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Distinguished Lecture Series
in **September** and **October 2022!**
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ISSUE 2 - June 2022

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Prof. Guo Song honoured by research authorities

RISA member named as Top Reviewer of The American Journal of Clinical Nutrition

ITF Midstream Research Scheme Funding secured for textile electronic interaction system

Prof. Li Qing conferred as Fellow of the Institute of Electrical and Electronics Engineers

Prof. Zheng Zijian conferred as Fellow of The Royal Society of Chemistry

Prof. Cao Jiannong conferred as Fellow of China Computer Federation

Member of RIAIoT partners with Huakun Daowei for establishing a data security research institute

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Smart Cities Research Institute
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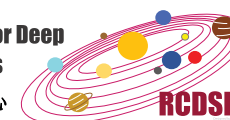
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Chief Editor's Corner

It was a fruitful spring for PAIR. Six interdisciplinary research teams garnered awards in the Geneva Inventions Expo, multiple researchers received major awards and honours from professional research authorities, and projects successfully obtained external funding. We also launched our Distinguished Lecture Series in April, with five to six lectures planned for this year. In addition, joint research symposia and workshops are under preparation. Please stay tuned for news about upcoming events.

PAIR and its ten Research Institutes and five Research Centres are continuing to advance interdisciplinary research even during the pandemic. We aim not only to generate unique knowledge and achieve the Sustainable Development Goals set by the United Nations, but also to offer new solutions that contribute to the knowledge-based economies of Hong Kong, the Guangdong-Hong Kong-Macao Greater Bay Area, and beyond.

In this issue, we have highlighted significant achievements of our researchers, including new findings in intelligent wearable systems, flash drought mitigation, a bifidobacterial study, a web-based solar irradiation map and flexible lithium batteries. Some of these findings are the results of funded projects in technology transfer and commercialisation via new start-ups and collaboration with the government. Examples include Unicool™ – an eco-friendly building coating, Omni-Cool-Dry™ – a fabric for dynamic thermal and moisture management, AkkMore™ – a supplement against obesity, and many more. Furthermore, we continue to showcase our constituent research units in our feature stories, including the Research Institute for Artificial Intelligence of Things, the Research Institute for Land and Space, and the Research Centre for SHARP Vision. The experiences that the Directors of these Research Institutes and Centres share with us are interesting and enlightening.

I hope you all enjoy the Spring 2022 issue of the PAIR Newsletter. Stay healthy and safe!



Prof. Chen Qingyan
Director of PolyU Academy for Interdisciplinary Research



Knowledge Transfer

Omni-Cool-Dry™: a desert beetle-inspired skin-like fabric for dynamic thermal and moisture management

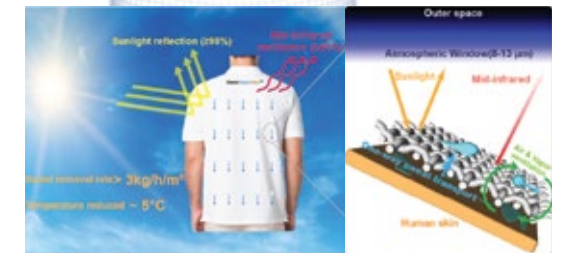


Dr Shou Dahua, Member of the Research Institute for Intelligent Wearable Systems (RI-IWEAR), developed a novel fabric that won a Silver Medal in the “Inventions Geneva Evaluation Days – Virtual Event”, a special online edition of the 2022 International Exhibition of Inventions of Geneva (Geneva Inventions Expo). The project that received the medal is Omni-Cool-Dry™.

Omni-Cool-Dry™ is a desert beetle-inspired skin-like fabric that promises all-day cooling and drying, breathability, and comfort under dynamic thermal conditions. This unique fabric quickly dissipates excessive sweat as water droplets to prevent the sensations of wetness and saturation. It also reflects solar radiation and emits body heat to the cold surroundings for cooling. Compared to conventional fabrics, Omni-Cool-Dry™ weighs 75% less, dissipates sweat three times faster, and is 50% less clingy during

heavy perspiration. This new fabric cools human skin to a temperature that is 5°C lower than that with a commercial cotton fabric.

Omni-Cool-Dry™ is water-repellent and coated all over with radiative cooling nanoparticles, while local water channels are patterned with a wettability gradient to serve as “sweat glands”. The fabrication process is scalable, cost-effective, and compatible with production processes in the textile industry. This fabric will help outdoor enthusiasts and athletes achieve their best performance. It will also boost the endurance of professionals such as medical personnel, construction workers, and firefighters.



Advanced air-conditioned face mask for heavy-duty users

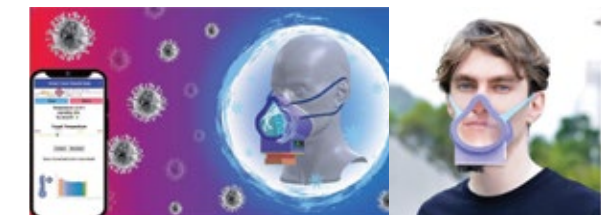
Face masks have become a daily necessity in public settings, especially as the COVID-19 pandemic has exploded around the world. However, the use of masks often results in high temperatures and thick humid air between the mask and the user's face. Mask wearers may experience thermal and wearing discomfort and breathing difficulties, heat-related illnesses, and poor mask functionality.

Dr Shou Dahua, Member of the Research Institute for Intelligent Wearable Systems, and his research team developed an air-conditioned face mask (AC Mask) which received the Gold Award and Special Award at the 35th World Genius Convention and Education Expo 2021 and the Gold Medal and Grand Award (Excellence in Innovation Award) at the 13th European Exhibition of Creativity and Innovation (EUROINVENT) 2021.

AC Mask goes beyond existing products. This automatic temperature-controllable mask provides cool air and easy breathing in the mask microclimate for consumers who demand greater comfort and protection from COVID-19, and for professionals working in hazardous environments. It brings revolutionary access to all-day cool breathing and thermal comfort during a variety of personal activities and under a range of thermal conditions. AC Mask keeps the wearer more comfortable and improves the user's performance.

The mask is fabricated from medical-grade silicone and biodegradable materials by means of 3D printing and has an excellent ergonomic design: an optimised ventilation system for easy breathing and efficient cooling along with breathing cycles; high conformability and sealing ability; a transparent front for improved communication; and a rechargeable battery and smartphone app for convenient long-term use.

Integrating a 3D printed frame and a thermoregulation unit, the new face mask strikes a balance between effective personal protection and wearing comfort. The AC Mask is worn with a disposable surgical face mask or fibrous filter, and its design allows thermoregulated ventilation, thus providing easier breathing and greater thermal comfort. The frame ensures sufficient space for ventilation inside the mask and prevents direct contact between the surgical mask and the wearer's face. The AC Mask is compatible with most existing disposable surgical masks or fibrous filters and can be reused after being sanitized. It is an ideal choice for medical professionals, caregivers, outdoor workers, firefighters, soldiers, etc. The mask is now ready for commercialisation.



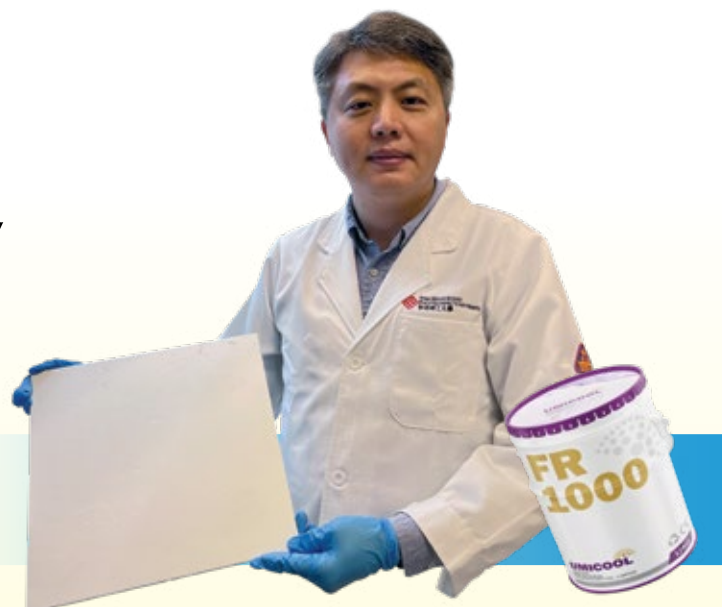
Knowledge Transfer

Umicool™: an eco-friendly building coating that keeps the interior 6°C cooler

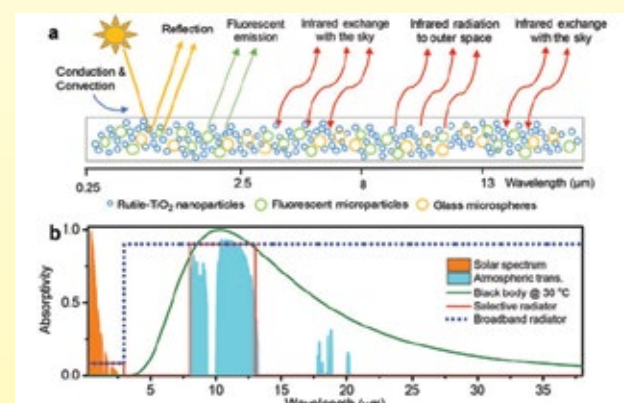
Passive daytime radiative cooling coating materials allow heat to be emitted into outer space through Earth's atmospheric infrared transparency window.

Prof. Dai Jianguo, Management Committee Member of the Research Institute for Land and Space (RILS) and Associate Head (Academic Development) of the Department of Civil and Environmental Engineering at PolyU, led a research team in the development of Umicool™ – an inexpensive, smart and eco-friendly coating product for passive building cooling.

The coating takes advantage of daytime radiative cooling but suppresses it at night when cooling is no longer needed. This is accomplished by widening the emissivity spectrum over the entire mid-infrared range. The strategy also uses common materials for the coatings; these materials are more likely to withstand long-term weathering. Umicool™ has demonstrated its capacity for keeping the interior of a model room at least 6°C cooler than the ambient temperature without using any electricity.



To commercialize Umicool™, Professor Dai co-founded a start-up company known as Pro-Infra Science & Tech Ltd. with other researchers. He has obtained an entrepreneurship fund of HK\$600,000 and two consultancy projects from the HKSAR Government. Umicool™ also won a Gold Medal in the “Inventions Geneva Evaluation Days – Virtual Event”, a special edition of the 2022 International Exhibition of Inventions of Geneva.



RiFood researcher develops an award-winning fungus-and plant-based supplement against obesity or prediabetes

Dr Gail Jinhui Chang, Core Member of the Research Institute for Future Food (RiFood) and Research Assistant Professor of the Department of Applied Biology and Chemical Technology at PolyU, has developed AkkMore™, a fungus-and plant-based supplement against obesity or prediabetes.

AkkMore™ is a nutritional supplement formula drink that improves the physical condition of user by building

a healthy microbiome. The drink boosts *Akkermansia muciniphila*, which is a beneficial bacterium that lives in the gut mucus layer. This bacterium maintains the mucus thickness and gut barrier integrity by providing short-chain fatty acids for gut cells. Recent studies have found decreased levels of *Akkermansia muciniphila* in many diseases, such as obesity and type 2 diabetes, possibly due to a high-fat diet, alcohol consumption or other aspects of an unhealthy lifestyle. AkkMore™ is a mixture of natural food ingredients that restores the abundance of *Akkermansia muciniphila*, thus repairing the gut barrier, reducing metabolic disorders and helping users to lose weight. The research team has recently completed animal studies as well as a pre-clinical trial in humans.

This research project received a Silver Medal in the “Inventions Geneva Evaluation Days – Virtual Event”, a special online edition of this year's International Exhibition of Inventions of Geneva.



Algorithmic music composition software for popularising AI education for non-professionals

It is become increasingly important for ordinary people without a professional background to know some of the basics of artificial intelligence (AI). Most current AI research areas, such as pattern recognition models, can be difficult or boring for the majority of the population. Inspired by the fact that most people are interested in music, Dr Chen Gong, a PhD alumnus of the Department of Computing at PolyU and Founder of RhySoul Technology (Shenzhen) Company Limited, developed an attractive study tool for secondary school students in the form of software.



The AI-powered software generates music automatically and allows ordinary people without a technology or engineering background to experience typical AI algorithms. The software divides the procedure of music composition into four steps. Users gain a hands-on experience of how the AI algorithms work. At the same time, each user receives a personalised musical piece. The software can be installed directly on a PC or Mac, and the graphical user interface is easy to understand. Users will learn that AI is not just a cutting-edge technical subject, but also an interesting and beautiful one.

The work is supported by the PolyU GBA Startup Postdoc Programme under the supervision of Prof. Cao Jiannong, Director of the Research Institute for Artificial Intelligence of Things (RIAIoT), Dean of the Graduate School, Chair Professor of Distributed and Mobile Computing, and Otto Poon Charitable Foundation Professor in Data Science; and Dr Liu Yan, Director of the Cognitive Computing Lab and Associate Professor of the Department of Computing at PolyU.

Feature Story

Internet of Things: a paradigm for integrating the physical and virtual worlds

“The Internet of Things has become one of the main focuses of technology development in Hong Kong, and the government is committed to keeping pace with advancements in IoT in order to build a smarter and more connected society.”

In our digital age, the “Artificial Intelligence of Things” (AIoT) has become a hot topic. IoT means “Internet of Things”, which is a paradigm for integrating devices in the physical world with the virtual world, enabling seamless connectivity and the process of identifying, sensing, computing, and control of physical systems. IoT has evolved over the past 20 years, from the early radio frequency identification-centred smart home to today’s advanced applications such as Industry 4.0. This trend is driven in particular by the availability of Big Data and AI. AIoT in simple terms means to make the IoT perform intelligence tasks with the help of integrating AI. Changing not only the definition of devices but also their functions, IoT provides a foundation for real-time monitoring, operational efficiency and resource optimisation. IoT also increases safety and facilitates innovative services in many areas, including smart cities, smart healthcare and smart logistics. The Internet of Things has become one of the main focuses of technology development in Hong Kong, and the government is committed to keeping pace with advancements in IoT in order to build a smarter and more connected society.

In this regard, PolyU established the Research Institute for Artificial Intelligence of Things (RIAloT) in May 2021 as one of the constituent research units of the PolyU Academy for Interdisciplinary Research (PAIR). RIAloT is now led by Prof. Cao Jiannong, Dean of the Graduate School, Associate Director of the University Research

Facility in Big Data Analytics, and Chair Professor of Distributed and Mobile Computing at PolyU. Under Professor Cao’s directorship, the members of RIAloT are conducting numerous projects ranging from technical areas like wireless sensing, IoT networks, edge computing, and blockchain to application domains including smart construction, logistics and healthcare.

By means of interdisciplinary collaboration, a current Research Grants Council (RGC) Research Impact Fund (RIF) project is using big data analytics and IoT to tackle grand challenges in food safety. There are three major challenges in food safety, namely, food traceability, food status/fraud detection, and risk prediction. Traditional inspection and sampling methods are inadequate. Working together with food safety experts and industry partners, researchers have developed artificial intelligence of things (AIoT) methods and techniques that integrate wireless sensor networks, blockchain, big data analytics and edge AI, providing automated, highly accurate, and efficient solutions securely and authentically. The techniques being developed include radio frequency identification (RFID) tag substitution detection, non-intrusive and low-cost liquid fraud detection and food freshness detection using image-to-image translation; and target and non-target food contaminant detection using big data analytics. Such research has led not only to high-quality publications but also to awards in innovation and invention.



“When people across diverse disciplines work together, they can identify new problems and/or find new angles for solving existing problems.”

Recently, Prof. Li Heng and Prof. Chen Wu, Associate Directors of RIAloT, have been awarded over HK\$7 million from the Innovation and Technology Fund (ITF) grant to enhance Hong Kong badminton players’ performance by using data analytics to identify areas in which the players can improve. The objectives are the efficient calculation of technical statistics, rapid analysis of opponents’ technical characteristics, data-driven evaluation of athletes’ performance and physical

conditions. IoT techniques such as sensing, computer vision and localisation, and big data analytics are needed to achieve these objectives. For example, the researchers will seek to recognise and count key actions with context data location and results, whether success or failure, as well as 3D positions of shuttlecocks and players.



Prof. Li Heng
Associate Director



Prof. Chen Wu
Associate Director

AIoT enables the generation of synergies across disciplines

Professor Cao believes that when people across diverse disciplines work together, they can identify new problems and/or find new angles for solving existing problems. He added: “Our approach to interdisciplinary research is problem-driven. We will periodically call for challenging problems in AIoT applications or technical fields, and hold meetings to discuss these problems, selecting those that identify the major challenges, which usually require solutions that combine knowledge and technologies from different fields. We will then call for solutions, inviting members to form interdisciplinary teams to work on the problems. Since the problems are large in scope, we will require the teams to develop end-to-end solutions, ranging from the underlying support to the upper-layer applications. In this way, we encourage members to think big and solve hard problems, thus making a much larger impact.” RIAIoT also plans to organise members into teams to apply for major grants with the aim of solving large and challenging problems.

More importantly, through collaboration with experts in other fields, Professor Cao has learned a great deal about identifying and solving problems that are important and challenging in those fields, rather than looking at things only from his own technical angle. In fact, members of RIAIoT are developing both

fundamental technologies and intelligent applications of AIoT, and therefore have many opportunities to collaborate with other research units, both internal and external. Professor Cao pointed out that significant efforts are required between the parties, including a clear mission, a sound implementation plan, commitment from leaders, trust and coordination, and face-to-face communication, in order to generate synergies.

Since its establishment, the Institute has been collaborating with colleagues in the Research Institute for Sustainable Urban Development (RISUD), Research Institute for Future Food (RiFood), Otto Poon Charitable Foundation Research Institute for Smart Energy (RISE), Research Institute for Land and Space (RILS), and Research Institute for Intelligent Wearable Systems (RI-IWEAR) on joint projects and joint proposals. “We hope to capture the fruit of collaboration by creating synergies when working closely together on problems of common interest.” said Professor Cao. RIAIoT and RISE have been working on projects related to AIoT-empowered smart buildings and energy. The synergies generated include bidding for major research grants from the Collaborative Research Fund (CRF), Research Impact Fund (RIF), Innovation and Technology Fund (ITF) and Green Tech Fund (GTF), joint publications in top journals, and collaborative training of PhD students. More recently, RIAIoT has been working closely with RiFood on the use of AI to develop novel solutions in food science. Researchers from both Institutes have benefitted greatly from their expertise and connections to the food industry, and they hope that the results of their research will be equally beneficial.

“Members of RIAIoT are developing both fundamental technologies and intelligent applications of AIoT, and therefore have many opportunities to collaborate with other research units, both internal and external.”



Future of AIoT requires use of big data

In simple terms, the purpose of AIoT is to make the Internet of Things perform intelligence tasks through the integration of AI. The IoT-driven digital transformation is continuing around the world, and new technologies are helping tackle ever more complex tasks. The widespread availability of AI and big data has greatly facilitated the use of AI to automate operations and decision-making. With AIoT, almost everything will become smarter, including digital devices, machines, vehicles and robots. With the big data generated by IoT sensors, networks and applications, AIoT can capture complex and intricate patterns and reveal hidden knowledge in order to make predictive decisions, for instance, in the maintenance of equipment, rather than just detecting events in a reactive manner. Along with other emerging technologies such as 5G/6G, smart sensors, robotics, edge computing and blockchain, AIoT will enable a worldwide shift towards digitalisation.

“With AIoT, almost everything will become smarter. With the big data generated by IoT sensors, networks and applications, AIoT can capture complex and intricate patterns and reveal hidden knowledge in order to make predictive decisions.”

According to the 2021 Policy Address, the Hong Kong government will invest significant resources in the development of Airport City in collaboration with Guangdong province. The government aims to strengthen Hong Kong International Airport as an international aviation hub. In this case, AIoT will play a fundamental role in the new Airport City. Almost all the operations in the city will need the support of AIoT infrastructure and services. Professor Cao elaborates, “Let me use our ITF project, the Big-Data-Driven Airport Resource Management Engine and Application Tools (BigARM), as an example. BigARM was initiated in collaboration with Hong Kong International Airport and the Logistics and Supply Chain MultiTech R&D Centre (LSCM) to provide support for efficient and smart airport resource management, thus improving the efficiency and intelligence of resource allocation. IoT sensors are used to collect multi-domain data, and then AI models and big data-driven algorithms are developed to predict unknown factors at the airport, such as flight arrival times, the numbers of arriving passengers, and bag counts, for the sake of more informed resource allocation. Not only the utilisation of resources, but also the time and accuracy in generating the resource allocation plan, have been greatly improved.”



“Everything is an experience! Experience more and learn more!”

Over the years, Professor Cao has accumulated considerable experience in time management, through extensive reading and by learning from others. “Actually, what we need to manage is not time, but our attention and energy, which are related to more intangible aspects: the feelings you may experience, the amount of sleep you need in order to feel refreshed, or the productive hours within the day. So, the target has changed: not to make use of every hour, but how to get important things done while maintaining your energy level. There are principles to learn and to follow, for example, the 80/20 Rule, organising yourself and your work, planning tomorrow today, delegating and empowering people, etc.” said Professor Cao. He believes that one can handle stress by shifting attention to activities one enjoys, such as reading books, watching movies, or shopping.

“Actually, what we need to manage is not time, but our attention and energy. Do not make use of every hour, but to get important things done while maintaining your energy level!”

Professor Cao earned his PhD at Washington State University. Looking back to those days, he recalled staying overnight in labs debugging programmes, and then, having completed the task, feeling happy as he walked home in the snow across campus, facing the rising sun. He explained: “Everything is an experience. Experience more and learn more; you can learn from experiences only by fixing your mistakes!”

Feature Story

A dialogue with Prof. Ding Xiaoli, Director of the Research Institute for Land and Space (RILS)



What are the key projects of RILS?

It is well known that there is a shortage of land and space for residences and for economic development in many parts of the world, especially in densely populated Asian cities like Hong Kong. RILS aims to become a world leader in developing innovative solutions for creating economical and environmentally friendly land and space. We have formed a strong multi-disciplinary research team consisting of over 30 academics who are experts in land surveying, land economics, land law, planning, environment, marine biology, aquaculture, structural engineering, geotechnical engineering, hydraulics, transportation, remote sensing, geographical information system, and public policy. The research is organised under five main research themes: (1) land reclamation, (2) innovative land and space solutions, (3) environmental treatment and impacts, (4) land economics and planning, and (5) land analytics and management. We have supported a variety of research projects. For example, we are studying new methods for fast and economical marine reclamation using sustainable fill materials; biodiversity and habitat in areas sensitive to land development; the relationship between land supply and Hong Kong's housing market; coastal erosion due to climate change; and value-added recycling of single-use food containers and masks.

How do you view RILS' role in solving the land shortage problem in Hong Kong?

Many agree that Hong Kong needs more land and space for residences and for economic development. However, the question of where to get the land has been very controversial. There have been heated debates on the topic, where many arguments were only based on personal preferences and not supported by solid science or scientific data. There have been some research efforts in Hong Kong that aimed to find land-supply solutions. For example, the Task Force on Land Supply, established by the government in September 2017, studied various options for creating land for Hong Kong. Our research is based on the existing work. By providing much-needed scientific input, especially by bringing together the various leading domain experts, we aim to answer many of the unresolved questions about land supply in Hong Kong and come out with some innovative solutions that are optimal given the environment and conditions here. Land supply determines to a large extent the future of Hong Kong. We will contribute to Hong Kong's future by helping to find some good solutions to this problem.

“We aim to answer many of the unresolved questions about land supply in Hong Kong and come out with some innovative solutions that are optimal given the environment and conditions here.”

Do you have any strategic plans to collaborate with governmental and industrial sectors?

Land and space supply is a practical issue but also requires serious scientific input. We welcome any opportunities to collaborate with both the governmental and industrial sectors. We have been discussing such collaborations with some potential partners, although the pandemic has hampered these efforts. Some solid collaborations are already ongoing. For instance, we are working with the Civil Engineering and Development Department (CEDD) and several consulting firms to test new approaches for land reclamation.

We have formed a strong International Advisory Committee (IAC) for RILS. The members of the IAC are either top scholars in the relevant research fields or very capable and experienced industrial leaders. We are very fortunate to have Ir Lam Sai-hung, former Permanent Secretary for Development (Works) of the HKSAR Government, as the Chairman of the IAC. The IAC will provide valuable strategic advice to RILS members on research, on collaborating with the governmental and industrial sectors, and on knowledge transfer.

We learnt that RILS has participated in discussions with CEDD on collaborations in Lantau Tomorrow Vision, a controversial project which is accused of draining the government's fiscal reserves and damaging the environment. What is the role of RILS in this project?

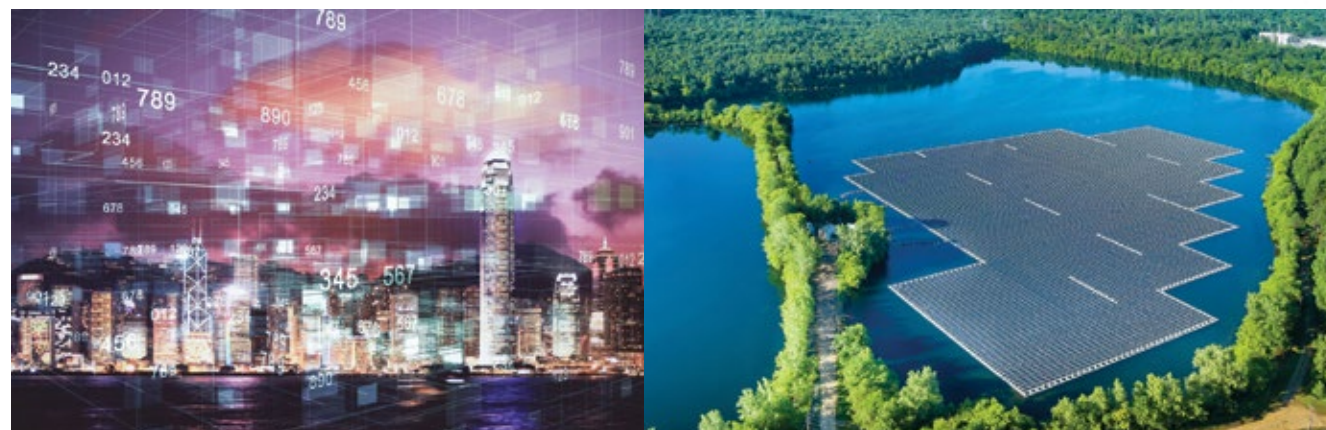
“When something is planned and designed now as part of the project, it should reflect the current and future trends of development and still not be out of date in 30 years.”

Members of RILS have participated in discussions with CEDD on collaborations in the project. Lantau Tomorrow is a complex project, and it is futuristic in nature, as its name implies; the vision will be realised in a time frame of 20 to 30 years. Research and development can help the project address various technical challenges and, more importantly, make it future-proof. For example, when something is planned and designed now as part of the project, it should reflect the current and future trends of developments and still not be out of date in 30 years. Our members are interested in contributing to the project by working with CEDD on innovative ideas and technologies, some of which are being developed by our members.

RILS aims to become a world leader in developing innovative solutions for creating economical and environmentally friendly land and space. Could you please share some of these innovative research outcomes with us, and describe their applicability in Hong Kong?

We are working on various innovative ideas that are of both academic and practical value. For example, as I mentioned above, a research team led by one of our members, Prof. Yin Jianhua of the Department of Civil and Environmental Engineering, is currently testing a new land reclamation technique in partnership with CEDD and the industry. Dredged sediment is used as fill material in the technique. The outcome of the field trial will provide a vital reference for sustainable marine reclamation in Hong Kong and is very applicable here. Our members are also working on various technical issues related to floating structures. Such ideas should also be very useful in Hong Kong for creating economical land areas.

“We have been working on advanced technologies for studying large-area ground displacements. Some of the new knowledge generated has been transferred to the industry to solve real problems.”



Would you please tell us more about your personal research pursuits?

My academic background is in land surveying. I am therefore interested generally in the use of spatial information to model the world. For example, we develop technologies for generating maps and 3D and 4D models of the world. I am particularly interested in technologies for monitoring geohazards and structural health conditions. We have been working on advanced technologies for studying large-area ground displacements such as those related to earthquakes, landslides, underground construction and land reclamation and the structural health of infrastructure such as buildings, bridges and underground pipelines. Some of the new knowledge generated has been transferred to the industry to solve real problems.

How do you prioritise your time among your research work, teaching and directorship?

Teaching and the associated activities such as marking normally do not allow any flexibility in time scheduling. I therefore give these activities the highest priority. Since my research work can be done almost anytime, I typically set a higher priority for the directorship between the two. This also means that I often need to catch up on my research in my spare time.



You have been in Australia for many years. Why did you decide to move your career development to Hong Kong?

Hong Kong is a very vibrant city and has a unique history with both the eastern and western cultures. These are the aspects that attracted me to Hong Kong.

“The shortage of land is one of the key problems faced by Hong Kong. We hope that RILS will be able to help Hong Kong by making significant contributions to the solution of this problem.”

What is the best-designed city in your mind? Are there any interesting/inspiring stories that you can share with us?

I like some of the cities in Australia, for example, Melbourne and Sydney. In Asia, I like some of the cities in Japan such as Osaka and Tokyo. In these cities, people normally live in harmony with nature. The cities are clean, and well designed and managed. Living in these cities makes one feel comfortable. It's very convenient, and you have easy access to things, but at the same time you do not feel too crowded.

I would just like to share a feeling. I have witnessed a few major natural disasters in China since I came to Hong Kong, either earthquakes or flooding. Each time I could see that the people of Hong Kong donated very generously to help those affected by the disasters. I was very moved by this and believe that most Hong Kong people have very loving and soft hearts. Many of these people were not so well off themselves, but they still wanted to help. Unfortunately, Hong Kong has been experiencing some difficulties and challenges in recent years. I hope that these problems can be overcome soon. The shortage of land is one of the key problems faced by Hong Kong. We hope that RILS will be able to help Hong Kong by making significant contributions to the solution of this problem.



Feature Story



A vision for creating knowledge and solutions that promote life-long healthy, SHARP vision

Vision is a gift with which we navigate freely and communicate expressively. Every one of us may be facing one or more types of eye problems, to some extent, such as myopia and astigmatism. The COVID-19 pandemic, for instance, has resulted in the suspension of face-to-face classes for considerable periods of time over the past two years. Researchers from the Research Centre for SHARP Vision (RCSV) found that myopia progression in schoolchildren has accelerated, and the share of students with astigmatism has increased by almost half. Vision health is at the heart of healthy living. Therefore, research into healthy vision is pertinent to mankind of all walks of life.

“RCSV was established to discover novel ways to promote the healthy development of vision; to maintain life-long healthy, sharp vision; and to restore, regenerate and rehabilitate vision.”

The RCSV was established to discover novel ways to promote the healthy development of vision; to maintain life-long healthy, sharp vision; and to restore, regenerate and rehabilitate vision. With its strategic initiatives and global collaborative network, RCSV is poised to provide a platform for collaboration by researchers of different disciplines in solving vision-related problems, expanding the frontiers of knowledge, and fostering sustainability for a better tomorrow. To promote the healthy development of vision, RCSV seeks to understand and safeguard the developmental processes that lead to comfortable, binocular and 20/20 vision, and to provide solutions that ensure healthy vision development. To enable people to maintain life-long healthy, sharp vision, RCSV strives to understand the causes of visual impairment and to provide solutions to sight-threatening eye diseases and age-related vision loss. Finally, in its mission to restore, regenerate and rehabilitate vision, RCSV aims to understand the processes and conditions that lead to visual impairment and to create solutions for vision restoration and rehabilitation.



Five SHARP themes for SHARP vision

According to Prof. To Chi-ho, Director of RCSV, Head of the School of Optometry (SO), Henry G. Leong Professor in Elderly Vision Health and Chair Professor of Experimental Optometry at PolyU, the robust SHARP structure facilitates RCSV's interdisciplinary research. “SHARP” represents five different themes that we focus on: ‘S’ represents ‘Shape Bioengineers’, that is, reshaping ocular refractive structures and related components by applying biomedical engineering approaches; ‘H’ represents ‘Health Processes’, that is, enhancing healthy visual development with the use of cutting-edge bioinformatics technology to understand healthy and aberrant processes; ‘A’ represents ‘Augmentation Therapy’, that is, empowering visual optics and quality of vision by means of innovative ophthalmic aids and circuits; ‘R’ represents ‘Regeneration Neurovision’, that is, preserving and restoring vision, psychosocial health and quality of life for the aging and disease-related visually impaired population; and ‘P’ represents ‘Patient Care’, that is, ensuring the best eyesight and eye care system for myopic and aging individuals with a holistic psychosocial approach through an optimised healthcare system.”

Indeed, the SHARP structure describes the interdisciplinary and experimental approaches through which RCSV members can contribute according to their expertise and work across teams that are tackling a variety of vision problems. This structure serves four main functions. First, the above five themes form an ecosystem, nurturing and supporting interdisciplinary research. Second, SHARP offers a platform to PhD students from different disciplines who are working on vision sciences and vision-related engineering projects, supervised by relevant experts, irrespective of their home departments. Third, the structure forms a hub for collaboration on vision-related problems by PolyU researchers from different disciplines as well as visiting researchers. Last but not least, it enhances access to concepts and technologies which are not traditionally associated with vision science.

A global hub for interdisciplinary research in SHARP vision

RCSV positions itself quite differently from other research units under the School of Optometry (SO) at PolyU. “RCSV is an interdisciplinary research centre with local and overseas expertise ranging from biological to clinical sciences, and from data science to engineering, while SO, which hosts the Centre for Myopia Research and the Laboratory for Experimental Optometry, is internationally recognised for its excellence in myopia and aging eye research,” Professor To explains. In fact, building on the existing strengths in myopia and aging eye research, RCSV is able to advance and expand its scope of research in order to understand and help people maintain healthy, sharp vision throughout their lives.

Professor To and three Associate Directors form the core leadership team overseeing all research development and operation. Three initiatives have also been formulated, with the aims of delivering sustainable outcomes including significant government and industry grants. Each Associate Director coordinates and ensures the deliverables specific to one of the initiatives. Dr Kee Chea-su, Associate Head of SO at PolyU, oversees the initiative of “Myopia: from mechanism to intervention”. Prof. Benny Cheung, Director of the State Key Laboratory of Ultra-precision Machining Technology and Professor of the Department of Industrial and Systems Engineering at PolyU, oversees the initiative of “Children's vision: from seeing to learning”. Prof. Yip Shea-ping, Head of the Department of Health Technology and Informatics and Associate Director of the University Research Facility in Life Sciences at PolyU, oversees the initiative of “Neurovision: from rehabilitation to regeneration”. This structure will significantly strengthen and extend RCSV's research capacities, not only for internal collaborators within PolyU but also with researchers from the Chinese mainland and overseas research institutes.



Prof. To Chi-ho
Director



Prof. Benny Cheung
Associate Director



Dr. Kee Chea-su
Associate Director



Prof. Yip Shea-ping
Associate Director

“The collaboration with other RIs and/or RCs will achieve synergy and further accelerate our transformation of research breakthroughs into practical solutions to global health issues.”

Under Professor To's directorship, RCSV is pleased to forge joint research projects with other research institutes (RIs) and research centres (RCs) under the PAIR umbrella. For example, RCSV is working with the Research Centre for Chinese Medicine Innovation (RCMI) on the application of Chinese medicine to eye care. “The collaboration with other RIs and/or RCs will achieve synergy and further accelerate our transformation of research breakthroughs into practical solutions to global health issues, for instance, sight-threatening diseases, thus echoing the missions of RCSV,” Professor To further explains.

Research to impact

All RCSV members own and champion this ethos, from the conception of projects to the implementation of results. A strong sense of downstream application and community or industry relevance is made explicit through project planning documentation and timeline management. In addition to applying for government competitive research funding, RCSV provides formalised channels for regular communication with the Research and Innovation Office (RIO) and Knowledge Transfer and Entrepreneurship Office (KTEO) of PolyU, vision industry stakeholders, and the Innovation and Technology Commission (ITC) of the HKSAR and Hong Kong Science and Technology Parks Corporation (HKSTP).

In particular, RCSV and the Centre for Eye and Vision Research (CEVR), a research collaboration between PolyU and the University of Waterloo (UW) supported by Health@InnoHK, can achieve synergy: RCSV, with a strong team in basic to mid-stream research, will join forces with CEVR, which specialises in mid-stream to downstream work, for the purposes of downstream knowledge transfer and commercialisation. In this collaboration, CEVR can provide RCSV with manpower from the Research Talent Hub; facilities from CEVR and HKSTP; an extensive collaborative network from UW's and HKSTP's strong local and international partnership network; and top-up funding in the form of an industrial partner who will strengthen the proposals to the funding schemes of ITC and University Grants Committee (UGC), in which there is an increasing emphasis on university-industry collaboration and the societal impact of research. Furthermore, CEVR



is already bringing UW's entrepreneurial culture to Hong Kong, and this culture can be translated to RCSV. “Through the concerted efforts of RCSV and CEVR, we anticipate that RCSV will be able to secure funding for collaborative projects with industry partners and submit patent applications. Researchers will be able to identify the best routes for downstream application as well as maximise opportunities and capabilities for commercialisation,” Professor To explains.

RCSV also has a wide network of collaboration with key multinational corporations in the eye care industry such as Johnson & Johnson, Hoya, Essilor and Carl Zeiss, to name a few. Its researchers have been working with these industrial partners to create new knowledge for the promotion of healthy life-long vision worldwide. With the well-established network of collaboration with vision care companies and the establishment of CEVR, RCSV offers a platform to researchers for identifying the best routes for downstream application and opportunities for commercialisation.

“Research to impact” is a prominent and recurrent motto of RCSV as the Centre envisions becoming a world leader in the creation of knowledge and solutions for the promotion of life-long healthy, sharp vision. “With research and innovation from RCSV's interdisciplinary research team, we will be able to significantly advance the current understanding of various eye problems, for instance, the eye growth control mechanism, and develop therapeutic approaches for the benefit of humankind.” Professor To added.



Embracing work-life balance and challenges in a research career

A research career or academic life is like a marathon race. One needs to get into a sustainable “aerobic” mode, rather than an “anaerobic” sprint which does not and cannot last. Professor To shares his insights into the work-life balance with PAIR: “Balancing life and work is very important as my aerobic rhythm, and it requires a lot of fine-tuning or trial and error. There is no one-size-fits-all method. I work hard to fill my schedule with important family matters first and try to accommodate family activities as much as possible, especially over holidays. Making one's family a priority is of utmost importance. Having a supportive and happy family gives me immense energy for charging ahead in my work. At the end of the day, it is a great blessing to have your family sharing your success in work and beyond.” Professor To is also a sportaholic. He enjoys playing sports regularly, such as badminton and swimming. He also likes to go hiking with friends. “These activities are an excellent way for me to break away from the office environment, not only for good physical health but also to refresh my mind for

creative thinking. Frequently my best research ideas or inspiration come while I'm out of the office, in a court or on the road,” he explains.

RCSV engages numerous research postgraduate students and young researchers in interdisciplinary research. Professor To encourages young scholars to enjoy doing research and embrace challenges: “A research career is not for everyone. Please don't do it if you don't enjoy it, because you won't go very far. If you like doing research, you must work very hard from the start. It is important to work with the best in the field through collaborations. You need strong communication skills in order to share ideas and collaborate with good people. This will make your research journey most enjoyable and exciting. As a young researcher, do not be afraid of failure, and go for opportunities to challenge yourself; and yet keep a humble mind, as there are a lot of smart people around whom you can learn from.”

“Making one's family a priority is of utmost importance. Having a supportive and happy family gives you immense energy for charging ahead in your work. At the end of the day, it is a great blessing to have your family sharing your success in work and beyond!”

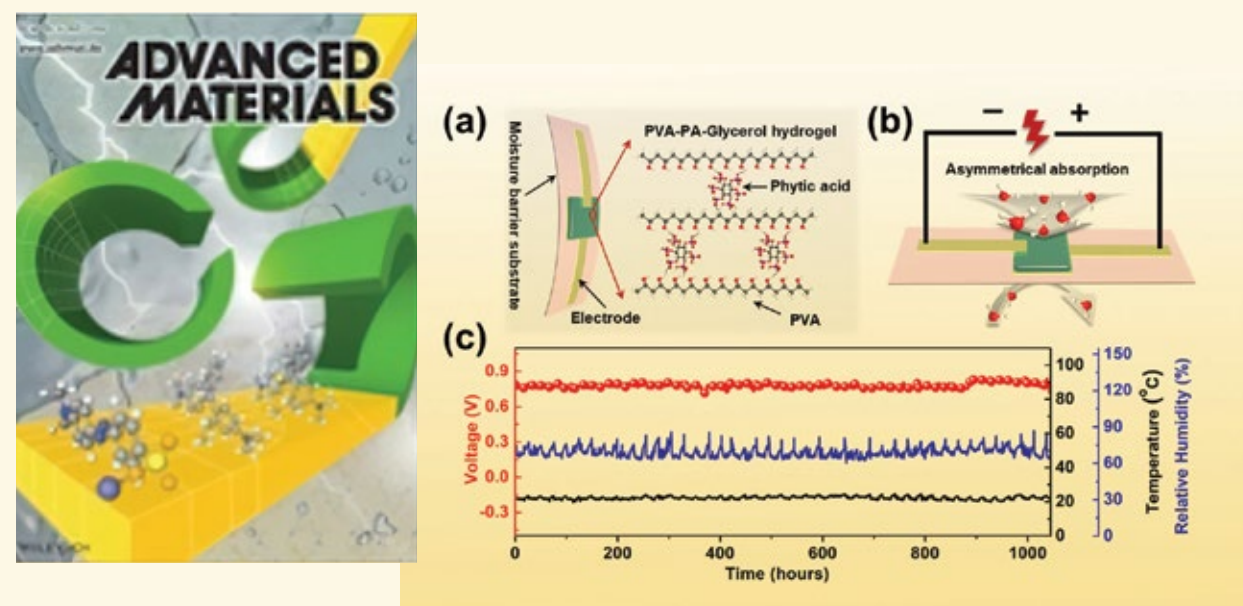
Research Achievement

Important progress in efficient and scalable moisture-electric generators made from ionic hydrogel

In the context of global resource shortages and a strong demand for carbon neutrality, simple and efficient green energy conversion technologies are essential for sustainable development of energy and human society. Moisture-electric generators (MEGs) use the chemical energy from atmospheric moisture to generate electricity directly, without producing pollutants or harmful gases. This technology is an emerging research focus in the energy field. However, most MEGs suffer from intermittent electrical signals and low current. In addition, large-scale integration and practical applications are still significant hurdles in current research.

To address this issue, a research team led by Prof. Tao Xiaoming, Director of the Research Institute for Intelligent Wearable Systems (RI-IWEAR), has developed a novel and efficient ionic hydrogel moisture-electric generator (IHMEG) that converts the chemical energy

released by captured moisture in the air into electricity, with efficient current density and power output. A single IHMEG unit of 0.25 cm^2 can continuously generate direct-current electricity with a constant open-circuit voltage of approximately 0.8 V for over 1000 hours, a high short-current density of $0.24 \text{ mA}\cdot\text{cm}^{-2}$, and a power density of up to $35 \text{ mW}\cdot\text{cm}^{-2}$. Significantly, large-scale integration of IHMEG units can be readily accomplished, providing a high voltage of up to 210 V . Thus, the flexible IHMEG will be capable of directly driving electronics in a variety of commercial applications, including electronic ink screens, metal electrodeposition setups and even light-emitting-diode arrays. The IHMEG features high cost-efficiency, an easily scalable fabrication process, and high power output. This new type of generator opens the way to developing a green, versatile and efficient power source for Internet-of-Things and wearable electronics.



The work was recently published in *Advanced Materials* (<https://doi.org/10.1002/adma.202200693>).

The first author is Dr Yang Su, a PhD graduate.

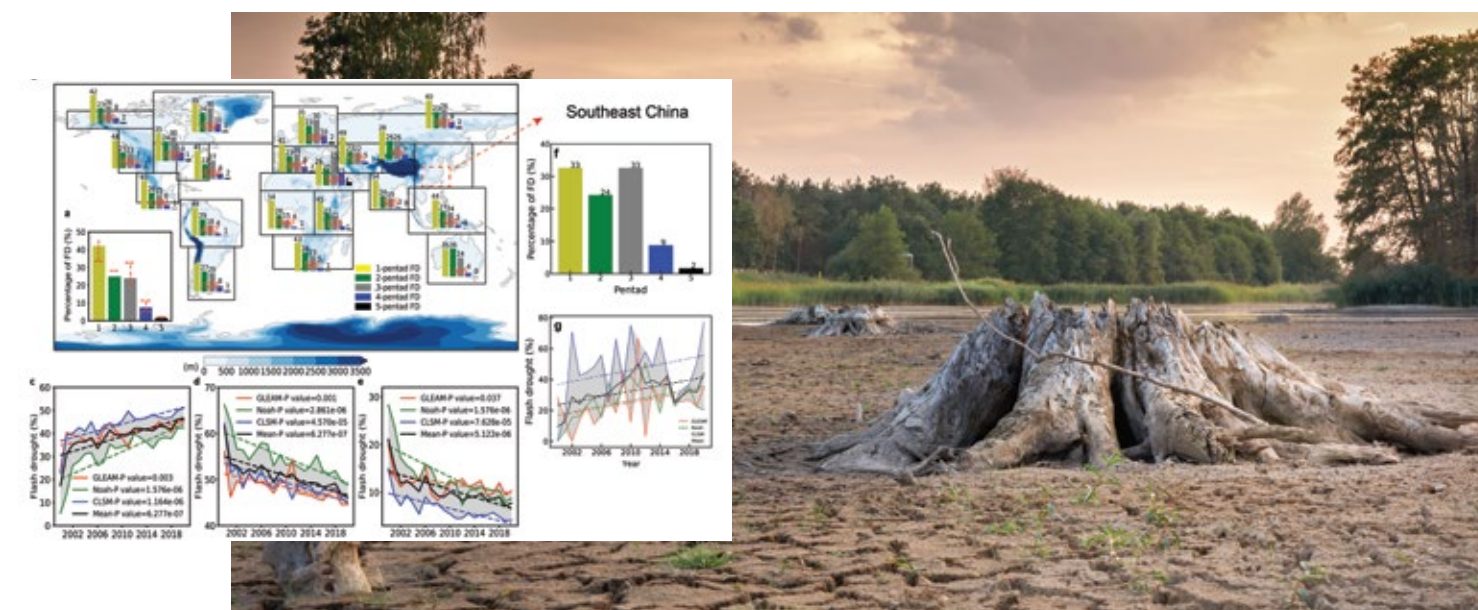
RILS' study helps policymakers develop flash drought mitigation and risk management strategies

Dr Wang Shuo, Member of the Research Institute for Land and Space (RILS) and Assistant Professor of the Department of Land Surveying and Geo-Informatics at PolyU, and his research teammates have found that in most regions of the world, flash droughts do not appear to be occurring more frequently. Rather, they are coming on faster. Between 2000 and 2020, approximately 34%-46% of flash droughts developed within five-day, and there was a significant increasing trend in the proportion of flash droughts with a five day onset time globally. Compared with traditional, slowly developing droughts, flash droughts evolve with a relatively fast depletion of soil moisture that may cause imbalances in ecosystems and agricultural systems.

Flash droughts are most likely to occur in humid and semi-humid regions, including southeastern China, Southeast Asia, East Asia, the Amazon basin, eastern North America, and southern South America. Thus, the increasing risk of flash droughts has been overlooked, without any early warning or emergency

response measures. These droughts pose a serious threat to ecosystem protection and the development of sustainable agriculture. Atmospheric aridity creates the perfect conditions for the occurrence of flash droughts, and the joint influence of soil moisture depletion and atmospheric aridity further intensifies the droughts' rapid onset. In other words, low soil moisture combined with a large vapor-pressure deficit accelerates the decline in soil moisture through land-atmosphere feedback. As a result, southeastern China with its strong land-atmosphere coupling is the most vulnerable to flash droughts.

The new study provides a deeper understanding of the rapid onset and driving mechanism of flash droughts. Accurate identification of flash drought-prone regions and global hot spots can help policymakers and stakeholders develop flash drought mitigation and risk management strategies. Furthermore, comprehensive assessment of onset development timescales for flash droughts facilitates the implementation of flash drought forecasts and early warning systems.



The study has been published in *Nature Communications*. (<https://doi.org/10.1038/s41467-022-28752-4>)

Research Achievement

RiFood's study reveals Bifidobacteria is almost non-existent in caesarean-born Chinese babies

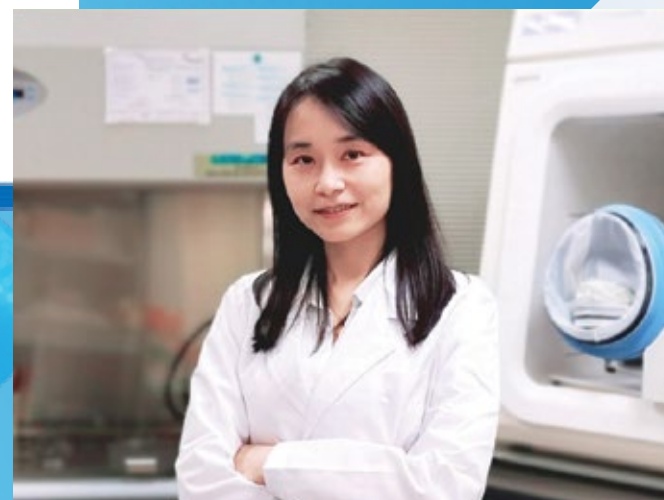
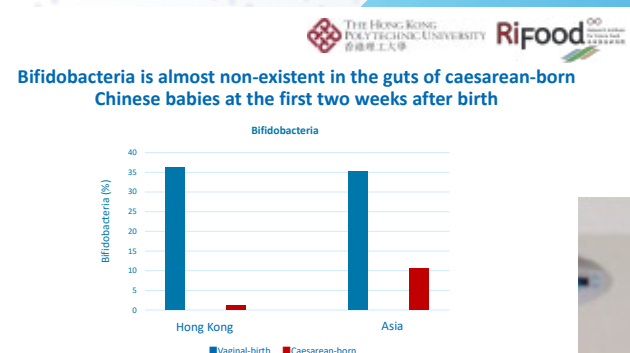
A study led by Dr Chiou Jiachi, Associate Director of the Research Institute for Future Food (RiFood) and Assistant Professor of the Department of Applied Biology and Chemical Technology at PolyU, has revealed that Bifidobacteria is nearly non-existent in the gut of babies born by caesarean section (C-section).

Bifidobacterium species are viewed as essential probiotics for proper immune development and good gut health among infants, protecting them from various intestinal and immune disorders.

In the study, Dr Chiou and her research team examined 70 faecal samples from newborn babies after their first

two weeks of life. They found that Bifidobacterium species were virtually non-existent in samples from C-section babies. In contrast, 37 faecal samples from vaginally birthed, breastfed babies had the necessary probiotic levels. Previous studies have detected Bifidobacteria in breastmilk, and hence breastfeeding may help to supplement the beneficial bacteria in the baby's gut microbiota.

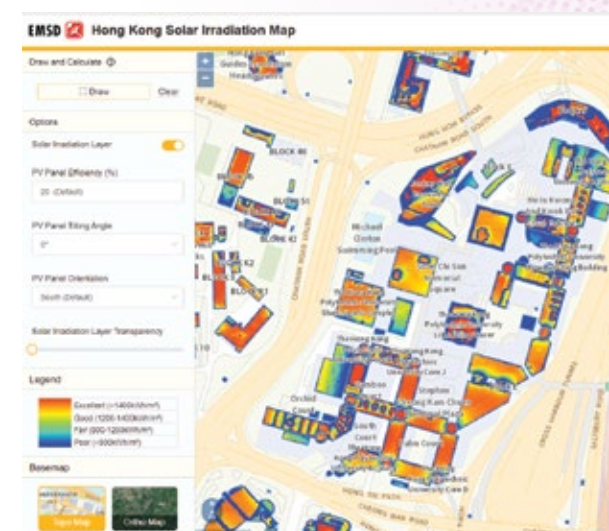
According to Dr Chiou, since 38% of births in Hong Kong are C-section deliveries, it is crucial to understand the special nutritional needs of C-section babies.



Web-based solar irradiation map encourages installation of private solar photovoltaic systems

To promote the widespread use of renewable energy in Hong Kong, the HKSAR government has introduced the Feed-in Tariff (FiT) scheme, by which the general public can sell electricity generated by solar photovoltaic (PV) systems to the power company at a higher rate than the normal electricity tariff. However, it is a challenge for people to identify appropriate locations on rooftops for the installation of PV systems. To address this issue, Prof. Charles Wong Man-sing, Management Committee Member of the Research Institute for Land and Space (RILS), and his research team have developed a web-based Hong Kong Solar Irradiation Map for the Electrical and Mechanical Services Department of the HKSAR government. The map encourages the installation of solar PV systems by enabling users to estimate the solar potential for all types of buildings in Hong Kong, including village houses and apartment, commercial and industrial buildings. Users can also draw outlines around specific areas on the map, via the web, and estimate the solar potential in those areas. The project received a silver medal at the 2022 International Exhibition of Inventions of Geneva together with the Electrical and Mechanical Services Department, HKSAR.

To develop the solar irradiation map, a digital surface model was used to simulate the solar irradiation at different tilt angles and orientations. The simulation model also considers the terrain, shading effects, and the atmospheric conditions in ten years of historical solar irradiation data from the Hong Kong Observatory. The simulation results exhibit an accuracy of 95% when compared with field validation measurements using in-situ pyranometers. The solar irradiation map was developed by employing geographic information systems (GIS) to identify suitable locations for deployment of PV systems, taking into account numerous criteria such as slope, site obstruction, shadow effect and barriers. Along with the generation capacity, the annual electricity generation and annual return of income from the FiT scheme can be estimated. With the use of the payback calculator, the approximate payback period can also be determined.



Website: <https://solarmap.emsd.gov.hk/>

Research Achievement

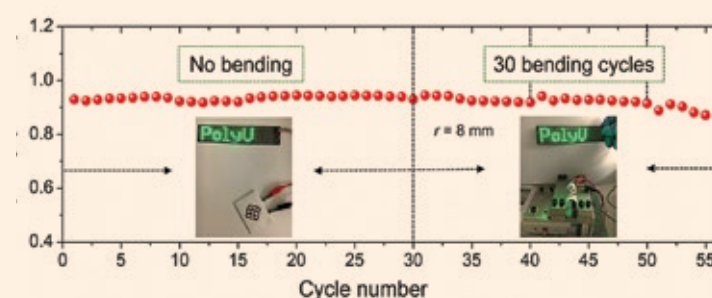
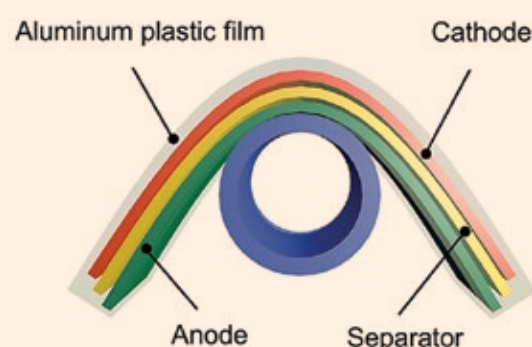
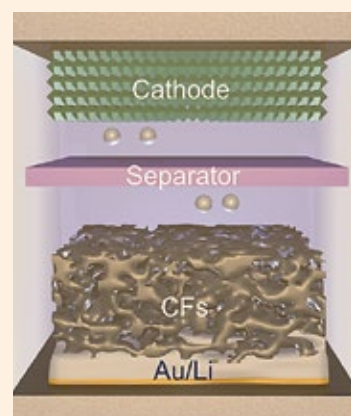
A simple bottom-side modification of carbon fabric with a lithiophilic gold layer that mitigates uncontrolled dendrite growth in flexible lithium batteries

Flexible and wearable electronics span a wide range of cutting-edge applications, from roll-up displays and implantable medical devices to smart communications and the Internet of Things. Such applications require high-energy-density power sources with adequate safety. Lithium-metal batteries are among the most promising power sources due to their high theoretical capacity, light weight, and cost efficiency. However, lithium dendrites at the top of the fabric anode increase the risk of separator piercing and thus the possibility of short circuits, especially when undergoing extreme mechanical deformation.

The safe use of flexible lithium metal batteries has been addressed by Prof. Zheng Zijian, Associate Director of the Research Institute for Intelligence Wearable Systems (RI-IWEAR), Associate Director of the University Research Facility in Materials Characterization and Device Fabrication (UMF), Member of the Research Institute for Smart Energy (RISE), and Professor of Institute of Textiles and Clothing at PolyU, and his research team. They

have recently published a journal review article titled “Au-Coated Carbon Fabric as Janus Current Collector for Dendrite-free Flexible Lithium Metal Anode and Battery” in *Applied Physics Reviews* (<https://aip.scitation.org/doi/10.1063/5.0083830>).

In their article, Professor Zheng and his colleagues proposed the incorporation of a 3D Janus current collector by means of a simple modification of the bottom side of carbon fabric (CC) with a lithiophilic gold layer. The Janus Au layer can guide an oriented deposition of lithium onto the bottom of the CC. The result is a highly flexible, stable and safe lithium metal anode. The lithium-free anode/separator interface mitigates the uncontrolled dendrite growth in flexible lithium batteries, effectively reducing the risk of short circuits and fire hazards. This modification is an important step in the development of high-energy-density and flexible lithium metal batteries. Both the anode and full battery can be folded completely (180°).



News & Event

Establishment of the Research Institute for Sports Science and Technology (RISports)

We are pleased to announce that The Hong Kong Polytechnic University (PolyU) will establish the Research Institute for Sports Science and Technology (RISports) in June 2022 under the umbrella of the PolyU Academy for Interdisciplinary Research (PAIR). Ir Prof. Zhang Ming, Chair Professor of Biomechanics at PolyU, will be the Director of the new research institute.

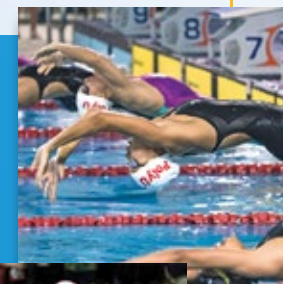
The RISports will be a cross disciplinary platform, aiming to integrate PolyU experts and to collaborate with world leaders to provide scientific and novel engineering solutions for sports. The major goals of RISports are 1) to conduct cutting-edge research in the thematic areas of sports science and technology; 2) to transfer scientific and engineering knowledge and applications to sports industry and sports institutes through collaboration with companies and organisations; and 3) to nurture future leaders in sports science and technology.

The vision is to be in the forefront of innovative sports solutions and a key research and service partner of Hong Kong and Mainland China sports industry and sports institute.

The mission is to strengthen multi-disciplinary research and collaboration to foster new science and technology solutions and applications in sports with an aim to establish a new level of sports experience for all and promote a high-quality and healthy lifestyle of all types of population through active engagement in sports and physical activity.

The research directions of the RISports will be focusing on the sports related products, services and solutions aiming at improving sports performance and experience for the elite athletes, general population as well as persons with special needs. Innovative sportswear and equipment as well as solutions for enhancing sports experience, comfort, and performance, improving training and rehabilitation efficacy, and reducing the risk of sports injury will be developed to enhance public engagement and safety for participation. Four research themes include 1) Sports Biomechanics and Human-Product Interaction; 2) Sports Product Design, Materials and Manufacturing; 3) Sports Measurement, Feedback and Instrumentation; and 4) Sports Training and Rehabilitation.

We believe RISports can help 1) elite athletes to enhance their performance and competitive skills, 2) general public to passionately participate in more sports and exercises happily and safely, and 3) persons with special needs such as disability, elderly and obesity to improve their quality of life and do sports therapy and rehabilitation.



News & Event

PAIR successfully hosts its first Distinguished Lecture Series by Prof. Catherine P. Koshland of UC Berkeley

The PAIR Distinguished Lecture Series was successfully held on 22 April 2022. We were honoured to have renowned scholar Prof. Catherine P. Koshland, Interim Executive Vice Chancellor & Provost at the University of California, Berkeley, USA, as the invited speaker. The webinar attracted over 350 participants from over 10 countries and regions. The distinguished participants included: (in alphabetical order of their last names)

- Prof. Chetwyn Chan, Vice President (Research and Development) of The Education University of Hong Kong
- Prof. Leonard Kwok-hon Cheng, President of Lingnan University
- Mr Richard Leung, Council Member of The Hong Kong Polytechnic University
- Prof. Paul Poon, Vice Chancellor of CLP Power Academy
- Prof. James Tang, Secretary-General of University Grants Committee Secretariat
- Prof. Christian Wagner, Provost of City University of Hong Kong
- Prof. Wang Wei, Pro-Vice-Chancellor (China) of Edith Cowan University; and
- Prof. Kwan-Leung Wong, Associate Academic Vice President (Teaching & Learning Development) of Hong Kong Shue Yan University.

The webinar was hosted by Prof. Chen Qingyan, Director of PolyU Academy for Interdisciplinary Research (PAIR) and Chair Professor of Building Thermal Science in the Department of Building Environment and Energy Engineering at PolyU. He briefed the audience on the establishment of PAIR with the aim of addressing societal challenges as outlined in the 17 Sustainable Development Goals (SDGs) set by the United Nations General Assembly's 2030 Agenda. "Universities have traditionally been places where scholars and students delve into individual research topics. Their research has been conducted along disciplinary lines in various faculties and departments, with the aim of expanding knowledge within disciplines. However, this approach cannot meet the needs of today. Thus, PolyU established ten research institutes (RIs) and five research centres (RCs) under PAIR that aim to generate unique knowledge, develop joint innovative projects, and achieve the SDGs", he explained.

Professor Koshland was then introduced by Prof. Jin-Guang Teng, President of PolyU. "I remember that in 2009, when I was the Dean of the Faculty of Construction and Land Use (since renamed as the Faculty of Construction and Environment, FCE), we had invited Professor Koshland to be the guest of honour in the PolyU 15th Congregation Ceremony. I am very pleased to meet her again today and would like to thank for her great support of PAIR."

Using UC Berkeley as an exemplar, Professor Koshland gave us a distinguished lecture on "Lighting the Way with Interdisciplinary Research since 1868". One of the hallmarks of UC Berkeley has always been the engagement of its faculty and students in research and education that expand across disciplines, combining multiple approaches to address major challenges facing the world today, which is also what we are seeking to do at PAIR of PolyU. Moreover, Professor Koshland shared with us the ways in which individuals and institutions can engage in interdisciplinary and multi-disciplinary research and education and how they can be creatively intertwined.

At the beginning of the webinar, Professor Koshland briefly described the collaboration of co-authors in the publishing of over 45,000 papers in peer reviewed journals with colleagues at over 6,000 universities and research institutions around the world, including PolyU. She then explained why, when and how interdisciplinary academic structures and research collaborations are established at UC Berkeley. "Obviously, to address a problem, you can't solve it without a diverse team, and no single individual can do that; and again, those efforts require collaborative work," she observed. She further explained that such interdisciplinary teams can develop powerful tools or methods to address many questions across multiple disciplines.

Next, Professor Koshland talked about the importance of establishing Organised Research Units, connecting with other world leaders via transformational partnerships, and transforming the professoriate to recruit the best minds in order to define new fields of collaborative research. UC Berkeley faculty can engage in collaborative, multidisciplinary and interdisciplinary research through the University's 50 multidisciplinary institutes and

centres, 41 UC Natural Reserve sites, and 7 Research Museums. The University also engages significantly with national laboratories, UC San Francisco, and even the National Aeronautics and Space Administration (NASA). This transformational partnership with NASA not only enables collaborative research in aeroscience, astrobiology, space and earth sciences, AI for flight systems, etc., but also helps attract new faculty and student talent to the University.

To conclude the lecture, Professor Koshland gave advice on opening competitions between faculty members which can help identify the best ideas, and top management should lead by replying on faculty ideas and strengths. It is also important to invest strategically in a sizable and manageable set of initiatives.

The lecture was followed by a panel discussion. The session was moderated by Prof. Christopher Chao, Vice President (Research and Innovation) and Chair Professor of Thermal and Environmental Engineering at PolyU, who was joined by two panellists, Prof. Li Xiang-dong, Dean of the Faculty of Construction and Environment and Chair Professor of Environmental Science and Technology at PolyU, as well as Prof. Li Yuguo, Associate Dean (Research) of the Faculty of Engineering and Chair Professor of Building Environment at The University of Hong Kong. The audience were impressed and inspired by Professor Koshland. They engaged in a fruitful discussion with her in the areas of teaching capacity and compensation of faculty members; key factors of success in interdisciplinary research and education; and the ways in which faculty and students can overcome barriers in communication.



News & Event

Members of PAIR’s constituent research units shine at Geneva Invention Expo

PolyU has once again excelled in the “Inventions Geneva Evaluation Days – Virtual Event”, a special online edition of the 2022 International Exhibition of Inventions of Geneva (Geneva Inventions Expo). The Exhibition is regarded as one of the most important annual global events devoted exclusively to inventions. This year, PolyU has garnered a total of six awards, including one Gold Medal with Congratulations of the Jury, one Gold Medal, three Silver Medals and one Bronze Medal. All of these medals were awarded to projects of PAIR’s research institutes and research centres.

Four of the six participating projects are operated by PolyU-supported start-ups and have already commercialised their research outputs. Representing the only university in Hong Kong taking part in the Nation’s space missions, the team led by Prof. Yung Kai Leung, Director of the Research Centre for Deep Space Explorations (RCDSE), is also actively developing instruments for the national space mission by leveraging the university’s expertise in precision engineering.

In addition, PolyU is striving to leverage its research to improve people’s quality of life. The participating projects this year, which are focused on cooling coatings, eco-friendly building materials, smart fabrics, nutritional supplements and an AI music learning platform, are just a few examples of this effort.



RIAlot members receive major awards for their interdisciplinary research projects



Prof. Xia Yong, Management Committee Member of the Research Institute for Artificial Intelligence of Things (RIAlot) and Associate Head of the Department of Civil and Environmental Engineering at PolyU, and his collaborators won the Structural Excellence Award 2021 – Commendation Merit from the Hong Kong Institution of Engineers for the co-authored paper titled “Analytical Solution to Temperature-induced Deformation of Suspension Bridges”. This study investigated the mechanisms of temperature-induced displacement of suspension bridges, and derived general analytical formulas for the thermal response of various suspension bridge components. The accuracy of the proposed formulas was verified using field monitoring data for the 2132-meter-long Tsing Ma Bridge in Hong Kong.

Meanwhile, Dr Luo Xiapu, Leading Member of RIAIoT and Professor of the Department of Computing at PolyU, received the ACM SIGSOFT Distinguished Paper Award at the 43rd International Conference on Software Engineering (ICSE) 2021 for the paper titled “ATVHunter: Reliable Version Detection of Third-Party Libraries for Vulnerability Identification in Android Apps”. ICSE is the most prestigious conference in the area of software engineering. The first author is Ms Zhan Xian, a PhD student of Dr Luo.

News & Event

Prof. Guo Song honoured by research authorities



Prof. Guo Song, Leading Member of the Research Institute for Artificial Intelligence of Things (RIAIoT) and Professor of the Department of Computing, has recently been named a Fellow of the Canadian Academy of Engineering (CAE). Established in 1987, the CAE is an independent, self-governing, non-profit organisation that serves Canada in engineering matters. Fellows of the CAE are nominated and elected by their peers, in view of their distinguished achievements and career-long service to the engineering profession. The Fellows provide engineering leadership in the fields of education, infrastructure, innovation, energy, transportation, and many others. A total of 52 new Fellows from all over the world were elected into the Academy in 2021.

Moreover, Professor Guo has recently been elevated to Fellow of the Asia-Pacific Artificial Intelligence Association (AAIA) for his contributions to edge learning. AAIA is an academic, non-profit, non-governmental organisation voluntarily formed by more than 400 academicians worldwide. It aims to build a broad AI industry, bringing together scientists and entrepreneurs related to AI applications. AAIA's main mission is to strengthen the efforts of scientists in the field of AI and other fields worldwide as they promote the development and application of AI through academic research, academic exchanges, science education, science exhibitions, academic conferences, academic publications, summer/winter camps and other activities.

Professor Guo has also been recognised by Clarivate Analytics in the 2021 list of Highly Cited Researchers for his exceptional research and scientific impact in the fields of both Computer Science and Engineering. Clarivate Analytics identifies the most influential scholars around the world according to research performance, as determined by the publication of multiple highly cited papers that rank in the top 1% by citations in each respective field. Approximately 6,600 researchers across the globe were named Highly Cited Researchers in 2021.

RISA member named as Top Reviewer of The American Journal of Clinical Nutrition



Dr Kenneth Lo, Member of the Research Institute for Smart Ageing (RISA), has been selected as one of five Top Reviewers for *The American Journal of Clinical Nutrition* in 2021 by Oxford Academic. Every year, the four American Society for Nutrition Journals, i.e., *The Journal of Nutrition*, *The American Journal of Clinical Nutrition*, *Advances in Nutrition*, and *Current Developments in Nutrition*, identify up to five ad hoc reviewers to be named as Top Reviewers from the previous year. Selections are based on the quality, number, and timeliness of manuscript reviews completed.

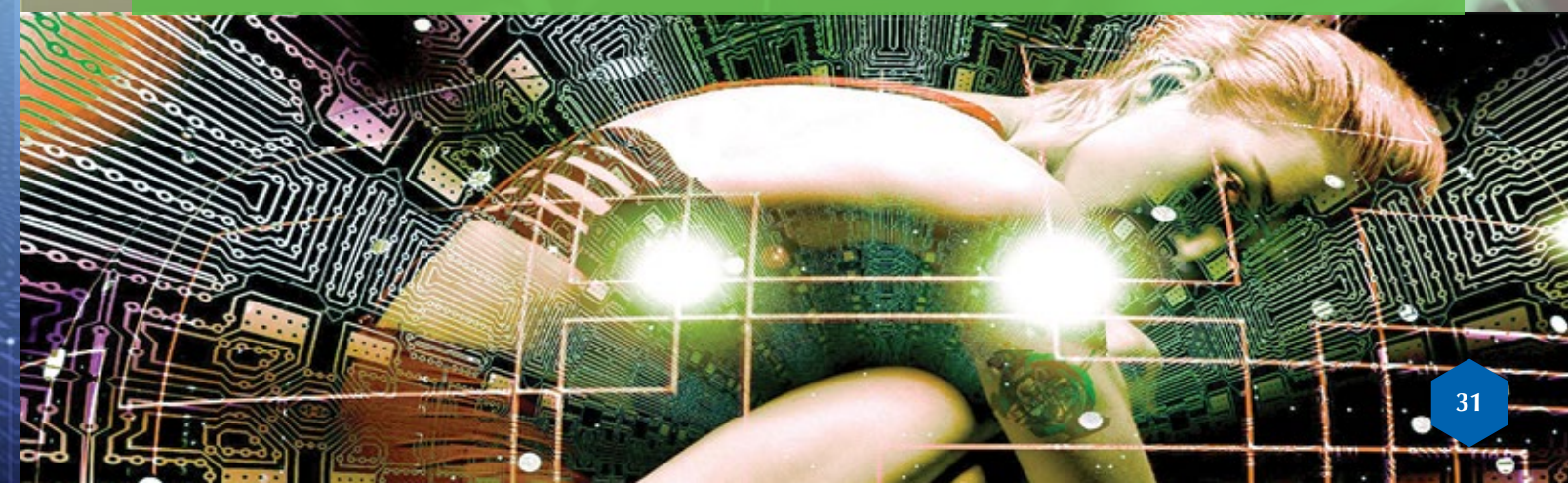
ITF Midstream Research Scheme Funding secured for textile electronic interaction system



Prof. Tao Xiaoming, Director of the Research Institute for Intelligent Wearable Systems (RI-IWEAR) and Chair Professor of Textile Technology at PolyU, and Dr Chai Yang, Core Member of RI-IWEAR and Assistant Dean (Research) of the Faculty of Applied Science and Textiles at PolyU, have recently secured approximately HK\$5 million under the Midstream Research Programmes for Universities from the Innovation and Technology Fund (ITF) for a three-year research project titled "Key Technologies for Textile Electronic Interaction System".

Human-computer-environment interaction technology has recently become a hot research topic as a result of its applications in smart cities, IoT, AI, VR/AR and robotics. Interactive textile electronic systems may provide suitable platforms because of their excellent wearable performance and unique immersive features, such as their light weight, large area, ease of use, flexibility, comfort, and low strain even under high deformations.

The key to extending the use of these textiles is to develop new technologies for textile-based interaction systems. The project will aim to develop these technologies by demonstrating a prototype system that comprises a modularised fabric display of over 16 million colours, audial communication, a fabric keyboard, memory, a wireless communication unit and a control unit. In this project, the processing methods for the surface enhancement of flexible fibrous substrates, and fabrication of new double-sided fibrous circuit boards will be investigated. Essential machines and tools will be developed for manufacturing fabric electronic modules from electronic yarns, interconnecting textile electronic modules, and determining the processing parameters, quality control methods and procedures. By using the newly developed processes, machines, and tools, the team will demonstrate novel electronic textile display products for human-computer-environment interaction in smart homes.



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Prof. Li Qing conferred as Fellow of the Institute of Electrical and Electronics Engineers



Prof. Li Qing, Management Committee Member of the Research Institute for Artificial Intelligence of Things (RIAIoT) and the Otto Poon Charitable Foundation Smart Cities Research Institute (SCRI), Chair Professor of Data Science, and Head of the Department of Computing at PolyU, has recently been elevated to Fellow of the Institute of Electrical and Electronics Engineers (IEEE) with effect from 1 January 2022, for his contributions to machine learning in multimedia, data mining and data warehousing.

The IEEE is the world's leading professional association for advancing technology for humanity. Through its 400,000-plus members in 160 countries, the association is a leading authority in a wide variety of areas ranging from aerospace systems, computers and telecommunications to biomedical engineering, electric power and consumer electronics. The IEEE Grade of Fellow is conferred by the association's Board of Directors upon a person with an outstanding record of accomplishments in any of the IEEE fields of interest. Fellow is the highest grade of membership in IEEE, with the number selected each year not exceeding 0.1% of its total voting members. IEEE Fellow is recognised by the technical community as a prestigious honor and an important career achievement.

Prof. Zheng Zijian conferred as Fellow of The Royal Society of Chemistry



Prof. Zheng Zijian, Associate Director of the Research Institute for Intelligent Wearable Systems (RI-IWEAR), Member of the Otto Poon Charitable Foundation Research Institute for Smart Energy (RISE), and Professor of the Institute of Textiles and Clothing at PolyU, has recently been conferred as Fellow of The Royal Society of Chemistry (FRSC).

The Royal Society of Chemistry was established in 1841 with the mission of advancing excellence in the chemical sciences. Members of the Society are conferred as Fellows if they have been in a senior position for more than five years and their efforts have made an impact in any field of the chemical sciences.

Prof. Cao Jiannong conferred as Fellow of China Computer Federation



Prof. Cao Jiannong, Director of the Research Institute for Artificial Intelligence of Things (RIAIoT), Otto Poon Charitable Foundation Professor in Data Science and Chair Professor of Distributed and Mobile Computing at PolyU, has recently been named the Fellow of China Computer Federation (CCF), the leading organisation on computing technology and applications in China. With the outstanding achievements and contributions in distributed computing, wireless network and mobile computing and big data analysis, Professor Cao was elected as one of the nine CCF Fellows this year.

CCF Fellow Program was initiated in 2008 to recognise members who have made outstanding achievements in the field of computer science or exceptional contributions to CCF with membership for more than five consecutive years. CCF Fellow is the highest level in the membership of CCF and currently, there are 150 CCF Fellows, accounting for 0.32% of professional members.

Member of RIAIoT partners with Huakun Daowei for establishing a data security research institute



Dr Hu Haibo, Member of the Research Institute for Intelligence of Things (RIAIoT) and Associate Professor of Department of Electronic and Information Engineering at PolyU, has recently cooperated with Huakun Daowei, a Chinese mainland IT company, to set up a data security institute and take up the role of Chief Security Consultant of the company.

Dr Hu will supervise the R&D and innovation of Huakun Daowei and the joint research institute in the field of privacy computing and provide technical consultation in information security, data management, etc., as well as explore more business scenarios for privacy computing technology. Dr Hu has been engaged in data management and privacy computing research for more than 20 years. He is a pioneer in the fields of data privacy and anti-machine learning. He has made pioneering work in the fields of query authentication, privacy query processing, location privacy protection, and machine learning model protection. Dr Hu has contributed to, and as the project principal chaired a number of National Natural Science Foundation of Innovative research projects by large companies such as Huawei.