



Weekly Newsletter
TECHNOLOGY
SURVEILLANCE

N° 48-2023

DIC 01TH, 2023





OBJECTIVE: *To provide weekly information about the latest global scientific and technological advancements, as well as the most innovative products and services entering the international market.*

I. NEWS

1.1 Three genes associated with neurodevelopmental disorders

An international study group led by researchers of Children's Hospital of Philadelphia (CHOP) have identified how three novel genes cause neurodevelopmental disorders. Researchers now have a better sense of the genes' roles in human brain development and function and their ability to serve as potential therapeutic targets in the future. The findings were recently published online by the Journal of Clinical Investigation.

In this study, researchers utilized genomic and clinical data from unrelated patients with neurodevelopmental disorders. Among the cohort, 46 patients had missense variants of the gene U2AF2 and six patients had variants of the gene PRPF19. In human stem cell and fly models, the researchers noticed issues with the formation of neurites, or protrusions on neurons that give them their shape, as well as issues with splicing and social deficits in the fly models. Deeper profiling revealed that at third gene, RBFOX1, had missense variants that affected splicing and loss of proper neuron function. These findings were later compared with those of patients in the study, which confirmed that variants in the three genes can lead to neurodevelopmental disorders.

For more information, visit the following link:

<https://www.chop.edu/news/researchers-identify-three-genes-associated-neurodevelopmental-disorders>

Reference

Leach, B. (Nov 28, 2023). Researchers identify three genes associated with neurodevelopmental disorders. Recovered Nov 28, 2023, The Children's Hospital of Philadelphia:

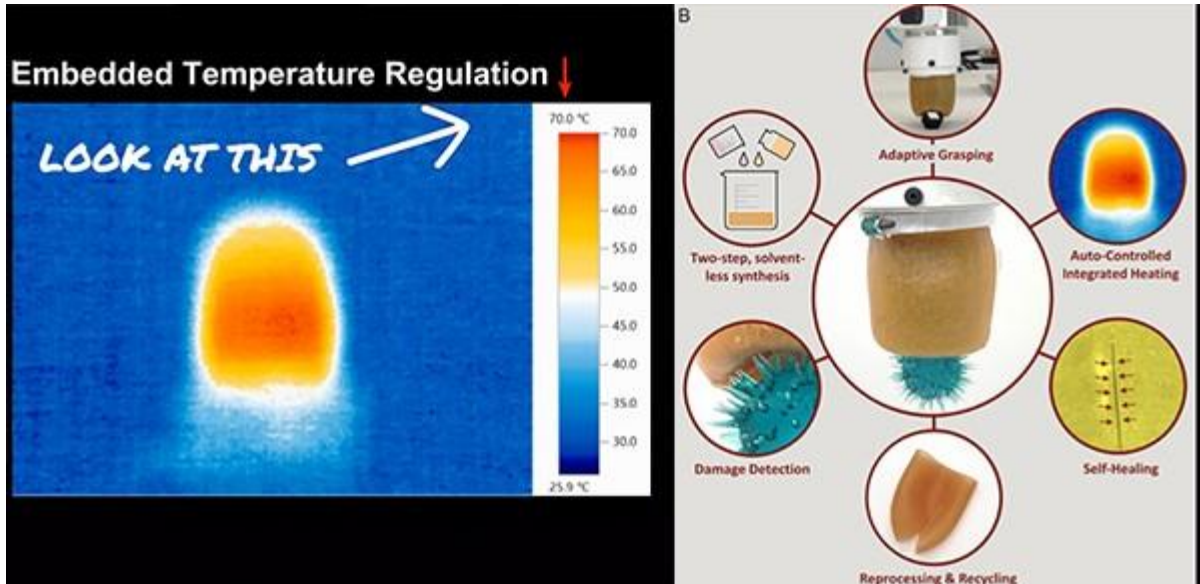
<https://www.chop.edu/news/researchers-identify-three-genes-associated-neurodevelopmental-disorders>

Information source: (The Children's Hospital of Philadelphia, 2023)



1.2 Self-healing robotic gripper could be the future of sustainable soft robotics

A deformable membrane of the gripper. Developed by researchers at the University of Cambridge and Vrije Universiteit Brussel, the elastomer – a special class of polymer with unique properties such as elasticity and toughness – is able to self-heal from macroscopic damages, including scratches and punctures sustained from direct contact with sharp objects or surfaces.



LEFT: Autonomous integrated heating achieves rapid healing at 70°C. RIGHT: An overview of the gripper's integrated system.

Credit: University of Cambridge

A pressure sensor acts as the damage detection early warning system. Meanwhile, autonomous integrated heating achieves rapid healing in approximately nine minutes at the desired temperature of 70°C. Unlike other universal robotic grippers, this proposed self-healing universal gripper can be fully reprocessed and recycled – something that is in contrast to the traditional silicones currently used in soft robotic grippers, which offer poor recyclability and a limited lifetime.

For more information, visit the following link:

<http://www.eng.cam.ac.uk/news/self-healing-robotic-gripper-could-be-future-sustainable-soft-robotics>

Reference

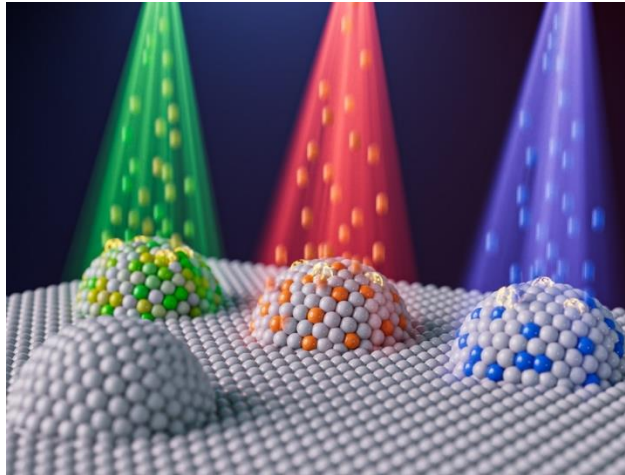
Iida, F. & Wang, H. (Nov 27, 2023). Self-healing robotic gripper could be the future of sustainable soft robotics. Recovered Nov 27, 2023, University of Cambridge:
<http://www.eng.cam.ac.uk/news/self-healing-robotic-gripper-could-be-future-sustainable-soft-robotics>

Information source: (University of Cambridge, 2023)



1.3 Nanoparticles using ion irradiation to advance clean energy and fuel conversion

Massachusetts Institute of Technology (MIT) researchers and colleagues have demonstrated a way to precisely control the size, composition, and other properties of nanoparticles key to the reactions involved in a variety of clean energy and environmental technologies. They did so by leveraging ion irradiation, a technique in which beams of charged particles bombard a material.



Artist's representation of nanoparticles with different compositions created by combining two techniques: metal exsolution and ion irradiation. The different colors represent different elements, such as nickel, that can be implanted into an exsolved metal particle to tailor the particle's compositions and reactivity.

Credit: Jiayue Wang, Massachusetts Institute of Technology

They went on to show that nanoparticles created this way have superior performance over their conventionally made counterparts. *"The materials we have worked on could advance several technologies, from fuel cells to generate CO₂-free electricity to the production of clean hydrogen feedstocks for the chemical industry [through electrolysis cells],"* says Bilge Yildiz, leader of the work and a professor in MIT's departments of Nuclear Science and Engineering and Materials Science and Engineering.

For more information, visit the following link:

<https://news.mit.edu/2023/team-engineers-nanoparticles-advance-clean-energy-fuel-conversion-1127>

Reference

Thomson, E. (Nov 27, 2023). Team engineers nanoparticles using ion irradiation to advance clean energy and fuel conversion. Recovered Nov 27, 2023, Massachusetts Institute of Technology:

<https://news.mit.edu/2023/team-engineers-nanoparticles-advance-clean-energy-fuel-conversion-1127>

Information source: (Massachusetts Institute of Technology, 2023)



1.4 Early-stage stem cell therapy trial shows promise for treating progressive multiple sclerosis

The study, led by scientists at the University of Cambridge, University of Milan Bicocca and Hospital Casa Sollievo della Sofferenza (Italy), is a step towards developing an advanced cell therapy treatment for progressive multiple sclerosis (MS). Over 2 million people live with MS worldwide, and while treatments exist that can reduce the severity and frequency of relapses, two-thirds of MS patients still transition into a debilitating secondary progressive phase of disease within 25-30 years of diagnosis, where disability grows steadily worse.

In MS, the body's own immune system attacks and damages myelin, the protective sheath around nerve fibres, causing disruption to messages sent around the brain and spinal cord. Key immune cells involved in this process are macrophages (literally "*big eaters*"), which ordinarily attack and rid the body of unwanted intruders. A particular type of macrophage known as a microglial cell is found throughout the brain and spinal cord. In progressive forms of MS, they attack the central nervous system (CNS), causing chronic inflammation and damage to nerve cells. Recent advances have raised expectations that stem cell therapies might help ameliorate this damage. These involve the transplantation of stem cells, the body's "*master cells*", which can be programmed to develop into almost any type of cell within the body.

For more information, visit the following link:

<https://www.cam.ac.uk/research/news/early-stage-stem-cell-therapy-trial-shows-promise-for-treating-progressive-ms>

Reference

Brierley, C. (Nov 27, 2023). Early-stage stem cell therapy trial shows promise for treating progressive MS. Recovered Nov 27, 2023, University of Cambridge:

<https://www.cam.ac.uk/research/news/early-stage-stem-cell-therapy-trial-shows-promise-for-treating-progressive-ms>

Information source: (University of Cambridge, 2023)



1.5 Artificial Intelligence that automatically detects methane plumes from space could be a powerful tool in combating climate change

There have been only very few methods to readily map methane plumes from aerial imagery and the processing step is highly time-consuming. This is because methane gas is transparent to both the human eye and the spectral ranges used in most satellite sensors. Even when satellite sensors operate in the correct spectral range to detect methane, the data is often obscured by noise, requiring laborious manual approaches to effectively identify the plumes.



Credit: University of Oxford

A new machine-learning tool developed by Oxford researchers overcomes these issues by detecting methane plumes in data from hyperspectral satellites. These detect narrower bands than more common multispectral satellites, making it easier to tune to the specific signature of methane and filter out noise. However, the amount of data they produce is much larger, making it challenging to process without artificial intelligence (AI).

For more information, visit the following link:

<https://www.ox.ac.uk/news/2023-11-23-ai-automatically-detects-methane-plumes-space-could-be-powerful-tool-combating>

Reference

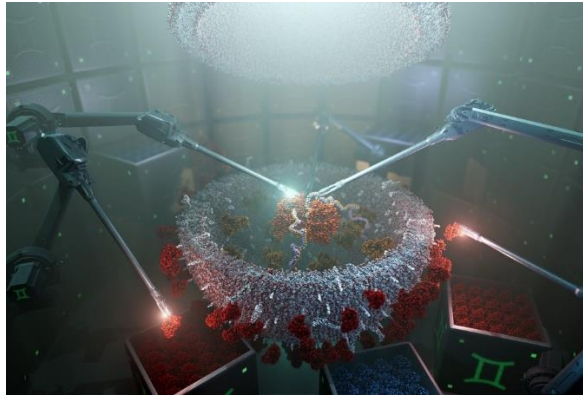
University of Oxford. (Nov 23, 2023). AI that automatically detects methane plumes from space could be a powerful tool in combating climate change. Recovered Nov 27, 2023, University of Oxford: <https://www.ox.ac.uk/news/2023-11-23-ai-automatically-detects-methane-plumes-space-could-be-powerful-tool-combating>

Information source: (University of Oxford, 2023)



1.6 New platform solves key problems in targeted drug delivery

In recent years, cell and gene therapies have shown significant promise for treating cancer, cystic fibrosis, diabetes, heart disease, HIV/AIDS and other difficult-to-treat diseases. But the lack of effective ways to deliver biological treatments into the body has posed a major barrier for bringing these new therapies to the market — and, ultimately, to the patients who need them most.



*A conceptual depiction of the GEMINI technology for assembling custom gene delivery vehicles.
Credit: Justin Muir, Northwestern University*

Now, Northwestern University synthetic biologists have developed a flexible new platform that solves part of this daunting delivery problem. Mimicking natural processes used by viruses, the delivery system binds to target cells and effectively transfers drugs inside. The workhorses behind this new platform are extracellular vesicles (EVs) — tiny, virus-sized nanoparticles that all cells already naturally produce.

For more information, visit the following link:

<https://news.northwestern.edu/stories/2023/11/new-platform-solves-key-problems-in-targeted-drug-delivery/>

Reference

Morris, A. (Nov 27, 2023). New platform solves key problems in targeted drug delivery. Recovered Nov 27, 2023, Northwestern University:

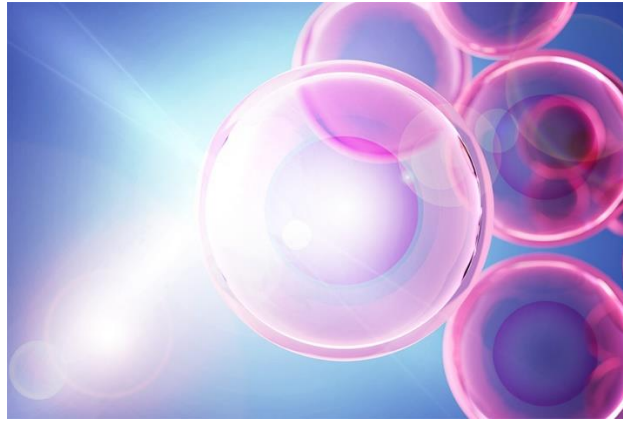
<https://news.northwestern.edu/stories/2023/11/new-platform-solves-key-problems-in-targeted-drug-delivery/>

Information source: (Northwestern University, 2023)



1.7 A new way to see the activity inside a living cell

Massachusetts Institute of Technology (MIT) researchers have developed an alternative method that allows them to observe up to seven different molecules at a time, and potentially even more than that. The new approach makes use of green or red fluorescent molecules that flicker on and off at different rates. By imaging a cell over several seconds, minutes, or hours, and then extracting each of the fluorescent signals using a computational algorithm, the amount of each target protein can be tracked as it changes over time.



Credit: Massachusetts Institute of Technology

In the new study, the researchers took a different approach: Instead of distinguishing signals based on their physical location, they created fluorescent signals that vary over time. The technique relies on “switchable fluorophores” — fluorescent proteins that turn on and off at a specific rate. For this study, Boyden and his group members identified four green switchable fluorophores, and then engineered two more, all of which turn on and off at different rates. They also identified two red fluorescent proteins that switch at different rates, and engineered one additional red fluorophore.

For more information, visit the following link:

<https://news.mit.edu/2023/new-method-fluorescent-labels-living-cell-1128>

Reference

Trafton, A. (Nov 28, 2023). A new way to see the activity inside a living cell. Recovered Nov 28, 2023, Massachusetts Institute of Technology:
<https://news.mit.edu/2023/new-method-fluorescent-labels-living-cell-1128>

Information source: (Massachusetts Institute of Technology, 2023)



1.8 How do you make a robot smarter? Program it to know what it doesn't know

Modern robots know how to sense their environment and respond to language, but what they don't know is often more important than what they do know. Teaching robots to ask for help is key to making them safer and more efficient. Engineers at Princeton University and Google have come up with a new way to teach robots to know when they don't know. The technique involves quantifying the fuzziness of human language and using that measurement to tell robots when to ask for further directions. Telling a robot to pick up a bowl from a table with only one bowl is fairly clear. But telling a robot to pick up a bowl when there are five bowls on the table generates a much higher degree of uncertainty — and triggers the robot to ask for clarification.



*Engineers at Princeton University and Google have come up with a new way to teach robots to know when they don't know and ask for clarification from a human.
Credit: Photo by the researchers, Princeton University*

Because tasks are typically more complex than a simple “pick up a bowl” command, the engineers use large language models (LLMs) — the technology behind tools such as ChatGPT — to gauge uncertainty in complex environments. LLMs are bringing robots powerful capabilities to follow human language, but LLM outputs are still frequently unreliable, said Anirudha Majumdar, an assistant professor of mechanical and aerospace engineering at Princeton and the senior author of a study outlining the new method.

For more information, visit the following link:

<https://engineering.princeton.edu/news/2023/11/28/how-do-you-make-robot-smarter-program-it-know-what-it-doesnt-know>

Reference

Sharlach, M. (Nov 28, 2023). How do you make a robot smarter? Program it to know what it doesn't know. Recovered Nov 28, 2023, Princeton University:
<https://engineering.princeton.edu/news/2023/11/28/how-do-you-make-robot-smarter-program-it-know-what-it-doesnt-know>

Information source: (Princeton University, 2023)



1.9 **Sophisticated bayesian spectral energy distribution synthesis and analysis tool for multi-band study of galaxies**

Recently, a study conducted by HAN Yunkun from Yunnan Observatories of the Chinese Academy of Sciences (CAS), Prof. FAN Lulu from the University of Science and Technology of China of CAS and ZHENG Xianzhong from Purple Mountain Observatory of CAS, among others, reported new findings in the performance test for simultaneous photometric redshift and stellar population parameter estimation of galaxies in the China Space Station Telescope (CSST) wide-field multiband imaging survey.

Galaxies are the fundamental units that constitute the universe. Studying the formation and evolution of galaxies helps unravel the nature of dark matter and dark energy. The multi-band spectral energy distribution (SED) analysis of galaxies can be utilized to measure fundamental physical parameters of galaxies such as their redshift, stellar mass, and star formation rate. This approach serves as a crucial foundation for understanding the myriad complex physical processes associated with stars, interstellar medium, and supermassive black holes within galaxies. The state-of-the-art telescopes such as James Webb Space Telescope (JWST), the Euclid space telescope, the forthcoming CSST, and Roman Space Telescope, will provide a massive amount of multi-wavelength data, which not only presents a tremendous opportunity for a deeper understanding of the formation and evolution of galaxies, but also poses significant challenges for the development of SED synthesis and analysis methods and tools.

For more information, visit the following link:

https://english.cas.cn/newsroom/research_news/phys/202311/t20231126_645004.shtml

Reference

Liu, J. (Nov 24, 2023). Researchers develop sophisticated bayesian spectral energy distribution synthesis and analysis tool for multi-band study of galaxies. Recovered Nov 28, 2023, Chinese Academy of Sciences: https://english.cas.cn/newsroom/research_news/phys/202311/t20231126_645004.shtml

Information source: (Chinese Academy of Sciences, 2023)



1.10 Improving autonomous driving

Self-driving cars must accurately assess and navigate a rapidly changing environment. Computer vision, which uses computation to extract information from imagery, is an important aspect of autonomous driving.



Driverless cars use computer vision to capture a scene's depth and motion to navigate safely and accurately.

Credit: iStock, Washington University in St. Louis

Nathan Jacobs, a professor of computer science and engineering at the McKelvey School of Engineering at Washington University in St. Louis, and a team of graduate students developed a joint learning framework to optimize stereo matching and optical flow for autonomous driving. Stereo matching generates maps of disparities between two images and is a critical step in depth estimation for avoiding obstacles. Optical flow aims to estimate per-pixel motion between video frames and is useful to estimate how objects are moving as well as how the camera is moving relative to them.

For more information, visit the following link:

<https://source.wustl.edu/2023/11/improving-autonomous-driving/>

Reference

Ogliore, T. (Nov 28, 2023). Ingestible electronic device detects breathing depression in patients. Recovered Nov 28, 2023, Washington University in St. Louis:

<https://source.wustl.edu/2023/11/improving-autonomous-driving/>

Information source: (Washington University in St. Louis, 2023)



1.11 More efficient recycling of batteries

The market for electric cars is growing rapidly and so does the need for lithium-ion batteries. Their recycling is an important part of the production cycle. Current methods are based on the decomposition of active battery materials into their molecular constituents, which is associated with a high consumption of energy and chemicals. Researchers of Karlsruhe Institute of Technology (KIT) and industry partners have now launched a collaboration to develop a more efficient recycling process for spent batteries, by means of which the active components are recovered while maintaining their functionality.



*Within the DiRecReg project, four institutes of KIT and seven companies develop a complete process chain for a better recycling of spent batteries and production waste
Credit: wbk, Karlsruhe Institute of Technology*

Electrification of the mobility sector is needed for Germany to reach its climate protection goals. Hence, it represents a megatrend in Germany's automotive industry. "The associated high need for lithium-ion batteries requires sustainable and closed material cycles, from battery materials throughout the battery lifecycle to recycling as well as a closed cycle of battery cell manufacture," says Dr. Marco Gleiß from the Institute for Mechanical Process Engineering and Mechanics. Gleiß is KIT's coordinator of the project "Agile Process Chain for Direct Recycling of Lithium-ion Batteries and Regeneration of Active Materials" (DiRecReg). "By closing the chain of added value, we can reduce Germany's and the European Union's dependence on raw materials," Gleiß adds.

For more information, visit the following link:

https://www.kit.edu/kit/english/pi_2023_098_recovering-materials-rather-than-shredding-more-efficient-recycling-of-batteries.php

Reference

Landgraf, M. (Nov 28, 2023). Recovering materials rather than shredding: more efficient recycling of batteries. Recovered Nov 28, 2023, Karlsruhe Institute of Technology:
https://www.kit.edu/kit/english/pi_2023_098_recovering-materials-rather-than-shredding-more-efficient-recycling-of-batteries.php

Information source: (Karlsruhe Institute of Technology, 2023)



1.12 Researchers engineer a material that can perform different tasks depending on temperature

Researchers report that they have developed a new composite material designed to change behaviors depending on temperature in order to perform specific tasks. These materials are poised to be part of the next generation of autonomous robotics that will interact with the environment.



Credit: University of Illinois Urbana-Champaign

The new study conducted by University of Illinois Urbana-Champaign civil and environmental engineering professor Shelly Zhang and graduate student Weichen Li, in collaboration with professor Tian Chen and graduate student Yue Wang from the University of Houston, uses computer algorithms, two distinct polymers and 3D printing to reverse engineer a material that expands and contracts in response to temperature change with or without human intervention. *“Creating a material or device that will respond in specific ways depending on its environment is very challenging to conceptualize using human intuition alone – there are just so many design possibilities out there,”* Zhang said. *“So, instead, we decided to work with a computer algorithm to help us determine the best combination of materials and geometry.”*

For more information, visit the following link:

<https://cee.illinois.edu/news/60635#:~:text=CHAMPAIGN%2C%20Ill.,will%20interact%20with%20the%20environment.>

Reference

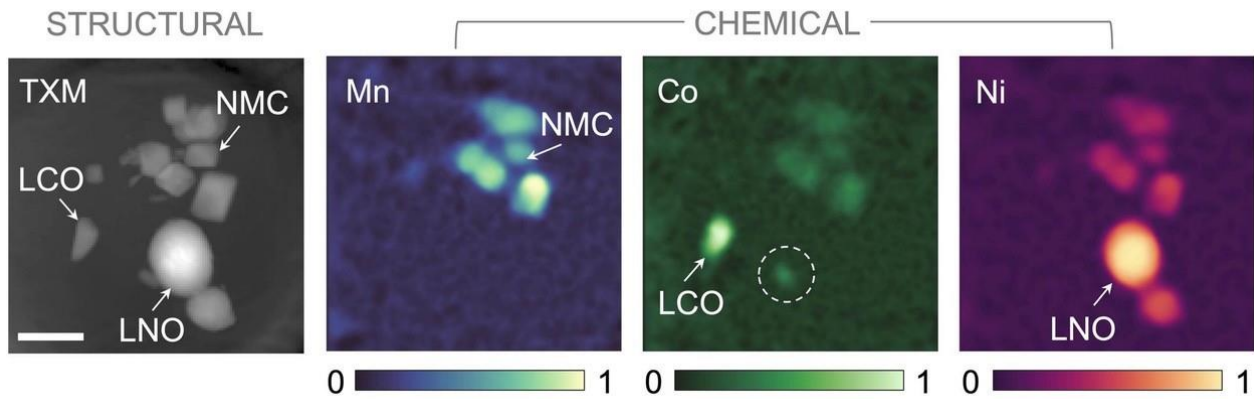
Yoksoulian, L. (Nov 28, 2023). Researchers engineer a material that can perform different tasks depending on temperature. Recovered Nov 28, 2023, University of Illinois Urbana-Champaign: <https://cee.illinois.edu/news/60635#:~:text=CHAMPAIGN%2C%20Ill.,will%20interact%20with%20the%20environment.>

Information source: (University of Illinois Urbana-Champaign, 2023)



1.13 Sandpaper X-ray technique could change how batteries are monitored

Batteries are challenging to observe and analyze. They can't really be opened up because of their volatile nature. One way to monitor batteries is through x-ray technology. However, the equipment is very expensive and those methods struggle to balance resolution, sensitivity and speed.



A composite battery cathode sample imaged by the developed methodology, which offers nano-scale resolution and compositional sensitivity
Credit: The University of Texas at Austin

One of the newest Texas Engineers has developed a low-cost method for using x-ray tech to capture images inside batteries and then deploying a software algorithm to fill in the blanks. Instead of an x-ray lens that may cost hundreds of thousands of dollars, this new research uses a couple sheets of sandpaper to structure the illumination in a sample in a way that allows for detailed mapping at the nanoscale. *"The data may look ugly to the eye, but it contains a lot of information that can be extracted by our algorithm,"* said Yijin Liu, an associate professor in the Walker Department of Mechanical Engineering who joined UT this fall.

For more information, visit the following link:

<https://cockrell.utexas.edu/news/archive/9771-sandpaper-x-ray-technique-could-change-how-batteries-are-monitored>.

Reference

The University of Texas at Austin. (Nov 27, 2023). Sandpaper X-ray technique could change how batteries are monitored. Recovered Nov 28, 2023, The University of Texas at Austin: <https://cockrell.utexas.edu/news/archive/9771-sandpaper-x-ray-technique-could-change-how-batteries-are-monitored>

Information source: (The University of Texas at Austin, 2023)



1.14 Purdue IoT software platform uses gaming to motivate energy-efficient behaviors in residential communities

State and municipal housing authorities, housing developers, HVAC vendors and utility providers can strengthen their energy-efficiency programs in residential community service areas with a patent-pending, Internet of Things (IoT) system developed by Purdue University researchers that uses gaming to incentivize users.



Purdue University researchers have created an IoT software platform called MySmartE that incentivizes people to use energy-efficiency programs developed by government and industry. MySmartE achieved more than 80% residential engagement and 30% energy-use reduction when deployed in more than 130 households across four Indiana cities.

Credit: Image provided, Purdue University

Panagiota Karava, professor in the Lyles School of Civil Engineering, leads a multidisciplinary research team that has developed MySmartE, an eco-feedback and gaming platform for residential energy management. “MySmartE addresses the need to effectively deploy energy-efficiency and decarbonization programs in residential communities that would result in measurable, transferable and sustainable outcomes,” Karava said. “This is accomplished by actively engaging and incentivizing residents in understanding and reducing their home energy use.”

For more information, visit the following link:

<https://www.purdue.edu/newsroom/releases/2023/Q4/purdue-iot-software-platform-uses-gaming-to-motivate-energy-efficient-behaviors-in-residential-communities.html>

Reference

Karava, P. (Nov 29, 2023). Purdue IoT software platform uses gaming to motivate energy-efficient behaviors in residential communities. Recovered Nov 29, 2023, Purdue University:

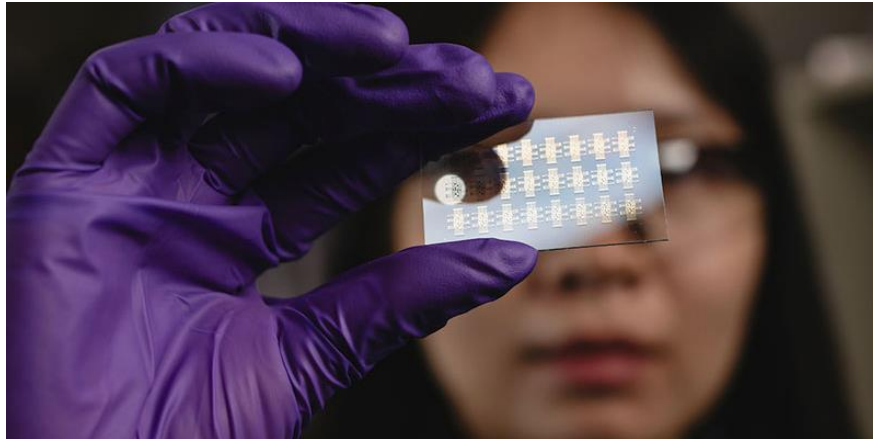
<https://www.purdue.edu/newsroom/releases/2023/Q4/purdue-iot-software-platform-uses-gaming-to-motivate-energy-efficient-behaviors-in-residential-communities.html>

Information source: (Purdue University, 2023)



1.15 Researchers look to the human eye to boost computer vision efficiency

Conventional silicon architecture has taken computer vision a long way, but Purdue University researchers are developing an alternative path — taking a cue from nature — that they say is the foundation of an artificial retina. Like our own visual system, the device is geared to sense change, making it more efficient in principle than the computationally demanding digital camera systems used in applications like self-driving cars and autonomous robots.



*Ke Chen at Purdue University displays a device for computer vision that mimics how retinal cells perceive light.
Crédito: Charles Jischke, Purdue University*

“Computer vision systems use a huge amount of energy, and that’s a bottleneck to using them widely. Our long-term goal is to use biomimicry to tackle the challenge of dynamic imaging with less data processing,” said Jianguo Mei, the Richard and Judith Wien Professor of Chemistry in Purdue’s College of Science. “By mimicking our retina in terms of light perception, our system can be potentially much less data intensive, though there is a long way ahead to integrate hardware with software to make it become a reality.”

For more information, visit the following link:

<https://www.purdue.edu/newsroom/releases/2023/Q4/researchers-look-to-the-human-eye-to-boost-computer-vision-efficiency.html>

Reference

Martialay, M. (Nov 29, 2023). Researchers look to the human eye to boost computer vision efficiency. Recovered Nov 29, 2023, Purdue University:

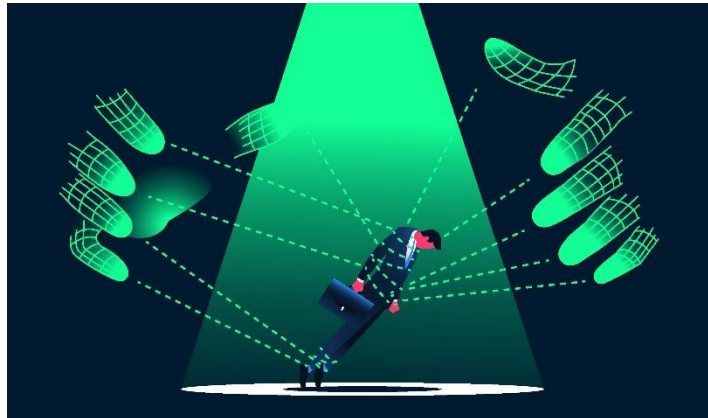
<https://www.purdue.edu/newsroom/releases/2023/Q4/researchers-look-to-the-human-eye-to-boost-computer-vision-efficiency.html>

Information source: (Purdue University, 2023)



1.16 Artificial Intelligence can write a wedding toast or summarize a paper. But what happens when it's asked to build a bomb?

During the past year, large language models (LLMs) have become incredibly adept at generating synthesizing information and producing humanlike outputs. LLMs are likened to digital librarians, as they have been trained on vast datasets sourced directly from the internet and can therefore generate or summarize text on nearly any topic. As a result, these LLMs have become ubiquitous in such fields as copywriting, software engineering, and entertainment.



*As large language models become increasingly adept at synthesizing information and producing human-like responses, many are concerned that malicious actors may use this technology in dangerous ways.
Credit: iStock/Moor Studio, University of Pennsylvania*

However, the body of knowledge and capabilities in LLMs make them attractive targets for malicious actors, and they are highly susceptible to failure modes—often referred to as jailbreaks—that trick these models into generating biased, toxic, or objectionable content.

For more information, visit the following link:

<https://penntoday.upenn.edu/news/ai-can-write-wedding-toast-or-summarize-paper-what-happens-when-its-asked-build-bomb>

Reference

Magubane, N. (Nov 29, 2023). AI can write a wedding toast or summarize a paper. But what happens when it's asked to build a bomb?. Recovered Nov 29, 2023, University of Pennsylvania:

<https://penntoday.upenn.edu/news/ai-can-write-wedding-toast-or-summarize-paper-what-happens-when-its-asked-build-bomb>

Information source: (University of Pennsylvania, 2023)



1.17 Bitcoin could support renewable energy development

Bitcoin mining is often perceived as environmentally damaging because it uses huge amounts of electricity to power its intensive computing needs, but what if the mining process could be used to mitigate climate change instead of accelerating it?

A new study led by Cornell researchers investigated planned renewable energy projects across the U.S. and calculated each project's potential to profit from bitcoin mining during the precommercial development phase, when a wind or solar farm is generating electricity, but has not yet been integrated into the grid. The findings suggest some developers could be recouping millions of dollars, which could be invested in future renewable energy projects. The researchers suggest several policy recommendations that could help improve the economic feasibility of renewable energy projects and reduce carbon emissions. One is to provide economic rewards for environmentally responsible cryptocurrency mining, such as carbon credits for avoided emissions.

For more information, visit the following link:

<https://news.cornell.edu/stories/2023/11/bitcoin-could-support-renewable-energy-development>

Reference

Tessaglia-Hymes, D. (Nov 27, 2023). Bitcoin could support renewable energy development. Recovered Nov 29, 2023, Cornell University:

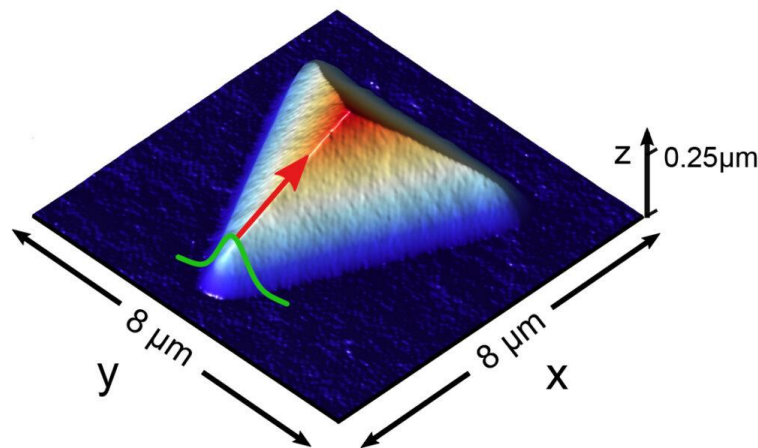
<https://news.cornell.edu/stories/2023/11/bitcoin-could-support-renewable-energy-development>

Information source: (Cornell University, 2023)



1.18 Hard-to-move quasiparticles glide up pyramid edges

A new kind of “wire” for moving excitons, developed at the University of Michigan, could help enable a new class of devices, perhaps including room temperature quantum computers. What’s more, the team observed a dramatic violation of Einstein’s relation, used to describe how particles spread out in space, and leveraged it to move excitons in much smaller packages than previously possible.



*A colorized atomic force microscopy image of a silicon dioxide pyramid with a single layer of tungsten diselenide draped over it. The green line is a graph of the exciton distribution, and the red arrow shows its path from the bottom of the pyramid. The colors on the surface and pyramid indicate the height at that location.
Credit: University of Michigan*

“Nature uses excitons in photosynthesis. We use excitons in OLED displays and some LEDs and solar cells,” said Parag Deotare, co-corresponding author of the study in ACS Nano supervising the experimental work, and an associate professor of electrical and computer engineering. “The ability to move excitons where we want will help us improve the efficiency of devices that already use excitons and expand excitonics into computing.”

For more information, visit the following link:

<https://news.umich.edu/nextgen-computing-hard-to-move-quasiparticles-glide-up-pyramid-edges/>

Reference

McAlpine, K. (Nov 28, 2023). Nextgen computing: Hard-to-move quasiparticles glide up pyramid edges. Recovered Nov 29, 2023, University of Michigan:
<https://news.umich.edu/nextgen-computing-hard-to-move-quasiparticles-glide-up-pyramid-edges/>

Information source: (University of Michigan, 2023)



1.19 Artificial Intelligence image generator Stable Diffusion perpetuates racial and gendered stereotypes

What does a person look like? If you use the popular artificial intelligence image generator Stable Diffusion to conjure answers, too frequently you'll see images of light-skinned men. Stable Diffusion's perpetuation of this harmful stereotype is among the findings of a new University of Washington study. Researchers also found that, when prompted to create images of "a person from Oceania," for instance, Stable Diffusion failed to equitably represent Indigenous peoples. Finally, the generator tended to sexualize images of women from certain Latin American countries (Colombia, Venezuela, Peru) as well as those from Mexico, India and Egypt.



University of Washington researchers found that when prompted to create pictures of "a person," the AI image generator over-represented light-skinned men, sexualized images of certain women of color and failed to equitably represent Indigenous peoples.

Credit: Ghosh et al. / EMNLP 2023 — AI generated image, University of Washington

"It's important to recognize that systems like Stable Diffusion produce results that can cause harm," said Sourojit Ghosh, a UW doctoral student in the human centered design and engineering department. "There is a near-complete erasure of nonbinary and Indigenous identities. For instance, an Indigenous person looking at Stable Diffusion's representation of people from Australia is not going to see their identity represented — that can be harmful and perpetuate stereotypes of the settler-colonial white people being more 'Australian' than Indigenous, darker-skinned people, whose land it originally was and continues to remain."

For more information, visit the following link:

<https://www.washington.edu/news/2023/11/29/ai-image-generator-stable-diffusion-perpetuates-racial-and-gendered-stereotypes-bias/>

Reference

Milne, S. (Nov 29, 2023). AI image generator Stable Diffusion perpetuates racial and gendered stereotypes, study finds. Recovered Nov 29, 2023, University of Washington:

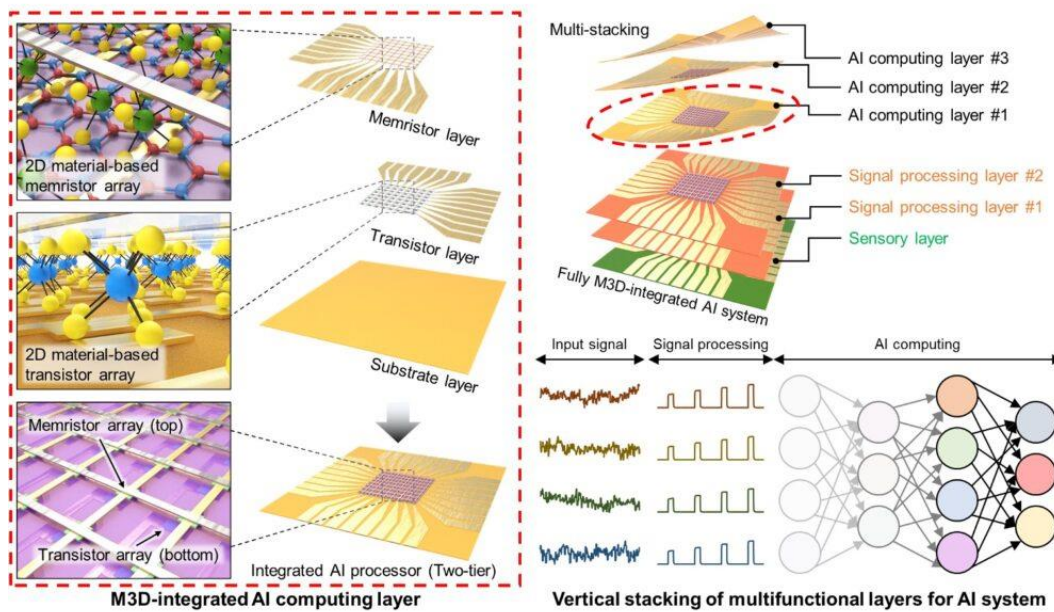
<https://www.washington.edu/news/2023/11/29/ai-image-generator-stable-diffusion-perpetuates-racial-and-gendered-stereotypes-bias/>

Information source: (University of Washington, 2023)



1.20 2D material reshapes 3D electronics for AI hardware

Multifunctional computer chips have evolved to do more with integrated sensors, processors, memory and other specialized components. However, as chips have expanded, the time required to move information between functional components has also grown. “Think of it like building a house,” said Sang-Hoon Bae, an assistant professor of mechanical engineering and materials science at the McKelvey School of Engineering at Washington University in St. Louis. “You build out laterally and up vertically to get more function, more room to do more specialized activities, but then you have to spend more time moving or communicating between rooms.”



Schematic illustration of an edge computing system based on monolithic 3D-integrated, 2D material-based electronics. The system stacks different functional layers, including AI computing layers, signal-processing layers and a sensory layer, and integrates them into an AI processor.

Credit: Image courtesy of Sang-Hoon Bae, Washington University in St. Louis

To address this challenge, Bae and a team of international collaborators, including researchers from the Massachusetts Institute of Technology, Yonsei University, Inha University, Georgia Institute of Technology and the University of Notre Dame, demonstrated monolithic 3D integration of layered 2D material into novel processing hardware for artificial intelligence (AI) computing. They envision that their new approach will not only provide a material-level solution for fully integrating many functions into a single, small electronic chip, but also pave the way for advanced AI computing.

For more information, visit the following link:

<https://source.wustl.edu/2023/11/2d-material-reshapes-3d-electronics-for-ai-hardware/>

Reference

Ballard, S. (Nov 29, 2023). 2D material reshapes 3D electronics for AI hardware. Recovered Nov 29, 2023, Washington University in St. Louis:

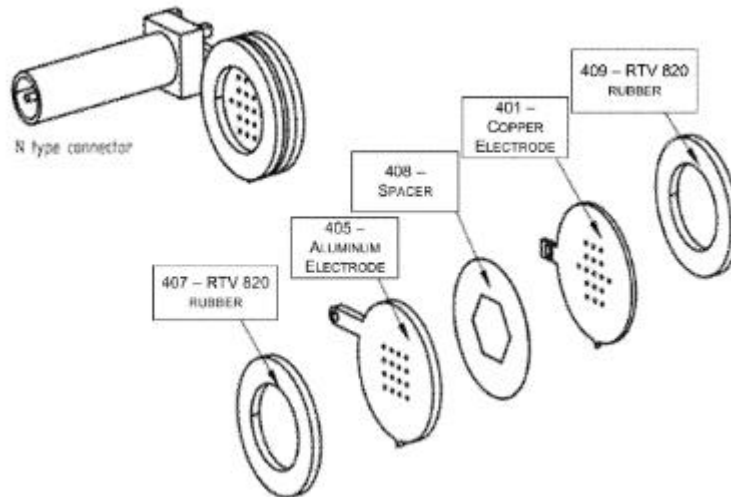
<https://source.wustl.edu/2023/11/2d-material-reshapes-3d-electronics-for-ai-hardware/>

Information source: (Washington University in St. Louis, 2023)

II. PATENTS

2.1. System and method for capturing and converting greenhouse gases

A system and device consisting of a high-electric field nano-pulse generator has been developed. Also, an assembled arrangement with nanomembrane and electrodes, and this previous device is proposed. In general terms, this new technology can be used to capture and convert carbon dioxide, methane or other greenhouse gases, to a broad range of carbon-based compounds and hydrogen.



*Illustrates the components of the electrode system following the new assembly process.
Credit: Romero, V.; Rodriguez, I.; Siles, A.; Esquivel, G. & Feix, T., WIPO IP Portal*

Also, this invention relates to an electrochemical cell that has specific and novel properties associated with new membrane-electrodes assemblies. Preferably, these assemblies associated with high electric fields provide specific conditions for greenhouse gases capturing and conversion in selective and efficient ways. In particular, these conditions are related to the commonly known plasma technology. This invention includes the purification steps before and after of the greenhouse gas conversion cell, called nano-filters. Therefore, a carbon capture system, method, and device are proposed. Data collected by the system are fed to an artificial intelligence.

For more information, visit the following link:

https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023225024&_cid=P10-LPSHC9-14035-1

Reference

Romero, V.; Rodriguez, I.; Siles, A.; Esquivel, G. & Feix, T. (Nov 23, 2023). System and method for capturing and converting greenhouse gases. Recovered Nov 24, 2023, WIPO IP Portal:

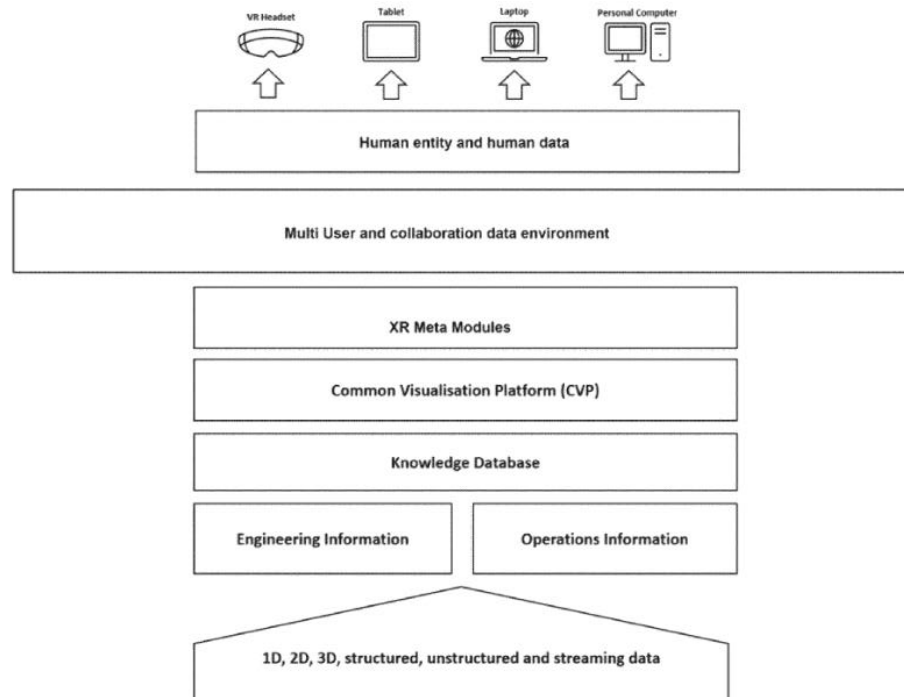
https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023225024&_cid=P10-LPSHC9-14035-1

Information source: (WIPO IP Portal, 2023)



2.2. Servers, systems, and methods for an industrial metaverse

In some embodiments, the system includes a virtual reality environment that includes a digital twin of at least a portion of a physical industrial environment. In some embodiments, the system is configured to change the virtual reality environment based on changes in the physical industrial environment.



Shows a high level schematic of the system representing a portion of the multiple features and technology according to some embodiments.

Credit: Galardo, M.; Giusti, A. & Bennett, S., WIPO IP Portal

In some embodiments, the changes are received by the system through sensors such as temperature and/or pressure sensors, as non-limiting examples. In some embodiments, the changes in the physical environment are detected through the analysis of images. In some embodiments, the system is configured to use artificial intelligence to detect the changes. In some embodiments, the system is configured to predict the effect of changes in the virtual and/or physical environment on other system components through variable changes in virtual models. In some embodiments, the system is configured to display the effects in the virtual environment before they are implemented in the physical environment.

For more information, visit the following link:

https://patentscope.wipo.int/search/es/detail.jsf?docId=US414869293&_cid=P10-LPSHC9-14035-1

Reference

Galardo, M.; Giusti, A. & Bennett, S. (Nov 16, 2023). Servers, systems, and methods for an industrial metaverse. Recovered Nov 17, 2023, WIPO IP Portal:

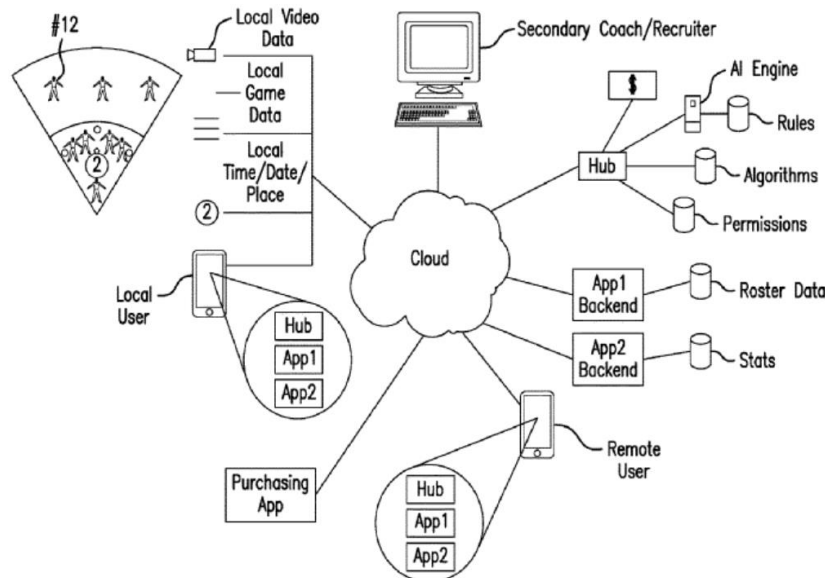
https://patentscope.wipo.int/search/es/detail.jsf?docId=US414869293&_cid=P10-LPSHC9-14035-1

Information source: (WIPO IP Portal, 2023)



2.3. Integrated sports hub application

An apparatus, system and method for a youth sports hub. The foregoing may include: an artificial intelligence (AI) engine capable of integration with a plurality of third party applications; an application programming interface (API) capable of providing the integration.



Illustrates a hub application having an integrated artificial intelligence (AI) engine, suitable to integrate with a variety of apps and/or app functionality.

Credit: McWilliams, T.; Fein, M. & Miltenberger, S., WIPO IP Portal

A hardware integrator capable of linking on-site hardware, including at least a video camera, a scoreboard, and an audio system, to the AI engine; and a graphical user interface (GUI) that is varied by the AI engine according to a user type as indicated by an account with the AI engine, and in which a user is presented with at least a computing interface that integrates simultaneous remote access to ones of the plurality of the third party applications, a video feed from the video camera, a game score from the scoreboard, and in-game audio from the audio system, regarding a particular player in a particular game as identified by the account.

For more information, visit the following link:

https://patentscope.wipo.int/search/es/detail.jsf?docId=US414866270&_cid=P10-LPSHC9-14035-1

Reference

McWilliams, T.; Fein, M. & Miltenberger, S. (Nov 16, 2023). Integrated sports hub application. Recovered Nov 17, 2023, WIPO IP Portal:

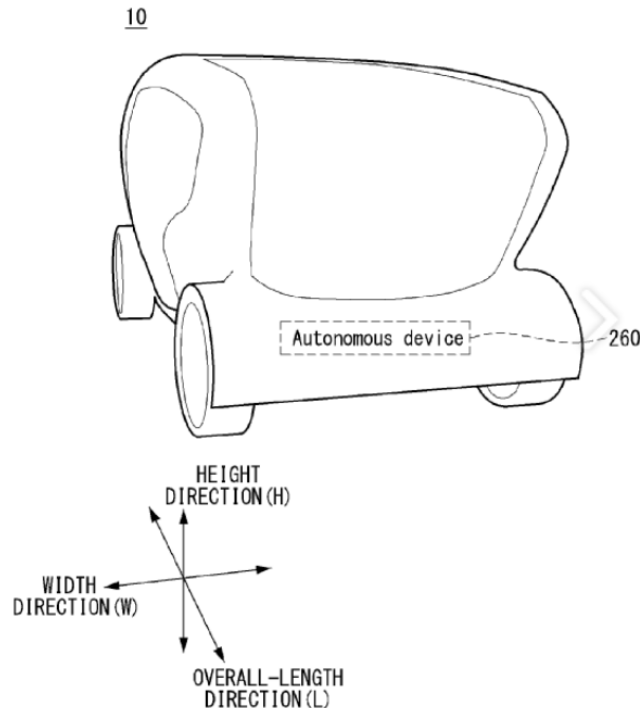
https://patentscope.wipo.int/search/es/detail.jsf?docId=US414866270&_cid=P10-LPSHC9-14035-1

Information source: (WIPO IP Portal, 2023)



2.4. Method for transmitting message at high rate by vehicle

A method for transmitting a controller area network (CAN) message by a first analysis module included in a controller of a vehicle, including measuring a communication state of a CAN bus of the vehicle.



*Is a diagram illustrating a vehicle according to an embodiment of the present disclosure.
Credit: Cheolseung, K.; Youngjin, H. & Jaejin, C., WIPO IP Portal*

Generating a forward list including information for forwarding the CAN message based on the measured value exceeding a first predetermined value; and transferring the forward list to a first forwarding module, wherein the first forwarding module is configured to forward the CAN message on the basis of the forward list. In addition, one or more of an autonomous vehicle, a user terminal, and a server in the present disclosure may be linked with an artificial intelligence module, a drone (unmanned aerial vehicle (UAV)) robot, an augmented reality (AR) device, a virtual reality (VR) device, a 5G service-related device, and the like.

For more information, visit the following link:

https://patentscope.wipo.int/search/es/detail.jsf?docId=US414872139&_cid=P10-LPSHC9-14035-1

Reference

Cheolseung, K.; Youngjin, H. & Jaejin, C. (Nov 23, 2023). Method for transmitting message at high rate by vehicle. Recovered Nov 24, 2023, WIPO IP Portal:

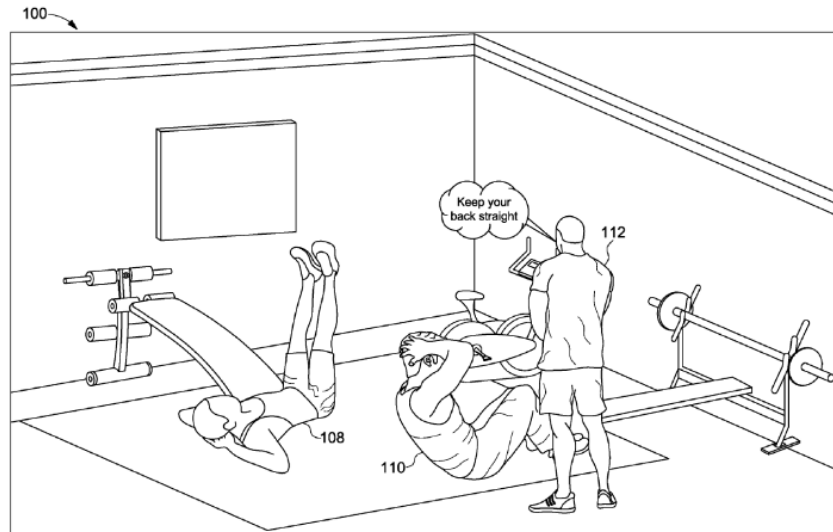
https://patentscope.wipo.int/search/es/detail.jsf?docId=US414872139&_cid=P10-LPSHC9-14035-1

Information source: (WIPO IP Portal, 2023)



2.5. Method and system for providing immersive and interactive fitness experience to a user

The invention relates to method and system for providing an immersive and interactive fitness experience to a user is disclosed. The method includes identifying a pose and a movement corresponding to the user performing one or more activities in a real-world environment; generating, in a metaverse or a virtual environment, an avatar corresponding to the user of the real-world environment based on the pose and the movement identified.



Illustrate exemplary scenarios for providing an immersive and interactive fitness experience to a user, in accordance with some embodiments.

Credit: Trehan, R., WIPO IP Portal

Rendering the pose and the movement identified in the avatar using an Extended Reality (XR) technique; monitoring a pattern of the one or more activities being performed by the user in the real-world environment and the corresponding avatar in the metaverse or the virtual environment using an Artificial Intelligence (AI) model; and dynamically providing a feedback to at least one of the user and the avatar based on the monitoring.

For more information, visit the following link:

https://patentscope.wipo.int/search/es/detail.jsf?docId=US414866248&_cid=P10-LPSHC9-14035-1

Reference

Trehan, R. (Nov 23, 2023). Method and system for providing immersive and interactive fitness experience to a user. Recovered Nov 24, 2023, WIPO IP Portal:

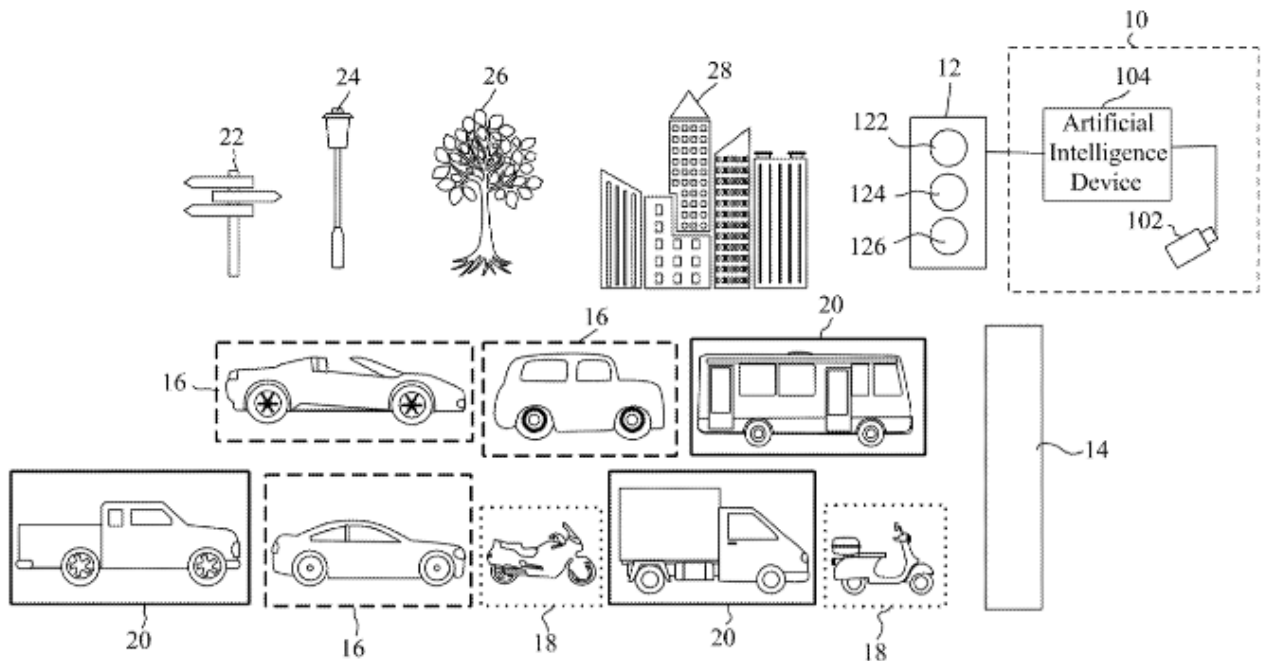
https://patentscope.wipo.int/search/es/detail.jsf?docId=US414866248&_cid=P10-LPSHC9-14035-1

Information source: (WIPO IP Portal, 2023)



2.6. Control system of traffic lights and method thereof

A method for determining a time length for developing a timing plan of traffic light control is disclosed.



*Shows a schematic diagram of an application of a control system of the present invention.
Credit: Cho, H.; Chen, H. & Wu, Y., WIPO IP Portal*

The method comprises the steps of: acquiring a first image at a preset time point before a red light of a traffic light is turned off, wherein the first image includes vehicles stopped at the red light; preprocessing the first image to generate a second image; extracting features from the second image by an artificial intelligence algorithm to generate a feature information, and determining a position relationship between vehicles on multiple lanes in the first image based on the feature information; and, determining the time length by the artificial intelligence algorithm according to the determined position relationship.

For more information, visit the following link:

<https://worldwide.espacenet.com/patent/search/family/088791889/publication/US2023377332A1?q=artificial%20intelligence>

Reference

Cho, H.; Chen, H. & Wu, Y. (Nov 23, 2023). Control system of traffic lights and method thereof. Recovered Nov 24, 2023, Espacenet Patent Search:

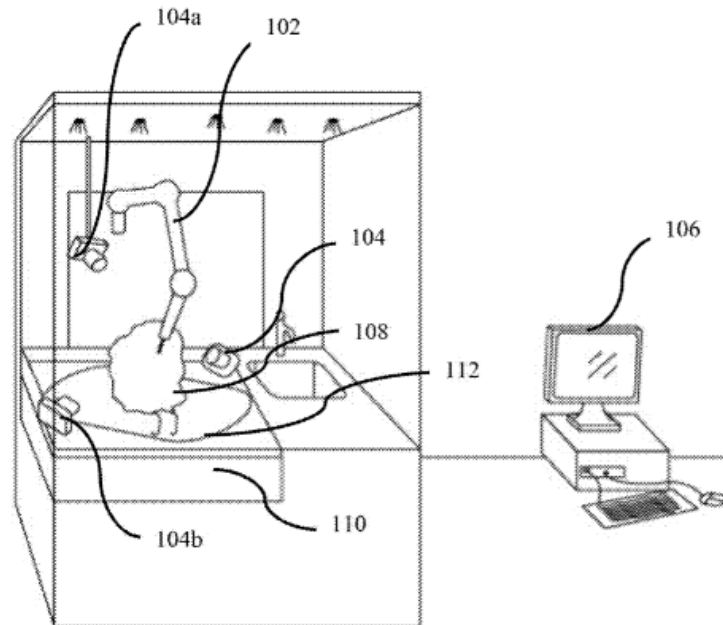
<https://worldwide.espacenet.com/patent/search/family/088791889/publication/US2023377332A1?q=artificial%20intelligence>

Information source: (Espacenet Patent Search, 2023)



2.7. System and method for automated gross examination of tissues

The various embodiments herein provide a system and method for automatic gross-examination of tissue samples. The apparatus is of cubicle shape comprising a bed where the specimen is placed, an ultrasound equipment mounted on top of cubicle box, a robotic arm mounted with a plurality of surgical blades, and a camera.



Illustrates a perspective view of an apparatus for automatic gross-examination of tissue samples, according to one embodiment herein.

Credit: Suresh, A.; Vutukuru, A. & Sampara, S., Espacenet Patent Search

The ultrasound technology is used to accurately understand the specimen, size and dimensions of a tumor that is studied. The robotic arm assisted surgical blades receive ultrasound output or camera output and accurately slice the specimen for further analysis. The information pertaining to gross examination is stored in an external server connected to the apparatus and analyzed using artificial intelligence algorithms.

For more information, visit the following link:

<https://worldwide.espacenet.com/patent/search/family/088791826/publication/US2023377148A1?q=artificial%20intelligence>

Reference

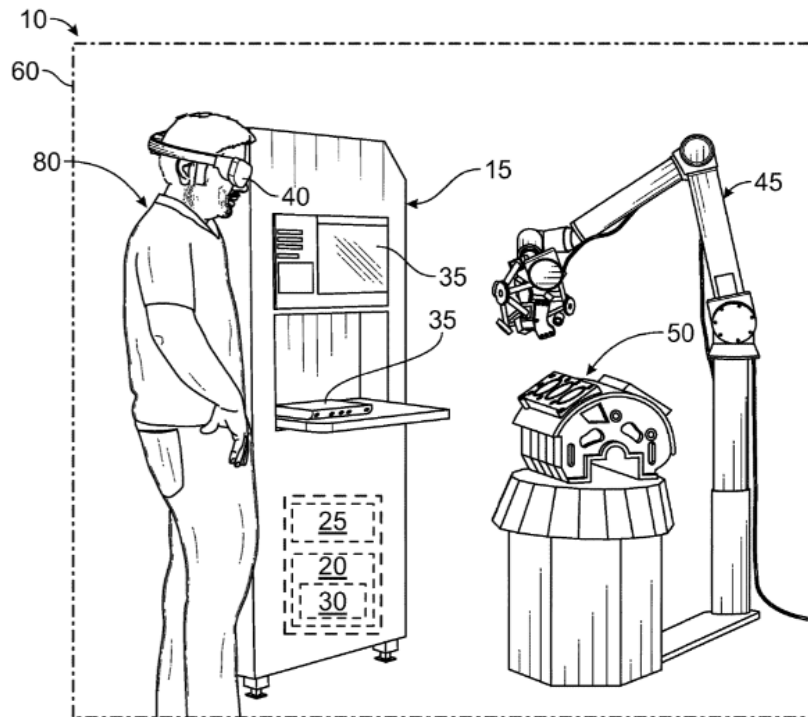
Suresh, A.; Vutukuru, A. & Sampara, S. (Nov 23, 2023). System and method for automated gross examination of tissues. Recovered Nov 24 2023, Espacenet Patent Search:

<https://worldwide.espacenet.com/patent/search/family/088791826/publication/US2023377148A1?q=artificial%20intelligence>

Information source: (Espacenet Patent Search, 2023)

2.8. Metrology 3D scanning system and method

A metrology three-dimensional (3D) scanning system includes a metrology 3D scanning application (app) comprising computing instructions that, when executed by one or more processors, causing the one or more processors to: record human-robot interaction (HRI) data as a human operator operates the HRI device.



Is an illustration of an example metrology 3D scanning system.

Credit: Kang, M.; Armstrong, L.; Robinson, M.; Alban, M.; Johnson, B. & Clark, J., Espacenet Patent Search

Generate a preliminary scan path based on the HRI data for operating a robotic element within an operating environment; move the robotic element along at least a portion of the preliminary scan path and record preliminary scan data comprising at least a subset of dimension data defining at least a target object; generate a metrology scanning path plan and a motion plan for the robotic element based on the preliminary scan data; and execute instructions to move the robotic element within the operating environment according to the metrology scanning path plan and the motion plan for scanning the target object.

For more information, visit the following link:

<https://worldwide.espacenet.com/patent/search/family/088792391/publication/US2023375334A1?q=3d>

Reference

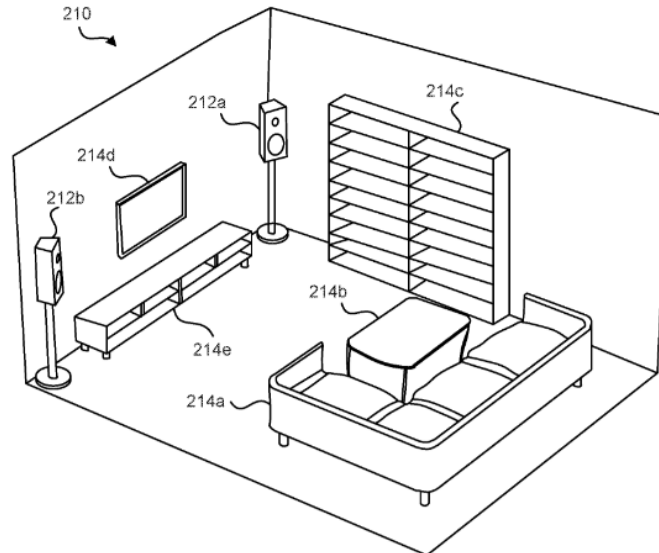
Kang, M.; Armstrong, L.; Robinson, M.; Alban, M.; Johnson, B. & Clark, J. (Nov 23, 2023). Metrology 3D scanning system and method. Recovered Nov 27, 2023, Espacenet Patent Search:
<https://worldwide.espacenet.com/patent/search/family/088792391/publication/US2023375334A1?q=3d>

Information source: (Espacenet Patent Search, 2023)



2.9. Extended reality sound simulations

The present specification describes examples of a computing device for generating an extended reality environment. The example computing device includes a processor to receive placement data for a virtual sound source within the extended reality environment based on a user action within the extended reality environment.



*Illustrates a view of an extended reality environment, according to an example.
Credit: Gonzalez, C.; Havlik, B.; Multari, A.; Kenchanahalli, P., Espacenet Patent Search*

The processor is also to simulate sound generated by the virtual sound source within the extended reality environment based on a user location within the extended reality environment. Sound may be simulated by the processor according to virtual sound source characteristics and interaction with virtual objects. The computing device also includes an extended reality data capture module to capture the placement data and modifications to the virtual sound source within the extended reality environment; and capture the user location within the extended reality environment. The computing device further includes a sound generation device to generate an audible sound of the simulated sound.

For more information, visit the following link:

<https://worldwide.espacenet.com/patent/search/family/088791230/publication/US2023379649A1?q=virtual%20reality>

Reference

Gonzalez, C.; Havlik, B.; Multari, A.; Kenchanahalli, P. (Nov 23, 2023). Extended reality sound simulations. Recovered Nov 27, 2023, Espacenet Patent Search:

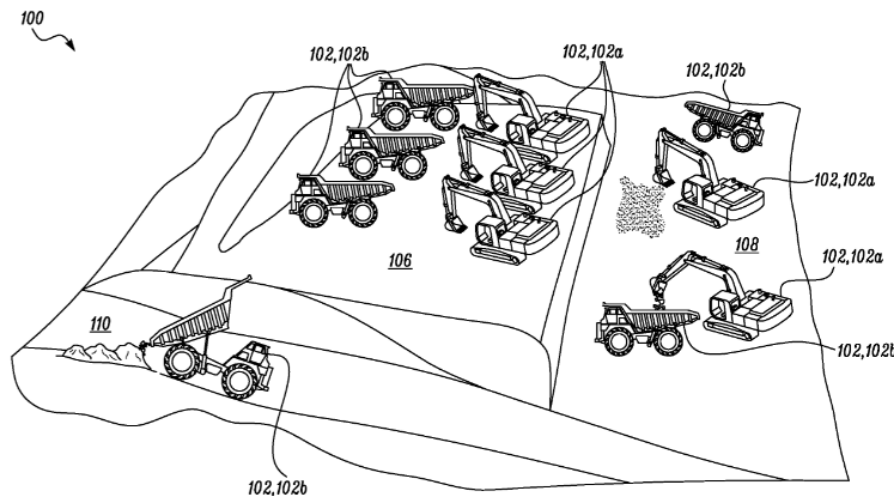
<https://worldwide.espacenet.com/patent/search/family/088791230/publication/US2023379649A1?q=virtual%20reality>

Information source: (Espacenet Patent Search, 2023)



2.10. System and method for suggesting operational zones for a worksite on a device

A method for suggesting and facilitating customization of one or more operational zones for a worksite on a device having a Graphical User Interface (GUI). The method includes obtaining, by a processor, operational data associated with at least one type of machine and displaying, by the processor, one or more operational areas corresponding to the one or more operational zones on the GUI based on the operational data meeting a threshold condition.



Illustrates an exemplary worksite with multiple operational zones, according to an embodiment of the present disclosure.

Credit: Selvaraj, V.; Ramamoorthy, R.; Krishnan, A.; Annadanam, K. & Prasad, P., Espacenet Patent Search

The method further includes receiving one or more user inputs from the GUI to modify the one or more operational areas displayed on the GUI and updating, by the processor, the threshold condition based on the one or more user inputs to generate an updated threshold condition. The method includes reconfiguring, by the processor, the one or more operational areas for subsequent display on the GUI if operational data subsequently received satisfies the updated threshold condition.

For more information, visit the following link:

<https://worldwide.espacenet.com/patent/search/family/088791894/publication/US2023377378A1?q=machine%20learning>

Reference

Selvaraj, V.; Ramamoorthy, R.; Krishnan, A.; Annadanam, K. & Prasad, P. (Nov 23, 2023). System and method for suggesting operational zones for a worksite on a device. Recovered Nov 27, 2023, Espacenet Patent Search:

<https://worldwide.espacenet.com/patent/search/family/088791894/publication/US2023377378A1?q=machine%20learning>

Information source: (Espacenet Patent Search, 2023)