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3D PRINTING

These Electronics-Free Robots Can Walk Right Off The 3D-Printer

"Imagine a robot that can walk, without electronics, and only with the addition of a cartridge of compressed gas, right off the 3D-printer. It can also be printed in one go, from one material.

That is exactly what roboticists have achieved in robots developed by the Bioinspired Robotics Laboratory at the University of California San Diego. They describe their work in an advanced online publication in the journal Advanced Intelligent Systems.

To achieve this feat, researchers aimed to use the simplest technology available: a desktop 3D-printer and an off-the-shelf printing material. This design approach is not only robust, it is also cheap—each robot costs about $20 to manufacture.

"This is a completely different way of looking at building machines," said Michael Tolley, a professor in the UC San Diego Department of Mechanical and Aerospace Engineering and the paper's senior author.

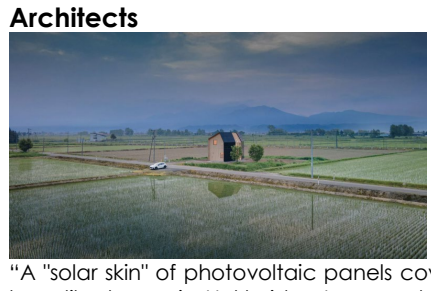
These robots could be used in settings where electronics cannot function. For example, the robots could be used for scientific reconnaissance in areas with strong radiation, or for disaster response or space exploration.

The researchers tested the robots in the lab and showed that as long as they were connected to a source of air or gas under constant pressure, they could keep functioning non-stop for three days. The team also showed that the robots could walk outdoors, untethered, using a compressed gas cartridge as a power source, and traverse different surfaces, including turf and sand. The robot can even walk underwater."

Source: UCSD (25 Mar 2025)

ARCHITECTURE

Solar Panel Facade Cloaks Off-Grid Home in Japan by Florian Busch Architects



"A "solar skin" of photovoltaic panels covers this barn-like home in Hokkaido, Japan, which has been completed by Tokyo-based Florian Busch Architects.

Called House W, the home was designed for a family who chose to leave Tokyo in order to live completely off-grid in an agricultural area near the Furano Plateau.

Drawing on the appearance of typical agricultural barns, Florian Busch Architects created a gabled form that was then "snapped" in half, angling its two ends to capture specific views and creating a central glazed strip providing light and warmth.

"The house's design starts with a compact volume, deliberately informed by the simplicity of a farmer's barn," the studio told Dezeen.

"However, the concept moves away from a single, compact mass and instead breaks the building into separate volumes, rotated to face the east and northwest."

"Rather than the conventional way of placing solar panels on top of a roof as a retrospective add-on, the detailing the building's exterior cladding, its 'solar skin', is a key driver of the design," it added."

Source: Dezeen (25 Mar 2025)

ARCHITECTURE

Beyond Form: How Light and Shadow Define Architectural Atmosphere

"Architecture is often defined by its physical form, materials, and structural elements, but light and shadow truly shape the experience of space. These elements influence perception, guide movement, and evoke emotional responses, transforming static structures into dynamic environments. Throughout history, architects have harnessed the interplay of light and shadow, using it as a fundamental design tool to create atmosphere and meaning.

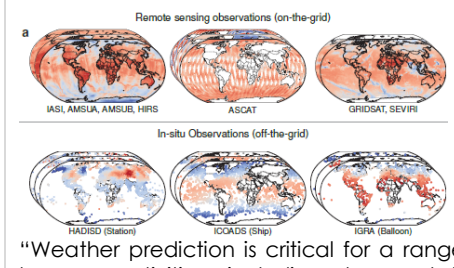
From the ancient temples of Egypt and Greece to modernist masterpieces, light has always been an integral part of architectural design. The Pantheon in Rome, with its oculus filtering daylight into the grand domed interior, demonstrates how natural light can create a sense of the divine. Gothic cathedrals, with their stained-glass windows, transformed interiors into kaleidoscopic experiences, emphasizing the spiritual dimension of architecture. In contemporary practice, architects continue exploring these principles, using natural and artificial light to shape perception and atmosphere.

Light and shadow do not merely illuminate space; they define it. The contrast between brightness and darkness enhances spatial depth, emphasizing the relationship between form and void. From Louis Kahn's poetic handling of natural light to Tadao Ando's dramatic use of contrast and Peter Zumthor's atmospheric compositions, architects transform light and shadow into essential elements of architectural storytelling."

Source: Archdaily (21 Mar 2025)

ATMOSPHERIC SCIENCE

End-To-End Data-Driven Weather Prediction

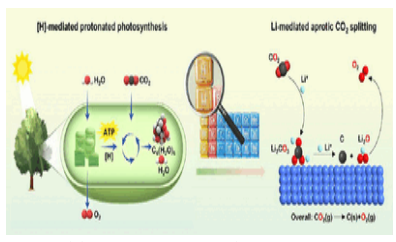


"Weather prediction is critical for a range of human activities including transportation, agriculture and industry, as well as the safety of the general public. Machine learning is transforming numerical weather prediction (NWP) by replacing the numerical solver with neural networks, improving the speed and accuracy of the forecasting component of the prediction pipeline. However, current models rely on numerical systems at initialisation and to produce local forecasts, limiting their achievable gains. Here we show that a single machine learning model can replace the entire NWP pipeline. Aardvark Weather, an end-to-end data-driven weather prediction system, ingests observations and produces global gridded forecasts and local station forecasts. The global forecasts outperform an operational NWP baseline for multiple variables and lead times. The local station forecasts are skillful up to ten days lead time, competing with a post-processed global NWP baseline and a state-of-the-art end-to-end forecasting system with input from human forecasters. End-to-end tuning further improves the accuracy of local forecasts. Our results show that skillful forecasting is possible without relying on NWP at deployment time, which will enable the full speed and accuracy benefits of data-driven models to be realised. We believe Aardvark Weather will be the starting point for a new generation of end-to-end models that will reduce computational costs by orders of magnitude, and enable rapid, affordable creation of customised models for a range of end-users."

Source: Nature (20 Mar 2025)

CHEMISTRY

Oxygen For Mars



"To mitigate global climate change, emissions of the primary culprit, carbon dioxide, must be drastically reduced. A newly developed process helps solve this problem: CO2 is directly split electrochemically into carbon and oxygen. As a Chinese research team reports in the journal Angewandte Chemie, oxygen could also be produced in this way under water or in space—without requiring stringent conditions such as pressure and temperature.

Leafy plants are masters of the art of carbon neutrality: during photosynthesis, they convert CO2 into oxygen and glucose. Hydrogen atoms play an important role as "mediators". However, the process is not particularly efficient. In addition, the oxygen produced does not come from the CO2 but from the absorbed water. True splitting of CO2 is not taking place in plants and also could not be achieved at moderate temperatures by technical means so far.

Ping He, Haoshen Zhou, and their team at Nanjing University, in collaboration with researcher from Fudan University (Shanghai) have now achieved their goal to directly split CO2 into elemental carbon and oxygen. Instead of hydrogen, the "mediator" in their method is lithium. The team developed an electrochemical device consisting of a gas cathode with a nanoscale cocatalyst made of ruthenium and cobalt (RuCo) as well as a metallic lithium anode. CO2 is fed into the cathode and undergoes a two-step electrochemical reduction with lithium. Initially, lithium carbonate Li2CO3 is formed, which reacts further to produce lithium oxide Li2O and elemental carbon. In an electrocatalytic oxidation process, the Li2O is then converted to lithium ions and oxygen gas O2. Use of an optimized RuCo catalyst allows for a very high

DESIGN

New Geometric Design of Material Provides Safer Bicycle Helmet

"By using new geometric shapes in the shock-absorbing material, researchers at the Universities of Gothenburg and Isfahan have developed a bicycle helmet that provides better protection against head injuries. The material absorbs shock by contracting bilaterally.

Bicycle helmets are important for protecting cyclists from head injuries, but traditional designs have limitations in terms of impact absorption and fit. Researchers at the University of Gothenburg and the University of Isfahan in Iran designed a bicycle helmet whose shock-absorbing material utilises what is called auxetic metastructures. The material is designed in special geometric patterns that behave differently under impact conditions compared to conventional foam liners.

"When exposed to energy from an impact, the liner material contracts, and this improves the absorption of impact energy, which means lower risks of injuries to a cyclist's head in an accident," says Mohsen Mirkhalaf, Associate Professor in the mechanics and physics of materials at the University of Gothenburg."

DESIGN

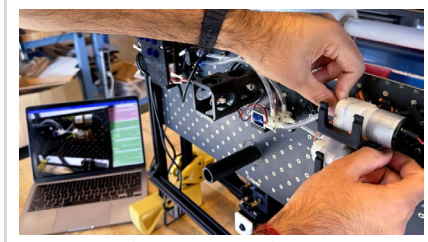
Nine Experimental Design Projects by Students at Free University of Bozen-Bolzano

"Dezeen School Shows: a project exploring the use of a water-purifying microalgae to meet net-zero emission targets is included in this School Show by students at the Free University of Bozen-Bolzano.

Also featured is an inflatable arts centre for young people and a book exploring the debate surrounding migration in Italy."

HARDWARE

Splatoverflow Enables Remote Hardware Troubleshooting



"A team of researchers from Cornell Tech has developed a new tool designed to revolutionize hardware troubleshooting, with the help of 3D phone scans.

SplatOverflow – inspired by StackOverflow, a widely used platform for tackling software issues – brings a similar approach to hardware support, enabling users to diagnose and fix hardware issues asynchronously with the help of remote experts.

A paper about the new tool will be presented April 30 at the Association of Computing Machinery's CHI conference on Human Factors in Computing Systems, taking place April 26-May 1 in Yokohama, Japan.

SplatOverflow was developed in the Matter of Tech Lab at Cornell Tech, directed by Thijs Roumen, assistant professor at Cornell Tech and the Cornell Ann S. Bowers College of Computing and Information Science (Cornell Bowers CIS)."

yield of O_2, over 98.6 %, significantly exceeding the efficiency of natural photosynthesis. As well as pure CO_2, successful tests were also carried out with mixed gases containing varying fractions of CO_2, including simulated flue gas, a CO_2/O_2 mixture, and simulated Mars gas. The atmosphere on Mars consists primarily of CO_2, though the pressure is less than 1 % of the pressure of Earth's atmosphere. The simulated Mars atmosphere thus contained a mixture of argon and 1 % CO_2.

If the required power comes from renewable energy, this method paves the way toward carbon neutrality. At the same time, it is a practical, controllable method for the production of O_2 from CO_2 with broad application potential—from the exploration of Mars and oxygen supply for spacesuits to underwater life support, breathing masks, indoor air purification, and industrial waste treatment."

Source: Wiley (24 Mar 2025)

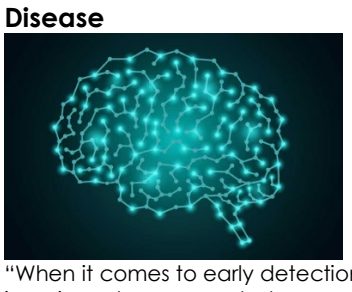
Source: Eurekalert! (25 Mar 2025)

Source: Dezeen (21 Mar 2025)

Source: Cornell (24 Mar 2025)

HEALTHCARE

Mass General Brigham Researchers Develop and Study an At-Home Smell Test for Early Detection of Alzheimer's Disease



"When it comes to early detection of cognitive impairment, a new study suggests that the nose knows. Researchers from Mass General Brigham developed olfactory tests—in which participants sniff odor labels that have been placed on a card—to assess people's ability to discriminate, identify, and remember odors. They found that participants could successfully take the test at home and that older adults with cognitive impairment scored lower on the test than cognitively normal adults. Results are published in Scientific Reports.

"Early detection of cognitive impairment could help us identify people who are at risk of Alzheimer's disease and intervene years before memory symptoms begin," said senior author Mark Albers, MD, PhD, of the Laboratory of Olfactory Neurotranslation, the McCance Center for Brain Health, and Department of Neurology at Massachusetts General Hospital, a founding member of the Mass General Brigham healthcare system. "Our goal has been to develop and validate a cost-effective, non-invasive test that can be performed at home, helping to set the stage for advancing research and treatment for Alzheimer's."

Source: massgeneralbrigham (24 Mar 2025)

MECHANICAL SYSTEMS

Technology Developed by MIT Engineers Makes Pesticides Stick to Plant Leaves

"Reducing the amount of agricultural sprays used by farmers — including fertilizers, pesticides and herbicides — could cut down the amount of polluting runoff that ends up in the environment while at the same time reducing farmers' costs and perhaps even enhancing their productivity. A classic win-win-win.

A team of researchers at MIT and a spinoff company they launched has developed a system to do just that. Their technology adds a thin coating around droplets as they are being sprayed onto a field, greatly reducing their tendency to bounce off leaves and end up wasted on the ground. Instead, the coated droplets stick to the leaves as intended.

The research is described today in the journal Soft Matter, in a paper by recent MIT alumni Vishnu Jayaprakash PhD '22 and Sreedath Panat PhD '23, graduate student Simon Rufer, and MIT professor of mechanical engineering Kripa Varanasi."

Source: Eurekalert! (25 Mar 2025)

TELECOMMUNICATIONS

Plasmonic Modulators Can Break the Wireless Terahertz Barrier: The Tech Could Find a Home In 6G Networks and AI Data Centers

"Modern telecommunications infrastructure relies on a broad range of technologies. But ironically, some of these technologies can't readily communicate with each other.

The electrical signals used for wireless communications, for example, can't just be shoved into the fiber-optic infrastructure that forms the backbone of modern networks. Instead, they must be first converted to light (and then back again). This important task is performed by a network component called an electro-optic (EO) modulator.

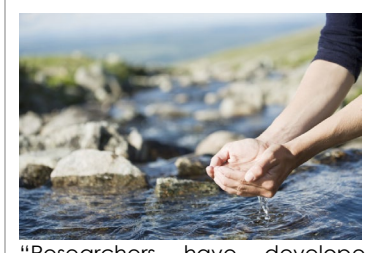
"All information that you have is in the electrical world, but once it leaves your house, it goes into fiber. So, you need components that can encode from the electrical to the optical world signals at enormous speed. That's where the modulator comes in," says Juerg Leuthold, the head of the Department of Information Technology and Electrical Engineering at ETH Zurich, the Swiss Federal Institute of Technology of Zurich.

Telecommunications providers hope that next-generation 6G networks will deliver wireless speeds up to a terabit per second, and possibly beyond. However, these fast wireless networks still need to connect with wired fiber-optic infrastructure. That means electro-optic modulators need an upgrade—or else they risk becoming a bottleneck."

Source: IEEE Spectrum (24 Mar 2025)

WATER PURIFICATION

3D Nanotech Blankets Offer New Path to Clean Drinking Water



"Researchers have developed a new material that, by harnessing the power of sunlight, can clear water of dangerous pollutants.

Created through a combination of soft chemistry gels and electrospinning — a technique where electrical force is applied to liquid to craft small fibers — the team constructed thin fiber-like strips of titanium dioxide (TiO_2), a compound often utilized in solar cells, gas sensors and various self-cleaning technologies.

Despite being a great alternative energy source, solar fuel systems that utilize TiO_2 nanoparticles are often power-limited because they can only undergo photocatalysis, or create chemical reactions, by absorbing non-visible UV light. This can cause significant challenges to implementation, including low efficiency and the need for complex filtration systems.

Yet when researchers added copper to the material to improve this process, their new structures, called nanomats, were able to absorb enough light energy to break down harmful pollutants in air and water, said Pelagia-Iren Gouma, lead author of the study and a professor of materials science and engineering at The Ohio State University."

Source: OSU (24 Mar 2025)