

Annual Report on Activities and Advancement of Knowledge Transfer 2023-24

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EXECUTIVE SUMMARY

In the fiscal year 2023/24, The Hong Kong Polytechnic University (PolyU, the University) achieved significant success in knowledge transfer (KT) and entrepreneurship, as highlighted in this report.

Section 2 of this report highlights PolyU's achievements in advancing KT and addressing real-world challenges with impactful innovations. As the first university in Hong Kong involved in multiple national space projects, PolyU contributed significantly to the Chang'e-6 lunar exploration mission, assisting the nation in completing the first lunar farside sampling in human history. PolyU also expanded the impact of its myopia control lens technologies by forming a global partnership with ZEISS Vision Care to accelerate market penetration and conduct joint research to develop further innovative solutions, aiming to benefit more children around the world. Other impactful cases include PolyU's advanced structural health monitoring technology for longspan bridges, cutting-edge research for predicting ozone levels, advanced tools and algorithms to enhance blockchain security and privacy, and evidence-based human-centric design for vertical urbanism to improve the quality of life. In 2023/24, our intellectual property (IP) income reached HK\$34.2 million, more than doubling from HK\$15.8 million in the previous year.

Section 3 outlines PolyU's infrastructure development and its Mainland and international collaborations. Notably, PolyU has signed memorandums of understanding (MOUs) with 13 municipal governments in Mainland China to establish Mainland Translational Research Institutes (MTRIs) in these cities, aligning PolyU's research capabilities with each city's industrial needs and comparative advantages to advance technological and economic development. Seven of these cities – Hangzhou, Huizhou, Jinjiang, Nanjing, Wenzhou, Wuxi, and Zhongshan – have entered into detailed collaboration agreements, focusing on areas such as advanced manufacturing, aerospace, biomedical technology, future food, intelligent transportation, microelectronics, medical aesthetics, new energy, and textile technology. PolyU will establish more MTRIs to expand this network. In addition, we have also established 23 universitylevel research centres and nine Joint Research Centres with prominent research institutions and industries worldwide to fortify research collaborations and amplify the impact of our research outcomes.

Section 4 outlines PolyU's accomplishments in KT and entrepreneurship through technology and social innovations. Our notable successes include two PolyUnurtured start-ups being featured in 'Forbes 30 Under 30 Asia 2024' list, three start-ups being listed in 'Forbes Asia 100 To Watch 2023', and PolyU academic-led start-up Telefield being the only Hong Kong company to win a Gold Award in the 'Guangdong-Hong Kong-Macao Greater Bay Area High- value Patent Portfolio Layout Competition 2023'. PolyU's entrepreneurial ecosystem has nurtured four unicorns, 20 ponies, and more than 500 start-ups. During 2023/24, our Micro Fund Programme attracted a record high of over 100 start-ups. Since its establishment, the GBA Start-up Postdoc Programme has cultivated 25 postdocs, 24 of whom have been admitted into external incubators, securing nearly HK\$27 million in follow-on funding and support. The Good Seed Programme for social innovations



has supported over 2,000 participants, awarding HK\$13 million in seed funding, while the PolyU Entrepreneurship Investment Fund has invested in 13 start-ups through top-up investment and direct co-investment.

During the reporting period, PolyU received over 120 local and international awards, including a record-breaking 45 awards at the International Exhibition of Inventions Geneva – the most among higher education institutions in Hong Kong. Three PolyU scholars received BOCHK's Science and Technology Innovation Prize 2023 for their accomplishments in Advanced Manufacturing and FinTech, and PolyU was the only prize-winning recipient from Hong Kong at the 3rd National Award for Excellence in Innovation. These accolades highlight PolyU's innovation and research excellence in multiple fields.

ADVANCING KNOWLEDGE TRANSFER TO EXPAND SOCIETAL IMPACT

2.1 Impactful Innovations Addressing Real-World Challenges

Here, we highlight examples of PolyU's research projects that have created a significant real-world impact, addressing pressing challenges in different fields, from engineering and technology to urban planning and environmental science.

Contributing to the Nation's Chang'e-6 Historic Lunar Far-side Sampling Mission

PolyU has contributed significantly to the Chang'e-6 lunar exploration mission, assisting the nation in completing the first lunar far-side sampling in human history.

Sampling on the moon's far side presents unprecedented challenges due to the absence of direct communication with the Earth. An interdisciplinary team led by Prof. YUNG Kai-leung from the Department of Industrial and Systems Engineering at PolyU collaborated with the China Academy of Space Technology (CAST) to develop and manufacture the 'Surface Sampling and Packing System'. Unlike previous methods adopted by other countries



involving drilling or manual excavation, this system is designed as a fully-automated multi-point lunar surface sampling system with a packaging mechanism. The system also incorporates enhancements based on previous space exploration experience, enabling timely sampling within a restricted timeframe, contributing to the success of the historic mission.

PolyU is the first university in Hong Kong to have been involved in multiple national space projects. Since 2010, we have collaborated with CAST to create sophisticated space instruments. We will continue to leverage our expertise in deep space research and collaborate with mainland researchers to contribute further to national space missions.

Intelligent Health Monitoring and Maintenance of Long-span Bridges

Long-span bridges in urban regions face risks from natural events such as typhoons and earthquakes. However, current Structural Health Monitoring (SHM) systems lack cost-effectiveness, efficiency, and accuracy due to centralised data processing



and limited sensor coverage. To tackle this, a team of interdisciplinary researchers led by Prof. XIA Yong of the Department of Civil and Environmental Engineering developed a machine learning algorithm that can immediately detect data anomalies and simulate bridge responses using a small number of sensors.

The decentralising data processing used to detect such anomalies has revolutionised traditional SHM systems, enabling faster analysis. Integration of 5G communication ensures rapid data transmission, while edge computing allows immediate local processing at each sensor site. This eliminates central data processing bottlenecks and enables comprehensive bridge health monitoring. The algorithm can also learn from other bridges, enhancing adaptability and accuracy.

This SHM system has been applied on key bridges, such as the Hong Kong–Zhuhai–Macao Bridge and the Cross Bay Link in Hong Kong, improving safety and reducing maintenance costs. The research, awarded the PolyU President's Award for Outstanding Achievement in Knowledge Transfer 2023, has led to new industry standards for bridge maintenance, ensuring long-term structural integrity and economic efficiency.

Securing the Future of Blockchain through Enhanced Security and Privacy

Blockchain technology is the foundation of many popular and emerging applications. But while it is reshaping many aspects of industry and government, it faces challenges in security and privacy that could hinder widespread adoption. With a market size that is expected to reach US\$67.4 billion by 2026¹, the continued success of blockchain technology relies on ensuring its security and privacy.

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By developing advanced tools and algorithms, teams

led by Prof. Allen AU and Prof. Daniel LUO from the Department of Computing have made significant strides towards this objective. One prominent outcome is new zero-knowledge proofs algorithm, which has been made open-source to encourage further innovation in the field, secured consecutive victories in one of the largest competitions organised by the Web3industry – the ZPRIZE competition – for the past two years, winning a total cash prize of US\$800,000.

They have also developed other tools to ensure the security and privacy of blockchain transactions. The BBS+ digital signature scheme, which is being standardised by the Internet Research Task Force, has been used in popular blockchain frameworks such as Hyperledger Fabric and Ursa to ensure that transactions are authentic and tamper-proof.

Their efforts have established PolyU as a leader in blockchain research, with PolyU being ranked first in the 'Best Universities for Blockchain 2022' rankings by CoinDesk. In 2023, the team established the first research lab focusing on Law and Web3, and a partnership with Red Date Technology, the main driver of China's Blockchain-based Service Network.

Improving Air Quality through Cuttingedge Research on Ozone and Particulates

Ozone pollution is a pressing environmental challenge, especially in densely populated areas such as Hong Kong. Prof. WANG Tao from the Department of Civil and Environmental Engineering and his air research team have overcome this challenge by initiating a comprehensive air-quality monitoring programme. The team's ground-breaking research on ozone pollution has



deepened understanding of local ozone chemistry and the impact of transboundary pollution.

The team has developed models that can predict ozone levels and accurately identify key ozone precursors, laying the groundwork for formulating precise control measures. Their insights into the counterintuitive rise in ozone levels, despite a decrease in other pollutants, influenced the implementation of ozone precursor monitoring and evidence-based control strategies by the Hong Kong SAR and mainland governments.

These efforts have led to improved air quality and significant contributions to national ozone pollution mitigation. The team's achievements have earned it the Environment Protection Science and Technology Award from the Ministry of Ecology and Environment of China.

Advancing Human-Centric Design for Vertical Urbanism: PolyU's Contribution to NEOM

The creation of a linear and vertical city that enhances human well-being, creates connectivity and fosters a sense of community is what underpins the vision for THE LINE, an ambitious project currently being developed in the newly designated special economic zone NEOM in Saudi Arabia. To help guide this thinking, a multi-disciplinary team led by Dr Sunny CHOI from the School of Design and Dr Bolton CHAU from the Department of Rehabilitation Sciences used Hong Kong as a model to study the psychological and social effects of vertical



urbanism. The team's approach combined neuroscientific research with AI-enabled urban planning to develop a framework for assessing the effects of high-density living on human cognition and experience. The team also explored place-identity – looking at how cultural, social, and scalar factors shape a sense of belonging and well-being in high-density settings.

The result is a comprehensive, evidence-based framework that supports NEOM by informing design inputs for THE LINE while also serving as a model for similar dense, high-rise developments across Asia, helping to improve the quality of life in vertical cities.

2.2 PolyU's Partnerships and Initiatives for Technology Commercialisation and Entrepreneurship

During 2023/24, PolyU continued to translate innovative technologies into tangible societal benefits through enhanced policies and measures. This resulted in a significant increase in intellectual property (IP) income, which more than doubled from HK\$15.8 million in the previous year to HK\$34.2 million.

Notably, PolyU partnered with ZEISS Vision Care, one of the world's leading manufacturers of eyeglass lenses and ophthalmic instruments, to accelerate the market



penetration of the University's patented myopia control lens technologies, and conduct joint research to further develop innovative solutions that will help preserve and improve vision for people around the world. PolyU has been at the forefront of addressing myopia with a novel non-invasive solution to slow the development of myopia in children. By partnering with leading industry names such as Hoya Vision Care and ZEISS Vision Care, and academic-

led start-up Vision Science and Technology Co. Ltd., PolyU's myopia control technologies have been incorporated in both contact lenses and spectacle lenses. These technologies have been commercially available since 2018, benefiting millions of people worldwide.

PolyU has developed a wide variety of patented technologies that are currently available for licensing. To expedite the commercialisation and drive the impact of these technologies, we have enhanced policies and initiatives to create new licensing schemes, such as the Trial License Scheme and Express License Scheme. The Trial License Scheme allows companies to use PolyU IPs on a trial basis for market and technology validation before formalising a licensing agreement. The Express License Scheme offers enterprises a streamlined approach to license PolyU's patents that were filed at least ten years previously, without upfront charges. Royalties are only charged when commercialisation gain is realised. These initiatives offer companies more flexibility in adopting PolyU's innovations to improve their products and services in response to market needs. Since their launch, these schemes have gained wide acceptance, and 17 licensing agreements have been signed.

In addition, to raise public awareness of the University's innovative technologies and entrepreneurship efforts, we have created two designated titles and logos: 'Powered by PolyU Tech' and 'PolyVenture from PolyU Entrepreneurship Programme'. These logos are for use by companies licensing PolyU's technologies and start-ups supported by PolyU, respectively. The branding initiative 'PolyImpact' has also been created to promote the University's innovations and their impact on society. An annual publication showcases PolyU's latest innovations and impactful projects under this brand. Another branding initiative, 'PolyVentures', aims to foster an entrepreneurial mindset among PolyU students, alumni, academics, and research staff. It creates a start-up ecosystem that supports their entrepreneurship journeys and equips them for long-term success.



2.3 Strengthening PolyU's Future Research Impact with Substantial Funding

PolyU secured several major research grants in 2023/24, enabling us to continue conducting impactful research that aligns with Hong Kong's strategic development goals.

Two PolyU projects awarded the RGC Theme-based Research Scheme 2023/24 funding

The University was awarded nearly HK\$100 million in funding from the Research Grants Council (RGC)'s Themebased Research Scheme in 2023/24 to support two major projects: 'Intelligent Tropical-storm-resilient System for Coastal Cities' and 'High-performance Collaborative Edge Computing Enabling Smart City Applications: Framework and Methodologies'. These initiatives will contribute to advancing sustainable urban development and align with Hong Kong's strategic research and innovation goals.

PolyU awarded RGC Strategic Topics Grant 2023/24 – *the highest funding allocation among all institutions*

PolyU was awarded over HK\$37 million from the RGC Strategic Topics Grant 2023/24 for a mental health technology project. The project aims to revolutionise the approach to diagnosing complex diseases like major psychiatric disorders by shifting from symptom-based diagnosis to Al-based, data-driven diagnosis, disease study and personalised therapy. The project will involve 20 investigators and collaborators from eight institutions in Hong Kong, the Mainland China and the United States.

Chief Executive's Policy Unit's Strategic Public Policy Research Funding Scheme 2023/24 – *the only HK institution receiving this funding*

In 2023/24, PolyU was granted HK\$3.96 million from the Chief Executive's Policy Unit's Strategic Public Policy Research Funding Scheme for the project 'Policy Framework for Cross-Regional Cooperation Strategies in the Greater Bay Area's Construction Industry'. We were the only local institution to receive such support this year. We also secured funding for eight projects under the Public Policy Research Funding Scheme. These projects are expected to influence government policy-making.

Five projects awarded RGC Research Impact Fund 2023/24 – the most among local universities

Five research projects received a total of HK\$20.9 million in funding from the RGC's Research Impact Fund 2023/24 – the most among local universities in terms of the number of funded projects. The projects span microbiology, construction and environment, geoinformatics technology, and intelligent wearable textiles.

Three projects awarded for Collaborative Research Scheme 2023/24 *Exercise – the most in terms of both number of awarded projects and amount of funding*

PolyU secured HK\$10.5 million in funding support for three research projects under the Collaborative Research Scheme 2023/24 Exercise – the most among local education institutions in terms of the number of funded projects and the amount of funding granted. The three projects aim to create innovative solutions for Al applications, cross-regional collaboration in the GBA construction industry, and typhoon-resistant renewable energy sources, respectively.

PolyU secures funding for six innovative railway technology projects from MTR Research Funding Scheme

PolyU secured HK\$7.25 million from the MTR Research Funding Scheme for six projects advancing railway technology. These projects focus on innovative solutions for smart railway systems, including emergency evacuation, sustainable development, noise control, autonomous trains, and fire resilience. The funding initiative supports research up to HK\$1.5 million per proposal and reaffirms PolyU's commitment to enhancing the quality and safety of mass public transport.

INFRASTRUCTURE DEVELOPMENT, MAINLAND AND INTERNATIONAL COLLABORATIONS

3.1 PolyU Academy for Interdisciplinary Research (PAIR) – the Largest Interdisciplinary Research and KT Platform in the GBA

PAIR is PolyU's central research platform, and the largest interdisciplinary research and KT platform of its kind in the GBA. It is dedicated to developing worldclass interdisciplinary solutions to significant societal challenges. It currently consists of 18 research units, bringing together more than 500 senior researchers from various disciplines.



During the reporting period, we established two new research centres under PAIR: the Research Centre of Textiles for Future Fashion, which is dedicated to driving sustainable development of the fashion and textile value chain; and the Research Centre for Digital Transformation of Tourism, which aims to digitally transform the tourism industry to promote sustainable travel and business practices.

PAIR's constituent research units achieved notable successes during the reporting period. Here, we present some key examples.

The Research Centre for SHARP Vision launched WHOeyes, a free mobile app for vision testing. WHOeyes is the first mobile app for vision testing endorsed by the World Health Organization. It also collaborated with Optical 88, an eyewear retailer, to develop a low-cost, portable, retinal fundus camera – a camera that photographs the interior surface of the eye – offering high-risk diabetic patients the ability to detect retinal diseases early through self-administered testing, thus overcoming the limitations of conventional equipment. Another collaboration with Rohto, an eye-care brand, resulted in the establishment of the PolyU–Rohto Centre of Research Excellence for Eye Care to further research in eye fatigue.

The Research Institute for Future Food has developed



novel selenium nanoparticles for managing postmenopausal osteoporosis. These nanoparticles, which have demonstrated promising results in cell studies and in vivo, enhance bone formation and mineralisation. The research team is collaborating with local industry partners to commercialise the health food products derived from this technology, which has garnered both national and international recognition.

3.2 Highlights of InnoHK Research Centres

PolyU has formed partnerships with leading global institutions under the Hong Kong government's InnoHK initiative. Through these partnerships, the University engages in impactful collaborative research to tackle global challenges. This section highlights the achievements of PolyU's three InnoHK Research Centres during the reporting period.

SLOPE: Advancing early detection of agerelated macular degeneration

The Centre for Eye and Vision Research has developed world's first application of quantum technology in vision science: the Structured Light Observation Perception Evaluation (SLOPE) device. SLOPE uses unique quantized spin-orbit beams to detect age-



related macular degeneration (AMD) – a condition affecting over 200 million individuals worldwide. By providing a rapid and non-invasive method for early-stage AMD detection and management, it seamlessly integrates into primary healthcare settings, enhancing AMD monitoring and potentially reducing the risk of severe vision loss.

SLOPE's groundbreaking innovation has earned recognition, including the Gold Medal with Congratulations of the Jury at the 2024 International Exhibition of Inventions Geneva. It also received a special prize from the Lucian Blaga University of Sibiu, Romania in recognition of its scientific creativity and originality.

WiseEye: Revolutionising textile inspection with AI

The Laboratory for Artificial Intelligence in Design (AiDLab) has developed WiseEye, an AI-based inspection system for textile materials. WiseEye revolutionises the global textile and apparel industries by automatically identifying and classifying defects in both solid colours and intricate patterns of woven and non-woven materials. By overcoming the challenge of automating textile inspection through machine vision algorithms and deep learning techniques, WiseEye achieves a defect detection rate of over 95% compared with a conventional rate of 70%. The system has been adopted by various brands,



including Banitore[®], boosting productivity and achieving defect detection rates of over 99%. To leverage this breakthrough, AiDLab has established WiseEye Automation Limited as a spinoff to market WiseEye globally.

Advancing reliability and safety in technology

The Centre for Advances in Reliability and Safety (CAiRS) has developed customised monitoring and prognostic tools to enhance product reliability and system safety. It has facilitated six new industry collaborations in areas that include aerospace, elevators, and semiconductors. CAiRS also has a collaboration agreement with Hong Kong Science and Technology Park (HKSTP) to offer testing and pilot-at-scale capabilities for microelectronics and advanced manufacturing start-ups. This collaboration focuses on third-generation semiconductors and 3D System in



Package, benefiting electric vehicles, 5G technology, and smart manufacturing and transport both in Hong Kong and the GBA. CAiRS has played a pivotal role in establishing the Hong Kong Chapter of the IEEE Reliability Society, which has provided a valuable platform for professionals, researchers, and students to exchange knowledge and enhance their skills in the field of reliability.

3.3 Translational Research Institutes in Mainland China

PolyU has established a network of Mainland Translational Research Institutes (MTRIs) to transform our research into targeted solutions for Mainland China. These institutes aim to align our research capabilities with the industrial and societal needs of various cities on the Mainland, thereby promoting research commercialisation and contributing to local development. To date, we have signed MOUs with 13 major cities. Seven of these cities – Hangzhou, Huizhou, Jinjiang, Nanjing, Wenzhou, Wuxi, and Zhongshan – have entered into detailed collaboration agreements with PolyU.

These MTRIs focus on different industry and technology areas, such as advanced manufacturing, aerospace, biomedical technology, future food, intelligent transportation, microelectronics, medical aesthetics, new energy, and textile technology. Each city's local district government will provide funding to support the daily operation for each MTRI for a period of five years. We will continue to establish more MTRIs to expand this network, tapping into different application scenarios in various fields and cities.



3.4 Strategic Partnerships with Industry for Joint Research and Applications

In order to fortify research collaborations and amplify the applicability of our research outcomes, PolyU has been forging numerous strategic partnerships with prominent research institutions and industries worldwide. Currently, PolyU has established 23 university-level research centres and nine Joint Research Centres on the Mainland. These centres encompass a diverse range of research domains, including artificial intelligence, blockchain, metaverse, carbon neutrality, biotechnology, marine infrastructure, advanced materials, Chinese history, and cultural and art technology. Here, we highlight some of the strategic partnerships established during the reporting period.



PolyU establishes Research Centre for Grid Modernisation to support sustainable energy development

PolyU has established the Research Centre for Grid Modernisation (RCGM) as an international platform develop innovative electric power systems to and work towards the twin goals of carbon neutrality and sustainable energy. RCGM brings together over academia, industry, 60 partners from and government to tackle grid reliability challenges exacerbated weather, climate by extreme unpredictability, infrastructure and ageing by developing secure, sustainable, and affordable power systems.

PolyU launches Research Centre for Electric Vehicles to achieve carbon neutrality goals

PolyU has established the Research Centre for Electric Vehicles (RCEV) to develop a cutting-edge research platform to address energy and technical challenges presented by modern electric vehicles (EVs). RCEV will focus on EV technologies, intelligent transportation systems, and energy management. This holistic approach will result in enhanced energy efficiency, environmental benefits, and the creation of new business opportunities. RCEV also signed MOUs with China Power International Development Limited and Wisdom Motor (HK) Limited respectively, aiming to foster industry-university-research collaborations to advance EV technologies for more impact.



Accel Group: Metaverse+ Joint Laboratory

PolyU and Accel Group Holdings Limited, a provider of electrical and mechanical engineering services, have established the PolyU–Accel Group Metaverse+ Joint Laboratory to enhance the research and application of metaverse technology in various sectors including enterprise cooperation, industrial applications, green and smart city initiatives, energy management, and



sustainable supply chain systems. The Accel Group plans to contribute HK\$10 million over five years to support diverse research initiatives aimed at improving production efficiency and quality, thus accelerating the transformation of Hong Kong into a green and smart city, and fostering the development of professional talent.

Axis Therapeutics: Joint Laboratory for Immunotherapy

PolyU has signed a collaboration agreement with Axis Therapeutics, a bio-tech company, for the establishment of the PolyU-Axis Therapeutics Joint Laboratory for Immunotherapy. The joint lab will focus on the development of new T-cell receptor therapies and targeting agents for cancer treatment. The collaboration will utilise PolyU's new clinical cGMP facility to conduct clinical trials and create up to 30 new biologics—living organism-based drugs that play a crucial role in advancing medicine and improving patient outcomes. This partnership aims to enhance cancer



treatment in Hong Kong through innovative cell therapy research and development.



Cainiao Group: Exploring new developments in green logistics

PolyU and Cainiao Group, a global leader in e-commerce logistics, have signed a Memorandum of Understanding to conduct joint research on the Meta-Box, an intelligent and recyclable transport carrier designed to enhance transportation efficiency, reduce costs, and promote sustainable development. This collaboration aims to devise green, efficient, and intelligent solutions to enhance the logistics industry and contribute to building a sustainable and digitised logistics system in Hong Kong.

Shanghai Westwell Technology: In-depth industry-university-research cooperation in artificial intelligence and autonomous driving

PolyU and Shanghai Westwell Technology, a company specialising in Al logistics, have created a joint innovation lab dedicated to Al and autonomous vehicle technology. This partnership will enhance resource sharing while developing cutting-edge technologies in navigation and positioning systems, spatial perception, and autonomous driving.



FOSTERING KT AND ENTREPRENEURSHIP WITH TECHNOLOGY AND SOCIAL INNOVATIONS

PolyU's commitment to entrepreneurship development is reflected in our track record of successful start-ups, which include unicorns and other high-value ventures. By nurturing a culture of innovation and providing a supportive and comprehensive ecosystem, we continue to support start-ups at various stages of their entrepreneurial journey and contribute to the growth and success of the entrepreneurial landscape.

4.1 Entrepreneurship Development: from Education to Acceleration

PolyU offers a wide range of entrepreneurship-focused programmes and state-of-the-art incubation facilities, coupled with tailored mentorship and networking opportunities to equip aspiring start-ups with the knowledge, skills, and resources needed to thrive in a dynamic business environment. Our acceleration programmes and Entrepreneurship Investment Fund (EIF) also provide dedicated support to start-ups to drive their growth and enable their transition from promising ideas to impactful businesses.



Proof-of-Concept (POC) Funding Scheme

The POC Funding Scheme is an ideation stage entrepreneurship programme designed to encourage innovative thinking in talented young people through hands-on learning and student-led research and development. This year, the scheme attracted 87 students, who created 45 projects. Outstanding projects included a novel prosthetic hand controlled by wireless sonomyography, and a drone with computer vision for automatic module installation in Modular Integrated Construction. Twenty-one projects have been accepted into the HKSTP Ideation Programme for further development.

Student-led Entrepreneurship Organisations

PolyU has established two student-led organisations: the Google Developer Student Club (GDSC) and the Entrepreneurship Society (ES). These organisations aim to encourage innovation and entrepreneurship among students. Over the past year, GDSC has held ten workshops and events, involving over 570 students. In the 2023/24 academic year, ES added 131 new members, expanding its total membership to 1,101.



PolyU's unique Industrial Centre supports prototyping and technology development

PolyU's Industrial Centre (IC) is the only one of its kind among local UGC-funded universities. It offers a comprehensive range of engineering facilities, equipment, and technologies to help researchers and students transform their ideas and inventions from lab to life.



IC offers over 160 types of facilities and equipment to innovators and makers. It also provides maker labs and short-term project spaces for start-ups to develop their ideas. These resources, along with technical support, help PolyU-supported start-ups create product prototypes and improve design and performance.

Two recent examples are Dress Green and JAPJAP. Both start-ups use IC maker labs, project spaces, and technical support to develop their designs and prototypes. Dress Green's co-founder, Ms. Emma Yu, was recently listed in the 'Forbes 30 Under 30 Asia 2024' list, while JAPJAP was a winning team in the Young Techpreneur Project 2023–2024.





PolyU InnoHubs in Hong Kong and Shenzhen: Collaborative Co-Working Spaces for PolyU Entrepreneurs

PolyU InnoHub Hong Kong and PolyU InnoHub Shenzhen offer co-working spaces and facilities to support startups. These hubs bring together students, academic staff, entrepreneurs, and industry partners through networking and training activities. As of June 2024, they had supported over 310 start-up teams or companies across diverse sectors including AI, healthcare, and advanced manufacturing.

In the 2023/24 academic year, PolyU InnoHub admitted 51 start-up teams or companies, over 80% of which had previously received funding from PolyU entrepreneurship programmes. PolyU InnoHub Shenzhen welcomed 29 start-up teams or companies, 50% of which are led by PhD entrepreneurs.

GBA Start-up Postdoc Programme

Micro Fund Scheme and Incubation Support: Igniting High-quality PolyVentures

PolyU is the first university in Hong Kong to partner with HKSTP to speed up the commercialisation of innovation and technology through the Micro Fund Scheme. In 2023/24, this scheme supported over 100 start-ups founded by PolyU alumni, students and staff, the highest number since it was launched in 2011. Around 60% of these start-ups have been fast-tracked into the HKSTP Ideation & Incubation Programmes.

Besides financial assistance, PolyU offers comprehensive training and incubation support to start-ups. To maximise the potential of projects, we work closely with our strategic partners, including HKSTP, Cyberport, the Chinese Manufacturers' Association of Hong Kong, and the Federation of Hong Kong Industries.



PolyU's GBA Start-up Postdoc Programme is the first of its kind among local institutions. This two-year programme promotes research-based entrepreneurship and empowers recent doctoral graduates to become 'technopreneurs' by tapping into support from PolyU's resources and networks. With guidance from both academic staff and industry experts, postdocs can conduct translational research and create tech ventures.

Since its launch in 2019, the programme has supported 25 postdocs, 24 of whom have been admitted to other local entrepreneurship programmes to accelerate their entrepreneurial progress. These postdocs have won 23 innovation and entrepreneurship awards, and secured nearly HK\$27 million in additional funding and support for their start-ups.



One successful case study is Bo InnoHealth Biotechnology

Company Limited, which has developed AkkMore[™], a novel fungus-based fat replacer designed to prevent obesity and enhance gut health, which has been incorporated into a variety of food products. The GBA Start-up Postdoc Programme has enabled this start-up to receive incubation support from the PolyU Micro Fund and PolyU Tech Launchpad Fund and multiple angel funds, as well as additional backing from the Incu-Tech Programme at HKSTP.

Two-tier Angel Fund scheme: Expediting start-up growth

To accelerate the growth of high potential technology startups, PolyU established an Angel Fund scheme in 2023. This scheme offers two levels of funding support: HK\$1 million and HK\$3 million. The aim is to capitalise on funding available from the Innovation and Technology Commission through its Technology Start-up Support Scheme for Universities. The scheme has been popular, attracting nearly 90 applications



for the HK\$1 million tier and 30 applications for the HK\$3 million tier. After a thorough evaluation by industry leaders and experienced investors, 16 start-ups were selected for the HK\$1 million tier, while eight start-ups were recommended for the HK\$3 million tier.

PolyU Entrepreneurship Investment Fund: Fuelling growth and innovation

The University has established the PolyU EIF as an early-stage equity investment fund to support the further scale-up of PolyU start-ups with promising innovative technologies or business models. After a rigorous selection process from a pool of start-ups involving PolyU members or commercialising PolyU IPs, the University invests in promising start-ups either through top-up investment or by co-investing with other lead investors through the EIF. As of 2023/24, EIF has invested in 13 start-ups, helping them grow and succeed.

RAISe+ Scheme: Turning research into realworld applications

In October 2023, the Hong Kong government launched the Research, Academic and Industry Sectors One-plus (RAISe+) Scheme to enhance Hong Kong's innovation and technology ecosystem by fostering collaboration between the Government, industries, universities, and research sectors. To support the Scheme and advance commercialisation, PolyU was the first institution in to partner with two renowned technology innovation investment companies, Shenwan Hongyuan (H.K.) Limited and Joincap Group, as our strategic investors. These two companies will set aside funding to invest in eligible



PolyU projects and foster further industry–university–research collaborations. In the first round of the RAISe+ Scheme applications, PolyU was awarded two projects: one to develop an energy-efficient liquid cooling system for data centres, and the other to develop next-generation composite current collectors for mobility and energy storage batteries.

Start-up Stories

The co-founders of two PolyU start-ups, LifeSparrow Solutions and Dress Green, have been featured in the prestigious 'Forbes 30 Under 30 Asia 2024' list in the Consumer Technology and Social Impact categories, respectively. Three PolyU supported start-ups – Telefield Medical Imaging Limited, Fleming MedLab, and Eieling Technology Limited – have been listed in the 'Forbes Asia 100 To Watch 2023'. These achievements exemplify their success in their entrepreneurial journeys.



LifeSparrow Solutions: Using AI to find missing hikers

LifeSparrow Solutions, co-founded by two alumni of the Department of Aeronautical and Aviation Engineering, has harnessed AI algorithms to empower search and rescue operations. In collaboration with the Fire Services Department, the company has developed an AI algorithm that uses drone-captured imagery to identify individuals missing in challenging and remote terrains, a growing phenomenon as hiking continues to gain popularity in Hong Kong. The company founders have been featured on CNN discussing their innovative search and rescue technology. Forbes also included LifeSparrow Solutions in its 2024 '30 Under 30 Asia: Consumer Technology' list.

Dress Green: Creating sustainable solutions for textile waste

Dress Green is a pioneering social enterprise that creates sustainable solutions for textile waste. By transforming discarded school and business uniforms into fashionable, eco-friendly apparel and other products, Dress Green not only helps reduce landfill waste but also provides meaningful employment for former textile workers in Hong Kong. The company tackles the vast waste issue head-on, employing local textile workers to recycle textiles by converting them into high-quality, eco-friendly products. PolyU has supported Dress Green with funding through its entrepreneurship programmes, technical advice and facilities through its Industrial Centre, and workspace at PolyU InnoHub, facilitating the company's growth from concept to reality.



Eieling Technology Limited: Transforming liver health diagnostics to serve the wider community

Eieling, a PolyU academic-led start-up, has created Liverscan[®], a palm-size wireless ultrasound imaging device for assessing liver fibrosis – an inflammatory condition that can lead to cirrhosis, liver function loss, or cancer. This non-invasive technology revolutionises liver disease prevention and diagnosis, eliminating the need for invasive biopsies. Liverscan[®] has obtained registration approval from the US Food and Drug Administration (FDA510K) and is already being used in many hospitals and clinics in Hong Kong, Macau, and beyond.



启动仪式

At the Asia Summit on Global Health held in May 2024, Eieling launched its five-year 'LiverCare – Hong Kong 10 Million Liver Scans Program'to improve public awareness of liver disease prevention, and promote the early detection and treatment of liver disease to reduce its impact. PolyU fully supports this programme and from July 2024 will be the first institution to conduct liver fibrosis and fatty liver screening for full-time university staff using Liverscan[®]. The research team will use the data collected to study the importance of a balanced diet and daily exercise, as well as regular liver disease screening to identify and monitor the progression of liver disease.

4.2 GBA Engagements to Explore Collaboration Opportunities

In addition to our support of entrepreneurship in Hong Kong, PolyU also actively helps its members and start-ups explore opportunities in the GBA by establishing innovation and entrepreneurship bases, organising visits to GBA cities to understand local policies and regulations, providing training and incubation support, and connecting with local governments and industries to expand networks and attract business, funding, and investment opportunities.

Establishment of Innovation and Entrepreneurship Bases

The PolyU Shenzhen Research Institute (SZRI) and the Shenzhen Human Resources and Social Security Bureau signed a memorandum of cooperation in July 2023 to promote innovation, entrepreneurship, and employment among talented young people from both Hong Kong and Shenzhen. The two parties also established the Hong Kong and Macau Youth Innovation and Entrepreneurship Base to provide comprehensive support services for PolyU students and Shenzhen's entrepreneurial teams.

PolyU and the Guangdong University of Technology signed an agreement in April 2024 to jointly nurture talent in entrepreneurship and innovation. This partnership aims to pursue comprehensive cooperation to foster a high-quality talent ecosystem. Initiatives include establishing a service consultation hub, organising international exchange activities,



and supporting the conception and incubation of entrepreneurial projects that align with the development of the GBA.

Visits to GBA Cities to Explore Collaboration Opportunities

PolyU facilitated exchanges and learning opportunities for its entrepreneurial community in the GBA. We organised themed events in Shenzhen, where participants gained insights into the city's entrepreneurial ecosystem and support measures, visited accelerator platforms, and explored its innovation infrastructure. PolyU postdocs and start-ups visited Nansha, Foshan, and Dongguan, engaging with local companies, research institutions, and innovation hubs. These visits provided valuable knowledge on industrial development, support policies, technology



advancements, and collaboration prospects, contributing to the growth and integration of PolyU's entrepreneurial ecosystem in the GBA.

Shenzhen Venture Capital Day

In December 2023, PolyU SZRI supported the Shenzhen Venture Capital Day, a flagship venture capital event created by the Shenzhen municipal government to foster strategic collaboration in venture capital and entrepreneurship in the GBA. At the event, PolyU SZRI signed a memorandum of cooperation with Bo Yue Capital, a prominent Chinese private equity firm. The event featured a roundtable forum, and a roadshow featuring projects from PolyU's Shenzhen Entrepreneurship Centre and achievement transformation initiatives.



4.3 Social Innovations Addressing Societal Challenges

In PolyU, we not only foster technological innovations but also support social innovations to positively impact society through the Jockey Club Design Institute for Social Innovation (J.C. DISI) and its programmes and projects.

Good Seed Programme

The Good Seed programme aims to empower young innovators to tackle poverty and exclusion in Hong Kong. Funded by the Social Innovation and Entrepreneurship Development Fund, the programme exemplifies how PolyU is helping young people develop their entrepreneurial skills while creating a positive social impact in their communities. Since 2019, the programme has supported 2,057 participants, generating 473 ideas and awarding HK\$13,000,000 in seed



funding to 65 projects. Notably, three projects from the 2022 cohort were selected for the HK\$50,000 Rosewood Foundation Prize, while a book titled 'Seed Experiment 3.0' was published in July 2024.

Enhancing Disadvantaged Children's Well-being through Applied Research and Cross-sector Collaborations

With support from the Hongkong Land HOME FUND, J.C. DISI launched the 'Furniture for Our Future' project in 2022, benefiting over 2,400 children living in inadequate housing. The project received recognition, including the Merit Award at the DFA Design for Asia Awards 2023. Moreover, J.C. DISI collaborated with PolyU departments and NGOs to understand the challenges faced by Small Group Homes (SGHs) operators and developed groundbreaking applied research to incorporate trauma-informed care design principles, WELL[™] building Standards, and



children's voice to formulate guiding principles for denationalising SGHs and to support the healing of the residents. The evidence-based social innovation project is now scaled up to become a Trust-Initiated Project, which the Department of Applied Social Sciences is involved as a key party to support impact measurement. These principles were presented to key SGHs operators and NGOs for consideration in transforming residential childcare services in Hong Kong.

Fostering an Inclusive Community

J.C. DISI spearheaded impactful initiatives to promote inclusivity in the community. Collaborating with Habitat for Humanity and Department of Applied Social Sciences, the team conducted 104 home assessments and 62 home modifications for older adults in public rental housing, empowering individuals to make informed decisions about their living arrangements through the 'J.C. DISI's Double Smart Assessment Indicators for Elderly-friendly Community'. PolyU Jockey Club Operation Solnno also focused on creating



dementia-friendly communities through projects such as 'From Eye Health to Dementia', which offered talks, workshops, and eye examinations to nearly 60 elderly participants. Additionally, its 'Gamification of Public-Education of Dementia-friendly Practices' project developed public educational games to raise awareness and foster empathy. J.C. DISI also collaborated with the Hong Kong Institute of Certified Property Managers to launch an Elderly (Dementia) Care Support Training programme in April and May 2024, with 54 trainees from 34 Estate Management Companies and 37 Property Estates participating in the programme.

4.4 Awards Recognising PolyU's Innovations and Research Breakthroughs

PolyU Triumphs at Geneva Inventions Expo

PolyU secured a record-breaking 45 awards in multiple categories at the 49th International Exhibition of Inventions Geneva, the highest number of awards among higher education institutions in Hong Kong. Among the top award winners were a portable high-definition corneal topographer and an Al-powered rail track defect detection system. The 45 awards included two special prizes, five Gold Medals with Congratulations of the Jury, 18 Gold Medals, 13 Silver Medals, and seven Bronze Medals. Nineteen of the awards were received for innovations developed under the InnoHK research centres led by PolyU in collaboration with top global research institutions.





PolyU Start-up Snatchs Gold Award in the 'Guangdong-Hong Kong-Macao Greater Bay Area High-value Patent Portfolio Layout Competition 2023'

Telefield Medical Imaging Limited (Telefield), founded by Prof. ZHENG Yongping from the Department of Biomedical Engineering, was the only Hong Kong start-up to secure a Gold Award in the 'Guangdong–Hong Kong–Macao Greater Bay Area High-value Patent Portfolio Layout Competition 2023'. Telefield, a pioneer in developing 3D ultrasound imaging equipment and solutions, with over 120 patents, has developed Scolioscan[®], the world's first and only radiation-free 3D ultrasound scoliosis assessment system. This innovative technology enables patients to undergo safe and unrestricted examinations of scoliosis and posture, eliminating the need for regular x-ray scans, which increase the risk of cancer.

Three PolyU Scholars Awarded BOCHK Science and Technology Innovation Prize 2023

Prof. Benny CHEUNG, Prof. Allen AU, and Prof. Daniel LUO of PolyU were awarded the Bank of China (Hong Kong) Limited (BOCHK) Science and Technology Innovation Prize 2023 for their accomplishments in the fields of Advanced Manufacturing and FinTech, respectively. Since the inception of this prestigious award last year, PolyU has reinforced its position as the leading institution in Hong Kong for innovation in science and technology by securing



a total of four awards. The three awardees were recognised for their work in ultra-precision machining technology, privacy-enhancing cryptographic algorithms for blockchains, and cybersecurity measures for critical infrastructures, respectively.

PolyU Scholar Honoured with National Innovation Award

Prof. CHUNG Kwok-fai, Director of the Chinese National Engineering Research Centre for Steel Construction (Hong Kong Branch) at PolyU, was the sole recipient from Hong Kong to receive a Certificate of Merit at the 3rd National



Award for Excellence in Innovation. Prof. CHUNG's influential contributions to structural steel engineering have led to significant advancements in the field, benefiting major construction projects such as the Cross Bay Link in Tseung Kwan O and the Quarta Ponte Marítima between Macau and Taipa. These innovations have not only generated economic and societal benefits but have also resulted in substantial savings in construction costs.

PolyU Scholar Awarded for Advancements in Material Physics and Smart Device Research

PolyU scholar Assistant Professor Dr Kathy K. LENG gained international recognition for her contributions to material physics. She received acclaim for her focus on molecularly thin 2D hybrid perovskites – super-thin



materials with precise control over electricity and light interaction. Dr LENG was named one of the '2023 Innovators Under 35' in the Asia Pacific region by the Massachusetts Institute of Technology Review. She also received the Croucher Tak Wah Mak Innovation Award for 2023, acknowledging her outstanding achievements in material physics.

PolyU's Music Therapy System Wins Consumer Electronics Show 2024 Innovation Award

PolyU's 'Music-with-Movement System for Older Adults' won the prestigious Consumer Electronics Show 2024 Innovation Award in the Accessibility & Aging Tech category. This unique system combines therapeutic music, movement, augmented reality games, and motion sensors to enhance the well-being of elderly individuals and their caregivers. The system was recognised for its outstanding design and impact on the quality of life, combatting social isolation by addressing cognitive and social engagement. PolyU is the only Hong Kong educational institution to have received this esteemed award.



CLOSING AND LOOKING FORWARD INNOVATIONS

As a leading academic institution in Hong Kong, PolyU is dedicated to driving positive change through our research. We are committed to advancing I&T, and to helping Hong Kong transform into an innovation hub in line with the Hong Kong I&T Development Blueprint.

In the coming years, we will continue to establish Mainland Translational Research Institutes (MTRIs) and capitalise on opportunities arising from national I&T policies. These MTRIs will serve as incubators for start-ups and spin-offs, supported by local government policies and industry networks. By leveraging our MTRI network, we aim to transfer our research output to industry through collaboration and entrepreneurship development.

Another priority is to strengthen our international partnership network. In the coming years, PolyU plans to collaborate with government organisations, higher education institutions, institutional investors, industry, and incubators to reinforce our role as a global innovation hub.

Our goal is to excel in KT and entrepreneurship, creating seamless links between research and its application. PolyU will position itself as a central hub, with Mainland subsidiaries and international partners facilitating technology transfer and supporting new ventures.

We will continue to nurture start-ups, leveraging our research expertise and infrastructure, industry network, and MTRI network to help entrepreneurs turn research into impactful solutions.

Finally, to ensure the effective execution of our strategic initiatives, we will continue to review and improve our policies and guidelines, and maintain proper governance.

PolyU is proud to be at the forefront of cutting-edge research and development in multiple fields. As we strive to extend the reach and significance of our research impact, we are excited about the future and the opportunities that it promises. Guided by our motto 'To learn and to apply, for the benefit of mankind', PolyU will continue to make impactful contributions that support the city's growth and advance I&T in the GBA, the nation, and the world.

Appendix 1: Key Performance Indicators

A summary of the key performance indicators for various KT areas are presented in the table below, with financial figures expressed in HK\$'000:

Performance Indicators	2022/23	2023/24
Patenting & Licensin	g	
No. of patents filed Note 1	307	402
No. of patents granted Note 1	130	155
Accumulative no. of licenses granted	174	200
Income generated from IPR Note 2	\$15,812	\$34,229
Expenditure involved in generating income from IPR	\$10,954	\$13,199
Consultancy, Collaborative / Contract Resear	ch & Spin-off / Joint Ve	entures
No. of collaborative research, income generated and total contract value Note 3	471 \$334,463 \$1,023,443	542 \$274,809 \$1,068,048
No. of contract research, income generated and total contract value Note 4	408 \$163,452 \$778,199	505 \$230,234 \$1,019,299
No. of consultancy projects and income generated Note 5	518 \$59,615	441 \$50,796
No. of economically active spin-off companies Notes 6	441	531
Net income generated (or net loss arising) from spin-off companies Notes 7	\$1,388	\$2,292
Other Knowledge Transfer / Disse	mination Activities	
No. of equipment and facility service agreements and income	128 \$4,282	102 \$4,680
No. of student contact hours for business or CPD needs Notes 8,9	3,010,571	3,285,446
Income received from CPD courses Note 9	1,250,145	1,489,802
No. of public lectures / symposiums / exhibitions and speeches to community	670	654
No. of performances and exhibitions of creative work by staff or students	52	69
No. of staff engaged as members of external advisory bodies	423	482

Notes:

- 1. The reported figures include patent or patent applications co-owned by PolyU and external parties as well as patent or patent applications owned or co-owned by PolyU's subsidiaries. A detailed list of patents granted is presented in <u>Appendix 2</u>.
- 2. The reported figure includes license income generated from PolyU supported start-ups which licensed PolyU's IPs.
- 3. Collaborative research income reported is on cash-receipt basis from on-going projects in the reporting period. As some of the internally funded projects also involved third parties as collaborators for KT purpose, the number of those projects was counted here but not the income nor project value.
- 4. Contract research projects are those involving third parties from public, private and NGO sectors. The income reported is on cash-receipt basis from on-going projects in the reporting period.
- 5. The reported figure includes income from corporate and executive development training related consultancies (including those delivered by KTEO as mentioned in Note 9 below) and income from consultancy and advisory services, such as investigation, advisory on business, management, social, technical or policy related issue(s), as well as product, technology, materials or process enhancements.
- 6. The reported figure includes the number of all active start-ups that were either funded by PolyU funding programmes (including PolyU Micro Fund, China Entrepreneurship Fund (CEF), Tech Incubation Fund (TIF), Tech Launchpad Fund (TLF), Maker Fund, Good Seed Programme), or those obtained license from PolyU to commercialise the University's IPs. Subsidiaries set up as operating vehicles for specific functional purposes, e.g., PTeC, Hotel ICON and PolyU Base in Shenzhen are not included.
- 7. The reported figures represent the license income generated from PolyU supported start-ups which licensed PolyU's IPs. This license income was also included in the "Income generated from IPR" (refer to Note 2 above).
- 8. The student contact hours are defined to be the number of enrolments multiplied by the number of contact/course hours.
- 9. The CPD courses include award-bearing and credit-bearing programmes (both in and outside Hong Kong) for learners already in work who are undertaking the course for purposes of professional development / upskilling / workforce development, in addition to short term non-credit-bearing training programmes. The reported figures include both full-time and part-time taught postgraduate programmes, part-time award bearing programmes offered by PolyU Proper, SPEED and non-award bearing courses offered by PolyU Proper, SPEED and KTEO, including the income of corporate and executive development training delivered via PTeC in the form of consultancy projects.

Appendix 2: List of Patents Granted in FY2023/24

No.	Official Title	Country/
1	Spectacle Lens (US Continuation Patent 3)	USA
2	Spectacle Lens (US Continuation Patent 4)	USA
3	キラルなサイクレン化合物お上びその使用	Japan
	(EN: Chiral Cyclen Compounds And Their Uses)	
4	納米纖維表面	China
5	Nanofiber Surfaces	Hong Kong
6	配電網分散式儲能投資優化方法及裝置	China
7	Electrodes For Batteries	India
8	Wideband Vibration Suppression Device Utilizing Properties Of Sonic Black Hole	USA
9	一種具有抗菌活性的化合物	China
10	Compounds With Antimicrobial Activity	Europe
11	抗菌活性を備えた化合物 (EN: Compounds With Antimicropial Activity)	Japan
12	(LN: Compounds With Antimicrobial Activity) 可注射式厭雷換能器、注射裝置、袖經刺激系統及方法	China
13	Method For Sonochemical Deposition of Metals On Textile Substrates	USA
14	針對抑制 jag1-notch1 信號通路的肽	China
15	表面修飾氣囊及其製備和應用	China
16	一種用微曝氣進行廢氣脫硫的計算模型、方法及即時監控裝置和系統	China
17	管道機器人和系統	China
18	一種彈性導體複合膜及其製備方法	China
19	用於延緩近視進展的鏡片和方法	China
20	Lens And Method For Retarding Myopia Progression	Hong Kong
21	一種能監測與跟蹤藥物遞送過程的載藥材料與其製備方法	China
22	雙柵極有機電化學電晶體	China
23	一種可抑制近視加深的虛擬實境設備及其光路結構	China
24	一種水凝膠賦形的鋅負極材料及其製備方法、負極和電池	China
25	用於保護佩戴者的面部的面罩	China
26	可擕式角膜地形圖採集系統	China
27	Bracewear For Spinal Correction And System For Posture Training	USA
28	Ultrasonic Transducer Assembly, Probe, System And Fabrication Process	Hong Kong
29	一種為無人駕駛車輛服務的道路定位標識	China
30	可拉伸的導電紗線及其製造方法	China
31	Baicalein Analogs For Use In Neuroprotection And Regulation Of Immune Reactivity	USA
32	Water-Responsive Shape Memory Wool Fiber, Fabric And Textile Comprising Thereof, And Method For Preparing The Same	USA
33	三維火場資訊的即時採集系統、即時採集設備和即時採集方法	China
34	A System, Device And Method To Collect The Real-Time 3D Data From The Fire Scene	Hong Kong
35	一種納米探針及其製備方法和應用、迴圈腫瘤細胞的 mirnas 的檢測系統	China
36	水性環氧固化劑及其製備方法和應用、水性環氧樹脂改性乳化瀝青	China
37	混凝土原料、混凝土及其製備方法和應用	China
38	Concrete Raw Material, Concrete And Preparation Method And Application Thereof	Hong Kong
39	Transparent Ultrasound Transducer With Light Beam Shaping And The Method For Assembling The Same	USA
40	過濾膜的表面改性方法及複合過濾膜	China

41	一種水泥基材料碳化再利用方法和一種碳酸鈣晶須材料	China
42	一種多維度智慧服裝壓力測試人台裝置、系統和方法	China
43	一種製備定向傳輸液體的材料的方法	China
44	基於對天花板的從地板向上查看感測的室內火災監測	China
45	Indoor Fire Monitoring Based On Look-Up-From-Floor Sensing Of Ceiling	USA
46	一體化水輪發電機	China
47	一種雙向流管道可自調節流量的水輪發電機組	China
48	一種電致發射率調控器件及其製備方法	China
49	Methods For Preparing Two-Dimensional Black Phosphorus	USA
50	Pure-H ₂ O-Fed Electrocatalytic CO ₂ Reduction to C ₂ H ₄ Beyond 1000-Hour Stability	USA
51	木質素製備芳香類單體方法	China
52	一種利用混凝土多孔骨料吸碳固碳的方法和混凝土	China
53	一種單嚮導濕面料及其織造方法	China
54	光纖傳感器及磁場強度測量裝置	China
55	納米高熵氧化物材料及其製備方法、鋰硫電池正極材料	China
56	An Internet-Based Infectious Disease Prevention And Control Training System And Method	Hong Kong
57	自動圖像分割系統和方法	Hong Kong
58	一種防抱死制動控制方法、系統及機電式制動裝置	Hong Kong
59	A Therapeutic And Interactive Music-With-Movement Programme For Older Adults With Cognitive Impairment	Hong Kong
60	Virtual Reality Motor-Cognitive Training For Older People With Cognitive Frailty	Hong Kong
61	3D 列印混凝土材料及其製備方法與應用	China
62	A System And Method For Intelligent Adaptive Wavefront Measurement For Optical	Hong Kong
	Characterization	
63	油煙淨化裝置及帶有該油煙淨化裝置的移動式廚房	China
64	心理壓力水準檢測方法、裝置及系統	Hong Kong
65	一種食品新鮮度檢測方法及系統	Hong Kong
66	A Certification Framework For Stem Industrial Products	Hong Kong
67	一種家用自釀啤酒機	China
68	一種家用自釀啤酒機的控制方法和裝置	Hong Kong
69	一種紙尿褲內部微氣候熱濕環境計算方法和系統	China
70	資料驅動的資源配置方法及裝置	Hong Kong
71	振動監測系統和振動監測方法	Hong Kong
72	髕骨自動活動裝置	Hong Kong
73	一種面向智慧製造加工過程中的控制優化方法和系統	Hong Kong
74	步行輔助器及助行設備	Hong Kong
75	一種基於三維列印的鞍座及自行車	Hong Kong
76	一種建築工程智慧化伸縮範本	Hong Kong
77	Ai-Based Failure Mechanism Prediction System And Method For Pcb Solder Joints	Hong Kong
78	Improving Rail Tracks Defect Classification Based On A Cascade Swin-Transformer Model	Hong Kong
79	A System And Method To Monitor Lithium-Ion Battery For Degradation Estimation And Fault Detection	Hong Kong
80	System And Method For Condition Monitoring Of An Induction Motor	Hong Kong
81	A System And Method Of Power Mosfet Diagnostic And Lifetime Estimation Using Ai Algorithm	Hong Kong
82	System And Method To Detect Anomalies In A Steel Wire Rope (SWR) Of An Elevator Based On Changes In Raw Magnetic Flux Leakage (MFL) Data	Hong Kong
83	System And Method Of Data-Driven Deep Learning Models For Detecting Anomalies In A Steel	Hong Kong

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84	System And Method For A 1D-Dicnn-Gru-Based Deep Learning Feature Extraction Model In Non- Intrusive Elevator Monitoring	Hong Kong
85	System And Method For A Devised Training Process For Imbalanced Dataset In Non-Intrusive Elevator Monitoring	Hong Kong
86	A System And Method Of Railway Track Rul Prediction Using Functional Data Analysis With Autoencoders	Hong Kong
87	System And Method Of Dc/Dc Converter Health Diagnostic And Rul Prediction Using Ai Algorithm	Hong Kong
88	一種 LBS 場景下的基於機器學習的移動端 AR 平臺	China
89	體外檢測蛋白間相互作用的方法和檢測試劑盒及其應用	China
90	一種流體濃度檢測方法及系統	China
91	分散式深度學習方法、裝置、參數伺服器及主工作節點	China
92	一種梯度傳輸方法、梯度傳輸裝置及參數伺服器	China
93	一種基於旋轉天線的圖像定位方法、裝置及終端設備	China
94	多目標形變監測方法、裝置和接收機	China
95	形變監測方法、裝置和接收機	China
96	干涉式形變監測方法、裝置和接收機	China
97	一種計算資源的分配方法及裝置	China
98	環境大氣中氣態亞硝酸濃度的測量方法及系統	China
99	電極及其製備方法、電池	China
100	PH 螢光探針及其合成方法與應用	China
101	一種老年人空間分析方法、裝置、終端設備及存儲介質	China
102	健康步行路徑規劃方法、裝置、終端設備及可讀存儲介質	China
103	Rfid 標籤識別方法、閱讀器、目標標籤及電腦介質	China
104	基於聲場變化的三維火場資訊探測與分析方法及系統	China
105	一種掃頻光頻梳相干層析成像虛像消除方法	China
106	基於資料量化與硬體加速的羽量級邊緣智慧系統	China
107	5-(2-(二取代膦基)苯基)-1-烷基-1h-吡唑膦配體及其製備方法和應用	China
108	一種腦靶向納米遞釋系統及其製備方法	China
109	一種基於幾何相位超構表面實現的標準相位檢測元件	China
110	一種基於機器異構性的聯邦學習方法	China
111	一種以喹啉鎓離子為骨架的螢光分子及其標記的多肽或蛋白質與製備方法	China
112	一種基於二分法的平面點雲分割和配准的方法	China
113	基於自監督學習式進化的大規模複雜網路社區檢測方法	China
114	一種複合光催化材料在光催化降解甲醛中的應用	China
115	高動態範圍多感測器測量儀器	China
116	一種多雷射雷達系統靜態標定方法	China
117	一種以喹啉鎓離子為骨架的半胱氨酸螢光探針及其合成方法與應用	China
118	一種基於光學相位放大的氣體檢測方法和系統	China
119	一種檢測活性氧分子的螢光探針及其製備方法與應用	China
120	一種應用於超寬頻波分複用系統的預放大參數優化方法	China
121	一種基於 LSTM 神經網路的室內軌跡誤差評估方法	China
122	一種室內外無縫定位及導航庫自構建方法	China
123	一種信號調製方法、裝置及存儲介質	China
124	一種全球導航衛星資料校準方法、裝置、終端及存儲介質	China
125	一種吡唑-醯胺骨架的膦配體及其製備方法與應用	China
126	一種雙壁空心組合梁及其施工方法	China
127	能特異性識別多種沙門氏菌血清型的單克隆抗體及製備方法、檢測試劑盒與應用	China

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128	含有二茂鐵的環戊二噻吩型金屬有機聚合物及其製備方法與應用、複合熱電薄膜	China
129	一種仿生自我調整視覺感測器及其製備方法	China
130	一種導電漿料及其製備方法	China
131	一種可靠且快速的電池去極化充放電控制運行方法	China
132	基於 MEMS 感測器和稀疏地標點的室內定位及優化方法	China
133	一種多源融合定位方法(一種新型的 Wi-Fi 精密測距,指紋,微感測器多源融合定位方法)	China
134	一種基於微腔回饋鎖定雷射器的微波信號產生方法	China
135	含有氦氧自由基(N-O·)與二茂鐵基團的非共軛有機聚合物及其製備方法與應用、複合熱	China
	電薄膜	
136	含自由基的一類金屬有機共軛聚合物的製備方法及其在熱電材料上的應用	China
137	一種模組化的管道缺陷檢測軟體機器人	China
138	一種換熱器及三相吸收式蓄能系統	China
139	一種適用於跨季節三相吸收式蓄能迴圈的工質對及其製備方法	China
140	一種鈣鈦礦量子點、深紫外光電探測器及其製備方法	China
141	一種基於尾氣火焰回熱的超焓陰燃系統與方法	China
142	一種產生連續渦環的滅火方法與系統	China
143	一類含有卟啉骨架結構的有機共軛聚合物及其製備方法與應用	China
144	異構環境的網路流量分類方法、裝置、終端及存儲介質	China
145	一種基於中繼資料輔助和聯邦學習的未知網路流量分類方法	China
146	一種基於反覆運算學習機制的有限冷量條件下的分配控制方法	China
147	基於超螺旋狀複合纖維的熱驅動變形織物及其製備方法	China
148	一種基於線性疊加的數位脈衝整形方法及光纖通信系統	China
149	一種粘附人工骨膜及其製備方法與應用	China
150	雙偏振聯合信號雜訊處理方法和雜訊處理裝置	China
151	一種基於相機磁場干擾的近場通信方法及系統	China
152	一種基於變色龍雜湊的加密驗證方法和系統	China
153	一種用於碳同位素檢測的全光纖化環形腔感測器件	China
154	一種基於滑窗變分自編碼器的非監督裂縫識別方法	China
155	一種微透鏡	China

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Appendix 3: Details of Selected Impact Cases

Case 1: Contributing to the Nation's Chang'e-6 Historic Lunar Far-side Sampling Mission

1. Summary of the Impact

In the evening of June 2nd, 2024, the Chang'e-6 lander performed the first-ever in human history acquisition of Lunar samples from the far side of the Moon. It gathered 1.9 kg of material from the Southern mare of the Apollo Basin. The Lunar surface samples were collected and packaged in a process performed by the Surface Sampling and Packing System (SSPS), developed and built by the Hong Kong Polytechnic University (PolyU). This was a significant step forward for our nation's space exploration and that of the world. The SSPS, a key component of the Chang'e 6 mission led by the China National Space Administration (CNSA), was the result of PolyU's collaboration with the China Academy of Space Technology (CAST).

2. Underpinning Research

Achieving anything on the Moon is made exceptionally difficult by the lack of atmosphere, the minimal gravity, extreme temperature variations, radiation exposure, and the arduous 384,000 km journey. The first and most significant challenge in the development of the Surface Sampling and Packing System (SPSS) was understanding the physical properties of the Lunar regolith that could be encountered when arriving on the far-side of the Moon, an area that no human has yet explored. An extensive literature review on the possible properties of the Lunar regolith was supported with input from international experts, to develop a systematic model of the possible sampling tool functionalities.

The result of this investigation was an SSPS equipped with every possible function for sample collection and deposition, such as impact digging, scooping using a claw, rock picking with impact for semi-submerged rocks, and coring and gripping. After sample acquisition, vibration was used to dislodge unwanted materials, and sample deposition used a piston-sweeping action to move sticky material. To fulfill all these functions, two samplers were required, both with sample size control to ensure smooth deposition into the sample container.

Research also determined the requirements for a packing system. The motion mechanism was locked from launch to landing and unlocked by itself for its operation phase to maintain the cleanliness of the container. This mechanism also functions to keep the rim of the sample container free from contamination during sample deposition and swept away excess material to ensure smooth locking and sealing of the lid.





Fig.1 - Samplers with cameras

Fig.2 - Packaging system

The research underpinning the development of the SSPS addressed major challenges in astronautical engineering, which is interdisciplinary and involved consideration of optimal thermo-characteristics, strength to weight ratios, precision motion, reliability, and material compatibility in space. The development of SSPS took advantage of PolyU's extensive research experience in diverse areas such as precision engineering, mechatronics, materials, design optimization, thermo-modelling, and micro/nano fabrication [R1]. Each stage of the development process was assessed by a CAST panel of experts. The research and engineering teams were led by Prof. YUNG Kai-leung of the Industrial and Systems Engineering Department and manufacturing was provided by the PolyU Industrial Centre.

The selection, automatic collection, and packaging of surface Lunar regolith by a single robotic system on the Moon has no precedent. Its concept formulation can only be started with extensive studies of the Lunar surface conditions, stiffness, cohesion, and particle size distributions. Sample acquisition affecting properties of the Lunar regolith such as electro-static force, inter granular locking force, and adhesive forces were also investigated and collected from collaborators and conferences. From the in-depth studies of the regolith properties, criteria for the development of the sampling and packaging system were formulated such as deriving the entrance and departure angle of different types of regolith and material requirements for the construction of samplers, container, and packaging system. One of the many important studies utilised the departure energy required to dislodge different types of regolith from the surface of the sampler [R2], necessary to ensure the sample did not become stuck in the sampler.

Studies of the regolith showed that a single sampler cannot cater for all the different types of Lunar regolith. Therefore, the system has included two samplers to cover both loose and sticky regolith types and provide redundancy. Multifunctional engineering techniques were used to optimize the parts for the actuators and the operational sampling and packaging sequence [R3] to keep the device within its mass budget. Research was carried out into the use of vibration and impact to dislodge debris during sampling and the precise deposition of samples into the container of the packaging system.

A hardware thermo-model was built to study heat flow across the device and its thermal capacity to ascertain the thermo-effect at its various interfaces, a critical issue to ensure accuracy and stability. Both passive (outer surfaces of the device casings with different surface treatments to achieve the required absorptivity, emissivity, reflectivity, etc.) and active thermal control (a thermo-electric cooler inside the camera) solutions were integrated to ensure performance at Lunar operating temperatures of up to 130°C [R4]. Research into high stiffness to weight ratio structures and mechanisms was undertaken with special attention towards chemical reactions and tribology in the space environment. Design optimization for high structural rigidity and precise motion was achieved through applying multi-domain-based design optimization strategies [R5, R6]. An advanced image deburring technique was used to develop image stabilization software for the near field cameras to ensure stable imaging despite vibration of the robotic arm.

3. References to Research

[R1] Liu H, Hu H, Yung KL, Xu Y, Zhang XW. Melt Pressure Signature Tracking Using an Adaptive Kalman Filter in Microinjection Molding. Advances in Mechanical Engineering 2013;5:801964. <u>https://doi.org/10.1155/2013/801964</u>.

[R2] Yung KL, Lam CW, Ko SM, Foster JA. The Phobos-Grunt microgravity soil preparation system. Acta Astronautica 2017;141:22–9. <u>https://doi.org/10.1016/j.actaastro.2017.09.026</u>.

[R3] Yung KL, 2021, Regolith Packaging System and Container with Lid, EU Patent EP4105631A1.

[R4] Weiss P, Yung KL, Kömle N, Ko SM, Kaufmann E, Kargl G. Thermal drill sampling system onboard high-velocity impactors for exploring the subsurface of Europa. Advances in Space Research 2011;48:743–54. https://doi.org/10.1016/j.asr.2010.01.015.

[R5] Weiss P, Yung KL. Mission architecture decision support system for robotic lunar exploration. Planetary and Space Science 2009;57:1434–45. <u>https://doi.org/10.1016/j.pss.2009.07.010</u>

[R6] Yung KL, Jiang Z-Z, He N, Ip WH, Huang M. System Dynamics Modeling of Innovation Ecosystem With Two Cases of Space Instruments. IEEE Transactions on Engineering Management 2020:1–10. https://doi.org/10.1109/TEM.2020.3018782.

The project was funded by China Academy of Space Technology and The Hong Kong Polytechnic University to Prof. YUNG Kai-leung to a value of around HK\$90 million for 25 Sep 2014 to 22 Sep 2025.

4. Impact and Benefits

The SSPS was the first instrument to take a sample from the Lunar far-side surface in human history. The system worked flawlessly. It successfully gathered surface samples from the Southern Mare of the Apollo Basin, the first material ever gathered from the far side of the Moon. The Lunar samples returned by the SSPS will have a profound impact on global Lunar research, with potential new discoveries in the field including detailed topological, morphological, petrographic, mineralogical, geological, physical, chemical, mechanical, tribological, and biological properties analysis. This new information reveals more about the history of the Moon, being described by Prof James

Head as a "treasure trove". The sample could include pieces of the Moon's interior, excavated by the giant impact that formed the South Pole – Aitken Basin, which would offer an unprecedented glimpse of the Moon's structure. The sample will also provide insight into why the far-side of the Moon has so few mare compared to the near-side and give clues as to history of the far-side's volcanic history. Further, as the far-side is not protected from deep space by the Earth, the surface may contain materials altered by or captured from the solar wind. The sample will also speed development of practical technologies as the south polar landing site is highly favoured for future long term crewed missions that will greatly benefit from in-situ resource utilisation. The Chang'e-6 samples will provide critical information about what resources are available in the southern polar regolith.

With the success of Chang'e-6, CAST and CNSA, the primary direct beneficiaries of the work, have continued confidence in the capabilities of PolyU to continue our decades long relationship providing reliable and successful spacecraft engineering payloads for signature missions of high impact.

In terms of cultural impact, the successful soft landing and sample return by Chang'e-6 were witnessed by billions on TV worldwide, with unprecedented coverage by hundreds of newspapers, media reports, and websites, both local and global. This has the impact of prestige for our nation and our city and generates significant global engagement with space exploration and science.

The impact of this work is not only that Hong Kong has demonstrated its ability to develop key payloads that successfully return samples from the Moon but also that it can utilize the technology to solve many other engineering and industrial problems on Earth. These included technologies such as Lightweight High Stiffness Structures, Advanced Tribology, High Precision Space Mechanisms and System Miniaturisation. The industrial applications included precision photography, high reliability unmanned aerial vehicles, and rugged terrain robots.

5. References to the Corroboration of Impact and Benefits

Scientific Impact and Sample Value

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- Scientific American <u>https://www.scientificamerican.com/article/china-returns-first-ever-samples-from-the-moons-far-side/</u>
- Yue Z, Gou S, Sun S, Yang W, Chen Y, Wang Y, et al. Geological context of the Chang'e-6 landing area and implications for sample analysis. The Innovation 2024;5:100663. <u>https://doi.org/10.1016/j.xinn.2024.100663</u>.
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- China News Service <u>https://m.chinanews.com/wap/detail/cht/zw/10242263.shtml</u>
- Al Jazeera https://www.aljazeera.com/news/2024/6/25/chinese-probe-returns-from-far-side-of-the-moon
- China Daily https://www.chinadailyhk.com/hk/article/585184
- The Guardian <u>https://www.theguardian.com/world/article/2024/jun/25/chinas-change-6-lunar-probe-returns-world-first-samples-from-far-side-of-the-moon</u>
- BBC <u>https://www.bbc.com/news/articles/c04447venm10</u>
- O Estado de S. Paulo <u>https://www.estadao.com.br/ciencia/uma-sonda-lunar-chinesa-retorna-a-terra-com-as-primeiras-amostras-do-mundo-de-lado-distante-da-lua/</u>
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- Neue Zürcher Zeitung <u>https://www.nzz.ch/wissenschaft/mondmission-change-6-chinas-triumph-im-weltraum-ld.1835296</u>
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Case 2: Intelligent Health Monitoring and Maintenance of Long-span Bridges

1. Summary of the Impact

Long-span bridges suffer from harsh corrosion environments, extreme loads, and operation deterioration. Their safety conditions are critical to the economy in urbanized regions such as Hong Kong, the Greater Bay Area, and beyond. The research team at the Department of Civil and Environmental Engineering (CEE) and Department of Computing (COMP) has developed intelligent health monitoring and maintenance systems for long-span bridges during the past years. In particular, they designed a novel decentralized wireless monitoring system, developed conditional simulation techniques to reconstruct loads and responses of the entire bridge from a small number of sensors, and optimized life-cycle maintenance strategies. The system has been applied to the Tsing Ma Bridge, the world longest Hong Kong-Zhuhai-Macao Bridge (HZMB), the Cross Bay Link, the Hong Kong Polytechnic University (PolyU) Footbridge, among others. The system ensures the safe operation of the bridges and saves the maintenance cost by 30%.

2. Underpinning Research

The recently developed structural health monitoring (SHM) technology aims to enhance structural safety and maintenance by installing a sensor network on the structure, collecting load and response data, and assessing structural conditions in real-time. However, the existing SHM technology is not mature in the following aspects: i) Current SHM systems collect and process sensor data in a data centre, which is inefficient in real-time data processing and condition assessment; ii) A long-span bridge consists of millions of members while the number of sensors is limited. Assessing the condition of the bridge using the data from sparse sensors is challenging; and iii) The current bridge maintenance relies on cumbersome inspection trucks or cranes, resulting in high costs, inefficiency, and inaccuracies.

The research team of CEE and COMP has conducted extensive studies during the past years to address the above challenges through developing intelligent health monitoring and maintenance systems. In particular, they have conducted the following innovative studies.

Regarding data collection and processing, they designed a novel decentralized wireless monitoring system that integrates sensor optimization, 5G communication, and edge computing to improve the system performance in sensor serviceability, data transmission, time synchronization, and data quality control. A new machine learning algorithm– source-free domain adaptation–is developed and embedded into NVIDIA edge computing boards to detect data anomalies in each sensor edge, realizing decentralized data processing. The source-free domain adaptation algorithm can utilize the knowledge learning from other bridges and avoid re-training models for new bridges, enhancing the efficiency and accuracy of the SHM system (Wang et al., 2024). The system has been installed on the HZMB, the world's longest sea-crossing bridge (Figure 1), and Shenzhen Chuangye Bridge. This is the first application of 5G communication and edge computing in bridge health monitoring. The edge computing and sensor optimization techniques have been patented. The developed system integration and AI-based data processing technique are also applied to the Cross Bay Link in Hong Kong in collaboration with China Communication Construction Company Highway Consultants Co. Ltd.

To alleviate the problem of sparse sensors, the team has developed conditional simulation techniques to reconstruct temperature, wind, traffic, and earthquake loads and responses of the entire bridge from a small number of sensors at limited locations. i) A unified global analysis is developed to calculate the temperature distribution and the associated responses of the entire bridge by using the measured air temperature and solar irradiation data (Shan et al., 2023a and 2023b). ii) A wind evolutionary power spectral density model is developed to obtain wind speeds of the entire bridge using measured wind speed data. Flutter and buffeting responses of the bridge can then be calculated (Huang et al., 2022). iii) An equivalent force-based Kalman-type filter technique is developed to estimate the traffic loads and responses of a bridge simultaneously from insufficient observations (Li et al., 2024). iv) The measured seabed motion data are adopted to calculate the nonstationary coherence functions and the evolutionary power spectral density at different locations. The earthquake loads and earthquake-induced vibrations of the bridge are calculated (Lu et al., 2022). The developed conditional simulation technique enables safety condition assessment of the entire bridge, solving the problem of sparse sensors. It has been applied to the HZMB.

The team has developed cutting-edge methodologies for condition prediction and decision-making for optimized bridge maintenance. i) One notable achievement is the development of the multi-attribute utility theory, enabling the comprehensive assessment of bridge condition and performance by considering deterioration and hazard effects simultaneously (Frangopol et al., 2017). ii) The team has created a decision-support framework to determine the most

optimal maintenance strategies by utilizing multi-objective optimization procedures (Lei et al., 2023). iii) Given the complexity of maintaining numerous components of sea-crossing bridges, deep reinforcement learning is employed to efficiently find the global optimal solution (Lai et al., 2024). It further provides lifetime intervention plans to decision-makers, enabling risk-informed decision-making regarding the maintenance of bridges in their service lives, which would reduce the maintenance cost. The developed techniques have already been successfully applied to the HZMB.



Figure 1. (a) Sensor layout of the Qingzhou Bridge on HZMB; (b) Wireless transmission and edge computing.

3. References to Research

The following external research funds have been secured.

- 1) 2020-2022, National Key R&D Program, Integrated Smart Operation and Maintenance Technologies for Hong Kong-Zhuhai-Macao Bridge, RMB 3.76 M.
- 2) 2020-2022, Key R&D Program of Guangdong Province, Intelligent Safety Monitoring and Emergency Control for Large-scale Sea-crossing Transportation Cluster Infrastructure, RMB 2.44 M.
- 3) 2023-2028, RGC-TBS, High-performance Collaborative Edge Computing Enabling Smart City Applications: Framework and Methodologies, HK\$ 50.82 M.
- 4) 2023-2025, Smart Traffic Fund, Digital Twin–based Long-span Bridge Health Monitoring, HK\$ 13.4 M.
- 5) 2023-2025, RGC-ANR, Smart and Flexible Climate Change Adaptation of Coastal Infrastructure (SMACHA), HK\$ 2.45 M.
- 6) 2024-2027, RGC-CRF, Towards Future Climate-resilient Sea-crossing Bridges via Intelligent Learning of Longterm Real Monitoring Data, HK\$ 5.05 M.

4. Impact and Benefits

The developed technologies have been applied to the HZMB, Shenzhen Chuangye Bridge, Cross Bay Link in Hong Kong, and PolyU Footbridge. These new SHM systems are more efficient and effective in data processing and condition assessment of large-scale bridges, thus protecting the infrastructure assets and enhancing transport efficiency. These applications showcase the practicality and effectiveness of the team's innovative research in real-world scenarios.

The maintenance cost of infrastructure is enormous and increases as the bridge ages. In the medium term, the optimized maintenance strategies will reduce the maintenance expense of infrastructure.

The team has developed a series of *Greater Bay Area Standards on Data for Intelligent Operation and Maintenance of Bridge-island-tunnel Crossings*. The standards regulate the monitoring and maintenance of bridges, benefiting the construction industry in the long term.

5. References to the Corroboration of Impact and Benefits

<u>Awards</u>

1) State Technological Innovation Award, 2nd Class, State Council, China, 2018. "Safety Assessment and Precise Local Damage Detection Technologies for Long-span Bridges".

- Science and Technology Award, 1st Class, Chinese Society for Vibration Engineering, 2023, "Machine Learning Methods for Structural Health Diagnosis and Operation Maintenance of Bridges".
- 3) Technological Progress Award, 1st Class, Hubei Provincial Science and Technological Award, 2023.

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- 2) Shan, Y. S., Li, L. F., Xia Q., Gao, W. B., Jing, Q. and Xia, Y., (2023a), "Temperature behavior of cable-stayed bridges. Part I global 3D temperature distribution by integrating heat-transfer analysis and field monitoring data", *Advances in Structural Engineering*, 26 (9), 1579-1599.
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- 5) Li, Y. X., Shan, Y.S., Sun, L. M. and Xia, Y., (2024), "Equivalent force-based Kalman-type filter and reduced system function for full-field response reconstruction", *Mechanical Systems and Signal Processing*, submitted.
- 6) Lu J, Hu L, Xia Z and Zhu S, (2022), "Conditional simulation of non-stationary spatially variable ground motions for long-span bridges across non-uniform site conditions", *Advances in Bridge Engineering*. 3:8.
- 7) Frangopol, D.M., Dong, Y., and Sabatino, S. (2017), "Bridge life-cycle performance and cost: Analysis, prediction, optimization and decision making", *Structure and Infrastructure Engineering*, 13 (10), 1239-1257.
- 8) Lei, X.M., Dong, Y., and Frangopol, D.M. (2023), "Sustainable life-cycle maintenance policy-making for network-level deteriorating bridges with convolutional autoencoder-structured reinforcement learning agent", *Journal of Bridge Engineering*, 28 (9).
- 9) Lai, L., Dong, Y., Andriotis, C.P., Wang, A., & Lei, X. (2024), "Synergetic-informed deep reinforcement learning for sustainable management of transportation networks with large action spaces". *Automation in Construction*, 160, 105302.

<u>Standards</u>

- 1) Guangdong-Hong Kong-Macao Greater Bay Area Standards, 2021, Data standard system for intelligent operation and maintenance of bridge-island-tunnel crossings Guidelines on the establishment of standards, T/GBAS 0001–2021.
- 2) Guangdong-Hong Kong-Macao Greater Bay Area Standards, 2021, *Data standard system for intelligent operation and maintenance of bridge-island-tunnel crossings General rules for data expression*, T/GBAS 0002–2021.
- 3) Guangdong-Hong Kong-Macao Greater Bay Area Standards, 2021, Data for intelligent operation and maintenance of bridge-island-tunnel crossings Bridge structures, T/GBAS 0003–2021.

Case 3: Securing the Future of Blockchain through Enhanced Security and Privacy

1. Summary of the Impact

The rapid development of blockchain technologies and their adoptions in various domains is widely regarded as the new driving force of the digital economy. It has also introduced a series of new challenges in security and privacy, primarily due to the decentralised and open nature of blockchain which render classical measures ineffective or inapplicable.

Prof. Allen AU Man-ho and Prof. Daniel LUO Xiapu from the Department of Computing together developed new algorithms and mechanisms to protect the assets, system, and network security of the blockchain ecosystem, providing cryptographic foundations for blockchain technology and promoting the development of financial technology applications built on blockchain platforms.

Their work has been acknowledged with various highly prestigious prizes, including the BOCHK Science and Technology Innovation Prize (Fintech) in 2023, ZPRIZE 2022 and ZPRIZE 2023, and numerous bug bounties from companies like Google, Samsung, Arbitrum, Polygon, etc.

• Underpinning Research

Security research is inherently a multifaceted research problem: the system is as secure as its weakest component. As such, Prof. AU and Prof. LUO's research take a comprehensive approach that addresses both algorithmic and systemlevel vulnerabilities. Their research, therefore, led to advancements in both cryptographic foundations and blockchain ecosystem security.

Cryptographic Foundation

Various cryptographic algorithms are used to protects users' digital identity, digital asset and is regulate how the set of decentralized blockchain nodes express agreement on ledger. The team developed new cryptographic algorithms with better efficiency and security. Their research is highlighted as follows:

- Zero-Knowledge Proofs (ZKP). ZKP is a cryptographic tool hide user identity and transaction data while still allowing them to be checked quickly. Existing ZKP are, however, notoriously expensive to compute. The team made several important contributions to ZKP. Firstly, they designed distributed computing techniques for ZKP and significant speedup proof computation by distributed computing and GPU. Their result won ZPRIZE with a cash award of 550K USD. Secondly, they reduced the cost of a particular application of ZKP, namely, ECDSA verification, by 8-fold. With this, they won ZPRIZE (sharing the prize with the team from Chinese Academy of Sciences) again in 2023 and a cash award of 250K USD. Thirdly, they also proposed an efficient ZKP with higher level of security, namely, security against attacker with access to the powerful quantum computers.
- <u>Threshold Cryptography</u>. To address single-point-of-failure, we investigate threshold cryptography which aims to distribute cryptographic keys and operations among multiple machines. The core idea is the store parts of the secret key in separate server in a way that the cryptographic operation can be completed without combining these parts. The team designed very efficient ways to conduct threshold key generation and signing for the standard signature scheme used in major blockchains. Based on this result, the team's PhD student developed a wallet system that received the Merit Award at the Financial Cryptography Competition organised by The People's Bank of China and Tsinghua University.

Blockchain Ecosystem Security

The team's research enhances the security of the ecosystem from user frontend to smart contracts and blockchain infrastructure. Their research is highlighted as follows:

• <u>Unmasking Vulnerabilities.</u> They are the first to uncover many vulnerabilities and exploits, and their seminal work on characterizing Ethereum received the Best Paper Award from INFOCOM'18, a premier conference on networking and their innovative research on the security of mobile frontends resulted in two ACM SIGSOFT Distinguished Paper Awards from ISSTA'22 and ICSE'21, two premier conferences on software engineering. The

team identified several critical vulnerabilities in both layer-1 blockchain and layer-2 systems and received bug bounty of more than 500K USD. They developed powerful tools to facilitate the security assessment of smart contracts for blockchain platforms (e.g., Ethereum, EOS, Algorand) running popular runtimes (e.g., EVM, WASM, AVM). Notably, they presented the first work on defining and detecting the vulnerabilities in Algorand smart contracts, reporting that 24.75% of its smart contracts have at least one vulnerability. They revealed severe vulnerabilities in Android system and Android apps, which have been confirmed and acknowledged by companies like Google, Samsung, Xiaomi, Vivo, Oppo, etc. with bug bounty and the app developers.

• <u>Defending Against Attacks.</u> Their work also aims to defend against attacks. They revealed various attacks on blockchain via transaction analysis. They are the first to reveal various MEV activities conducted through Flashbots by adversaries to make profit. They developed tools that detected 7,472 inconsistent ERC-20 Tokens that can conduct malicious activities, e.g., cheat users, etc. Also, they designed a novel generic online detection framework (SODA) for smart contracts and developed many new approaches and practical tools to detect and dissect mobile malware.

2. References to Research

- 2024 2025 Zero-Knowledge Proof Based Identity and Data Trustworthiness. Funded by Huawei International Pte. Ltd. HKD 2,343,391. PI: Allen
- 2023-2025 PolyU and Cybaverse Academy Joint Lab in Law and Web3, 2023 2025. Funded by Cyberverse Academy. HKD 6,000,000. PI: Allen
- 2023 2028 Algorand Centre of Excellence on Sustainability Informatics for the Pacific. Funded by Algorand Centre of Excellence. AUD 2,590,000 (PolyU's share), co-I: Allen, Daniel
- 2024 2026 Boosting the Security of Blockchain DApps by Speeding Up Vulnerability Discovery and Defending Against Stealthy Attacks, RGC GRF. HKD 1,228,619. PI: Daniel
- 2022 2024 Security Analysis of Cross-Platform Blockchain DApps and its Applications, RGC GRF. HKD 1,093,580. PI: Daniel
- 2022 2024. New Frontiers of Lattice-Based Cryptography, RGC GRF. HKD 677,841. PI: Allen
- 2021 2023 Hardening Blockchains Against DoS Attacks Exploiting Gas Mechanism, RGC GRF. HKD 501,957.
 PI: Daniel
- 2021 2023. Practical Post-Quantum Zero-Knowledge Proof, RGC GRF. HKD 702,915. PI: Allen

3. Impact and Benefits

The impact and contributions are demonstrated by the increasing collaboration with, and impressive funding support from the government and industry, and also witnessed by the high amount of cash award received as well as the further development and adoption of the proposed algorithms and tools.

- Over the past 5 years, Prof. AU has secured over HK 30 million in external grants, and Prof. LUO has secured over HK 20 million in external grants
- Prof. AU and Prof. LUO together won the prestigious BOCHK Science and Technology Innovation Prize (FinTech) in 2023 which comes with cash prize of 2 million HKD
- Prof. AU's work in ZKP won ZPRIZE twice, and received cash awards of 800K USD in total
- Prof. LUO's work in vulnerability detection helped identified a number of critical bugs in blockchains, and received over 500K USD of bug bounty
- Both Prof. AU and Prof. LUO were invited as founding members of the HKMA's Central Bank Digital Currency Expert Group



Figure 1. Prof. Allen AU and Prof. Daniel LUO received the BOCHK Science and Technology Innovation Prize (Fintech) in 2023



Figure 2. (right to left) Dr Xingye LU, Phd Candidate Mengling LIU, PhD Candidate Yang HENG and Prof. Allen AU won ZPRIZE again in 2023

4. References to the Corroboration of Impact and Benefits

Publications

- Rupeng Yang, Man Ho Au, Zhenfei Zhang, Qiuliang Xu, Zuoxia Yu and William Whyte, "Efficient Lattice-Based Zero-Knowledge Arguments with Standard Soundness: Construction and Applications", Advances in Cryptology -CRYPTO 2019 - 39th Annual International Cryptology Conference, Santa Barbara, CA, USA, August 2019
- Haiyang Xue, Man Ho Au, Mengling Liu, Kwan Yin Chan, Handong Cui, Xiang Xie, Tsz Hon Yuen and Chengru Zhang, "Efficient Multiplicative-to-Additive Function from Joye-Libert Cryptosystem and Its Application to Threshold ECDSA", Proceedings of the 30th ACM Conference on Computer and Communications Security (CCS), Copenhagen, Denmark, November 2023
- Zhiyuan Sun, Xiapu Luo, Yinqian Zhang, "Panda: Security Analysis of Algorand Smart Contracts", Proceedings of the 32nd USENIX Security Symposium (USENIX SEC), Anaheim, USA, August 2023
- Zihao Li, Jianfeng Li, Zheyuan He, Xiapu Luo, Ting Wang, Xiaoze Ni, Wenwu Yang, Xi Chen, Ting Chen, "Demystifying DeFi MEV Activities in Flashbots Bundle", Proceedings of the 30th ACM Conference on Computer and Communications Security (CCS), Copenhagen, Denmark, November 2023

Media coverage

Press release (23 May 2024) <u>https://www.polyu.edu.hk/media/media-releases/2024/0523_polyu-wins-zprize-2023-for-blockchain-innovation-again/</u>

Press release (17 May 2023) <u>https://www.polyu.edu.hk/media/media-releases/2023/0517 polyu-scholars-win-zprize-for-ground-breaking-web3-technology/</u>

Press release (07 Nov 2023) <u>https://www.polyu.edu.hk/media/media-releases/2023/1107_three-polyu-scholars-seize-bochk-science-and-technology-innovation-prize-202/</u>

紫荊網 - https://zijing.com.cn/article/2024-05/31/content 1246125660596129792.html

紫荊網 - <u>https://bau.com.hk/article/2023-05/17/content_1108405925281931264.html</u>

信報 - <u>https://www1.hkej.com/dailynews/finnews/article/3459230/</u>

京港學術交流中心 - <u>https://www.bhkaec.org.hk/a/131851-cht</u>

https://www.miragenews.com/polyu-backs-hkmas-project-ensemble-central-bank-1197919/

星島頭條- <u>https://www.stheadline.com/edu-news/3327303/</u>金管局推數碼貨幣項目 <u>Ensemble-理大專家參與研</u> <u>究私隱安全-推動數碼金融發展</u>

TVB - https://polyu.me/3plotQe

RTHK - https://www.rthk.hk/tv/dtt32/programme/hkunited/episode/897603

Case 4: Improving Air Quality through Cutting-edge Research on Ozone and Particulates

1. Summary of the Impact

The Air Research Team from the Department of Civil and Environmental Engineering of PolyU investigated local and regional pollution, especially photochemical (ozone) pollution. By demonstrating the impact of long-range transport to Hong Kong's ozone pollution, their research provided key data to support the expansion of Hong Kong Government's air- quality monitoring network. Their computer models have been used in multiple cities across China in developing ozone mitigation strategy by determining the key factors that controlled ozone pollution. The research outcomes were adopted by the Hong Kong Government for developing a regional strategy with Guangdong and supported mainland governments in mitigating summertime ozone pollution since 2020. Their technology was used to remove vehicle-emitted air pollutants at roadside of Hong Kong.

2. Underpinning Research

In the early 1990s Prof. WANG and his colleagues established a background atmospheric monitoring station in Hong Kong, the first of its kind in South China. With the aid of back trajectories, satellite data, and chemistry transport models, they demonstrated that the increasing ambient O3 concentrations in Hong Kong were substantially contributed by long-range transport from mainland China in the early years and more recently from Southeast Asia. These results suggest necessity to consider outside contribution to Hong Kong's ozone pollution [1,2].



Figure 1. Surface ozone trend in four types of air mass at PolyU Hok Tsui Background Air Monitoring Station during 1994–2018. (a) Spatial distribution of four types of 10-day hourly backward trajectories arriving at Hong Kong: East China (blue), Aged continental (red), Central China + PRD (yellow), and Marine (green).

Prof. WANG Tao and Prof. GUO Hai developed observation and emission-based models and applied them in Hong Kong and other cities of China to determine the key precursors (NOx or VOC species) that control ozone production in these cities. In particular, the observation-based model, that is, using the observed ambient concentrations of chemical and meteorological parameters to constrain chemical model to quantify the response of ozone to each precursor, is a quick and effective tool for analysing the observation data to gain insight into local ozone chemistry [3].

Prof. WANG investigated ozone responses to the emission reductions resulting from the implementation of China's Air Pollution Prevention and Action Plan (The Action Plan). By analysing data from national environmental monitoring network with statistical and chemical transport models, they show that while there were significant declines in ambient concentrations of primary pollutants after the Action Plan, ozone levels in many urban areas have risen. They quantified the impact of meteorological and emission changes on the O3 levels, indicating that the particulatetargeting measures increased ozone due to reduced NOx titration and increased solar radiation and reduced uptake of radicals by particulates. VOC control would have avoided the side effect of the PM control on ozone [4].



Figure 2. Rates of changes in the simulated (a) and observed (b) surface MDA8 O3 mixing ratios in summer from 2013 to 2017. (c) and (d) present the rates of changes in the simulated MDA8 O3 mixing ratios due to variations in meteorological conditions and anthropogenic emissions in summer from 2013 to 2017.





With increased numbers of registered vehicles and the ageing of old vehicles, roadside air pollution, especially NO₂ pollution, is a major air quality challenge in Hong Kong. In collaboration with Highways Department and Environmental Protection Department, Prof. Shun-cheng Lee explored the possibility of applying their self-developed streetlamp-type air cleaning systems for improving air quality at sidewalks. Seven units of self-developed active air purifying systems



Prof. LI Xiangdong and Dr LING Jin identified a globally important but overlooked issue, i.e., people exposed to similar mass concentrations of PM2.5 have different health consequences. To tackle this neglected issue and to improve current regulation of PM2.5, they developed a novel mixture-toxicity modeling approach to quantify the toxicity contribution of components to the combined effects of PM2.5. They found the unequal toxicity of inhalable PM emitted from energy use in the residential sector and coal-fired power plants (CFPPs). The incomplete burning of solid fuels in household stoves generates much higher concentrations of carbonaceous matter, resulting in more than one order of magnitude greater toxicity than that from CFPPs. They suggest that PM2.5-related toxicity should be considered when making air pollution emission control strategies, and incomplete combustion sources should receive more policy attention [6].



Figure 5. Different emission rates and health impact from soil fuel consumption from residential household coal (HC) and biomass (HB) and coal fired power plants (CFPP). (a) PM2.5 emissions (b) and PM2.5-related toxic potency-adjusted emissions (c) conbributed from the residential sector and CFPPs.

3. References to Research

- [1]. Wang, T.*, Dai, J. N., Lam, K. S., Nan Poon, C., and Brasseur, G. P.: Twenty-five years of lower tropospheric ozone observations in tropical East Asia: The influence of emissions and weather patterns, *Geophysical Research Letters*, 46, 11463-11470, 10.1029/2019gl084459, 2019.
- [2]. Xue, L., Wang, T., Louie, P.K., Luk, C.W., Blake, D.R. and Xu, Z.: Increasing external effects negate local efforts to control ozone air pollution: a case study of Hong Kong and implications for other Chinese cities, *Environ. Sci. & Tech.*, DOI: 10.1021/es503278g, 2014.
- [3]. Xue, L. K. *, T. Wang*, J. Gao, A. J. Ding, X. H. Zhou, D. R. Blake, X. F. Wang, S. M. Saunders, S. J. Fan, H. C. Zuo, Q. Z. Zhang, and W. X. Wang. "Ground-level ozone in four Chinese cities: Precursors, regional transport and heterogeneous processes." *Atmospheric Chemistry and Physics*, 14, no. 23 (2014): 13175-88. http://dx.doi.org/10.5194/acp-14-13175-2014.
- [4]. Liu, Y. M. and Wang, T.*: Worsening urban ozone pollution in China from 2013 to 2017-Part 2: The effects of emission changes and implications for multi-pollutant control, *Atmospheric Chemistry and Physics*, 20, 6323-6337, 10.5194/acp-20-6323-2020, 2020.
- [5]. Xinwei Li, Shuwen Han, Pengge Wang, Han Mei, Zhi Ning, Fan Dong, Long Cui, Yu Huang, Tao Wang, Shao-Yuan Leu, Meng Wang, Shun-cheng Lee, "Application of roadside air purifiers in urban street canyons: A pilot-scale study in Hong Kong". *Science of Total Environment*, 912, 168671, 2024.
- [6]. Wu, D., Zheng, H. T., Li, Q.*, Jin, L., Lyu, R., Ding, X., Huo, Y. Q., Zhao, B., Jiang, J. K., Chen, J. M., Li, X.D.*, Wang, S.X.* Toxic potency-adjusted control of air pollution for solid fuel combustion. *Nature Energy*, 2022, 9, 345–350.

4. Impact and Benefits

Elevated ambient ozone concentrations impair human health and vegetation and also contribute to global warming. Ozone pollution has received growing concerns from Hong Kong and mainland governments because of the rising ozone concentrations in many urban areas (including Hong Kong) despite significant improvements in sulfur, nitrogen and particulate pollution. Ozone pollution in a city is not only produced by the ozone precursors emitted in that city but is transported from outside the city. Thus, mitigating the ozone pollution in the city requires reducing local ozone production by reducing anthropogenic emissions of NOx, VOCs, or both within that city and decreasing outside contributions. Both are challenging as former is complicated by the non-linear dependence of ozone to its precursors, and the latter requires knowledge of background ozone and regional cooperation. The team's systematic monitoring and analysis of ozone and precursors have aided the governments in understanding the problem and developing control strategy, as detailed below.

The PolyU background monitoring work has yielded invaluable information on the trend of background ozone air quality in southern China. The station's data was previously been used by the United Nation's IPCC reports, and the station was used by the Hong Kong Environmental Protection Department (HKEPD) in a number of local air quality projects. Recently, the team used the data from 2013-2019 in a study commissioned by the Hong Kong Environmental Protection Department (HKEPD) for studying tropospheric ozone trend and its impact on ozone in Hong Kong. The data reveals the ozone concentrations in the background air transported from mainland China has stabilized whereas the contribution from Southeast Asia has increased in the recent decade, indicating shifting challenge in managing background ozone. The importance of the background air monitoring provided key data supporting the HKEPD to establish the Cape D'Aguilar Supersite Air Quality Monitoring Station near PolyU's, and the results helped HKEPD to develop joint pollution control plan with Guangdong province.

To mitigate the ozone problem, Hong Kong and many other cities embarked monitoring of ozone precursors along with ozone in recent years. The team's observation-based model was used to analyse the data in Hong Kong and more than 10 other cities to identify the ozone formation regimes and key precursor species (such as alkenes and aromatics) in ozone formation, and the results allowed the city's air quality managers in assessing and refining evidence-based control measures in these cities, leading to improved ozone pollution in some cities since 2020. The impact of this work won an Environment Protection Science and Technology Award from the Ministry of Ecology and Environment of China.

After the implementation of the Air Pollution Prevention and Action Plan (2013-2017), the ambient concentrations of most of air pollutants have decreased, however, the ozone levels have increased. It is of critical importance for the

governments to find out the reasons and to refine the control measures. The team's research suggested that (1) the rising ozone concentrations in urban areas were caused by the large reductions of NOx, SO2 and primary particulate matters, and concurrent reductions of VOCs would have counteracted or overcome the dis-benefits of NOx and PM control on ozone and (2) weather changes need to be considered when evaluating the year-to-year variation of air quality. Their research also demonstrated similar complex responses of ozone to the huge emissions during city lockdown for containment of Covid-19 virus in 2020 and 2022. The increasing ozone levels in winter could worsen the winter haze – a serious problem in north China, suggesting need to control ozone not only in summer but also in winter. They conveyed their findings to the National Center for Joint Air Pollution Control under the Ministry of Ecology and Environment, and their methodology and findings have been adopted in the recent campaigns to control summer ozone pollution in China, which has led to decreasing ozone concentrations in many cities.

The pilot tests of the roadside air cleaning systems demonstrated its capability in reducing roadside pollution, and further application of this system in air pollution-affected semi-confined public places such as public transportation interchanges was supported (HK\$5,561,400) by the Green Tech Fund set up by the Hong Kong Government. The HKEPD plans to use the technology in other heavily traffic roads in the city.

5. References to the Corroboration of Impact and Benefits

- The Environmental Protection Science and Technology Award (2nd class) for "Development of explicit atmospheric chemical box model and its applications in secondary air pollution control", Ministry of Ecology and Environment of China. The award is based on the early development of observation-based model and later applications in the mainland for developing ozone control measures. The model has been applied to more than 10 cities across China.
- Letter from the Deputy Director of National Center for Joint Pollution Control (established by the Ministry of Ecology and Environment) to acknowledge the contributions of the team's research on ozone and coal burning to the evaluation and development of air pollution policy in mainland China.
- Letter from Principal Assistant Secretary of the HKSAR Government's Ecology and Environment Bureau to acknowledge their research impact on air pollution monitoring, regional control strategy development, and the design of a large three-year ozone study commissioned by the Hong Kong Environmental Protection Department (HKEPD).
- Letter from a Principal Environmental Protection Officer from the HKEPD to acknowledge the impact of their research on mitigation of roadside air pollution.
- Letter from Whuan City Environment and Ecology Bureau to acknowledge the advice on control of ship VOCs emissions for reducing ozone pollution.
- Bluebook on Atmospheric Ozone Pollution Prevention and Control in China (2023) published by the Ozone
 Pollution Control Professional Committee of China Environmental Science Society which adopts two figures
 of their two publications to show the non-linear response of ambient ozone concentrations to emission
 reductions during Covid-19 Pandemic in 2020 and 2022. (The Bluebook is used by national, provincial and
 city environmental officials, environmental consultants, as well as academics).
- Letter from the Ozone Pollution Control Professional Committee to acknowledge their contribution to the writing and adoption of their research result of the Bluebook on Atmospheric Ozone Pollution Prevention and Control in China (2020).
- Letter from a major Chinese home appliances company (Gree) acknowledging joint development of air purifiers for indoor air.
- Their research was cited in the UK Environment Agency's Review on Airborne Antimicrobial Resistance (2020).

Appendix 4: PolyU InnoHub / Entrepreneurship Activities

Date	Event	Partnering Organisation(s)
4 Jul 2023	Health Future Challenge 2023 Briefing Session	
20 Jul 2023	Health Future Challenge 2023 Roadshow	
28 - 29 Jul 2023	Health Future Challenge 2023 Ideation Gala	Thermo Fisher Scientific, Chinachem Group, Medicom
7 Aug 2023	Innohub 2023-24 Welcome Party	
9 Aug 2023	Start-up's Guide: Streamlining E-commerce Fulfillment for a Seamless Customer Experience	
25 Aug 2023	Entrepreneurship Society Event - Practical workshop for start-ups: Accounting, Payroll, and Compliance Essentials	
30 Aug 2023	Orientation Showcase 2023	
5 Sep 2023	Start-up's Guide: IP Strategy for Sustained Business Competitiveness	
7 Sep 2023	MBA Orientation Workshop 2023	
18 Sep 2023	Google Developer Student Club - Road Show	
19 Sep 2023	POC Funding Scheme 2023 Cohort 2 - Road Show	
20 Sep 2023	POC Funding Scheme 2023 Cohort 2 - Briefing Session	
9 Oct 2023	Practical Workshop for Start-ups: Accounting, Payroll, and Compliance Essentials	
12 Oct 2023	Micro Fund 2023-24 Cohort 1 - Briefing Session	
14 Oct 2023	Google Developer Student Club - AI/ML Symposium 2023: From Theory to Impact	
20 Oct 2023	Angel Fund Scheme 2023-24 - Briefing Session	
21 Oct 2023	POC Funding Scheme 2023 Cohort 2 Bootcamp	
25 Oct 2023	Micro Fund 2023-24 Cohort 1 - Road Show	
25 Oct 2023	Angel Fund Scheme 2023-24 - Road Show	
27 Oct 2023	Google Developer Student Club - Google Mingle	
1 Nov 2023	Micro Fund 2023-24 Cohort 1 - Briefing Session II	
9 Nov 2023	South Asian Society X Google Developer Student Club Industry Talk	
15 Nov 2023	HKAI Lab X Entrepreneurship Society - AI-powered Futures: Unlocking Entrepreneurship and Career Paths	HKAI Lab
21 Nov 2023	Google Developer Student Club workshop: Make Your Own Chat Bot!	
5 - 8 Dec 2023	Micro Fund 2023-24 Cohort 1 - Elevator Pitch	
8 Dec 2023	Social Innovation Regional Forum 2023	
21 Dec 2023	Hong Kong Techathon+ 2024 workshop - Start-Up Boat Game: A	
	Practical Guide to Writing Business Proposals	
27 Dec 2023	International Student Association x Google Developer Student Club Christmas Networking	
2 - 19 Jan 2024	InnoX Winter Camp 2024	Hong Kong X Foundation
5, 15, 22, 29	Micro Fund 2023-24 Cohort 1 - Lean Launchpad Programme Briefing &	
17 Jan 2024	College of Undergraduate Researchers and Innovators (CURI) Orientation Day Sharing	

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Date	Event	Partnering Organisation(s)
26 - 28 Jan 2024	Hong Kong Techathon 2024+	Hong Kong Science & Technology Parks Corporation
29 Jan 2024	HKPC Recycling Fund Seminar	Hong Kong Productivity Council
2 Feb 2024	Google Solution Challenge 2024	
19 Feb 2024	IP sharing to Biomedical Engineering UG students	
21 Feb 2024	IP sharing to CURI	
21 - 22 Feb 2024	Innovation & Entrepreneurship Fair	
22 Feb 2024	Micro Fund 2023-24 Cohort 2 - Briefing Session I	
28 Feb 2024	Google Developer Student Club workshop: Build and Boost Your Online Presence	
4 Mar 2024	Micro Fund 2023-24 Cohort 2 - Class Visit	
4 Mar 2024	10th Hong Kong University Student Competition - Briefing session	
6 Mar – 17 Apr 2024	Knowledge Transfer Briefing for students in different majors	
19 - 22 Mar 2024	Career Fair 2024	
20 Mar 2024	Micro Fund 2023-24 Cohort 2 - Briefing Session II	
20 Mar 2024	Google Developer Student Club workshop: SEO 101 For Getting Your Website to Page 1 workshop	
25 Mar 2024	PolyU Innohub X HKAI Lab: AI-powered Futures: Unlocking Entrepreneurship and Career Paths	HKAI Lab
27 Mar 2024	Micro Fund 2023-24 Cohort 2 - Roadshow	
1 - 8 April 2024	'X + Innovation and Entrepreneurship' Programme Info Booth	
3 Apr 2024	PolyU x China Prosperity Capital: Innovation & Investment Connect	China Prosperity Capital
9 Apr 2024	Google Developer Student Club workshop: JobSights	
16 May 2024	[Unicorn x Industry] Industry Disruptors' Fireside Chat - Transforming Traditional Consumer Industries	
27 May 2024	Seminar on Government Funding Scheme	Hong Kong Productivity Council
7, 17, 24 June, 2, 8 July 2024	Micro Fund 2023-24 Cohort 2 - Lean Launchpad Programme Orientation & Training	

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Appendix 5: Awards Won by PolyU Teams / Start-ups

Name of Competition / Award	No. of
(by alphabetical order)	Awards
B4B Challenge 2023-24 Award	1
Best SME's Awards 2024	1
Climate Action Recognition Scheme	1
Cyberport University Partnership Programme	4
Esri Young Scholar Award 2024	2
Falling Wall Science Summit 2023	1
Fintech Awards 2023	1
Forbes 30 Under 30 Asia list 2024	2
Forbes Asia 100 To Watch 2023	3
Green PropTech Innovator Challenges	1
Guangdong-Hong Kong-Macao Greater Bay Area High-value Patent Portfolio Layout Competition 2023	1
HK Techathon+ 2024	11
HKTDC X Hang Seng Bank InnoClub Award	1
Hong Kong ICT Awards 2023	5
Hong Kong Value Creation for Technology 2024	1
i-CREATe 2023	1
James Dyson Award	1
JUMPSTARTER 2023 Global Pitch Competition	1
MIT Urban Tech Week 2023 Final Showcase	2
Qianhai-Guangdong-Hong Kong-Macao-Taiwan Youth Innovation and	2
Entrepreneurship Competition 2023 (HONG KONG DIVISION)	
Start-up Express 2024	1
The 10th Hong Kong University Student Innovation and Entrepreneurship Competition	19
The 3rd Asia Exhibition of Innovations and Inventions Hong Kong	8
The 49th International Exhibition of Inventions Geneva	26
The 6th Hong Kong Value Creation for Technology Pitching Competition	1
The 9 th Hong Kong University Student Innovation and Entrepreneurship Competition	12
Young Techpreneur Project 2023-24	3
第十八屆"挑戰盃"全國大學生課外學術科技作品競賽 (Chinese Name only)	2
第十屆「創青春」粵港澳大灣區青年創新創業大賽決賽(Chinese Name only)	3
第十屆中國國際「互聯網 + 」大學生創新創業大賽 (Chinese Name only)	5
Total	123

Thanks.

Appendix 6: Marketing, Networking and Engagement Activities

Date	Event	Photo
Jul 2023	PolyU-Harbin Institute of TechnologyEstablish Research Collaboration andStudent ExchangePolyU and Harbin Institute of Technology(HIT) signed an MoU to establish an in-depthinstitutional platform for student exchangeand research collaboration in bioinformatics,chemical engineering, and artificialintelligence. Both institutions consented tojointly explore frontier scientific fields,further promote the exchanges betweenprofessors and students, and thedevelopment of industry-university-researchcollaboration to cultivate outstandingtalents, promote scientific andtechnological progress, and promote socialdevelopment.	
Jul 2023	PolyU and NVIDIA co-organised the 1st Asia Pacific Art and Culture Technology forum PolyU and NVIDIA have agreed to jointly establish the research centre on culture and art technology and co-organised the 1st Asia Pacific Art and Culture Technology forum. The research centre serves as an international interdisciplinary collaborative platform connecting researchers and practitioners from various disciplines. The forum attracted around 100 attendees, including senior management and top representatives from Invest HK, the British Consulate-General, Adobe, Moleskine, NVIDIA, Unity, Tencent Games Lightspeed Studios. etc.	
Jul 2023	AiDLab entered a licensing agreement with Caritas-Hong Kong Services AiDLab entered a licensing agreement with Caritas-Hong Kong Services for the Elderly (the licensee) on 20 July 2023 for the application of intelligent illuminative textiles technology.	Cigning Ceremony of License Agreement

Jul 2023	Partnership with Human Resources and Social Security Bureau of Shenzhen Municipality PolyU and the Human Resources and Social Security Bureau of Shenzhen Municipality signed an MoU and unveiled the plaque of the "Hong Kong-Macao Youth Innovation and Entrepreneurial Base (The Hong Kong Polytechnic University)". The two parties will closely collaborate on multiple initiatives related to innovation and entrepreneurship, employment facilitation, and high-end innovative talent development. The partnership will greatly enhance the integration of resources and the translation of research outcomes in Shenzhen and Hong Kong, and promote in-depth exchanges and cooperation between the youth of the two cities.	 Intervence Intervence
Jul 2023 – Jun 2024	Partnership with EMSD PolyU is in long-term collaboration with the Electrical and Mechanical Services Department (EMSD), HKSAR, to promote innovation and technology (I&T) by showcasing PolyU start-ups at their signature events, such as E&M I&T Day 2023 and Green I&T Day, as well as in the E&M InnoZone at the EMSD Headquarters. The collaboration effectively raised awareness of the strengths of these start-ups in providing innovative I&T solutions in the areas of sustainable construction, eco-friendly technologies and green materials.	
Jul 2023 – Jun 2024	Industry Engagement via CEO Club To promote the translation of PolyU research into impact through knowledge transfer and commercialisation, the CEO PolyVentures Series of seminars provided an excellent platform for in-depth exchange between PolyU start-ups and our industry partners. The speakers from PolyU start-ups presented their innovations in sought- after areas such as blockchains and robotics to the audience from different industries, while the greatly inspired audience actively explored collaboration opportunities with the speakers. Meanwhile, visits to PolyU's Industrial Centre and Design Show were arranged to deepen our industry partners' understanding of PolyU's research and innovation capabilities.	

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Jul	Visits by Industry Delegations in Hong Kong	
2023 – Jun 2024	Delegations from prestigious industry associations, including the Federation of Hong Kong Industries (FHKI), Hong Kong Federation of Innovative Technologies and Manufacturing Industries (FITMI) and The Hong Kong Electronic Industries Association (HKEIA), paid exchange visits to PolyU. Greeted by the University's Senior Management and research teams, the delegates were highly impressed by PolyU's exceptional innovations and cutting-edge research facilities, as well as the innovative products of PolyU start-ups. The visits significantly strengthened the mutual understanding between PolyU and different industrial sectors, paving the way for future cooperation on knowledge transfer.	
Aug	CEVR signed an MoU with Aier Eye Hospital	前20号指党山人 附 带用0 封禁险电面
2025	CEVR signed an MoU with Aier Eye Hospital Group Co., Ltd. (Aier) on 14 August 2023 to strengthen the strategic collaboration between CEVR and Aier in accelerating translational vision research from laboratory discoveries to impactful commercial applications.	Control of the International Control of the Control of Contro
Aug 2023	PolyU-Guangming District Government, MoU Signing	
	PolyU signed an MoU with the Guangming District Government, Shenzhen for the establishment of the PolyU-Shenzhen Industrial Technology and Innovation Research Institute, strengthening and facilitating the exchange of pedagogy, technology and talent between Hong Kong and Shenzhen. The collaboration encourages and assists young faculty and alumni from PolyU to start businesses in Guangming District, while establishing a sustainable development base for technological innovation and entrepreneurship. It also aims to cultivate future industry leaders, making substantive contributions to the construction of a high-level talent aggregation area in the Greater Bay Area.	光明区人民政府 香港理工大学 合作各忘录签约仪式

Participation of

Aug	PolyImpact Unicorn X Industry Series	() La Davier
2023 May 2024	A new series called "PolyImpact: Unicorn x Industry" was launched to prepare I&T talents and start-ups for their entrepreneurial endeavours, providing valuable opportunities for them to interact with and learn the secrets of success from unicorns and industry leaders. Two episodes, in the form of a forum or a fireside chat, focused on the logistics industry and the transformation of traditional industries respectively. The audiences had an excellent chance to gain hints and tips from a co- founder of PolyU unicorn GoGoX, and esteemed speakers from industry leaders / innovators such as SF Express, Klook and Bowtie, as well as the venture builder Inspect Element. The series sparked engaging conversations and vehement exchange of ideas, fostering out-of-the-box thinking among the participants.	Pulyimpact Novigating Challenges and Embracing Opportunits Intel Jogittis Industry Aug 2001000 Total Aug 2001000 Total Aug 2001000
Sep 2023	AiDLab and Banitore [®] signed an MoU AiDLab and Banitore [®] signed an MoU on 18 September 2023 to enhance the collaboration in utilising AI for textile inspection in various product lines.	ADLabH@rblg" doffree Sd#SBR@rt ADLabH@rblabWellSpinbsCerentor 19 Septembr 2033
Sep 2023	PolyU-Jiangsu: 2nd Jiangsu Industry- University-Research Exchange Conference PolyU participated and showcased its innovations at the 2nd Jiangsu Industry- University-Research Exchange Conference. PolyU also signed an MoU with the Productivity Centre of Jiangsu Province to establish a virtual innovation and technology transfer centre jointly where PolyU's potential technologies and projects may match with the Jiangsu industry for potential translational research.	

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Sep 2023	PolyU-Jinjiang Technology and Innovation Research Institute, Signing and Unveiling Ceremony PolyU signed an agreement with Jinjiang Municipal People's Government for the establishment of the PolyU-Jinjiang Technology and Innovation Research Institute, which marks a significant achievement in promoting deeper cooperation between Fujian and Hong Kong. This is the first research institute established by PolyU beyond the Greater Bay Area, which aims to leverage innovative local and international resources, mainly focusing on textile technology, future food, microelectronics, and innovation and technology policy. It strives to become a hub of technology innovation and attract a cluster of emerging industries, helping to shape the future and foster global connections.	
Sep 2023 & May 2024	PolyU-France: Sustainability Lecture Series in Fashion and Food Since 2020, PolyU and the Consulate General of France in Hong Kong and Macau have jointly initiated the Sustainable Lecture Series. The series featured two lectures, one themed on Fashion in September 2023 and another on Food in May 2024. These lectures have attracted over 500 attendees and brought together esteemed speakers from the academic and business communities of France and Hong Kong, providing them with a platform to share their perspectives, experiences, and best practices in sustainability.	

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Sep	PolyU and Cainiao Group signed to research	
2023	collaborate on Meta-Box	
	PolyU and Cainiao Group signed an MoU to establish collaborative research framework on Meta-Box to advance green, efficient, and intelligent logistics solutions. Through collaborative technology research and development, the partnership aims to advance green, efficient, and intelligent logistics solutions. This technology will enhance transportation efficiency, reduce costs, and promote sustainable development by connecting various modes of transportation within a new smart logistics system known as the Cyber-Physical Internet.	Reflection and Construction of
Sep	Rethink HK 2023	
2023	PolyU showcased impactful solutions for achieving carbon neutrality and sustainability at the Rethink expo, attracting over 6,000+ attendees. The PolyU booth features a wide spectrum of innovations, including sustainable construction materials and economical and sustainable reclamation solutions. Industry practitioners engaged in discussions with our researchers for path- breaking research projects aimed at achieving carbon neutrality.	
Oct 2023	InnoCarnival 2023	
	At the nine-day InnoCarnival this year, the PolyU pavilion showcased green technologies developed by PolyU research centres and institutes and PolyU start-ups, such as novel green materials and technologies for carbon- neutral construction, 3D concrete printing technology and applications, and food waste- derived 3D printing materials. Visitors from all walks of life gained a better understanding of the contribution made by the PolyU community in driving sustainable urban development in Hong Kong. Post- event publicity efforts were made to further raise awareness of the University's achievements in this area.	

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	Oct 2023	PolyU signed MoU with the Hong Kong Monetary Authority (HKMA) to establish the CBDC Expert Group on Digital Currency Security	
		PolyU and the Hong Kong Monetary Authority, together with four other local universities, signed framework MoU to establish the Central Bank Digital Currency (CBDC) Expert Group to support the HKMA's exploration of key policy and technical issues surrounding CBDC. The MoU signifies a strategic partnership aimed at fostering collaboration and gathering expert insights from technical, analytical and academic perspectives on various topics related to CBDC.	CBC Exper Groß Benorandum of Understanding Signing Ceremony
	Oct	PolyU-Rohto Centre of Research Excellence	Rohto
	& Nov	for Eye Care and Konto Event on eye fatigue	であることのである。 であることのである。 であることのである。 であることのであった。 であることのであった。 「日本ののののです。」 「日本ののののです。」 「日本ののののです。」 「日本ののののです。」 「日本ののののです。」 「日本ののののです。」 「日本ののののです。」 「日本ののののです。」 「日本ののののです。」 「日本ののののです。」 「日本ののののです。」 「日本のののです。」 「日本のののです。」 「日本のののです。」 「日本のののです。」 「日本のののです。」 「日本のののです。」 「日本のののです。」 「日本ののです。 「日本ののです。 「日本ののです。 「日本ののです。 「日本ののです。 「日本ののです。 「ののです。 「日本ののです。 「ののです。 「日本ののです。 「ののです。 「」 「」ののです。 「」ののです。 「
	2023	PolyU has partnered with Rohto, an eye care brand under Mentholatum, to establish the PolyU-Rohto Centre of Research Excellence for Eye Care. This Centre is dedicated to conducting research on ocular fatigue. In November, PolyU further supported a campus event aimed at raising public awareness of eye fatigue issues among students. Through this collaboration between industry and academia, the Centre aims to establish and promote globally unified diagnostic standards, as well as develop a multi-level diagnosis system specifically for eye fatigue.	
	Oct	Tradeshows and Exhibitions	撤额副技有限公司 Ballng Tachackery Linited
	– Jun 2024	Over 20 PolyU start-ups and various PolyU technologies were showcased in Hong Kong Electronics Fair (Autumn Edition), Entrepreneurship Day, Business of IP Asia Forum (BIP Asia), InnoHealth Showcase Asia Summit on Global Health, Hong Kong International Medical and Healthcare Fair, InnoEx, as well as Science Fair 2023-2024. A wide range of domain areas were covered, which include healthcare and well-being, gerontechnology, patient care, aquaculture, green and sustainability, vision health, AI, robotics, computer vision, firefighting, emergency management, etc. These promising companies presented their innovations and technologies to visitors from industry and the general public, and attracted attention from visitors from various sectors.	

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Nov 2023	PolyU-HangzhouTechnologyandInnovation Research Institute, Signing and Unveiling CeremonyNoveling CeremonyPolyU signed an agreement with Hangzhou Municipal People's Government for the establishmentof 	
Nov 2023	PolyU-Wenzhou, Technology and Innovation Research Institute, Signing and Unveiling Ceremony PolyU signed agreements with the Wenzhou Municipal People's Government and the Administration Committee of Wenzhou Bay New Area to set up a technology and innovation research institute in Wenzhou. The Institute will engage in close collaborations with local key industries in the areas of marine engineering equipment and technology, flexible electronics, and ultra- precision manufacturing to advance their core technologies, outcome transformation, talent development, and innovation and entrepreneurship, promoting the high- quality economic development of the cities.	Althant Beege Attautor A
Nov 2023	PolyU-Wuxi Technology and Innovation Research Institute PolyU-Wuxi Technology and Innovation Research Institute officially inaugurated, driving collaboration and advancements in the innovation and technology industry.	西港理工大学无規科技创新研究院合用 THE POLYU-WUXI TECHNOLOGY AND INNOVATION RESEARCH INSTITUTE IS OPPICIALLY OPEN シーンシーンシーンシーンシーン・シーン・シーン 国際工大学大阪、福祉新聞空

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Nov 2023	PolyU-HKSI:Establishjointresearch centre for advancing sports and technology developmentPolyU and the Hong Kong Sports Institute (HKSI) signed an MoU for the establishment of the "PolyU–HKSI Research Centre" (the 	
Dec 2023	AiDLab entered a licensing agreement with Letstea AiDLab entered a licensing agreement with Letstea Limited (the licensee), an automation and mechanical engineering technology company in the F&B industry, on 15 December 2023 to enhance their inspection capabilities, improve product quality, and enable them to deliver higher- quality products to their customers.	Signing Ceremony of License Agreement Letstea Limited
Dec 2023	Strategic collaboration between CEVR and DEFTA CEVR and DEFTA Partners have formed a strategic collaboration to advance technology transfer and commercialisation in eye and vision health research. This partnership leverages DEFTA's business network and CEVR's research achievements to promote global innovation and improve eye health worldwide.	眼視覺研究中心與 DEFTA Partners 合作協議簽署儀式 5-12-203
Dec 2023	US-AP Panel Workshop on Standardization of Methodology in Ophthalmology PolyU co-hosted a US-Asia Pacific panel workshop with the National Eye Institute (NEI) of the National Institutes of Health (NIH) from the United States. This marked NEI's first global effort to organise a workshop on standardising methodology for integrating artificial intelligence into clinical practice in ophthalmology. The workshop was chaired by Prof Mingguang HE, Chair Professor of Experimental Ophthalmology and Director of the Research Centre for SHARP Vision at PolyU, and Dr John Prakash,	

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Dec	Visit by Delegation of Futian District People's	
2023	Government A delegation led by the Deputy District Mayor of the Futian District People's Government of Shenzhen visited PolyU to introduce several research projects planned to be implemented in the Futian District, as well as the new look and progress of the Hetao Shenzhen-Hong Kong Science and Technology Innovation Cooperation Zone and discussed the potential collaboration opportunities.	福田区区委访问团 到访 香港理工大学 藤锦光教授 香港理工大学校长 中国科学院院士 2023年12月6日
Dec 2023	Visit by Delegation of Hubei Government A delegation led by the Director of Hong Kong and Macao Affairs Office of the Hubei Provincial People's Government visited PolyU to review the major collaboration projects, including the establishment of the PolyU- Wuhan Technology and Innovation Research Institute and the joint laboratory between PolyU and Wuhan University of Technology. The delegation also visited the University Library to learn about its modern facilities and systematic user services.	
Dec 2023	Visit by Delegation of Fujian Government A delegation led by the Vice Governor of Fujian Provincial People's Government visited PolyU to exchange views on deepening collaboration between Hong Kong and Fujian on technology and innovation development. Both parties reviewed the progress of the PolyU- Jinjiang Technology and Innovation Research Institute and exchanged views on laboratory management, collaboration with leading enterprises, and the recruitment of global professionals to contribute to Fujian's development.	
Dec 2023	3rd Asia Exhibition of Innovations and Inventions Hong Kong Jointly organised by the Hong Kong Exporters' Association and Palexpo, Geneva, the Asia Exhibition of Innovations and Inventions Hong Kong (AEII) is an annual exhibition cum competition devoted to innovations and inventions of Asia. In this year's AEII, the PolyU teams won a total of eight awards, including a Special Prize from Technopol Group. The ground-breaking technologies demonstrated the long-lasting, real-world impact brought by the PolyU community's inventions and innovations.	

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Dec	ALITM Training Courses in Hong Kong 2022	
2023	Designed for technology transfer practitioners	
2023	Designed for technology transfer practitioners The 2.5-day AUTM training courses widely covered the key issues of the technology transfer process, such as stakeholder engagement, sharing and alignment of objectives, and the commercial exploitation of IPs, greatly enriched the knowledge of the participating academics and professionals. PolyU co-organised with The Hong Kong University of Science and Technology the courses' fireside chat that explored how universities facilitate technology transfer through entrepreneurship programmes and the licensing of biomedical/healthcare technologies in collaboration with industry partners. The engaging discussion sparked enthusiasm for the transfer of university technology and its potential to create significant impact on society.	<image/>
Jan 2024	CES 2024 CES® is a globally renowned tech event that serves as a platform for breakthrough technologies and innovators worldwide. PolyU showcased its innovative prowess at CES 2024 by presenting 10 projects across diverse fields such as AI, Healthcare, AR/VR, and Metaverse. Dr Daphne Cheung, Associate Professor in the School of Nursing of PolyU, a ground-breaking therapeutic music-with- movement system has won a prestigious global consumer product award in the 'Accessibility & Aging Tech' category at the Consumer Electronics Show (CES) 2024 Innovation Awards.	
Jan 2024	Visit by Delegation of Quanzhou Municipal People's Government A delegation led by the Deputy Mayor of Quanzhou Municipal People's Government visited PolyU to exchange views on deepening collaboration between Hong Kong and Quanzhou in technology and innovation development. Both parties reached a consensus on strengthening cooperation further, which has a great significance for promoting the development of Research Institute.	

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Jan	Visit by Delegation of Wenzhou Municipal
2024	People's Government
	A delegation lad by the Deputy Mayor of

A delegation led by the Deputy Mayor of Wenzhou Municipal People's Government visited PolyU to exchange views on deepening technological innovation cooperation between Hong Kong and Wenzhou. Visits to the Industrial Centre Laboratory, Centre for Eye and Vision Research, and the State Key Laboratory of Ultra-precision Machining Technology were made, introducing PolyU's achievements in new-material structural technologies for marine engineering and cutting-edge technological fields.

JanPolyU-Rhein Köster Joint Laboratory on Smart2024Manufacturing

PolyU and Rhein Köster signed an MoU to establish the "PolyU-Rhein Köster Joint Laboratory on Smart Manufacturing" (Joint Lab). PolyU is the only university in Hong Kong to set up a joint lab with Rhein Köster, showcasing the outstanding research capabilities of our researchers in the respective field. With the aim of advancing intelligent manufacturing and fostering the development of Industry 4.0, the joint lab will focus on research topics such as industrial intelligent robots or collaborative robots, digital twins construction of smart factories and production lines, and predictive maintenance of complex equipment or production lines.

JanThe 4th International Symposium on2024Emerging Memory and Computing

PolyU hosted the 4th International Symposium on Emerging Memory and Computing, which attracted more than a hundred worldwide experts and professionals from the United States, China, Japan, Germany, etc., in the field gathering at PolyU to share and discuss the latest research and technology in emerging memorv and computing. This highly anticipated international symposium brings together distinguished researchers, engineers, and experts from across the globe to exchange their latest findings and insights in the rapidly evolving field of emerging memory and computing.





Lab	CEV/D shaping an	
2024	clinical research project on myopia In February 2024, CEVR obtained a sponsorship of HK\$1.2 million worth of myopia eyeglass lenses and frames to support a two-year clinical research project on managing myopia in children.	Perez BORA
Feb 2024	PolyU-Daya Bay, Establishing Research Platform	创新引领 新质起航 大亚湾坪山河科技创新走廊规划建设启动仪式 企业、科研院校签约
	the Daya Bay Economic and Technological Development Zone to contribute to the development of the corridor.	
Feb 2024	PolyU Establishes the Research Centre for Electric Vehicles (RCEV) and hosts forum on Intelligent EVs and Energy for Carbon Neutrality PolyU hosted the establishment of the Research Centre for Electric Vehicles (RCEV) and the Forum on Intelligent EV and Energy for Carbon Neutrality. The event was attended by approximately 350 staff and	Launch Ceremony of Research Contro reliectri Johin S cui Provide S cui P
	students, as well as leaders from government, innovation and technology, energy, and academic sectors. The Centre aims to develop a cutting-edge research platform to address energy and technical challenges in modern electric vehicles. During the launch ceremony, two MoUs were signed between the RCEV and China Power International Development Limited, and Wisdom Motor (HK) Limited, respectively.	

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Feb 2024	PolyU as the Partnering University of "Couture 3.0" PolyU is thrilled to be the partnering university of "Couture 3.0," a groundbreaking competition that brings together the worlds of fashion, technology, and education. Co- organised by The Consulate General of France in Hong Kong and Macau and The Sandbox, this event has been an incredible platform for innovation. Teaming up with PolyU and ESMOD École Supérieure des Arts et techniques de la Mode, the competition provided these future designers with a fruitful experience.	
Feb 2024	PolyU support the 2024 Sham Shui Po District Inter-school Creative Technology Competition PolyU supported the 2024 Sham Shui Po District Inter-school Creative Technology competition on 24 February 2024. Approximately 100 primary and secondary school students from the district participated in this competition, which focused on tackling three challenging issues in the Sham Shui Po district: Subdivided units, Cleanliness of back alleys, and Aging population. The event aimed to cultivate young talent, inspire innovations and unite the community.	2023-2024年度 2023-2024年度 2023-2024年度 近代世代宗白明高和技社等 岡心社區、以創新科技改善居民生活
Feb 2024	PolyVentures Business Meetup on Robotics Innovation This business meetup was devoted to robotics technology and innovation, and featured an engaging showcase of PolyU start-ups in this field. Not only did the audience gain unique insight from a PolyU expert in intelligent robotics and automation about the influence of robotics on the manufacturing industry, they also had an eye-opening experience with the cutting- edge robotics products of four PolyU start- ups. The founders of these start-ups, who are PolyU students or alumni, explained how they successfully transformed their academic knowledge into impactful products under the PolyVentures ecosystem. The products showcased are expected to benefit various sectors, including construction, pipe engineering, rehabilitation and fire safety.	

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Mar 2024	Visit by Delegation of Wenzhou Government A delegation led by the member of the Standing Committee of the Wenzhou Communist Party Committee and the Head of the Organisation Department visited PolyU for strengthening the communication and cooperation between Wenzhou and PolyU in the recruitment of high-level science, technology and innovation talents, establishing a strategic partnership in talent resource sharing and information exchange, and attracting more PolyU graduates to Wenzhou for employment and starting up business.	香港理工大學 - 温州 す工作聯絡站簽約及想 2024年3月15
Mar 2024	Visit by Delegation of Quanzhou Government A delegation led by the member of Communist Party Secretary of Quanzhou City visited PolyU. In addition to the establishment of the PolyU-Jinjiang Technology and Innovation Research Institute, PolyU hopes to leverage the strengths of both parties and enhance technological collaboration with government entities and businesses. The goal is to foster technological innovation, facilitate the practical application of research findings, and strive for breakthroughs in research achievements. PolyU seeks to make substantial contributions to the economic prosperity of both regions, ultimately supporting the nation in attaining high- quality development.	

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Mar 2024	PolyU-Ganzhou, Strategic Collaborative Framework Agreement Signing for the establishment of PolyU-Xingguo Textiles Technology and Innovation Research Institute PolyU partnered with the Ganzhou Municipal Government and the Xingguo County Government in Jiangxi province to capitalise on their strengths and promote the high- quality development of the textile industry in Ganzhou and Hong Kong. The establishment of PolyU- Xingguo Textiles Technology and Innovation Research Institute would promote in-depth and effective industry-university- research	は 略 合 作 框 架 协 议 签 约 仪 式 香 準 理 大 学 ・ 送 서 ど ・ ご か ど してい ・ ご か び た か か い た か
Mar	innovative development of the textile industry in Ganzhou and its counties, while creating further opportunities for PolyU in terms of education, research and translation of research into innovative outcomes in the field of textiles.	
2024	strategic framework partnership PolyU and Hexagon Leica Geosystems (Qingdao) Co., Ltd. (Hexagon), a global leader in digital reality and industrial 4.0 solutions, have established strategic framework partnership to join forces in advancing cutting-edge technology and innovation. The partnership aims to foster R&D in surveying, geographic information mapping technology and equipment, as well as positioning and navigation systems. The two parties will explore the establishment of a joint lab focusing on research topics such as precise positioning, the use of Al and machine learning in surveying and other forwarding-looking technology issues.	
Mar 2024	PolyU partnered with Jianyin High-tech Zone in cooperation on technology and research collaboration With the support of the Department of Science and Technology of Jiangsu and the Jiangsu Productivity Promotion Center, PolyU and Jiangyin High-tech Zone signed an MoU for technology and research collaboration. This MoU will further expand the areas of cooperation between Jiangsu and Hong Kong. By enhancing the supply of technological innovation resources, the Jiangyin government will support PolyU's innovation projects, which will be developed and applied in the Jiangyin High-tech Zone.	★ * * * * * * * * * * * * *

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Mar 2024	PolyU Co-organized and showcased at the 7th Global Intelligent Industry Conference PolyU co-organised the 7th Global Intelligent Industry Conference at the Shenzhen World	
	Exhibition & Convention Centre. Introducing innovative technology research achievements in various fields of intelligent industry to experts, scholars, and industry professionals from both China and abroad. PolyU also showcased research projects in areas such as smart equipment, autonomous driving, and smart manufacturing.	
Mar 2024	Partnership with Wuling Motors PolyU signed an MoU with Wuling Motors Holdings Limited, a major Chinese manufacturer of automobiles, to jointly advance the research and development of electric vehicles (EVs). Delegates from Wuling Motors also visited PolyU's Electrical Machines Laboratory and engaged in extensive exchange with relevant research teams to learn about the University's latest achievements in EV research, and explore the incubation of tech enterprises, talent exchange and training. The collaboration is expected to elevate EV innovation to new heights and fuel the continuation of Wuling's near century-old legend.	Control
Apr 2024	Partnership with The Guangdong University of Technology PolyU and Guangdong University of Technology (GDUT) reached an agreement to jointly cultivate innovative and entrepreneurial talents. Together, they have launched the "Guangdong-Hong Kong-Macao Greater Bay Area Immersive Experience Project" which promotes talent exchange and the implementation of entrepreneurial cooperation projects through a credit system, creating a high-quality talent ecosystem for innovation and technology. PolyU and GDUT will embark on comprehensive cooperation, utilising the innovative and entrepreneurial teaching resources, professional talents and social networks of both universities to achieve effective resource sharing.	していたいでは、 していたいでいでいたいでいでいでいでいでいでいでいでいでいでいでいでいでいでいでい

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Anr	AiDI ab and CaiRS participated in InnoFX	
2024	AiDLab and CAiRS participated in the InnoEx on 13-16 April 2024 at the Hong Kong Convention and Exhibition Centre to showcase their innovations and technological advancements. InnoEx was jointly organised by the HKSAR Government and the Hong Kong Trade Development Council to bring together influential tech experts, entrepreneurs, thought leaders and investors from the region to discuss collaborations, share upcoming trends and exchange insights into future opportunities.	Compared in address Example in ad
Apr 2024	 PolyU collaborates with Shanghai Westwell Technology to establish joint innovation laboratory PolyU and Shanghai Westwell Technology Co. Ltd signed an agreement for research collaboration in artificial intelligence and autonomous vehicle technology during the "Invest in Shanghai • Share the Future" promotion campaign. This strategic partnership will together build a joint innovation laboratory to explore the frontiers and application practices in these fields. 	四 金羅 "投资上海・共享未来"海外行系列活动(中国香港站)项目签约 или или и или и или и или или или или и
Apr 2024	Key Innovation Research Partner for Digital Economy Summit 2024 PolyU RIO participated in the Digital Economy Summit (DES) 2024, jointly organised by the HKSAR government and Cyberport. As the only Innovation Research Partner of the event, PolyU showcases the latest technologies of AR, blockchain, cybersecurity, and precise positioning to the participants. The event attracted over 5,000 online and onsite attendees from around the world.	

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Apr	PolyU participated in the 2024 China	
2024	Science Fiction Convention	
	PolyU participated in the 8th China Science Fiction Convention held in Beijing. The convention showcased advanced technologies in VR/AR, holographic imaging, artificial intelligence, motion capture, etc., providing attendees with an immersive science fiction experience. During the event, Prof. Christopher Chao, Vice President (Research and Innovation), was interviewed by a few media to share PolyU's latest developments and his view on the prospects of the science fiction industry. Prof. Wang Zuankai, Associate Vice President (Research and Innovation), was invited to give a keynote to share his latest research project and insight in I&T talent cultivation.	
Apr	49th International Exhibition of Inventions	
2024	Geneva At this edition of the international event, PolyU swept a record-breaking number of 45 accolades, including two Special Prizes. The 43 showcased projects spanned the fields of life sciences and healthcare, renewable energy, new energy vehicles, materials and sensing technology, civil engineering, food science, and vision and eye health. Among award-winning innovations, 19 were developed under the InnoHK research centres led by PolyU in collaboration with top research institutions around the world, and 12 were driven by PolyU start-ups, including those led by PolyU scholars. As post-event promotion, a press briefing was held to showcase the award-winning innovations from PolyU and the three InnoHK research centres	AST INTERNATIONAL COMPANY CO

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Apr 2024	Global Partnership with ZEISS Vision Care PolyU entered into a global partnership with ZEISS Vision Care, a world market leader of optical lens and ophthalmic instrument manufacturing, to expand the impact and speed up the market penetration of PolyU's proprietary myopia control lens technologies. A PolyU delegation visited the headquarters of ZEISS Vision Care in Germany to sign the licensing agreement and discuss the directions of future joint research and development. More myopic children worldwide are expected to benefit from this global partnership. It will accelerate the market presence of PolyU innovations, amplify the impact of our research and endeavours in commercialisation, and intensify University- industry collaboration.	<image/>
Apr 2024	PolyU collaborates with Axis Therapeutics to establish joint laboratory for immunotherapy PolyU signed a joint laboratory agreement with Axis Therapeutics (Axis) to foster cancer immunotherapy research and development, with the aim of improving cancer treatment for patients in Hong Kong. This collaboration will facilitate clinical trials of new T-cell receptor therapy using the newly established clinical Current Good Manufacturing Practice (cGMP) facility at PolyU and the development of at least 30 new targeting agents against novel T-cell targets in cancer immunotherapy.	Exercise Constraints Exercise Const
Apr 2024	Visit by Delegation of CHINT Group for Technological Exchange A delegation of CHINT Group visited PolyU to exchange views on strengthening cooperation in technology and innovation between the two sides. The delegation visited the Research Institute for Artificial Intelligence of Things (RIAIOT), Advanced Materials and Electronics Laboratory, and State Key Laboratory of Ultra-precision Machining Technology (SKL-UPMT).	

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Apr 2024	Visit by Delegation of Quanzhou Government for Technological Exchange A delegation led by the Quanzhou Municipal Bureau of Industry and Information Technology, along with leading industry representatives from the textile and garment, sports footwear and apparel, and new materials sectors, visited PolyU and engaged in the discussion on facilitating the practical application of research achievements. PolyU aims to strengthen technological collaboration with Fujian government entities and businesses, making a greater contribution to the economic prosperity of both regions.	
Apr 2024 & Jun 2024	Exploration of collaboration with Nanshan Hospital Clinical research is essential to the translation of biomedical research. SZRI is actively establishing collaborations with local clinical units on an institutional level. In this regard, a delegation led by SZRI visited Nanshan Hospital on 17 April. PIs from PolyU specializing in stem cell engineering, immunotherapy, and related fields presented their work during the meeting.	
	The Director of Nanshan Hospital, Dr. Hou, expressed great enthusiasm for the proposed collaboration and offered resources such as research space and student halls for PolyU's PIs to utilize. To foster deeper exchanges between PolyU's PIs and clinicians, a research seminar was held on 30 June. The seminar aimed to enhance mutual understanding and identify specific areas for initial collaboration.	数结生命 教死扶 伤 甘于奉献 大爱无器
May 2024	YIRA 2024 PolyU Young Innovative Researcher Award (YIRA) is a university-level award to recognise young faculty members whose researches demonstrate excellence in addressing global challenges. This year, we have honoured six young researchers whose researches cover a wide range of areas and bring benefits to materials science, green energy, environmental development, and healthcare through the utilisation of cutting- edge technologies.	Virginitie Virginitie Vir

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May	Asia Summit on Global Health 2024 and	ASIA
2024	MoU with PanMediso Capital Investment	SUMMIT
	Company Limited	ON GLOBAL
	PolyU is the Thematic Session and Health Innovation Partner at this year's Asia Summit on Global Health, with many academics participating in the annual flagship healthcare event. A total of 12 projects/ start-ups showcased research excellence across pharmaceutical, AI & digital health, medical device & diagnostics, etc. During the event, an MoU signing ceremony with PanMediso Capital Investment Company was held. PolyU will join hands with the company in further research and development in the area of AI imaging technology and research in nuclear medicine.	<complex-block></complex-block>
Maria	Visit he Delegation of Mansher of the	
May 2024	Visit by Delegation of Member of the Standing Committee of the Fujian Provincial People's Congress A delegation led by the member of the Standing Committee of the Fujian Provincial People's Congress and the Mayor of Jinjiang Municipal People's Government visited PolyU to exchange views on strengthening cooperation in technology and innovation between Fujian and Hong Kong. In addition to the establishment of the PolyU-Jinjiang Technology and Innovation Research Institute, PolyU hopes to cooperate with Quanzhou City to jointly establish a comprehensive ecosystem involving the government, industry, academia, and research institutions, aligning with the major strategic development of Quanzhou City, Fujian Province, and even the nation as a whole.	<image/> <image/>

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May 2024	PolyU-Huizhou Daya Bay, Agreement Signing for establishment of PolyU-Daya Bay Technology and Innovation Research Institute PolyU signed a cooperation agreement with the Huizhou Municipal Government (Daya Bay Economic and Technological Development Zone) for the joint establishment of the PolyU- Daya Bay Technology and Innovation Research Institute. The Research Institute will focus on the fields of petrochemicals, new energy materials, artificial intelligence, and smart manufacturing. Through cooperation with Huizhou and the Daya Bay Development Zone, it will fully leverage the advantages of all parties and implement an innovation- driven development strategy to actively promote industry-university-research collaboration, making contributions to the technological innovation of Hong Kong, Huizhou and the Nation, and creating a new model of government-university collaboration.	<image/> <page-header></page-header>
May 2024	PolyU-Guangxi, MoU Signing for Academic Exchange PolyU signed an MoU with Guangxi University to explore opportunities for academic exchange and collaborative research in the fields of civil and environmental engineering. The agreement aims to jointly explore approaches to cultivating doctoral students and post-doctoral researchers. The two universities will collaborate to explore frontier technology fields, establish research platforms, and drive technological innovation, setting a new benchmark for science and technology cooperation between Guangxi and Hong Kong.	
Jun 2024	PolyU partnered with Shandong University of Science and Technology on global exchange PolyU and Shandong University of Science and Technology have signed an MoU to establish a strategic framework partnership. This partnership aims to strengthen collaboration in student exchange and research collaboration and to expand cooperation into broader areas. The institutions also seek to explore opportunities for international academic research collaboration.	● たまりおよまで ● たまりおよまで ● □ 日本まで □ 日本まで □□ 日本まで □ 日本まで □ 日本まで □ 日本まで □ 日本まで □ 日本まで

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Jun	BIO International Convention 2024	
2024	BIO International Convention is the largest and most comprehensive event for biotechnology, representing the full ecosystem of biotech with over 20,000 industry leaders from across the globe. The event offers opportunities to broaden the network within the global industry and inspire innovation for further collaboration. PolyU showcased our cutting-edge research and innovation in Life Sciences and Healthcare.	Time for Science to SCHORE SAVE the Date! BIO International Convention June 3-6, 2024 San Diego, CA
Jun 2024	International Forum on Shipping, Ports and Airports 2024 The 12th International Forum on Shipping, Ports and Airports (IFSPA) 2024 will be held in Singapore. The forum is organised by The Hong Kong Polytechnic University and Nanyang Technological University. It aims to invite international academics and practitioners to discuss and exchange views on issues related to global maritime and aviation economics, policy, and management. The event also serves as a platform for networking and promoting academic-industry collaboration.	
Jun 2024	3 rd Nanchang INT Health Expo PolyU participated in the China (Nanchang) International Health Industry Conference and Expo (China INT Health Expo) in Nanchang, Jiangxi. Under this year's theme "Integrating Innovative Industries to Build a Healthy China", six healthcare innovations from PolyU teams and start-ups were showcased in the PolyU pavilion. A VIP delegation headed by Mr SHI Ke, Vice Governor of the People's Government of Jiangxi Province, visited the PolyU pavilion and exchanged with PolyU researchers. The exhibition was covered in local and national media, raising awareness about PolyU's research strengths, technologies and innovations in the medical and healthcare sector in the Chinese mainland.	

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Jun 2024	World Intelligence Expo 2024 PolyU will participate in the World Intelligence Expo 2024 in Tianjin to showcase technology innovations and to join other valuable exchange activities. The Expo will showcase a blend of exhibitions and intelligent experiences, encompassing exhibitions, competitions, concurrent conferences, and interactive showcases, which will create a new platform for showcasing Chinese innovation, leading the development trends of the intelligent technology industry, and gathering resources to deepen cooperation on a high- end level.	2024世界智能产业博览会
Jun 2024	PolyU "Flying High" Exhibition in Paris 2024 marks a special year of the Paris Summer Olympic Games, as well as the 60 th anniversary of the establishment of Sino- French diplomatic relations. As an effort of international outreach for the University's innovations, PolyU is hosting an exhibition in Paris to showcase our interdisciplinary research capabilities and innovations, with the themes of fashion and textiles, as well as sustainable materials.	<image/>

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