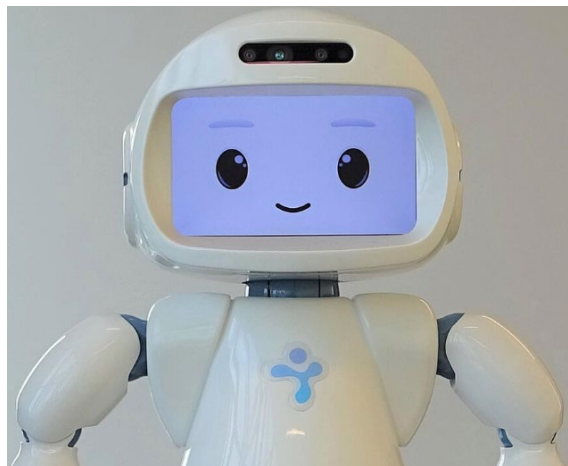# Weekly Newsletter
TECHNOLOGY SURVEILLANCE

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   Robot helps students with learning disabilities stay focused

Engineering researchers at the University of Waterloo are successfully using a robot to help keep children with learning disabilities focused on their work. This was one of the key results in a new study that also found both the youngsters and their instructors valued the positive classroom contributions made by the robot.

Credit: University of Waterloo

"There is definitely a great potential for using robots in the public education system," said Dr. Kerstin Dautenhahn, a professor of electrical and computer engineering. *"Overall, the findings imply that the robot has a positive effect on students." Building on promising earlier research, the researchers divided 16 students with learning disabilities into two groups. In one group, students worked one-on-one with an instructor only. In the other group, the students worked one-on-one with an instructor and a QT robot. In the latter group, the instructor used a tablet to direct the robot, which then autonomously performed various activities using its speech and gestures.*

For more information, visit the following link:
https://uwaterloo.ca/news/media/robot-helps-students-learning-disabilities-stay-focused

Reference
University of Waterloo. (February 12, 2023). Robot helps students with learning disabilities stay focused. Recovered February 21, 2023, University of Waterloo: https://uwaterloo.ca/news/media/robot-helps-students-learning-disabilities-stay-focused

Information source: (University of Waterloo, 2023)

1.2   Keeping drivers safe with a road that can melt snow, ice on its own

Slipping and sliding on snowy or icy roads is dangerous. Salt and sand help melt ice or provide traction, but excessive use is bad for the environment. And sometimes, a surprise storm can blow through before these materials can be applied. Now, researchers reporting in ACS Omega have filled microcapsules with a chloride-free salt mixture that's added into asphalt before roads are paved, providing long-term snow melting capabilities in a real-world test.

In a pilot test, a section of a highway ramp with a chloride-free asphalt additive in it could melt snow.
Credit: Adapted from ACS Omega 2023, DOI

Recently, researchers have incorporated salt-storage systems into *"anti-icing asphalt"* to remove snow and prevent black ice from forming. However, these asphalt pavements use corrosive chloride-based salts and only release snow-melting substances for a few years. So, Yarong Peng, Quansheng Zhao, Xiaomeng Chu and colleagues wanted to develop a longer-term, chloride-free additive to effectively melt and remove snow cover on winter roads. The researchers prepared a sodium acetate salt and combined it with a surfactant, silicon dioxide, sodium bicarbonate and blast furnace slag — a waste product from power plant operations — to produce a fine powder. They then coated the particles in the powder with a polymer solution, forming tiny microcapsules. Next, the team replaced some of the mineral filler in an asphalt mixture with the microcapsules.

For more information, visit the following link:
https://www.acs.org/pressroom/presspacs/2023/february/keeping-drivers-safe-with-a-road-that-can-melt-snow-ice-on-its-own.html

Reference
American Chemical Society. (February 16, 2023). Keeping drivers safe with a road that can melt snow, ice on its own. Recovered February 17, 2023, American Chemical Society:
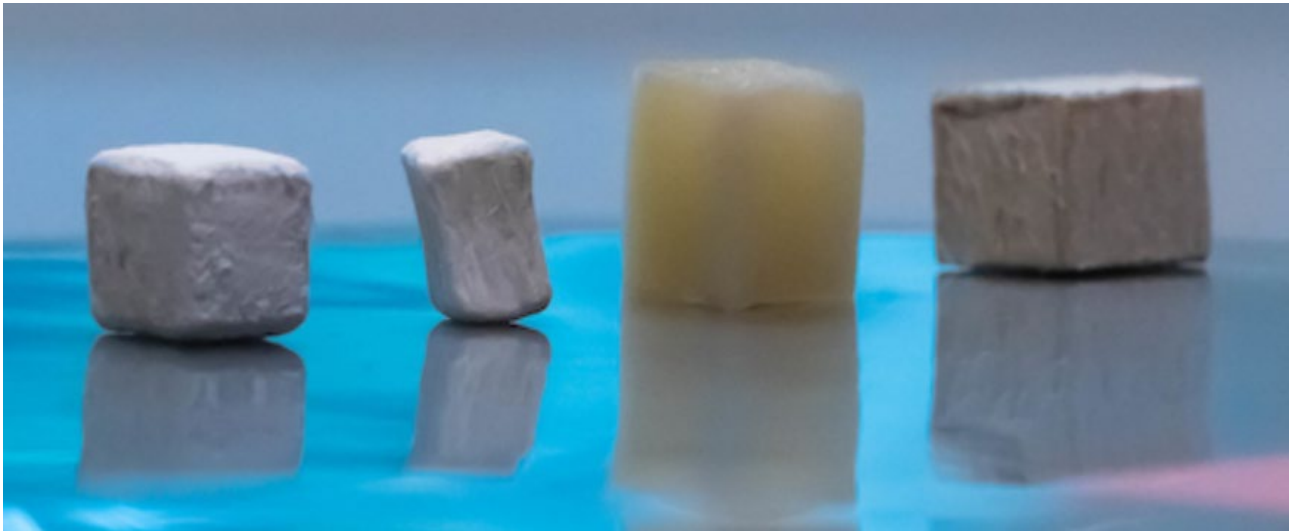
https://www.acs.org/pressroom/presspacs/2023/february/keeping-drivers-safe-with-a-road-that-can-melt-snow-ice-on-its-own.html

Information source: (ACS Chemistry for life, 2023)

1.3   Engineered wood grows stronger while trapping carbon dioxide

Rice University scientists have figured out a way to engineer wood to trap carbon dioxide through a potentially scalable, energy-efficient process that also makes the material stronger for use in construction.

Wood pieces at different stages of modification, from natural (far right) to delignified (second from right) to dried, bleached and delignified (second from left) and MOF-infused functional wood (first on the left).
Credit: Gustavo Raskosky/Rice University

Developing sustainable alternatives to existing materials could help mitigate climate change and reduce carbon dioxide emissions. Working to address both issues at once, materials scientist Muhammad Rahman and collaborators found a way to incorporate molecules of a carbon dioxide-trapping crystalline porous material into wood, according to a study published in Cell Reports Physical Science. *"Wood is a sustainable, renewable structural material that we already use extensively,"* Rahman said. *"Our engineered wood did exhibit greater strength than normal, untreated wood."*

For more information, visit the following link:
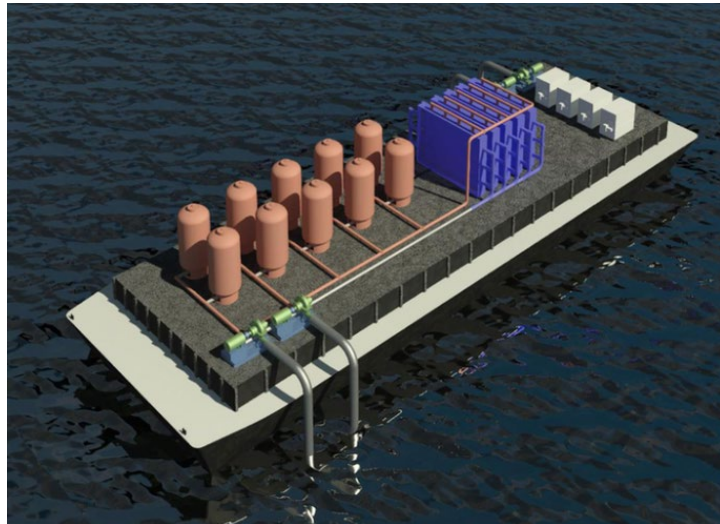https://news.rice.edu/news/2023/engineered-wood-grows-stronger-while-trapping-carbon-dioxide

Reference
Clark, S. C. (February 16, 2023). Engineered wood grows stronger while trapping carbon dioxide. Recovered February 17, 2023, Rice University: https://news.rice.edu/news/2023/engineered-wood-grows-stronger-while-trapping-carbon-dioxide

Information source: (Rice University, 2023)

1.4   How to pull carbon dioxide out of seawater

A new method for removing the greenhouse gas from the ocean could be far more efficient than existing systems for removing it from the air. As carbon dioxide continues to build up in the Earth's atmosphere, research teams around the world have spent years seeking ways to remove the gas efficiently from the air. Meanwhile, the world's number one *"sink"* for carbon dioxide from the atmosphere is the ocean, which soaks up some 30 to 40% of all of the gas produced by human activities.

Researchers have found an effective new method for removing carbon dioxide from the ocean. It could be implemented by ships that would process seawater as they travel, or at offshore drilling platforms or aquaculture fish farms.
Credit: Alan Hatton, Kripa Varanasi, Seoni Kim, Michael Nitzsche, Simon Rufer y Jack Lake, MIT

Now, a team of researchers at MIT says they may have found the key to a truly efficient and inexpensive removal mechanism. The existing methods for removing carbon dioxide from seawater apply a voltage across a stack of membranes to acidify a feed stream by water splitting. This converts bicarbonates in the water to molecules of CO2, which can then be removed under vacuum. Hatton, who is the Ralph Landau Professor of Chemical Engineering, notes that the membranes are expensive, and chemicals are required to drive the overall electrode reactions at either end of the stack, adding further to the expense and complexity of the processes. *"We wanted to avoid the need for introducing chemicals to the anode and cathode half cells and to avoid the use of membranes if at all possible,"* he says.

For more information, visit the following link:
https://news.mit.edu/2023/carbon-dioxide-out-seawater-ocean-decorbonization-0216

Reference
Chandler, D. L. (February 16, 2023). How to pull carbon dioxide out of seawater. Recovered February 17, 2023, Massachusetts Institute of Technology: https://news.mit.edu/2023/carbon-dioxide-out-seawater-ocean-decorbonization-0216

Information source: (Massachusetts Institute of Technology, 2023)
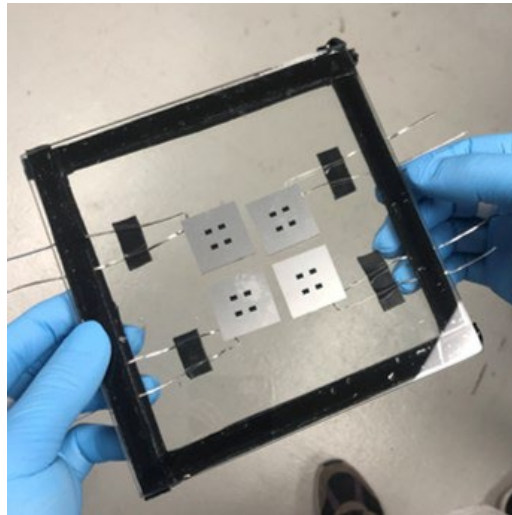
Information source: (Massachusetts Institute of Technology, 2023)

1.5   Physicists solve durability issue in next generation solar cells

The clean energy research led by The University of Toledo (uToledo) in collaboration with the University of Washington, University of Toronto, Northwestern University and Swiss Federal Laboratories for Materials Science and Technology solved the problem with the durability of perovskite solar cells, taking the technology one step closer to powering solar panels in the consumer market.

Solar cells ready for durability test.
Credit: Christine Billau, The University of Toledo

"Perovskite solar cells offer a route to lowering the cost of solar electricity given their high-power conversion efficiencies and low manufacturing cost," said Dr. Yanfa Yan, UToledo Distinguished University Professor of physics and a member of the UToledo Wright Center for Photovoltaics Innovation and Commercialization. *"However, we needed to strengthen the emerging solar cell technology's endurance during outdoor operation."* The team discovered the ingredient that enhances adhesion and mechanical toughness. Researchers experimentally demonstrated that perovskite solar cells treated with 1,3-bis(diphenylphosphino)propane (DPPP), a diphosphine Lewis base molecule, retained a high-power conversion efficiency and exhibited superior durability after continuous operation under simulated sun illumination for more than 3,500 hours, or more than 145 days. They used what is called one sun illumination, which is equivalent to outdoor sunlight.

For more information, visit the following link:
https://news.utoledo.edu/index.php/02_16_2023/physicists-solve-durability-issue-in-next-generation-solar-cells

Reference
Billau, C. (February 16, 2023). Physicists solve durability issue in next-generation solar cells. Recovered February 17, 2023, The University of Toledo: https://news.utoledo.edu/index.php/02_16_2023/physicists-solve-durability-issue-in-next-generation-solar-cells

Information source: (University College London, 2023)

1.6   A way to govern ethical use of Artificial Intelligence without hindering advancement

Researchers develop a framework for guarding against the potential harms of Artificial Intelligence that also overcomes the inflexible nature of government regulation. Texas A&M University School of Public Health researchers are developing a new governance model for ethical guidance and enforcement in the rapidly advancing field of Artificial Intelligence (AI). Known as Copyleft Artificial Intelligence with Trusted Enforcement, or CAITE, the researchers believe this model will guard against the potential harms of Artificial Intelligence without hindering technological advancements.

Credit: Rae Lynn Mitchell, Texas A&M University School of Public Health

The CAITE model is built on an ethical use license. This license would restrict certain unethical AI uses and require users to abide by a code of conduct. Importantly, it would use a copyleft approach to ensure that developers who create derivative models and data must also use the same license terms as the parent works. The license would assign the enforcement rights of the license to a designated third-party known as a CAITE host. In this way, the enforcement rights for all these ethical use licenses would pool in a single organization, empowering the CAITE host as a quasi-government regulator of AI. *"This approach combines the best of two worlds: a model that is as fast and flexible as industry, but with enforcement teeth and power of a traditional government regulator,"* Schmit said, assistant professor at the School of Public Health and director of the Program in Health Law and Policy.

For more information, visit the following link:
https://today.tamu.edu/2023/02/16/a-way-to-govern-ethical-use-of-artificial-intelligence-without-hindering-advancement/

Reference
Mitchell, R. L. (February 16, 2023). A way to govern ethical use of Artificial Intelligence without hindering advancement. Recovered February 17, 2023, Texas A&M University:
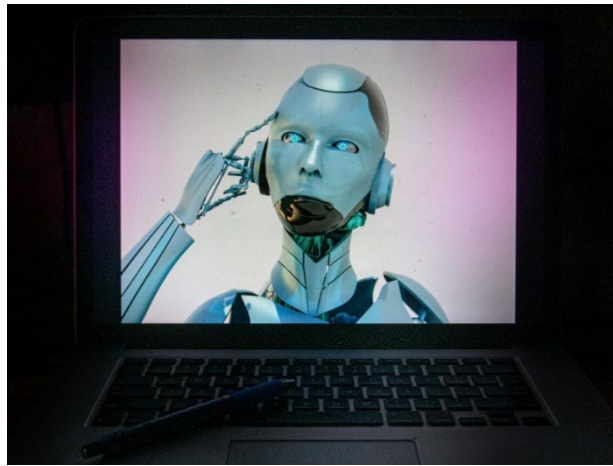
https://today.tamu.edu/2023/02/16/a-way-to-govern-ethical-use-of-artificial-intelligence-without-hindering-advancement/

Information source: (Texas A&M University School of Public Health, 2023)

1.7   Text generators may plagiarize beyond "copy and paste"

The researchers focused on identifying three forms of plagiarism: verbatim, or directly copying and pasting content; paraphrase, or rewording and restructuring content without citing the original source; and idea, or using the main idea from a text without proper attribution. They constructed a pipeline for automated plagiarism detection and tested it against OpenAI's GPT-2 because the language model's training data is available online, allowing the researchers to compare generated texts to the 8 million documents used to pre-train GPT-2.

Language models that generate text in response to user prompts plagiarize content in more ways than one, according to a Penn State-led research team that conducted the first study to directly examine the phenomenon.
Credit: freepik.com

The scientists used 210,000 generated texts to test for plagiarism in pre-trained language models and fine-tuned language models, or models trained further to focus on specific topic areas. In this case, the team fine-tuned three language models to focus on scientific documents, scholarly articles related to COVID-19, and patent claims. They used an open-source search engine to retrieve the top 10 training documents most similar to each generated text and modified an existing text alignment algorithm to better detect instances of verbatim, paraphrase and idea plagiarism. The team found that the language models committed all three types of plagiarism, and that the larger the dataset and parameters used to train the model, the more often plagiarism occurred.

For more information, visit the following link:
https://www.psu.edu/news/research/story/beyond-memorization-text-generators-may-plagiarize-beyond-copy-and-paste/

Reference
Tutella, F. (February 16, 2023). Beyond memorization: Text generators may plagiarize beyond *"copy and paste"*. Recovered February 17, 2023, The Pennsylvania State University: https://www.psu.edu/news/research/story/beyond-memorization-text-generators-may-plagiarize-beyond-copy-and-paste/

Information source: (The Pennsylvania State University, 2023)

1.8   Machine Learning helps determine success of advanced genome editing

A new tool to predict the chances of successfully inserting a gene-edited sequence of DNA into the genome of a cell, using a technique known as prime editing, has been developed by researchers at the Wellcome Sanger Institute. An evolution of CRISPR-Cas9 gene editing technology, prime editing has huge potential to treat genetic disease in humans, from cancer to cystic fibrosis. But thus far, the factors determining the success of edits are not well understood.

Study assesses thousands of DNA sequences introduced into the genome using prime editors.
Credit: Adobestock

The study, published in Nature Biotechnology, assessed thousands of different DNA sequences introduced into the genome using prime editors. These data were then used to train a Machine Learning algorithm to help researchers design the best fix for a given genetic flaw, which promises to speed up efforts to bring prime editing into the clinic. Developed in 2012, CRISPR-Cas9 was the first easily programmable gene editing technology. These *"molecular scissors"* enabled researchers to cut DNA at any position in the genome in order to remove, add or alter sections of the DNA sequence. The technology has been used to study which genes are important for various conditions, from cancer to rare diseases, and to develop treatments that fix or turn off harmful mutations or genes.

For more information, visit the following link:
https://www.sanger.ac.uk/news_item/machine-learning-helps-determine-success-of-advanced-genome-editing/

Reference
Sanger Institute. (February 16, 2023). Machine Learning helps determine success of advanced genome editing. Recovered February 17, 2023, Wellcome Sanger Institute: https://www.sanger.ac.uk/news_item/machine-learning-helps-determine-success-of-advanced-genome-editing/

Information source: (Wellcome Sanger Institute, 2023)

1.9   Brain cells linked to pediatric seizures

Christos Papadelis, University of Texas at Arlington bioengineer, and his doctoral student have discovered how to identify which brain cells lead to epileptic episodes in children. Papadelis and his team used noninvasive techniques and advanced computational methods to measure the electric and magnetic signals generated by neural cells in the human brain and identify functional networks that are responsible for the generation of seizures in children suffering from epilepsy. This new method identifies those functional networks with high precision.

"By identifying which parts of the brain are producing the seizures, we can then resect them with brain surgery or ablate them with laser," Papadelis said. *"The test we developed pinpoints exactly where the epilepsy network is occurring. Currently, there is no clinical exam to identify this brain area with high precision. "This research has real promise".* Additionally, Michael Cho, chair of the UTA Department of Bioengineering said: *"In many areas, the quicker and more accurately the problems are detected and solved, the better chance patients have of living normal lives. The diagnostic tool is great in that it is non-invasive as well."*

For more information, visit the following link:
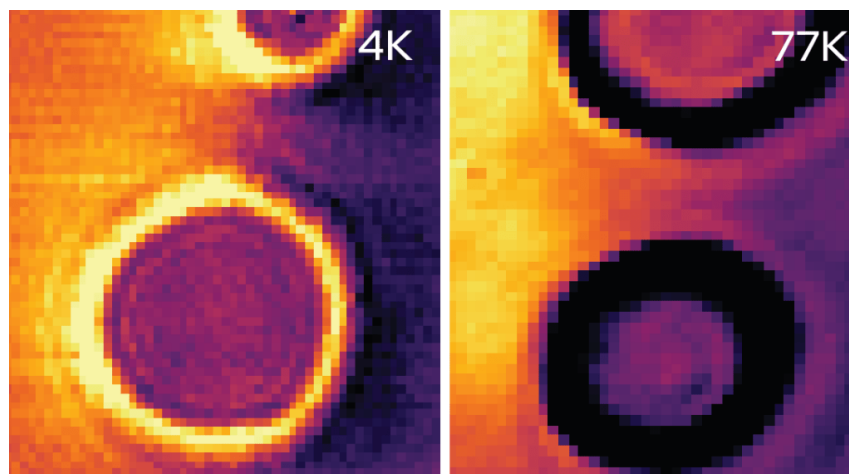https://www.uta.edu/news/news-releases/2023/02/16/brain-papadelis-epilepsy

Reference
BOOTH, H. (February 16, 2023). UTA Research professor identifies brain cells linked to pediatric seizures. Recovered February 17, 2023, The University of Texas at Arlington: https://www.uta.edu/news/news-releases/2023/02/16/brain-papadelis-epilepsy

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

1.10   Smooth sailing for electrons in graphene

Physicists at the University of Wisconsin–Madison directly measured, for the first time at nanometer resolution, the fluid-like flow of electrons in graphene. The results, which will appear in the journal *Science* on Feb. 17, have applications in developing new, low-resistance materials, where electrical transport would be more efficient. Graphene, an atom-thick sheet of carbon arranged in a honeycomb pattern, is an especially pure electrical conductor, making it an ideal material to study electron flow with very low resistance. Here, researchers intentionally added impurities at known distances and found that electron flow changes from gas-like to fluid-like as temperatures rise.

A heatmap of electron location in graphene shows that at the lower temperature (left panel), the electrons are more likely to bump into impurities (circles), with relatively fewer making it through the channel between impurities. At higher temperatures (right panel), electron flow shifts to being fluid-like. Fewer are stuck at the impurities and more flow through the channels. Credit: Sarah Perdue, University of Wisconsin–Madison

The researchers intentionally introduced obstacles in the graphene, spaced at controlled distances and then applied a current across the sheet. Using a technique called scanning tunneling potentiometry (STP), they measured the voltage with nanometer resolution at all points on the graphene, producing a 2D map of the electron flow pattern. No matter the obstacle spacing, the drop in voltage through the channel was much lower at higher temp (77 kelvins) vs lower temp (4 kelvin), indicating lower resistance with more electrons passing through.

For more information, visit the following link:
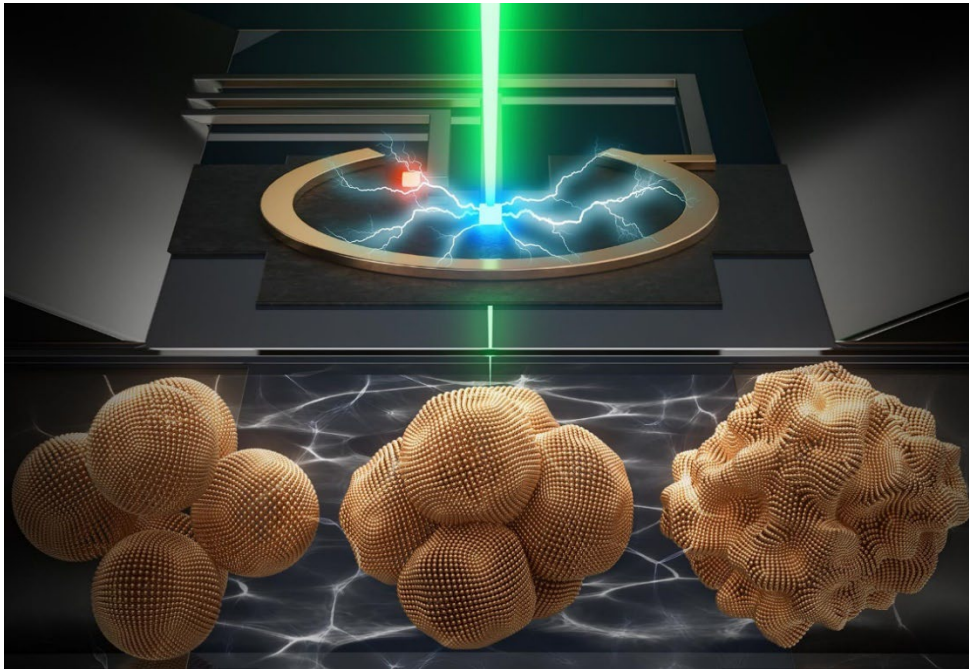https://news.wisc.edu/smooth-sailing-for-electrons-in-graphene/

Reference
Perdue, S. (February 16, 2023). Smooth sailing for electrons in graphene. Recovered February 20, 2023, University of Wisconsin: https://news.wisc.edu/smooth-sailing-for-electrons-in-graphene/

Information source: (University of Wisconsin–Madison, 2023)

1.11   How a record-breaking copper catalyst converts CO2 into liquid fuels

Researchers at Berkeley Lab have made real-time movies of copper nanoparticles as they evolve to convert carbon dioxide and water into renewable fuels and chemicals. Their new insights could help advance the next generation of solar fuels.

Artist's rendering of a copper nanoparticle as it evolves during CO2 electrolysis: Copper nanoparticles (left) combine into larger metallic copper "nanograins" (right) within seconds of the electrochemical reaction, reducing CO2 into new multicarbon products.
Credit: Yao Yang/Berkeley Lab

The work was made possible by combining a new imaging technique called 4D electrochemical liquid-cell STEM (scanning transmission electron microscopy) with a soft X-ray probe to investigate the same sample environment: copper nanoparticles in liquid. Scientists who study artificial photosynthesis materials and reactions have wanted to combine the power of an electron probe with X-rays, but the two techniques typically can't be performed by the same instrument.

For more information, visit the following link:
https://newscenter.lbl.gov/2023/02/16/copper-catalyst-converts-co2-into-liquid-fuels/

Reference
Duque, T. (February 16, 2023). How a record-breaking copper catalyst converts CO2 into liquid fuels. Recovered February 20, 2023, Lawrence Berkeley National Laboratory: https://newscenter.lbl.gov/2023/02/16/copper-catalyst-converts-co2-into-liquid-fuels/

Information source: (Lawrence Berkeley National Laboratory, 2023)

1.12   Electronic metadevices break barriers to ultra-fast communications

École Polytechnique Fédérale de Lausanne (EPFL) researchers have come up with a new approach to electronics that involves engineering metastructures at the sub-wavelength scale. It could launch the next generation of ultra-fast devices for exchanging massive amounts of data, with applications in 6G communications and beyond.

Credit: Celia Luterbacher, École polytechnique fédérale de Lausanne

Crucially, the device can operate at electromagnetic frequencies in the terahertz range (between 0.3-30 THz) – significantly faster than the gigahertz waves used in today's electronics. They can therefore carry much greater quantities of information for a given signal or period, giving them great potential for applications in 6G communications and beyond. *"We found that manipulating radiofrequency fields at microscopic scales can significantly boost the performance of electronic devices, without relying on aggressive downscaling,"* explains Samizadeh Nikoo, EPFL researcher.

For more information, visit the following link:
https://news.epfl.ch/news/electronic-metadevices-break-barriers-to-ultra-fas/
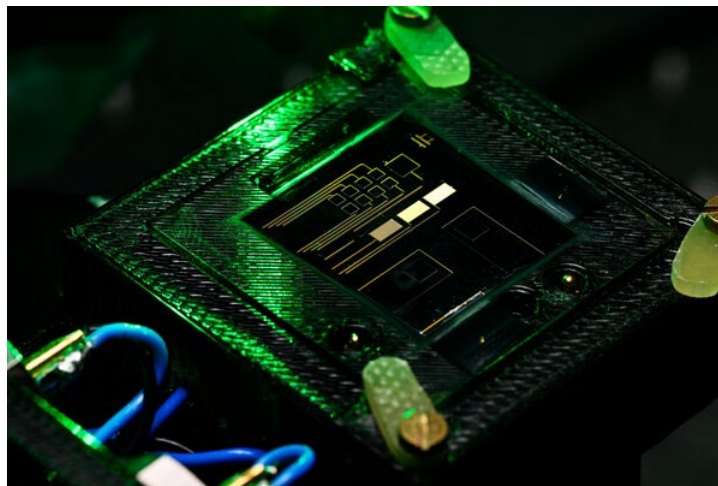
Reference
Luterbacher, C. (February 17, 2023). Electronic metadevices break barriers to ultra-fast communications. Recovered February 20, 2023, Ecole Polytechnique Fédérale de Lausanne: https://news.epfl.ch/news/electronic-metadevices-break-barriers-to-ultra-fas/

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

1.13   "Harry Potter" light sensor achieves magically high efficiency of 200%

Using green light and a double-layered cell, PhD researcher Riccardo Ollearo has come up with a photodiode that has sensitivity that many can only dream of. Solar panels with multiple stacked cells are currently breaking records. Remarkably, a team of researchers from Eindhoven University of Technology and TNO (Netherlands Organization for Applied Scientific Research) at Holst Centre have now managed to make photodiodes - based on a similar technology - with a photoelectron yield of more than 200%. You would think that efficiencies of more than 100% are only possible using alchemy and other Harry Potter-like wizardry.

The photodiode used in the experiment.
Credit: Bart van Overbeeke, TU/e Eindhoven University of Technology

Photodiodes are light-sensitive semiconductor devices that produce a current when they absorb photons from a light source. They are used as sensors in a variety of applications, including medical purposes, wearable monitoring, light communication, surveillance systems, and machine vision. In all these domains, high sensitivity is key. For a photodiode to work correctly, it has to meet two conditions. Firstly, it should minimize the current that is generated in the absence of light, the so-called dark current. The less dark current, the more sensitive the diode. Secondly, it should be able to distinguish the level of background light (the 'noise') from the relevant infrared light. Unfortunately, these two things usually do not go together, on the contrary.

For more information, visit the following link:
https://www.tue.nl/en/news-and-events/news-overview/17-02-2023-this-harry-potter-light-sensor-achieves-magically-high-efficiency-of-200-per-cent/

Reference
Appeven, H. v. (February 17, 2023). This *"Harry Potter"* light sensor achieves magically high efficiency of 200 per cent. Recovered February 20, 2023, Eindhoven University of Technology: https://www.tue.nl/en/news-and-events/news-overview/17-02-2023-this-harry-potter-light-sensor-achieves-magically-high-efficiency-of-200-per-cent/

Information source: (TU/e Eindhoven University of Technology, 2023)

1.14   Researchers aim to bring humans back into the loop, as Artificial Intelligence use and misuse rises

Artificial Intelligence is dominating headlines—enabling new innovations that drive business performance—yet the negative implications for society are an afterthought. A trans-Atlantic team of researchers, including two from the University of Michigan, has reviewed information systems research on what's known as the *"Fourth Industrial Revolution"* and found an overwhelming focus on technology-enabled business benefits.

Credit: Jeff Karoub y Kate McAlpine, University of Michigan

Nigel Melville, associate professor of technology and operations at U-M's Ross School of Business and design science program director, said: *"Our new framework is a theory-based attempt to go in a new direction by recentering humans in actions and outcomes in the discourse about ever-smarter machines."* Their study aims to help society, including regulators considering Artificial Intelligence safety regulations and organizations considering adopting Artificial Intelligence, understand the societal implications of ever-smarter machines.

For more information, visit the following link:
https://news.umich.edu/u-m-researchers-aim-to-bring-humans-back-into-the-loop-as-ai-use-and-misuse-rises/

Reference
Karoub, J., & McAlpine, K. (February 20, 2023). U-M researchers aim to bring humans back into the loop, as AI use and misuse rises. Recovered February 20, 2023, University of

Michigan: https://news.umich.edu/u-m-researchers-aim-to-bring-humans-back-into-the-loop-as-ai-use-and-misuse-rises/

Information source: (University of Michigan, 2023)

1.15   Wearable device for vocal fatigue senses when your voice needs a break

Northwestern University researchers have developed the first smart wearable device to continuously track how much people use their voices, alerting them to overuse before vocal fatigue and potential injury set in. The first-of-its-kind, battery-powered, wireless device and accompanying algorithms could be a game-changer for professional singers, teachers, politicians, call-center workers, coaches and anyone who relies on their voices to communicate effectively and make a living. It also could help clinicians remotely and continuously monitor patients with voice disorders throughout their treatment.

Developed by an interdisciplinary team of materials scientists, biomedical engineers, opera singers and a speech-language pathologist. The soft, flexible, postage-stamp-sized device comfortably adheres to the upper chest to sense the subtle vibrations associated with talking and singing. From there, the captured data is instantaneously streamed via Bluetooth to the users' smartphone or tablet, so they can monitor their vocal activities in real time throughout the day and measure cumulative total vocal usage. Custom machine-learning algorithms distinguish the difference between speaking and singing, enabling singers to separately track each activity.

For more information, visit the following link:
https://news.northwestern.edu/stories/2023/02/first-wearable-device-for-vocal-fatigue-senses-when-your-voice-needs-a-break/

Reference
Morris, A. (February 20, 2023). First wearable device for vocal fatigue senses when your voice needs a break. Recovered February 20, 2023, Northwestern University: https://news.northwestern.edu/stories/2023/02/first-wearable-device-for-vocal-fatigue-senses-when-your-voice-needs-a-break/

Information source: (Northwestern University, 2023)

1.16   Researchers create custom technology in quest to understand memory

A pair of researchers in the Department of Neurobiology and Behavior are designing new technology and research methods to discover how brain circuits support learning and memory.

The Brain Computation and Behavior Lab, led by Antonio Fernandez-Ruiz, an assistant professor and Nancy and Peter Meinig Family Investigator in the Life Sciences in the College of Arts and Sciences, and Azahara Oliva, also an assistant professor in A&S, studies both spatial and social memory in rodents using a combination of methods — naturalistic behavioral tasks, in vivo electrophysiology, calcium imaging, optogenetic manipulations (using a combination of light and genetic engineering to control brain cells) and anatomical circuit mapping. *"I think of the brain as a complex system, with so many components coordinating in a precise balance for the system to work,"* Oliva said. *"But this system, is not only the sum of its parts, once is all functioning, very interesting processes emerge, such as the ability to generate memories - we remember things since very early on in our life, yet we never stop learning new stuff."*

For more information, visit the following link:
https://news.cornell.edu/stories/2023/02/researchers-create-custom-technology-quest-understand-memory

Reference
Hovis, K. (February 20, 2023). Researchers create custom technology in quest to understand memory. Recovered February 20, 2023, Cornell University: https://news.cornell.edu/stories/2023/02/researchers-create-custom-technology-quest-understand-memory

Information source: (Cornell University, 2023)

1.17   Novel algorithm proposed for inversion of aerosol optical depth

A research team led by Prof. SUN Xiaobing from the Anhui Institute of Optics and Fine Mechanics, Hefei Institutes of Physical Science (HFIPS), Chinese Academy of Sciences (CAS), has proposed an optimal inversion algorithm based on combined utilization of multi-band intensity and polarization information. This algorithm can meet the requirements of single-angle and multi-band polarization aerosol detection. Aerosol optical depth (AOD) is used to characterize the extinction effect of aerosol on solar radiation, which plays an important role in remote sensing atmospheric correction and fine particulate pollution assessment.

The proposed algorithm does not need prior information of the ground. It uses polarization information of short-wave infrared band to separate ground and atmospheric information, and then uses scalar information to obtain the final result. *"By decoupling the surface and atmosphere, our method can avoid inversion error and spatio-temporal matching error caused by the late updating of the surface reflectance database,"* said Prof. SUN. The researchers used the observation data of a high-precision polarization scanner (POSP) onboard the hyperspectral observation satellite (GF-5B) to verify the algorithm.

For more information, visit the following link:
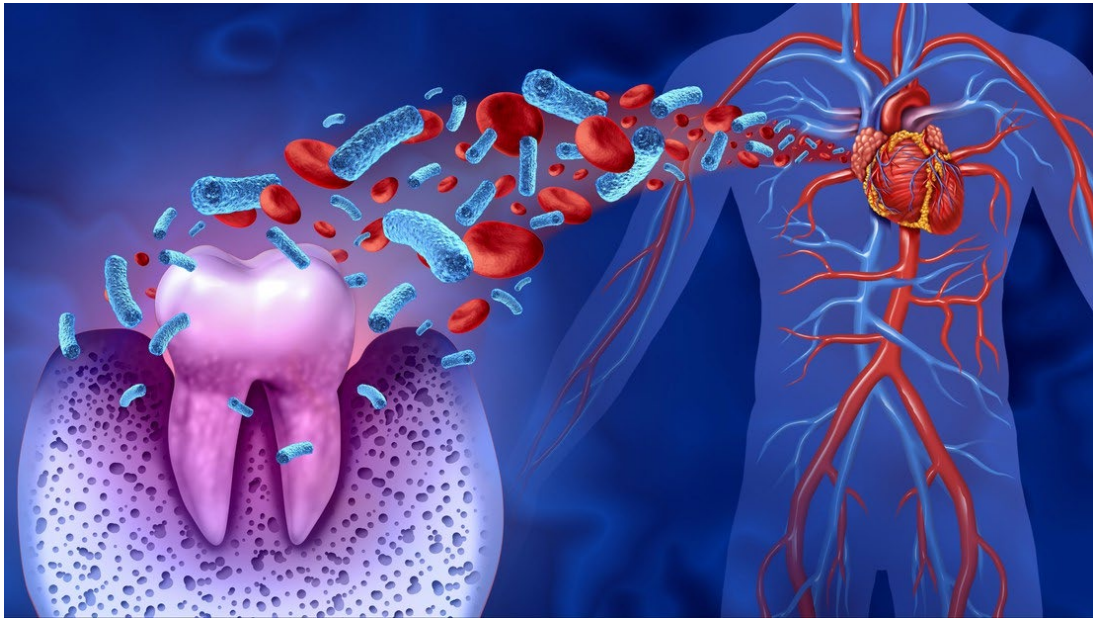https://english.cas.cn/newsroom/research_news/earth/202302/t20230220_327430.shtml

Reference
Yuan, L. (February 20, 2023). Novel Algorithm Proposed for Inversion of Aerosol Optical Depth. Recovered February 20, 2023, Chinese Academy of Sciences: https://english.cas.cn/newsroom/research_news/earth/202302/t20230220_327430.shtml

Information source: (Chinese Academy Of Sciences, 2023)

1.18   Oral bacteria may increase heart disease risk

Researchers at École polytechnique fédérale de Lausanne (EPFL) have found that infection with a common bacterium that is linked to periodontal disease, oral cancers, and bad breath may cause a small increase in the risk of cardiovascular disease.

Credit: ELife, Nik Papageorgiou, École Polytechnique Fédérale de Lausanne

The study suggests another potential risk factor that physicians might screen for to identify individuals at risk of heart disease. It may also indicate that treatments for colonization or infection with the oral bacterium Fusobacterium nucleatum may help reduce heart disease risk. Researchers analyzed genetic information, health data, and blood samples from a subset of 3,459 people who participated in the CoLaus|PsyCoLaus study – a Swiss population-based cohort. Around 6% of the participants experienced a heart attack or another harmful cardiovascular event during the 12-year follow-up period.

For more information, visit the following link:
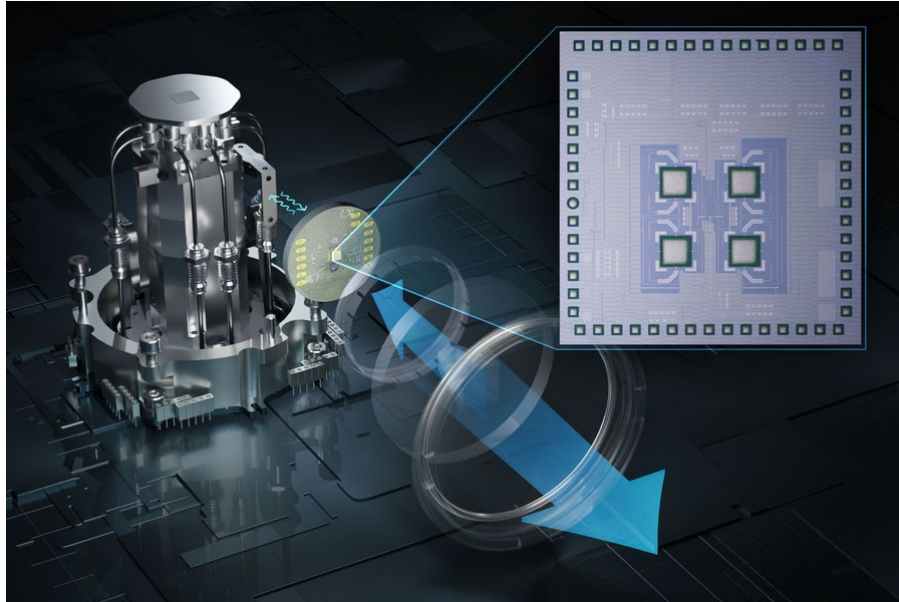https://news.epfl.ch/news/oral-bacteria-may-increase-heart-disease-risk/

Reference
Papageorgiou, N. (February 20, 2023). Oral bacteria may increase heart disease risk. Recovered February 20, 2023, Ecole Polytechnique Fédérale de Lausanne: https://news.epfl.ch/news/oral-bacteria-may-increase-heart-disease-risk/

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

1.19   A new way for quantum computing systems to keep their cool

A wireless technique enables a super-cold quantum computer to send and receive data without generating too much error-causing heat.

This image shows a transceiver chip the researchers developed that is placed inside a complex refrigerator that houses a quantum computer. The chip sends and receives data to and from electronics outside of the refrigerator using high-speed terahertz waves.
Credit: Jinchen Wang, Massachusetts Institute of Technology

An interdisciplinary team of MIT researchers has developed a wireless communication system that enables a quantum computer to send and receive data to and from electronics outside the refrigerator using high-speed terahertz waves. A transceiver chip placed inside the fridge can receive and transmit data. Terahertz waves generated outside the refrigerator are beamed in through a glass window. Data encoded onto these waves can be received by the chip. That chip also acts as a mirror, delivering data from the qubits on the terahertz waves it reflects to their source. This reflection process also bounces back much of the power sent into the fridge, so the process generates only a minimal amount of heat. The contactless communication system consumes up to 10 times less power than systems with metal cables.

For more information, visit the following link:
https://news.mit.edu/2023/new-way-quantum-computing-systems-keep-their-cool-0221

Reference
Zewe, A. (February 21, 2023). A new way for quantum computing systems to keep their cool. Recovered February 21, 2023, Massachusetts Institute of Technology: https://news.mit.edu/2023/new-way-quantum-computing-systems-keep-their-cool-0221

Information source: (Massachusetts Institute of Technology, 2023)
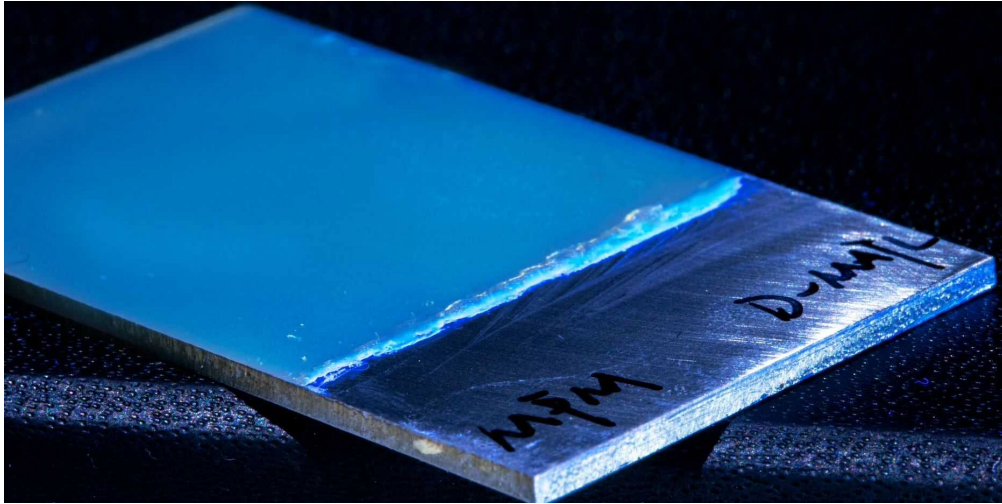
Information source: (Massachusetts Institute of Technology, 2023)

1.20   New corrosion protection that repairs itself

Eidgenössische Technische Hochschule Zúrich (ETH Zurich) researchers have developed an extraordinary protection against corrosion after a chance discovery. It glows in places where it is not damaged, repairs itself – and can be reused multiple times.

Fluorescent corrosion protection on a metal plate.
Credit: Marco D'Elia / Eidgenössische Technische Hochschule Zúrich

Researchers at ETH Zurich led by Markus Niederberger and Walter Caseri from the Laboratory for Multifunctional Materials have now presented a new solution. Over the past years, they have developed a plastic that could greatly improve and simplify corrosion protection. Poly (phenylene methylene) is the miracle material's name, or PPM for short. This new corrosion protection material kills several birds with one stone. When mixed as paint and heated, PPM can be sprayed onto a surface and becomes solid. The polymer indicates holes and cracks in the protective layer by failing to fluoresce. What's more, it repairs any damage itself without further external intervention. And at the end of a product's life, the polymer can be completely removed and recycled with only minimal material loss. The recycled polymer can then be applied to another surface with no loss in its special properties and functions.

For more information, visit the following link:
https://ethz.ch/en/news-and-events/eth-news/news/2023/02/new-corrosion-protection-that-repairs-itself.html

Reference
Rüegg, P. (February 21, 2023). New corrosion protection that repairs itself. Recovered February 21, 2023, Eidgenössische Technische Hochschule Zürich: https://ethz.ch/en/news-and-events/eth-news/news/2023/02/new-corrosion-protection-that-repairs-itself.html
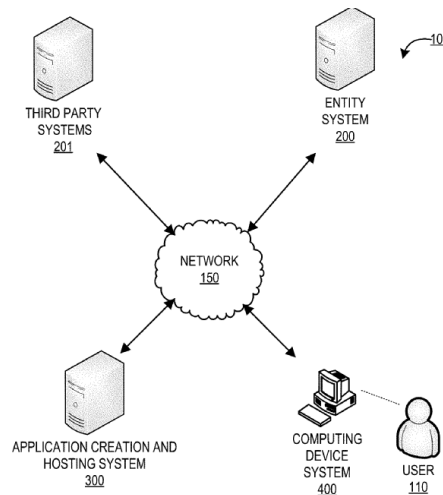
Information source: (Eidgenössische Technische Hochschule Zúrich, 2023)

II.   PATENTS

2.1.   Centralized dynamic portal for creating and hosting static and dynamic applications

Embodiments of the present invention provide a system for creating and hosting static and dynamic applications.

Provides a block diagram illustrating a system environment for dynamically creating and hosting static and dynamic applications, in accordance with an embodiment of the invention.
Credit: Jagadeeswaran, A., Ghelani, K., & Karuppannan, S. K., WIPO IP Portal

The system is configured for receiving one or more inputs from at least one user, wherein the one or more inputs are associated with creation of one or more applications, extracting one or more templates and present the one or more templates to the at least one user, selecting a template of the one or more templates, automatically selecting a server from one or more servers to host the one or more applications, establishing a connection to the server and extract a data set from the server, rendering data in the data set and apply the data to the template, via an Artificial Intelligence engine, generating one or more template previews based on applying the data to the template, and displaying the one or more template previews to the at least one user.

For more information, visit the following link:
https://patentscope.wipo.int/search/en/detail.jsf?docId=US391882168&_cid=P20-LEE80S-54713-1

Reference
Jagadeeswaran, A., Ghelani, K., & Karuppannan, S. K. (February 16, 2023). Centralized dynamic portal for creating and hosting static and dynamic applications. Recovered February 16, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/en/detail.jsf?docId=US391882168&_cid=P20-LEE80S-54713-1
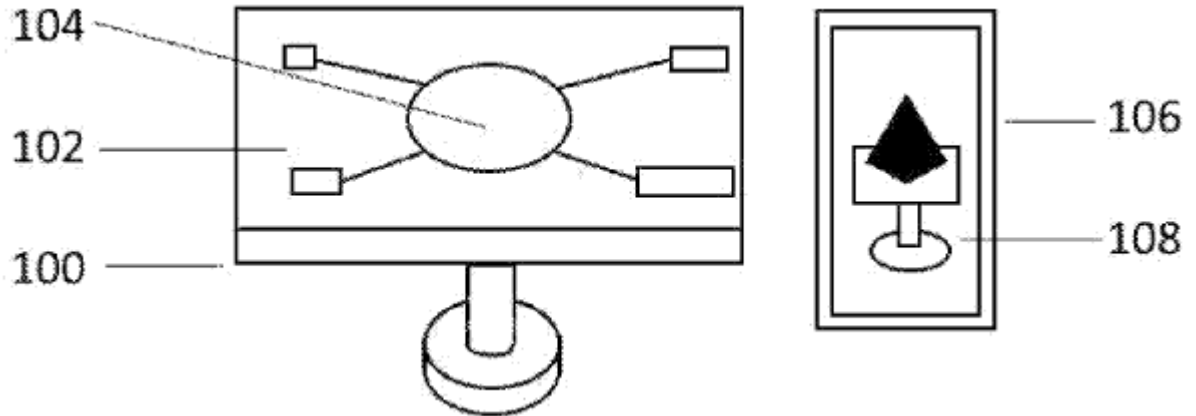
Information source: (WIPO IP Portal, 2023)

2.2.   Rotational device for an augmented reality display surface using NFC Technology

A device for displaying AR markings comprising a top and a base, with the top rotatably attached to the base, and the base configured to be held by a hand or placed on a fixed surface.

Show views of an exemplary device.
Credit: Johnston, A. M., & Romero, L. A., WIPO IP Portal

The AR markings are positioned on the top such that when the top rotates with respect to the base, so do the AR markings. When the AR markings are scanned by an appropriate scanning and display device, such as a smart phone, a 3d image associated with the AR markings will be displayed on the display device as an augmented reality projection. When the top rotates with respect to the base, so too does the augmented reality projection.

For more information, visit the following link:
https://patentscope.wipo.int/search/en/detail.jsf?docId=US391881205&_cid=P10-LEEGRF-16909-1
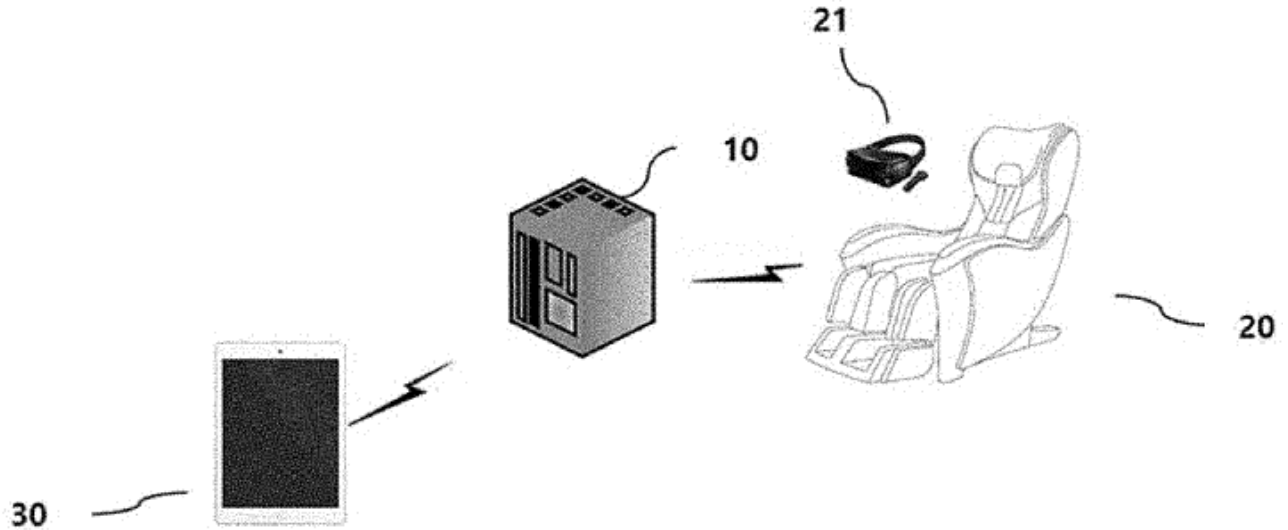
Reference
Johnston, A. M., & Romero, L. A. (February 16, 2023). Rotational device for an augmented reality display surface using NFC technology. February 16, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/en/detail.jsf?docId=US391881205&_cid=P10-LEEGRF-16909-1

Information source: (WIPO IP Portal, 2023)

2.3.   Virtual content experience system and control method for same

Disclosed is a virtual content experience system. In the virtual content experience system, a central server for driving the system contains:

Are diagrams illustrating an overall system configuration of the present disclosure.
Credit: Yang, B. S., WIPO IP Portal

A content conversion unit which converts two-dimensional image content, received by means of a data transmission and reception unit or input by a user, into a stereoscopic image; a motion information generation unit which recognizes text information extracted from the two-dimensional image content and converts the text information into motion information; a content playback control unit which is provided to transmit the motion information to a motion information management unit provided in a virtual reality experience chair, or receive start information and end information about the motion information from the motion information management unit to generate and change control information for controlling whether to provide new two-dimensional image content; and a display unit for displaying the content conversion unit, and the motion information or control information.

For more information, visit the following link:
https://patentscope.wipo.int/search/en/detail.jsf?docId=US391883127&_cid=P22-LEE8WQ-47910-1
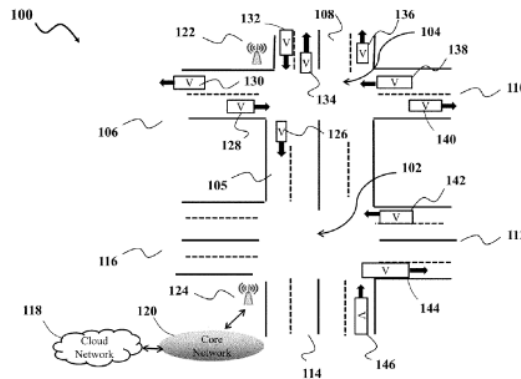
Reference
Yang, B. S. (February 16, 2023). Virtual content experience system and control method for same. Recovered February 16, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/en/detail.jsf?docId=US391883127&_cid=P22-LEE8WQ-47910-1

Information source: (WIPO IP Portal, 2023)

2.4. Global multi-vehicle decision making system for connected and automated vehicles in dynamic environment

Connected and automated vehicles (CAVs) have shown the potential to improve safety, increase road throughput, and optimize energy efficiency and emissions in several complicated traffic scenarios.

Illustrates an example of a traffic scenario in a local area of multiple interconnected conflict zones, and the need for global multi-vehicle decision making of controlled and non-controlled vehicles.
Credit Quirynen, R., Cairano, S. D., Ravikumar, S., Bhagat, A., & Zeino, E., WIPO IP Portal

This invention describes a mixed-integer programming (MIP) optimization method for global multi-vehicle decision making and motion planning of CAVs in a highly dynamic environment that consists of multiple human-driven, i.e., conventional or manual, vehicles and multiple conflict zones, such as merging points and intersections. The proposed approach ensures safety, high throughput and energy efficiency by solving a global multi-vehicle constrained optimization problem. The solution provides a feasible and optimal time schedule through road segments and conflict zones for the automated vehicles, by using information from the position, velocity, and destination of the manual vehicles, which cannot be directly controlled. Despite MIP having combinatorial complexity, the proposed formulation remains feasible for real-time implementation in the infrastructure, such as in mobile edge computers (MECs).

For more information, visit the following link:
https://patentscope.wipo.int/search/en/detail.jsf?docId=US391881003&_cid=P22-LEE9DY-54035-2
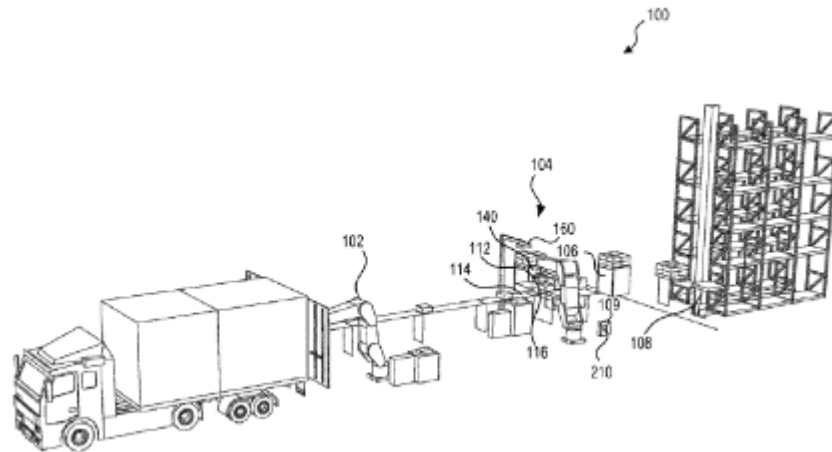
Reference
Quirynen, R., Cairano, S. D., Ravikumar, S., Bhagat, A., & Zeino, E. (February 16, 2023). Global multi-vehicle decision making system for connected and automated vehicles in dynamic environment. Recovered February 16, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/en/detail.jsf?docId=US391881003&_cid=P22-LEE9DY-54035-2

Information source: (WIPO IP Portal, 2023)

2.5.   Robotic systems with gripping mechanisms, and related systems and methods

Robotic systems with variable gripping mechanisms, and related systems and methods are disclosed herein.

Is an illustration of an example environment in which a robotic system with a gripping mechanism can operate in accordance with some embodiments of the present technology. Credit: Lei, L., Zhang, Y., Ye, X., Xu, Y., Coats, B., Diankov, R. N., . . . Huang, G., WIPO IP Portal

In some embodiments, the robotic system includes a robotic arm and an object-gripping assembly coupled to the robotic arm. The object-gripping assembly can include a main body coupled to the robotic arm through an external connector on an upper surface of the main body and a vacuum operated gripping component coupled to a lower surface of the main body. The object-gripping assembly can also include a variable-width gripping component coupled to the main body. The variable-width gripping component is movable between a fully folded state, a plurality of extended states, and a clamping state to grip a variety of target objects of varying shapes, sizes, weights, and orientations.

For more information, visit the following link:
https://patentscope.wipo.int/search/en/detail.jsf?docId=US391883858&_cid=P22-LEE9OM-57896-2

Reference
Lei, L., Zhang, Y., Ye, X., Xu, Y., Coats, B., Diankov, R. N., . . . Huang, G. (February 16, 2023). Robotic systems with gripping mechanisms, and related systems and methods. Recovered February 16, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/en/detail.jsf?docId=US391883858&_cid=P22-LEE9OM-57896-2

Information source: (WIPO IP Portal, 2023)

2.6.   Conversational Artificial Intelligence system in a virtual reality space

A system for speech interpretation from a users' speech, while in a virtual environment, aided by user data and virtual world data.

This system includes a virtual reality device comprising one or more user input devices, one or more user output devices, and a communication module. The output devices outputting a virtual environment to the user. A database stores information about elements in the virtual environment. An Artificial Intelligence module performs speech interpretation. The Artificial Intelligence module comprises a speech-to-text module that interprets user speech into a plurality of textual interpretations, and based on a ranking of the textual interpretations, select a top interpretation. An augmentation module adds context into the user speech to aid interpreting the speech. The context is derived from user data regarding the user's interaction with the virtual environment, and virtual environment data defining an element in the virtual environment with which the user is interacting.

For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/085201068/publication/WO2023018908A1?q=Artificial%20intelligence

Reference
Kaplan, J. (February 16, 2023). Conversational Artificial Intelligence system in a virtual reality space. Recovered February 16, 2023, Espacenet Patent Search: https://worldwide.espacenet.com/patent/search/family/085201068/publication/WO2023018908A1?q=Artificial%20intelligence

Information source: (Espacenet Patent Search, 2023)

2.7.   Enhanced on-the-go Artificial Intelligence for wireless devices

This disclosure describes systems, methods, and devices related to facilitating Machine Learning-based operations at a User Equipment (UE) connected to a radio access network (RAN).

A network AI/ML (Artificial Intelligence/Machine Learning) service or function may identify a first request, received from a user equipment (UE) device, for a Machine Learning model configuration; determine a location of the UE device; select, based on the first request and the location, an available Machine Learning agent; format a second request to the available Machine Learning agent for the Machine Learning configuration; identify the Machine Learning configuration received from the available Machine Learning agent based on the second request; and format a response to the first request, the response comprising the Machine Learning configuration for the UE device.

For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/085200314/publication/WO2023018726A1?q=Artificial%20intelligence
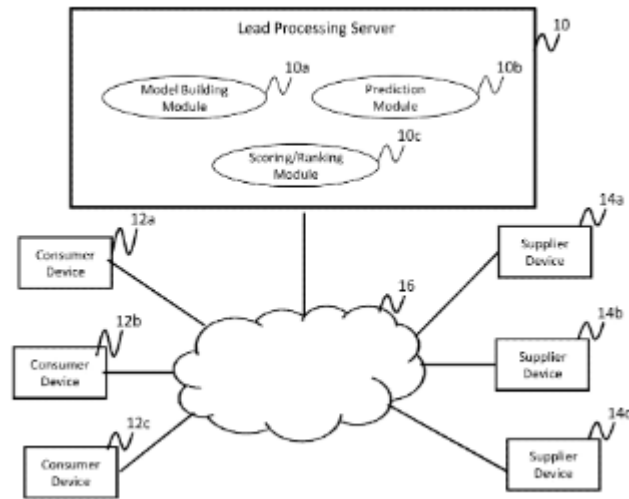
Reference
Mueck, M. D., Filippou, M., Luetzenkirchen, T., & Gomes Baltar, L. (February 16, 2023). Enhanced on-the-go Artificial Intelligence for wireless devices. Recovered February 16, 2023,   Espacenet   Patent   Search: https://worldwide.espacenet.com/patent/search/family/085200314/publication/WO2023018726A1?q=Artificial%20intelligence

Information source: (Espacenet Patent Search, 2023)

2.8.   System and methods for automatically building a Machine Learning model

Systems and methods for automatically building a Machine Learning (ML) model are disclosed. A plurality of variables is displayed via a graphical user interface (GUI).

Is a system for processing and distributing lead traffic according to an exemplary embodiment.
Credit: Kotolyan, A., Espacenet Patent Search

A target variable and a first independent variable are identified from the plurality of variables. A parameter associated with the ML model is identified. Collected data is received via the GUI. A first ML model is built using as inputs, the parameter and the collected data associated with the first independent variable and the target variable. A change is made to at least a portion of the inputs used to build the first ML model. A second ML model is built based on the change. A prediction accuracy of the first ML model is compared to the prediction accuracy of the second ML model. Either the first or second ML model is selected based on the prediction accuracy.

For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/085177367/publication/US202304 8301A1?q=Machine%20learning
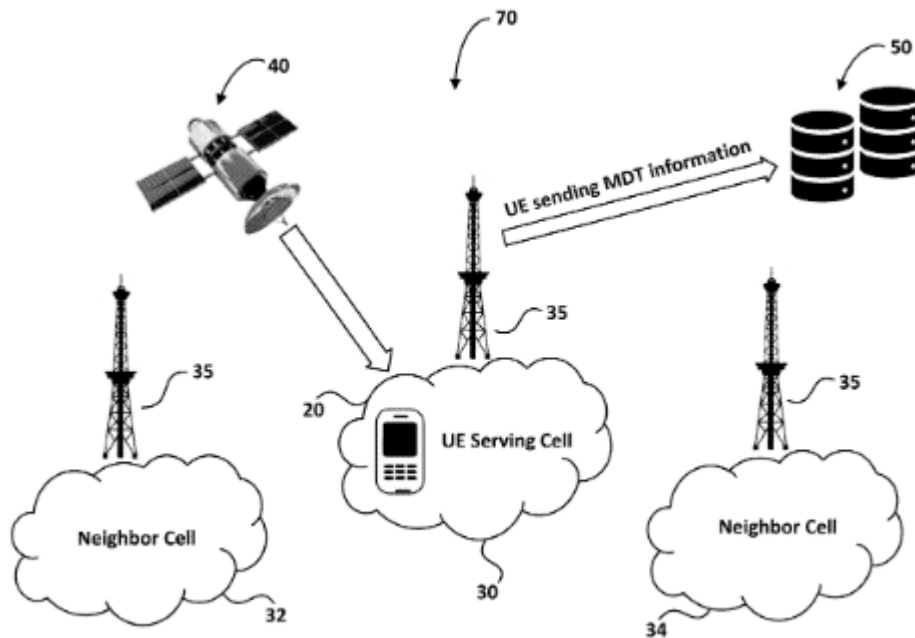
Reference
Kotolyan, A. (February 16, 2023). Systems and methods for automatically building a Machine Learning model. Recovered February 16, 2023, Espacenet Patent Search: https://worldwide.espacenet.com/patent/search/family/085177367/publication/US202304 8301A1?q=Machine%20learning

Information source: (Espacenet Patent Search, 2023)

2.9.   Determining geolocation of devices in a communication network

A Machine Learning method performed by a communication network monitoring device in which an incoming signaling record is received that includes radio signal attributes from a UE in the cellular communication network.

Illustrates, in simplified overview, a generalized communication system.
Credit: Hafeez, I., Espacenet Patent Search

A determination is made as to whether the UE incoming signaling record contains location (GPS) data. If the UE incoming signaling record contains GPS data, a ML model is generated for determining a location of future UEs in the communication network utilizing the GPS data and the radio signal attributes from the incoming UE signaling record. And if GPS data is not included in the UE incoming signaling record, then first a corrected TA (Timing Advance) value is determined which is then used, along with other radio signal attributes of the UE, to determine/predict a geolocation for the UE using Machine Learning techniques.

For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/085177349/publication/US2023048073A1?q=Machine%20learning
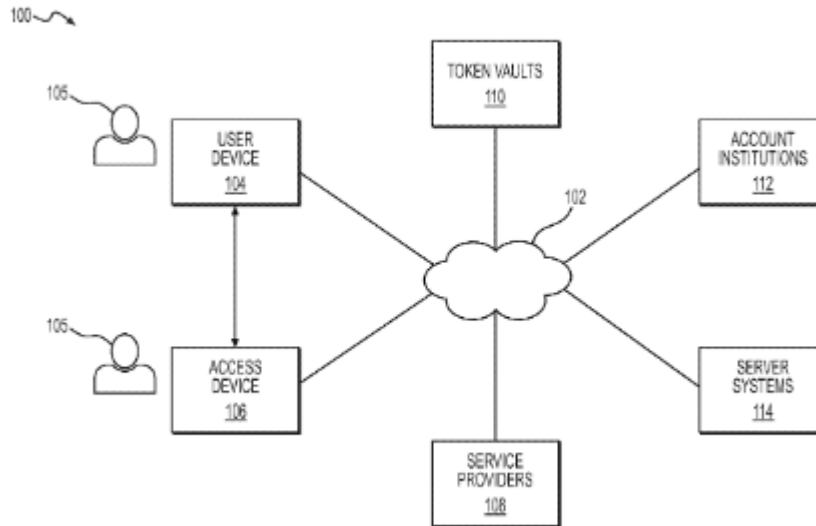
Reference
Hafeez, I. (February 16, 2023). Determining geolocation of devices in a communication network. Recovered February 17, 2023, Espacenet Patent Search: https://worldwide.espacenet.com/patent/search/family/085177349/publication/US2023048073A1?q=Machine%20learning

Information source: (Espacenet Patent Search, 2023)

2.10. Methods and systems for determining verification information related to virtual cards

Disclosed are systems and methods for utilizing virtual reality for virtual cards.

Depicts an exemplary system infrastructure, according to one or more embodiments.
Credit: Olenoski, M., Espacenet Patent Search

For example, a method of determining verification information may include: obtaining an image of a merchant site of a merchant captured by at least one camera of a first computing device, wherein the merchant site is displayed on a display of a second computing device; identifying one or more characters in the captured image; determining that the identified one or more characters indicate a virtual credit card number associated with a user; determining a card verification value associated with the virtual credit card number and an expiration date associated with the virtual credit card number; and displaying information regarding the determined virtual credit card number on a display of the first computing device.

For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/085176707/publication/US2023052968A1?q=Virtual%20reality

Reference
Olenoski, M. (February 16, 2023). Methods and systems for determining verification information related to virtual cards. Recovered February 17, 2023, Espacenet Patent Search:
https://worldwide.espacenet.com/patent/search/family/085176707/publication/US2023052968A1?q=Virtual%20reality

Information source: (Espacenet Patent Search, 2023)