Topics

Proof of Concept Tests with EMIEW 3 Humanoid Robot

—Promoting Service Robotics Business—

SERVICE ROBOTICS MARKET POISED FOR GROWTH

Japan's increasingly aging population and declining birth rate are creating major public concern about the shrinking workforce and about how to meet the demand for senior medical and nursing care. Robots are now being viewed as a promising way of solving these problems. Robots have become the subject of growing interest in recent years due to technical innovations in the elemental technologies they require such as sensors, artificial intelligence (AI), and information processing. These innovations are bringing robots closer to everyday reality at an increasingly rapid pace.

The Japanese government has released a new strategy[*1] that aims to double the size of the robotics market for the manufacturing sector by 2020, and to increase it by a factor of 20 for the service industry and other non-manufacturing sectors. With the growth of private-sector investment for robot development expected to be particularly high in the service industry, the market for interactive service robots designed to assist users with routine activities is predicted to grow to a size rivaling the industrial robot market by 2020[*2].

EMIEW 3, HUMAN-SYMBIOTIC ROBOT THAT PROVIDES USER ASSISTANCE AND INFORMATION SERVICES

At the 2005 World Exposition in Aichi, Japan (EXPO 2005 AICHI, JAPAN), Hitachi, Ltd. debuted a humanoid robot called Excellent Mobility and Interactive Existence as Workmate (EMIEW) that had versatile communication skills and the ability to safely coexist with humans, and since then, has been working on developing robots that can live with humans. In 2007, Hitachi announced EMIEW 2, which was used to develop and demonstrate a variety of functions that are needed for user assistance and information services. It had an autonomous travel function enabling it to match the speed a human walking at a brisk pace, a hearing function that could isolate human voices amid noise, a function for identifying objects by referencing online data, and a function that used multiple networked indoor cameras as eyes to find objects. Hitachi has recently been working on refining robot intelligence processes by using AI technology to develop various functions. For example, it has developed a function enabling appropriate responses to questions regardless of phrasing, and a hazard avoidance function for predicting the risk of humans suddenly emerging from blind spots.

In 2016, Hitachi developed EMIEW 3 along with a new robot IT platform with a "remote brain" configuration. EMIEW 3 is intended for practical service use at customers' sites and was developed for safer and more stable operation. Like its predecessor, EMIEW 3 is equipped with a compact, lightweight body (with a height of 90 cm and a weight of 15 kg), has a maximum travel speed of 6 km/h that allows it to keep up with a human, and a function that enables travel over level differences of up to 15 mm high. A new topple-restore function has been added that enables the robot to return to a standing posture after a fall, enabling it to continue with the task at hand. Other functions have been moved to the cloud-based robot IT platform. This platform handles advanced intelligence processing such as voice, image, and language processing, along with data collection/analysis and behavior planning. The use of this remote brain configuration enables a lighter robot body, improved intelligence processing capacity, and expanded functions coordinated with outside systems such as surveillance cameras. It also enables centralized operation monitoring and control of multiple robots at multiple sites, supporting applications such as information sharing among multiple robots, and relaying services from one robot to another. This design enables EMIEW 3 to provide user assistance and information services more effectively.

*1 Robot Revolution Realization Council, Ministry of Economy, Trade and Industry, "New Robot Strategy, Japan's Robot Strategy—Vision, Strategy, Action Plan—," (Jan. 2015), http://www.meti.go.jp/english/press/2015/pdf/0123_01b.pdf.

*2 New Energy and Industrial Technology Development Organization, "Market Outlook for Robot Industry Through 2035," http://www.nedo.go.jp/content/100080673.pdf in Japanese.

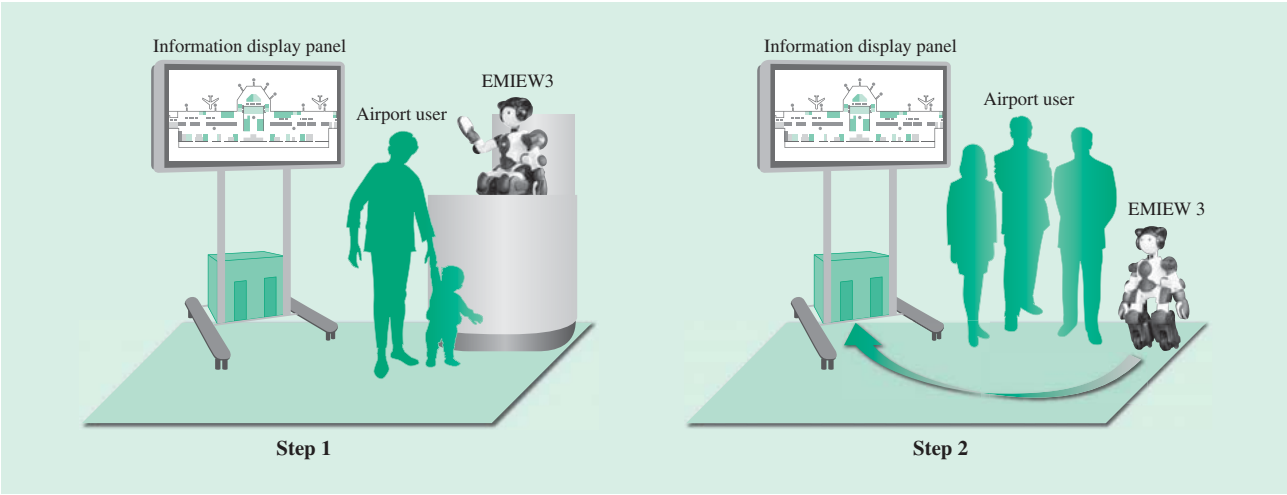
Photo of EMIEW 3 PoC testing at Haneda Airport

PROOF OF CONCEPT TESTING AIMED AT PRACTICAL SERVICE USE

In September 2016, Hitachi teamed up with Japan Airport Terminal Co., Ltd. to start Proof of Concept (PoC) testing of a service for travelers provided by EMIEW 3 at Haneda Airport Domestic Terminal 2. The testing examines the effectiveness of EMIEW 3's multilingual dialogue function and autonomous travel function in providing airport users with information about airport shops and facilities, and in guiding them to their destinations. By assessing EMIEW 3's various capabilities for assisting information services, the testing is designed to improve the quality of services created for a wide range of users, to enable smooth movement by optimizing how information is provided, and to create new added value by helping augment user assistance and information services in public spaces such as airports and crowded locations such as commercial facilities.

The test protocol consists of a three-step process. In Step 1, EMIEW 3 greets airport users at a specially-created information counter, interacting with them in Japanese and English. EMIEW 3 responds to user questions by referring to an adjacent information display panel. It provides information from resources displayed there such as maps, the airport facility overview, and photos of shops. In Step 2, EMIEW 3 responds to user questions by using its autonomous travel function to guide users to the information display panel, providing answers and explanations. In Step 3, EMIEW 3 travels greater distances on the terminal floor to guide users who have asked for directions to their destinations.

Currently, Step 1 and Step 2 have been completed, and the volume of questions from airport users to EMIEW 3 has exceeded expectations, demonstrating a high demand for user assistance and information services in airports. EMIEW 3's voice recognition technology demonstrated its applicability to real-world services, showing that it could reliably isolate individual airport user voices without being hampered by loud airport public address (PA) system announcements. Hitachi also tested coordinating two EMIEW 3 units. It was found that users lost their hesitation in directing their questions to a robot when they were guided by one EMIEW 3 unit to another unit (that provided the information service). This approach was a more effective method of operation. But it was also found that EMIEW 3's interactions have still not attained the sophistication of human interpersonal communication (involving elements such appropriate timing and eye contact), and it will be necessary to improve in areas such as signal processing and voice processing.



Illustrations of Steps 1 and 2 of PoC testing

CREATING SERVICE ROBOTICS BUSINESS THROUGH COLLABORATIVE CREATION WITH CUSTOMERS

In Step 3 of the test protocol, the plan is to have EMIEW 3 guide airport users to the nearest restroom, elevator, or other facility, and to assess performance by establishing quantitative indices for factors such as the proper speed for EMIEW 3 to travel autonomously, and the ratio of users asking for directions to a destination. Hitachi will continue to promote the commercialization of service robotics by utilizing the needs and knowledge of the site gained from the results of repeated PoC testing to improve service robotics, beginning with more sophisticated intelligence, while taking advantage of the benefits of expandability, which enables the addition of applications that coordinate with customer business systems.

Specifically, Hitachi is looking into using robot IT platforms that can be coordinated with customers' business systems to create standardized packages, for example, to coordinate with equipment such as surveillance cameras, while applications that customers want can be built like plug-ins at a higher level. This means that collaborative creation with customers will become an important part of developing robotics solutions. Many customers do not understand how to use or benefit from robots, however, so Hitachi will work on developing robot-driven services with customers by sharing the challenges and visions of robotics using facilities such as the newly established Robotics Co-Creation Room in Hitachinaka, Ibaraki prefecture.

Hitachi will continue to work on promoting its service robotics business through collaborative creation with customers, while applying EMIEW technologies to create social innovations that solve societal issues.