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Mainframes-Powering the Digital Age

In the ever-evolving landscape of technology, where trends come and go, one technology has stood the test of time: the mainframe computer. Despite the rise of distributed computing and cloud services, mainframes have continued to play the critical role in powering the digital age. Mainframes as a service(MFaaS) models allow organizations to leverage the power of mainframes without the need for heavy upfront investments. In the modern era, mainframes have evolved into highly advanced and capable system.

This article delves into the enduring relevance of mainframes, where unique characteristics, and their contributions to modern computing.

The Evolution of mainframes

Mainframes have come a long way since their inception in the 1950s. Initially designed to handle large scale data processing for corporations and government agencies, mainframes have continuously evolved to meet the demand of the digital era. Today's mainframes combine decades of refinement with cutting-edge technologies, offering unmatched performance, reliability, and security.

Unparalleled Processing Power

One of the defining features of mainframes is the immense processing power. These systems are capable of executing millions of instructions per second, enabling the handling of massive workloads. Mainframes are optimized for transaction processing and batch processing, making them ideal for industries such as finance, healthcare and telecommunications, where high volumes of data need to be processed in real time.

Superior Reliability and availability

Mainframes have a well-deserved reputation for their exceptional reliability and availability. These systems are designed with re redundant components and fault-tolerant architectures, ensuring minimal downtime. Furthermore, mainframes can be upgraded or repaired without disrupting ongoing operations, making them highly reliable platforms for critical business applications that require continuous availability.

Enhanced security and compliance

Data security is the paramount concern in today's digital landscape. Mainframe excel in this area, offering robust security features to protect sensitive information. Mainframe security encompasses encryption, access controls, authentication mechanisms and auditing capabilities. Moreover, mainframes are designed to meet stringent regulatory compliance requirements, making them a preferred choice for industries that handle sensitive data such as finance and healthcare.

Integration with Modern Technologies

Mainframes have not remained isolated from the advancements in modern technology. They have embraced open standards and evolved to integrate with contemporary technologies such as cloud computing, virtualization, and analytics. Through hybrid cloud models, organizations can leverage mainframes alongside distributed systems, achieving the best of both worlds in terms of scalability, flexibility, and cost optimization.

RPA work with the mainframe

Most organizations retail the most valuable asset, their business data, on the mainframe(80 percent of the world's corporate data resides on mainframes).Using RPA initiatives, enterprises can leverage this unique information to increase productivity, reduce errors, and improve customer service. They use one of two methods to integrate RPA- either using web service or the more traditional Application Programming Interfaces (APIs),such as HLLAPI, or .net.

Mainframe Statistics

1. Mainframes are used by 71% of Fortune companies

More specifically, these companies use IBM Z systems. The industry has consolidated around the strongest vendor on the block, and IBM has continued to invest in its highly secure, highly scalable Z platform.

2. Mainframes handle 90% of all credit card transactions

Did you buy something with your Visa or Mastercard today? More likely than not, a mainframe made it possible. Peter Rutten, Research Director, IDC tells us why: "There is no platform that can conduct the same number of transactions per second with the high availability and security that mainframe supplies."

3. Mainframes handle 68% of the world production IT workloads, yet they account for only 6 percent of IT costs.

That's according to IBM, which obviously has a horse in the mainframe race, and it is unclear exactly how these figures were calculated. However, if you assume that these numbers are anywhere close to accurate, they are impressive, especially for what they reveal about the cost efficiency of mainframes.

4. Each IBM z16 mainframe can handle19 billon business transactions a day

That's a lot of credit card payments, stock trades, and other business-critical transactions. Scalability, reliability, and security are essential for these kinds of mission-critical workloads.

5. Revenue from Z System sales spiked77% year-over- year with the 2022 release of the newest IBM mainframe, the z16 system

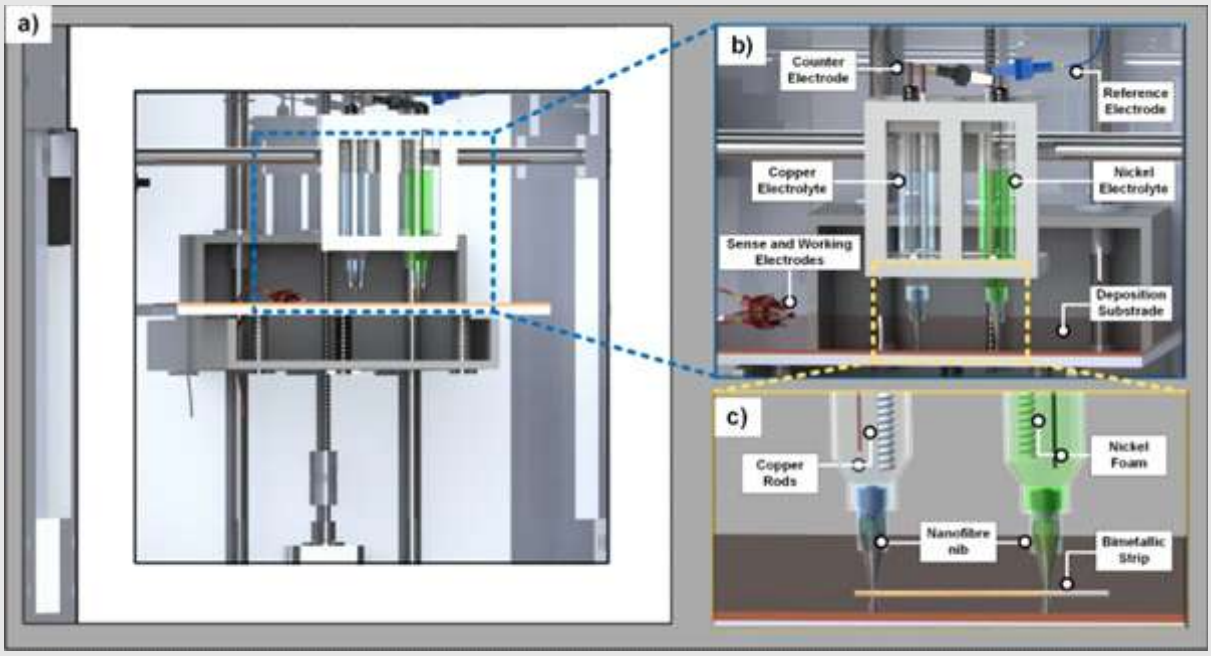
Yes, IBM continues to make money from mainframe sales. In its Q2 2022 earnings report, IBM executives cited the latest mainframe's capacity for large-scale AI, resilient security, and cloud-native capabilities.

6. 92 of the top 100 banks and all top 10 insurers worldwide use IBM mainframes

Sure, the cloud is great and x86 servers are cheap, but when you're a company with millions of transactions to process each day and ultra-tight security needs, nothing beats the mainframe.

Conclusion

Despite the emergence of new computing paradigms, mainframes continue to be bedrock of enterprise computing. Their unmatched processing power, reliability, security and scalability make them an indispensable asset in today's digital age. Mainframes bridge the gap between legacy systems and modern technologies, enabling organizations to meet the demand of rapidly evolving business landscape while preserving their investment in mission-critical applications. As we look to the future, mainframes will undoubtedly continue play a pivotal role in shaping the technology landscape.



Scientists 3D-print two types of steel in the same layer

Best of all, the new method employs common inexpensive tools making it convenient for manufacturers and repair shops to use it in the near term. Amit Bandyopadhyay, senior author of the study, noted that the development could potentially be used to make high-performance medical implants or even parts for space travel.

"It has very broad applications because any place that is doing any kind of welding can now expand their design concepts or find applications where they can combine a very hard material and a soft material almost simultaneously," said Bandyopadhyay, a professor in WSU's School of Mechanical and Materials Engineering.

The idea behind the invention came from nature. Trees and bones get their strength from the way layered rings of different materials interact with each other. Tests on the new resulting material showed greater strength than either stainless steel or mild steel have on their own.

The new method even bypasses an old complication that saw 3D printing with multiple metals requiring stopping and changing metal wires. The new technique eliminates that pause and allows welders to combine two or more metals in the same layer while the metals are still hot.

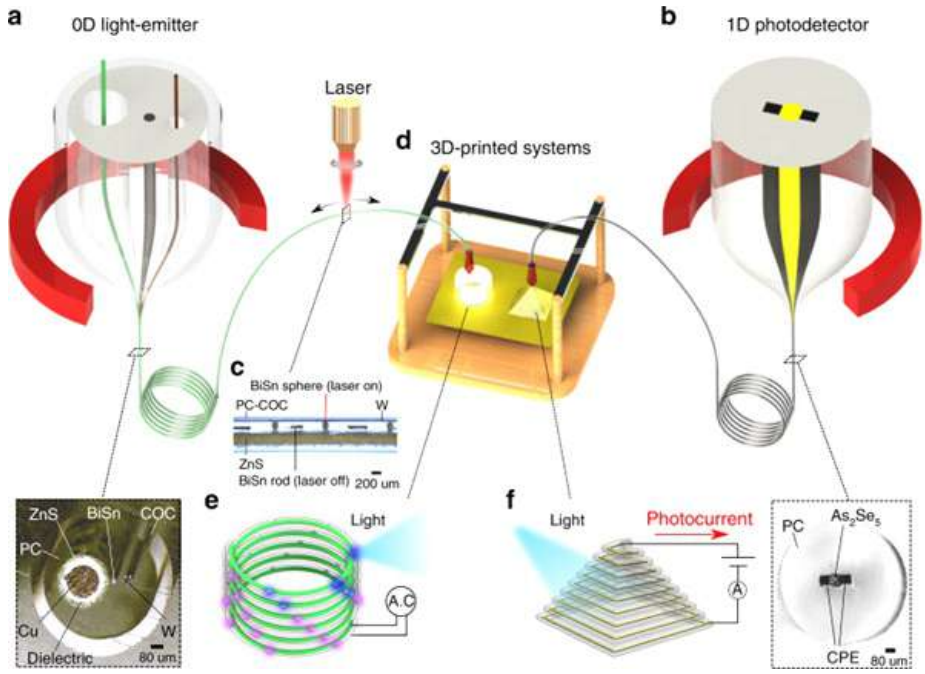
"This method deposits the metals in a circle instead of just in a line. By doing that, it fundamentally departs from what's been possible," said in the statement Lile Squires, a WSU mechanical engineering doctoral student and the study's first author. "Going in a circle essentially allows one material to bear hug the other material, which can't happen when printing in a straight line or in sandwiched layers."

Highlights

- *Engineers at Washington State University have developed a new method for 3D printing bimetallic materials inspired by the structural complexity of trees and bones.*
- *The method allows two types of steel to be 3D printed in the same circular layer, resulting in a bimetallic material that is 33% to 42% stronger than individual metals.*
- *The new technique overcomes the need to stop and change metal wires during 3D printing with multiple metals, allowing for the simultaneous combination of different materials in the same layer while they are still hot.*
- *University engineers were inspired by the structural complexity of trees and bones to conceive of a method to 3D-print two types of steel in the same circular layer, resulting in a bimetallic material that is 33 percent to 42 percent stronger than metal alone.*

The future holds great promise for the new method with applications possible in medical manufacturing processes that print joint replacements with durable titanium on the outside and an inner material such as magnetic steel with healing properties. Even better, structures used in space could be equipped with a high-temperature resistant material surrounding inner material with cooling properties to help it maintain a consistent temperature.

"This concept has both welders printing, so we can use multiple materials in the same layer itself, creating advantages as they combine," said Bandyopadhyay. "and it doesn't have to stop at just two materials. It can be expanded."



The study is published in the journal *Nature Communications.*

Bimetallic wire arc additive manufacturing (AM) has traditionally been limited to depositions characterized by single planar interfaces. This study demonstrates a more complex radial interface concept, with in situ mechanical interlocking and as built properties suggesting a prestressed compressive effect. A 308 L stainless core is surrounded by a mild steel casing, incrementally maintaining the interface throughout the Z-direction. A small difference in the thermal expansion coefficient between these steels creates residual stresses at their interface. X-ray diffraction analysis confirms phase purity and microstructural characterization reveals columnar grain growth independent of layer transitions. Hardness values are consistent with thermal dissipation characteristics, and the compressive strength of the bimetallic structures shows a 33% to 42% improvement over monolithic controls. Our results demonstrate that biomimetic radial bimetallic variation is feasible with improved mechanical response over monolithic compositions, providing a basis for advanced structural design and implementation using arc based metal AM.

- *Highlights*

- *Researchers at Northwestern Engineering have developed a high-resolution camera capable of seeing around corners and through objects like human skin and bones.*
- *The camera utilizes non-line-of-sight (NLoS) imaging, a relatively new research field, to capture scattered light and reconstruct it into a coherent image, allowing for detailed imaging of fast-moving objects and even tiny capillaries.*
- *The technology has potential applications in noninvasive medical imaging, early-warning navigation systems for vehicles, and industrial inspection in confined spaces, and it can be extended to other wavelengths such as radio waves for space exploration or underwater acoustic imaging.*

A new camera can see through almost anything, including human tissue and bones

When asked what superpowers they would like to have, many say the ability to see through things. Now, there may be a camera that could give people that gift.

Developed by Northwestern Engineering researchers, the new high-resolution camera can see around corners and through human skin and even bones. It also has the potential to image fast-moving objects such as speeding cars or even the beating heart.

The relatively new research field is called non-line-of-sight (NLoS) imaging and comes with a level of resolution so high that it could even capture the tiniest capillaries at work.

“Our technology will usher in a new wave of imaging capabilities,” said in a statement the McCormick School of Engineering's Florian Willomitzer, first author of the study.

“Our current sensor prototypes use visible or infrared light, but the principle is universal and could be extended to other wavelengths. For example, the same method could be applied to radio waves for space exploration or underwater acoustic imaging. It can be applied to many areas, and we have only scratched the surface.”

The new technology could be used in applications ranging from noninvasive medical imaging, early-warning navigation systems for vehicles, and industrial inspection in tightly confined spaces. But how does it work?

It essentially intercepts the scattered light coming from an object in order to reconstruct the inherent information about its time of travel to reveal the original object. The scientists compare it to shining a flashlight through your hand.

In this case, you should see the bone in your hand but the light coming through scatters the bone image resulting in just a large dot. NLoS can capture this scattered light and reconstruct it into a coherent image.

This same technique can be applied to goals as different as seeing around a corner and imaging an organ inside the human body through all the tissue and bones, making for a powerful versatile camera.

Two of the fastest runaway stars discovered in the Milky Way

Two stars moving at breakneck speeds have been spotted in our galaxy.

According to the Harvard-Smithsonian Center for Astrophysics, two white dwarfs are the fastest runaway stars and might explain the genesis of some types of supernovae.

White dwarfs are stars that have depleted their nuclear fuel. Our own Sun may become one a billion years from now.

The latest data was gathered using the European Space Agency's Gaia survey, an ongoing endeavor to map the Milky Way with great precision. The survey also collects information on the movements of stars in the Milky Way galaxy.

Six free moving stars were discovered by astronomers in total. As per the study, Type 1a supernovas are likely responsible for kicking out these runaway stars from their original positions.

- *Highlights*

- *Two white dwarf stars have been identified as the fastest runaway stars in our galaxy, with speeds of 1,420 miles per second and 1,053 miles per second.*
- *The discovery was made using data from the Gaia survey, which aims to map the Milky Way with precision and track the movements of stars.*
- *These runaway stars are believed to have been ejected from their initial star clusters by binary star pairs or supernova explosions, and their study provides insights into the genesis of certain types of supernovae.*

Two of them break the record for the fastest radial velocity (the motion of a star with respect to an observer's line of sight) ever seen.

The new fastest star is J0927, followed by J1235 in the galaxy. The fastest J0927 clocks at a massive speed of 1,420 miles (2,285 kilometers) per second, while J1235 clocks in at 1,053 miles (1,694 kilometers per second.

What are runaway stars?

The Sun, like all other stars, moves in a particular orbit around the center of our galaxy. However, within this, there are local movements of some stars, known as runaway stars, that move at higher speeds than expected.

The strongest evidence shows that free moving stars are usually ejected from their initial star clusters by pairs of binary stars or a supernova explosion.

To understand the origin of these runaway stars, astronomers' study various parameters, including differences in velocity and spectroscopic signatures. This data also helps them to classify the type of star.

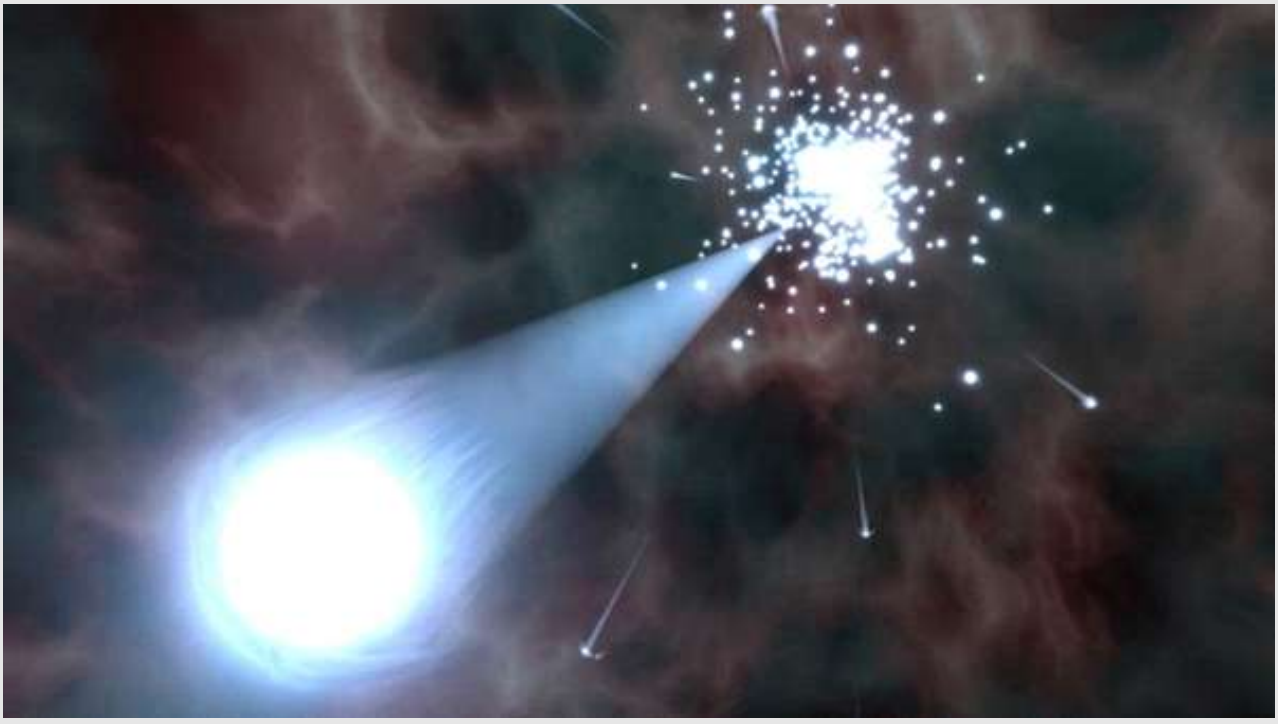
This is not the first time that astronomers have spotted runaway stars, but in terms of speed, these two are said to be the fastest known to date. According to the authors of the new study, there might be even faster stars than the currently known ones. They are, however, difficult to locate since scientists tend only to notice the brightest ones. But they will continue to explore and understand the dynamics behind runaway stars.

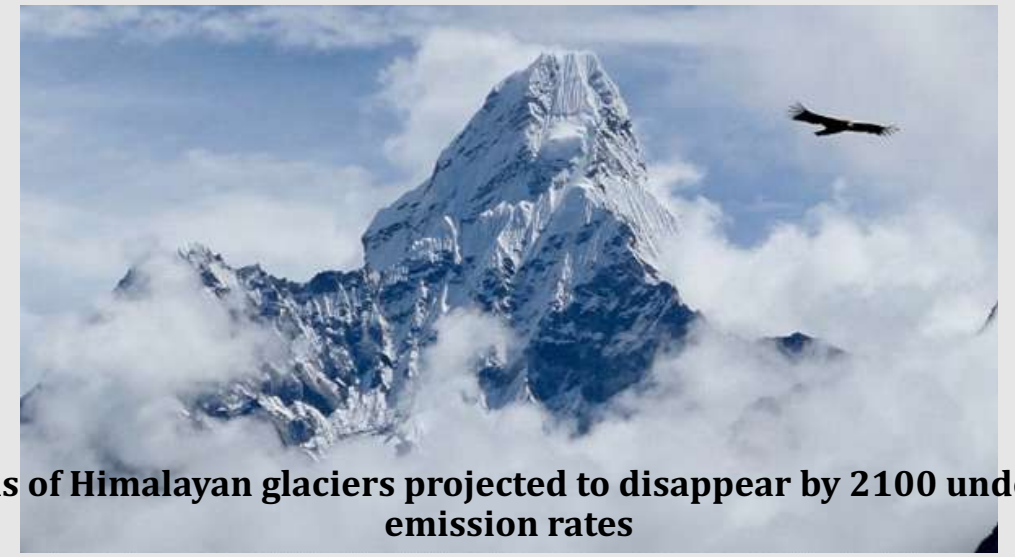
Their findings are available on the preprint server arXiv and the study has been submitted for publication in the *Open Journal of Astrophysics*.

We report a spectroscopic search for hypervelocity white dwarfs (WDs) that are runaways from Type Ia supernovae (SNe Ia) and related thermonuclear explosions. Candidates are selected from Gaia data with high tangential velocities and blue colors. We find six new runaways, including four stars with radial velocities (RVs) >1000kms−1 and total space velocities ≳1300kms−1. These are most likely the surviving donors from double-degenerate binaries in which the other WD exploded. The other two objects have lower minimum velocities, ≳600kms−1, and may have formed through a different mechanism, such as pure deflagration of a WD in a Type Iax supernova.

The four fastest stars are hotter and smaller than the previously known "D6 stars," with effective temperatures ranging from ∼20,000 to ∼130,000 K and radii of ∼0.02−0.10R. Three of these have carbon-dominated atmospheres, and one has a helium-dominated atmosphere. Two stars have RVs of −1694 and −2285kms−1 -- the fastest systemic stellar RVs ever measured. Their inferred birth velocities, ∼2200−2500kms−1, imply that both WDs in the progenitor binary had masses >1.0M.

The high observed velocities suggest that a dominant fraction of the observed hypervelocity WD population comes from double-degenerate binaries whose total mass significantly exceeds the Chandrasekhar limit. However, the two nearest and faintest D6 stars have the lowest velocities and masses, suggesting that observational selection effects favor rarer, higher-mass stars. A significant population of fainter low-mass runaways may still await discovery. We infer a birth rate of D6 stars that is consistent with the SN Ia rate. The birth rate is poorly constrained, however, because the luminosities and lifetimes of D6 stars are uncertain.





Two-thirds of Himalayan glaciers projected to disappear by 2100 under current emission rates

As global surface air temperatures breached 1.5degrees celcius above pre-industrial levels for the first time earlier this month, scientists are emphasizing the need for immediate measures to ensure adherence to stay within the threshold.

According to the Intergovernmental Panel on Climate Change (IPCC), countries under the 2015 Paris Agreement agreed to cut greenhouse gas emissions with a view to 'holding the increase in the global average temperature to well below two-degree Celsius above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 degree celsius above pre-industrial levels'.

Director of the International Cryosphere Climate Initiative (ICCI), Pam Pearson, said, "There have been huge strides in cryosphere science since the Paris Agreement was agreed. We understand today what we did not fully appreciate then: that ice responds much more quickly and irreversibly to temperature rises than previously thought."

Pearson further accentuates that billions of people's lives depend on a low-emission pathway.

Therefore, It's crucial for governments and civil society to be aware of the extreme implications of even just 1.5 degrees Celsius of warming on the cryosphere.

"This is the only way to slow or avoid catastrophic impacts," she says. The new assessment report by the International Centre for Integrated Mountain Development (ICIMOD) finds that the Himalayan glaciers would certainly lose one-third of their glaciers by 2100 if global warming is restricted to 1.5 degrees Celsius.

- *Highlights*
  - *Global surface air temperatures have exceeded the critical 1.5 degrees Celsius threshold, highlighting the urgent need for immediate action to stay within safe limits and mitigate further climate change impacts.*
  - *The new assessment report by the ICIMOD reveals alarming projections for the Himalayan glaciers, indicating a potential loss of one-third of their volume by 2100 under a 1.5 degrees Celsius warming scenario. If current emission rates persist, this loss could increase to two-thirds, posing severe threats to freshwater availability and river systems.*
  - *The consequences of melting glaciers in the Himalayan region are far reaching, including water and food insecurity, disrupted ecosystems, compromised energy sources, and increased risks of landslides.*

With current emission rates and environmental policies, scientists project that the Hindu Kush Himalayan could experience the loss of two-thirds of its glacier volume by 2100.

"Hindu Kush Himalayan glaciers disappeared 65% faster in 2011–2020 compared with the previous decade," according to the ICIMOD. Additionally, the report indicates that by the end of the century, the HKH region could face a potential loss of up to 80 percent of the glacier's volume based on current emission trajectories.

Alluding to the details, the report suggests that snow cover could fall by up to a quarter under high-emissions scenarios.

As a result, it could drastically reduce freshwater for major rivers including Amu Darya (where it contributes up to 74 percent of river flow), the Indus (40 percent), and Helmand (77 percent).

Overall, 12 rivers flow through the Himalayan glaciers across 16 Asian countries, the report says, "providing fresh water and other vital ecosystem services to 240 million people in the mountains and a further 1.65 billion downstream."

The report finds that as temperatures increase, so does the risk to life and infrastructure as previously frozen ground will fall away from high altitudes to create dangerous and destructive landslides.

Devastating consequences

Such a scenario will have devastating repercussions on the livelihoods of not only the communities residing in and around the region, but also millions of people across Asia.

The loss of glacier volume will cause water and food insecurity, and disrupt ecosystems and energy sources.

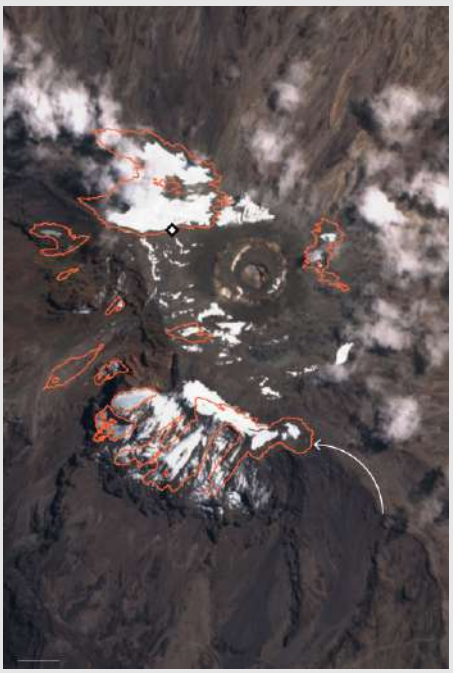
According to the ICIMOD, the report was published after cryosphere scientists at the Bonn Climate Change Conference sounded the alarm at the speed and scale of ice melt worldwide.

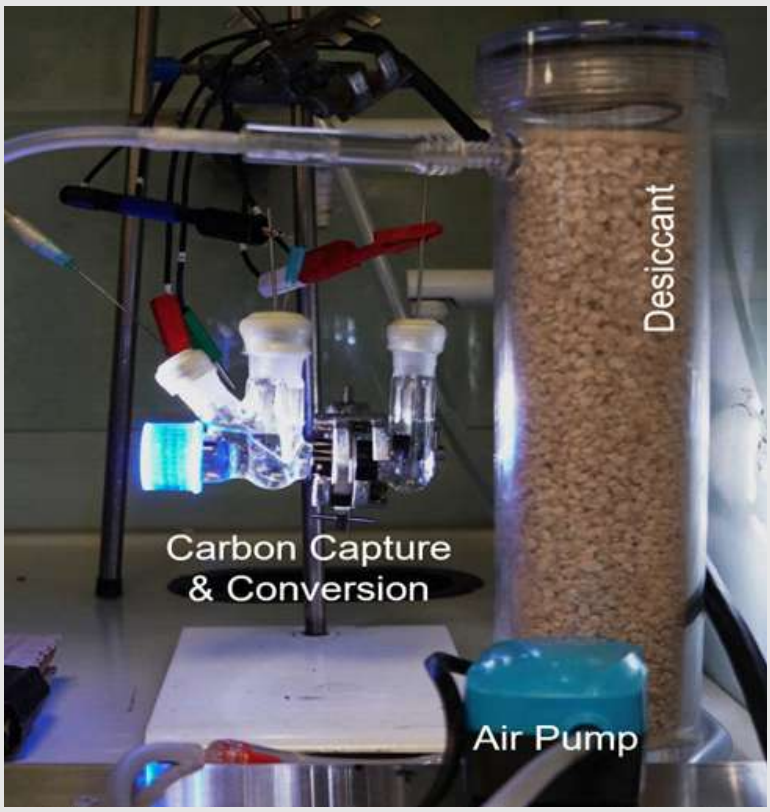
It states that the rate at which ice is melting exceeds the worst-case scenario projections from the IPCC.

Another recent study shows that Arctic waters could lose all their summer-end sea ice as early as 2030.

Izabella Koziell, ICIMOD's Deputy Director General says that there's still time to save this critical region if we cut emissions extensively and quickly.

"The glaciers of the Hindu Kush Himalaya are a major component of the Earth system. With two billion people in Asia reliant on the water that glaciers and snow here hold, the consequences of losing this cryosphere are too vast to contemplate. We need leaders to act now to prevent catastrophe," Koziell says.





- *Highlights*

- *Researchers from the University of Cambridge have developed a solar-powered reactor that can capture carbon dioxide (CO2) from industrial processes or directly from the air and convert it into sustainable fuels and valuable chemical products.*
- *The solar-driven technology demonstrated the conversion of CO2 into syngas, a key building block for sustainable liquid fuels, and plastic waste into glycolic acid, which is widely used in the cosmetics industry.*
- *The team successfully captured and concentrated CO2 from real-world sources, such as industrial exhaust and the air itself, marking an important step towards producing clean fuels without relying on environmentally destructive oil and gas extraction.*

Clean, sustainable fuels made 'from thin air' and plastic waste

Researchers have demonstrated how carbon dioxide can be captured from industrial processes—or even directly from the air and transformed into clean, sustainable fuels using just the energy from the sun.

The researchers, from the University of Cambridge, developed a solar-powered reactor that converts captured CO2 and plastic waste into sustainable fules and other valuable chemical products. In tests, CO2 was converted into syngas, a key building block for sustainable liquid fuels, and plastic bottles were converted into glycolic acid, which is widely used in the cosmetics industry.

Unlike earlier tests of their solar fuels technology however, the team took CO2 from real-world sources such as industrial exhaust or the air itself. The researchers were able to capture and concentrate the CO2 and convert it into sustainable fuel.

Although improvements are needed before this technology can be used at an industrial scale, the results, reported in the journal Joule, represent another important step toward the production of clean fuels to power the economy, without the need for environmentally destructive oil and gas extraction.

For several years, Professor Erwin Reisner's research group, based in the Yusuf Hamied Department of Chemistry, has been developing sustainable, net-zero carbon fuels inspired by photosynthesis, the process by which plants convert sunlight into food—using artificial leaves. These artificial leaves convert CO2 and water into fuels using just the power of the sun.

To date, their solar-driven experiments have used pure, concentrated CO2 from a cylinder, but for the technology to be of practical use, it needs to be able to actively capture CO2 from industrial process, or directly from the air. However, since CO2 is just one of many types of molecules in the air we breathe, making this technology selective enough to convert highly diluted CO2 is a huge technical challenge.

"We're not just interested in decarbonization, but de-fossilization we need to completely eliminate fossil fuels in order to create a truly circular economy," said Reisner. "In the medium term, this technology could help reduce carbon emissions by capturing them from industry and turning them into something useful, but ultimately, we need to cut fossil fuels out of the equation entirely and capture CO2 from the air."
The researchers took their inspiration from carbon capture and storage (CCS), where CO2 is captured and then pumped and stored underground.
"CCS is a technology that's popular with the fossil fuel industry as a way to reduce carbon emissions while continuing oil and gas exploration," said Reisner. "But if instead of carbon capture

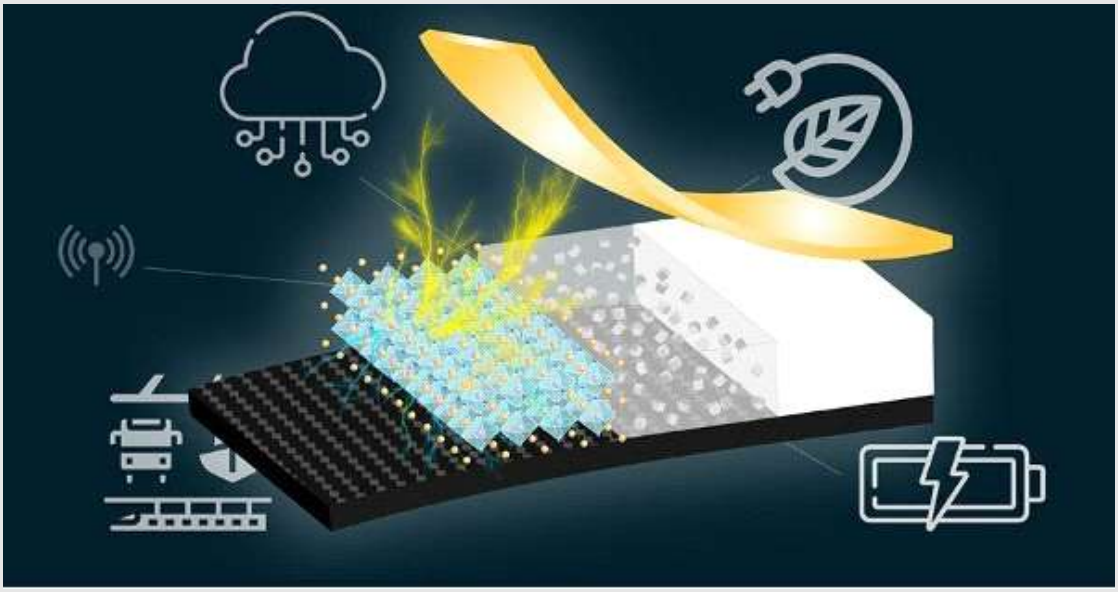
and storage, we had carbon capture and utilization, we could make something useful from CO2 instead of burying it underground, with unknown long-term consequences, and eliminate the use of fossil fuels."
The researchers adapted their solar driven technology so that it works with flue gas or directly from the air, converting CO2 and plastics into fuel and chemicals using only the power of the sun.

By bubbling air through the system containing an alkaline solution, the CO2 selectively gets trapped, and the other gases present in air, such as nitrogen and oxygen, harmlessly bubble out. This bubbling process allows the researchers to concentrate the CO2 from air in solution, making it easier to work with.
The integrated system contains a photocathode and an anode. The system has two compartments: on one side is captured CO2 solution that gets converted into syngas, a simple fuel. On the other side plastics are converted into useful chemicals using only sunlight.

"The plastic component is an important trick to this system," said coauthor Dr. Motiar Rahaman. "Capturing and using CO2 from the air makes the chemistry more difficult. But, if we add plastic waste to the system, the plastic donates electrons to the CO2. The plastic breaks down to glycolic acid, which is widely used in the cosmetics industry, and the CO2 is converted into syngas, which is a simple fuel."
"This solar-powered system takes two harmful waste products plastic and carbon emissions and converts them into something truly useful," said co-first author Dr. Sayan Kar.

"Instead of storing CO2 underground, like in CCS, we can capture it from the air and make clean fuel from it," said Rahaman. "This way, we can cut out the fossil fuel industry from the process of fuel production, which can hopefully help us avoid climate destruction."
"The fact that we can effectively take CO2 from air and make something useful from it is special," said Kar. "It's satisfying to see that we can actually do it using only sunlight."

The scientists are currently working on a bench-top demonstrator device with improved efficiency and practicality to highlight the benefits of coupling direct air capture with CO2 utilization as a path to a zero-carbon future.



Researchers develop new device that transforms vibrations into electricity for self-powered sensors

An international research group has engineered a new energy-generating device by combining piezoelectric composites with carbon fiber-reinforced polymer (CFRP), a commonly used material that is both light and strong. The new device transforms vibrations from the surrounding environment into electricity, providing an efficient and reliable means for self-powered sensors.

Details of the group's research were published in the journal Nano Energy on June 13, 2023.

Energy harvesting involves converting energy from the environment into usable electrical energy and is something crucial for ensuring a sustainable future.

"Everyday items, from fridges to street lamps, are connected to the internet as part of the Internet of Things (IoT), and many of them are equipped with sensors that collect data," says Fumio Narita, co-author of the study and professor at Tohoku University's Graduate School of Environmental Studies. "But these IoT devices need power to function, which is challenging if they are in remote places, or if there are lots of them."

The sun's rays, heat, and vibration all can generate electrical power. Vibrational energy can be utilized thanks to piezoelectric materials' ability to generate electricity when physically stressed. Meanwhile, CFRP lends itself to applications in the aerospace and automotive industries, sports equipment, and medical equipment because of its durability and lightness.

"We pondered whether a piezoelectric vibration energy harvester (PVEH), harnessing the robustness of CFRP together with a piezoelectric composite, could be a more efficient and durable means of harvesting energy," says Narita.

The group fabricated the device using a combination of CFRP and potassium sodium niobate (KNN) nanoparticles mixed with epoxy resin. The CFRP served as both an electrode and a reinforcement substrate.

The so-called C-PVEH device lived up to its expectations. Tests and simulations revealed that it could maintain high performance even after being bent more than 100,000 times.

- *Highlights*

  - *An international research group has developed a new energy-generating device that combines piezoelectric composites with carbon fiber-reinforced polymer (CFRP) to transform vibrations from the surrounding environment into electricity. This innovation provides an efficient and reliable means for self-powered sensors.*
  - *The device, called the C-PVEH (Carbon Fiber-Reinforced Polymer Piezoelectric Vibration Energy Harvester), utilizes the piezoelectric properties of the composite material to generate electricity when physically stressed. CFRP, known for its durability and lightness, serves as both an electrode and a reinforcement substrate in the device.*
  - *The C-PVEH device demonstrated impressive performance, maintaining high efficiency even after being bent more than 100,000 times. It effectively stored the generated electricity and powered LED lights. Moreover, it outperformed other polymer composites based on potassium sodium niobate in terms of energy output density.*

Lasers enable internet backbone via satellite, may soon eliminate need for deep-sea cables

Optical data communications lasers can transmit several tens of terabits per second, despite a huge amount of disruptive air turbulence. ETH Zurich scientists and their European partners demonstrated this capacity with lasers between the mountain peak, Jungfraujoch, and the city of Bern in Switzerland. This will soon eliminate the necessity of expensive deep sea cables.

The backbone of the internet is formed by a dense network of fiber-optic cables, each of which transports up to more than 100 terabits of data per second (1 terabit = 10^{12} digital 1/0 signals) between the network nodes. The connections between continents take place via deep sea networks which is an enormous expense: a single cable across the Atlantic requires an investment of hundreds of millions of dollars. TeleGeography, a specialized consulting firm, announced that there currently are 530 active undersea cables and that number is on the rise.

Soon, however, this expense may drop substantially. Scientists at ETH Zurich, working together with partners from the space industry, have demonstrated terabit optical data transmission through the air in a European Horizon 2020 project. In the future, this will enable much more cost effective and much faster backbone connections via near earth satellite constellations. Their work is published in the journal Light: Science & Applications.

To achieve this milestone, the project partners took a significant leap forward in establishing a satellite optical communication link through a successful test conducted between the alpine mountain peak, Jungfraujoch, and the Swiss city of Bern. Although the laser system was not directly tested with an orbiting satellite, they accomplished high-data transmission over a free-space distance of 53km (33 miles).

- *Highlights*
  - *Researchers at ETH Zurich and their European partners have successfully demonstrated terabit optical data transmission through the air, overcoming disruptive air turbulence between the mountain peak Jungfraujoch and the city of Bern in Switzerland.*
  - *The breakthrough has the potential to significantly reduce the cost of backbone connections by utilizing near-earth satellite constellations, eliminating the need for expensive deep-sea cables in the future*
  - *The team employed laser optical systems operating in the near-infrared range with shorter wavelengths, allowing for the transmission of more information per unit of time compared to radio technologies used in satellite internet connections.*

"For optical data transmission, our test route between the High Altitude Research Station on the Jungfraujoch and the Zimmerwald Observatory at the University of Bern is much more challenging than between a satellite and a ground station," explains Yannik Horst, the study's lead author and a researcher at ETH Zurich's Institute of Electromagnetic Fields headed by Professor Jürg Leuthold.

The laser beam travels through the dense atmosphere near the ground. In the process, many factors diverse turbulence in the air over the high snow-covered mountains, the water surface of Lake Thun, the densely built-up Thun metropolitan area and the plane influence the movement of the light waves and consequently also the transmission of data. The shimmering of the air, triggered by thermal phenomena, disturbs the uniform movement of light and can be seen on hot summer days by the naked eye.

Satellite internet uses slow microwave transmission

Internet connections via satellite are not anything new. The best-known example today is Elon Musk's Starlink, a network of more than 2,000 satellites orbiting close to the Earth that provides internet access to virtually every corner of the world. However, transmitting data between satellites and ground stations uses radio technologies, which are considerably less powerful. Like a wireless local area network (WLAN) or mobile communications, such technologies operate in the microwave range of the spectrum and thus have wavelengths measuring several centimeters.

Laser optical systems, in contrast, operate in the near-infrared range with wavelengths of a few micrometers, which are about 10,000 times shorter. As a result, they can transport more information per unit of time.

To ensure a strong enough signal by the time it reaches a distant receiver, the laser's parallel light waves are sent through a telescope that can measure several dozen centimeters in diameter. This wide beam of light must be precisely aimed at a receiving telescope with a diameter of the same order of magnitude as the width of the transmitted light beam upon arrival.

To achieve the highest possible data rates, the laser's light wave is modulated in such a way that a receiver can detect different states encoded onto a single symbol. This means each symbol transmits more than one bit of information. In practice, this involves different amplitudes and phase angles of the light wave. Each combination of phase angle and amplitude then forms a different information symbol that may be encoded into a transmitted symbol. Thus, with a scheme comprising 16 states (16 QAM), each oscillation can transmit 4 bits, and with a scheme comprising 64 states (64 QAM), 6 bits.

The fluctuating turbulence of the air particles results in varying speeds of light waves both within and at the edges of the light cone. As a result, when the light waves arrive at the detector of the receiving station, the amplitudes and phase angles either add together or cancel each other out, producing false values.

Mirrors correct wave phase 1,500 times per second

To prevent these errors, Paris-based project partner ONERA deployed a microelectromechanical system (MEMS) chip with a matrix of 97 tiny adjustable mirrors. The mirrors' deformations correct the phase shift of the beam on its intersection surface along the currently measured gradient 1,500 times per second, ultimately improving the signals by a factor of about 500.
This improvement was essential in achieving a bandwidth of 1 terabit per second over a distance of 53 kilometers, Horst points out.

For the first time, new robust light modulation formats were demonstrated. This enabled a huge increase in detection sensitivity and thus high data rates, even under the worst weather conditions or at low laser power. This increase is achieved by cleverly encoding the information bits in properties of the light wave such as amplitude, phase and polarization. "With our new 4D binary phase-shift keying, or BPSK, modulation format, an information bit can still be correctly detected at the receiver even with a very small number about four of light particles," Horst explains.

All in all, the specific skills of three partners were needed for the project's success. French space company, Thales Alenia Space is an expert in targeting lasers with centimeter accuracy over thousands of kilometers in space.

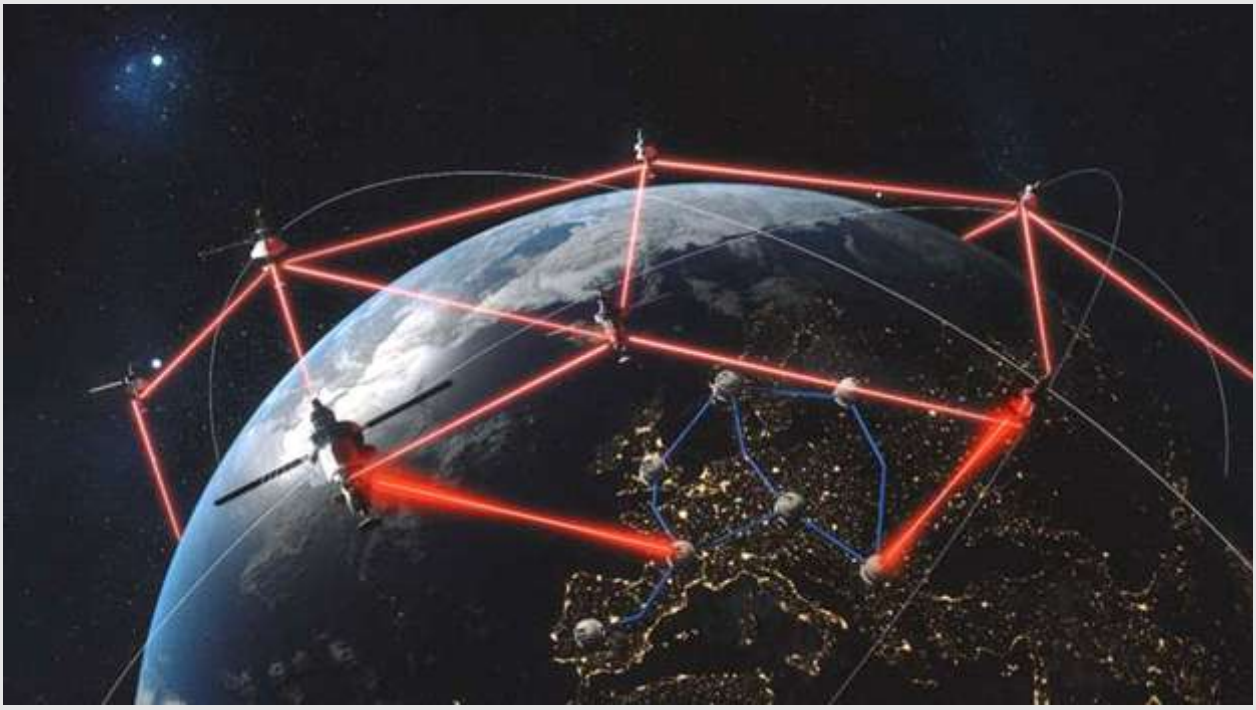
ONERA, also French, is an aerospace research institute with expertise in MEMS-based adaptive optics, which has largely eliminated the effects of shimmering in the air. The most effective method of signal modulation, which is essential for high data rates, is a specialty of Leuthold's ETH Zurich research group.

Easily expandable to 40 terabits per second

The results of the experiment, presented for the first time at the European Conference on Optical Communication (ECOC) in Basel is causing a sensation worldwide. Leuthold says, "Our system represents a breakthrough. Until now, only two options have been possible: connecting either large distances with small bandwidths of a few gigabits or short distances of a few meters with large bandwidths using free-space lasers."

Moreover, the performance of 1 terabit per second was achieved with a single wavelength. In future practical applications, the system can be easily scaled up to 40 channels and thus to 40 terabits per second using standard technologies.

However, scaling up is not something Leuthold and his team will be concerning themselves with; practical implementation of the concept in a marketable product will be carried out by the industry partners. Nevertheless, there is one part of the work that the ETH Zurich scientists will continue to pursue: In the future, the new modulation format they developed is likely to increase bandwidths in other data transmission methods where the energy of the beam can become a limiting factor.



Google StyleDrop generates images from text

- *Highlights*

  - *Google Research has developed StyleDrop, a text-to-image generative vision transformer that incorporates user-specified artistic styles and object descriptions to generate customized images.*
  - *StyleDrop is capable of capturing nuances and details of user-provided styles, such as color schemes, shading, design patterns, and local and global effects.*
  - *The system can generate images reflecting the user's specifications in approximately three minutes, offering a versatile and efficient tool for art directors and graphic designers.*
  - *StyleDrop works in conjunction with Google's Muse, a generative vision transformer that offers a high degree of photorealism and has been trained on 3 billion parameters.*
  - *Evaluations of StyleDrop's output show it outperforms other leading image and text generation methods, according to industry standard CLIP text and style scoring, as well as user feedback.*

It took Da Vinci 16 years to paint the Mona Lisa. Some say he needed 12 years just to paint her lips.

There is no truth to the rumors that slow Internet was the cause. But Da Vinci, a polymath who dabbled in botany, engineering, science, sculpture, and geology as well as painting, surely would have appreciated a new text-to-image generative vision transformer developed by Google Research.

Google's StyleDrop, as described in a June, 1 paper on the arXiv preprint server, lets users describe objects and specify artistic styles they wish to have incorporated in the generated output.

StyleDrop returns images reflecting the user's specifications in about three minutes.

"The proposed method is extremely versatile and captures nuances and details of a user-provided style, such as color schemes, shading, design patterns, and local and global effects," Google said in its report "StyleDrop: Text-to-Image Generation in Any Style."

StyleDrop also creates typography that faithfully incorporates stylistic features of images.

For example, users could propose an image of a bridge, a letter and then specify a style of drawing. Such styles could be "melting golden rendering," "wooden sculpture," "3D rendering," "cartoon drawing" or any other preferred style. One's imagination is the only limit.

StyleDrop will then generate impressive renderings of objects with a Dali-like dripping bridge, or perhaps a cartoon-like version, along with letters incorporating the same characteristics.

StyleDrop works in connection with Google's Muse, a generative vision transformer unveiled earlier this year that offers a remarkable degree of photorealism. Muse was trained on 3 billion parameters, ensuring capacity for high-quality image generation.

Style references

(a) StyleDrop

(b) Dreambooth on Imagen

Researchers evaluated the accuracy and quality of StyleDrop's output using industry standard CLIP text and style scoring as well as user feedback. Evaluations found StyleDrop "convincingly outperforms" other leading image-and text-generation methods, including DreamBooth, Imagen and Stable Diffusion.

The developers see this program, which has no yet been released to the public, as an invaluable aid to art directors and graphics designers who can create photorealistic imagery of designated products or themes that include text reflecting the same colors, structuring and style.

For a new product campaign, say for a new soda brand, an artist could propose in just a few words a sleek-shaped glass bottle nestled amid thousands of tulips in a Dutch field, with accompany text featuring letters constructed of 3D rendered glass, in the style of Impressionist Monet. In three minutes, with the right wording, a new ad campaign featuring a warm, brightly colored, scenic skyscape could be born.

The renowned typographer Helmut Schmidt once said, "Typography needs to be felt. Typography needs to be experienced." StyleDrop may well help designers bring a greater degree of intimacy and connectedness to their work.
The report acknowledges, however, that copyright protection is a concern.
"We recognize potential pitfalls such as the ability to copy individual artists' styles without their consent, and urge the responsible use of our technology," the report stated.

And just what instructions would Da Vinci have used for StyleDrop? "Draw a picture of an attractive noblewoman, kind of smiling but not too much, sitting outdoors with mountains in the background. Draw in the style of … Da Vinci." With the job done in three minutes instead of 16 years Leonardo, who loved botany, would have had plenty more time to go out and smell those roses.

Microsoft joins Indian government to train 6K students, 200 educators in cyber security skills

- *Highlights*

- *Microsoft will offer a wide range of courses, including training in AI, cloud computing, web development and cyber security skills for students.*
- *Microsoft will train 6,000 students and 200 educators in digital and cyber-security skills in the country.*

Microsoft has signed a memorandum of understanding (MoU) with Directorate General of Training (DGT) under the Ministry of Skills Development and Entrepreneurship (MSDE) to train 6,000 students and 200 educators in digital and cyber-security skills in the country. As part of this collaboration with, Microsoft will offer a wide range of courses, including training in AI, cloud computing, web development and cyber security skills for students and 200 faculty members at government-led Industrial Training Institutes (ITIs) and National Skills Training Institutions (NSTIs).

The training will empower young students with industry-relevant skills, enhancing their employability, and connecting them to relevant job opportunities. In addition, trained faculty members can then train ITI students attending computer operator and programming assistant (COPA) training.

Atul Kumar Tiwari Secretary of the Ministry of Skill Development and Entrepreneurship, was quoted as saying that "Trends such as demographic transitions and technological changes such as Industry 4.0, Web 3.0, and extended reality technology are introducing immense possibilities for our youth that will change their lives forever." "Trends such as demographic transitions and technological changes such as extended reality technology are introducing immense possibilities for our youth that will change their lives forever."

Infosys launches Topaz, an AI-first set of services, solutions and platforms

- *Highlights*

- *Infosys, a leading IT services company has launched Topaz.*
- *Topaz is built on Infosys applied AI framework, enabling the development of an AI-first core that enhances the capabilities of individuals and provide their perfect solutions.*

With an AI first approach, Topaz aims to unleash the potential of humans, enterprises, and communities, enabling them to tap into the next wave of opportunities arising from unprecedented innovations, connected ecosystems, and increased efficiencies. Infosys emphasizes its commitment to a "responsible by design" approach, ensuring unwavering ethics, trust, privacy, security, and compliance within the AI-powered solutions.

Harnessing the Power of Infosys Cobalt and Data Analytics

Topaz integrates the capabilities of Infosys Cobalt cloud and data analytics, leveraging their collective power to drive AI-enabled business transformations. By delivering tailored solutions and intuitive experiences, Topaz enables businesses to unlock growth potential and derive value from their data assets.

Real-World Applications and Success Stories

Infosys highlights the successful implementation of Topaz in various sectors. For instance, a food and beverages chain utilized Topaz to autonomously connect disparate data signals from new partners, resulting in an exceptional off-store consumer experience with an impressive accuracy rate of over 95 percent. Additionally, a national railway company utilized Topaz to build a smart hub, facilitating agile value-chains and optimizing functions such as logistics.

Future goals for this AI:-

As Infosys **CEO Salil Parekh** expressed, "Infosys Topaz is helping us amplify the potential of people both our own and our clients'. We are seeing strong interest from our clients for efficiency and productivity-enhancing programs, even as businesses are keen to secure their future growth.

AI supercomputer 'AIRAWAT' puts India among top supercomputing league

- *Highlights*

- *The AI Supercomputer 'AIRAWAT', situated at C-DAC, Pune, achieved an impressive global ranking of 75th on the esteemed Top 500 Global Supercomputing List.*
- *AIRAWAT is part of the Government of India's National Program on AI and represents a significant stride forward in the country's AI capabilities.*

The AI Supercomputer 'AIRAWAT', installed at C-DAC, Pune has been ranked 75th in the world. It was declared so in the 61st edition of Top 500 Global Supercomputing List at the International Supercomputing Conference (ISC 2023) in Germany. It puts India on top of AI Supercomputing nations worldwide. The system is installed under National Program on AI by Government of India.

"We need to make Artificial Intelligence in India and Artificial Intelligence work for India" Prime Minister Shri Narendra Modi's vision "AI FOR ALL".

Speaking on this achievement, Ministry of Electronics & Information Technology (MeitY) Secretary Shri Alkesh Sharma said, "Artificial Intelligence is the most promising technology in the digital age. India has a strong ecosystem and competitive advantage for AI due to its massive data availability, strong digital economy and skilled workforce. India has been working in the Applied AI with focus on Natural Language Processing, Image Procession, Pattern Recognition, Agriculture, Medical Imaging, Education, Health Care, Audio assistance, Robotics and developing solutions for the strategic sectors." India will pursue AI technology to empower citizens and organization to solve the most pressing problems of society and economy to make the world a better place, he added.

President & CEO, NeGD and MeitY Additional Secretary Shri Abhishek Singh stated, "Proof of Concept (PoC) AI Research Analytics and Knowledge Dissemination Platform (AIRAWAT) of 200 AI Petaflops Mixed Precision peak compute capacity is currently funded by MeitY and implemented by C-DAC, Pune. The AIRAWAT PoC of 200 AI Petaflops integrated with PARAM Siddhi-AI of 210. AI Petaflops gives a total peak compute of 410 AI Petaflops Mixed Precision and sustained compute capacity of 8.5 Petaflops (Rmax) Double Precision. The peak compute capacity (Double Precision, Rpeak) is 13 Petaflops." He added that AIRAWAT is in line with vision of Prime Minister Shri Narendra Modi for the country to enable technology and Artificial Intelligence for the welfare of common people contributing to socio-economic growth of the nation. It may be noted that MeitY has already envisioned roadmap for scaling AIRAWAT to 1,000 AI Petaflops Mixed Precision compute capacity to cater to the current AI computational needs.

Additional Secretary, Meity Shri Bhuvnesh Kumar said, “C-DAC has been pioneer in HPC and AI right from its inception and this entry in the top 500 list is another feather in the cap of C-DAC. The Ministry has always been supporting the implementation of such larger supercomputing systems to accelerate the innovations in science and technology. The C-DAC should enable easy access to such state-of-the-art infrastructure to the Indian community at a nominal cost.”

Ms. Kavita Bhatia, Scientist in Emerging Technologies, MeitY mentioned, “In alignment with the Atmanirbhar Bharat initiative of Government of India, 'AIRAWAT' will empower the Academia, Research Labs, Scientific Community, Industry and Start-Ups to develop indigenous AI enabled products/solutions especially for solving India specific grand challenges complex real-life problems. This AI infrastructure will enable to achieve the vision envisaged under National Program on AI (NPAI).”

Ms. Sunita Verma, Scientist in R&D in Electronics, IT, AI & ET, Digital Bhashini, MeitY pointed out, “Supercomputing is a core strength of C-DAC. Since the last three and half decades C-DAC has been carrying out R&D in Supercomputing and AI. The MeitY has entrusted C-DAC to deploy the supercomputers under NSM for the Indian scientific and research community. We are making consistent efforts to be at par with the global standards. The system installed at C-DAC Pune shall also be beneficial for Digital India BHASHINI program of the Government.”

Shri E Magesh, Director General, C-DAC said on the feat, “Currently being the fastest Supercomputer in the country, it is designed and architected to be on a scalable infrastructure to act as a common computational cloud platform connecting all Centers of Research Excellence in AI, Indian Centers for Transformational AI, Academic, Research Labs, Scientific Community, Industry and Start-ups. We have initiated the process of on-boarding start-ups and MSMEs working in AI domains in the country.” He congratulated C-DAC, Pune teams led by Col Asheet Kumar Nath, Executive Director, C-DAC, Pune for their excellent efforts to install this system and making it for selection to Top500 List thus making India proud.