

## Appendix

### 1. List of Collaborative Projects between FLAIR and World-renowned Research Institutions and Enterprises

Research Institutions and Enterprises	Collaborative Projects
<b>Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences</b>	Jointly build the “National Industrial and Information Department's Public Service Platform on the Industrialisation of Innovation Achievement for Robotics and Intelligent Manufacturing - Hong Kong Base” to collaborate on R&D in intelligent automation manufacturing, robotics, flexible production, and other fields. It will promote technological innovation, product upgrades, and extension of the industrial chain and become a vital support platform for both parties' technical research as well as cooperation among industry, academia and research sectors.
<b>Huawei International Co. Limited</b>	Collaborate on R&D in machine learning (ML) and artificial intelligence (AI) projects, leveraging the computing power of Huawei's Ascend series products to accelerate the development of various AI models.
<b>Reitar Logtech Group Limited</b>	Intended to establish a joint venture to deepen cooperation in intelligent logistics and warehousing. By combining our respective strengths, we aim to provide the logistics industry with efficient and high value-added solutions.
<b>NY Technology Limited</b>	Cooperate to establish a joint venture and apply artificial intelligence and robotics technologies to various industries, including developing a user-friendly and multifunctional mobile robotics platform.
<b>Siemens Limited</b>	Jointly explore the development of sensor applications for key technology research in industrial equipment prediction and health management using edge computing, IIoT, and 5G technologies. Technologies developed by FLAIR will be included in Siemens' global innovation cooperation platform Xcelerator and promoted worldwide.
<b>SmartMore Corporation Limited</b>	Collaborate on R&D of industrial artificial intelligence and robotic technologies.
<b>Shenzhen Institute of Artificial Intelligence and Robotics for Society</b>	Engage in long-term cooperation through technological collaboration, integration among industry, academia and research sectors, commercialisation of technological achievements, high-tech innovation and entrepreneurship investment, joint construction of national R&D platforms, talent cultivation and exchange etc., to jointly undertake national major research projects and special projects, cater to the technical needs of enterprises, promote industrial innovations and upgrading, drive commercialisation of technological accomplishment, and achieve win-win cooperation between both parties.

## 2. New Technologies and Research Achievements Showcased on “FLAIR Open Day”

Project	Description
<p><b>(1) Hephaestus: Industrial Artificial Intelligence Application Platform</b></p> <p><b>In collaboration with:</b> The Hong Kong Productivity Council (HKPC)</p>	<p>This industrial artificial intelligence application platform is designed for the industries to unleash the power of AI on their industrial businesses. The platform is highly adaptable, easy to organise, streamlined and time-saving, with deep learning/ machine learning and AI application software templates. The platform can provide clients with customisable industrial applications in a timely manner.</p>
<p><b>(2) Development of Key Technologies and Applications of Industrial Equipment Prognosis and Health Management using Edge Computing, IIoT and 5G</b></p> <p><b>In collaboration with:</b> Electrical and Mechanical Services Department of the HKSAR Government</p>	<p>An AI powered Prognostic and Health Management (PHM) system with IoT edge computing to monitor status of automatic doors and other industrial equipment which can detect and predict faults, and predict Remaining Useful Life (RUL) using deep learning. The project won Gold Medal in “2023 Geneva International Exhibition of Inventions”.</p>
<p><b>(3) Flexible Assembly Line with Collaborative Robotics and Flexible Semi-automation</b></p> <p><b>In collaboration with:</b> HKPC and Pro-Technic Machinery Limited</p>	<p>With a flexible “hand”(collaborative robot), the robot first inspects complex objects from all angles. Then its intelligent 'eye' (high-resolution camera) detects minor defects on the surface. Finally, its intelligent 'AI brain' autonomously locates the next best view for the product and rapidly adapts to new products on the production line, then explores unknown defects through unsupervised learning using a limited number of golden samples, thus achieving intelligent product quality inspection. The project has obtained patents in Hong Kong and Mainland China with an aim at continuous improvement on detection accuracy, enhancing product quality, saving labour costs, and accelerating product transformation. This project was shortlisted for the HKSTP's Ideation Programme for nurturing technology start-ups and won the Innovation Award at “TechConnect 2023”.</p>
<p><b>(4) Development of Interactive Control System for Robot Manipulation in Assembly Application</b></p> <p><b>Collaboration partners:</b> HKPC and the Hong Kong Joint Research Lab for Applications of Intelligent Automation</p>	<p>The technology allows intuitive interaction through Augmented Reality (AR) glasses so that the human operator can monitor as well as control the industrial robot arm both on-site and remotely. Robotic tasks can be demonstrated by humans in the AR environment and the skill can be transferred directly to the robot arm for task execution without the need of complex programming.</p> <p>The technology provides a new complementary framework for human-machine collaboration that balances the safety of humans</p>

Technology (co-founded by HKPC, Department of Automation, Tsinghua University, and Research Institute of Tsinghua, Pearl River Delta)	and the efficiency of robots. The robot carries out given tasks using a vision-based adaptive controller, and the human operator collaborates with the robot in the null space. Additionally, the robot can simultaneously learn the expert's demonstration in task space and null space with dynamic movement primitives (DMP). Human demonstration and involvement are enabled via AR devices, achieving simple and efficient data collection from demonstration. The technology has won the TechConnect 2023 Innovation Awards.
<b>(5) AI-based Quality Prediction and Root Cause Analysis using Machine Learning</b>	An AI-based system that analyses various production data of a manufacturing process so as to perform quality prediction and root cause analysis to improve product quality. This project won Bronze Medal in 2023 Geneva International Exhibition of Inventions.
<b>(6) AI Monitor and Decision Support for Production Processes</b>	The systematic visualised interactive software platform is a system that monitors and analyses the logistic processes, identifies bottlenecks and their root causes, predicts potential bottlenecks and provides contingency plans based on log data. It predicts when and where bottlenecks will occur in the process and how they will occur, providing a "process bottleneck detection and prediction" system for the logistics and related supply chain industries. This project has been shortlisted for the Ideation Programme for Hong Kong Science & Technology Parks Corporation (HKSTP)'s Ideation Programme for nurturing technology start-ups.
<b>(7) AI enabled Multi-purpose Mobile Robotic Platform for Agile and Easy to Use Temporary Automation</b>  In collaboration with: NY Technology Limited	This modular mobile robotic platform can complete various tasks in processing and production in different industries, with advantages including horizontal and vertical expansion capability, short setup time, ease of use, advanced navigation, and support for long-term operation. This project has been shortlisted for the Ideation Programme for HKSTP's Ideation Programme for nurturing technology start-ups.
<b>(8) Inspection Vision System for Surface Defects of Industrial Products</b>	This system is an AI-based inspection framework for detecting and evaluating defects in the LCD screen manufacturing process. The system evaluates how to handle defective products based on automatic defect segmentation and classification results. The original compatible automatic labelling algorithm only requires little pixel-level annotations for model training, while providing decent accuracy in detection, improving product quality and reducing yield loss. This project has been shortlisted for HKSTP's Ideation Programme for nurturing technology start-ups.