TECH OFFER

Automating Equipment with Advanced AI for Autonomous Manufacturing

KEY INFORMATION

TECHNOLOGY CATEGORY:

Infocomm - Artificial Intelligence

Infocomm - Robotics & Automation

Manufacturing - Assembly, Automation & Robotics

Infocomm - Smart Cities

TECHNOLOGY READINESS LEVEL (TRL): TRL9

COUNTRY: SINGAPORE

ID NUMBER: TO175297

OVERVIEW

Automation for advanced manufacturing has reached its limits due to human biological limitations as well as the need for repetitive, standardized workflows. Deep learning AI is necessary to automate dynamic, non-standard workflows so as to enable true autonomous manufacturing.

The product owner has developed an AI controller capable of connecting to manufacturing equipment non-intrusively, through low-level hardware interfaces (e.g. VGA, HDMI, USB), without any modifications or software installation to the existing system. Inside the controller is a powerful manufacturing AI agent that emulates both human judgment and behaviour, capable of fully autonomizing all operations as well as forecast equipment health. With incremental learning capabilities, it can generate new insights for equipment as well as process optimization. Factories can also use this product for intelligent remote control and monitoring (RCM) through their command-and-control platform. Unlike other command centers, this platform need not be

manned by subject domain experts. Instead, only an engineer is required to ensure all AI agents are online.

The technology solution has been piloted and successfully deployed within notable semiconductor manufacturers. The technology owner is seeking collaboration opportunities with other advanced manufacturing industries, such as aerospace or medical devices, looking to leverage on smarter autonomous manufacturing and OEM equipment manufacturers looking to explore leveraging on AI capabilities into their existing and future equipment for a more competitive edge.

TECHNOLOGY FEATURES & SPECIFICATIONS

This product combines advancements in AI, software, and hardware as illustrated below:

AI Agent

- Vision-Driven Intelligent Process Automation: With a much more advanced version of robotic process automation (RPA), it is capable of interpreting highly complex UI from the equipment to make real-time dynamic decisions.
- Equipment Health Prediction: The product automatically collects and analyzes all forms of data from the equipment – process logs, UI information, etc. – and provides a health indicator. A decreasing trend in the health indicator or any anomaly is flagged as a potential issue to be investigated.
- Equipment Parameter Optimization: Some machines require tuning to ensure that it is performing at its most efficient state or can run the process consistent with expectation. The Equipment Parameter Optimization will analyze and determine the most optimum values for these tuning parameters, and with its Vision-Driven Process Automation, the AI agent can automate the tuning process of any machine with these parameter values.

Hardware

- Non-intrusive compact form factor that supports all major equipment types (e.g. Windows, Linux, Unix, DOS, Sun Microsystem)
- Multiple low-level hardware interfaces connection (e.g. VGA, HDMI, USB, PS/2) for easy plug-and-play
- Communicates with equipment via numerous industrial protocols (e.g. MODBUS, RJ45, TCP, RS485/232)

Software

- Remote control and monitoring (RCM)
- GUI no-code programmer to automate simple workflows using RPA

POTENTIAL APPLICATIONS

The technology solution can be used for any manufacturing processes (e.g. advanced or precision engineering) that benefits from the utilisation of AI capabilities. These applications include:

- **Equipment with Repetitive Workflow:** This is for machines that have simple operation function, workflow, or user interface. The operator is expected to perform simple, repetitive tasks such as start process, pause process, select recipe, and clear a fixed set of alarm notifications. These operations can be automated using the AI's RPA capabilities.
- **Equipment with Dynamic or Recipe-Dependent Workflow:** Many machines require operators to carry out actions based on information set in their recipes. In this case, RPA may be inefficient as it requires an automated RPA workflow for each recipe, with a new workflow for each new recipe created. This technology is able to automate any complex workflow processes into a RPA with dynamic logic.

- **Equipment using Vision Processes (e.g. lithography, visual defect detection):** Using the AI's smart vision capability, it enables autonomous intervention or further automation to improve the vision process by analysing the deployed vision sensors to improve accuracy and optimise parameters which previously require manual intervention.
- **Equipment that Requires Tuning:** Some machines require constant/routine tuning as part of the preventive maintenance or for recipe creation/optimisation. The tuning process require high level of technical expertise and experience to analyse current performance and to tune accordingly. The AI is able to shorten the tuning downtime while eliminating inconsistencies, resulting in an improved and consistent autonomous tuning process.

MARKET TRENDS & OPPORTUNITIES

The further need for improving productivity and development of AI functionalities enable industrial automation to take a further step. More advanced AI models can now enable further emulation of human judgement and processes on the production floor, shifting from repetitive industrial automation to true autonomy. With more complex and faster workflow requiring immediate responses, there is industrial shift from slower cloud computing to faster edge computing execution. Lastly, legacy equipment currently deployed can now leverage on AI functionalities to further enhance operational efficiency, resulting in an improvement in Overall Equipment Effectiveness (OEE).

UNIQUE VALUE PROPOSITION

The technology solution achieves true autonomy in dynamic workflows with any equipment through simple plug-and-play form factor, using advanced computer vision, insight generation and deep learning. This eliminates the need for expert human judgement and technical expertise required to operate and manage. The non-intrusive hardware uses low-level interfaces for connectivity, avoiding the need for long and complex downtime for equipment modification and software installation. With edge computing and easy integration to downstream and upstream processes, the AI agent is able to coordinate across workflows, optimising operations to occur seamlessly without expert monitoring. Lastly, it provides reliable machine performance insights based on current operational data, focusing on proactive and positive maintenance strategies rather than historical failures.