MINISTRY OF EXTERNAL AFFAIRS

NEW, EMERGING & STRATEGIC TECHNOLOGIES (NEST) DIVISION

NEWSLETTER

JUNE 2024

ARTIFICIAL INTELLIGENCE

1. Google Brings AI Assistant Gemini's Mobile App to India in 9 Languages:

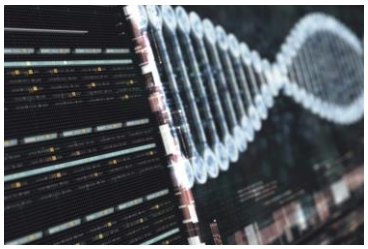
Amid the growing debate over artificial intelligence (AI) models, Google launched its AI assistant Gemini's mobile app in India. The Gemini app is now available in India, supporting English and nine languages — Hindi, Bengali, Gujarati, Kannada, Malayalam, Marathi, Tamil, Telugu, and Urdu. The app allows users to type, talk, or even add an image to get the assistance they need. Additionally, it will unlock new features in Gemini Advanced such as new data analysis capabilities and file uploads, and it will also launch the ability to chat with Gemini in Google Messages, starting in English. With a 1 million token context window, Gemini Advanced now has the longest context of any widely available consumer chatbot worldwide.
https://www.ndtv.com/india-news/google-brings-ai-assistant-geminis-mobile-app-to-india-in-9-languages-5913806

2. NVIDIA presents the latest advancements in visual AI:

NVIDIA researchers presented new visual generative AI models and techniques at the Computer Vision and Pattern Recognition (CVPR) conference in 2024 in Seattle. The advancements span areas like custom image generation, 3D scene

editing, visual language understanding, and autonomous vehicle perception. One of the headlining research projects is JeDi, a new technique that allows creators to rapidly customize diffusion models, the leading approach for text-to-image generation to depict specific objects or characters using just a few reference images, rather than the time-intensive process of fine-tuning on custom datasets. Another breakthrough is FoundationPose, a new foundation model that can instantly understand and track the 3D pose of objects in videos without per-object training. It set a new performance record and could unlock new AR and robotics applications. NVIDIA researchers also introduced NeRFDeformer, a method to edit the 3D scene captured by a Neural Radiance Field (NeRF) using a single 2D snapshot, rather than having to manually reanimate changes or recreate the NeRF entirely. This could streamline 3D scene editing for graphics, robotics, and digital twin applications. On the visual language front, NVIDIA collaborated with MIT to develop VILA, a new family of vision language models that achieve state-of-the-art performance in understanding images, videos, and text. With enhanced reasoning capabilities, VILA can even comprehend internet memes by combining visual and linguistic understanding.
https://www.artificialintelligence-news.com/2024/06/17/nvidia-presents-latest-advancements-visual-ai/

3. AI-Powered Blood Test: A Lifesaving Leap in Early Cancer Detection:



Scientists at Weill Cornell Medicine, New York-Presbyterian, the New York Genome Center (NYGC), and Memorial Sloan Kettering Cancer Center (MSK) A new AI-powered method has demonstrated a breakthrough in detecting tumor DNA from blood tests, showing high sensitivity and accuracy. This technology, known as MRD-EDGE, could revolutionize the early detection and monitoring of cancer, including lung, breast, and colorectal cancers and precancerous conditions. It offers a promising advancement over traditional methods by

identifying cancer recurrence months or even years earlier. The researchers also demonstrated that MRD-EDGE can detect even mutant DNA from precancerous colorectal adenomas, the polyps from which colorectal tumors develop.
https://scitechdaily.com/ai-powered-blood-test-a-lifesaving-leap-in-early-cancer-detection/

4. Google, Microsoft, and 4 tech giants other than Nvidia are making their own AI chips:

Nvidia's rise to the top of the tech industry is attributed to the explosion of Artificial Intelligence (AI) technology. While known for its graphics processing units (GPUs) for gaming, Nvidia has cleverly positioned itself for the future as its GPUs turned out to be perfect for the complex calculations needed in AI tasks like training large learning models. Companies like Google, Microsoft, Amazon, and Meta heavily rely on Nvidia's H100 AI chips, specifically designed for AI applications, offering significant performance boosts compared to traditional CPUs. However, with high demand and limited supply, some tech giants have either already announced or are looking to launch their own AI chips to have an edge. Google has been making and relying on custom-designed tensor processing units (TPUs) to power its AI models. Their latest chip, Trillium, announced at the Google I/O event, boasts a claimed performance of five times that of its predecessor, TPU v5e. Companies like Assembly AI, Hugging Face, and Anthropic utilize Google's TPUs. Microsoft announced the Azure Maia 100 AI chip, which is designed to run cloud-based AI workloads. AWS Trainium is the machine learning (ML) chip that AWS purpose-built for deep learning (DL) training. Facebook-parent Meta is focusing on AI and revealed plans for “Artemis,” a second-generation AI chip focused on providing the right balance of compute memory bandwidth and memory capacity for serving ranking and recommendation models. Advanced Micro Devices (AMD) unveiled its latest AI processor, the MI325X accelerator, which

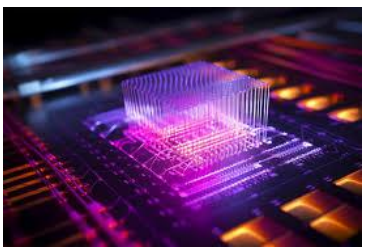
will be available in 2024, the MI350 in 2025, and the MI400 series in 2026. Intel has also introduced the first-generation Intel Gaudi AI deep learning processor designed for deep learning performance and efficiency.
https://timesofindia.indiatimes.com/technology/tech-news/google-microsoft-and-4-tech-giants-other-than-nvidia-that-are-making-their-own-ai-chips/articleshow/111212747.cms

5. AI Chip Breakthrough: Memristors Mimic Neural Timekeeping:

Researchers at the University of Michigan have developed a memristor, a hardware analog of neurons, that can mimic the brain's method of timekeeping by relaxing at different rates after receiving a signal. This innovation could enable artificial neural networks to process time-dependent data more efficiently, like audio and video. Memristors can potentially reduce AI's energy consumption by up to 90% compared to current GPUs, which are inefficient due to their need to load the entire network from external memory sequentially. The new memristor material system may improve AI chip energy efficiency by six times over existing materials. This development addresses the growing energy demands of AI, projected to account for 0.5% of global electricity consumption by 2027, and offers a more efficient approach to scaling neural networks for processing larger datasets.
https://scitechdaily.com/ai-chip-breakthrough-memristors-mimic-neural-timekeeping/

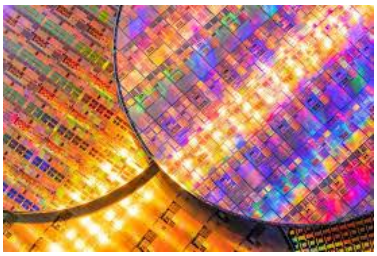
SEMICONDUCTOR

1. The Future of AI and 5G: Scientists Develop the First Universal,Programmable, and Multifunctional Photonic Chip:



Researchers from the Photonics Research Laboratory (PRL)-iTEAM at the Universitat Politecnica de Valencia, in collaboration with iPRONICS, have developed a groundbreaking photonic chip. This chip is the world's first to be universal, programmable, and multifunctional, making it a significant advancement for the telecommunications industry, data centers, and AI computing infrastructures. It is poised to enhance a variety of applications, including 5G communications, quantum computing, satellites, drones, and autonomous vehicles. This chip has already been integrated into an iPRONICS product, the Smartlight, and Vodafone has already used it in testing.
https://scitechdaily.com/the-future-of-ai-and-5g-scientists-develop-the-first-universal-programmable-and-multifunctional-photonic-chip/

2. SK KeyFoundry Achieves Breakthrough in GaN Power Semiconductor Development:



SK KeyFoundry, Korea, has made significant strides in the development of Gallium Nitride (GaN) power semiconductors, which offer several advantages over traditional silicon, including higher efficiency, faster switching speeds, and greater thermal conductivity, making it particularly suitable for high-power and high-frequency applications. The company will start producing power semiconductors for Tesla and plans to produce power management chips (PMIC) at its 8-inch wafer fab in Cheongju. The GaN power semiconductor market is projected to grow at an annual average rate of 33%, from $500 million last year to $6.4 billion by 2032. This rapid growth is driven by the increasing demand for advanced power semiconductors in various applications, including electric vehicles and renewable energy systems.
https://www.businesskorea.co.kr/news/articleView.html?idxno=219589

3. Rapidus and IBM Expand Collaboration to Chiplet Packaging Technology for 2nm-Generation Semiconductors:

It is part of an international collaboration within the “Development of Chiplet and Package Design and Manufacturing Technology for 2nm-Generation Semiconductors” framework. The project is being conducted by Japan’s New Energy and Industrial Technology Development Organization (NEDO) and builds on an existing agreement with IBM for the joint development of 2nm node technology. As part of the agreement, IBM and Rapidus engineers will collaborate at IBM’s North American facilities for R&D and manufacturing of semiconductor packaging for high-performance computer systems. The companies will pursue initiatives that will allow Japan to play an even more important role in the semiconductor packaging supply chain. IBM's breakthrough innovations are in AI, quantum computing, industry-specific cloud solutions, and consulting, and Rapidus Corporation aims to develop and manufacture the world’s most advanced logic semiconductors by developing and providing services to shorten cycle times for design, wafer processes, 3D packaging, and other aspects of semiconductor production.
https://newsroom.ibm.com/2024-06-03-Rapidus-and-IBM-Expand-Collaboration-to-Chiplet-Packaging-Technology-for-2nm-Generation-Semiconductors

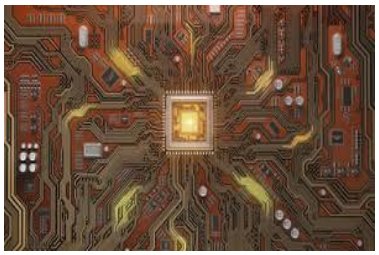
QUANTUM

1. Nanoscale Discovery Offers a New, Energy-Efficient Approach to Quantum Computing:

The rapidly growing popularity of artificial intelligence comes with an increasing desire for fast and energy-efficient computing devices and calls for novel ways to store and process information. The electric currents in

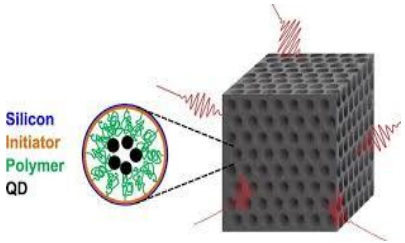
conventional devices suffer from energy losses and subsequent heating of the environment. One alternative for the “lossy” electric currents is to store and process information in waves, using the spins of the electrons instead of their charges. These spins can be seen as the elementary units of magnets. Researchers from Lancaster University and Radboud University Nijmegen have discovered a method to generate, modulate, and amplify propagating spin waves at the nanoscale, paving the way for energy-efficient quantum information technologies. Their work involves using light pulses to control spin waves, potentially revolutionizing data processing. The dynamics of such spin waves are intrinsically nonlinear, meaning that the waves with different frequencies and wavelengths can be converted into each other.
https://scitechdaily.com/nanoscale-discovery-offers-a-new-energy-efficient-approach-to-quantum-computing/

2. IBM and AIST Sign MOU to Advance Next-Gen Quantum Computing:



To stimulate the quantum hardware and component industry, the National Institute of Advanced Industrial Science and Technology (AIST) and IBM will work together to promote the development of next-generation quantum computers and their supply chain. AIST and IBM will work together to involve Japanese industries in the procurement of quantum hardware parts, fostering supplier development in the process. AIST is the country’s largest public research organization for bridging innovative technological seeds with commercial applications, enhancing industry and societal welfare.
https://www.hpcwire.com/off-the-wire/ibm-and-aist-sign-mou-to-advance-next-gen-quantum-computing/

3. Photon Emission Control for Quantum Applications Sets Precision Record:



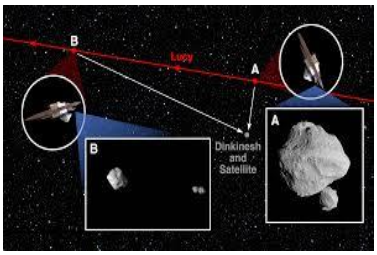
Light emission is a power-hungry process. Reducing the brightness of a smartphone's screen means longer battery life, as does reducing any unwanted energy from the screen. In order to reduce power consumption, photons have to be emitted in a more controlled manner. This is particularly important for the stable, efficient management of single-photon sources for quantum information, miniaturized light sources, and numerous other applications. Researchers at the University of Twente (UT) demonstrated a way to control the emission of photons with record-setting precision by using nanophotonic tools, specifically tiny chemical chains of polymer brushes to hold photon sources in place. Through their demonstration, the team showed that excited light sources can be reduced by nearly 50×.
https://www.photonics.com/Articles/Photon_Emission_Control_for_Quantum_Applications/p5/a70053

4. Quantum Machines Opens the Israeli Quantum Computing Center, Housing Three Quantum Computers Including the World's Most Advanced Test-bed:

Quantum Machines (QM), the leading provider of processor-based quantum controllers, announced the opening of the Israeli Quantum Computing Center (IQCC), a world-class research facility that will serve the quantum computing industry and academic community in Israel and worldwide. The center was built with the support of the Israel Innovation Authority and is located at Tel Aviv University. The center boasts a superconducting quantum computer with a 25-qubit quantum processor manufactured by Quantware and an 8-mode photonic quantum computer by ORCA (quantum chemistry program package). Additional quantum processors and quantum computers will be added in the coming months. Users will also be able to leverage advanced quantum software developed by Classiq. The QBridge software solution, co-developed by Quantum Machines and ParTec, will allow for hybrid quantum-classical workflows.
https://www.quantum-machines.co/press_release/quantum-machines-opens-the-israeli-quantum-computing-center/

SPACE

1. Twin Moons of Dinkinesh: NASA's Lucy Unveils a Surprising Discovery:

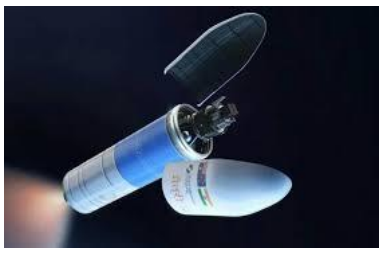


NASA's Lucy spacecraft's recent exploration of asteroid Dinkinesh revealed significant geological features indicating its internal strength and complex history. These findings suggest that Dinkinesh responded dynamically to stress over millions of years, which helps scientists understand the formation and evolution of small bodies in the solar system. During the flyby, Lucy discovers that Dinkinesh has a small moon, which is named Selam by the mission.
https://scitechdaily.com/twin-moons-of-dinkinesh-nasas-lucy-unveils-a-surprising-discovery/

2. ISRO achieves third consecutive success in Pushpak safe landing:

The Indian Space Research Organisation (ISRO) has achieved a third consecutive success in the Reusable Launch Vehicle (RLV) or Pushpak Landing Experiment (LEX). The third and final test in the LEX series was conducted at the Aeronautical Test Range (ATR) in Chitradurga, Karnataka. In a span of 15 months, the Indian Space Agency (ISRO) has completed all three autonomous landing tests of its spaceplane 'Pushpak.' ISRO will now have to work towards launching a larger version of this spaceplane to space on a modified rocket, testing the plane in earth orbit, and demonstrating its capability to re-enter the atmosphere and return to earth safely for a runway landing.
https://www.newindianexpress.com/nation/2024/Jun/23/isro-achieves-third-consecutive-success-in-pushpak-safe-landing

3. NewSpace India Limited (NSIL) and Space Machines Company announced the next Optimus spacecraft onboard Small Satellite Launch Vehicle (SSLV):



NewSpace India Limited (NSIL), a Govt. of India company under the Department of Space and the commercial arm of the Indian Space Research Organization (ISRO) and Space Machines Company, an Australian-Indian in-space servicing firm, sets the stage for the launch of Space Machines Company's second Optimus spacecraft weighing 450kg, the largest Australian-designed and built spacecraft so far. Slated for a Dedicated launch on board NSIL/ISRO's Small Satellite Launch Vehicle (SSLV) in 2026, this mission will mark a defining moment for both nations in the area of space collaboration. This mission, named Space MAITRI (Mission for Australia India's Technology, Research, and Innovation), marks a significant milestone in the strategic partnership between Australia and India in the space domain, focusing on debris management and sustainability.

https://www.nsilindia.co.in/sites/default/files/NSIL%20and%20SMC_SSLV%20%281%29.pdf

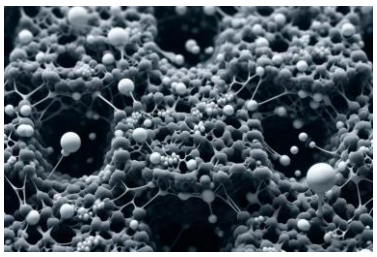
CLEAN TECHNOLOGIES

1. Stanford Unveils Game-Changing Liquid Fuel Technology for Grid Energy Storage:

Batteries, smartphones, and electric vehicle batteries use lithium-ion technologies to store electricity for the grid. Due to the energy storage scale, researchers continue searching for systems that can supplement those technologies. A Stanford team led by Robert Waymouth is developing a

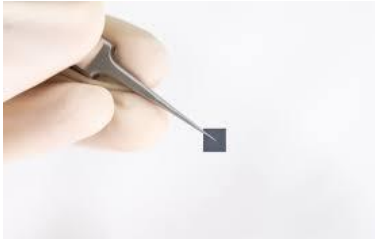
method to store energy in liquid fuels using liquid organic hydrogen carriers (LOHCs). They developed a catalyst system to combine two protons and two electrons with acetone to generate the LOHC isopropanol selectively without generating hydrogen gas. He did this using iridium as the catalyst. Someday, LOHCs could widely function as liquid batteries for storing energy and efficiently returning it as usable fuel or electricity when needed. They mention that when we have excess energy and no demand for it on the grid, it can be stored as isopropanol. When we need energy, it can be returned as electricity.
https://scitechdaily.com/stanford-unveils-game-changing-liquid-fuel-technology-for-grid-energy-storage/

2. Carbon Capture Breakthrough: Cambridge's New Material for Direct Air CO2 Absorption:



Direct air capture, which uses sponge-like materials to remove carbon dioxide from the atmosphere, is one potential approach for carbon capture, but current approaches are expensive, require high temperatures and the use of natural gas, and lack stability. Researchers at the University of Cambridge have adapted a battery-charging technique to energize activated charcoal, which is commonly used in household water filters. The researchers discovered that by charging the charcoal 'sponge' with ions that form reversible bonds with CO2, the charged material could successfully capture CO2 directly from the air. This new approach, requiring lower regeneration temperatures, promises to make carbon capture more sustainable and cost-effective.
https://scitechdaily.com/carbon-capture-breakthrough-cambridges-new-material-for-direct-air-co2-absorption/

3. Japanese firm develops material for batteries with 100-times higher energy density:



Japanese multinational electronics corporation TDK announced that it had developed a material for solid-state batteries, and this technology can be utilized in various wearable devices, such as wireless earphones, hearing aids, smart watches, and environmental sensors. The new material uses oxide-based solid electrolyte and lithium alloy anodes that can be applied to replace coin cell primary batteries in compliance with EU battery regulations, which require them to be replaced by rechargeable batteries, which is expected to reduce environmental impact. The new technology also enables batteries to come in smaller sizes and provide them longer operating times.
https://www.aa.com.tr/en/asia-pacific/japanese-firm-develops-material-for-batteries-with-100-times-higher-energy-density/3252154

4. China to regulate lithium-ion battery industry amid fast expansion:

China's Ministry of Industry and Information Technology issued new guidelines for its lithium-ion battery industry, aiming to transform, upgrade, and promote high-quality development amid rapid expansion in the sector. The guidelines will not be legally binding and are instead aimed at encouraging and guiding the sector, stressing that lithium battery companies must avoid projects that purely expand capacity. Instead, they should strengthen technical innovation, raise product quality, and lower production costs. The guidelines also urge firms against building production facilities on protected farmland or ecologically important areas. Existing factories in protected areas should be shut down or strictly control their scale and gradually move away. The ministry also called on companies to obey national workplace safety laws and comply with existing product standards.
https://auto.economictimes.indiatimes.com/news/auto-components/china-to-regulate-lithium-ion-battery-industry-amid-fast-expansion/111137372

BIOTECHNOLOGY and HEALTH

1. Decoding Disease: UC San Diego's Leap in Gene Editing:

The human genome consists of approximately 3 billion base pairs; humans are 99.6% identical in their genetic makeup. The remaining 0.4% accounts for differences between individuals. Specific combinations of mutations in these base pairs provide essential clues about the causes of complex health issues, including heart disease and neurodegenerative diseases like schizophrenia. Traditional methods for modeling or correcting mutations in live cells are notably inefficient, particularly when installing multiple point mutations simultaneously across the genome. However, researchers from the University of California, San Diego, have developed new genome editing tools called multiplexed orthogonal base editors (MOBEs) that can efficiently install multiple point mutations at once. This tool enhances the understanding and modeling of genetic diseases by allowing for controlled variant installation in the lab, offering a new approach to studying complex diseases.
https://scitechdaily.com/decoding-disease-uc-san-diegos-leap-in-gene-editing/

2. Biomedicine Breakthrough: Complete Gene Insertion Now Possible in Human Cells:

Researchers at the Broad Institute of MIT and Harvard have improved gene-editing to efficiently insert entire genes into human cells, offering the potential for single-gene therapies for diseases like cystic fibrosis. This method combines prime editing with new enzymes to enhance editing efficiency, potentially

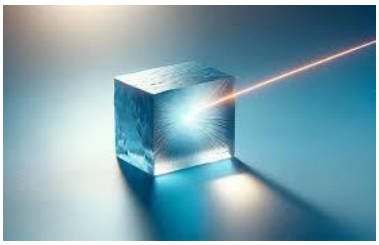
revolutionizing gene therapy. The new method uses a combination of prime editing, which can directly make a wide range of edits up to about 100 or 200 base pairs, and newly developed recombinase enzymes that efficiently insert large pieces of DNA thousands of base pairs in length at specific sites in the genome. This system, called eePASSIGE, can make gene-sized edits several times more efficiently than other similar methods
https://scitechdaily.com/biomedicine-breakthrough-complete-gene-insertion-now-possible-in-human-cells/

3. 15 Years in the Making – Scientists Invent "Living Bioelectronics" That Can Heal Skin:

Researchers from the University of Chicago have created living bio-electronics, a device combining cells, gel, and electronics to monitor and treat skin conditions. Tested on mice, the device reduces inflammation and holds potential for broader medical applications. *S. epidermidis* microbes are tucked into the gel, and the device is placed on the skin. The bacteria secrete compounds that reduce inflammation, and the sensor monitors the skin for signals like skin temperature and humidity. The team is working to commercialize the technology.
https://scitechdaily.com/15-years-in-the-making-scientists-invent-living-bioelectronics-that-can-heal-skin/

OTHER

1. 21 New Laser Materials Uncovered in Groundbreaking Global Study:



Organic solid-state lasers (OSLs) offer significant potential for various applications due to their flexibility, color adjustability, and high efficiency. Nevertheless, they are challenging to produce. With the need for potentially over 150,000 experiments to identify viable new materials, fully exploring this space could take many lifetimes. In fact, only 10-20 new OSL materials have been tested in the previous few decades. Researchers with the Acceleration Consortium based at the University of Toronto took up this challenge and used self-driving lab (SDL) technology that, once set up, enabled them to synthesize and test over 1000 potential OSL materials and discover at least 21 top-performing OSL gain candidates. Six research teams from five global laboratories significantly shortened the materials discovery timeline from years to just a few months. This significantly advanced molecular optoelectronics and paved the way for the discovery of future materials.
https://scitechdaily.com/21-new-laser-materials-uncovered-in-groundbreaking-global-study/

2. JOINT FACT SHEET: The United States and India Continue to Chart an Ambitious Course for the Initiative on Critical and Emerging Technology:

The second meeting of the U.S.-India initiative on Critical and Emerging Technology (iCET) took place in New Delhi on 17th June 2024. This initiative, launched in January 2023, aims to deepen strategic cooperation in key technology sectors like space, semiconductors, AI, and clean energy, with a focus on co-production, co-development, and research and development. Key points discussed included preventing the leakage of sensitive technologies, addressing barriers to bilateral trade and cooperation, and fostering private-sector investment. The meeting emphasized the importance of industry and academic collaboration in maintaining leadership in innovation. Notable achievements and future plans include: Innovation Ecosystems: A combined $90+ million in funding for the U.S.-India Global Challenges Institute and nearly $5 million for joint research projects; Space Technology: Joint efforts between

NASA and ISRO, including a joint mission to the International Space Station and a Synthetic Aperture Radar satellite project; Defense Cooperation: Progress on India's acquisition of MQ-9B platforms, the INDUS-X Summit, and the co-production of GE engines; Telecommunications: Advancements in Open RAN technology and 5G/6G collaboration; Biotechnology: Launch of the "Bio-5" consortium and a joint funding opportunity between the National Science Foundation and the Indian Department of Biotechnology; Semiconductors: A new strategic partnership for semiconductor development and a joint readiness assessment; Clean Energy and Critical Minerals: Initiatives in critical mineral supply chains, including a bilateral memorandum of understanding and collaborations on rare earth elements; Quantum, AI, and Computing: New quantum science and technology cooperation, high-performance computing collaboration, and AI initiatives.

https://www.whitehouse.gov/briefing-room/statements-releases/2024/06/17/joint-fact-sheet-the-united-states-and-india-continue-to-chart-an-ambitious-course-for-the-initiative-on-critical-and-emerging-technology/

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