Weekly Newsletter
TECHNOLOGY SURVEILLANCE

Nº 24-2023 JUN 16TH, 2023

CONCYTEC

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 New view on how neurons communicate

An often-overlooked communication strategy for neurons might be more prevalent than previously believed.

Credit: University of Oregon

New research from biology professor Adam Miller's lab in the UO's College of Arts and Sciences illuminates the importance of neuron-to-neuron communication via direct electrical signaling, instead of the usual chemical messengers sent between cells. The team also identified proteins that might link disruptions in these electrical pathways to conditions like autism and epilepsy.

For more information, visit the following link:
https://around.uoregon.edu/content/uo-neuroscientists-get-new-view-how-neurons-communicate

Reference
Hamers, L. (Jun 12, 2023). UO neuroscientists get a new view on how neurons communicate. Recovered Jun 12, 2023, University of Oregon:

https://around.uoregon.edu/content/uo-neuroscientists-get-new-view-how-neurons-communicate

Information source: (University of Oregon, 2023)

1.2 Megawatt electrical motor designed could help electrify aviation

Team of MIT engineers is now creating a 1-megawatt motor that could be a key stepping stone toward electrifying larger aircraft. The team has designed and tested the major components of the motor, and shown through detailed computations that the coupled components can work as a whole to generate one megawatt of power, at a weight and size competitive with current small aero-engines.

Credit: Massachusetts Institute of Technology

For all-electric applications, the team envisions the motor could be paired with a source of electricity such as a battery or a fuel cell. The motor could then turn the electrical energy into mechanical work to power a plane's propellers. The electrical machine could also be paired with a traditional turbofan jet engine to run as a hybrid propulsion system, providing electric propulsion during certain phases of a flight.

For more information, visit the following link:
https://news.mit.edu/2023/megawatt-motor-could-help-electrify-aviation-0608

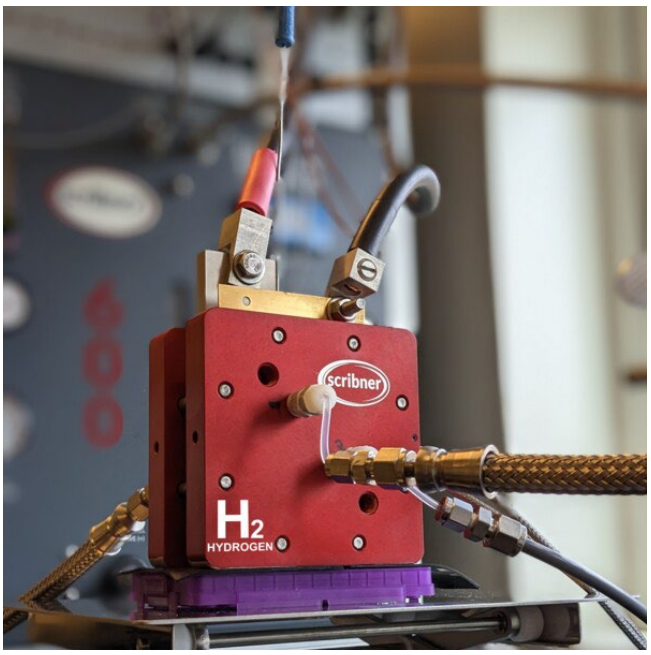
Reference

Chu, J. (Jun 08, 2023). Megawatt electrical motor designed by MIT engineers could help electrify aviation. Recovered Jun 09, 2023, Massachusetts Institute of Technology: https://news.mit.edu/2023/megawatt-motor-could-help-electrify-aviation-0608

Information source: (Massachusetts Institute of Technology, 2023)

1.3 A step closer towards cheap hydrogen

Umeå University researchers have made a breakthrough that may make hydrogen—a clean, CO2-free fuel—more affordable. The team has developed a new method that improves how hydrogen gas is produced from water and electricity, a process that's crucial in our shift toward a more sustainable society.



The researchers produce hydrogen in the lab with a PEM electrolyser. Credit: Umeå University

This major advancement comes from a study led by Eduardo Gracia, a researcher at the Department of Physics at Umeå University. Hydrogen gas is an excellent energy source that can be used to replace fossil fuels. It is produced through a process called water electrolysis where water is split into hydrogen and oxygen. The process requires an electrocatalyst to facilitate the reaction, and nowadays the most efficient technology for such a process is the Proton Exchange Membrane (PEM) water electrolysis.

For more information, visit the following link:
https://www.umu.se/en/news/a-step-closer-towards-cheap-hydrogen_11779256/

Reference
Brännström, S. (Jun 08, 2023). A step closer towards cheap hydrogen. Recovered Jun 09, 2023, Umeå University:
https://www.umu.se/en/news/a-step-closer-towards-cheap-hydrogen_11779256/

Information source: (Umeå University, 2023)

1.4 New recipes for better solar fuel production

Modifying the materials commonly used as photocatalysts helps to overcome their limitations, says the first author of one of the team's recent studies, Yanan Zhao. One of the most widely used materials is titanium dioxide.

"Titanium dioxide can harness energy directly from the sun with negligible pollution and shows great potential in the development of solar-related technologies," she says. *"However, it can only be activated by UV light, which accounts for only 7% of sunlight. It cannot absorb the energy of visible light,"* explains Zhao, who received her master's degree in chemistry from XJTLU and was awarded a full scholarship to pursue her PhD at the University of North Dakota. The researchers found that adding boron nitride to a form of titanium dioxide produced a photocatalyst that can absorb the energy of more wavelengths than UV light. Boron nitride, a compound of boron and nitrogen, has good electrical conductivity and can withstand temperatures of up to 2000 degrees Celsius. Zhao explains the process: *"To prepare the composite photocatalytic material, we combined boron nitride with titanate nanotubes, which are tube-like structures with dimensions measured in nanometres – one nanometre is one-billionth of a metre." "By optimising the ratio of boron nitride to titanate nanotubes and using chemical processes to combine the compounds, we produced a very stable composite photocatalyst. It can absorb light from a wider range of wavelengths and produce more hydrogen compared to traditional physical mixing methods."*

For more information, visit the following link:
https://www.xjtlu.edu.cn/en/news/2023/06/new-recipes-for-better-solar-fuel-production

Reference

Wang, L. & Diamond, C. (Jun 09, 2023). New recipes for better solar fuel production. Recovered Jun 09, 2023, Xi'an Jiaotong-Liverpool University: https://www.xjtlu.edu.cn/en/news/2023/06/new-recipes-for-better-solar-fuel-production

Information source: (Xi'an Jiaotong-Liverpool University, 2023)

1.5 A furnace for safe timber buildings

Timber construction is undergoing a renaissance in Switzerland. ETH researchers at the Hönggerberg campus are using a fire simulator to test timber components for the construction of buildings of all sizes. The custom-built oven permits simulations of realistic fire scenarios.

After 90 minutes, the wooden piece is removed from the furnace and extinguished. Credit: Michael Steiner, Eidgenössische Technische Hochschule Zürich

Not all building fires develop in the same way. The flammable material catches fire, the temperature rises, and the fire grows and spreads. The compartment size and properties, the fire load, the temperature, and the oxygen concentration in the burning room influence its development. The most recent acquisition of the Institute of Structural Engineering in the Department of Civil, Environmental and Geomatic Engineering at ETH Zurich is intended to show how timber structures behave in different fire scenarios. The insights gained from this will help to expand the potential applications of timber as a safe and sustainable construction material.

For more information, visit the following link:
https://ethz.ch/en/news-and-events/eth-news/news/2023/06/a-furnace-for-safe-timber-buildings.html

Reference
Gross, M. (Jun 08, 2023). A furnace for safe timber buildings. Recovered Jun 09, 2023, Eidgenössische Technische Hochschule Zürich: https://ethz.ch/en/news-and-events/eth-news/news/2023/06/a-furnace-for-safe-timber-buildings.html

Information source: (Eidgenössische Technische Hochschule Zürich, 2023)

1.6 Team finds reliable predictor of plant species persistence, coexistence

In a new study reported in the journal Nature, O'Dwyer and his colleague, U. of I. graduate student Kenneth Jops, report the development of a method for determining whether pairs or groups of plant species are likely to coexist over time. Using data from published studies, their approach reliably predicts the complementary life histories of pairs of plants that – while competing for many of the same resources – manage to thrive in a shared habitat.

The method relies on the painstaking collection of years of data about each species, O'Dwyer said. *"Over the last 50 or so years, people have gathered more and more data about plant life histories, your death rates, your reproductive rates, how many seeds you're producing, how quickly you grow into the next life stage – and all of that can be changing throughout your lifespan,"* he said. *"And we write this as a matrix that roughly describes all those aspects of life history – and it's different for every species". "Plant biodiversity is a huge and complex question and I'm glad we were able to shed some light on how life history fits into that puzzle," Jops said. "I hope this will encourage researchers to collect life history data across larger communities so we can apply our theory along with niche, fitness differences and environmental factors to better explain biodiversity patterns across the globe."*

For more information, visit the following link:
https://news.illinois.edu/view/6367/932191349

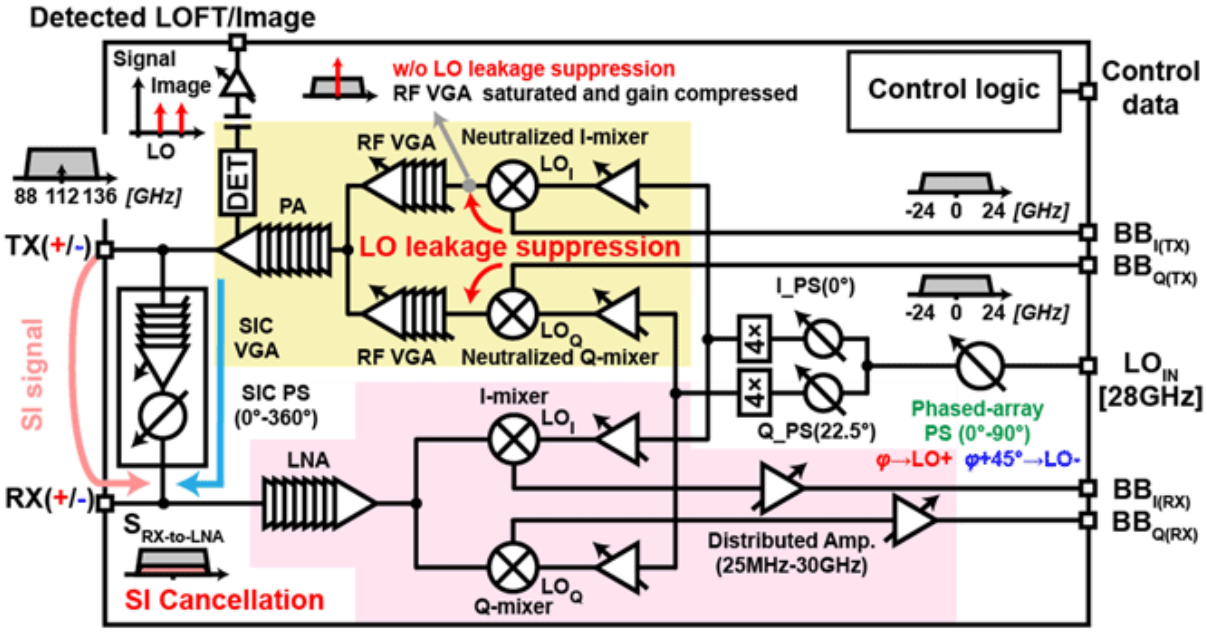
Reference

Yates, D. (Jun 08, 2023). Team finds reliable predictor of plant species persistence, coexistence. Recovered Jun 09, 2023, University of Illinois Urbana-Champaign: https://news.illinois.edu/view/6367/932191349

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

1.7 Preparing the Stage for 6G: A Fast and Compact Transceiver for Sub-THz Frequencies

Scientists and engineers in the field of telecommunications are already working on the technologies that will be used for sixth generation (6G) networks. Ideally, 6G should deliver data rates of over 100 gigabits per second (Gb/s) and support extremely low latencies for applications such as autonomous cars and virtual reality. One way to meet these massive requirements for transmission and reception is to adopt a full-duplex (FD) architecture operating at sub-THz frequencies from 88 to 136 GHz.



Block diagram of the proposed full-duplex (FD) transceiver. Credit: Tokyo Institute of Technology

The main advantage of the FD architecture is that it enables a single system to both transmit and receive signals, effectively doubling the throughput. One way to implement this architecture is to make the transmission and reception modules share a single antenna. This helps reduce the size of the circuit and allows both parts to make full use of the available frequency spectrum. However, single-antenna FD architectures suffer greatly from self-interference (SI), a phenomenon in which the transmitted signal leaks into the receiver side. Such systems must include circuits for SI cancellation that attempt to cancel the generated SI by injecting an equal signal with the opposite polarity. In the sub-THz band, implementing effective SI cancellation is much more challenging than in lower frequencies, which remains a hurdle to single-antenna FD designs.

For more information, visit the following link:
https://www.titech.ac.jp/english/news/2023/066926

Reference

Okada, K. (Jun 09, 2023). Preparing the stage for 6G: a fast and compact transceiver for sub-THz frequencies. Recovered Jun 09, 2023, Tokyo Institute of Technology: https://www.titech.ac.jp/english/news/2023/066926

Information source: (Tokyo Institute of Technology, 2023)

1.8 First Integrated Single-Cell Atlas of the Human Lung

Single-cell technologies, developed in the past decade, enable researchers to study tissues at the resolution of individual cells, giving insight into the different functions of cells that make a whole organ do its job. However, generating a single-cell dataset is time-consuming and expensive, and generally, only a few individuals are included in each study. An international team of researchers now created a single-cell atlas of the human lung by combining 49 different published and newly generated datasets. This provided insight into the wide variety of cells and cell types existing in our lungs.

Prof. Fabian Theis, Head of the Computational Health Center, Director of the Institute of Computational Biology at Helmholtz Munich and Professor at the Technical University of Munich (TUM), explains the project: *"We have created a first integrated reference atlas of the human lung, which includes data from more than a hundred healthy people and reveals how the cells from individuals vary with age, sex, and smoking history. The sheer numbers of cells and individuals involved now gives us the power to see rare cell types and identify new cell states that have not previously been described."* Dr Malte Lücken, Group leader at the Institute of Computational Biology and the Institute of Lung Health & Immunity at Helmholtz Munich adds: *"A comprehensive organ atlas requires many datasets to capture the diversity between both cells and individuals, but combining different datasets is a huge challenge. We developed a benchmarking pipeline to find the optimal method to integrate all datasets into the atlas, using artificial intelligence, and combined knowledge and data from almost 40 previous lung studies."*

For more information, visit the following link:
https://www.tum.de/en/news-and-events/all-news/press-releases/details/erster-ganzheitlicher-einzelzell-atlas-der-menschlichen-lunge

Reference
Theis, F. (Jun 09, 2023). First integrated single-cell atlas of the human lung. Recovered Jun 09, 2023, Technical University of Munich: https://www.tum.de/en/news-and-events/all-news/press-releases/details/erster-ganzheitlicher-einzelzell-atlas-der-menschlichen-lunge

Information source: (Technical University of Munich, 2023)

1.9 Digital tool spots academic text spawned by CHATGPT with 99% accuracy

The peer-reviewed journal *Cell Reports Physical Science* published research showing the efficacy of her AI-detection method, along with sufficient source code for others to replicate the tool. Desaire, the Keith D. Wilner Chair in Chemistry at KU, said accurate AI-detection tools urgently are required to defend scientific integrity. *"ChatGPT and all other AI text generators like it make up facts,"* she said. *"In academic science publishing — writings about new discoveries and the edge of human knowledge — we really can't afford to pollute the literature with believable-sounding falsehoods."*

Desaire said the success of her detection method depends on narrowing the scope of writing under scrutiny to scientific writing of the kind found commonly in peer-reviewed journals. This improves accuracy over existing AI-detection tools, like the RoBERTa detector, which aim to detect AI in more general writing. Desaire and her team's success at detecting AI text may stem from the high level of human insight (versus machine-learning pattern detection) that went into devising the code. *"We used a much smaller dataset and much more human intervention to identify the key differences for our detector to focus on,"* Desaire said. *"To be exact, we built our strategy using just 64 human-written documents and 128 AI documents as our training data. This is maybe 100,000 times smaller than the size of data sets used to train other detectors. People often gloss over numbers. But 100,000 times — that's the difference between the cost of a cup of coffee and a house. So, we had this small data set, which could be processed super quickly, and all the documents could actually be read by people. We used our human brains to find useful differences in the document sets, we didn't rely on the strategies to differentiate humans and AI that had been developed previously."*

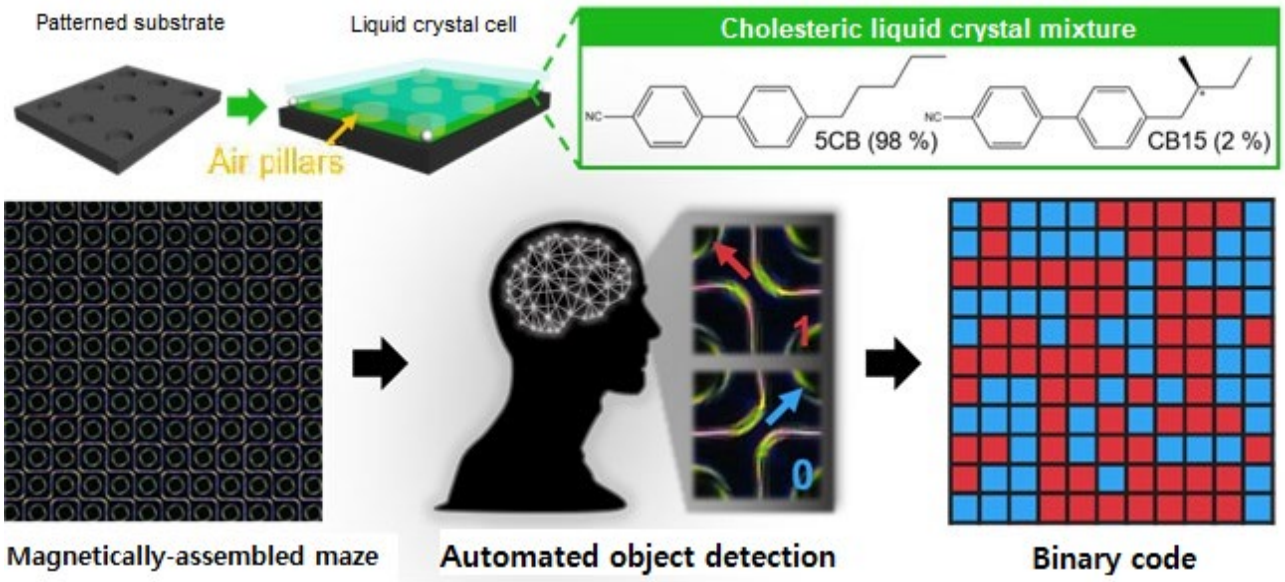
For more information, visit the following link:
https://news.ku.edu/2023/05/19/digital-tool-spots-academic-text-spawned-chatgpt-99-percent-accuracy

Reference
Weybright, S. (Jun 08, 2023). Digital tool spots academic text spawned by CHATGPT with 99% accuracy. Recovered Jun 12, 2023, The University of Kansas: https://news.ku.edu/2023/05/19/digital-tool-spots-academic-text-spawned-chatgpt-99-percent-accuracy

Information source: (The University of Kansas, 2023)

1.10 KAIST research team develops a forgery prevention technique using salmon DNA

With the development of the Internet of Things in recent years, various electronic devices and services can now be connected to the internet and carry out new innovative functions. However, counterfeiting technologies that infringe on individuals' privacy have also entered the marketplace.



Security technology using the maze made up of magnetically-assembled structures formed on a substrate patterned with liquid crystal materials.
Credit: Korea Advanced Institute of Science and Technology

The technique developed by the research team involves random and spontaneous patterns that naturally occur during the self-assembly of two different types of soft materials, which can be used in the same way as human fingerprints for non-replicable security. This is very significant in that even non-experts in the field of security can construct anti-counterfeiting systems through simple actions like drawing a picture.

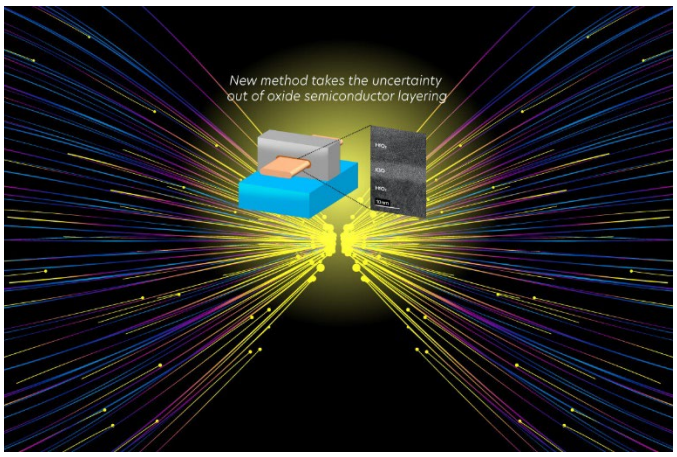
For more information, visit the following link:
https://news.kaist.ac.kr/newsen/html/news/?mode=V&mng_no=29450&skey=&sval=&list_s_date=2023-06-08&list_e_date=2023-06-13&GotoPage=1

Reference
Korea Advanced Institute of Science and Technology. (Jun 08, 2023). KAIST research team develops a forgery prevention technique using salmon DNA. Recovered Jun 12, 2023, Korea Advanced Institute of Science and Technology: https://news.kaist.ac.kr/newsen/html/news/?mode=V&mng_no=29450&skey=&sval=&list_s_date=2023-06-08&list_e_date=2023-06-13&GotoPage=1

Information source: (Korea Advanced Institute of Science and Technology, 2023)

1.11 New method takes the uncertainty out of oxide semiconductor layering

In a study recently published for the VLSI Symposium 2023, researchers from Institute of Industrial Science, The University of Tokyo have reported a deposition process for nanosheet oxide semiconductor. The oxide semiconductor resulting from this process has high carrier mobility and reliability in transistors.



Credit: the University of Tokyo.

3D integrated circuits are made up of multiple layers that each play a role in the overall function. Oxide semiconductors are attracting a lot of attention as materials for various circuit components because they can be processed at low temperature, while still having high carrier mobility and low charge leakage, and are able to withstand high voltages. There are also advantages to using oxides rather than metals in processes where electrodes may be exposed to oxygen during the integration process and become oxidized.

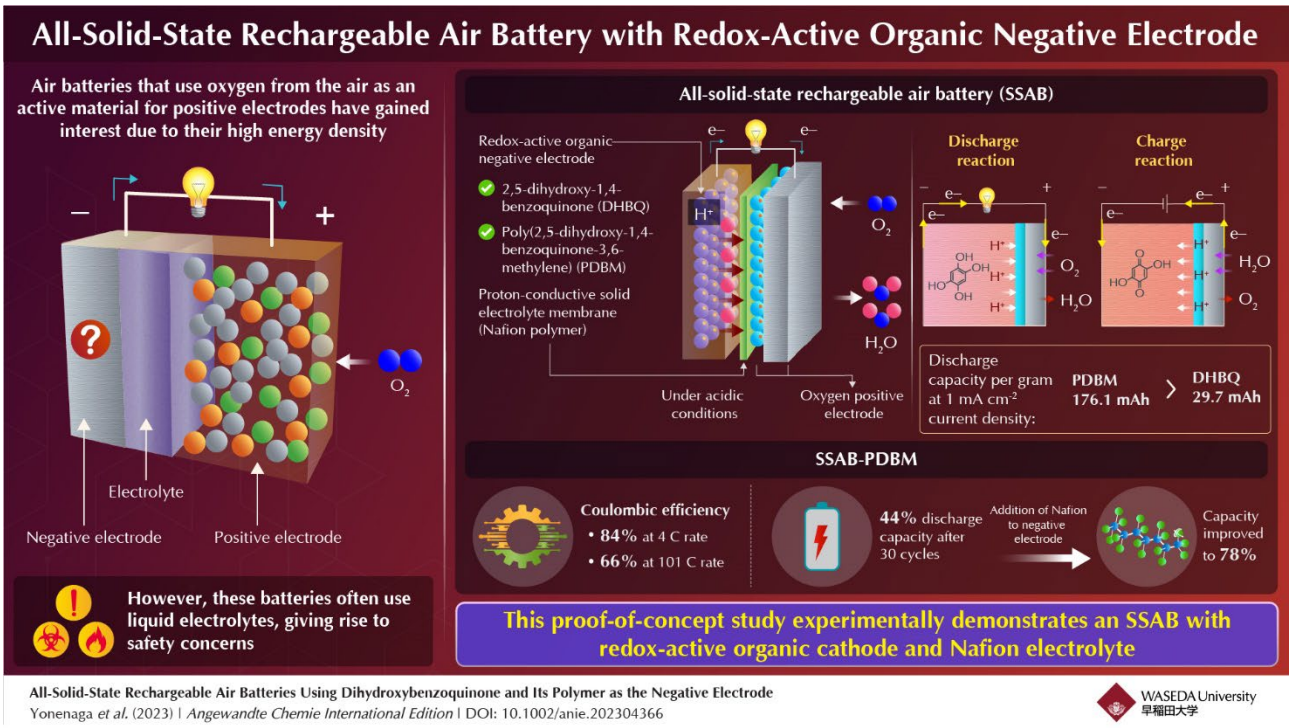
For more information, visit the following link:
https://www.iis.u-tokyo.ac.jp/en/news/4233/

Reference
Kobayashi, M. (Jun 09, 2023). New method takes the uncertainty out of oxide semiconductor layering. Recovered Jun 12, 2023, The University of Tokyo: https://www.iis.u-tokyo.ac.jp/en/news/4233/

Information source: (The University of Tokyo, 2023)

1.12 A novel, completely solid, rechargeable air battery

Solid-state batteries use solid electrodes and solid electrolytes, unlike the more commonly known lithium-ion batteries, which use liquid electrolytes. Solid-state batteries overcome various challenges associated with liquid-based batteries, such as flammability, limited voltage, unstable reactants, and poor long-term cyclability and strength. Making advances in this field, researchers recently demonstrated an all-solid-state rechargeable air battery composed of a redox-active organic negative electrode and a proton-conductive polymer electrolyte.



All-solid-state rechargeable air battery (SSAB) with redox-active organic negative electrode. Credit: Waseda University

This study demonstrates the successful operation of all-solid-state rechargeable air battery (SSAB) comprising redox-active organic molecules as the negative electrode, a proton-conductive polymer as the solid electrolyte, and an oxygen-reducing, diffusion type positive electrode. The researchers hope that it will pave the way for further advancements. *"This technology can extend the battery life of small electronic gadgets such as smartphones and eventually contribute to realizing a carbon-free society,"* concludes Miyatake.

For more information, visit the following link:
https://www.waseda.jp/top/en/news/78001

Reference

Yonenaga, M.; Kaiwa, Y.; Oka, K.; Oyaizu, K. & Miyatake, K. (Jun 12, 2023). A novel, completely solid, rechargeable air battery. Recovered Jun 12, 2023, Waseda University: https://www.waseda.jp/top/en/news/78001

Information source: (Waseda University, 2023)

1.13 Artificial Intelligence unlikely to gain human-like cognition, unless connected to real world through robots

University of Sheffield researchers say artificial intelligence systems are unlikely to gain human-like cognition, unless they're connected to the real world through robots and designed using principles from evolution.

Credit: The University of Sheffield

Current AI systems, such as ChatGPT, copy some processes in the human brain to use datasets to solve difficult problems, but Sheffield researchers say this form of disembodied AI is unlikely to resemble the complexities of real brain processing no matter how big these datasets become. Biological intelligence - such as the human brain - is achieved through a specific architecture that learns and improves using its connections to the real world, but this is rarely used in the design of AI

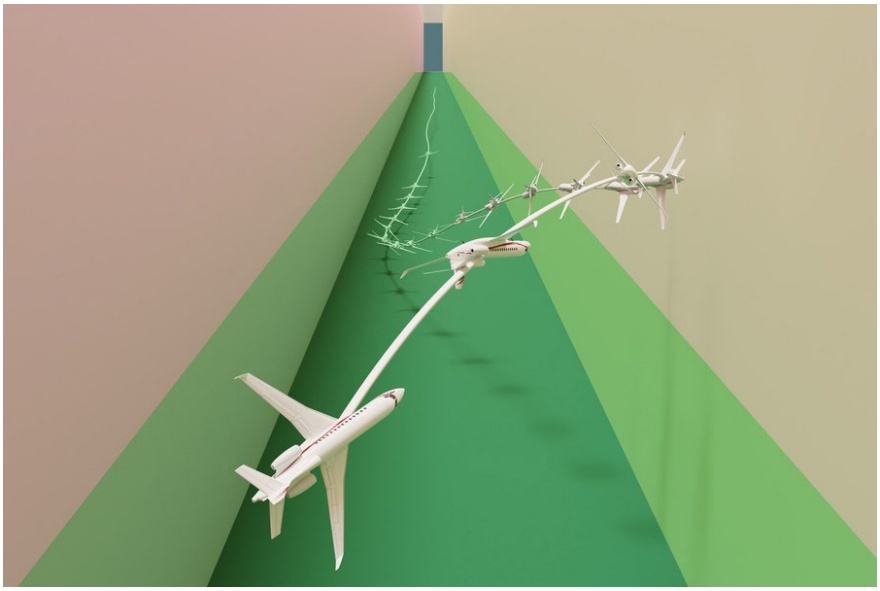
For more information, visit the following link:
https://www.sheffield.ac.uk/news/ai-unlikely-gain-human-cognition-unless-connected-real-world-through-robots

Reference
Barton, S. (Jun 12, 2023). AI unlikely to gain human-like cognition, unless connected to real world through robots. Recovered Jun 12, 2023, University of Sheffield: https://www.sheffield.ac.uk/news/ai-unlikely-gain-human-cognition-unless-connected-real-world-through-robots

Information source: (University of Sheffield, 2023)

1.14 A step toward safe and reliable autopilots for flying

MIT researchers have developed a new technique that can solve complex stabilize-avoid problems better than other methods. Their machine-learning approach matches or exceeds the safety of existing methods while providing a tenfold increase in stability, meaning the agent reaches and remains stable within its goal region.



MIT researchers developed a machine-learning technique that can autonomously drive a car or fly a plane through a very difficult "stabilize-avoid" scenario, in which the vehicle must stabilize its trajectory to arrive at and stay within some goal region, while avoiding obstacles. Credit: Massachusetts Institute of Technology

More effective techniques use reinforcement learning, a machine-learning method where an agent learns by trial-and-error with a reward for behavior that gets it closer to a goal. But there are really two goals here — remain stable and avoid obstacles — and finding the right balance is tedious. To test their approach, they designed a number of control experiments with different initial conditions. For instance, in some simulations, the autonomous agent needs to reach and stay inside a goal region while making drastic maneuvers to avoid obstacles that are on a collision course with it.

For more information, visit the following link:
https://news.mit.edu/2023/safe-and-reliable-autopilots-flying-0612

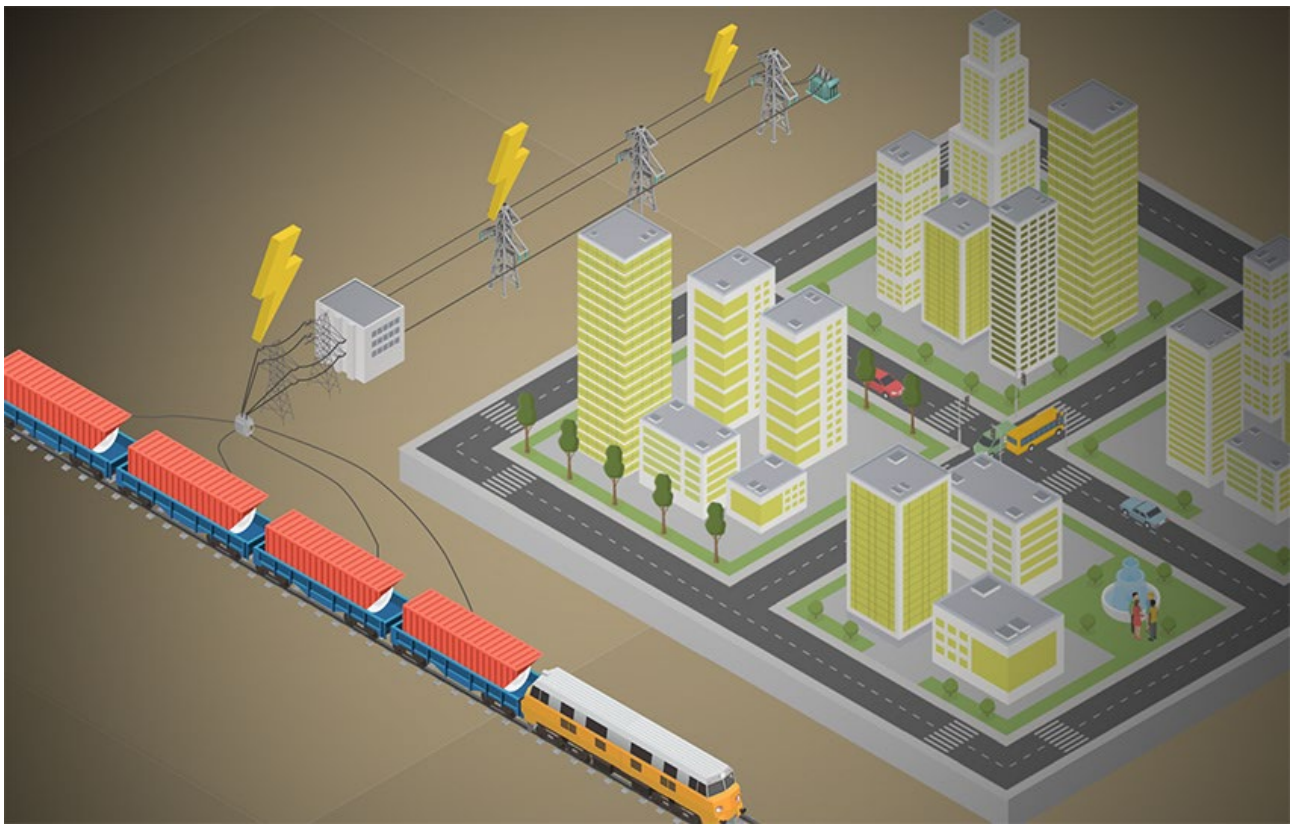
Reference

Zewe, A. (Jun 12, 2023). A step toward safe and reliable autopilots for flying. Recovered Jun 12, 2023, Massachusetts Institute of Technology: https://news.mit.edu/2023/safe-and-reliable-autopilots-flying-0612

Information source: (Massachusetts Institute of Technology, 2023)

1.15 Railways could be a key "utility player" for backup power

New research points to a flexible, cost-effective option for backup power when trouble strikes: batteries aboard trains. A study from the U.S. Department of Energy's Lawrence Berkeley National Laboratory (Berkeley Lab) finds that rail-based mobile energy storage is a feasible way to ensure reliability during exceptional events.



Credit: David Routt/Paint It Black TV Productions

Previous research has shown that, in theory, rail-based energy storage could play a role in meeting the country's daily electricity needs. Berkeley Lab researchers wanted to take this idea further to see whether rail-borne batteries could cost-effectively provide backup power for extreme events – and whether the scenario was feasible on the existing U.S. rail network.

For more information, visit the following link:
https://newscenter.lbl.gov/2023/06/12/railways-key-utility-player-for-backup-power/

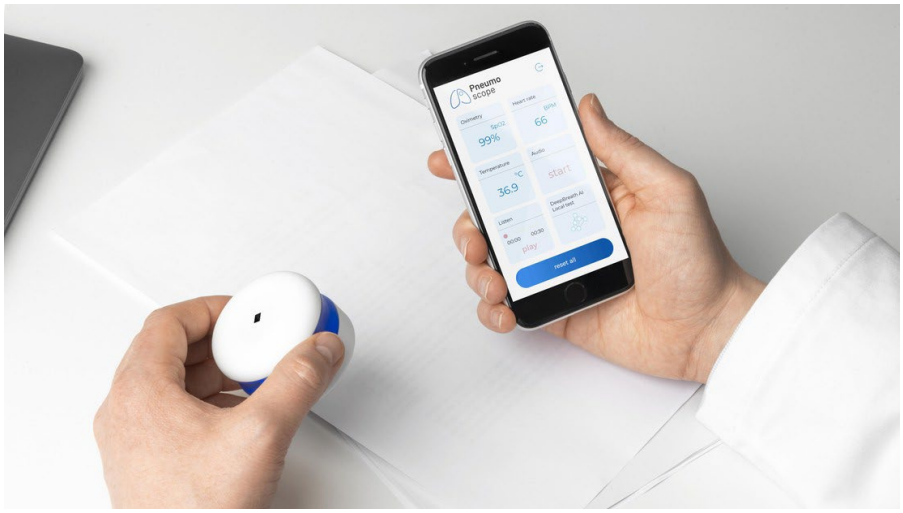
Reference

Nuñez, C. (Jun 12, 2023). Railways could be a key *"utility player"* for backup power. Recovered Jun 12, 2023, Lawrence Berkeley National Laboratory: https://newscenter.lbl.gov/2023/06/12/railways-key-utility-player-for-backup-power/

Information source: (Lawrence Berkeley National Laboratory, 2023)

1.16 Deep Learning to identify respiratory disease

A new AI algorithm developed at Ecole Polytechnique Fédérale de Lausanne (EPFL, por sus siglas en francés) and University Hospital Geneva (HUG) will power an intelligent stethoscope - Pneumoscope - with the potential to improve the management of respiratory disease in low-resource and remote settings.



Credit: Ecole Polytechnique Fédérale de Lausanne

Dr Hartley's team is leading the AI development for Onescope and she is particularly excited by the potential of the tool in low-resource and remote settings. *"Reusable, consumable-free diagnostic tools like this intelligent stethoscope have the unique advantage of guaranteed sustainability,"* she explained, adding *"AI tools also have the potential to continually improve themselves and I am hopeful that we could expand the algorithm to other respiratory diseases and populations with further data."*

For more information, visit the following link:
https://actu.epfl.ch/news/deepbreath-using-deep-learning-to-identify-respi-2/

Reference
Petersen, T. (Jun 12, 2023). DeepBreath: Using Deep Learning to identify respiratory disease. Recovered Jun 13, 2023, Ecole Polytechnique Fédérale de Lausanne: https://actu.epfl.ch/news/deepbreath-using-deep-learning-to-identify-respi-2/

Information source: (Ecole Polytechnique Fédérale de Lausanne, 2023)

1.17 How can bias be removed from artificial intelligence-powered hiring platforms?

Today, 70% of companies use automated applicant tracking systems to find and hire talent, according to industry estimates. However, many of the algorithms used by recruiters to manage their hiring process have been shown to reproduce, and sometime amplify, biases and human errors they are supposed to eliminate.

"Hiring is a crucible in which forces of preference, privilege, prejudice, law, and now, algorithms and data, interact to shape an individual's future," said Dwork, who has made pioneering contributions to private data analysis, cryptography, distributed computing, and the theory of algorithmic fairness. *"We will investigate pathways to minimize the transfer of persistent patterns of hiring bias and discrimination onto electronic platforms, from data and algorithms to corrective transformations and law."* Dwork's research has demonstrated that systems composed of elements that are *"fair"* in isolation are not necessarily fair overall.

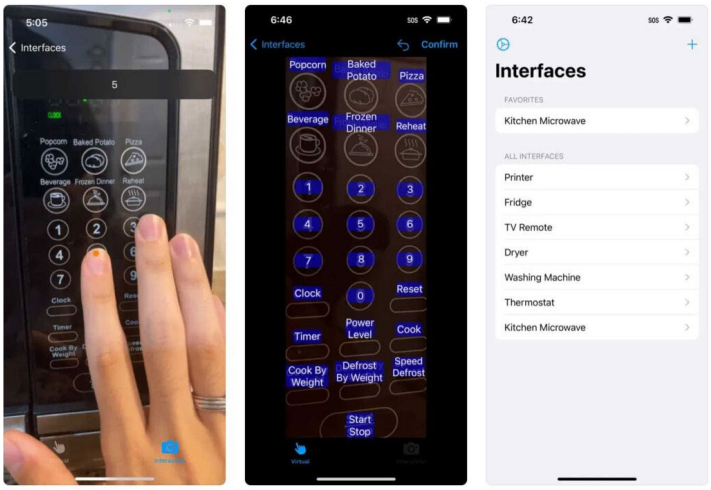
For more information, visit the following link:
https://seas.harvard.edu/news/2023/06/how-can-bias-be-removed-artificial-intelligence-powered-hiring-platforms

Reference
Dwork, C. (Jun 12, 2023). How can bias be removed from artificial intelligence-powered hiring platforms?. Recovered Jun 13, 2023, Harvard John A. Paulson School of Engineering and Applied Sciences: https://seas.harvard.edu/news/2023/06/how-can-bias-be-removed-artificial-intelligence-powered-hiring-platforms

Information source: (Harvard John A. Paulson School of Engineering and Applied Sciences, 2023)

1.18 New apps for visually impaired users provide virtual labels for controls and a way to explore images

Visually impaired iPhone users have two new free tools at their disposal, developed by a team now based at the University of Michigan. One can read the labels on control panels while the other identifies features in an image so that users can explore it through touch and audio feedback.



VizLens uses a smartphone's camera to view control interfaces, such as the one on this microwave, and read each label. When a user touches the button in the camera's view, the smartphone can read out the label.
Credit: Human-AI Lab, University of Michigan

VizLens is essentially a screen reader that can function in the real world. It reads labels at the direction of the user, who points with their fingers at buttons of interest on control panels. With it, users can employ their smartphone cameras to understand and operate a variety of interfaces in their everyday environments, including home appliances and public kiosks. *"A blind user can take a picture of an interface, and we use optical character recognition to automatically detect the text labels. A user can first familiarize themself with the layout on their smartphone touchscreen. Then, they can move their finger on the physical appliance control panel, and the app will speak out the button under the user's finger,"* said Anhong Guo, U-M assistant professor of computer science and engineering, who led the development of both apps.

For more information, visit the following link:
https://news.umich.edu/new-apps-for-visually-impaired-users-provide-virtual-labels-for-controls-and-a-way-to-explore-images/

Reference

France, E. (Jun 12, 2023). New apps for visually impaired users provide virtual labels for controls and a way to explore images. Recovered Jun 13, 2023, University of Michigan: https://news.umich.edu/new-apps-for-visually-impaired-users-provide-virtual-labels-for-controls-and-a-way-to-explore-images/

Information source: (University of Michigan, 2023)

1.19 Four-legged robot traverses tricky terrains thanks to improved 3D vision

Researchers led by the University of California San Diego have developed a new model that trains four-legged robots to see more clearly in 3D. The advance enabled a robot to autonomously cross challenging terrain with ease—including stairs, rocky ground and gap-filled paths—while clearing obstacles in its way.

To improve the robot's 3D perception, the researchers developed a model that first takes 2D images from the camera and translates them into 3D space. It does this by looking at a short video sequence that consists of the current frame and a few previous frames, then extracting pieces of 3D information from each 2D frame. That includes information about the robot's leg movements such as joint angle, joint velocity and distance from the ground. The model compares the information from the previous frames with information from the current frame to estimate the 3D transformation between the past and the present. The model fuses all that information together so that it can use the current frame to synthesize the previous frames. As the robot moves, the model checks the synthesized frames against the frames that the camera has already captured. If they are a good match, then the model knows that it has learned the correct representation of the 3D scene. Otherwise, it makes corrections until it gets it right. The 3D representation is used to control the robot's movement. By synthesizing visual information from the past, the robot is able to remember what it has seen, as well as the actions its legs have taken before, and use that memory to inform its next moves.

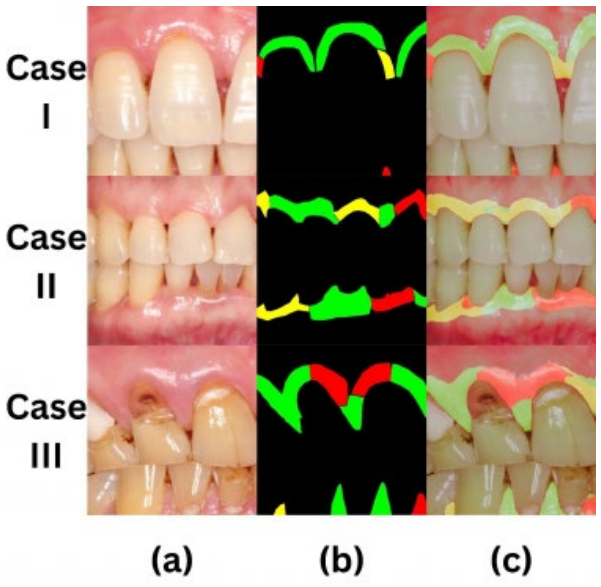
For more information, visit the following link:
https://today.ucsd.edu/story/four-legged-robot-traverses-tricky-terrains-thanks-to-improved-3d-vision

Reference
Labios, L. (Jun 13, 2023). Four-legged robot traverses tricky terrains thanks to improved 3D vision. Recovered Jun 13, 2023, University of California - San Diego: https://today.ucsd.edu/story/four-legged-robot-traverses-tricky-terrains-thanks-to-improved-3d-vision

Information source: (University of California - San Diego, 2023)

1.20 Artificial Intelligence for early detection of gum inflammation

A groundbreaking study led by researchers at the Faculty of Dentistry of the University of Hong Kong (HKU), in collaboration with multiple international institutions has successfully demonstrated the use of artificial intelligence (AI) in detecting gum inflammation, also known as gingivitis, from intraoral photographs.



Three cases illustrating dentist's visual examination (b) and AI's detection (c) of gum problems. (a) Intraoral photograph. (b) Health status labelled by a calibrated dentist (green=healthy, red=diseased, yellow=questionable). (c) AI detection results
Credit: Faculty of Dentistry, The University of Hong Kong

This cutting-edge technology can revolutionise early detection and prevention of oral and systemic diseases linked to gum inflammation, such as tooth loss, cardiovascular diseases, and diabetes. The study, published in the prestigious International *Dental Journal*, an official journal of the World Dental Federation (FDI), shows that AI algorithms can analyse patients' intraoral photographs to detect signs of inflammation like redness, swelling, and bleeding along the gum margin with over 90% accuracy, matching the visual examination of a dentist. This innovative technology enables population-wide monitoring of gum health and paves the way for more personalised dental care.

For more information, visit the following link:
https://hku.hk/press/news_detail_26242.html

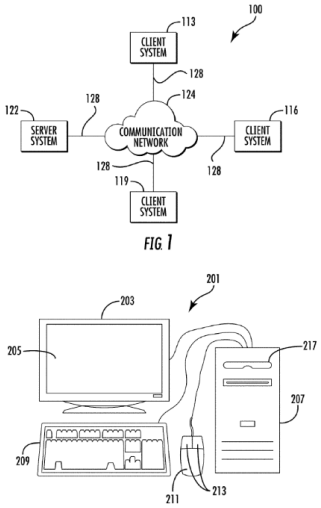
Reference
Tang, M. (Jun 14, 2023). HKU Dentistry team uses artificial intelligence for early detection of gum inflammation. Recovered Jun 14, 2023, The University of Hong Kong: https://hku.hk/press/news_detail_26242.html

Information source: (The University of Hong Kong, 2023)

2 PATENTS

2.1 Diverse cosmetic and skin care product matching system

Various techniques pertain to a system having multiple mobile computing devices that includes a unified front end computing device and a mobile computing device of a client, a first artificial intelligence model operatively coupled to the multiple mobile computing devices and predicting a predicted body characteristic of a part of a body of the client for providing body care to the client.



Shows a more detailed diagram of an exemplary client or server computer which may be used in an implementation of the invention.
Credit: Tendulkar, P.; Mensah, N.; Teresa, A.; Bertone, J.; Zhu, L.; Stokes, J.; Liujanto, W.; Oelckers, A.; Mccotter, M.; Haddar, H.; Kavanagh, F.; Adiraju, A. & Janardhan, N., WIPO IP Portal

A second artificial intelligence model operatively coupled to the multiple mobile computing devices and predicting a list of products or services for the body care at least by executing a recommendation service on the list of products or services, and a data lake that is integrated with multiple application programming interfaces across multiple computing nodes and stores multiple types of data for predicting the list of products or services by the first artificial intelligence model and for predicting the personalized recommendation by the second artificial intelligence model.

For more information, visit the following link:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US399236620&_cid=P22-LIW4U4-22855-5

Reference
Tendulkar, P.; Mensah, N.; Teresa, A.; Bertone, J.; Zhu, L.; Stokes, J.; Liujanto, W.; Oelckers, A.; Mccotter, M.; Haddar, H.; Kavanagh, F.; Adiraju, A. & Janardhan, N. (Jun 08, 2023).

Diverse cosmetic and skin care product matching system. Recovered Jun 08, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/es/detail.jsf?docId=US399236620&_cid=P22-LIW4U4-22855-5

Information source: (WIPO IP Portal, 2023)

2.2 Electronic apparatus and control method thereof

An electronic apparatus and a control method thereof are provided. The control method of the electronic apparatus includes receiving, from a first external electronic apparatus and a second external electronic apparatus, a first artificial intelligence model and a second artificial intelligence model used by the first and second external electronic apparatuses, respectively.

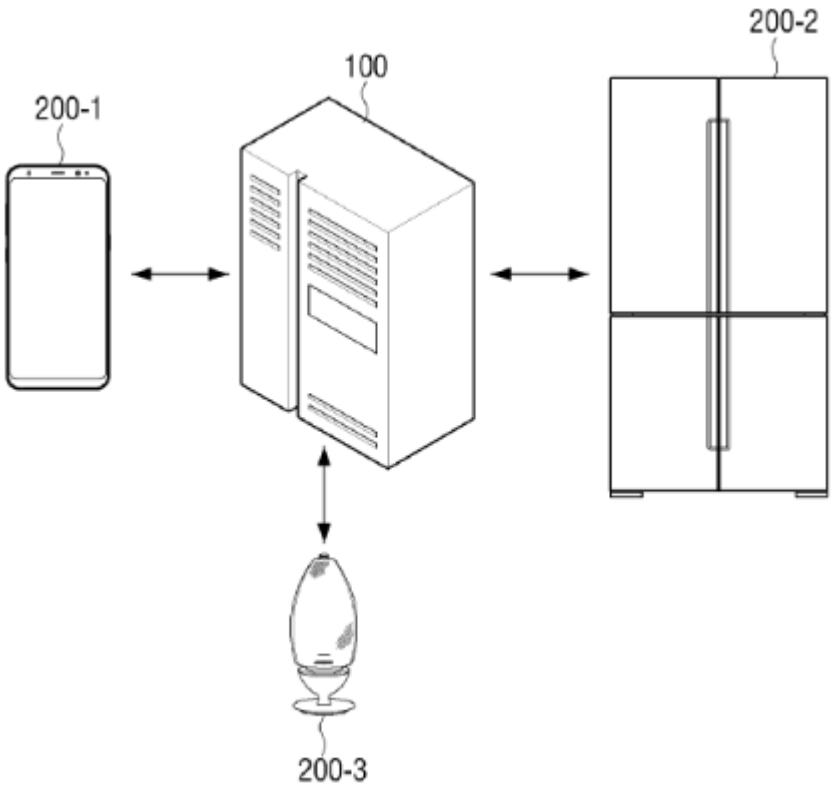


Diagram schematically illustrating an embodiment of the disclosure. Credit: Han, Y.: Kim, K. & et. al., WIPO IP Portal

And a plurality of learning data stored in the first and second external electronic apparatuses, identifying first learning data, which corresponds to second learning data received from the second external electronic apparatus, among learning data received from the first external electronic apparatus, training the second artificial intelligence model used by the second external electronic apparatus based on the first learning data, and transmitting the trained second artificial intelligence model to the second external electronic apparatus.

For more information, visit the following link:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US399236411&_cid=P22-LIW4U4-22855-6

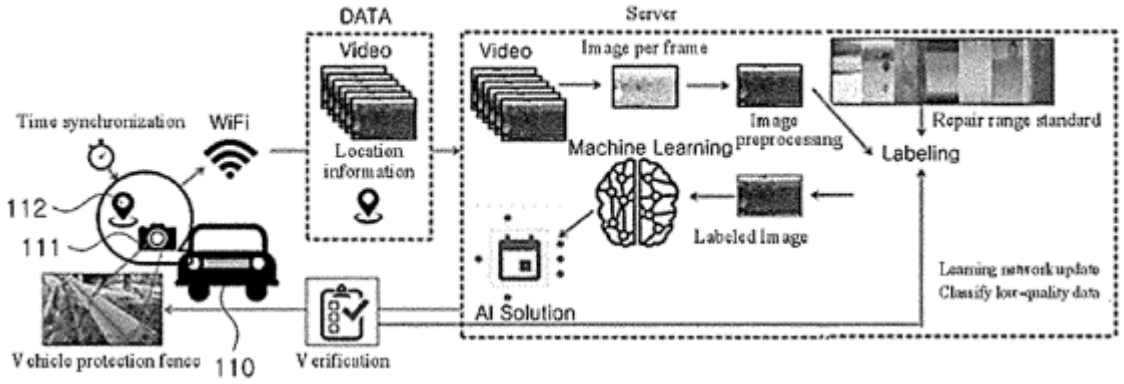
Reference

Han, Y.: Kim, K. & et. al. (Jun 08, 2023). Electronic apparatus and control method thereof. Recovered Jun 08, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/es/detail.jsf?docId=US399236411&_cid=P22-LIW4U4-22855-6

Information source: (WIPO IP Portal, 2023)

2.3 Vehicle protection fence repair plating system and method using artificial intelligence

Disclosed is a vehicle protection fence repair plating system and method using artificial intelligence. The system includes a data management module that collects video data about a vehicle protection fence and pre-processes images per frame.



Schematic configuration diagram for describing overall operation of a vehicle protection fence repair plating system using artificial intelligence according to an embodiment of the inventive concept.
Credit: Chon, H.; Han, A. & et. al., WIPO IP Portal

A data prediction module that receives the data of the pre-processed image and performs machine learning for a corrosion level of the vehicle protection fence according to a preset labeling standard to detect a work area, and a process management module that standardizes customized work instructions according to a determination result of an image state of the vehicle protection fence, which has been machine-learned, wherein the data prediction module specifies a repair range of the vehicle protection fence and a work method for each repair range according to the labeling standard.

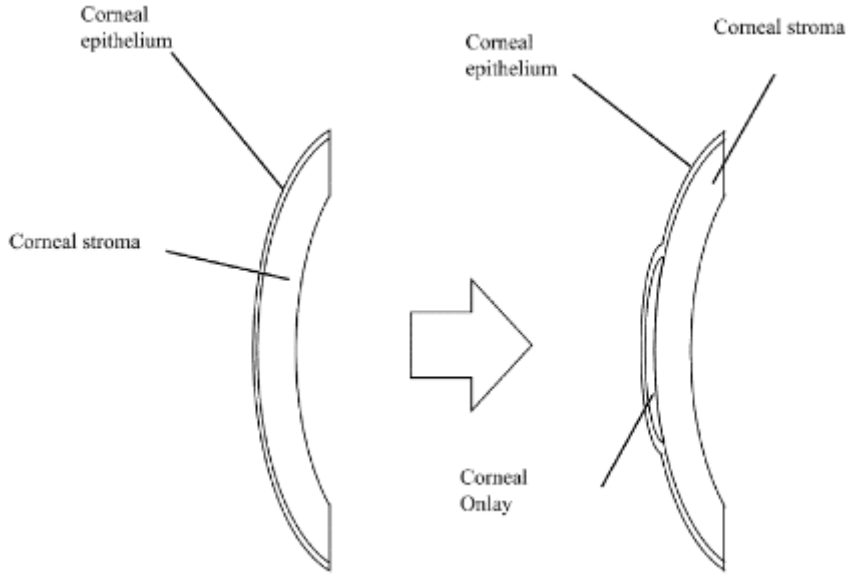
For more information, visit the following link:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US399236716&_cid=P22-LIW4U4-22855-2

Reference
Chon, H.; Han, A. & et. al. (Jun 08, 2023). Vehicle protection fence repair plating system and method using artificial intelligence. Recovered Jun 08, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/es/detail.jsf?docId=US399236716&_cid=P22-LIW4U4-22855-2

Information source: (WIPO IP Portal, 2023)

2.4 Bioengineered corneal grafts

The present invention discloses bioengineered corneal grafts for treating either or both Keratoconus and visual impairment, selected from (i) a corneal Onlay comprises or coated by at least one member of Group A, consisting of biocompatible synthetic materials; at least one member of Group B, consisting of at least one type of biological polymer and optionally, at least one member of Group C, consisting of at least one type of protein.



Schematically illustrates a corneal Onlay according one embodiment of the present invention. Credit: Eisenbach, A.; Eitan, A. & et. al., WIPO IP Portal

(ii) An intrastromal corneal lenticule graft, configured to mimic native corneal stroma tissue by means of its optical properties, mechanical properties, permeability and interaction with corneal stromal cells; wherein at least one portion of said lenticule comprises or coated by at least one member of Group D, consisting of transparent crosslinked hydrogel; at least one member of Group E, consisting of collagen; collagen methacrylate, recombinant mammal collagen, mammal-sourced collagen; and optionally, at least one member of Group F, consisting of Keratocytes and/or stem cells and any combination thereof. The present invention further discloses compositions, methods for production, implementation and treatment of medical indications by aforesaid corneal graft.

For more information, visit the following link:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US399237352&_cid=P22-LIW6XQ-50628-1

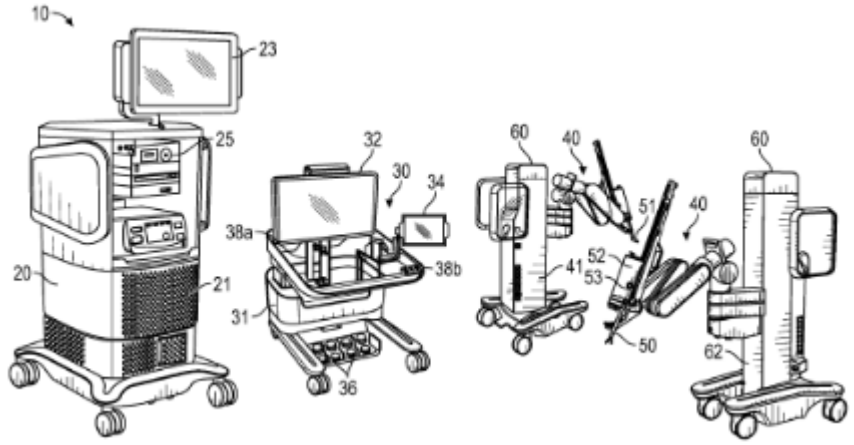
Reference
Eisenbach, A.; Eitan, A. & et. al. (Jun 08, 2023). Bioengineered corneal grafts. Recovered Jun 08, 2023, WIPO IP Portal:

https://patentscope.wipo.int/search/es/detail.jsf?docId=US399237352&_cid=P22-LIW6XQ-50628-1

Information source: (WIPO IP Portal, 2023)

2.5 System and method for integrated control of 3D visualization through a surgical robotic system

A surgical robotic system includes a control tower, a mobile cart, and a surgical console. The mobile cart is coupled to the control tower and includes a surgical robotic arm.



Schematic illustration of a surgical robotic system including a control tower, a console, and one or more surgical robotic arms in accordance with aspects of the present disclosure; Credit: Meglan, D.; Rosenberg, M. & Pierce, R., WIPO IP Portal

The surgical robotic arm includes a surgical instrument and an image capture device. The surgical instrument is actuatable in response to a user input and configured to treat a target tissue in real-time. The image capture device for capturing at least one of images or video of the target tissue in real-time. The surgical console includes a user input device for generating a user input, and a controller. The controller is operably coupled to the user input device and configured to switch, based on the user input, from a first mode to a second mode, and from the second mode to the first mode.

For more information, visit the following link:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US399237018&_cid=P22-LIW777-54063-2

Reference
Meglan, D.; Rosenberg, M. & Pierce, R. (Jun 08, 2023). System and method for integrated control of 3D visualization through a surgical robotic system. Recovered Jun 08, 2023, WIPO IP Portal:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US399237018&_cid=P22-LIW777-54063-2

Information source: (WIPO IP Portal, 2023)

2.6 Computing apparatus and method for performing reinforcement learning using multimodal artificial intelligence agent

Disclosed herein are a computing apparatus and method for performing reinforcement learning using a multimodal artificial intelligence agent.

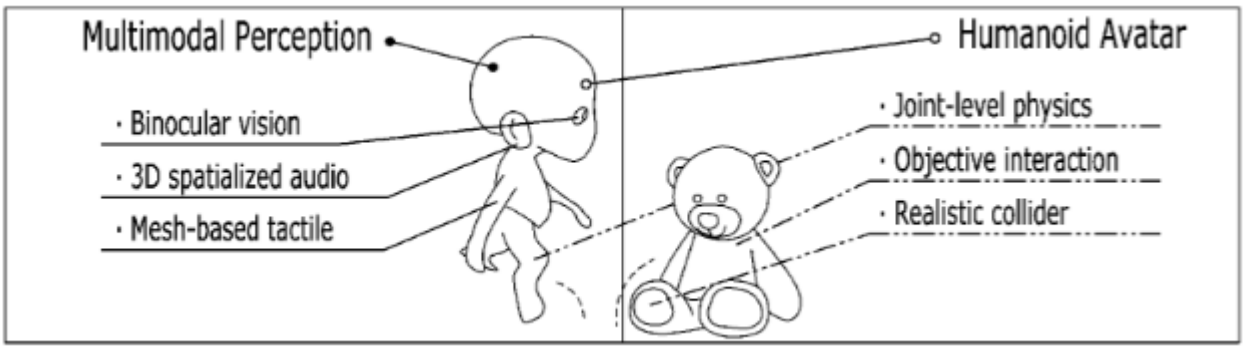


Diagram illustrating the humanoid characteristics of a multimodal artificial intelligence agent. Credit: Zhang, B.; Oh, H.; Park, K.; Lee, Y.; Lee, M.; Lee, M.; Lee, G. & Park, J., Espacenet Patent Search

The method for performing reinforcement learning using a multimodal artificial intelligence agent includes: dividing frames, included in images acquired by capturing a virtual environment, into a plurality of sections; and performing reinforcement learning by applying any one of a plurality of guidance types to each of the plurality of sections and then allowing a multimodal artificial intelligence agent to interact with the virtual environment through the images. The plurality of guidance types is classified into three or more types according to their guidance level. Performing the reinforcement learning is performing reinforcement learning by applying a moderate-level guidance type to the sections of predetermined critical periods and also applying any one of the plurality of guidance types to the other sections.

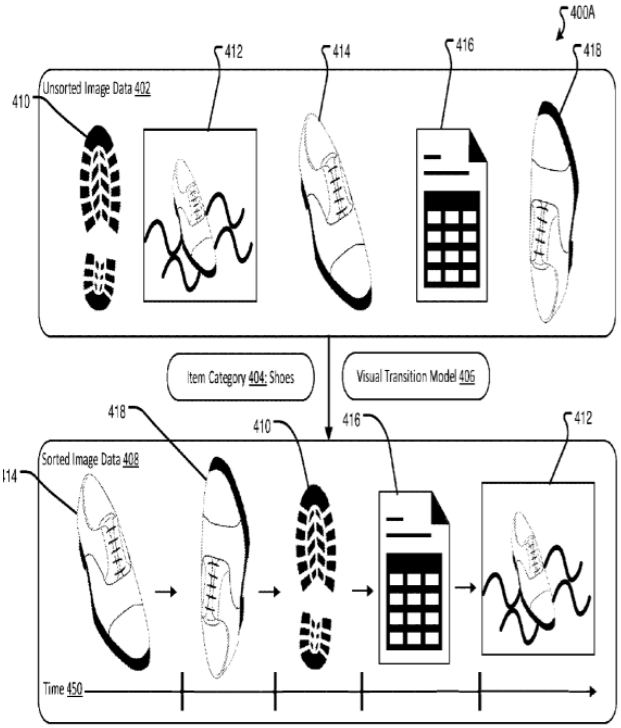
For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/086607839/publication/US2023177820A1?q=artificial%20intelligence

Reference
Zhang, B.; Oh, H.; Park, K.; Lee, Y.; Lee, M.; Lee, M.; Lee, G. & Park, J. (Jun 08, 2023). Computing apparatus and method for performing reinforcement learning using multimodal artificial intelligence agent. Recovered Jun 08, 2023, Espacenet Patent Search:
https://worldwide.espacenet.com/patent/search/family/086607839/publication/US2023177820A1?q=artificial%20intelligence

Information source: (Espacenet Patent Search, 2023)

2.7 Automated video generation from images for e-commerce applications

Systems and methods are provided for automatically generating a video associated with an item in the marketplace. An image receiver receives images associated with an item of an item listing. An image extractor generates visual descriptors for each image through computer vision analysis and extracts a unique set of images by removing redundant images.



Illustrates an example of extracting and sorting images in accordance with aspects of the present disclosure.
Credit: Solmaz, B., Espacenet Patent Search

An image sorter sorts images in the unique set of images based on an item category and generates a sequence of images for generating a video. A text placer automatically identifies a region in an image and inserts text into the image using textual attributes as predicted by a model. A video data optimizes a generated video using another model trained based on manual adjustments previously made to other exemplary video data. The disclosed technology publishes the automatically generated video data for viewing by viewers in the marketplace.

For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/084439859/publication/EP4195136A1?q=machine%20learning

Reference
Solmaz, B. (Jun 08, 2023). Automated video generation from images for e-commerce applications. Recovered Jun 08, 2023, Espacenet Patent Search:

https://worldwide.espacenet.com/patent/search/family/084439859/publication/EP4195136A1?q=machine%20learning

Information source: (Espacenet Patent Search, 2023)

2.8 Systems and methods for training a model to determine a type of environment surrounding a user

A method for determining an environment in which a user is located is described. The method includes receiving a plurality of sets of audio data based on sounds emitted in a plurality of environments. Each of the plurality of environments has a different combination of objects.

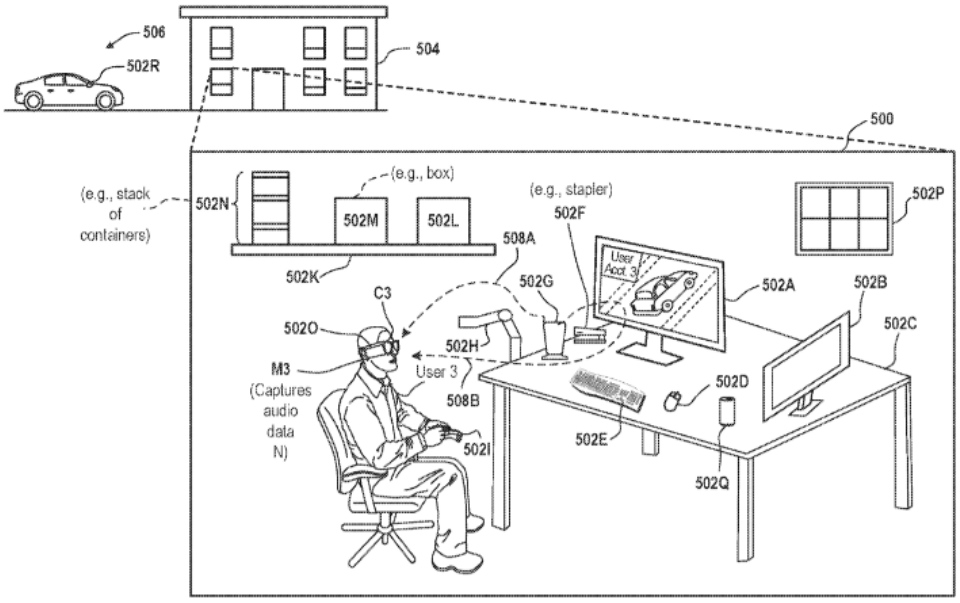


Diagram of an embodiment of an environment to illustrate use of the AI model to identify objects within an environment, and to determine states of the objects within the environment and arrangement of the objects within the environment.
Credit: Sangston, B. & Young, A., Espacenet Patent Search

The method further includes receiving input data regarding the plurality of environments, and training an artificial intelligence (AI) model based on the plurality of sets of audio data and the input data. The method includes applying the AI model to audio data captured from an environment surrounding the first user to determine a type of the environment.

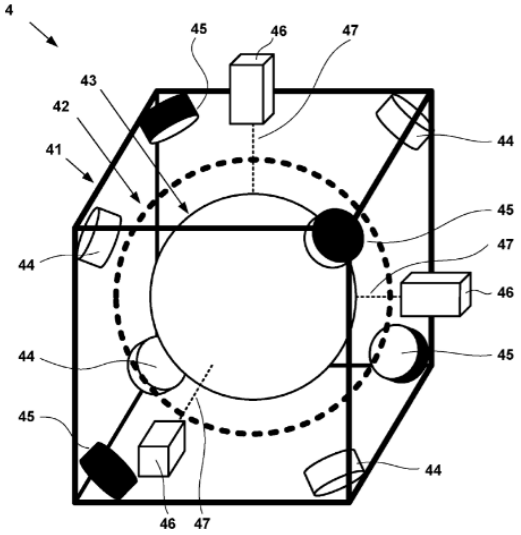
For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/084602587/publication/WO2023101839A1?q=artificial%20intelligence

Reference
Sangston, B. & Young, A. (Jun 08, 2023). Systems and methods for training a model to determine a type of environment surrounding a user. Recovered Jun 09, 2023, Espacenet Patent Search:
https://worldwide.espacenet.com/patent/search/family/084602587/publication/WO2023101839A1?q=artificial%20intelligence

Information source: (Espacenet Patent Search, 2023)

2.9 3D sound analysis system

A system comprising sound wave sensors for high fidelity sound wave detection from any 3D directions and identification of 3D coordinates of sound sources, means to separate the sound emanations of each sound source with good to high fidelity, and means to reconstruct sound sources with good to high fidelity generally including its lobal patterns.



Illustrates a perspective view of a manufacturable microphone module utilizing a magnetically levitated bubble, comprising a structural cage, bubble protection cage, bubble incorporating magnetic responsive material, electromagnets for bubble positioning and others.
Credit: Symons, I., Espacenet Patent Search

The system enables microphones systems capable of detecting sound with substantially high linearity in frequency response, sensitivity, and directionality, combined with any desired form of volumetric sensing such as spherical, hemispherical, conic and so forth, including multiple defined lobes, or selecting any desired volume and shape. Sound wave sensors can comprise a multitude or combinations of system means such as sound beams, levitated bubble interactions, tethered bubble interactions, fibre interactions, laser interferometry, RF tuned circuit techniques, and so forth, wherein all such methods ultimately employ a form of bidirectional sound sensing means.

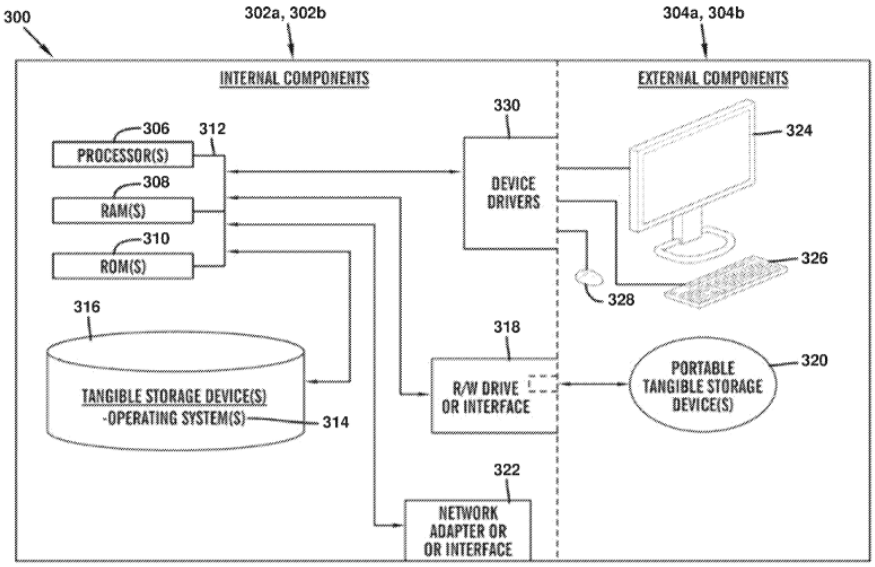
For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/086611228/publication/WO2023097377A1?q=3d

Reference
Symons, I. (Jun 08, 2023). 3D sound analysis system. Recovered Jun 09, 2023, Espacenet Patent Search:
https://worldwide.espacenet.com/patent/search/family/086611228/publication/WO2023097377A1?q=3d

Information source: (Espacenet Patent Search, 2023)

2.10 Artificial Intelligence-based presenter selection for web conference

A method, computer system, and a computer program product for artificial intelligence-based virtual meeting presentation oversight are provided.



Block diagram of internal and external components of computers and servers. Credit: Sivaswamy, H.; Varada, S.; Yamalapalli, R.; Padisetti, T., Espacenet Patent Search

A stream of a virtual meeting having a first computer designated for screen sharing control is received. A broadcast hindrance update from the first computer is received. The broadcast hindrance update is input into a machine learning model. As output from the machine learning model a recommendation regarding switching of the screen sharing control is received. In response to the receiving and to the recommendation indicating that the screen sharing control should be switched, a control switching signal is sent to a second computer participating in the virtual meeting.

For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/086607664/publication/US2023177305A1?q=artificial%20intelligence

Reference
Sivaswamy, H.; Varada, S.; Yamalapalli, R.; Padisetti, T. (Jun 08, 2023). AI-based presenter selection for web conference. Recovered Jun 09, 2023, Espacenet Patent Search: https://worldwide.espacenet.com/patent/search/family/086607664/publication/US2023177305A1?q=artificial%20intelligence

Information source: (Espacenet Patent Search, 2023)