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How the NVIDIA Omniverse is shaping the future of 3D

Introduction

The metaverse is set to become the next step in the evolution of the internet, combining the raw power of the internet as we know it with immersive media platforms like virtual and mixed-reality projects. Yet, after years of hearing about the potential of the metaverse, few mass-market solutions have come to fruition as promised. Meta's investment in the Quest platform has yet to pay off on its potential, while other aging tech giants seem unsure how to wrangle the concept of the metaverse.

But for those in the 3D community, the metaverse is too important to ignore despite its rocky future. In one way or another, the metaverse will be a major platform for content in the coming years, and NVIDIA's Omniverse platform is set to be one of the major players. The Omniverse is designed to integrate the many concepts of the metaverse into a versatile platform that companies and users can use to build metaverse experiences and tools. The concept is bold, especially since NVIDIA charges a hefty fee for enterprise users. Yet, it is one of the few industry standards being built at the moment that seems to be gaining traction.Additionally, the platform already works on NVIDIA's existing RTX graphics cards, making local rendering and rendering using online render services simple.

So let's take a look at NVIDIA's Omniverse and how it is set to change the course of the 3D industry and the workflows of the artists behind it.

What is the NVIDIA Omniverse?

In a nutshell, the NVIDIA Omniverse is a platform that enables real-time collaboration and simulation for designers and engineers. It utilizes NVIDIA's RTX technology to visualize complex models and environments with high accuracy and fidelity. By facilitating seamless collaboration between geographically dispersed teams, Omniverse can help reduce development and testing time and bring new products to market faster.

So how exactly does the Omniverse work? On the surface, the tool seems a little ambiguous, but this is because of the wide variety of data NVIDIA has designed it to work with. The Omniverse is designed to be a hub for building 3D experiences and digital twins that are augmented by real-world data. If you can think of a use case, odds are, the Omniverse supports it. From production collaboration to VR environments and scientific simulations, the platform handles everything 3D.

At its core, the Omniverse platform is built on Pixar's universal scene.

Description (USD) standard. USD is a framework that Pixar developed for its own pipeline before sourcing it for the wider 3D community. The fact that theOmniverse is built on USD means that it is inherently compatible with almost all 3D software from the beginning. From 3ds Max and Maya to Cesium, Blender, or Adobe Substance 3D Painter, the platform natively connects to pretty much anything.

On top of USD, NVIDIA has built a series of apps and development frameworks for building workflows and applications that allow multiple users, datasets, and applications to interact. At first, this might seem commonplace, USD itself already promises many of the benefits that the Omniverse highlights. But NVIDIA has merged these benefits into a platform that is much more than the sum of its parts. Anyone from developers, to artists can work with and expand the abilities of the platform, making it a perfect tool for studios to integrate at every part of their pipeline.

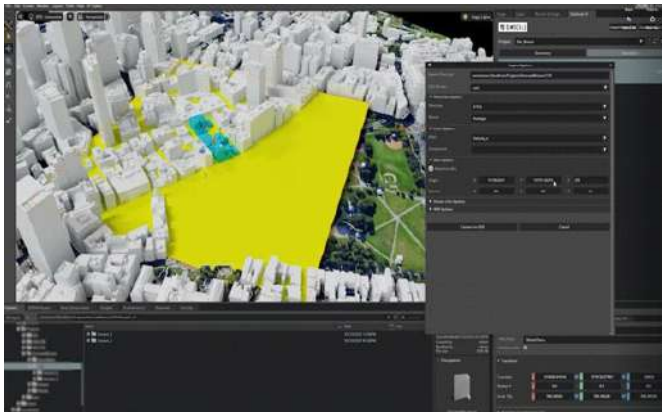
For example, the Omniverse promises to support real-time AI-driven physical simulations based on real-world sensor data merged with virtual 3D data. NVIDIAbelieves that the capabilities will be good enough for anyone from warehouse operators to scientists to use the Omniverse to manage their data and create accurate simulations. Apart from these industries, the platform is also set to be a truly next-gen game platform. Examples like NVIDIA's Marbles RTX demo show that 3D tools combined with simulation and AI tools can result in some crazy-good playable experiences.

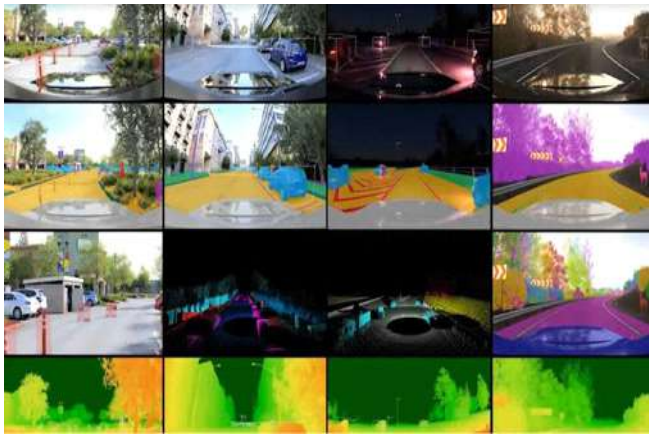
How the Omniverse is set to change the industry

Advances in project collaboration are some of the greatest innovations the Omniverse brings. The platform allows dozens of artists to combine and visualize their work in a single real-time scene. While this is a promise the industry has repeatedly heard, NVIDIA's tools have come the closest to delivering. For example, NVIDIA's USD Composer lets artists build scenes from various datasets while tracking asset and scene modifications by the rest of their team. Aside from productivity improvements, the collaborative aspect will allow artists to focus on their creative output rather than wrangling with data imports, exports, and changes.

The Omniverse may also have an impact on the core workflows of 3D artists. Due to software incompatibilities, studios often choose a carefully considered software-centric workflow where each piece interlocks with the next. The wide compatibility of the Omniverse has the power to change that by making the platform the hub for integrating all the tools artists may want to use. Workflows can become more flexible and open than ever by allowing artists to use the tools they need and know rather than the ones mandated by the workflow.

The physics simulations that the Omniverse can generate are perhaps the most anticipated feature of the platform. Simulations are known for being highly time-intensive tasks, requiring careful consideration of workflows and software choices. The Omniverse's simulations, however, integrate into the rest of the Omniverse platform using NVIDIA's PhysX framework, meaning no additional software is needed to add simulations to a project. The simulations the platform creates are highly accurate and are designed for any use case, including game simulations, film VFX, and even architectural engineering simulations.





Render farms and the Omniverse

Although the Omniverse brings a lot of power to artists, it also requires some in return. One of the core aspects of the platform is its integration with NVIDIA's RTX graphics cards and servers. The perk to this is that for many projects, it doesn't require any special hardware, meaning games and apps developed with the Omniverse can be used by customers on their existing gaming PCs and workstations.

However, for more power-hungry projects, like PhysX simulations and film-quality ray-traced environments, NVIDIA suggests using its commercial-grade GPU lineup. Using a render farm is often the best way to access the power that the Omniverse needs. Cloud rendering services allow artists to offload projects to be rendered on render servers that have the power to process the large and complex 3D environments the Omniverse can generate. Render farms equipped with RTX graphics cards can be the most efficient and scalable way to render projects. Having the flexibility to render whatever is needed whenever adds another layer of freedom to the already impressive abilities of the Omniverse.

Conclusion

The NVIDIA Omniverse and technologies like it are already making big waves in the 3D graphics industry. From gaming, to architectural visualization, to real-time interactive experiences, the platform is targeting all of the latest emerging technology sectors and doing a great job of it.

With the ever-changing landscape of the 3D industry and emerging XR technologies, It's hard to predict whether the Omniverse will become the new industry standard NVIDIA hopes it will be. Yet, the platform is likely to at least play an important role in the intermediate steps of the metaverse. First-iteration technologies like the Omniverse are often the ones that shape the industry the most, even if the platform isn't as lasting as the industry itself. Because of this, it's worth exploring what the Omniverse can do and how it can be integrated into your current and future 3D projects.

Highlights

- *"StructCode: MIT's Game-Changing Tech Turns Everyday Objects into Data-Infused Superheroes"*
- *"Unlocking Object Superpowers: MIT's StructCode Embeds Information for Enhanced Interaction"*
- *"MIT's StructCode Breakthrough: Objects Get a Digital Upgrade for Interactive Experiences"*
- *"Data-Infused Objects: MIT's StructCode Technology Transforms the Way We Interact"*

To get a sense of what StructCode is all about, says Mustafa Doğa Doğan, think of Superman. Not the "faster than a speeding bullet" and "more powerful than a locomotive" version, but a Superman, or Superwoman, who sees the world differently from ordinary mortals—someone who can look around a room and glean all kinds of information about ordinary objects that is not apparent to people with less penetrating faculties.

That, in a nutshell, is "the high-level idea behind StructCode," explains Doğan, a Ph.D. student in electrical engineering and computer science at MIT and an affiliate of the MIT Computer Science and Artificial Intelligence Laboratory (CSAIL). "The goal is to change the way we interact with objects" to make those interactions more meaningful and more meaning-laden "by embedding information into objects in ways that can be readily accessed."

StructCode grew out of an effort called Infrared Tags, which Doğan and other colleagues introduced in 2022. In last year's approach, "invisible" tags that can only be seen with cameras capable of detecting infrared light were used to reveal information about physical objects.

The drawback there was that many cameras cannot perceive infrared light. Moreover, the method for fabricating these objects and affixing the tags to their surfaces relied on 3D printers, which tend to be very slow and often can only make objects that are small.

StructCode, at least in its original version, relies on objects produced with laser-cutting techniques that can be manufactured within minutes, rather than the hours it might take on a 3D printer. Information can be extracted from these objects, moreover, with the RGB cameras that are commonly found in smartphones; the ability to operate in the infrared range of the spectrum is not required.

In their initial demonstrations of the idea, the MIT-led team decided to construct their objects out of wood, making pieces such as furniture, picture frames, flowerpots, or toys that are well suited to laser-cut fabrication. A key question that had to be resolved was this: How can information be stored in a way that is

unobtrusive and durable, as compared to externally attached bar codes and QR codes, and also will not undermine an object's structural integrity?

The solution that the team has come up with, for now, is to rely on joints, which are ubiquitous in wooden objects made out of more than one component. Perhaps the most familiar is the finger joint, which has a kind of zigzag pattern whereby two wooden pieces adjoin at right angles such that every protruding "finger" along the joint of the first piece fits into a corresponding "gap" in the joint of the second piece and, similarly, every gap in the joint of the first piece is filled with a finger from the second.

"Joints have these repeating features, which are like repeating bits," Dogan says. To create a code, the researchers slightly vary the length of the gaps or fingers. A standard size length is accorded a 1. A slightly shorter length is assigned a 0, and a slightly longer length is assigned a 2. The encoding scheme is based on the sequence of these numbers, or bits, that can be observed along a joint. For every string of four bits, there are 81 (3^4) possible variations.

The team also demonstrated ways of encoding messages in "living hinges" a kind of joint that is made by taking a flat, rigid piece of material and making it bendable by cutting a series of parallel, vertical lines. As with the finger joints, the distance between these lines can be varied: 1 being the standard length, 0 being a slightly shorter length, and 2 being slightly longer. And in this way, a code can be assembled from an object that contains a living hinge.

"In the realm of materials and design, there is often an inclination to associate novelty and innovation with entirely new materials or manufacturing techniques," notes Elvin Karana, a professor of materials innovation and design at the Delft University of Technology. One of the things that impresses Karana most about StructCode is that it provides a novel means of storing data by "applying a commonly used technique like laser cutting and a material as ubiquitous as wood."

The idea for StructCode, adds University of Colorado computer scientist Ellen Yi-Luen Do, is "simple, elegant, and totally makes sense. It's like having the Rosetta Stone to help decipher Egyptian hieroglyphs."

Patrick Baudisch, a computer scientist at the Hasso Plattner Institute in Germany, views StructCode as "a great step forward for personal fabrication. It takes a key piece of functionality that's only offered today for mass-produced goods and brings it to custom objects."

Here, in brief, is how it works: First, a laser cutter guided by a model created via StructCode fabricates an object into which encoded information has been embedded. After downloading a StructCode app, an user can decode the hidden message by pointing a cellphone camera at the object, which can (aided by StructCode software) detect subtle variations in length found in an object's outward-facing joints or living hinges.

The process is even easier if the user is equipped with augmented reality glasses, Doğan says. "In that case, you don't need to point a camera. The information comes up automatically." And that can give people more of the "superpowers" that the designers of StructCode hope to confer.

"The object doesn't need to contain a lot of information," Doğan adds. "Just enough in the form of, say, URLs—to direct people to places they can find out what they need to know."

Users might be sent to a website where they can obtain information about the object how to care for it, and perhaps eventually how to disassemble it and recycle (or safely dispose of) its contents. A flowerpot that was made with living hinges might inform a user, based on records that are maintained online, as to when the plant inside the pot was last watered and when it needs to be watered again.

Children examining a toy crocodile could, through StructCode, learn scientific details about various parts of the animal's anatomy. A picture frame made with finger joints modified by StructCode could help people find out about the painting inside the frame and about the person (or persons) who created the art work perhaps linking to a video of an artist talking about this work directly.

"This technique could pave the way for new applications, such as interactive museum exhibits," says Raf Ramakers, a computer scientist at Hasselt University in Belgium. "It holds the potential for broadening the scope of how we perceive and interact with everyday objects" which is precisely the goal that motivates the work of Doğan and his colleagues.

Scientists begin building AI for scientific discovery using tech behind ChatGPT

Highlights

- *"Polymathic AI Unleashes Revolutionary Scientific Discovery Power"*
- *"Harnessing AI Across Disciplines: Polymathic AI Transforms Research"*
- *"Polymathic AI: Bridging the Gap Between Scientific Fields"*
- *"Openness and Transparency: Polymathic AI Democratizes Scientific Advancement"*

An international team of scientists, including from the University of Cambridge, have launched a new research collaboration that will leverage the same technology behind ChatGPT to build an AI-powered tool for scientific discovery.

While ChatGPT deals in words and sentences, the team's AI will learn from numerical data and physics simulations from across scientific fields to aid scientists in modeling everything from supergiant stars to the Earth's climate. The team launched the initiative, called Polynathic AI earlier this week, alongside the publication of a series of related papers on the *arXiv* open access repository.

"This will completely change how people use AI and machine learning in science," said Polymathic AI principal investigator Shirley Ho, a group leader at the Flatiron Institute's Center for Computational Astrophysics in New York City. The idea behind Polymathic AI "is similar to how it's easier to learn a new language when you already know five languages," said Ho.

Starting with a large, pre-trained model, known as a foundation model, can be both faster and more accurate than building a scientific model from scratch. That can be true even if the training data isn't obviously relevant to the problem at hand.

"It's been difficult to carry out academic research on full-scale foundation models due to the scale of computing power required," said co-investigator Miles Cranmer, from Cambridge's Department of Applied Mathematics and Theoretical Physics and Institute of Astronomy. "Our collaboration with Simons Foundation has provided us with unique resources to start prototyping these models for use inbasic science, which researchers around the world will be able to build from it's exciting."

"Polymathic AI can show us commonalities and connections between different fields that might have been missed," said co-investigator Siavash Golkar, a guest researcher at the Flatiron Institute's Center for Computational Astrophysics.

“In previous centuries, some of the most influential scientists were polymaths with a wide-ranging grasp of different fields. This allowed them to see connections that helped them get inspiration for their work. With each scientific domain becoming more and more specialized, it is increasingly challenging to stay at the forefront of multiple fields. I think this is a place where AI can help us by aggregating information from many disciplines."

The Polymathic AI team includes researchers from the Simons Foundation and its Flatiron Institute, New York University, the University of Cambridge, Princeton University and the Lawrence Berkeley National Laboratory. The team includes experts in physics, astrophysics, mathematics, artificial intelligence and neuroscience.

Scientists have used AI tools before, but they've primarily been purpose-built and trained using relevant data.

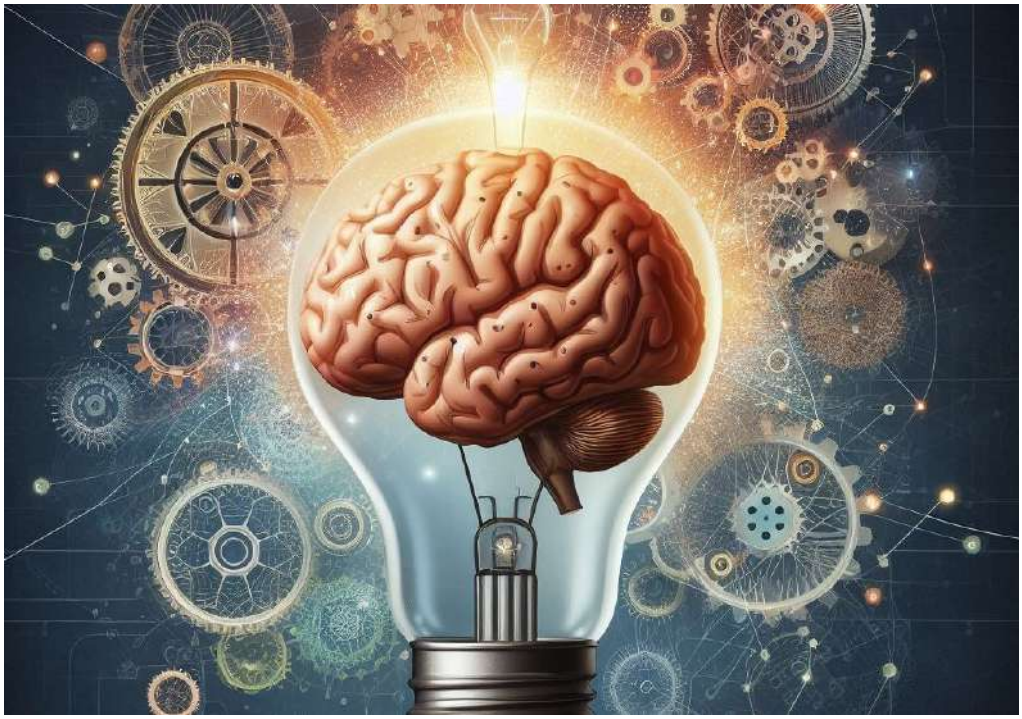
"Despite rapid progress of machine learning in recent years in various scientific fields, in almost all cases, machine learning solutions are developed for specific use cases and trained on some very specific data," said co-investigator Francois Lanusse, a cosmologist at the Center national de la recherche scientfique (CNRS) in France.

"This creates boundaries both within and between disciplines, meaning that scientists using AI for their research do not benefit from information that may exist, but in a different format, or in a different field entirely."

Polymathic AI's project will learn using data from diverse sources across physics and astrophysics (and eventually fields such as chemistry and genomics, its creators say) and apply that multidisciplinary savvy to a wide range of scientific problems. The project will "connect many seemingly disparate subfields into something greater than the sum of their parts," said project member Mariel Pettee, a postdoctoral researcher at Lawrence Berkeley National Laboratory.

ChatGPT has well-known limitations when it comes to accuracy (for instance, the chatbot says 2,023 times 1,234 is 2,497,582 rather than the correct answer of 2,496,382). Polymathic AI's project will avoid many of those pitfalls, Ho said, by treating numbers as actual numbers, not just characters on the same level as letters and punctuation. The training data will also use real scientific datasets that capture the physics underlying the cosmos.

Transparency and openness are a big part of the project, Ho said. "We want to make everything public. We want to democratize AI for science in such a way that, in a few years, we'll be able to serve a pre-trained model to the community that can help improve scientific analyses across a wide variety of problems and domains."



New biosensors allow earbuds to record brain activity and exercise levels

Highlights

- *"Innovative Earbuds with Brain and Body Sensors for Health Monitoring"*
- *"UC San Diego Team Develops Earbuds That Record Brain Activity and Lactate Levels"*
- *"Groundbreaking Earbud Sensors Transmit Brain and Health Data in Real-Time"*
- *"Future of Health and Wellness: Wearable Earbuds for Brain and Metabolite Tracking"*

A pair of earbuds, equipped with flexible sensors, can record brain activity and lactate levels for health monitoring and diagnosing neurodegenerative conditions. Developed by a multidisciplinary team from UC San Diego, these sensors wirelessly transmit data for real-time analysis on smartphones or laptops. The sensors are compact and suitable for real-world use, even during exercise. The integration of brain and body sensors in earbuds is a groundbreaking advancement. The team envisions a future where wearable sensors enhance health and wellness by tracking brain activity and metabolites. The earbuds' convenience and proximity to sweat glands and the brain make them an ideal platform for this technology.

Researchers worked on designing compact sensors and finding suitable materials for data collection. The sensors were placed on the tragus to capture lactate data and on the temporal lobe for EEG signals. The challenge was to fit both sensors in the ear, ensure signal reliability, and reduce crosstalk. They used a stamp-like stretchable sensor on the earbud for this purpose.

The earbuds hold promise for therapies, including auditory neurofeedback for neurological disorders. Researchers are exploring ways to eliminate the need for exercise to gather lactate data and are planning to integrate electronics into the sensor for wireless data transmission. The potential applications include monitoring oxygen and glucose levels. Sensor evaluation and validation were comprehensive, highlighting the potential of continuous sensing in the ear canal for wearables.

Data and Validation

Data from an electroencephalogram (EEG), which measures electrical activity in the brain, and sweat lactate, an organic acid the body produces during exercise and normal metabolic activity, can be combined for a variety of purposes. For example, they can be used to diagnose different types of seizures, including epileptic seizures. They can also be used for monitoring effort during physical exercise and monitoring levels of stress and focus.

The researchers validated the data collected during this proof-of-concept study against data obtained from commercially available dry contact EEG headsets and lactate-containing blood samples. The data the flexible sensors collected were just as effective.

Why Earbuds?

The team felt that the ubiquitous wearing of earbuds translated to an untapped potential for gathering brain and body signals conveniently, both for wellness and health.

“Earbuds have been around for decades, and in many ways were one of the first wearable devices on the market,” said Patrick Mercier, a professor in the UC San Diego Department of Electrical and Computer Engineering. “This research takes important first steps to show that impactful data can be measured from the human body simply by augmenting the capabilities of earbuds that people already use daily. Since there are no major frictions to using this technology, we anticipate eventual wide scale adoption.”

The ear has sweat glands and is close to the brain, said Yuchen Xu, co-first author of the paper, and a postdoctoral researcher in Cauwenberghs's lab. “It's a natural entry point–people are used to wearing earbuds,” he said.

Building the Sensors

Such a system requires multi-domain expertise, which is how this project came about in the Center for Wearable Sensors at UC San Diego where bioengineering professor Cauwenberghs collaborated with nanoengineering professors Joseph Wang and Sheng Xu, who have extensive experience in designing and building stretchable, flexible, and high-performance chemical sensors. Patrick Mercier, a professor in the Jacobs School Department of Electrical and Computer Engineering, also lent his extensive experience in low-power biomedical electronics and wireless systems to the project.

The first step in building the in ear sensors was confirming that EEG and lactate data could be gathered in the ear. Researchers had to design smaller, more compact instruments to gather electrophysiological signals, such as EEG data, that would fit on an earbud. They also had to find a suitable material to collect sweat and sense lactate. After preliminary experiments on human subjects, researchers determined that the best location to collect and record lactate data was the tragus, where sweat accumulates at the entrance of the ear. The team also knew from previous experience that to collect EEG data, high-performance physiological electrodes pointed toward the temporal lobe were required.

“The primary technical challenge was not only fitting two sensors in the ear, which is a small space that varies from one individual to another, but also reliably acquiring signals from both EEG and lactate,” said Yuchen Xu. “We also had to accommodate for earbuds integration and reduce crosstalk. That's when we landed on the idea of a stamp-like stretchable sensor, which is a simple addition to the earbud itself, but has all the necessary functions we needed and gave us enough freedom for our designs.”

To make sure that the electrophysiological sensors had firm contact with the ear, researchers designed 3D, spring-loaded sensors that hold contact but can adjust as earbuds move. On the other hand, to improve sweat collection, researchers covered the electrochemical sensors with a see-through hydrogel film. “It's sponge-like and hydrophilic,” Yuchen Xu said. “It acts as a mechanical cushion between skin and sensors and also helps collect sweat.”

It is difficult to avoid crosstalk between the two sensors given the limited space inside the ear. Researchers analyzed various material selections, structural designs and validated the feasibility of simultaneously recording EEG and lactate signals with two sensors separated by two millimeters.

Future Opportunities

One of the devices' limitations is that in order to gather enough lactate to meaningfully analyze data, subjects need to perform exercise or other physical activity that get people to sweat. In future work, researchers will aim to do away with this requirement.

“The next step is also to integrate electronics into the sensor,” Yuchen Xu said.

The team is also working on processing the data on the device itself. Ultimately, the goal is to transmit the processed data wirelessly to a computer or a smartphone. In-ear sensors could also gather additional data, such as oxygen saturation levels and glucose levels

International scientists make refined map of world's '8th continent' Zealandia

Highlights

- *"Zealandia, often referred to as the eighth continent, remains shrouded in oceanic mystery, with a staggering 94% of its expanse concealed beneath the sea's surface"*
- *"The remaining 6% peeks above the waves, encompassing islands such as New Zealand and its neighboring isles"*
- *"The geological history of Zealandia dates back approximately 83 million years"*

A dedicated team of international geologists and seismologists has embarked on a mission to chart the depths of Zealandia, a relatively unknown landmass submerged beneath the Pacific Ocean. Their efforts have resulted in the creation of an updated and highly detailed map that sheds light on the continent's intriguing geological features.

Creating the refined map of Zealandia was no small feat. The research team embarked on a comprehensive journey, utilizing an array of methodologies to illuminate this submerged realm.

To refine the existing maps, the scientists meticulously examined rock samples and sediment specimens collected from the ocean floor. These valuable materials were acquired through drilling operations and coastal expeditions within the region.

The research journey extended beyond rock samples. The team delved into seismic data gathered from the Zealandia area, further enhancing their understanding of its geological makeup.

With these essential resources at their disposal, the scientists embarked on the monumental task of mapping Zealandia in unprecedented detail. This submerged continent spans a vast 5 million square kilometers.

The examination of the samples uncovered intriguing geological patterns in Western Antarctica, hinting at the presence of a potential subduction zone near Campbell Plateau on New Zealand's western coast. Despite this revelation, magnetic anomalies in the region did not disprove theories of a strike-slip along the Campbell Fault.

The scientists proposed that the Campbell Magnetic Anomaly System originated from the stretching of Gondwana as it underwent a process of fragmentation. This stretching ultimately led to a significant rupture, resulting in the creation of the ocean floor that now constitutes the lower portions of Zealandia.

The geological history of Zealandia dates back approximately 83 million years when volcanic forces played a pivotal role in the separation of the supercontinent Gondwana, giving rise to the continents we recognize today.

Google introduces earthquake alerts system for Android users in India

Highlights

- *"The Earthquake Alerts System harnesses the power of the tiny accelerometers present in Android smartphones"*
- *"When an earthquake's initial tremors are felt, Android devices with the Earthquake Alerts System enabled will pick up on these vibrations through their accelerometers"*
- *"Once the system confirms the presence of seismic activity, it sends alerts to users in the affected region"*

Search giant Google has unveiled its Earthquake Alerts System for Android smartphone users in India. Developed in collaboration with the National Disaster Management Authority (NDMA) and the National Seismology Center (NSC), this system offers early warnings of seismic activities and is available in multiple Indian languages.

In a country like India, which is susceptible to seismic activities, timely information about earthquakes can make a significant difference in mitigating the impact of these natural disasters. Google's Earthquake Alerts System aims to provide Android users with crucial information and alerts when an earthquake is detected in their area.

How does google's earthquake system work

These accelerometers are typically used to detect the orientation and movement of the device, but Google has repurposed them to detect seismic activity. Here's how it works:

Initial Detection: When an earthquake's initial tremors are felt, Android devices with the Earthquake Alerts System enabled will pick up on these vibrations through their accelerometers.

Data Aggregation: The system doesn't rely solely on one device; instead, it aggregates data from multiple smartphones in a specific geographical area. This helps in determining the extent of seismic activity more accurately.

Estimating Epicenter and Magnitude: By analyzing the data from multiple devices, the system can estimate the earthquake's epicenter and magnitude. This information is crucial for understanding the potential impact of the earthquake.

Alerting Users: Once the system confirms the presence of seismic activity, it sends alerts to users in the affected region. These alerts include information about the earthquake's magnitude and safety tips on how to respond.

What is NASA's Psyche mission

Highlights

- *"The Psyche mission represents an ambitious venture to explore a distinct metallic asteroid positioned in orbit between Mars and Jupiter"*
- *"The metallic cores of rocky planets like Earth are concealed deep beneath layers of rock and crust, Psyche offers a rare opportunity to directly investigate one such core "*
- *"The mission is spearheaded by Arizona State University, with NASA's Jet Propulsion Laboratory overseeing mission management, operations, and navigation"*

The exceptional feature of this asteroid, named Psyche, is its composition, believed to be the exposed nickel-iron core of an ancient planet – a fundamental building block of our solar system. The Psyche mission represents an ambitious venture to explore a distinct metallic asteroid positioned in orbit between Mars and Jupiter.

The spacecraft's solar-electric propulsion system will be constructed by Maxar (formerly SSL), complemented by a suite of scientific instruments.

GOALS

Exploring a Metal World: Psyche represents a novel celestial body made predominantly of metal, contrasting with the typical rock and ice composition of other objects in our solar system.

Peering Inside Terrestrial Planets: Psyche will facilitate an unprecedented examination of the interiors of terrestrial planets, including Earth, which are otherwise hidden from view.

Unveiling Iron Cores: The primary objective is to comprehend a previously uncharted component of planet formation: iron cores.

OBJECTIVES

Core Identification: Determine whether Psyche is indeed a core or composed of un-melted materials.

Age Determination: Assess the relative ages of different regions on Psyche's surface.

Elemental Composition: Investigate whether small metal bodies like Psyche contain the same light elements found in Earth's high-pressure core.

Environmental Conditions: Ascertain whether Psyche formed under more oxidizing or reducing conditions compared to Earth's core.

Topography Characterization: Study the topography of Psyche to gain insights into its surface features and structure.

The Psyche spacecraft is traveling to a unique metal-rich asteroid with the same name, orbiting the Sun between Mars and Jupiter. By August 2029 the spacecraft will begin exploring the asteroid that scientists think because of its high metal content may be the partial core of a planetesimal, a building block of an early planet.

Type 2 diabetes patients can benefit from e-bikes study confirms

Highlights

- *"Global Diabetes Challenge: The article addresses the alarming projection that 642 million people will be diagnosed with diabetes by 2040, with type 2 diabetes accounting for 90% of cases. This places significant strain on healthcare systems due to the associated costs and health complications"*
- *"E-Bikes for Diabetes Management: A new study from the University of Bristol suggests that electric bikes (e-bikes) can serve as a valuable tool for managing type 2 diabetes in adults"*
- *"Factors Influencing E-Cycling Adoption: The research explores the factors influencing the adoption of e-cycling among people with type 2 diabetes. It identifies key elements such as skills, knowledge, confidence, and the joy of e-cycling as facilitators for sustained physical activity"*

Around 642 million people will be diagnosed with diabetes globally by 2040, with type 2 diabetes accounting for 90% of cases. Health systems are under a great deal of strain due to the expense of type 2 diabetes' continuing maintenance and treatment, as well as the problems it causes.

Health experts say that a crucial element in the management of type 2 diabetes is physical activity, with limited exposure. A new study has now found that electric bikes (e-bikes) may be a vital tool for treating the illness in adults.

Researchers from the University of Bristol found that e-bikes can act as a different type of active transportation that can improve health while getting around some of the frequent problems with traditional riding.

Moderate activity

The prevention and management of type 2 diabetes depend heavily on physical activity. However, people with type 2 diabetes are less physically active than people without the condition, and many fall short of the recommended 150 minutes of physical activity each week.

According to the team, interventions intended to increase physical activity in this group sometimes need a large amount of contact time and expertise, which restricts their capacity to be scaled. When given the freedom to self-regulate their activities, people frequently revert to fewer levels of activity. In order to effectively promote behavior, change beyond the intervention time, it is necessary to create treatments that are less labor-intensive.

Despite many similarities to traditional bicycles, e-bikes need less physical effort to ride and may be used more frequently for longer distances. Despite the electrical aid, research indicates that e-cycling is conducted at least moderately intensely and produces equivalent or slightly lower bodily indicators of intensity than traditional cycling. "However, given that individuals report e-cycling for longer and more frequently than they do a conventional bicycle, e-cycling is often associated with greater weekly energy expenditure than a conventional bicycle," said the study.

Influencing factors

The study analyzed how e-bike riders perceived the activity in comparison to other kinds of exercise. The team studied responses from 16 participants from an e-cycling group by conducting one-on-one semi-structured interviews.

According to the team, the creation of a conceptual understanding of the elements that have the greatest impact on e-cycling participation in this demographic will be made possible by knowing how participants perceive e-cycling, in particular, the barriers and facilitators to riding.

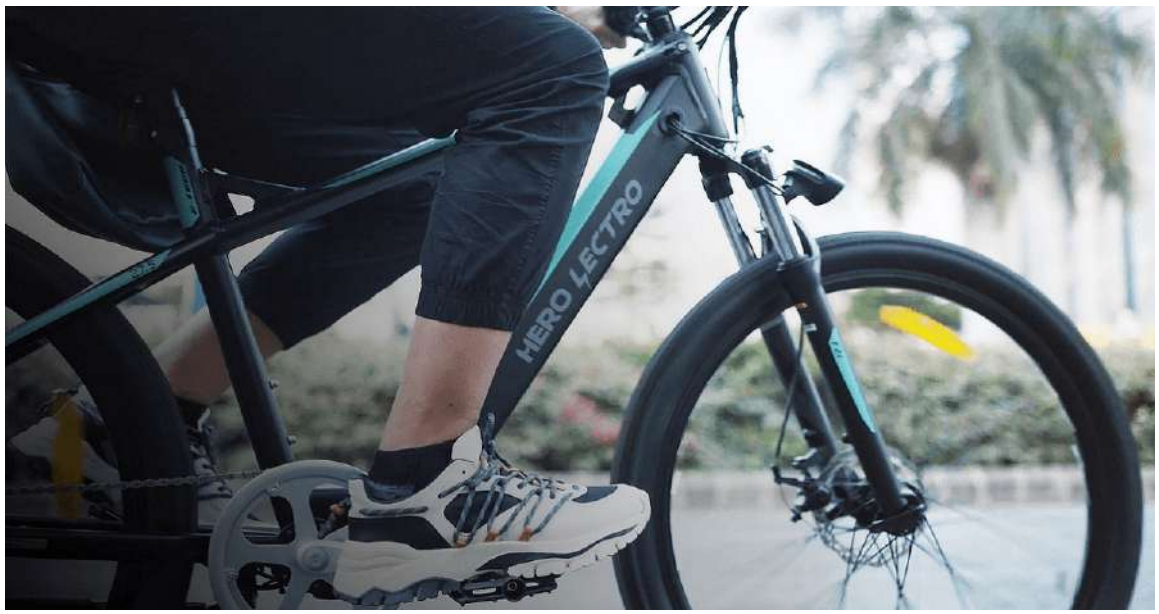
It found that factors like skills, knowledge, belief about capabilities, belief about consequences, and environmental context and resources are the main categories affecting its adoption. The team found that "e-bike training facilitated e-cycling engagement by providing participants with the skills, knowledge, and confidence needed to ride the e-bike and ride on the road. In addition, the enjoyment of e-cycling was a key facilitator to engagement."

In what may not come as a surprise, electric bikes provide users with a feeling of independence and empowerment since they can customize and enjoy their rides by adjusting the degree of assistance to meet their energy levels. The ability of riders to maintain faster speeds and explore new terrain significantly increases the pleasure factor, transforming fitness from a job into an adventure.

The results show that people with type 2 diabetes have a better chance of developing sustained physical activity by focusing their attention on e-cycling initiatives. The team hopes that the results of this study can be utilized to create a more focused e-cycling intervention that focuses on the variables that were shown to affect e-cycling participation.

The details regarding their work were published in the journal *Frontiers*.

Physical activity (PA) is a key component in the management of type 2 diabetes. However, this population has low rates of PA engagement. Electrically assisted cycling has been identified as a means through which to increase PA by incorporating activity into daily life while overcoming some of the barriers to conventional cycling. The determinants of e-cycling among people living with chronic disease are largely unknown. The aim of this research was to explore the determinants of e-cycling among individuals with type 2 diabetes using the Theoretical Domains Framework (TDF) and the Capability, Opportunity, and Motivation for Behavior change model (COM-B). This information is important for determining the suitability of future e-cycling initiatives and, if appropriate, informing future e-cycling interventions.



New method recycles 98% of lithium from electric batteries

Highlights

- *"Efficient Battery Recycling: A new hydrometallurgy-based method for recycling electric car batteries has been developed, allowing for the recovery of 100% of aluminum and 98% of lithium, while minimizing the loss of other precious metals like nickel, cobalt, and manganese"*
- *"Innovative Use of Oxalic Acid: The researchers have achieved this breakthrough by using oxalic acid, an environmentally favorable substance found in plants like rhubarb and spinach"*
- *"Sustainable Battery Recycling: This new recycling technique offers a sustainable solution for recovering valuable metals from electric car batteries "*

A new recipe recycling precious metals from electric batteries using hydrometallurgy has been invented that is more efficient and effective than traditional approaches. The new technique allows for the recovery of 100 percent of the aluminum and 98 percent of the lithium in electric car batteries while minimizing the loss of nickel, cobalt, and manganese.

This is according to a press release published by Chalmers University of Technology.

Enhancing the use of oxalic acid

"So far, no one has managed to find exactly the right conditions for separating this much lithium using oxalic acid, whilst also removing all the aluminum. Since all batteries contain aluminum, we need to be able to remove it without losing the other metals," said Léa Rouquette, PhD student at the Department of Chemistry and Chemical Engineering at Chalmers.

Hydrometallurgy is often used for the extraction of various metals, including copper, gold, silver, uranium, and rare earth elements. It is chosen as the main recycling method when the ore is refractory or difficult to process through conventional pyrometallurgical methods, which involve high-temperature processes.

In this new version of an old process, the researchers have developed a fascinating new method for utilizing oxalic acid, an environmentally favourable substance that can be found in plants like rhubarb and spinach, by precisely adjusting temperature, concentration, and time.

Martina Petranikova, Associate Professor at the Department of Chemistry and Chemical Engineering at Chalmers highlighted the industry's ever-growing need for alternatives to inorganic chemicals creating one of the biggest bottlenecks in today's processes in terms of removing residual materials like aluminum. Their new method, she argued, can offer the recycling industry new options, and help resolve age-old problems.

With the new technique, the researchers recover the lithium and aluminum first, essentially reversing the order of traditional hydrometallurgy. This allows them to lessen the waste of precious metals needed to produce new batteries.

An essential last step that separates aluminium and lithium

The procedure' last step, when the black mixture is filtered, is similar to making coffee. The other metals are left in the "solids," while lithium and aluminum end up in the liquid. The procedure then moves on to the separation of lithium and aluminum.

“Since the metals have very different properties, we do not think it will be hard to separate them. Our method is a promising new route for battery recycling – a route that definitely warrants further exploration,” said Rouquette.

“As the method can be scaled up, we hope it can be used in industry in future years,” said Petranikova.

When compared to some pyrometallurgical techniques, hydrometallurgical procedures can be more energy and environmentally friendly, making them particularly suitable for some ores and industrial waste products. In addition, hydrometallurgy enables the recovery of important metals from low-grade ores and secondary sources, supporting the circular economy and the sustainability of resources.

Cooling trend in California super-volcano, but seismic risks still loom

Highlights

- *"Long Valley Caldera Seismic Activity: The article highlights concern about increased seismic activity in the Long Valley Caldera, situated on top of a massive dormant super-volcano"*
- *"Innovative Seismic Imaging: The research team used advanced techniques, including distributed acoustic sensing (DAS) with fiber optic cables, to create detailed subterranean images of the Long Valley Caldera"*
- *"Potential for Earthquake and Small Eruptions: While the researchers do not believe the region is gearing up for another super volcanic eruption, they emphasize that the cooling process may release enough gas and liquid to cause earthquakes and small eruptions"*

This activity is of high concern since it is taking place in the Long Valley Caldera area, located on top of a massive dormant super volcano.

The Long Valley Caldera was formed 760,000 years ago by a catastrophic eruption that sent 650 cubic kilometers of ash into the atmosphere. To put this in context, this ash could cover the whole of Los Angeles with a one-kilo-meter-thick sheet of sediment.

New Caltech-led research has attempted to determine the factors responsible for the region's increased activity over the last few decades. The team generated the most intricate 6.2 mile (10-km) deep subterranean images of the Long Valley Caldera.

These high-resolution images reveal that the recent seismic activity is related to the discharge of fluids and gases as the area cools and stabilizes.

"We don't think the region is gearing up for another super volcanic eruption, but the cooling process may release enough gas and liquid to cause earthquakes and small eruptions. For example, in May 1980, there were four magnitude 6 earthquakes in the region alone," said Zhong Wen Zhan in an official release.

Moreover, the images showcase that the volcano's magma chamber is encircled by a hardened cap of crystalline rock, which also points to molten magma gradually cooling and solidifying.

Creation of underground images

Creating the subsurface pictures was not an easy feat.

Scientists use a process to investigate seismic waves generated by earthquakes to derive the properties of

Researchers may measure differences in the timing of these waves as they propagate through the Earth's subsurface using seismometers placed at several sites.

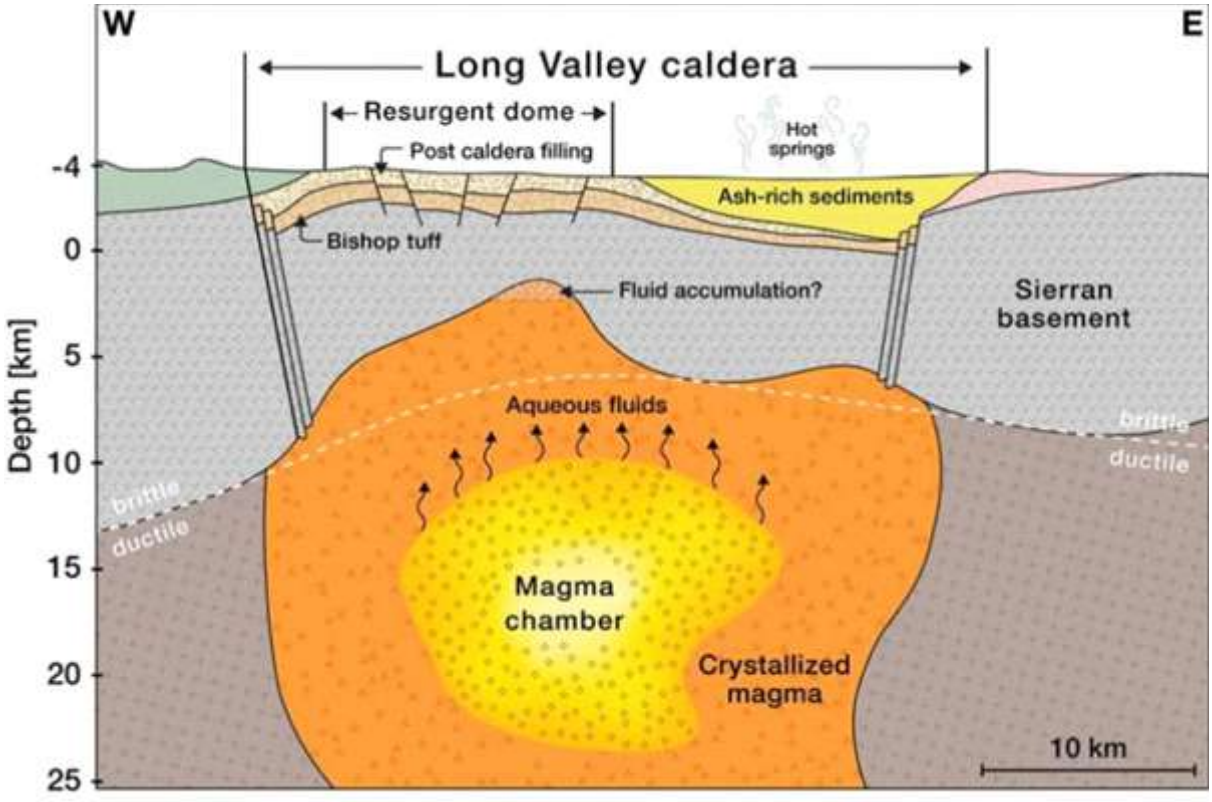
Using this method, researchers may create precise images of the subsurface environment, which will aid in their understanding of the geological structures and compositions under the Earth's surface.

The researchers used fibre optic cables instead of seismometers to make seismic readings utilizing a technology known as distributed acoustic sensing (DAS).

Over the course of a year and a half, the team harnessed the cable to record over 2,000 seismic events, with most of them being too minor to be perceptible by humans. These measurements were then processed using a machine learning algorithm, which subsequently generated the resulting subsurface image.

Up next, the team intends to employ a 124-mile (200-km) long cable to conduct imaging at even greater depths within the Earth's crust, reaching approximately 15 to 20 kilometres deep.

Geophysical characterization of calderas is fundamental in assessing their potential for future catastrophic volcanic eruptions. The mechanism behind the unrest of Long Valley Caldera in California remains highly debated, with recent periods of uplift and seismicity driven either by the release of aqueous fluids from the magma chamber or by the intrusion of magma into the upper crust. We use distributed acoustic sensing data recorded along a 100-kilometer fibre-optic cable traversing the caldera to image its subsurface structure. Our images highlight a definite separation between the shallow hydrothermal system and the large magma chamber located at ~12-kilometer depth. The combination of the geological evidence with our results shows how fluids exsolved through second boiling provide the source of the observed uplift and seismicity.

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Glimpses