THE HONG KONG
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Press Release
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**Appendix**

## PolyU’s winning innovations at the 49th Geneva Inventions Expo

| Project description | Principal Investigator(s) | Image(s) | Award(s) |
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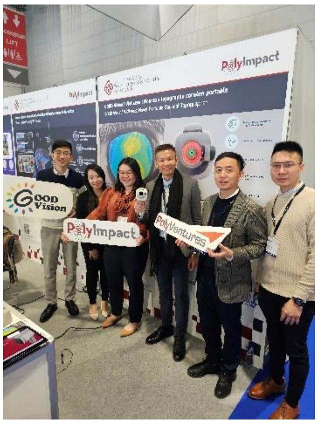
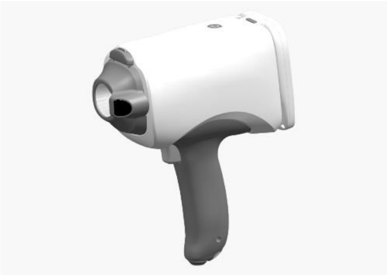
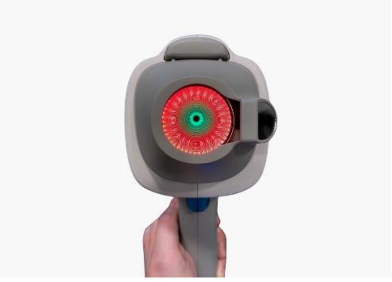
| **GOOD Vision/Wellsees: Novel Portable Corneal Topographer**<br>Astigmatism, which affects over half the world’s population, has surged due to abnormal visual habits during the COVID-19 pandemic. This condition can cause blurred vision, asthenopia, headaches and even vision loss. Early detection and proactive care can mitigate these effects. Our portable corneal topographer is a compact, powerful tool for early detection of astigmatism. It combines a high-resolution CCD camera, 32 Placido rings, and an AI-driven algorithm to accurately measure refractive power. This enables healthcare providers to quickly address refractive needs, ensuring timely interventions. The device’s portability allows for easy eye-checks anywhere, promoting early detection of corneal abnormalities. The advanced AI system ensures accurate measurements, overcoming instability. This technology simplifies diagnosis, integrates with astigmatism management, and breaks down geographical barriers, making it a commercially viable solution for widespread vision care. | **Prof. KEE Chea-su**<br>Head and Professor, School of Optometry; Deputy Director of CEVR; Co-founder, GOOD Vision Technologies Co., Limited/Wellsees Technologies Co., Ltd. (a PolyU academic-led startup) |  <br><br><br>Download images: [https://polyu.me/4aHuGy9](https://polyu.me/4aHuGy9) | Prize of the Saudi Arabian Delegation<br>Gold Medal |

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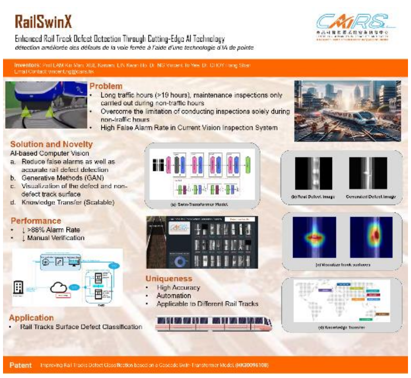
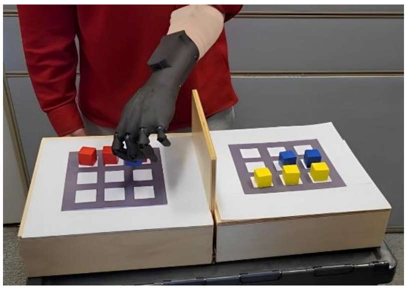
| **RailSwinX: Enhanced Rail Track Defect Detection through Cutting Edge AI Technology**<br>AI enhances rail safety: A cascaded swin-transformer precisely classifies track defects. Analysing real/false-alarm images ensure accuracy, and reliability, introducing a new era of proactive maintenance. | **Prof. Kenneth LAM Kin-man**<br>CEO and Centre Director of Centre for Advances in Reliability and Safety (CAiRS) | <br>RailSwinX<br>Enhanced Rail Track Defect Detection Through Cutting-Edge AI Technology<br>*détection améliorée des défauts de la voie ferrée à l'aide d'une technologie d'IA de pointe*<br>Problem<br>• Long traffic hours (>19 hours), maintenance inspections only carried out during non-traffic hours<br>• Overcome the limitation of conducting inspections solely during non-traffic hours<br>• High False Alarm Rate in Current Vision Inspection System<br>Solution and Novelty<br>AI-based Computer Vision<br>a. Reduce false alarms as well as accurate rail defect detection<br>b. Generative Methods (GAN)<br>c. Visualization of the defect and non-defect track surface<br>d. Knowledge Transfer (Scalable)<br>Performance<br>• ↓ >88% Alarm Rate<br>• ↓ Manual Verification<br>Uniqueness<br>• High Accuracy<br>• Automation<br>• Applicable to Different Rail Tracks<br>Application<br>• Rail Tracks Surface Defect Classification<br>Patent Improving Rail Tracks Defect Classification based on a Cascade Swin-Transformer Model (HK30096108)<br>Download image:<br>https://polyu.me/4aHuGy9 | Prize of the International Federation of Inventors' Association – IFIA<br><br>Gold Medal |
| **ProRuka — Novel Prosthetic Hand Controlled by Wireless Sonomyography**<br>ProRuka is a novel 3D printed prosthetic powered hand that can move its fingers independently. It is controlled by stump muscle signals collected by wireless wearable ultrasound imaging known as sonomyography. These signals are analysed by AI algorithms in real-time to decode the natural control mechanism of a human hand. The AI model can also classify a specific hand gesture and the degree of action, based on the activation pattern of all muscles combined in the scanning area. ProRuka allows more intuitive control of the prosthetic hand and can predict more complex hand gestures with higher accuracy. The mechanical design is based on the natural dimensions and proportions of the human hand and is lightweight and cost-effective. ProRuka aims to improve the comfort and acceptance of prosthetic hand users, and help them regain quality of life, independence and confidence. | **Prof. Yongping ZHENG**<br>Henry G. Leong Professor in Biomedical Engineering;<br>Chair Professor of Biomedical Engineering;<br>Director, Research Institute for Smart Ageing;<br>Director, Jockey Club Smart Ageing Hub<br><br>**Mr Vaheh NAZARI**<br>Research Assistant, Department of Biomedical Engineering | PolyImpact<br>PolyU Inventions and Innovations that Benefit the World<br><br>Download images:<br>https://polyu.me/4aHuGy9 | Gold Medal with Congratulations of the Jury |

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| **Augmented Reality (AR) Software Built to Aid the Visually Impaired**<br>Individuals with visual impairments may encounter various forms of vision loss, which can be attributed to neurological or ocular disorders, as well as the natural process of ageing. Visually impaired individuals need a technologically advanced solution that is safe, affordable, and tailored to patients’ specific needs to navigate independently in their daily lives. “Augmented Reality Obstacle Detection” (ObstAR) is a specifically designed and personalised navigation device based on augmented reality technology, allowing visually impaired individuals to move freely and safely. It aims to minimise their dependence on conventional assistive tools, like walking canes or assistance from others. | **Prof. Allen Cheong**<br>Associate Head and Professor, School of Optometry; Deputy Director of CEVR<br>*Project from Centre for Eye and Vision Research (Set up as a joint partnership between PolyU and the University of Waterloo, Canada under the Health@InnoHK cluster)* | <br>Download image: https://polyu.me/4aHuGy9 | Gold Medal with Congratulations of the Jury |
| **SLOPE – Structured Light Observation, Perception and Evaluation**<br>SLOPE is the first novel functional test device that can detect early-stage age-related macular degeneration (AMD) prior to the manifestation of structural alterations detectable by conventional equipment such as Fundus Photography or Optical Coherence Tomography. Utilising quantised spin-orbit beams, SLOPE generates a distinct entoptic pattern perceptible to the human eye. Healthy eyes can see the images clearly, while eyes with | **Co-Principal Investigator: Dr Dennis Tse**<br>Associate Professor, School of Optometry<br>*Project from Centre for Eye and Vision Research (Set up as a joint partnership between PolyU and the University of* | <br>Download image: https://polyu.me/4aHuGy9 | Gold Medal with Congratulations of the Jury |

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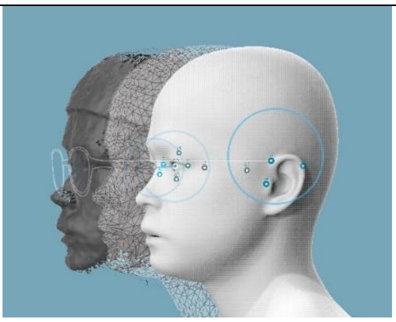
| AMD perceive the images differently. The new device facilitates early AMD detection in screening centre or health clinic, mitigating vision loss risks. Through partnerships with the public and private sectors, the team is fostering a widespread eye health screening practice, hopefully reducing the prevalence of AMD. | *Waterloo, Canada under the Health@InnoHK cluster)* | | |
| **AI-Driven Ergonomic Headwear Customisation System**<br>Properly fitting and comfortable headwear is crucial for individuals' well-being, safety, and overall experience. For example, ill-fitting eyeglasses can cause discomfort, hinder vision, and strain the eyes. Helmets play a vital role in protecting individuals during physical activities, reducing the risk of head injuries. This is especially important for children with growing heads and varying head sizes and shapes. To address these concerns, the invention "AI-Driven Ergonomic Headwear Customisation System" is made. It ensures headwear products are tailored to individuals, providing both a proper fit and comfort. This system is significant in delivering headwear that meets individuals' needs. | **Dr Yan LUXIMON**<br>Associate Professor, School of Design<br>*Project from AiDLab (established under the AIR@InnoHK cluster in collaboration with the Royal College of Art, UK)* | <br>Download image:<br>https://polyu.me/4aHuGy9 | Gold Medal with Congratulations of the Jury |
| **AI Knitted Textile System with Interactive Illumination**<br>It possesses 2 unique features: An offline system based on self-built algorithm and a patented illuminative Polymeric Optical Fibre (POF) knitted textile, Intuitive commands with immediate responses enable customisation and facilitates inclusive interaction. This textile | **Prof. Jeanne TAN**<br>Centre Assistant Director, AiDLab<br>Professor, School of Fashion and Textiles<br>*Project from AiDLab (established* | <br>Download image:<br>https://polyu.me/4aHuGy9 | Gold Medal with Congratulations of the Jury |

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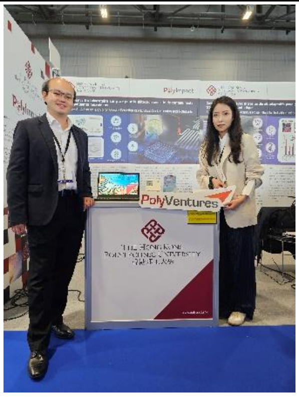
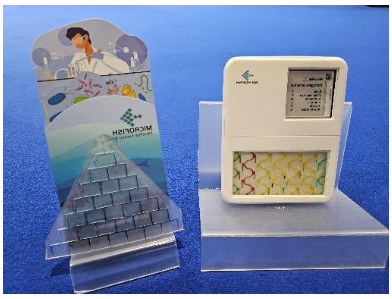
| system can be applied in the contexts of interior design, product design and sensory rehabilitation. | *under the AIR@InnoHK cluster in collaboration with the Royal College of Art, UK)* | | |
| **MicroFish: A Lab-on-a-chip for On-site Detection of Microbial Contamination and Pollutants**<br>MicroFish is a palm-sized lab-on-a-chip device that can detect microbial pathogens and pollutants in the environment. It works by injecting a sample into the device, which has built-in colorimetric chemical sensors that change colour based on the presence or absence of contaminants. MicroFish enables rapid, cost-effective on-site monitoring of potential microbial outbreaks in aquacultures and livestock farms with limited access to diagnostic laboratories. By detecting contaminants early, MicroFish can prevent microbial outbreaks or pollution from spreading. This reduces livestock mortality, thus preventing serious economic losses and ensuring food security. This project supports the UN Sustainable Development Goals, including Life Below Water, and Clean Water and Sanitation. | **Dr CHUA Song Lin**<br>Assistant Professor, Department of Applied Biology and Chemical Technology; Co-founder, Microfish Limited (a PolyU academic-led startup)<br>**Dr LIU Yang Sylvia**<br>GBA Startup Postdoctoral Fellow, Department of Applied Biology and Chemical Technology; Co-founder, Microfish Limited (a PolyU academic-led startup)<br>**Dr KHOO Bee Luan**<br>Assistant Professor, Department of Biomedical Engineering, City | <br><br>Download images:<br>https://polyu.me/4aHuGy9 | Gold Medal |

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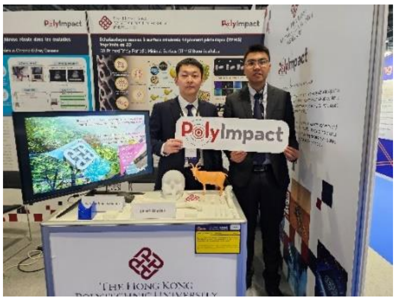
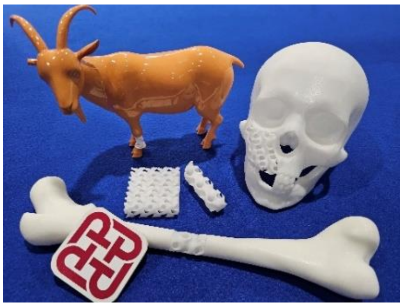
| | University of Hong Kong | | |
| **3D Printed Triply Periodic Minimal Surface (TPMS) Bone Scaffolds**<br>Triply Periodic Minimal Surface (TPMS) scaffolds mimicking trabecular bone are 3D printed with hyperboloidal topography using β-tricalcium phosphate. The TPMS scaffolds show high porosity and interconnectivity, which can reduce stress concentration for increased mechanical strength. They can also support the adhesion and proliferation of human mesenchymal stem cells and enhance their osteoblastic differentiation and angiogenic paracrine for "osteogenesis-angiogenesis coupling".<br>This is achieved by reorganising cytoskeleton via hyperboloidal topography with focal adhesion kinase and mitogen activated protein kinase pathway activation. The in-vivo evaluation further demonstrates that the TPMS scaffolds boost enhanced new bone formation and neovascularisation. In summary, the scaffolds provide a purely physical way to guide the osteogenic and angiogenic cell fates and demonstrate drastic but quantifiable improvements in bone regeneration without introducing exogenous factors. These features offer the scaffolds a head-start towards a simple, safe, efficient and personalised bone graft with tremendous clinical potential. | **Dr ZHAO Xin**<br>Associate Professor, Department of Applied Biology and Chemical Technology; Founder, ReNew Biotechnology Limited (a PolyU academic-led startup) | <br><br>Download images: https://polyu.me/4aHuGy9 | Gold Medal |

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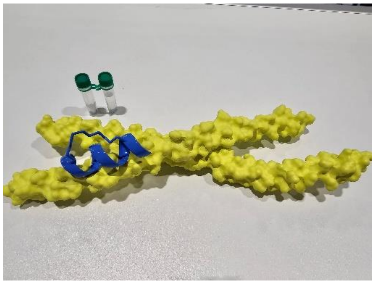
| **Autophagy-targeting Peptidomimetics as Novel Cancer Therapeutics**<br>Autophagy has long been regarded as a key factor in cancer formation and development. The team has developed chemically modified molecules called peptidomimetics that target the autophagy process and inhibit cancer cell proliferation. They have also validated this approach in multiple animal models. The peptidomimetics have good anti-tumour efficacy in multiple cancers, especially those for which there are no effective therapies, such as triple-negative breast cancer and pancreatic cancer. The hydrocarbon stapling of the peptidomimetics also allows them to have high stability. Meanwhile, the peptidomimetics have a clear target, the critical autophagy regulator, Beclin 1. By binding to Beclin1 with high affinity, peptidomimetics can regulate autophagy and mediate the related cell signalling pathways in cancer biogenesis and development. The high selectivity of our peptidomimetics means that they have a good safety record in animals. This indicates that they have the potential to be an effective strategy for malignant cancers. | **Prof. ZHAO Yanxiang**<br>Associate Head, Departmental Learning and Teaching Committee Chair, and Professor, Department of Applied Biology and Chemical Technology | PolyImpact<br>PolyImpact<br>PolyU Inventions and Innovations that Benefit the World<br>Download images: https://polyu.me/4aHuGy9 | Gold Medal |
| **Flexible Perovskite Solar Modules Based on Surface Reconstruction Technology**<br>The invention is a flexible perovskite solar module based on surface reconstruction technology. | **Prof. YAN Feng**<br>Associate Director, Research Institute for Intelligent Wearable | | Gold Medal |

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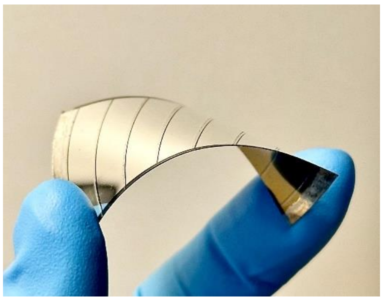
| It features a flexible design that allows it to conform to different surfaces and shapes. The surface reconstruction technology enhances the stability and performance of the perovskite material, in turn improving durability and efficiency. The advantages of this invention include high power conversion efficiency comparable to traditional solar cells, lightweight and thin construction for easy installation, and versatile applications across various industries. The lightweight and flexible nature of the module enables integration into clothing, backpacks, vehicles and curved surfaces of buildings. The benefits of this invention include increased adoption of renewable energy, cost-effective manufacturing and positive environmental impact. The flexibility and efficiency of the perovskite solar module promote the transition to a sustainable energy future, while reducing manufacturing costs and making solar energy more accessible. | Systems; Chair Professor of Organic Electronics, Department of Applied Physics | <br><br>Download images: https://polyu.me/4aHuGy9 | |
| **A Fireproof Solar PV Vacuum-Glazing Wall Panel (FSVG) as Building Insulation Layer**<br>Fire emergencies involving building facades have dramatically increased in recent years. The main culprit is combustible external wall insulation, which can ignite and spread rapidly due to the chimney effect of high-rise buildings. London, Shanghai and Tianjin have experienced tragic accidents | **Prof. YANG Hongxing**<br>Professor, Department of Building Environment and Energy Engineering | | Gold Medal |

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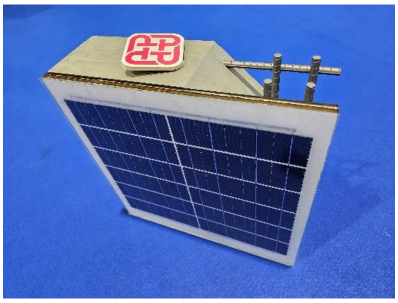
| involving this material, resulting in deaths, injuries and property damage. This novel Fireproof Solar PV Vacuum-Glazing (FSVG) wall panel addresses this challenge. It is a non-combustible and highly thermal insulation material that combines superior thermal insulation, soundproofing and power generation to help create low-carbon buildings. In Hong Kong, FSVG wall panels can replace traditional curtain walls while also generating solar power, reducing the cooling load of buildings by 57% and generating 170kWh/m2 of electricity every year. The invention is especially suitable in areas with cold winters, such as Shanghai and Beijing, where external wall insulation is necessary. It can save a large amount of energy without posing any fire hazard. | | <br><br>Download images:<br>https://polyu.me/4aHuGy9 | |
| **Mobile Ankle-foot Exoneuromusculoskeleton**<br>The mobile ankle-foot exoneuromusculoskeleton is the first device of its kind to combine the advantages of exoskeletons, soft pneumatic muscles, neuromuscular electrical stimulation and tactile sensory feedback into a single, lightweight wearable system powered by a small rechargeable battery. This unique combination can effectively correct poststroke footdrop and foot inversion, which are common issues faced by stroke survivors. It is also easy to use by non-professionals for self-help | **Dr Xiaoling HU**<br>Associate Professor, Department of Biomedical Engineering; Founder, Thecon Technology HK Ltd. (a PolyU academic-led startup) | | Gold Medal |

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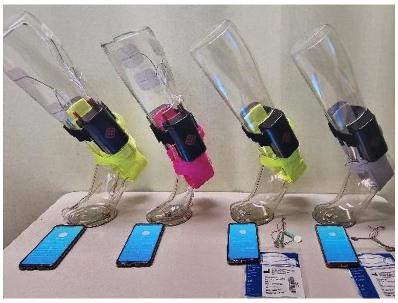
| telerehabilitation. The device is connected to the Internet of Things, which allows it to connect professionals and multiple poststroke users in different locations. This enables the efficient management of rehabilitation and motivates users to continue their training through incentive schemes, which, in turn, enhances the efficiency and effectiveness of rehabilitation and reduces the burden on professionals. By enabling remote and self-help telerehabilitation, it can also provide quality care to more stroke survivors who need it. | | <br><br>Download images:<br>https://polyu.me/4aHuGy9 | |
| **FRP-ECC-HSC Composite Column**<br>The FRP-ECC-HSC composite column is a novel structural column comprising three layers: an outer Fibre-Reinforced Polymer (FRP) tube, a middle Engineered Cementitious Composite (ECC) ring and an inner High Strength Concrete (HSC) core. Unlike conventional FRP-confined HSC columns, which may crack locally and fail prematurely due to the high brittleness of HSC, this column uses the ECC ring, which has excellent tensile and cracking behaviour, to redistribute the hoop stress and strain from the HSC core to the FRP tube. This results in a more uniform lateral confinement, a larger FRP confining efficiency, as well as a higher column deformability than conventional FRP-confined HSC columns. The FRP-ECC-HSC composite column | **Prof. Tak-Ming CHAN**<br>Professor,<br>Department of Civil and Environmental Engineering<br><br>**Dr Shuai LI**<br>Postdoctoral Fellow,<br>Department of Civil and Environmental Engineering<br><br>**Prof. Ben YOUNG**<br>Vice President (Student and Global Affairs);<br>Chair Professor of Steel Structures,<br>Department of Civil and | PolyImpact | Gold Medal |

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| has excellent compressive behaviour with both high loading capacity and high ductility. It has great potential for use in infrastructure in marine environments and coastal areas. | Environmental Engineering | <br>Download images:<br>[https://polyu.me/4aHuGy9](https://polyu.me/4aHuGy9) | |
| **Multi-Functional High-Power-Density Integrated Onboard Charger for Electric Vehicles**<br>Electric vehicles are usually charged using conductive (plug-in) charging. However, wireless charging is becoming more popular and has many advantages. Future electric vehicles are expected to have both conductive and wireless chargers. Very few solutions currently combine both types of chargers. Those that do have disadvantages such as necessitating a large number of components, an inefficient conductive charger or a slow charging time because it is not possible to energise both chargers at the same time. This new multi-functional integrated on-board charger (IOBC) overcomes these problems by offering both conductive and wireless charging in one compact design. By sharing the pickup coil of the wireless charger with the conductive charger, the IOBC does not need additional components and can control both chargers independently. This achieves efficient, simultaneous power transfer with few components, and minimal volume, and cost. | **Dr WONG Chi Shing**<br>Postdoctoral Fellow, Department of Electrical and Electronic Engineering<br><br>**Dr LOO Ka Hong**<br>Associate Professor, Department of Electrical and Electronic Engineering; Assistant Dean (External Engagement), Faculty of Engineering<br><br>**Dr LIU Junwei**<br>Research Assistant Professor, Department of Electrical and Electronic Engineering | <br> <br>Download images:<br>[https://polyu.me/4aHuGy9](https://polyu.me/4aHuGy9) | Gold Medal |
| **Virtual MRI Contrast Enhancement System for Precise** | **Prof. CAI Jing**<br>Associate Dean, Faculty of Health | | Gold Medal |

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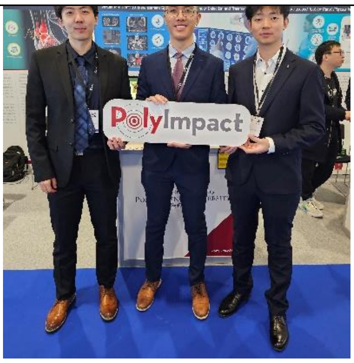
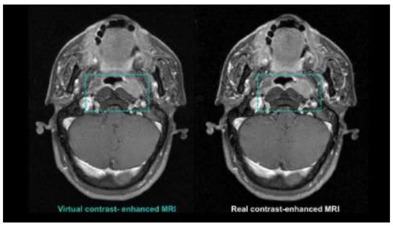
| **Tumour Detection and Treatment**<br>The Contrast-Free Virtual Enhancement MRI system revolutionises the precision of tumour treatment by offering high-resolution imaging without the need for contrast agents. With its advanced algorithms and innovative imaging techniques, this invention enables precise tumour visualisation, helping to plan and monitor treatment accurately, and ensure patient safety, cost-effectiveness and enhanced accuracy of treatment.<br><br>By eliminating the use of contrast agents, the team minimises potential risks and prioritises patient well-being. It also reduces imaging costs, making it a cost-effective solution for healthcare providers. The enhanced accuracy of tumour visualisation leads to improved treatment outcomes and patient care. It sets a new standard in non-invasive, safe, and highly accurate tumour imaging, allowing for more precise and targeted treatment strategies. Ultimately, it contributes to advancing the field of precision medicine and improving patient outcomes in the fight against cancer. | and Social Sciences;<br>Professor, Department of Health Technology and Informatics;<br>Technical Advisor, MedVision Limited (a PolyU start-up) |  <br> <br>Download images:<br>https://polyu.me/4aHuGy9 | |
| **Smart-CKD: Ultrasound Tool for Renal Fibrosis in Chronic Kidney Disease**<br>Smart-CKD (S-CKD) is an innovative computer-aided diagnostic tool that revolutionises the clinical management of chronic | **Dr CHEN Ziman**<br>Postdoctoral Fellow, Department of Health | | Gold Medal |

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| kidney disease (CKD) patients. It uses a machine learning algorithm to combine key clinical parameters - mainly age, ultrasonic renal length and end-diastolic flow velocity of interlobar renal artery - to effectively distinguish between mild and moderate-to-severe renal fibrosis, thus providing valuable insights for tailored therapeutic interventions.<br><br>S-CKD is non-invasive and cost-effective as it uses routine medical imaging and basic demographic data. It can easily access data from medical records and seamlessly integrates into existing diagnostic processes, making it a practical and accessible tool. Using S-CKD promises enhanced clinical management, empowering healthcare practitioners to make better decisions on treatment plans and follow-up schedules, as well as improve patient outcomes that can transform kidney disease management. | Technology and Informatics<br><br>**Prof. YING Tin Cheung**<br>Associate Head and Professor, Department of Health Technology and Informatics | <br> <br>Download images: [https://polyu.me/4aHuGy9](https://polyu.me/4aHuGy9) | |
| **Vcare – Vision Training VR Device**<br>Vcare offers personalised vision correction training for myopia, amblyopia and strabismus. It combines hardware and software to provide engaging VR games and exercises for active participation. Unlike traditional methods, this non-invasive solution minimises side-effects and complications. Vcare has a patented multi-folded lens module with a varifocal mechanism in the VR headset. This | **Dr TANG Yuk Ming**<br>Senior Lecturer, Department of Industrial and Systems Engineering; Co-founder, Vcare Vision Technology Limited (a PolyU academic-led startup) | PolyImpact<br>PolyVentures<br>vcare<br>PolyImpact<br>PolyU Inventions and Innovations that Benefit the World | Gold Medal |

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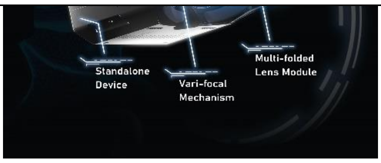
| innovative technology allows users to automatically adjust the focal length during their VR experience, providing optimal visual clarity without the need for manual adjustments or glasses for different distances. This design enhances flexibility and convenience, enabling users to freely navigate and interact within the VR environment while enjoying a clear visual experience. Prioritising rigorous research and clinical trials to ensure effectiveness and safety, the team has collaborated with eye care professionals to provide a safe, convenient and enjoyable alternative for vision correction training. | |  Standalone Device<br>Vari-focal Mechanism<br>Multi-folded Lens Module<br>Download images: [https://polyu.me/4aHuGy9](https://polyu.me/4aHuGy9) | |
| **Patellar Auto-mobilising Device (PAD)**<br>Patellofemoral pain syndrome is a common knee problem that reduces the mobility of the patella (kneecap). Manual rhythmic mobilisation of the patella can help relieve pain by creating distraction (bone separation) and enhancing movement. The Patellar Auto-mobilising Device (PAD) automates this process using negative pressure. The PAD consists of an air-sealed kneecap, a mini vacuum pump, a control circuit, an elastic garment suspension mechanism and a rechargeable battery. The device can be worn on the knee and adjusted to create a personalised level of negative pressure that distracts the patellar from the femur. It has various modes that | **Prof. FU Siu Ngor**<br>Associate Head and Peter Hung Professor in Pain Management, Department of Rehabilitation Sciences; Associate Director of Research Institute for Sports Science and Technology<br><br>**Dr Kam-lun LEUNG**<br>Principal Research Fellow, Department of Rehabilitation Sciences | PolyImpact<br>THE HONG KONG POLYTECHNIC UNIVERSITY<br>香港理工大學 | Gold Medal |

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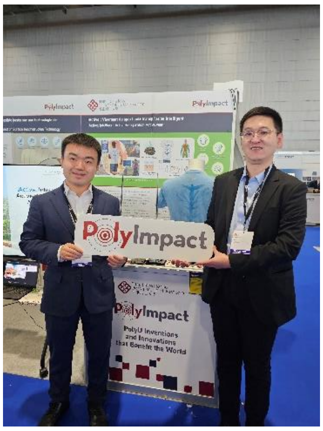
| can hold and release the negative pressure at different time intervals for various conditions. It also allows knee movement under the negative pressure. | | <br>Download images:<br>https://polyu.me/4aHuGy9 | |
| **iActive: Intelligent Active-Perspiration Activewear**<br>iActive sportswear features artificial sweat glands and a root-like liquid transport system, to dissipate sweat faster, and with more control. Unlike traditional sportswear – which, with perspiration, becomes heavy and clingy and does not breathe effectively – iActive excels at active sweat management, ensuring dry, comfortable, high-performance activewear. iActive creates a breathable and dry skin microclimate by dissipating sweat at a rate that is three times faster than the maximum human sweating rate. It also reduces discomfort from post-exercise chills. A smartphone app further aids personalised sweat management by wirelessly adjusting the sweat level of iActive to ensure a dry, relaxing workout experience. It is 60% lighter and 50% less clingy when soaked, providing the wearer with all-round comfort. iActive is highly sought after by athletes, sports enthusiasts, construction workers, hyperhidrosis patients and high-performance professionals, signifying an innovative and sustainable future in sportswear technology. | **Dr SHOU Dahua**<br>Limin Endowed Young Scholar in Advanced Textiles Technologies, and Assistant Professor, School of Fashion and Textiles | <br> <br>Download images:<br>https://polyu.me/4aHuGy9 | Gold Medal |
| **AiDA: AI-based Design Assistant for Fashion** | **Prof. Calvin WONG** | | Gold Medal |

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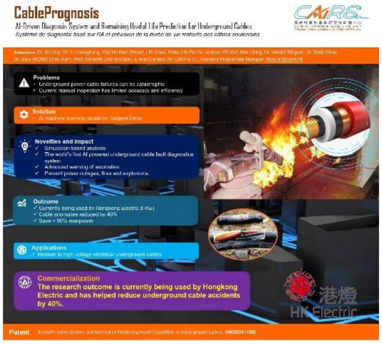
| Currently, fashion designers prepare their mood boards to start their creation process. It then usually takes a few weeks to months to modify, refine and finalise the new collections. AI-based Design Assistant for Fashion, named AiDA embedded with various AI technologies, is the first designer-led AI system to serve as an assistant to fashion designers and positions as an inspiration tool to enhance and accelerate the fashion design process. Through the co-working relationship between fashion designer and AiDA, AiDA can provide many design possibilities speedily, say 8 outfits in 10 seconds each time and speed up the whole fashion design process by 70%. | Centre Director of AiDLab; Cheng Yik Hung Professor in Fashion, School of Fashion and Textiles<br>*Project from AiDLab (established under the AIR@InnoHK cluster in collaboration with the Royal College of Art, UK)* | <br>Download image: [https://polyu.me/4aHuGy9](https://polyu.me/4aHuGy9) | |
| **CablePrognosis: AI-Driven Predictive Health Index System and Remaining Useful Life Prediction for Underground Cables**<br>Health index system for predicting health condition in underground cables by measuring tan-delta signal data of cables. Design of a composite health index and calculation of remaining useful life (RUL) using AI. | **Centre for Advances in Reliability and Safety (CAiRS)** | <br>CablePrognosis<br>AI-Driven Diagnosis System and Remaining Useful Life Prediction for Underground Cables<br>Système de diagnostic basé sur l'IA et prévision de la durée de vie restante des câbles souterrains<br>Problems<br>• Underground power cable failures can be catastrophic<br>• Current manual inspection has limited accuracy and efficiency<br>Solution<br>• AI machine learning model on Tangent Delta<br>Novelties and Impact<br>✓ Simulation-based analysis<br>✓ The world's first AI powered underground cable fault diagnostics system<br>✓ Advanced warning of anomalies<br>✓ Prevent power outages, fires and explosions.<br>Outcome<br>✓ Currently being used by Hongkong Electric (HKE)<br>✓ Cable anomalies reduced by 40%<br>✓ Save > 90% manpower<br>Applications<br>✓ Medium to high voltage electrical underground cables<br>Commercialization<br>The research outcome is currently being used by Hongkong Electric and has helped reduce underground cable accidents by 40%.<br>Patent A Health Index System and Method of Predicting Health Condition in Underground Cables. (HK30081188)<br>Download image: [https://polyu.me/4aHuGy9](https://polyu.me/4aHuGy9) | Gold Medal |

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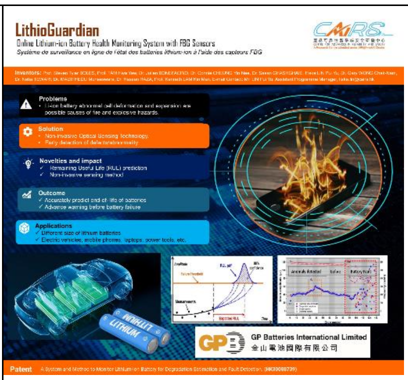
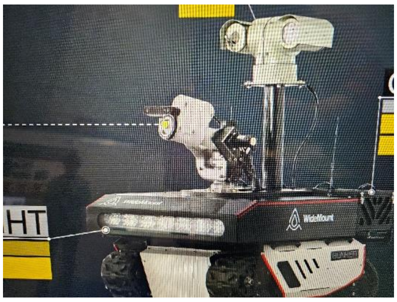
| **LithioGuardian: Online Lithium-ion Battery Health Monitoring System with FBG Sensors**<br>A system and method for monitoring the health condition of lithium-ion batteries using Fiber Bragg grating (FBG) sensors and the provision of advance warning before battery failure. | **Centre for Advances in Reliability and Safety (CAiRS)** | LithioGuardian<br>Online Lithium-ion Battery Health Monitoring System with FBG Sensors<br>*Système de surveillance en ligne de l'état des batteries lithium-ion à l'aide des capteurs FBG*<br>Problems<br>• Li-ion battery abnormal cell deformation and expansion are possible causes of fire and explosive hazards.<br>Solution<br>• Non-invasive Optical Sensing Technology.<br>• Early detection of defects/abnormality<br>Novelties and impact<br>✓ Remaining Useful Life (RUL) prediction<br>✓ Non-invasive sensing method<br>Outcome<br>✓ Accurately predict end-of-life of batteries<br>✓ Advance warning before battery failure<br>Applications<br>✓ Different size of lithium batteries<br>✓ Electric vehicles, mobile phones, laptops, power tools, etc.<br>GP Batteries International Limited<br>金山電池國際有限公司<br>Patent A System and Method to Monitor Lithium-ion Battery for Degradation Estimation and Fault Detection. (HK30088739)<br>Download image:<br>https://polyu.me/4aHuGy9 | Gold Medal |
| **Smart Firefighting Robot**<br>The Smart Firefighting Robot uses multiple artificial intelligence technologies to act autonomously, providing critical support to firefighters in hazardous situations. Like other firefighting robots, this robot has sensors, communication systems and other features. The difference, however, is that this robot is highly autonomous and intelligent, making it extremely easy to use. It can improve the efficiency and effectiveness of fire rescue and firefighting, reduce causalities and damage to property caused by fire, and provide important support for firefighters. The team hopes that this invention can usher in a new era of smart firefighting robots and increase their uptake among firefighting organisations. | **Dr HUANG Xinyan**<br>Associate Professor, Department of Building Environment and Energy Engineering; Advisor, Widemount Dynamics Tech Limited (a PolyU academic-led startup)<br><br>**Mr WANG Meng**<br>Research Assistant, Department of Building Environment and Energy Engineering; Founder, Widemount Dynamics Tech Limited (a PolyU academic-led startup) | PolyVentures<br>Smart Firefighting Robot<br>PolyImpact Download images:<br>https://polyu.me/4aHuGy9 | Silver Medal |

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| **Ammonia Powered Electric Vehicle**<br>Having successfully developed the world's first ammonia-powered electric vehicle, PolyU has extended this work to ammonia-based fuel cell range extenders in electric-powered light vehicles and minibuses, helping advance clean energy goals. Current energy storage technology, based on lithium-ion batteries, faces challenges such as long charging times, limited availability of charging stations and environmental concerns.<br><br>The team's cutting-edge ammonia-powered technology is cheaper, safer and more user-friendly than the hydrogen fuel cells required for lithium-ion batteries. Ammonia is also easier to handle than hydrogen, which is highly explosive and must be stored under high pressure. The infrastructure for handling ammonia – such as storage, filling stations and transportation – is simpler, safer and more cost-effective. This revolutionary project unlocks new possibilities for an ammonia-powered economy, which can overcome the limitations of a hydrogen-powered economy. This clean and carbon-free energy solution has many potential applications, such as in backup power systems, rural electrification projects, microgrid projects and the automotive industry. | **Prof. CHENG Ka-wai Eric**<br>Professor, Department of Electrical and Electronic Engineering | PolyImpact<br>PolyImpact<br>PolyU Inventions and Innovations that Benefit the World<br> <br>Download images:<br>https://polyu.me/4aHuGy9 | Silver Medal |

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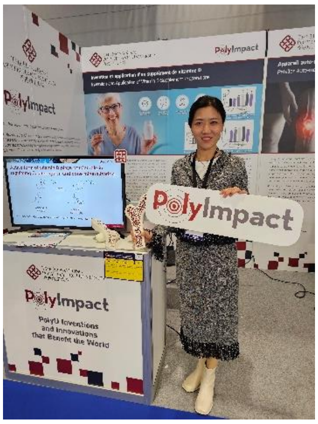
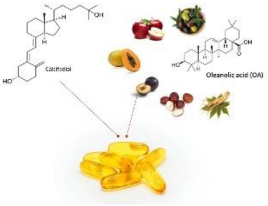
| **Invention and Application of Vitamin D Supplement Preparations**<br>This invention involves a novel vitamin D supplement preparation and its application. The vitamin D supplement contains two active ingredients: calcitriol and oleanolic acid. Oleanolic acid is a natural product that boosts the activity of CYP27B1 (a vitamin D3 bioactivation enzyme) at low concentrations in bone marrow stromal cells and osteoblasts, thereby enhancing the synthesis of bioactive vitamin D3 (1,25(OH)2D3) and promoting osteogenesis. The invention uses an oily mixture formulation of low concentration oleanolic acid and 25(OH)D3, which is more effective in promoting osteoblast differentiation than using either ingredient alone. The oily mixture also increases the bioavailability of oleanolic acid, significantly reducing the amount needed and alleviating the toxic effects of high-dose oral administration of the natural product on tissues and cells. This vitamin D supplement preparation can be used to prevent and treat bone diseases caused by vitamin D deficiency. | **Prof. WONG Man Sau**<br>Director, Research Centre for Chinese Medicine Innovation;<br>Professor, Department of Food Science and Nutrition |   PolyImpact<br>PolyU Inventions and Innovations that Benefit the World<br> <br>Download images:<br>https://polyu.me/4aHuGy9 | Silver Medal |
| **Precision Gene Editing for Enhanced Stem Cell-Retinal Neuron Generation**<br>This invention is an integrated workflow that enhances the differentiation of induced pluripotent stem cells (iPSCs) into retinal ganglion cells (RGCs). It | **Dr HUANG Chien-ling**<br>Associate Professor, Department of Health Technology and Informatics; | | Silver Medal |

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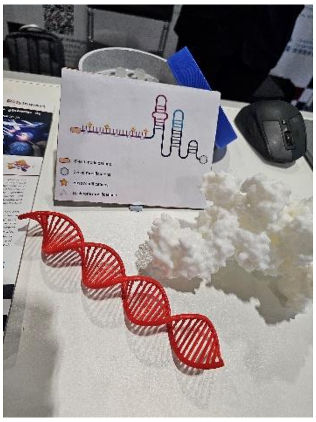
| combines synthetic RNA-based CRISPR editing, single-cell RNA sequencing analysis and artificial intelligence-assisted bioinformatics for genome integrity confirmation.<br>The comprehensive approach overcomes the limitations of current methods and offers a safer, more precise and more efficient way to enhance the efficiency of differentiating iPSCs to RGCs. Synthetic RNA-based CRISPR editing ensures the precision and safety of gene editing, while single-cell RNA sequencing provides the dynamic gene expression profiles of the differentiated cells. Meanwhile, CNVPipe-AI, a bioinformatics pipeline, confirms the genome integrity of the edited cells through detection of copy number variations. This invention has broad applications in regenerative medicine and precision disease modeling. Its impact extends to accelerating advancements in stem cell-based therapies and precision medicine, with potential benefits for patients with degenerative eye diseases. | Principal Investigator, Centre for Eye and Vision Research Limited<br>**Prof. YIP Shea-ping**<br>Head and Chair Professor of Diagnostic Science and Molecular Genetics, Department of Health Technology and Informatics; Principal Investigator, Centre for Eye and Vision Research Limited | <br><br>Download images: https://polyu.me/4aHuGy9 | |
| **A Smart 3D+AI Industrial IoT (IIoT) Sensor for Precise Measurement**<br>The Smart 3D+AI industrial IoT (IIoT) measurement sensor uses patented 3D+AI technology to achieve ultra-precise 3D measurements in a single snapshot through non-contact, single-lens autostereoscopic technology. With | **Dr LI Da**<br>Founder, PlusD Technology Limited (a PolyU startup) | PolyVentures<br>PolyImpact<br>PolyU Inventions and Innovations that Benefit the World | Silver Medal |

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| high frame rates and efficient HDR imaging, it uses AI deep learning to recognise, position and track targets in industrial environments. This sensor can establish an intelligent vision ecosystem that provides comprehensive information on dimensions, status and visual features. The customised products for micro-measurement and macro-measurement have been widely deployed in leading automotive industries in Mainland China with positive feedback. Their use promises to accelerate industrial processes both domestically and internationally, driving advancements toward Industry 4.0. | | <br>Download images:<br>[https://polyu.me/4aHuGy9](https://polyu.me/4aHuGy9) | |
| **Novel Nano-imprinting Technology for Anti-counterfeiting Micro-images and Information Storage**<br>This novel nano-imprinting technology creates micro-images on high-value products for anti-counterfeiting and information storage. Each pixel in the micro-image is encoded by adjusting its direction, allowing a massive amount information to be stored inside. In this way, a string of anti-counterfeiting code can be digitally encoded into the micro-image. The micro-image cannot be replicated without knowing the code, so that this technology is more effective in preventing counterfeiting in comparison to traditional image anti-counterfeiting methods. The technology combines precision motion control technology and | **Prof. Sandy Suet TO**<br>Professor, State Key Laboratory of Ultraprecision Machining Technology, Department of Industrial and Systems Engineering<br><br>**Dr Zhanwen SUN**<br>Postdoctoral Fellow, State Key Laboratory of Ultraprecision Machining Technology, Department of Industrial and | PolyImpact<br> | Silver Medal |

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| piezoelectric drive technology to achieve high-precision machining of micro/nanoscale structures. This enables it to create micro-images and QR codes on various industrial materials. Given its wide range of applications, this technology is expected to revolutionise existing image anti-counterfeiting technology and extend its use to protect valuable products and store important information. | Systems Engineering<br>**Dr Lenny Wai Sze YIP**<br>Research Assistant Professor, State Key Laboratory of Ultraprecision Machining Technology, Department of Industrial and Systems Engineering | Download images:<br>https://polyu.me/4aHuGy9 | |
| **Smart Headset featuring Adaptive Noise Filters for Individuals with Autism Spectrum Disorder**<br>This innovative smart headset creates a personalised adaptive noise filter for users with Autism Spectrum Disorder(ASD). The noise filter is based on each user's unique aural perception response, reducing irritating noise without interfering with normal everyday sounds such as speech. This makes the sound perceived by the user more comfortable, helping alleviate negative behaviour triggered by intolerable sound stimuli. The smart headset works with a mobile application that quickly assesses the aural perception response of each user and creates a unique noise filter. The smart headset is a significant technological breakthrough that could transform the lives of individuals with ASD by making | **Dr CHOY Yat Sze**<br>Associate Professor, Department of Mechanical Engineering | PolyImpact<br> <br>Download images:<br>https://polyu.me/4aHuGy9 | Silver Medal |

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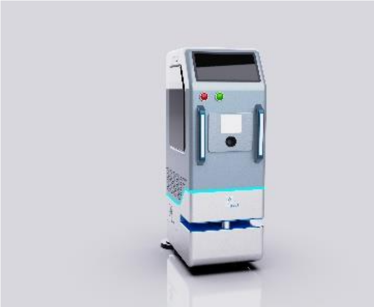
| their daily experiences more manageable and enjoyable. It also enhances their communication, education and social lives, thus benefitting both the users and their families by improving their quality of life. | | | |
| **ZC-01™ Automatic Washroom Cleaning Robot**<br>The ZC-01™ is a commercial toilet cleaning robot that operates either manually or automatically. It uses non-visual LiDAR and infrared sensors for adaptive cruise and can clean toilets and urinals in a contactless way, with drying and UV sterilisation functions. Before cleaning, the ZC-01™ can detect and open the toilet lid. The ZC-01™ can reduce the cost of commercial cleaning and help industry become more environmentally-friendly by recording energy and chemical consumption. Most importantly, ZC-01™ can reduce work aversion in commercial washroom cleaning. The target market of the ZC-01™ is Hong Kong's commercial buildings, government buildings, large public toilets, international airport, and its international conference venue AsiaWorld-Expo, as well as large highway rest areas in the mainland China – all places that require a large amount of cleaning. | **Mr LEE Tsz Chung Curry**<br>Founder, ZeeqClean Technology Limited<br>(a PolyU start-up) | <br><br>Download images:<br>https://polyu.me/4aHuGy9 | Silver Medal |
| **WiseEye: A standalone AI based defect detection, classification and grading system for textiles**<br>In global textile and apparel industries, the inspection of textile | **Prof. Calvin WONG**<br>Centre Director of AiDLab; Cheng Yik Hung | | Silver Medal |

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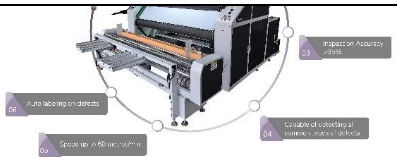
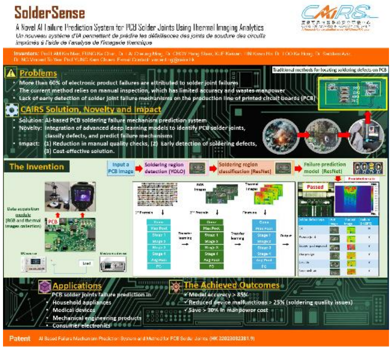
| materials relies mainly on human visual inspection which is unreliable and inefficient. WiseEye is a pioneer standalone AI based inspection system to detect, classify and grade defects automatically and instantly on common woven, knitted, and non-woven textile materials in high-speed inspection environments. It alleviates the problem of shortage of highly skilled quality inspectors and minimises downstream wastage. | Professor in Fashion, School of Fashion and Textiles<br>*Project from AiDLab (established under the AIR@InnoHK cluster in collaboration with the Royal College of Art, UK)* |   Inspection Accuracy >95%<br>03<br>Auto labeling on defects<br>06<br>Capable of detecting all common types of defects<br>04<br>Speed up to 60 metres/min<br>05<br>Download image: [https://polyu.me/4aHuGy9](https://polyu.me/4aHuGy9) | |
| **SolderSense: A Novel AI Failure Prediction System for PCB Solder Joints Using Thermal Imaging Analytics**<br>An AI system predicts PCB solder joint failures and identifies their causes, providing an economical solution to detect early solder joint defects during manufacturing processes and improve reliability. | **Centre for Advances in Reliability and Safety (CAiRS)** |   SolderSense<br>Download image: [https://polyu.me/4aHuGy9](https://polyu.me/4aHuGy9) | Silver Medal |
| **WireInspect: Anomaly Detection System for Elevator Steel Wire Ropes Using Deep Learning Models**<br>Data driven system and method for detecting anomalies in elevator steel wire ropes (SWRs) using deep learning models. Improved efficiency and accuracy in identification and warning of defects and anomalies. | **Centre for Advances in Reliability and Safety (CAiRS)** | WireInspect<br>Download image: [https://polyu.me/4aHuGy9](https://polyu.me/4aHuGy9) | Silver Medal |

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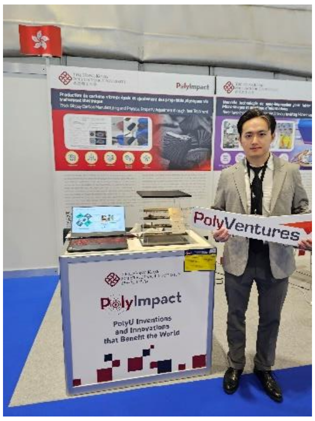
| **RoboGuide: Intelligent Collision Avoidance Tracking and Hazardous Object Detection for Robot Temi**<br>Enhancement of moving robot to track moving object for collision avoidance and detect hazardous object detection in specific application usage. | **Centre for Advances in Reliability and Safety (CAiRS)** | RoboGuide<br>Intelligent Collision Avoidance Tracking and Hazardous Object Detection for Robot Temi<br>ROBOCORE<br>Collision Avoidance Prediction<br>Hazardous Object Detection<br>Download image: [https://polyu.me/4aHuGy9](https://polyu.me/4aHuGy9) | Silver Medal |
| **ClearLens: Cutting-Edge Camera Tampering and Anomaly Detection System for Video Surveillance**<br>AI methods to automatically detect four anomaly types of image blurriness from smart surveillance videos camera system in real-time. Covers spray painted, defocused, dirt and hazy images against normal output. | **Centre for Advances in Reliability and Safety (CAiRS)** | ClearLens<br>Cutting-Edge Camera Tampering and Anomaly Detection System for Video Surveillance<br>système de pointe permettant de détecter les anomalies et le sabotage des caméras de vidéosurveillance<br>Normal<br>Defocus<br>Download image: [https://polyu.me/4aHuGy9](https://polyu.me/4aHuGy9) | Silver Medal |
| **Thick Glassy Carbon Manufacturing and Physical Property Adjustment through Heat Treatment**<br>Glassy carbon is a carbon material that does not form graphite crystals and has excellent physical and chemical properties. It can be used in various applications such as glass molding and the semiconductor industry. However, this material has a number of challenges, such as size limitations, high preparation costs and high hardness that make it difficult to process directly. To overcome these challenges, the team has developed a way to produce large, | **Mr YANG YI**<br>PhD Student, Department of Mechanical Engineering; Founder, Discarbonery Technology Limited (a PolyU startup) |  PolyVentures<br>PolyImpact<br>PolyU Inventions and Innovations that Benefit the World | Bronze Medal |

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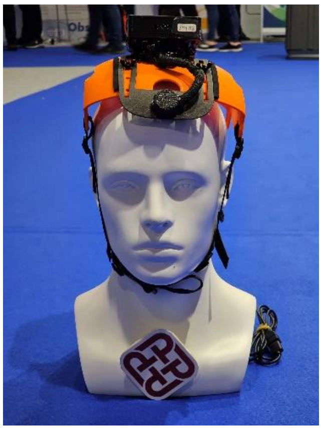
| cost-effective, shape-controlled glassy carbon products and a way to use heat treatment to subsequently adjust their physical properties. These strategies enable us to fine-tune the properties of glassy carbon to suit different applications and extend product lifespan. | | <br>Download images: [https://polyu.me/4aHuGy9](https://polyu.me/4aHuGy9) | |
| **Transcutaneous Electrical Nerve Stimulation (TENS) Hat to Limit Dementia Progression**<br>The TENS Hat is a head-mounted device that delivers a constant ultra-low current to stimulate specific acupoints in the head region through the skin. It can effectively slow cognitive decline in patients with mild dementia. Treatments to stop the progression of dementia, or cure it, are limited. The available medicines only help with managing symptoms temporarily, often with many side effects. The TENS Hat combines TENS and practice of Chinese medicine to create a novel, patented, wearable headset optimised for cognitive enhancement. Our pioneering approach applies mild, non-invasive electrical stimulation to various acupoints in the head. With the contact pads optimally positioned, patients can use the TENS Hat with ease at home with minimal training, and without the need for an acupuncturist, greatly enhancing adherence of the treatment. | **Dr SETO Sai-wang**<br>Associate Director, Research Centre for Chinese Medicine Innovation; Assistant Professor, Department of Food Science and Nutrition<br><br>**Prof. Samuel LO**<br>Honorary Professor, Department of Applied Biology and Chemical Technology | PolyImpact<br><br>Download images: [https://polyu.me/4aHuGy9](https://polyu.me/4aHuGy9) | Bronze Medal |
| **AR Smart Headset with Gesture Recognition and Control** | **Dr Carman LEE**<br>Associate Professor, | | Bronze Medal |

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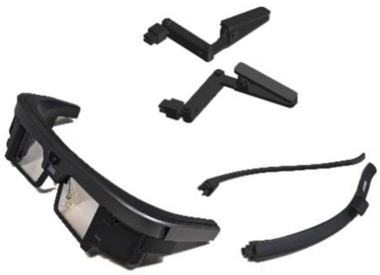
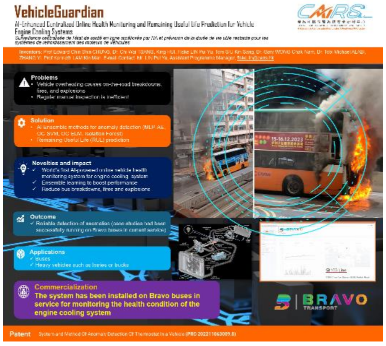
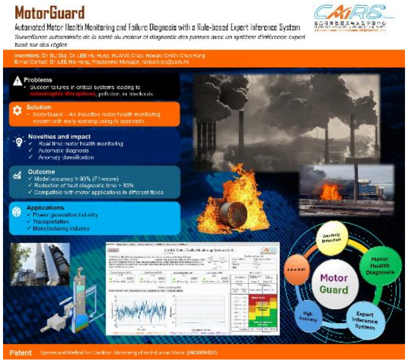
| The AR Smart Headset transforms user experience with augmented reality and gesture control. Its unique modular design integrates seamlessly with high-quality headphones, offering a value-added element to the headphones for industrial and entertainment purposes. The gesture recognition system enables effective control in noisy environments and supports passive QR code scanning for various applications from the egocentric view of the user. The highlighted technical features include the gesture control module, modular product design and passive QR code scanning. | Department of Industrial and Systems Engineering<br>*Project from AiDLab (established under the AIR@InnoHK cluster in collaboration with the Royal College of Art, UK)* | <br>Download image:<br>https://polyu.me/4aHuGy9 | |
| **VehicleGuardian: AI-Enhanced Online Health Monitoring and Remaining Useful Life Prediction for Vehicle Engine Cooling Systems**<br>A pioneering approach to detect anomalies in a vehicle's engine cooling system using AI. Prediction of remaining useful life (RUL) and provision of an early warning signal before an engine cooling system fails. | **Centre for Advances in Reliability and Safety (CAiRS)** | <br>VehicleGuardian<br>AI-Enhanced Centralized Online Health Monitoring and Remaining Useful Life Prediction for Vehicle Engine Cooling Systems<br>*Surveillance centralisée de l'état de santé en ligne améliorée par l'IA et prévision de la durée de vie utile restante pour les systèmes de refroidissement des moteurs de véhicules*<br>Inventors: Prof Edward Chin Shin CHUNG, Dr. Chi Wai TSANG, King HUI, Fiske LIN Pui Yu, Tom SIU Kin Sang, Dr. Gary WONG Chak Nam, Dr. Tobi Michael ALABI, ZHANG Yi, Prof Kenneth LAM Kin Man. E-mail Contact: Mr. LIN Pui Yu, Assistant Programme Manager, fiske.lin@cairs.hk<br>Problems<br>• Vehicle overheating causes on-the-road breakdowns, fires, and explosions<br>• Regular manual inspection is inefficient<br>Solution<br>• AI Ensemble methods for anomaly detection (MLP AE, OC SVM, OC ELM, Isolation Forest)<br>• Remaining Useful Life (RUL) prediction<br>Novelties and impact<br>✓ World's first AI-powered online vehicle health monitoring system for engine cooling system<br>✓ Ensemble learning to boost performance<br>✓ Reduce bus breakdowns, fires and explosions<br>Outcome<br>✓ Reliable detection of anomalies (case studies had been successfully running on Bravo buses in current service)<br>Applications<br>✓ Buses<br>✓ Heavy vehicles such as lorries or trucks<br>Commercialization<br>The system has been installed on Bravo buses in service for monitoring the health condition of the engine cooling system<br>Patent System and Method Of Anomaly Detection Of Thermostat In a Vehicle (PRC 202211063009.8)<br>Download image:<br>https://polyu.me/4aHuGy9 | Bronze Medal |
| **MotorGuard: Automated Motor Health Monitoring and Failure Diagnosis with a Rule-Based Expert Inference System**<br>System for automatic diagnosis of anomalies in induction motors using a rule-based expert-inference approach. It can predict the remaining useful life of motor using AI. | **Centre for Advances in Reliability and Safety (CAiRS)** | <br>MotorGuard<br>Automated Motor Health Monitoring and Failure Diagnosis with a Rule-based Expert Inference System<br>*Surveillance automatisée de la santé du moteur et diagnostic des pannes avec un système d'inférence expert basé sur des règles*<br>Inventors: Dr. BU Siqi, Dr. LEE Hiu Hung, HUANG Chao, Howard CHAN Chun Hung<br>E-mail Contact: Dr. LEE Hiu Hung, Programme Manager, rainbow.lee@cairs.hk<br>Problems<br>• Sudden failures in critical systems leading to catastrophic disruptions, pollution, or blackouts<br>Solution<br>• MotorGuard – An induction motor health monitoring system with early warning using AI approach<br>Novelties and impact<br>✓ Real time motor health monitoring<br>✓ Automatic diagnosis<br>✓ Anomaly classification<br>Outcome<br>✓ Model accuracy ≥ 90% (F1-score)<br>✓ Reduction of fault diagnostic time ≥ 80%<br>✓ Compatible with motor applications in different fields<br>Applications<br>✓ Power generation industry<br>✓ Transportation<br>✓ Manufacturing industry<br>Patent System and Method for Condition Monitoring of an Induction Motor (HK30094437)<br> Anomaly Detection<br>Motor Health Diagnosis<br>Expert Inference System<br>High Accuracy<br>Automation<br>Motor Guard<br>Download image:<br>https://polyu.me/4aHuGy9 | Bronze Medal |

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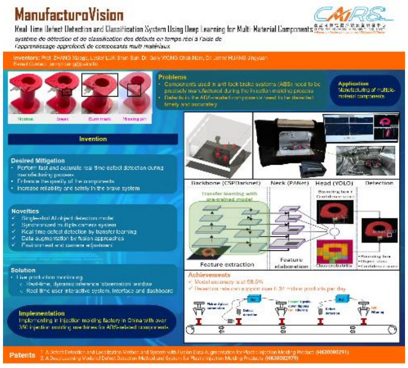
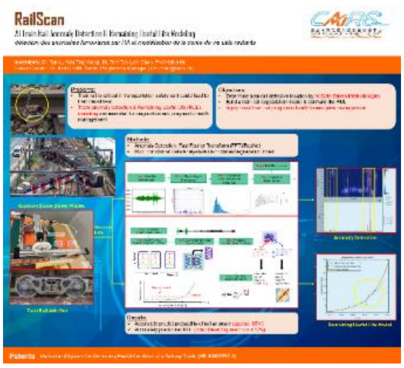
| **ManufacturoVision: Real-Time Defect Detection and Classification System Using Deep Learning for Multi-Material Components**<br>A fast and accurate real-time defect detection system for manufacturing products/components, with deep learning algorithm trained with environmental-fused augmented data. | **Centre for Advances in Reliability and Safety (CAiRS)** | <br> <br>Download image:<br>https://polyu.me/4aHuGy9 | Bronze Medal |
| **RailScan: AI Rail Anomaly Detection and Remaining Useful Life Modelling**<br>Train rail anomaly detection system applying train rail vibration data on deep learning models (ResNet/VAE) to learn the defective signals and estimate the remaining useful life. | **Centre for Advances in Reliability and Safety (CAiRS)** | <br> <br>Download image:<br>https://polyu.me/4aHuGy9 | Bronze Medal |

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POLYTECHNIC UNIVERSITY
香港理工大學

Press Release
新聞稿