAB) and organizations

Accredited companies play a critical role in the carbon credit ecosystem.

The role of CCAB is to ensure that projects adhere to international standards. They verify & validate the emissions reductions and issue carbon credits. These companies include organizations setting standards, Validation/Verification bodies (VVBs), and project developers. The key players in the field include.

a. Standard-Setting Organizations

These organizations establish protocols for carbon credit projects ensuring that emissions reductions are real, additional, and permanent.

Verra: It administers the most widely used carbon crediting program globally i.e. Verified Carbon Standard (VCS). It certifies projects in forestry, renewable energy & blue carbon ecosystems. It also operates other programs like the Climate, Community and Biodiversity (CCB) Standards.

Gold Standard: It focuses mainly on high-quality carbon offset projects with strong environmental and social benefits. It certifies projects in renewable energy, clean cooking, and water access. Also it's very popular for projects aligned with the Sustainable Development Goals (SDGs).

American Carbon Registry (ACR): This is the leading registry for carbon offset projects in North America, specialize in forestry, agriculture and methane capture.

Climate Action Reserve (CAR): It mainly focuses on North American projects. It is recognized for its strict protocols in forestry, agriculture as well as waste management.

Clean Development Mechanism (CDM): This program under the Kyoto Protocol allows emission reduction projects in the developing countries to earn certified emission reduction (CER) credits.

b. Validation and Verification Bodies (VVBs)

These companies validate the project designs and verify the emissions reductions to ensure compliance with standards.

Det Norske Veritas (DNV): This body provides the validation and verification services for a wide range of carbon credit projects, including the renewable energy, forestry, and industrial processes.

TÜV SÜD: It specializes in verifying the projects in renewable energy, industrial energy efficiency and forestry. It is accredited under multiple carbon credit standards.

SGS: This is one of the world's largest verification companies, offering services in forestry, agriculture, and energy projects.

SCS Global Services: It focuses on the forestry, agriculture, and land-use projects.

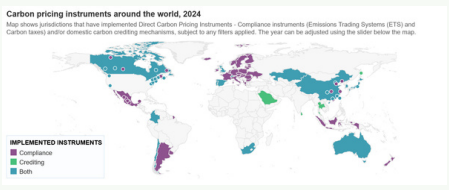
Bureau Veritas: It Provides validation and verification services for a variety of sectors.

c. Project Developers and Consultants
d. Registries and Marketplaces
e. Regional Accreditation Entities

Carbon Pricing Dashboard by World Bank

The Carbon Pricing Dashboard has been developed by The World Bank and can be accessed by following this website link: carbonpricingdashboard.worldbank.org. The dashboard provides details about direct carbon pricing instruments and carbon markets around the world. The dashboard includes data published in the World Bank's State and Trends of Carbon Pricing Report and is structured into two main sections: compliance instruments and carbon crediting markets.

When you click on the tabs on the dashboard, you can access details on carbon taxes and emissions trading systems. This includes detailed information and visualizations on design attributes, GHG emissions coverage, price, and revenue. As well you can click on the tabs underneath carbon crediting markets to access information and visualizations regarding crediting mechanisms (internati-onal, independent, and governmental), including the issuances.

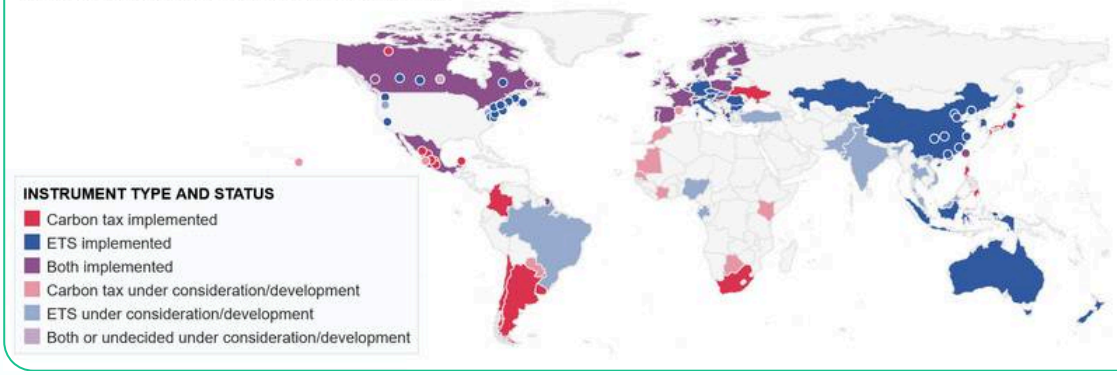


Carbon Pricing Instruments in 2024
(Source: World Bank)

State and Trends of Carbon Compliance (Source: worldbank.org)

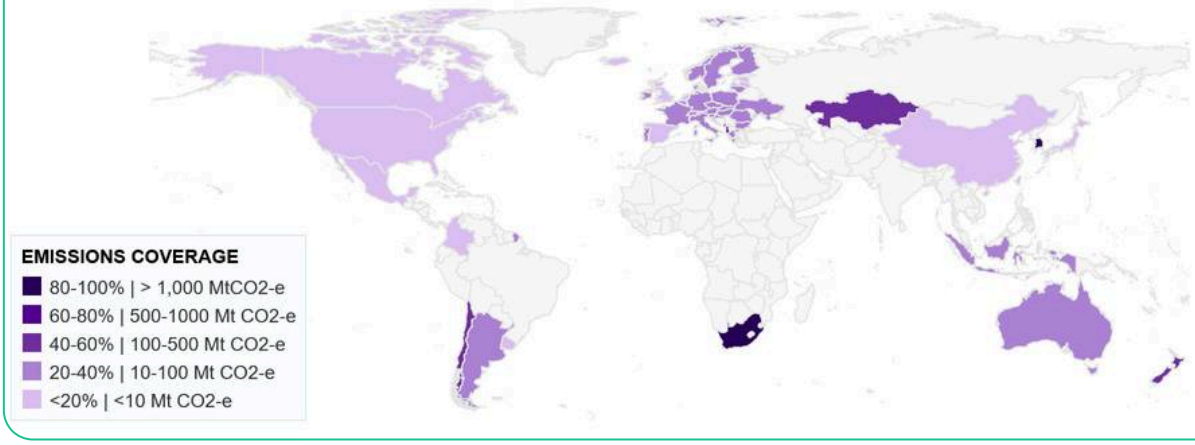
Compliance carbon pricing instruments around the world, 2024

Map shows jurisdictions with carbon taxes or emissions trading systems implemented, under development or under consideration, subject to any filters applied in the table below the map. The year can be adjusted using the slider below the map.



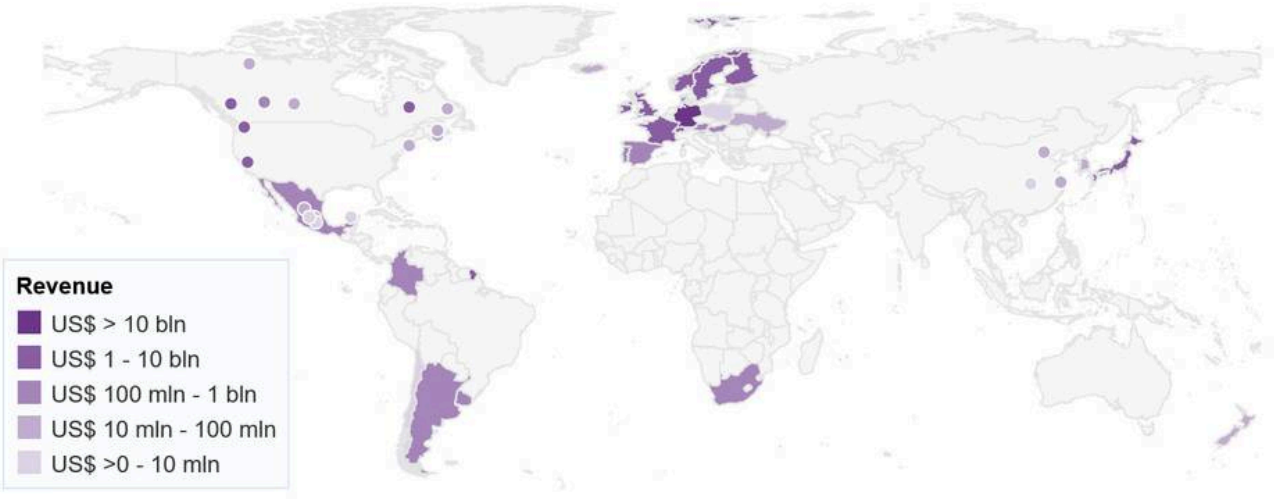
Covered emissions, 2024

Map shows jurisdictions with carbon taxes or emissions trading sytems implemented, under development or under consideration, subject to any filters applied in the table below the map. The year can be adjusted using the slider below the map.



Government revenue from carbon pricing, 2023

Heat map shows the level of annual government revenue collected by each jurisdiction through emissions trading sytems and carbon taxes (US$ millions/year), subject to any filters applied. The year can be adjusted using the slider below the map.



magazine@orbital.co.ke

QGIS Platform

Creating Charts and Statistical Reports with DataPlotly Plugin

DataPlotly for QGIS

DataPlotly plugin for QGIS is a significant development in integration of interactive data visualization capabilities within GIS environment. DataPlotly is known for its simple yet dynamic and customizable charts, complements QGIS's robust geospatial analysis features. The plugin bridges the gap between geospatial data representation and advanced visual storytelling. This allows users to produce the publication-quality interactive visual representations.

Installation: The process of installing DataPlotly plugin in QGIS is simple. You need to access it in the QGIS Plugin Manager. However, its documentation could empha-size the prerequisites such as compatibility with QGIS versions and Python dependencies like Dash and Pandas. The installation process is straight-forward. For a beginner, it is crucial to get a more detailed step-by-step guide to avoid common challenges during the installation process.

The plugin integrates seamlessly into QGIS's interface and maintains the software's intuitive workflow. It provides a dedicated panel and toolset, making it accessible without overwhelming the user interface. This integration ensures that both the beginner and advanced users can quickly incorporate Plotly's visualization tools without steep learning curves.

A highlight of the Plotly plugin is its wide range of supported visualizations, from simple scatter plots and bar charts to more advanced heatmaps and 3D plots. The plugin also allows users to customize chart aesthetics directly through a GUI and code-based inputs. However, the level of customization might vary based on users' familiarity with Plotly's Python library. This can be be a limitation for non-coders.

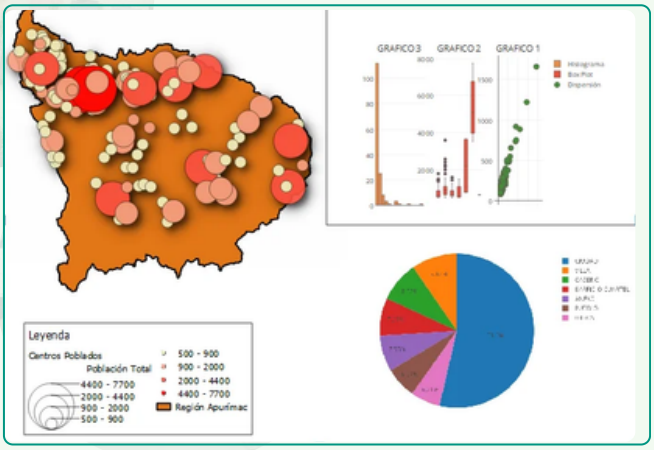
Capabilities: The plugin handles a variety of spatial data sources including shapefiles, GeoJSON, and attribute tables from QGIS layers. The users care able to filter and pre-process data in QGIS before creating visuals. However, the limitations might arise when handling large GIS datasets since Plotly's performance is heavily dependent on the browser and operating system capabilities.

Strengths and Weaknesses

One of the plugin's strengths include its ability to generate interactive charts which can be embedded in web applications or exported as static images. Its interactivity include zooming, panning, and hovering for detailed data exploration. In fact, exporting interactive content could benefit from additional export formats such as standalone HTML files thus making data sharing more accessible.

The integration of Plotly with QGIS enhances the its capability as a free geospatial data analysis tool. The interactivity and visual appeal of Plotly's charts make the plugin useful for presentations, educational purposes and decision-making processes.

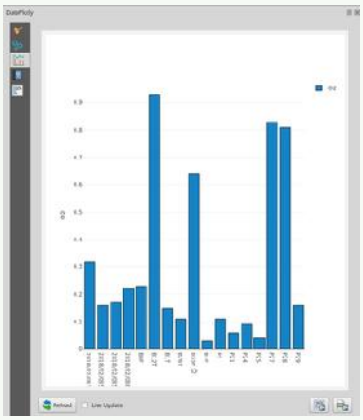
Despite numerous strengths, the plugin has also its limitations. The performance issues with large datasets or complex visualizations may affect its applicability in enterprise-grade projects. Furthermore, reliance on web technologies for rendering may pose challenges in offline or resource-constrained environments.



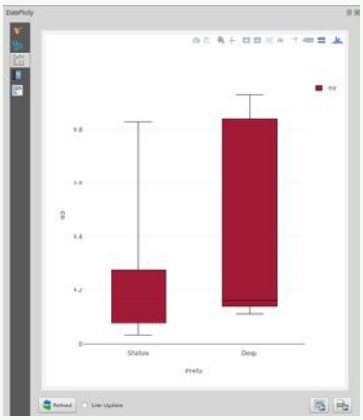
Customizations

The users can create and customize dynamic plots e.g. scatter plots, histograms, bar charts directly within the QGIS interface. Plotly enables seamless interaction with GIS data attributes hence offers options to style plots through color schemes, axis scaling, labels, and tool-tips. It also supports linking plots to map views. It allows for synchronized updates when filtering or selecting features.

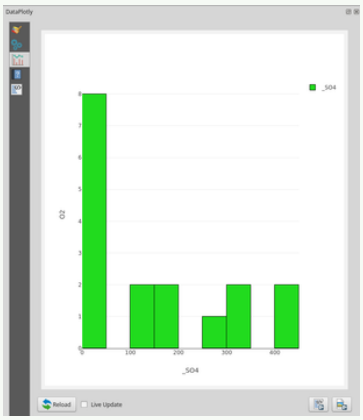
Types of charts by DataPlotly



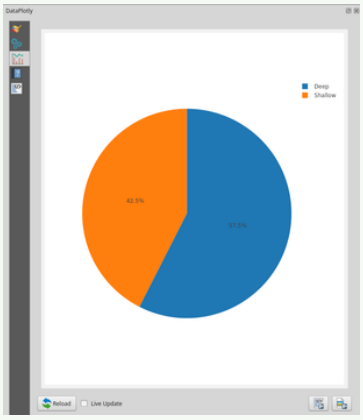
Bar Chart



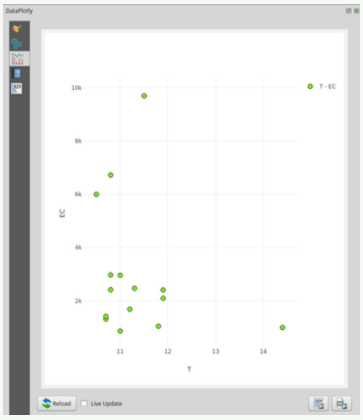
Box Plot



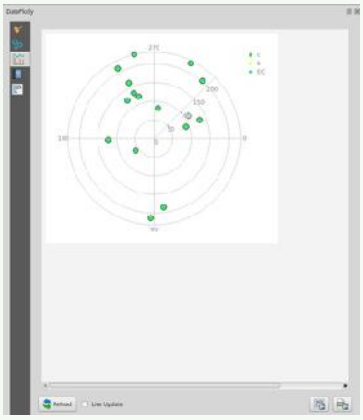
Histogram



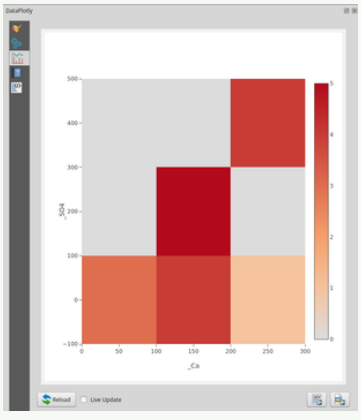
Pie Chart



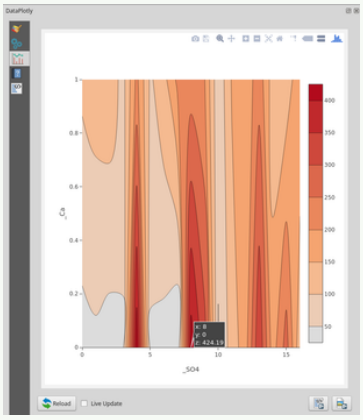
Scatter Plot



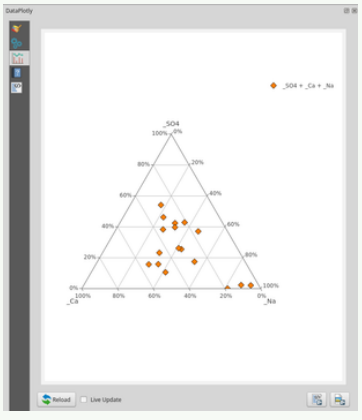
Polar Plot



2D Histogram



Contour Plot



Ternary Plot

DataPlotly plugin for QGIS is a robust addition for GIS professionals who intend to enrich their geo projects with dynamic and interactive graphical visualizations. There is room for improvement in its documentation including performance and advanced sharing options. However, its current capabilities enhance the visualization pipeline in QGIS.

Additionally, the plugin allows you to create different plot types. You can also overlay the plots in the same plot canvas or load them in different plot canvas. The plugin's potential to combine the geospatial and analytical insights makes it a promising tool for GIS professionals and researchers.

Mobile Mapping

Evolution of MM and how AI is driving the technology





Steve Jacobs

Mr. Steve Jacobs is a Mobile mapping specialized at Bluesky Geospatial Ltd., a UK based company. He has wealthy of experience spanning 10 years in LiDAR, UAV and mobile mapping solutions. He has handled mega Geospatial projects in the UK and other European countries.

Mobile mapping is a method of mapping using a data collection system and a moving vehicle, mostly a car or van. Typically, the data collection system is equipped with a GNSS receiver, an inertial navigation system (INS) and cameras and/or a LiDAR system.

According to inertiallabs.com, in mobile mapping, as in aerial mapping using unmanned aerial vehicles or drones, accuracy is important consideration. The accuracy of each component of the data collection system will ultimately affect the accuracy of the outputs such as raw data and maps.

Components of Mobile Mapping System

1. Positioning System - #1 GNSS

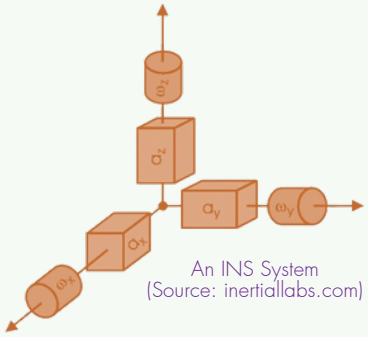
GNSS technology is a collection of satellite positioning systems (i.e. the GPS - **US**, GLONASS - **Russia**, Galileo - **EU** and BeiDou - **China**) with a global coverage. GNSS provides positioning, navigation, and timing services.



GNSS consists of many satellites that orbit the Earth in fixed orbits. Each satellite constantly transmits radio signals containing information about the time of departure of the signal and the orbital position of the satellite. Using data from multiple satellites in space, the receiver can pinpoint its location by three coordinates (latitude, longitude, altitude) and time via **Trilateration** technique.

2. Positioning System #2 **INS**

An Inertial Navigation System (INS) is a device that uses **Gyroscopes** and **Accelerometers** (main components that make up an Inertial measurement Unit – IMU). Magnetometers are to determine the orientation angles, position, and velocity of an object without external data sources.



An INS System
(Source: inertiallabs.com)

3. Positioning System #3 **SLAM**

The **S**imultaneous **L**ocalization **A**nd **M**apping (SLAM) is a modern technology that allows autonomous systems to simultaneously build a map of an unknown environment and then determines their location in that environment.

SLAM uses various types of sensors including LiDAR systems, cameras or ultrasonic sensors. The IMUs are then used to determine the orientation of these sensors i.e. the GNSS and INS, LiDAR/cameras etc. are also integrated with INS and GNSS is integrated to compute the coordinates.

Principles of operation of the SLAM

The sensors collect information about the area being mapped and the movement of the device. The LiDAR system measures the distance to objects and creates point cloud. The camera provides visual information (i.e. images), which are then analyzed to highlight key features (such as corners, the contours and other landmarks). The localization (SLAM) involves determining the current position and orientation of a device in space based on sensor data.

Algorithms such as the Kalman filter or particle filter are often used to minimize errors & smooth out noise in sensor data.

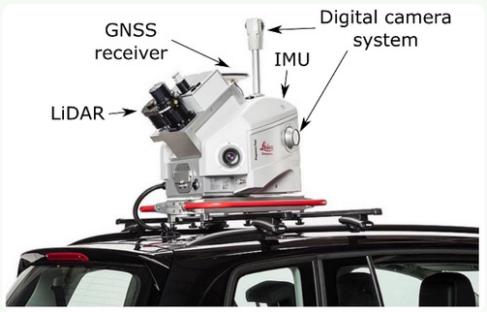
As the device moves, the system builds a map of the surrounding space using the sensor data.

Advantages of using SLAM

SLAM enjoys complete autonomy due to its ability to work in almost any or all conditions. It can work in tunnels, cities, forests, etc. where is limited or complete absence of a GNSS signal.

Disadvantages of using SLAM

In most cases, while using SLAM, there is no georeferencing of data, i.e., the map is local. Therefore, the ability to work is limited by weather conditions. SLAM also requires large computing power to process data in real time, if LiDAR or high-resolution cameras are used. The collected data also requires large storage space. The cost of processing software is also another bottleneck.



Components of Mobile Mapping System
(Source: mdpi.com)

Integration of Mobile Mapping with AI

In MM, the computer vision AI excels in automating the extraction and recognition of features from images or video data collected during mapping. As well, new deep learning-based AI algorithms analyzes the MM images to extract inventory and create accurate digital maps.

References: Inertial Labs



SPONSORED

Trimble MX90

MOBILE MAPPING SYSTEM

Elevate your large-scale scanning and mobile mapping.



Achieve new levels of productivity

Premium

Powerful leading-edge mobile mapping solution with state-of-the-art Trimble® GNSS and inertial technology.

Delivers high-resolution immersive imagery for feature detection and inspection tasks and high-density colourised point clouds with rich and accurate color projections.

Produces precise feature-rich data from trusted field-proven laser technology and immersive 360-degree panoramic and targeted cameras.

Productivity

Collect data right the first time and discover a new level of productivity by leveraging the complete Trimble field-to-finish workflow.

Efficiently capture, process and extract a wide range of meaningful deliverables to maximise the value of mobile mapping data to your organisation.

Achieve high-quality data in challenging GNSS environments with an AP+60 IMU combined with the InFusion+ trajectory processing engine.

Simplicity

Easy installation with single cable connection.

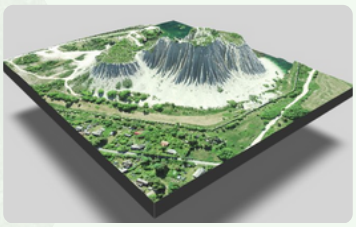
Reduces costs related to road closures and enhances safety by minimising the need to work in traffic on hazardous highways.

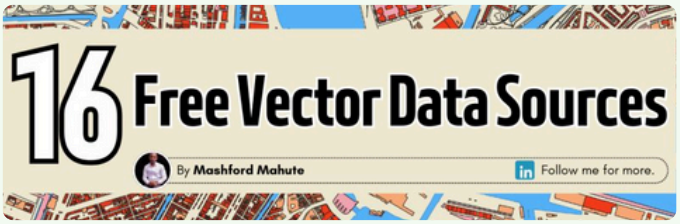
Manages mobile data capture with intuitive field software that ensures efficient and organised field operations.

Leverage Trimble office software to export and easily integrate into a wide range of applications or cloud-based solutions for easy data sharing.

Trimble®

Find out more at:
geospatial.trimble.com/mx90







1. OpenStreetMap (OSM)
➡ URL: openstreetmap.org
➡ Data: Roads, buildings, land use, and more.
➡ Format: Shapefile, GeoJSON, OSM XML.

2. Geofabrik
➡ URL: download.geofabrik.de
➡ Data: Extracts of OSM data by region.
➡ Format: Shapefile, GeoJSON, PBF.

3. Humanitarian Data Exchange (HDX)
➡ URL: data.humdata.org
➡ Data: Humanitarian-related datasets, including population and infrastructure.
➡ Format: Shapefile, GeoJSON, CSV.

4. HYDROSHEDS
➡ URL: hydrosheds.org/products
➡ Data: Rivers, Lakes, Basins, Waterfalls, etc.
➡ Format: Shapefile

5. FAO GeoNetwork
➡ URL: fao.org/geonetwork
➡ Data: Agriculture, fisheries & environmental data.
➡ Format: Shapefile, GeoJSON.

6. USGS Earth Explorer
➡ URL: earthexplorer.usgs.gov
➡ Data: Hydrography, transportation, boundaries.
➡ Format: Shapefile, KML

7. Natural Earth
➡ URL: naturalearthdata.com
➡ Data: Political boundaries, cultural and physical features.
➡ Format: Shapefile, GeoJSON.

8. European Environment Agency (EEA)
➡ URL: eea.europa.eu
➡ Data: Environmental themes like land cover, air quality, and biodiversity.
➡ Format: Shapefile, GeoJSON.

9. GADM (Global Administrative Areas)
➡ URL: gadm.org
➡ Data: Admin boundaries at multiple levels.
➡ Format: Shapefile, GeoJSON, KML.

10. DIVA-GIS
➡ URL: diva-gis.org
➡ Data: Country-level data on climate, population, and administrative boundaries.

11. UNEP Environmental Data Explorer
➡ URL: uneplive.unep.org
➡ Data: Environmental indicators & spatial datasets.
➡ Format: Shapefile, GeoJSON.

12. NASA Socioeconomic Data Center (SEDAC)
➡ URL: sedac.ciesin.columbia.edu
➡ Data: Population, infrastructure & environmental indicators.
➡ Format: Shapefile, GeoJSON, KML.

13. World Resources Institute (WRI) Open Data Portal
➡ URL: 1. OpenStreetMap (OSM)
➡ URL: 2. openstreetmap.org
➡ Data: Roads, buildings, land use, and more.
➡ Format: Shapefile, GeoJSON, OSM XML.

14. Global Forest Watch
➡ URL: globalforestwatch.org
➡ Data: Forest cover, deforestation, and land use.
➡ Format: Shapefile, GeoJSON, KML.

15. Africa GeoPortal
➡ URL: africageoportal.com
➡ Data: Administrative boundaries, land cover, and infrastructure across Africa.
➡ Format: Shapefile, GeoJSON.

16. Koordinates
➡ URL: koordinates.com
➡ Data: Various themes including environmental, infrastructure, and social data.
➡ Format: Shapefile, GeoJSON and KML.





Facts about Land Survey



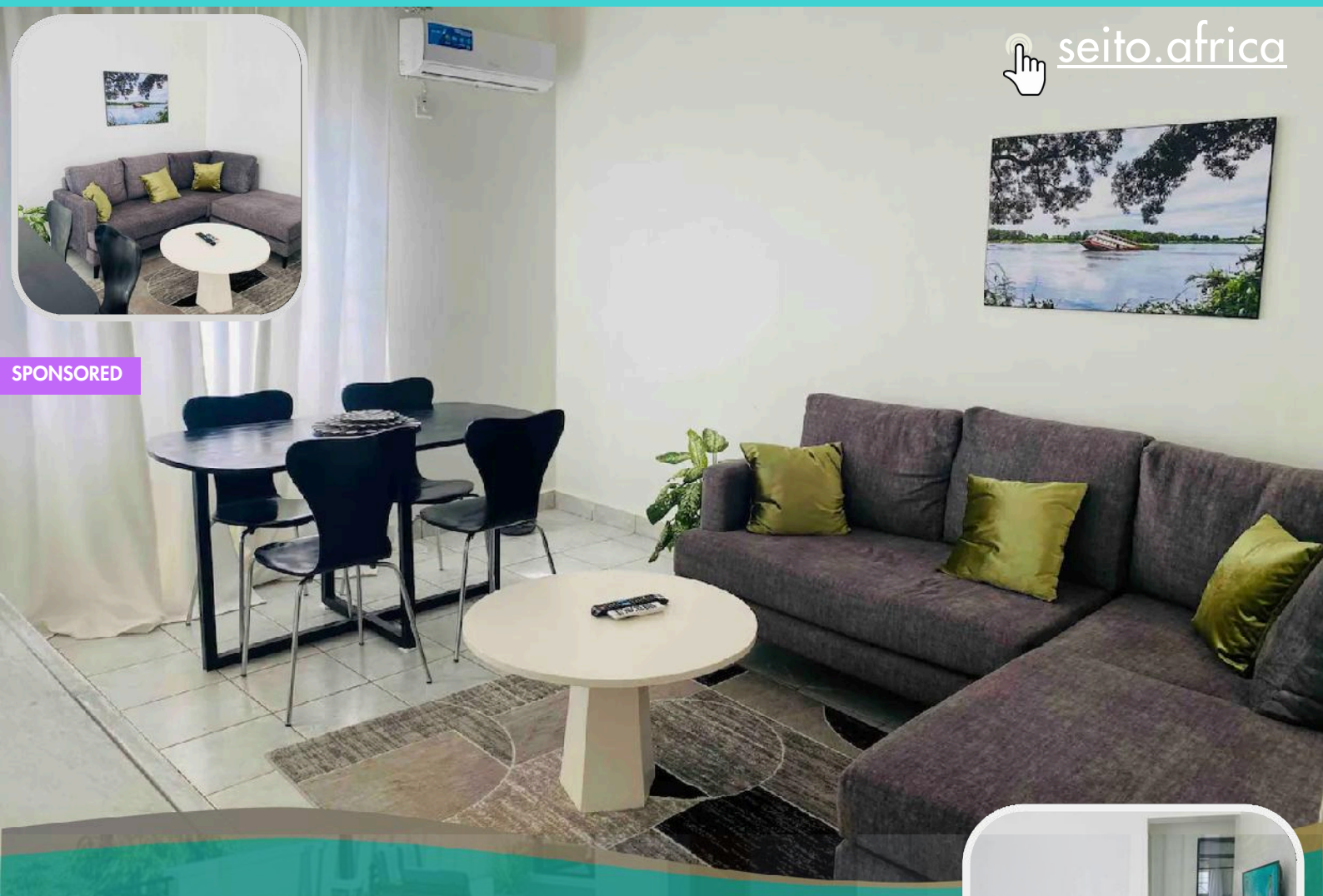
According to **mnsurveying.com** website, the occupation of land surveying dates back to ancient times! The Egyptians were the first civilizations to utilize private land surveying. The history of the practice goes back even further than 3,000 years! Here are some facts about land surveying profession:

- The construction of landmarks like the Great Pyramids of Egypt and Stonehenge relied on early surveying techniques. The ancient surveyors used tools like plumb bobs and ropes to achieve astonishingly precise alignments still admired today
- And did you know that, the first president of the USA, George Washington, worked as a land surveyor? Cap. James Cook, an explorer known for traveling to all of Earth's major continents, was also a professional land surveyor.
- During the Berlin Conference in1884–1885, the colonial powers divided Africa into spheres of influence based on maps and surveys, disregarding existing ethnic and cultural boundaries. This caused and continues to cause many conflicts thus impacting on the political stability and inter-ethnic relations.
- The boundaries of countries, cities, and private properties owe their existence to land surveying. For instance, the **Mason-Dixon Line** (an imaginary boundary that separates Pennsylvania, Maryland, Delaware, and West Virginia), surveyed in the 1760s, resolved the colonial land disputes and later became a symbolic boundary in the US history.
- Survey work in Kenya started around 1902 with establishment of Survey of Kenya a year later. It is not until 1948 that a department to offer such service was established to support the Governments policy of maximum exp-oitation of its land &natural resources.
- The alienation of land through surveys and its allocation to settlers was a major cause of the Mau Mau rebellion (1952–1960). Many Kikuyu people were forced off their ancestral lands into reserves or as laborers on settler farms. This fueled insurgency.
- After Kenya gained independence in 1963, Political elites acquired large parcels, leaving many landless.

SEITO BnB

REGISTER TODAY!

BROWSE AND BOOK AN AIRBNB HOUSE FOR FREE --->



seito.africa

SPONSORED

KEY FEATURES

- LISTING PER TOWN
- SEARCH & FILTER
- CLIENT REVIEWS
- FREE OF CHARGE
- HOST DASHBOARD
- GOOGLE MAPS
- BOOKING FORMS





The Battle for Space

New Glenn Set to Challenge SpaceX in Historic Launch





According to Blue Origin website, the New Glenn shall lift off from Launch Complex 36. Following separation, the first stage will autonomously descend to a landing platform located several hundred miles downrange in the Atlantic. The two BE-3Us ignite, propelling the second stage into space. The fairing separates and the Blue Ring Pathfinder payload, which will remain affixed to the second stage throughout the duration of the mission, will be placed in Medium Earth Orbit (MEO).

Blue Origin's New Glenn is launching to challenge the **Elon Musk's** SpaceX dominance, representing major significant advancement for **Jeff Bezos'** aerospace firm.

The latest developments suggest that Blue Origin is on the brink of transforming the space industry with the imminent launch of its New Glenn rocket. Scheduled for liftoff on Sunday 12th Jan 2025, the towering 30-story rocket is expected to be a formidable competitor to Elon Musk's SpaceX, potentially altering the market dynamics.

Blue Origin's decade-long commitment to this project has been driven by a desire to capture a substantial slice of the lucrative satellite launch market. New Glenn has been meticulously developed to meet the growing demand for satellite constellation missions, challenging the market stronghold of SpaceX's Falcon 9 rockets.

Blue Origin LLC's new flagship rocket is poised to blast off for the first time in a crucial test of the Jeff Bezos-backed firm's ability to challenge SpaceX's ironclad grip on the launch market.

New Glenn, originally intended to launch as early as 2020, is set to lift off as soon as Monday out of Cape Canaveral in Florida, during a three-hour launch window that begins at 1 AM local time. That reflects a one-day delay due to sea conditions, according to a post on X.

The mission aims to put a Blue Origin test satellite into orbit and then land the rocket's lower portion on a drone ship in the Atlantic Ocean.

The flight will serve as a critical demonstration for Blue Origin, which has struggled for years to accomplish its ambitious plans for space exploration. Though the company has shuttled paying tourists to the edge of space and back, it has lacked the capability of sending people and satellites to orbit.

That stands in stark contrast to Elon Musk's SpaceX, which has been in operation for much of the same time as Blue Origin but has far surpassed the Bezos-funded firm in launch capability.

SpaceX's Falcon 9 rocket is the most prolific orbital vehicle globally. Like Musk, Bezos is one of the world's richest people with numerous business interests. He founded Amazon.com Inc. and also owns the Washington Post newspaper.

Sources:

1. japantimes.co.jp
2. lemonde.fr
3. blueorigin.com

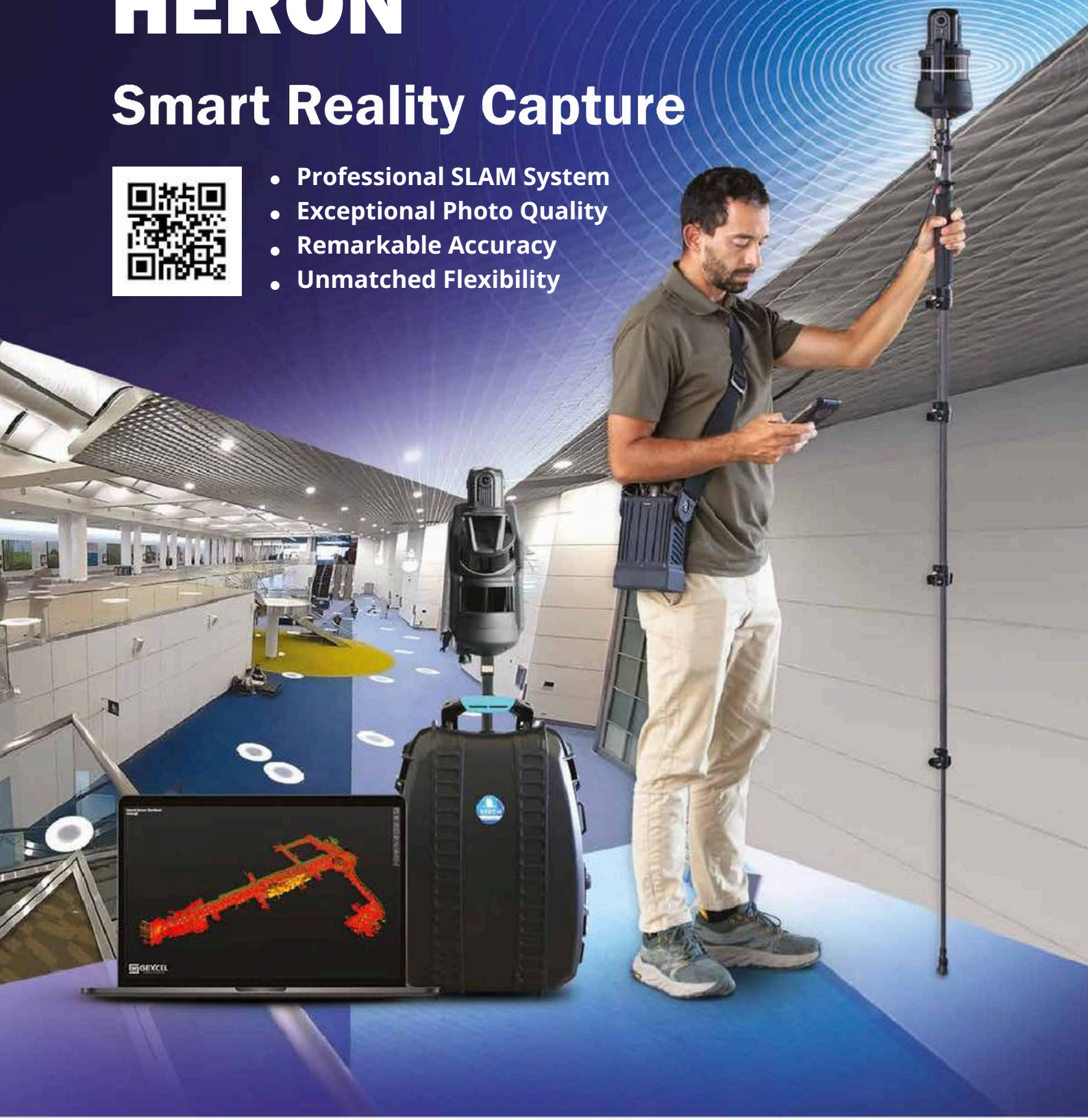


SPONSORED

HERON®

Smart Reality Capture

- Professional SLAM System
- Exceptional Photo Quality
- Remarkable Accuracy
- Unmatched Flexibility



GEXCEL
GEOMATICS & EXCELLENCE

www.gexcel.it

sales@gexcel.it



"Earth provides enough to satisfy every man's needs,
but not every man's greed" — Mahatma Gandhi