MINISTRY OF EXTERNAL AFFAIRS

NEW, EMERGING & STRATEGIC TECHNOLOGIES (NEST) DIVISION

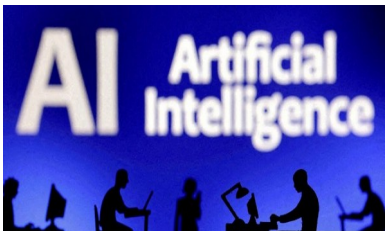
NEWSLETTER

APRIL 2024

IMPORTANT EMERGING TECHNOLOGY NEWS

ARTIFICIAL INTELLIGENCE and CYBER

1. The US and the UK sign agreement on AI safety testing:



Following through commitments made at the Bletchley Park AI Safety Summit last year, the United States and the United Kingdom on April 1 signed an agreement that would see them work together to develop tests for the most advanced artificial intelligence (AI) models. Both countries will share vital information about the capabilities and risks associated with AI models and systems, which has taken effect immediately. They will also share fundamental technical research on AI safety and security with each other, and work on aligning their approach towards safely deploying AI systems.
https://indianexpress.com/article/explained/explained-sci-tech/us-uk-agreement-ai-safety-testing-9248773/

2. Microsoft to invest US$2.9 billion in AI and cloud infrastructure in Japan while boosting the nation's skills, research and cybersecurity:

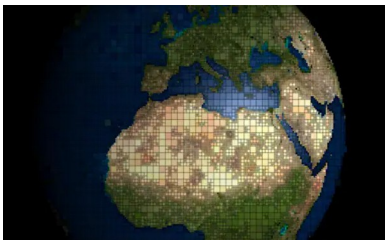
Microsoft announces its investment of US$2.9 billion over the next two years to bolster its hyper-scale cloud computing and AI infrastructure in Japan. This initiative accompanies an expansion of digital skilling programs, aiming to train over 3 million individuals in AI over the next three years. Additionally, Microsoft will inaugurate its first Microsoft Research Asia lab in Japan and deepen collaboration on cybersecurity with the Japanese Government. Microsoft will extend its Code; Without Barriers program to Japan, offering specialized training for women in AI-enabled work and

providing free educational content on AI, cybersecurity, and digital skills in partnership with the United Nations Institute for Training and Research (UNITAR).
https://www.itnewsafrica.com/2024/04/2-9-billion-investment-in-ai-cloud-infrastructure-in-japan/

3. US Homeland Security names AI safety, security advisory board:

The U.S. Homeland Security Department (DHS) announced a blue-ribbon board that includes the CEOs of OpenAI, Microsoft, Google parent Alphabet and Nvidia that will advise the government on the role of artificial intelligence. The board will develop recommendations for the transportation sector, pipeline and power grid operators, internet service providers and others to "prevent and prepare for AI-related disruptions to critical services that impact national or economic security, public health, or safety." The board would help ensure the safe deployment of AI technology and how to address threats posed by this technology to vital services like energy, utilities, transportation, defense, information technology, food and agriculture, and financial services.
https://ciso.economictimes.indiatimes.com/news/ot-security/us-homeland-security-names-ai-safety-security-advisory-board/109680059

4. UK Starts Drafting AI Regulations for Most Powerful Models:



The UK is starting to draft regulations to govern artificial intelligence, focusing on the most powerful language models which underpin OpenAI’s ChatGPT. Policy officials at the Department for Science, Innovation and Technology are in the early stages of devising legislation to limit potential harms caused by the emerging technology. The government is likely to wait until France hosts an AI conference either later this year or early next to launch a consultation on the topic. The UK does not officially have a policy preventing companies from releasing AI models that have not been evaluated

for safety. Neither does it have the power to pull any existing model from the market if it violates safety standards or to fine a company over those violations.
https://www.theverge.com/2024/4/15/24131392/uk-ai-regulation-draft-safety

5. NATO to launch new cyber center to contest cyberspace 'at all times':

NATO will establish a new cyber center i.e. NATO Integrated Cyber Centre (NICC) at its military headquarters in Mons, Belgium. It marks the fruition of a significant doctrinal shift in how the alliance approaches operations in cyberspace. The institution would help develop cyber competencies among allies through to a tactical-level command for combined operations, similar to NATO's maritime (MARCOM), air (AIRCOM), and land (LANDCOM) command centers.
https://therecord.media/nato-new-military-civilian-cyber-center-mons-belgium?utm_source=substack&utm_medium=email

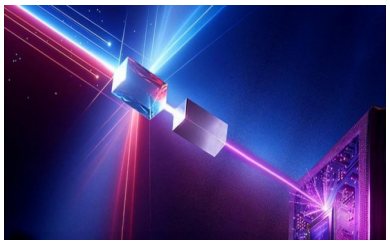
6. AI Act in the medicinal product life-cycle:

The European Federation of Pharmaceutical Industries and Associations (EFPIA) issued a statement on the implementation of the AI Act in the pharmaceutical sector, noting AI's increasing role in medicine development. They stress the need for AI regulations to be fit-for-purpose, adequately tailored and risk-based, and not to duplicate existing rules. EFPIA proposes five considerations: 1) R&D of AI-based drug development tools should qualify for the AI Act's research exemption if used solely for scientific research; 2) AI used in R&D of medicines not falling under the exemption should not be labelled "high risk" as per the Act's criteria in Article 6; 3) Additional regulation for R&D of AI is unnecessary, as existing rules for medicine development suffice; 4) EFPIA welcomes the European Medicines Agency's efforts to assess the impact of AI in R&D; and 5) AI regulation should be adaptable to various contexts, including development stages, risk assessments and human oversight.

https://www.ema.europa.eu/en/use-artificial-intelligence-ai-medicinal-product-lifecycle

SEMICONDUCTOR

1. Advancements in Deep Ultraviolet Laser Technology:

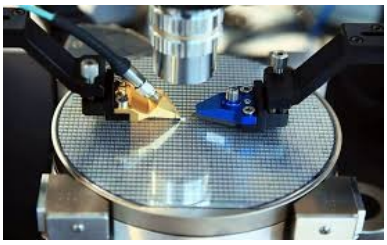


Researchers at the Chinese Academy of Sciences achieved a remarkable 60-milliwatt (mW) solid-state Deep Ultraviolet (DUV) laser at 193 nm with a narrow line-width using a sophisticated two-stage sum frequency generation process employing LBO crystals. This innovation not only boosts pattern precision but also accelerates lithography speed. These advancements not only push the boundaries of DUV laser technology but also hold promise for revolutionizing myriad applications across scientific and industrial domains.
https://scitechdaily.com/advancements-in-deep-ultraviolet-laser-technology/

2. Biden administration agrees to provide 6.4 billion to Samsung for making computer chips:

The Biden administration has reached an agreement to provide up to $6.4 billion in direct funding for Samsung Electronics to develop a computer chip manufacturing and research cluster in Texas. The government support comes from the CHIPS and Science Act which will propel Texas into a state of the art semiconductor ecosystem. It puts US on track to hit the goal of producing 20% of the world's leading edge chips in the United States by the end of the decade. The project will create at least 17,000 construction jobs and more than 4,500 manufacturing jobs.
https://www.theweek.in/wire-updates/international/2024/04/15/fgn16-us-biden-computer-chips.html

3. Scientists inch closer to holy grail of memory breakthrough — producing tech that combines NAND and RAM features could be much cheaper to produce and consume far less power:



A revolutionary new memory device that combines the features of DRAM and NAND flash memory is being developed by a group of researchers at the Korea Advanced Institute of Science and Technology (KAIST). The team's breakthrough promises cheaper, power-efficient solutions that could potentially replace existing memory solutions or be used to implement neuromorphic. The team established a way to electrically form phase change materials in an extremely small area, successfully developing an ultra-low-power phase change memory device. Notably, this consumes 15 times less power than previous phase change memory models which used expensive lithography tools, a significant breakthrough in the quest for cost and energy efficient memory development.

https://www.techradar.com/pro/scientists-inch-closer-to-holy-grail-of-memory-breakthrough-producing-tech-that-combines-nand-and-ram-features-could-be-much-cheaper-to-produce-and-consume-far-less-power

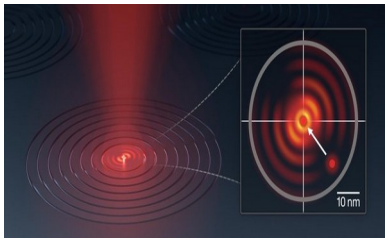
4. Researchers Develop “Goldene” – A New Form of Ultra-Thin Gold With Semiconductor Properties:

Researchers from Linkoping University, Sweden, has developed a sheets of gold only a single atom layer thick termed as goldene. To create goldene, the researchers used a three-dimensional base material where gold is embedded between layers of titanium and carbon. This material have given the gold new properties that can make it suitable for use in applications such as carbon dioxide conversion, hydrogen production, and production of value-added chemicals. Moreover, the amount of gold used in applications today can be much reduced.

https://scitechdaily.com/researchers-develop-goldene-a-new-form-of-ultra-thin-gold-with-semiconductor-properties/

QUANTUM

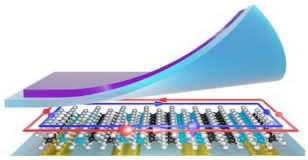
1. NIST's Breakthrough in Quantum Dot Alignment:



Researchers at the National Institute of Standards and Technology (NIST) and their colleagues have now developed standards and calibrations for optical microscopes that allow quantum dots to be aligned with the center of a photonic component to within an error of 10 to 20 nanometres (about one-thousandth the thickness of a sheet of paper). The NIST team created two types of traceable standards to calibrate optical microscopes—first at room temperature to analyze the fabrication process, and then at cryogenic temperatures to measure the location of quantum dots. Such alignment is critical for chip-scale devices that employ the radiation emitted by quantum dots to store and transmit quantum information. A model developed by the researchers predicts that if microscopes are calibrated using the new standards, then the number of high-performance devices could increase by as much as a hundred-fold.

https://scitechdaily.com/bullseye-precision-nists-breakthrough-in-quantum-dot-alignment/

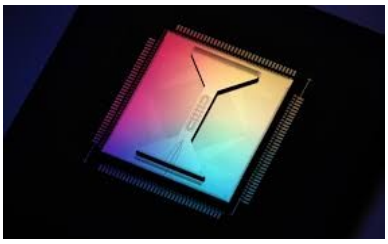
2. Dual Topological Insulating States Found in Monolayer Material:



Scientists at Boston College have identified a material known as a dual quantum spin Hall insulator, which offers a promising foundation for investigating exotic quantum phases and electromagnetism. The novel material called called TaIrTe4, created from tantalum, iridium, and tellurium, where its interior is insulating and electricity flows along its boundaries without any energy loss. The material exhibited zero electrical conductivity within its interior, while its boundaries remain conductive. This unique combination makes these materials a focus of researchers trying to develop future generations of energy-efficient electronic devices.

https://scitechdaily.com/beyond-theory-dual-topological-insulating-states-found-in-monolayer-material/

3. Quantinuum and Microsoft achieve breakthrough that unlocks a new era of reliable quantum computing:



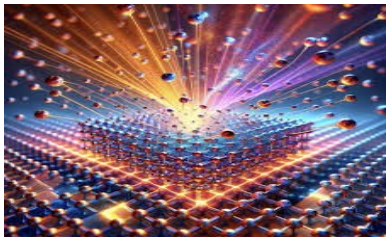
Microsoft's innovative qubit-virtualization system with the unique architectural features and fidelity of Quantinuum's System Model H2 quantum computer teams have demonstrated the most reliable logical qubits on record with logical circuit error rates 800 times lower than the corresponding physical circuit error rates. It is a crucial milestone on the path to building a hybrid supercomputing system that can truly transform research and innovation across many industries for decades to come. It also further bolsters H2's title as the highest performing quantum computer in the world. In 2025, a new H-Series quantum computer, Helios (H-Series), will be introduced by improving both physical qubit count and physical fidelity. This will take us and our users below threshold for a wider set of error correcting codes and make that device capable of supporting at least 10 highly reliable logical qubits.
https://www.quantinuum.com/news/a-new-breakthrough-in-logical-quantum-computing-reveals-the-scale-of-our-industry-leadership

4. India Celebrates World Quantum Day 2024 - Aspires to lead in Quantum Science and Technology:

As the world celebrates World Quantum Day on April 14, 2024, India stands at the forefront of a transformative era, poised to shape the global quantum landscape and unlock new frontiers of possibility. This occasion reflects India's ongoing efforts and aspirations to excel in diverse fields leveraging quantum principles. One of the key drivers behind India's quantum leap is the National Quantum Mission (NQM), conceptualized and propelled by the Prime Minister Science Technology Advisory Council (PM-STIAC). With a substantial investment of Rs 6003.65 Crore over eight years, NQM aims to catalyze scientific and industrial R&D, fostering a robust ecosystem for Quantum Technology (QT) in India. India also celebrated the day with a

vision to establish itself as a global frontrunner in the realms of quantum science and technology.
https://pib.gov.in/PressReleasePage.aspx?PRID=2017843

5. Powerful New Tool Ushers In New Era of Quantum Materials Research:



Professor from Institut national de la recherche scientifique (INRS), along with colleagues Marta Zonno from Canadian Light Source (CLS) and Andrea Damascelli from UBC's Stewart Blusson Quantum Matter Institute (Blusson QMI), illustrates that TR-ARPES has rapidly matured into a powerful technique over the last two decades. The technique called time- and angle-resolved photo-emission spectroscopy (TR-ARPES) has emerged as a powerful tool, allowing researchers to explore the equilibrium and dynamical properties of quantum materials via light-matter interaction. The technique called time- and angle-resolved photo-emission spectroscopy (TR-ARPES) has emerged as a powerful tool, allowing researchers to explore the equilibrium and dynamical properties of quantum materials via light-matter interaction. Research into quantum materials through TR-ARPES is leading to revolutionary breakthroughs and is set to propel technological progress that will transform industries such as mining, energy, transportation, and medical technology.
https://scitechdaily.com/powerful-new-tool-ushers-in-new-era-of-quantum-materials-research/

6. Nvidia to help Japan build hybrid quantum-supercomputer:

The National Institute of Advanced Industrial Science and Technology, Japan is building a quantum-AI hybrid cloud system with Nvidia called ABCI-Q, as part of the country's quantum computing initiative which will offer quantum computing capability for use by researchers and companies. Nvidia, the top designer of artificial intelligence chips based in Silicon Valley, is already supplying graphic processing units to the ABCI-Q, but will also provide quantum computing software via a cloud service.

The technology institute envisions such applications as drug research and logistics optimization.
https://asia.nikkei.com/Business/Technology/Nvidia-to-help-Japan-build-hybrid-quantum-supercomputer?utm_source=substack&utm_medium=email

SPACE and EARTH SCIENCE

1. Decoding the Moon: Artemis III's Revolutionary Instruments Explained:

NASA has chosen the first science instruments designed for astronauts to deploy on the surface of the Moon during Artemis III. Once installed near the lunar South Pole, the three instruments will collect valuable scientific data about the lunar environment, the lunar interior, and how to sustain a long-duration human presence on the Moon, which will help prepare NASA to send astronauts to Mars. These instruments will investigate seismic activities, plant growth in lunar conditions, and subsurface characteristics, marking a significant advancement in lunar science. Artemis III, the first mission to return astronauts to the surface of the Moon in more than 50 years, will explore the south polar region of the Moon, within 6 degrees of latitude from the South Pole. This mission will also provide the opportunity to learn about the history of the Moon through previously unstudied lunar materials.

https://scitechdaily.com/decoding-the-moon-artemis-iiis-revolutionary-instruments-explained/

2. Unlocking the Secrets of Earth's Freshwater With NASA's Latest Software:

Researchers from NASA developed an Observational System Simulation Experiment (OSSE) tool to optimize the planning of science missions monitoring terrestrial freshwater storage, integrating various sensing technologies and modeling tools like NASA's LIS (Land Information System) and TAT-C (Trade-space Analysis Tool for

Designing Constellations). It will aid in planning dynamic Earth observation missions, featuring a cost estimator and the ability to incorporate different types of space-borne sensors.
https://scitechdaily.com/unlocking-the-secrets-of-earths-freshwater-with-nasas-latest-software/

3. Breakthrough Device Brings Scientists a Step Closer to Successfully Growing Plants in Space:

Researchers at the University of Illinois have created stretchable sensors that can monitor plant growth and transmit data remotely, overcoming initial challenges to potentially revolutionize agricultural practices on Earth and in space. The polymer sensors are resilient to humidity and temperature, can stretch over 400% while remaining attached to a plant as it grows, and send a wireless signal to a remote monitoring location. This work is motivated by the needs of astronauts to grow vegetables sustainably while they are on long missions. The 'Stretchable-Polymer-Electronics-based Autonomous Remote Strain Sensor,' or SPEARS2 is an exciting technical advance to perform precise, non-invasive measurements of plant growth in real time.
https://scitechdaily.com/breakthrough-device-brings-scientists-a-step-closer-to-successfully-growing-plants-in-space/

4. Bengaluru gets Asia's first dedicated centre for space domain awareness:

Bengaluru has become home to Asia's first dedicated command and control centre for space domain awareness. The state-of-the-art facility was inaugurated at the newly opened global headquarters of Digantara, a space situational awareness (SSA) company. This advanced facility of the centre will play a vital role in ensuring safety and sustainability of satellite operations around the world by tracking objects in orbit. The centre prepares to launch a constellation of which aims to address current data

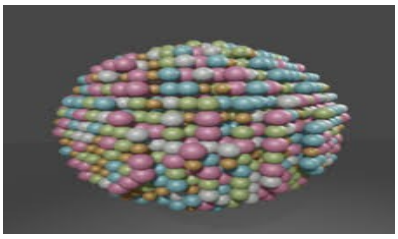
inadequacies from both qualitative and quantitative perspectives. Digantara which is a space situational awareness company is building end-to-end infrastructure to address the difficulties of space operations and situational awareness through its Space — Mission Assurance Platform (Space-MAP).
https://timesofindia.indiatimes.com/city/bengaluru/bluru-gets-asias-first-dedicated-centre-for-space-domain-awareness/articleshow/109446300.cms

GREEN ENERGY and CRITICAL MINERAL

1. Negative emissions despite enormous energy input:

Researchers at Empa are working on a pyrolysis process that is to be used in a demonstration plant in the Tech Cluster Zug, Switzerland. The pyrolysis process is to separate the carbon in natural gas before combustion, what remains is pure hydrogen, with which the industrial high-temperature processes can be operated, and the separated carbon as a powder, which is to be further processed for applications in construction and agriculture. A demonstration plant is currently in the design phase and will be set up in Zug over the next two years. If natural gas is decarbonized by pyrolysis beforehand and only the resulting hydrogen is used to generate high-temperature heat, CO_2 emissions can be reduced by 40% to 178 kg. One challenge is costs, however, if it were possible to market the carbon as a raw material for non-energy applications, the entire process could certainly be economically viable.
https://www.empa.ch/web/s604/oekobilanz-pyrolyse

2. Continuous synthesis of high-entropy alloy nanoparticles by in-flight alloying of elemental metals:



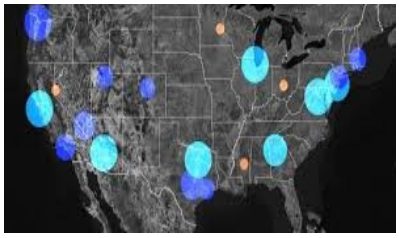
High-entropy alloy (HEA) nanoparticles (NPs) exhibit unusual combinations of functional properties. However, their scalable synthesis remains a significant

challenge requiring extreme fabrication conditions. Metal salts are often employed as precursors because of their low decomposition temperatures, yet contain potential impurities. Here researchers from different institutions in Canada have proposed an ultra-fast (< 100 ms), one-step method that enables the continuous synthesis of HEA NPs directly from elemental metal powders via in-flight alloying. A high-temperature plasma jet is employed for rapid heating/cooling and demonstrates the synthesis of CrFeCoNiMo HEA NPs (~ 50 nm) at a high rate approaching 35 g/h with a conversion efficiency of 42%. The thermofluid simulation reveals that the properties of HEA NPs can be tailored by the plasma gas which affects the thermal history of NPs. The HEA NPs demonstrate an excellent light absorption of > 96% over a wide spectrum, representing great potential for photo-thermal conversion of solar energy at large scales. The work shows that the thermal plasma process developed could provide a promising route towards industrial scale production of HEA NPs.
https://nrc-publications.canada.ca/eng/view/object/?id=0108338a-3f5c-478d-b535-d1bf0f26411e

3. Self-cleaning solar panels boost efficiency with wind power:

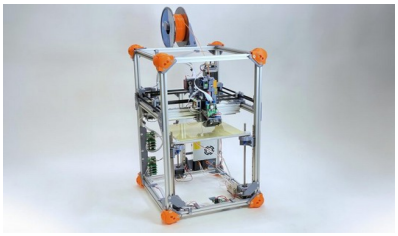
Solar energy is vital for a sustainable future, but dust, debris, and other environmental contaminants can create a layer of grime that dramatically reduces solar cell efficiency. Traditionally, panels require manual cleaning, a costly and labor-intensive process. This maintenance is especially difficult in deserts, remote installations, and even potential off-world applications. A research team at DGIST (Daegu Gyeongbuk Institute of Science and Technology) in South Korea has unveiled an ingenious device that enhances solar power generation by keeping panels free of dust and other contaminants. Their innovation combines a wind-powered energy harvesting device with an electrodynamic screen (EDS). The EDS removes contaminants through high-voltage electric fields, but previous versions required an external power source that could negate the efficiency gains of solar power. This new device elegantly solves the problem. This is a major step towards ensuring solar power remains a dominant solution for a cleaner future.
https://interestingengineering.com/energy/self-cleaning-solar-panels-boost-efficiency-with-wind-power

4. Sam Altman Invests in Energy Startup Focused on AI Data Centers:



As AI continues its exponential growth, investors are becoming increasingly concerned about the energy grid's ability to meet the relentless power demands of AI technologies. In response, AI investors are taking proactive steps to address this challenge, investing heavily in green energy startups like Exowatt. Altman, venture capital firm Andreesen Horowitzin, and several other investors have injected about $20 million into Exowatt, a startup focused on providing renewable energy solutions tailored for data centres to support the future development of AI.
https://www.firstpost.com/tech/openais-sam-altman-to-invest-in-green-energy-as-power-grids-incapable-of-feeding-ai-13762656.html

5. How a New 3D Printer Automatically Masters Diverse Sustainable Materials:



Researchers from from MIT's Center for Bits and Atoms (CBA), the U.S. National Institute of Standards and Technology (NIST), and the National Center for Scientific Research in Greece (Demokritos) developed a 3D printer that can automatically identify the parameters of an unknown material on its own. The researcher modified the extruder, the "heart" of a 3D printer, so it can measure the forces and flow of a material. These data, gathered through a 20-minute test, are fed into a mathematical function that is used to automatically generate printing parameters. These parameters can be entered into off-the-shelf 3D printing software and used to print with a never-before-seen material. The advance could help make 3D printing more sustainable, enabling printing with renewable or recyclable materials that are difficult to characterize.
https://scitechdaily.com/how-a-new-3d-printer-automatically-masters-diverse-sustainable-materials/

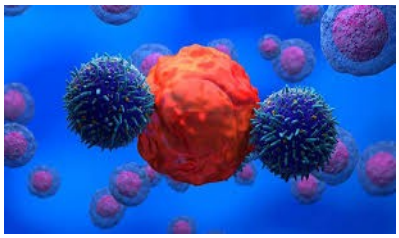
BIOTECHNOLOGY and HEALTH

1. MIT's AI Breakthrough: Pioneering New Antibiotics To Combat MRSA:

Using artificial intelligence, MIT researchers discovered compounds that effectively kill methicillin-resistant *Staphylococcus aureus* (MRSA), a deadly bacterium, while being safe for human cells. The compounds also show very low toxicity against human cells, making them particularly good drug candidates. Their work makes the AI's predictive process transparent, marks a significant step in the fight against antibiotic-resistant bacteria. Similar approaches based on chemical sub-structures to design compounds de novo to discover new classes of antibiotics against different pathogens.

https://scitechdaily.com/mits-ai-breakthrough-pioneering-new-antibiotics-to-combat-mrsa/

2. India launches India's first home-grown gene therapy for cancer:



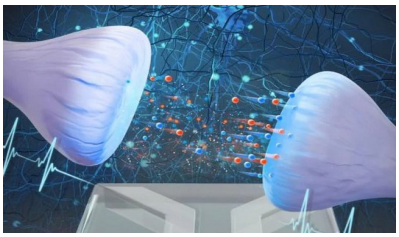
On April 04, 2024, The President of India launched India's first home-grown gene therapy for cancer at IIT Bombay. As this line of treatment, named "CAR-T cell therapy", is accessible and affordable, and will provide a new hope for the whole of humankind. CAR-T cell therapy is considered to be one of the most phenomenal advances in medical science, but it is extremely costly, and beyond the reach of most patients around the world. India's NexCAR19 CAR T-cell therapy is the country's first 'Made in India' CAR T-cell therapy, which will significantly bring down the cost of cancer treatment. The therapy is developed through collaboration between the Indian Institute of Technology, Bombay and Tata Memorial Hospital in association with industry partner ImmunoACT.

https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2017142

3. SCTIMST develops TB diagnostic kit:

The nation is on the path to TB elimination, the lack of an accurate, fast and affordable population-level screening tool to identify pulmonary TB easily, has always been a challenge. The AG Chitra TB diagnostic kit, developed by the Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST) and licenced to M/S Agappe Diagnostics, Kochi, was unveiled. The kit had been approved by the Central Drugs Standard Control Organization (CDSCO) for manufacturing and marketing. The technology has been developed as an open platform, avoiding the need for proprietary machines to amplify DNA. The PCR testing centres established during the COVID-19 pandemic can now be re-purposed for TB diagnosis using this kit. The sample-to-result time is around one hour and has an accuracy of 97.71%.
https://www.thehindu.com/news/national/kerala/sctimst-develops-tb-diagnostic-kit/article68043360.ece

4. Scientists Create First Brain-like Computer Using Water and Salt:



Theoretical physicists at Utrecht University, together with experimental physicists at Sogang University in South Korea, have succeeded in building an artificial synapse. This synapse works with water and salt and provides the first evidence that a system using the same medium as our brains can process complex information. Central to this discovery is a minute device measuring 150 by 200 micrometers, which mimics the behaviour of a synapse, an essential component in the brain responsible for transmitting signals between neurons. The device is an iontronic memristor, comprises a cone-shaped micro-channel filled with a solution of water and salt. Upon receiving electrical impulses, ions within the liquid migrate through the channel, leading to alterations in ion concentration. Depending on the intensity (or duration) of the impulse, the conductivity of the channel adjusts accordingly, mirroring the strengthening or weakening of connections between neurons. The extent of change

in conductance serves as a measurable representation of the input signal. An additional finding is that the length of the channel impacts the duration required for concentration changes to dissipate. “This suggests the possibility of tailoring channels to retain and process information for varying durations, again akin to the synaptic mechanisms observed in our brains,
https://scitechdaily.com/scientists-create-first-brain-like-computer-using-water-and-salt/

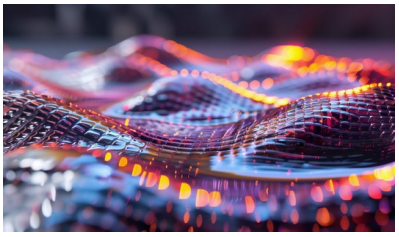
TELECOMMUNICATION

1. TRAI releases recommendations on “Encouraging Innovative Technologies, Services, Use Cases and Business Models through Regulatory Sandbox in Digital Communication Sector”:

In view of new technological developments in 5G/6G, Machine to Machine Communications, Artificial Intelligence, the Internet of Things, Virtual Reality, and others, there is a need to provide an environment in which new technologies, services, use cases and business models can be tested in live networks, or existing functions or processes can be refined. To address this pressing need, On April 2024, DoT came up with recommendations: It outline all the relevant components in detail and offer a comprehensive framework for conducting Sandbox testing for the Digital Communication sector. To ensure accountability on part of Government agencies involved, strict timelines have been provided for completing the application evaluation process. The regulatory framework includes clear documentation requirements and application, evaluation & approval procedures to ensure transparency throughout the Regulatory Sandbox (RS) process. The Telecommunication Act’ 2023 has already extended the scope of Digital Bharat Nidhi to facilitate innovation and experimentation in the telecom sector by extending suitable financial support. The recommended Regulatory Sandbox framework is expected to give the Digital Communication industry’s startup ecosystem access to real network environments and other data of telecom network to help test the reliability of new applications before bringing them to market.
https://pib.gov.in/PressReleasePage.aspx?PRID=2017749

OTHERS

1. Harvard Scientists Have Developed an "Intelligent" Liquid:



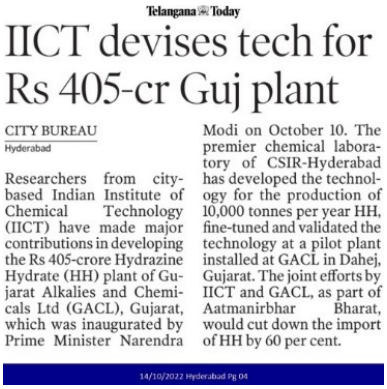
Scientists at the Harvard, School of Engineering and Applied Sciences developed a versatile programmable meta-fluid (50 to 500 microns) that can change its properties, including viscosity and optical transparency, in response to pressure. This new class of fluid has potential applications in robotics, optical devices, and energy dissipation, showcasing a significant breakthrough in metamaterial technology. This is the first meta-fluid that has been shown to transition between Newtonian and non-Newtonian states. The application space for these scalable, easy-to-produce meta-fluids is huge.

https://scitechdaily.com/not-science-fiction-harvard-scientists-have-developed-an-intelligent-liquid/

INNOVATIONS AND ACHIEVEMENTS BY INDIAN INSTITUITIONS

1. CSIR:

a) An Improved process technology for Hydrazine Hydrate:



Telangana Today

IICT devises tech for Rs 405-cr Guj plant

CITY BUREAU
Hyderabad

Researchers from city-based Indian Institute of Chemical Technology (IICT) have made major contributions in developing the Rs 405-crore Hydrazine Hydrate (HH) plant of Gujarat Alkalies and Chemicals Ltd (GACL), Gujarat, which was inaugurated by Prime Minister Narendra Modi on October 10. The premier chemical laboratory of CSIR-Hyderabad has developed the technology for the production of 10,000 tonnes per year HH, fine-tuned and validated the technology at a pilot plant installed at GACL in Dahej, Gujarat. The joint efforts by IICT and GACL, as part of Aatmanirbhar Bharat, would cut down the import of HH by 60 per cent.

14/10/2022 Hyderabad Pg 04

It is an Indigenously developed process at bench scale of 100 gms/hr, scaled up to pilot plant of 12 kgs/hr and to commercial plant of 10,000 TPA capacity. The basic and detailed engineering designs of 80% hydrazine hydrate commercial plant were

prepared by CSIR-IICT. It has been proved and demonstrated that more than 90% of the recoveries of catalyst and solvent are recycled back in to the process. The plant is set-up by M/s Gujarat Alkalies and Chemicals Limited, at their Dahej complex and is in operation. The technology is in Technology Readiness Level 9 stage granted with Indian Patent No. 378643 and US Patent No. US 11225413B2. The potential application of hydrazine hydrate are: Polymerization and blowing Agent, Agro-chemicals, water treatment, pharmaceuticals and other areas.

2. Indian Institute of Technology, Roorkee:

a) System for autonomous vehicular communication based on a blockchain network and method:

The technology (Technology Readiness Level 4; Patented) is a novel privacy-preserving lightweight (zk-)SNARK authentication protocol in blockchain-enabled distributed Software-Defined Vehicular Networks (SDVN) relates to a system for autonomous vehicular communication. The system includes a computing device associated with a trusted authority configured to facilitate registration of a plurality of vehicles, a plurality of roadside units and a plurality of controllers configured to control the plurality of road side units. Each roadside unit within a transmission range of a vehicle from plurality of vehicles, is configured to initiate key exchange mechanism upon the entry of respective vehicle into transmission range of corresponding roadside unit. Advantageously, the present invention relates to a seamless and cost efficient authentication method for multiple handovers of the plurality of vehicles.

b) A nano-catalytic membrane reactor for hazardous dye degradation:

The technology (Technology Readiness Level 4; Patented) relates to a nano-catalytic membrane reactor for hazardous dye degradation. The nano-catalytic membrane reactor has been prepared by embedding lamda-carageenan coated cuprous oxide nanocube catalyst into the Poly(vinylidene fluoride) PVDF membrane through phase-inversion membrane casting process. The synthesized catalytic membrane reactor comprises of excellent catalytic, antifouling, and antimicrobial efficiency which could efficiently degrade the hazardous water pollutant dyes. The catalytic membrane reactor could efficiently protect itself from fouling and bacteria contamination with self-cleansing properties. The catalytic membrane can efficiently work on a routine peristaltic pump based operational setup to remove/degrade hazardous textile dye wastes in a continuous flow manner in an in-situ fashion.

c) Biodegradable oxygen scavenging films and its preparation method:

The technology (Technology Readiness Level 5; Patented) relates to the biodegradable polymeric materials (polyvinyl alcohol and natural rubber latex) have been introduced as an oxygen scavenger composition. The synthesized polymer composite is doped with Manganese chloride and Acetophenone. The composition was later activated using different UV light exposure times for its oxygen-scavenging activity. The developed oxygen scavenging composition can be used in food packaging and automotive applications.

d) System and method to predict trajectory by way point dropping:

The invention (Technology Readiness Level 4; Patented) is an innovative method for precise trajectory prediction in Dynamic Mulch-Agent Environment, particularly in autonomous driving, robotics, and related applications. The method involves inputting the past trajectory and predicting the future trajectory of the agents. The technology utilizes the way point dropping to provide efficient learning to the model; this encourages the model to learn explicit information for diverse predictions. It utilizes stochastic drop and fixed drop to improve model learning. This approach compels the model to learn vivid representations and interaction strengths among the past trajectories, which improves future trajectory prediction.

e) A portable system and method for in-situ tensile testing in high pressure gas environment including hydrogen:

The invention (Technology Readiness Level 3; Patented) relates to a portable system and method for in-situ tensile testing in high pressure gas environment including hydrogen. The system integrates high-pressure gas chamber, especially under a hydrogen environment and in-situ tensile testing. This system consists of a load frame, monitoring window and digital monitoring of the gas pressure, which enhances the quality of the properties to be measured. The invention provides a method for performing in-situ tensile testing in a hydrogen environment under high pressure. This helps in various applications, such as storing and transporting hydrogen gas. This helps in categorizing the use of the material for hydrogen gas in vehicles, thus ensuring safety.

f) AI-driven intelligent process for multi-spectral non-invasive 3d imaging system:

The invention (Technology Readiness Level 3; Patented) relates to a hybrid multi-spectral scanning laser ophthalmoscopy and optical coherence tomography system computed tomography (CT) system for its automatic imaging scanning process. The invention uses: (a) interferometer integrated with a stepper motor to move its

reference arm and (b) voltage controlled variable liquid lens to create the entrance pupil plane of both OCT and SLO sections to acquire multi-spectrum data, simultaneously. A process pipeline: (a) to control the stepper motor, voltage of VFL, (b) to acquire data, (c) to convert the RAW data into B Scan images is integrated to AI driven decision-making step to act reference arm position and voltage of VFL such that best optical alignment is set automatically by extracting the maximum features or similarity from B Scan images in real time. The A.I. driven step also provides self-calibration estimating spatial resolution in Z direction.

3. Indian Council of Agricultural Research:

a) Genetically improved freshwater prawn *Macrobrachium rosenbergii:*

CIFA-GI Scampi® (Technology Readiness Level 8; Patented) is a genetically-improved and faster growing strain of giant freshwater prawn Macrobrachium rosenbergii (also called 'scampi') developed through selective breeding. Selective breeding was performed with a wide genetic base population from three geographically distant locations (Gujarat, Kerala and Odisha) in India. The generation interval for scampi is one year. The cumulative selection response has been > 50% and cost benefit ratio ranging from 1.48 to 1.98 after 14 generations of selection.

b) Novel impedimetric electrochemical sensor assay for rapid detection of *Penaeus monodon* in shrimp products, ensuring accurate labeling:

The innovation (Technology Readiness Level 5) encompasses the development of an impedimetric electrochemical sensor assay that involves the hybridization of target DNA to thiol-modified detector probes firmly anchored to the sensor surface. This cutting-edge method is designed to swiftly authenticate the presence of *Penaeus monodon*, commonly known as Tiger shrimp, in both raw and processed shrimp products. The assay operates with remarkable rapidity, delivering results within a time-frame of an hour.

c) BIOIMMUNIZER:

In-vitro Bio-immunization technology is a novel tissue culture technology for production of Fusarium wilt disease tolerant plants of banana. The process includes engineering the biomolecule into the banana tissue culture plantlets during in-vitro organogenesis phase. Pot culture and Field studies conducted in the hot spot regions of Fusarium wilt revealed that Bio-immunized plantlets were able to sustain the disease incidence to about 98% for a period of 9 months after planting and 85% till harvest.

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