Press Release
For Immediate Release

HITACHI

Hitachi develops Physical AI technology that learns and optimizes its own motion behavior on-site to automate complex tasks

Applicable across a variety of workplaces, including manufacturing, equipment maintenance, and logistics, and achieves practical on-site speed and quality for tasks previously difficult to automate

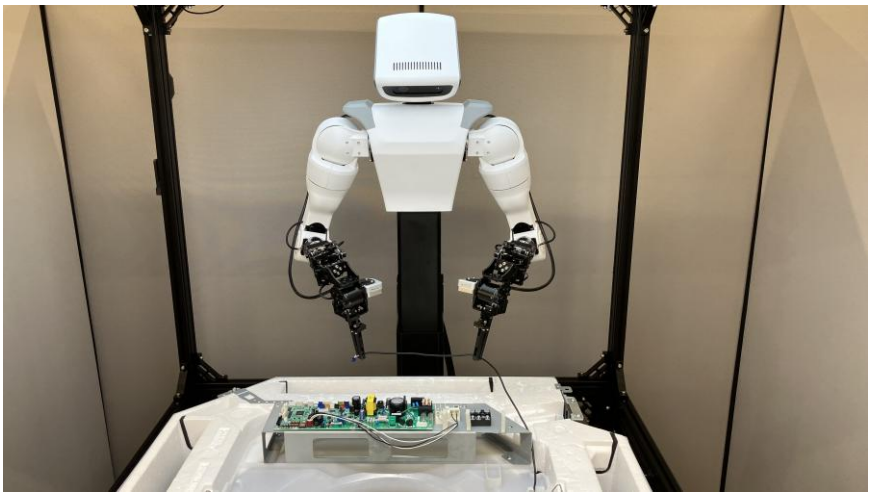

Figure 1. Operation of a Physical AI robot

Tokyo, March 23, 2026 Hitachi, Ltd. (TSE 6501, "Hitachi") is globally advancing its "HMAX by Hitachi" ("HMAX") suite of next-generation solutions, which leverage AI to transform social infrastructure, under the One Hitachi initiative. Through this effort, Hitachi aims to bring about industrial sites where people, AI, and robots evolve together, maximize value creation, and drive innovation in social infrastructure. As part of this initiative, Hitachi has developed physical AI technology that autonomously learns on-site and enhances the speed and quality of operations while continuously optimizing its own motion behavior.

Robots equipped with this technology continuously learn from behavioral data and task-related know-how generated in real-world environments, enabling them to evolve in response to changes in on-site conditions and task requirements. In addition, by utilizing sensor data for vision and force/tactile sensing, the robots precisely control the magnitude and direction of force applied when interacting with objects. This enables the automation of complex tasks requiring delicate handling of flexible materials, such as wire-harness assembly. The technology has the potential for use across a wide range of industrial settings, including manufacturing, equipment maintenance, and logistics, and makes tasks that were previously difficult to automate possible to perform at practical on-site levels of speed and quality.

This technology represents one of the core underpinnings "Integrated World Infrastructure Model (IWIM)," [*1]. promoted by Hitachi within the HMAX framework of solutions that embody Lumada 3.0. Going forward, Hitachi will continue to integrate domain knowledge cultivated from real-world operations into AI and leverage strengths in its physical AI, which enables end-to-end

deployment from design and implementation through to operational improvement, to enhance productivity and support business growth for customers' industrial sites on a global scale.

*1 Integrated World Infrastructure Model (IWIM): A model announced by Hitachi in November 2025 to support the development of physical AI and HMAX. By integrating AI technologies with the knowledge and methodologies Hitachi has accumulated in the social infrastructure domain, Integrated World Infrastructure Model (IWIM) enables accurate understanding, reasoning, and response to real-world phenomena. This establishes an AI foundation capable of continuous, autonomous evolution in the field, including functions such as prediction, planning, and control of the phenomena (e.g., autonomously evolving manufacturing automation).

Background and issues

In industrial settings, labor shortages are becoming increasingly severe, while the aging population of skilled workers heightens the need to pass technical expertise on to younger generations. The challenges are particularly evident in environments that handle a wide variety of products. Not only do tasks differ from one process to another, but many operations also require delicate force control and precise movements. As a result, reliance on human workers, especially skilled technicians, has remained inevitable.

To address these challenges, Hitachi has been advancing its research and development of physical AI technologies aimed at automating on-site operations. While the efforts have made progress on automating simple tasks, diverse environments with different equipment, components, and procedures have required system downtime for collecting data and making operational adjustments whenever operating conditions or objects change. The resulting difficulties in ensuring general-purpose applicability and flexibility have left challenges in automating processes with frequent changes as well as complex and delicate tasks.

Features of the technologies developed to address these challenges

In light of these challenges, Hitachi has developed the following physical AI technologies:

1. AI that continuously evolves on-site by learning and optimizing itself

The developed AI is immediately deployable on-site and continues to learn[*2] autonomously by incorporating on-site operational data and the know-how of skilled workers. Through continuous learning, the AI effectively trains itself through repeated experience, improving both the speed and quality of operations. As it flexibly adapts to differences in work environments, equipment configurations, process changes, and new task patterns by accumulating on-site data, it continually evolves toward optimal motion. For example, the AI selectively collects only successful behavioral data during tasks and uses it for additional learning to improve its motion accuracy. Even when the equipment or product specifications change, there is no need for large-scale retraining or system modifications; instead, the AI autonomously learns and optimizes using the latest on-site data.

*2 Part of this research is supported by the JST Moonshot R&D Program (Grant Number JPMJMS2031).

2. Hitachi's proprietary high-speed AI model (100 Hz) for rapid adaptation to diverse environments and processes

In conventional robots, the number of motion commands that on-board AI can issue has been limited to 10 per second, making it difficult to handle delicate tasks involving soft components or cables. Based on a deep predictive learning[*3] technology that took shape through joint research with Waseda University, Hitachi has developed an AI model capable of issuing commands at

high speeds of up to 100 per second. This speed is comparable to how quickly humans make subconscious, reflexive muscle adjustments, enabling instantaneous processing of sensor data such as tactile information and allowing robots to perform complex tasks with human-equivalent speed and precision. In addition, the developed AI model features a compact, energy-efficient design[*4] and can learn effectively from limited data, making rapid deployment possible across a wide range of robots and environments.

*3 A deep learning technology in which AI predicts future states and autonomously determines and executes actions while minimizing discrepancies between its predictions and actual conditions.
*4 While large language models typically have billions to tens of billions of parameters, this model has on the order of hundreds of thousands, resulting in reduced computational requirements and lower power consumption during training and inference.

3. "Whole-body coordinated motion learning" that enables human-like movement

Humans acquire an understanding of their own bodily structure and ease of movement (physicality) from an early age. As a result, they subconsciously select optimal positions and postures for the nature of the work involved to efficiently coordinate their entire body when performing tasks. Drawing on this understanding, Hitachi developed an algorithm that enables robots to learn coordinated movements with their entire body, including not only the arms and hands but also the entire upper and lower body. This allows robots to move while autonomously assuming optimal positions and postures relative to target objects, reducing variability in work quality and minimizing rework and consequently alleviating the burden on human workers.

Looking ahead

Aiming to deploy the technology as a core component of HMAX, Hitachi will continue to conduct technological demonstrations across a variety of workplaces both within and outside the Group. As part of these efforts, Hitachi will open a "Physical AI Experience Studio" [*5] on April 1, 2026, within its Lumada Innovation Hub Tokyo co-creation facility to accelerate the resolution of on-site challenges through collaboration with customers and partners. Robots equipped with the technology will be on permanent display to generate greater interest in and enhance the understanding of Hitachi's latest physical AI technologies and expertise.

*5 Hitachi News Release: "Hitachi opens Physical AI Experience Studio to co-create with customers for the social implementation of physical AI"

About Lumada:
Lumada: Hitachi

About HMAX:
HMAX | Lumada: Hitachi

Physical AI Website:
https://www.hitachi.co.jp/products/it/lumada/hmax/physical_ai/index.html

About Hitachi, Ltd.
Through its Social Innovation Business (SIB) that brings together IT, OT (Operational Technology) and products, Hitachi contributes to a harmonized society where the environment, wellbeing, and economic growth are in balance. Hitachi operates globally in four sectors – Digital Systems & Services, Energy, Mobility, and Connective Industries –

and the Strategic SIB Business Unit for new growth businesses. With Lumada at its core, Hitachi generates value from integrating data, technology and domain knowledge to solve customer and social challenges. Revenues for FY2024 (ended March 31, 2025) totaled 9,783.3 billion yen, with 618 consolidated subsidiaries and approximately 280,000 employees worldwide. Visit us at www.hitachi.com.

Contact
Hitachi, Ltd.
Research & Development Group
https://www8.hitachi.co.jp/inquiry/hitachi-ltd/hqrd/news/en/form.jsp