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Tue, 24 May 2022

Super Hornets land in Goa; Trials begin for fighters for IAC

Two twin seater F/A-18 E/F Block III Super Hornets of Boeing have landed at INS Hansa in Goa, for trials on the Indian Navy's Shore Based Test Facility (SBTF). These aircraft will be undergoing a series of trials until early next month and will showcase their ski-jump ability as well as their compatibility to operate from India's first Indigenous Aircraft Carrier (IAC). This is expected to be commissioned in August after completing its sea trials which are going on. Financial Express Online had recently reported that these aircraft will reach India towards the end of May-early June for trials at INS Hansa. There are two aerospace companies – Dassault Aviation of France and Boeing of the US. They both are in the race for fighter jets which the Indian Navy is planning to buy for the IAC. During the trials the manufacturers are demonstrating the compatibility of their machines with the Indian Navy's aircraft carrier which uses the Ski-jump to launch the aircraft.

Has Rafale demonstrated its compatibility?

Yes, earlier this year the French company had sent in its Rafale-M aircraft for the trials.

Rafale-M Vs F/A-18 Super Hornet

To avoid a single vendor situation, both have undergone trials. Though both aircraft have been designed to operate from aircraft carriers which have a catapult mechanism, according to experts, to get any of these Both the Rafale-M and F/A-18 are originally designed to operate from carriers with a catapult launch mechanism and to make them operational from IAC, there is a need to carry out minor modifications. Financial Express Online has reported recently that Rafale-M (Marine) has also undergone trials and has recently been upgraded. Reports from France indicated that it is ready to offer the Rafale-M for the requirement of IAC to be commissioned in the Eastern Command fleet.

QUAD & Indo-Pacific

For India, keeping the maritime lanes free, and open for all, India, France and the US all have the same views as far as freedom of navigation, maritime domain awareness and laws are concerned. These lanes need to be open and free as they are critical for the trade and economy. France has asserted it is an "Indo-Pacific country" and it is willing to develop closer relationships with neighbouring countries and it considers India at the centre of this strategy. The US is also a

member of AUKUS (Australia, the US and the UK) which was formed in 2021, when the three countries joined together and the UK and Australia will get help from both the US and the UK to build nuclear submarines.

Once any of the aircraft is selected, according to sources, there will be a government to government agreement to ensure a speedy process to acquire the aircraft. Will it be a fighter jet from the US or France? Only time will tell. However, according to experts, "India could prefer to go with the Rafale-M as it already has Rafale jets in the Indian Air Force (IAF) Fleet, and the company is ready to offer the naval version too. As reported earlier, the Boeing F/A-18 has already demonstrated its ability in 2020 to take off from Ski-jump at a shore-based facility located at Naval Air Station Patuxent River in Maryland. The Boeing fighter is twin seater and Rafale-M does not have a twin seater trainer. The American fighter has an electronic warfare version which is of interest to the Indian Navy. While finalising the deal, the size of the aircraft, its fit on the IAC and lifts would all be factored in.

Background

The Request for Information which was floated in 2017 by the Indian Navy was for procuring 57 twin engine fighter jets, however, it was downsized to 26 multi-role carrier-borne fighters (MRCBF) and this included eight twin seater trainer variants and 18 single seat variants. These aircraft are expected to replace the ageing MiG-29 K aircraft and in view of the long drawn war between Ukraine and Russia, India is looking at other options. The navy is facing a shortage of aircraft to operate from both its carriers — INS Vikramaditya & the IAC Vikrant when it will be commissioned.

<https://www.financialexpress.com/defence/super-hornets-land-in-go-a-trials-begin-for-fighters-for-iac/2536513/lite/>

THE ECONOMIC TIMES

Tue, 24 May 2022

Mini Defence Expo in Kolkata from July 6-9

A mini Defence Expo will be held for the first time in Kolkata from July 6 to 9, Eastern Army Commander Lt Gen RP Kalita said here on Tuesday. The event will give an opportunity to the start-ups and MSMEs to showcase their products, he said. "From July 6 to 9, we are planning to hold a mini Defence Expo in Kolkata," GOC-in-C, Eastern Command, Kalita said at a programme here. He asked industry members to join the three-day expo to be held in the city for the first time. The Eastern Army Commander said that the armed forces are in touch with premier educational institutions for research and development of new products and that he had recently visited IIT Guwahati. Kalita said that the Russia-Ukraine war has taught that a nation has to fight its war alone and that this signifies the importance of self-reliance.

<https://economictimes.indiatimes.com/news/defence/mini-defence-expo-in-kolkata-from-july-6-9/articleshow/91764469.cms?from=mdr>

Quad leaders roll out major initiative to improve monitoring maritime activities across Indo-Pacific

Four-nation grouping Quad on Tuesday launched a major new initiative for the Indo-Pacific that allows the partner countries to fully monitor the waters on their shores and help ensure peace and stability in the region, a move that comes amid China's increasingly intimidatory behaviour. The announcement on the rollout of the Indo-Pacific Maritime Domain Awareness (IPMDA) came at the end of the second in-person Quad summit attended by Prime Minister Narendra Modi, US President Joe Biden, Japanese Prime Minister Fumio Kishida and his Australian counterpart Anthony Albanese.

A joint statement by the four leaders said the IPMDA will support and work in consultation with Indo-Pacific nations and regional information fusion centres in the Indian Ocean, Southeast Asia, and the Pacific Islands by providing technology and training to support shared maritime domain awareness to promote stability and prosperity. The leaders reaffirmed their commitment to a free and open Indo-Pacific and vowed to work "tirelessly to deliver tangible results" for the region. The IPMDA embodies what the Quad stands for: catalysing our joint efforts towards concrete results that help to make the region more stable and prosperous," it said. The leaders also announced the establishment of the 'Quad Partnership on Humanitarian Assistance and Disaster Relief (HADR) in the Indo-Pacific' that is aimed at further strengthening collaboration to effectively respond to disasters in the region.

https://m.economictimes.com/news/defence/quad-leaders-roll-out-major-initiative-to-improve-monitoring-maritime-activities-across-indo-pacific/amp_articleshow/91763219.cms



Modi Invites US Industries to Partner with India to manufacture in Defence sector under Make in India, Atmanirbhar Bharat programmes

Prime Minister Narendra Modi on Tuesday extended a warm and strong invitation to American companies to participate in co-development, co-design and co-manufacture even absolute manufacturing under the Make in India and the Atmanirbhar Bharat programmes under the rubrics of defence. Prime Minister Modi extended the invitation to the US industries during the productive talks he had with US President Joe Biden on the sidelines of the Quad summit in Tokyo. "The question of India-US defence partnership did come up in discussions between Prime Minister Modi and President Biden. But it was very clear the focus of the discussion was on defence manufacturing by the American companies in India under the framework of Make in

India and Atmanirbhar Bharat," Foreign Secretary Vinay Kwatra said during a media briefing here.

"Prime Minister Modi extended a warm and a strong invitation to the US industry to come to India to participate in the co-development, co-design and co-manufacture, even absolute manufacturing under the Make in India and Atmanirbhar Bharat. The focus was on defence manufacturing in India under the rubrics of defence," he said while responding to a question about whether the Biden administration has offered a USD 500 million aid package. It was reported by a Western media outlet that the package under consideration would include foreign military financing of as much as USD 500 million to wean off India from purchasing military equipment from Russia. The report said that if the deal works out, it would make India one of the largest recipients of such aid behind Israel and Egypt. It's unclear when the deal would be announced, or what weapons would be included.

<https://www.news18.com/news/india/modi-invites-us-industries-to-partner-with-india-to-manufacture-in-defence-sector-under-make-in-india-atmanirbhar-bharat-programmes-5239087.html>



Tue, 24 May 2022

India: Defence Minister Rajnath Singh to preside over first-ever private Defence Expo

In a first, a private Defence Expo will be held in India, to bring together Indian Micro Small and Medium Industries (MSMEs) and large defence manufacturers and create business opportunities, where the former can supply components for the latter. Generally, Defence Expos are organized by the Indian Government and are aimed at having foreign manufacturers and Indian ones exhibit their offerings to Indian and foreign customers. To be held at the Chennai Trade Center between 26-28th May, this event titled "Defence & technology Expo Empowering MSME" is being organized by Swatantra Foundation, a think tank based in the Southern Indian city. "Our focus for this event is to connect MSMEs with large Defence manufacturers through B2B meetings to create business opportunities" said S Ramasubramanian, Founder & President of Swatantra Foundation

According to the organizers, the Business-to-Business event will witness the participation of more than 250 MSMEs and 50 Defence Public sector undertakings and large corporates. Hindustan Aeronautics Limited, BEML, Bharat Dynamics, Heavy Vehicles Factory, Engine Factory, Ordnance Factory Medak, Indian Navy Indigenisation, Indian Navy procurement, Indian Air force BRDs, Indian Air force Indigenisation, Indian Air force procurement, ISRO, DRDO, Dassault Systemes, Super Auto Forge, Munition India Group, Advanced Weapons Group, Bharat Forge are some of the prominent participants.

"This is the first-ever private sector held Defence Expo in the country, conceived with the aim of accelerating the 'Atmanirbhar Bharat' vision of the Government through indigenisation of components for defence equipment. The event will be a great platform for MSMEs to showcase their capabilities and for large Defence PSUs and Corporates to display their indigenisation requirements" said S Seetharaman, Chairman of the Event Steering Committee.

R Hariharan, National Vice President, Lagu Udyog Bharati added, “Govt of India has announced several defence equipment components for positive indigenisation in recent months, which augurs well for the MSMEs to enter the Defence Production sector as suppliers to large corporates and Defence PSUs. Large off-set requirement obligations on foreign defence manufacturers for recent defence imports also opens up the sector for private players significantly. This expo is being conducted at this opportune time to connect all the players in a common platform”

Organized by Swatantra Foundation, along with TIDCO & Lagu Udyog Bharati, the Expo will be inaugurated on 26th May, by Minister of State for Defence Ajay Bhatt and the Valedictory function on the final day ay 28th will be presided over by Defence Minister Rajnath Singh.

<https://www.wionews.com/india-news/india-defence-minister-rajnath-singh-to-preside-over-first-ever-private-defence-expo-481901>

Science & Technology News

INDIA
TODAY

Tue, 24 May 2022

Is Mercury hiding on Earth? Research suggests it arrived during early days of Solar System

When Europe's Solar Orbiter conducted its closest flyby to the Sun, the probe was in the orbit of the innermost planet of our solar system -- Mercury. The planet's just a little larger than our Moon, and should not exist this close to the Sun, but Mercury, defying all odds, looms large, casting its shadow on the star. New research suggests this planet was much bigger and its fate was doomed by a collision that sent pieces of it flying across. Some of it landed on Earth. The planet that we see today is a remnant of a super-Mercury that existed billions of years ago. The latest theory has been proposed at the Lunar and Planetary Science Conference in Houston, in which scientists have focussed on a small fraction of meteorites found in the village of Aubres in France that could match the scientific models of conditions on Mercury.

Known as aubrites, they are pale in color and contain small amounts of metal. These form a small fraction of nearly 70,000 meteorites that have been gathered from across the world. While most of these meteorites are from the asteroid belt between Mars and Jupiter, a significant amount of these space rocks is from Mars and the Moon. So far, 80 aubrite meteorites have been found on Earth. "Aubrites share similar exotic mineralogies with Mercury's lavas and are therefore regarded as potential analogues to Mercury's crust. It has however been assumed that they are not Mercurian meteorites, mostly based on chemical and physical arguments of asteroidal origin," Dr. Camille Cartier, a planetary scientist at the University of Lorraine in France said in the paper. While Mercury today does not have a mantle unlike Earth, a long-standing idea holds that proto-Mercury or super-Mercury once possessed a larger silicate mantle that was removed by an early giant impact.

While the team does not have a specimen of Mercury yet, they say that it is likely that large amounts of ejected debris from the collision are gravitationally captured by the inner planets during their outward course. They calculated that up to 20 per cent of escaped particles could collide with Venus and about 5 per cent with Earth. "If proto-Mercury was 0.3 to 0.8 Earth masses and lost most of its mantle, that would potentially represent 1 per cent to 2.5 per cent Earth-mass of aubritic material accreting to the Earth," the paper said. Scientists have, however, not yet announced these strange materials to be part of Mercury, as another group has speculated, that they have originated from E-type asteroids.

However, if it is proven that these space rocks are indeed shards from planet Mercury, it will mean that an ancient planet was hiding on Earth eons before humans set foot. Scientists will get a good view of the planet and its mysterious origin when the BepiColombo, a mission jointly developed by Europe and Japan begins orbiting to the innermost planet in 2025.

<https://www.indiatoday.in/science/story/is-mercury-hiding-on-earth-research-suggests-it-arrived-during-early-days-of-solar-system-1953314-2022-05-24>



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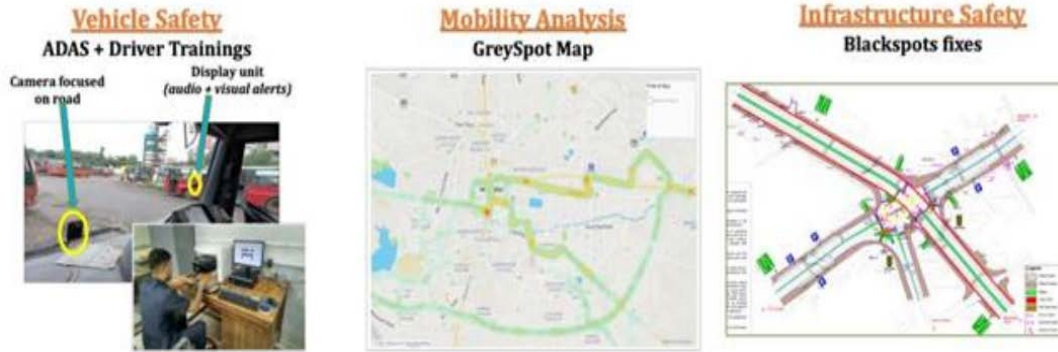
Tue, 24 May 2022 2:17 PM

AI to make roads in India safer to drive

Artificial Intelligence (AI) powered solutions may soon make roads in India a safer place to drive. A unique AI approach that uses the predictive power of AI to identify risks on the road, and a collision alert system to communicate timely alerts to drivers, to make several improvements related to road safety, is being implemented in Nagpur City with an objective of resulting in a significant reduction of accidents. The project 'Intelligent Solutions for Road Safety through Technology and Engineering' (iRASTE) at Nagpur will identify potential accident-causing scenarios while driving a vehicle and alert drivers about the same with the help of the Advance Driver Assistance System (ADAS). The project will also identify 'greyspots', i.e., by data analysis and mobility analysis by continuously monitoring dynamic risks on the entire road network. Greyspots are locations on roads, which left unaddressed could become blackspots (locations with fatal accidents). The system also conducts continuous monitoring of roads and designs engineering fixes to correct existing road blackspots for preventive maintenance and improved road infrastructure.

The iRASTE project is under by the I-Hub Foundation, IIIT Hyderabad, a Technology Innovation Hub (TIH) set up in the technology vertical- Data Banks & Data Services supported by the Department of Science and Technology (DST) under its National Mission on Interdisciplinary Cyber Physical Systems (NM-ICPS) along with INAI (Applied AI Research Institute). The project consortium includes CSIR-CRRI, and Nagpur Municipal Corporation, with Mahindra and Intel as the industry partners.

The Hub is working to coordinate, integrate, and amplify basic and applied research in broad data-driven technologies as well as its dissemination and translation across the country. One of the primary aims is to prepare a critical resource for the future use by researchers, startups, and industry, mainly in the areas of smart mobility, healthcare along with smart buildings. What makes the iRASTE project even more unique is that AI and technology is being applied to create practical solutions, as a blueprint, for Indian conditions. While the initial rollout of iRASTE is in Nagpur, the eventual goal is to replicate the solution in other cities too. Currently, talks are on with the Telangana government to adopt the technology in a fleet of buses that ply on highways. There are further plans to extend the scope of iRASTE to Goa and Gujarat also.



I-Hub Foundation has also used techniques ranging from machine learning, computer vision and computational sensing for several other data-driven technological solutions in the mobility sector. One such solution is the India Driving Dataset (IDD), a dataset for road scene understanding in unstructured environments captured from Indian roads, which stands out by deviating from the worldwide assumptions of well-delineated infrastructure such as lanes, limited traffic participants, low variation in object or background appearance and strong adherence to traffic rules.

The dataset, a first of its kind, consists of 10,000 images, finely annotated with 34 classes collected from 182 drive sequences on Indian roads obtained from a front-facing camera attached to a car driven around Hyderabad, Bangalore, and their outskirts. The dataset is released in the public domain for unrestricted use under public license and is becoming a defacto dataset for all analysis on Indian road scenes. Currently, there are over 5000 registered users for this dataset across the world. Another dataset called Open World Object Detection on Road Scenes (ORDER) has also been developed using the India Driving Dataset that could be used by autonomous navigation systems in Indian driving conditions for localization and classification of the objects in a road scene. Besides this, a Mobility Car Data Platform (MCDP) has been designed with several sensors – cameras, LIDARs, with necessary compute for anyone to capture or process data on the car that can help researchers and start-ups in India test their automotive algorithms and approaches in navigation and research on Indian roads.

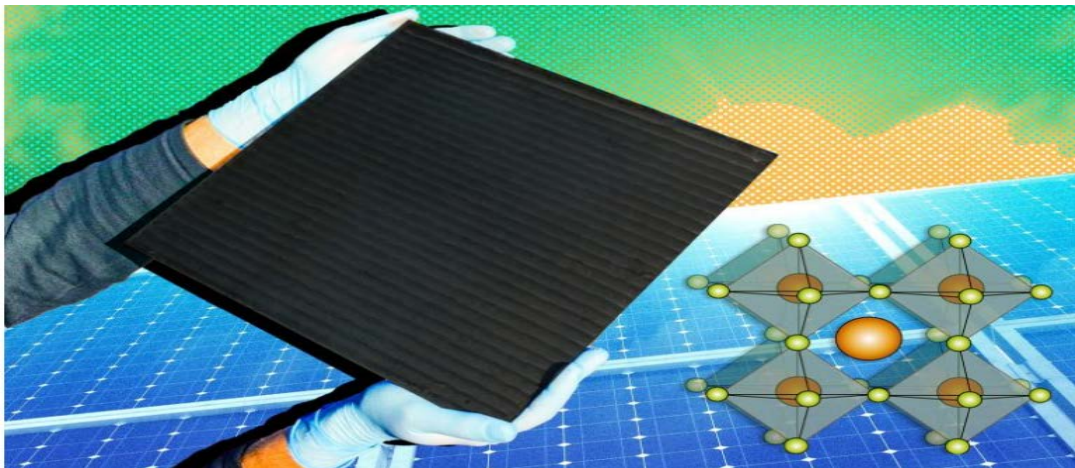
LaneRoadNet (LRNet), a new framework with an integrated mechanism considering lane and road parameters using deep learning, has been designed to address problems of Indian roads, which have several obstacles, occluded lane markings, broken dividers, cracks, potholes, etc. that put the drivers at significant risk while driving. In this framework, a road quality score is calculated with the help of a modular scoring function. The final score helps the authorities to assess road quality and prioritize maintenance schedules of the road so as to improve the drivability. In order to help local self-government institutions employ suitable rejuvenation methods in tree starved streets, I-Hub Foundation designed a framework for street tree detection, counting and visualization that uses object detectors and a matching counting algorithm. The work has paved way for a quick, accurate, and inexpensive way to recognize tree-starved streets.

<https://www.pib.gov.in/PressReleasePage.aspx?PRID=1827881>

Artificial Intelligence helps scale up advanced Solar cell manufacturing

Perovskite materials would be superior to silicon in PV cells, but manufacturing such cells at scale is a huge hurdle. Machine learning can help. Perovskites are a family of materials that are currently the leading contender to replace the silicon-based solar photovoltaics that are in broad use today. They carry the promise of panels that are far lighter and thinner, that could be made in large volumes with ultra-high throughput at room temperature instead of at hundreds of degrees, and that are easier and cheaper to transport and install. But bringing these materials from small laboratory experiments into a product that can be manufactured competitively has been a protracted struggle.

Production of perovskite-based solar cells involves optimizing at least a dozen or so variables at once, even within one particular manufacturing approach among many possibilities. However, a new system based on a novel approach to machine learning could speed up the development of optimized production methods and help make the next generation of solar power a reality. The system, developed by researchers at MIT and Stanford University over the last few years, makes it possible to integrate data from prior experiments, and information based on personal observations by experienced workers, into the machine learning process. This makes the outcomes more accurate and has already led to the manufacturing of perovskite cells with an energy conversion efficiency of 18.5 percent, which is a competitive level for today's market.



The optimized production of perovskite solar cells could be sped up thanks to a new machine learning system.

The research was recently published in the journal *Joule*, in a paper by MIT professor of mechanical engineering Tonio Buonassisi, Stanford professor of materials science and engineering Reinhold Dauskardt, recent MIT research assistant Zhe Liu, Stanford doctoral graduate Nicholas Rolston, and three others. Perovskites are a group of layered crystalline compounds defined by the configuration of the atoms in their crystal lattice. There are thousands of such possible compounds and many different ways of making them. While most lab-scale development of perovskite materials uses a spin-coating technique,

that's not practical for larger-scale manufacturing, so companies and labs around the world have been searching for ways of translating these lab materials into a practical, manufacturable product.

"There's always a big challenge when you're trying to take a lab-scale process and then transfer it to something like a startup or a manufacturing line," says Rolston, who is now an assistant professor at Arizona State University. The team looked at a process that they felt had the greatest potential, a method called rapid spray plasma processing, or RSPP. The manufacturing process would involve a moving roll-to-roll surface, or series of sheets, on which the precursor solutions for the perovskite compound would be sprayed or ink-jetted as the sheet rolled by. The material would then move on to a curing stage, providing a rapid and continuous output "with throughputs that are higher than for any other photovoltaic technology," Rolston says.

"The real breakthrough with this platform is that it would allow us to scale in a way that no other material has allowed us to do," he adds. "Even materials like silicon require a much longer timeframe because of the processing that's done. Whereas you can think of [this approach as more] like spray painting." Within that process, at least a dozen variables may affect the outcome, with some of them being more controllable than others. These include the composition of the starting materials, the temperature, the humidity, the speed of the processing path, the distance of the nozzle used to spray the material onto a substrate, and the methods of curing the material. Many of these factors can interact with each other, and if the process is in the open air, then humidity, for example, may be uncontrolled. Evaluating all possible combinations of these variables through experimentation is impossible, so machine learning was needed to help guide the experimental process.

But while most machine-learning systems use raw data such as measurements of the electrical and other properties of test samples, they don't typically incorporate human experience such as qualitative observations made by the experimenters of the visual and other properties of the test samples, or information from other experiments reported by other researchers. So, the team found a way to incorporate such outside information into the machine learning model, using a probability factor based on a mathematical technique called Bayesian Optimization.

Using the system, he says, "having a model that comes from experimental data, we can find out trends that we weren't able to see before." For example, they initially had trouble adjusting for uncontrolled variations in humidity in their ambient setting. But the model showed them "that we could overcome our humidity challenges by changing the temperature, for instance, and by changing some of the other knobs." The system now allows experimenters to much more rapidly guide their process in order to optimize it for a given set of conditions or required outcomes. In their experiments, the team focused on optimizing the power output, but the system could also be used to simultaneously incorporate other criteria, such as cost and durability — something members of the team are continuing to work on, Buonassisi says. The scientists were encouraged by the Department of Energy, which sponsored the work, to commercialize the technology, and they're currently focusing on tech transfer to existing perovskite manufacturers. "We are reaching out to companies now," Buonassisi says, and the code they developed has been made freely available through an open-source server. "It's now on GitHub, anyone can download it, anyone can run it," he says. "We're happy to help companies get started in using our code."

Already, several companies are gearing up to produce perovskite-based solar panels, even though they are still working out the details of how to produce them, says Liu, who is now at the Northwestern Polytechnical University in Xi'an, China. He says companies there are not yet doing large-scale manufacturing, but instead starting with smaller, high-value applications such as building-integrated solar tiles where appearance is important. Three of these companies "are on track or are being pushed by investors to manufacture 1 meter by 2-meter rectangular modules [comparable to today's most common solar panels], within two years," he says. "The problem is, they don't have a consensus on what manufacturing technology to use," Liu says. The RSPP method, developed at Stanford, "still has a good

chance” to be competitive, he says. And the machine learning system the team developed could prove to be important in guiding the optimization of whatever process ends up being used.

“The primary goal was to accelerate the process, so it required less time, less experiments, and less human hours to develop something that is usable right away, for free, for industry,” he says. “Existing work on machine-learning-driven perovskite PV fabrication largely focuses on spin-coating, a lab-scale technique,” says Ted Sargent, University Professor at the University of Toronto, who was not associated with this work, which he says demonstrates “a workflow that is readily adapted to the deposition techniques that dominate the thin-film industry. Only a handful of groups have the simultaneous expertise in engineering and computation to drive such advances.” Sargent adds that this approach “could be an exciting advance for the manufacture of a broader family of materials” including LEDs, other PV technologies, and graphene, “in short, any industry that uses some form of vapor or vacuum deposition.”

<https://scitechdaily.com/artificial-intelligence-helps-scale-up-advanced-solar-cell-manufacturing/amp/>



Tue, 24 May 2022

Study explores how older adults react while interacting with humanoid robots

Robots are gradually being introduced in a wide range of real-world settings, including malls, manufacturing facilities, and healthcare facilities. A way in which robots could be particularly useful is in assisting seniors in both their homes and elderly care facilities. Researchers at University of Bari and University of Parma have recently published a new study exploring the emotional reactions of a small group of seniors after they interacted with Pepper, a humanoid robotic system. Their paper, available in Springer Link's *Human-Friendly Robotics 2021*, suggests that seniors can display both negative and positive emotions while interacting with robots.

"We previously conducted other studies with the NAO robot in the context of Cognitive Stimulation Therapy (CTS) and we measured not only the performance of seniors in terms of task completion, but also in terms of engagement and affective response," Berardina De Carolis, one of the researchers who carried out the study, told TechXplore. "Our results were promising. When Pepper arrived in our department, we noticed that some of its features could overcome the limitations of the NAO robot (i.e., the display, the height, the possibility to move in a room, etc.) and produce better results." In their previous studies, the researchers had investigated the impact of using NAO, a programmable humanoid robotic platform, to perform CST on senior adults. CTS is a form of therapy aimed at enhancing the mental skills of older adults or younger patients with memory and cognitive impairments. In one of their studies, the team specifically looked at how acceptant the patients were of the robots and on how well they performed on tasks.

"For instance, we used NAO H25 in a healthcare center for cognitive disorders and dementia, as model in demonstrating not only physical exercises to a group of seniors, but also in groups therapy sessions to assist the therapist with recovering and/or maintaining cognitive abilities such as memory, orientation and communication skills providing to the participants instructions, suggestions, and consequences," Olimpia Pino, another researcher involved in the studies, told Tech Xplore. After their lab received the Pepper robot, De Carolis, Pino and their colleagues decided to conduct a new investigation at the Alzheimer's center in Bari, adapting the tasks they used in their previous work to leverage the new robot's more advanced communication abilities. Due to the COVID-19 pandemic, however, they were forced to reduce their sample of participants and conclude their experiment earlier. Nonetheless, their study

provides a general indication of how seniors might react to interactions with the Pepper robot and to CST sessions assisted by the robot.

"The progressive use of humanoid robots in assistive or therapeutic functions raised several issues concerning participants' engagement and acceptance," Pino explained. "In our previous research, when we chose experimental tasks such as prose recall, calculations, matching song-singer, we noticed that robots made tasks more engaging, and, in some circumstances, patients reacted enthusiastically to their interactions with the robots. Moreover, most participants indicated they would like to have the robot at home." In their new study, De Carolis, Pino and their colleagues analyzed the emotions of 8 seniors while they completed memory tasks with support from the Pepper robot. To do this, they compared the predictions made by an automatic Facial Expression Recognition (FER) system specifically trained to detect emotions in the faces of older adults with observations made by three human raters. The Pepper robot proved to be particularly well-suited for their activities, as it features tactile sensors on its head and hands, as well as a tablet on which it can play videos or images, and buttons that users can press to interact with the robot.

"Despite many difficulties in programming the robot and the consequent still too limited ability to appear natural, it has been observed that elders became more engaged with Pepper along sessions showing more positive facial expressions," Pino explained. "It is desirable that robots applied to real world applications perform their activities in reactive but flexible manner. Thus, robots capable to adapt to human interaction are particularly suitable." De Carolis, Pino and her colleagues found that participants exhibited both negative and positive emotions while interacting with the robot on memory tasks. Interestingly, human annotators observed more positive emotions than the automatic emotion recognition system did. Nonetheless, most of the emotional reactions of seniors appeared to be positive. "Humanoid robots seem promising since they can support more engaging interactions with users, and results obtained so far are encouraging," Pino said. "The integration of robotics into both formal and informal care opens new possibilities for improving the lives of patients and alleviating the burden on caregivers and healthcare services. However, to make the FER model more robust in real-time and in the wild we will need to explore the use of deep learning."

The recent findings gathered by this team of researchers further confirm the potential of introducing robots in elderly care facilities and other therapeutic settings for older adults. In their next studies, De Carolis, Pino and her colleagues plan to gather a larger dataset with senior facial expressions, to develop and train a deep learning method that can predict their participant's emotions with greater accuracy. "In our future research, we also want to personalize the interventions and tasks to meet the needs of individual patience and, since we developed a module for analyzing the seniors' behavior in terms of speech, gaze and emotions, we want to endow the robot with the possibility to react and adapt its answers to the recognized senior's feedback," De Carolis added.

<https://techxplore.com/news/2022-05-explores-older-adults-react-interacting.html>



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Electrode design paves way for high-performance hybrid biofuel cells

Amphiphilic assembly generates hybrid biofuel cells with improved power output and operational stability. Enzyme electrodes are useful in a variety of applications, including biosensing systems and electrochemical devices. Biofuel cells (BFCs) are especially promising candidates for powering a wide range of bioelectronic devices by converting biochemical energy into electricity under mild biological conditions. Despite their characteristics, most biofuel cells provide low power output and short-term operational stability due to their poor electron transfer between enzymes and electrodes and between neighboring enzymes. These electron transfer issues are closely related to the performance of nearly all electrochemical sensors, including BFCs and other bioelectronics.

In the journal *Applied Physics Reviews*, by AIP Publishing, scientists from Korea and the United States address these shortcomings via an amphiphilic assembly designed to prepare high-performance biofuel cells. The method, which can induce favorable interfacial interactions between electrocatalysts and significantly improve the electron transfer kinetics of electrodes, generated hybrid biofuel cells with high power output and good operational stability. “Our novel electrode design using an amphiphilic assembly, which breaks with the common perspective of enzyme immobilization, can maximize the electron transfer at the enzyme/enzyme and enzyme/electrode interfaces as well as realize high operational stability, inducing the formation of a perfect and nanoblended enzyme layer,” said author Cheong Hoon Kwon.

The method induced favorable interfacial interactions between electrocatalysts and improved electron transfer kinetics of electrodes. It achieved unprecedented mass loading of hydrophilic enzyme and hydrophobic/conductive metal nanoparticles and greatly increased electron transfer efficiency and current density. Amphiphilic assembled multilayers composed of glucose oxidases in aqueous media and hydrophobic/conductive nanoparticles in nonpolar media were deposited onto cotton fiber/textile to form the anode, which has notably increased electron transfer efficiency and immobilization stability. The cathode was formed by sputtering platinum onto the gold nanoparticle-coated cotton fibrils to improve the efficiency of the oxygen reduction reaction. The researchers believe the assembly method may provide a basis for preparing a variety of high-performance electrochemical devices, including biofuel cells. “Our results could be of significant interest to various researchers and engineers working in the areas of self-assembly, energy conversion, and electrochemical sensors, in addition to BFCs,” said Jinhan Cho, a co-author on the paper.

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