WRS Future Convenience Store Challenge 2024

Innovation Task

Rulebook

2024/6/18

Revision History

June 18, 2024

- First draft

0. Terminology

Term	Definition
Big Data	Data collected on customers, staff and products in convenience stores.
Digital Twin	Models for customers, staff and products in convenience stores and their applications.
IoT Devices	Various sensors and actuators can be networked to collect data or drive actuators in real time.
Mobile Robot	A robot that can move autonomously.
Infrastructure	Unique infrastructure that can be installed inside the convenience store to support the robot's tasks. This equipment includes markings, IC tags, sensors, actuators, and auxiliary tools attached to products, etc. Infrastructure consisting of sensors and actuators can also be considered as stationary robots.
Manipulator	Robot arms, end effectors, and other equipment for manipulation tasks which can be installed on a mobile robot or as part of the infrastructure.
Product(s) or Item(s)	Article(s) for sale in the convenience store.
Customer	Person who visits the store to purchase products.
Container	Box-like repository for holding and transporting multiple products.
Product Display Area	Section of the convenience store where display cases or shelves are installed.
Cashier Area	Section of the convenience store where the cashier counter is installed.
Eat-in Area	Section of the convenience store where customers can consume the purchased products.
Restroom	Section of the convenience store where the toilet is installed.
Aisle	Section of the convenience store for customers and robots to come and go.
Backyard	Section of the convenience store where customers are not allowed.

Display Cases	Shelves for displaying products. At the start, multiple products are mixed in these cases.
Chief Judge	Judge who declares the start of the task and issues instructions to the participants.
Assistant Judge	Judge who assists the Chief Judge by performing measurements for scoring, catching rule violations, etc.
Operator	Team member who starts the robot operation inside the competition field. After starting the robot, the operator leaves the competition field.
Safety Observer	Team member who manages the safety of the system inside the competition field and performs operations such as emergency stop. This team member may be the same as the Operator.

1. Overview

This competition (Innovation Task) focuses on the overall operations within a convenience store, expecting participants to propose solutions or services that leverage information and communication technologies such as big data, digital twins, and IoT, as well as robotics technologies to create a new kind of convenience store. Participants are to set tasks in line with the concept of this competition and freely propose solutions or new services in an open task format.

There are two methods of participating in the competition: one is presenting ideas through presentations using videos or other media, and the other is demonstrating ideas using actual systems. Participants choose one of these methods and apply for participation.

Those who participate in the competition and perform demonstrations will use the systems, robots, and infrastructure they have developed to demonstrate in a simulated store space, competing on the novelty, usefulness, and feasibility of their developed systems.

In the competition store, "display cases" and "cashier counters" are available for use. Their placement and use can be decided based on the participants' demonstrations.

In addition, the proposed system must contribute to energy saving in general, and/or to work efficiency.

2. Flow of the Competition Task

The competition time is 10 minutes. In case of presentation only, the presentation time is 10 minutes. In case a demonstration is to be conducted, the flow of the task in the mandatory order is:

(1) Presentation: 2 minutes

(2) Demonstration of proposal: 8 minutes

Participants must indicate their progression to the judges when moving from (1) to (2) and when completing the task. After the competition, there will be a Q&A time about 5 minutes long.

Please note the presentations and the demonstrations must be done in English or in Japanese, which is the official language of the competition.

2.1. Renovation Time

Participants will add or replace furniture such as shelves and other infrastructure, install their robot, and set products as necessary. For example:

- Installation of unique infrastructure inside the convenience store
- Replacement of existing furniture such as display cases and the cashier counter
- Arranging their robot and products in any initial positions inside the simulated convenience store.

The renovation time is NOT included in the task time for the competition. Participants should complete the renovation of the competition field BEFORE their competition standby time.

2.2. Presentation

Explanation of the proposal is provided. Participants must inform the judges when the presentation is over or if the presentation will be conducted at the same time as the demonstration.

2.3. Demonstration

After the judges confirm that the preparations are finished, they declare the start of the competition time.

If the participants demonstrate the system, they give a presentation, and after that, they operate the system with a command to start the operation.

However, if there is a system malfunction and continuing the task is deemed difficult, the participants can decide to retry the task as described hereafter.

3. Details of the Challenge

3.1. Innovation Task

Participants are free to set tasks related to convenience store operations and propose solutions or services that utilize digital twin, big data, and IoT technologies to create the convenience store of the future. The competition targets the overall operations within a convenience store and expects proposals and demonstrations that suggest new services for future convenience stores. Examples of tasks include the following:

- Improving the quality of customer service
- Reducing the workload of store staff
- Maximizing customer satisfaction
- Maximizing sales opportunities and revenue
- Optimizing the efficiency/use of robots

In the demonstrations, participants are expected to showcase the concrete usage of the proposed system by performing scenarios and so on. It is essential that the proposals are original ideas that have not yet been commercialized; introductions of commercialized products will not be accepted.

The judging panel evaluates those demonstrations from the perspectives outlined below.

- Innovation
- Viability
- Feasibility

The three criteria are evaluated based on the following viewpoints:
how valuable the proposal is as a new service at a convenience store, and how feasible the proposal is to be introduced to all convenience stores worldwide in a specific style of convenience stores. Also, in the case of proposals that assume big data or digital twin models, the technical feasibility of the proposal will be evaluated.

Additionally, awards will be given in the following two categories:

- Best Innovative Idea Award
- Best Innovative Idea Demonstration Award

Participants are responsible for preparing the actors of customers and store staff in their demonstrations.

3.2. Requirements for Digital Twin, and Big Data

Participants may use hypothetical models for digital twins, big data, and IoT devices, but they must specifically envision big data and other resources that will be obtainable and usable in the future and propose methods for their utilization. Additionally, there is a virtual environment called the Social Intelligence Generation Simulator (SIGVerse ™). A 3D environment of a convenience store is provided, and 3D models of the store environment and products are available. For more details, please refer to the following URL.

Social Intelligence Generation Simulator (SIGVerse ™)
https://github.com/FCSCinCyberSpace

3.3. Retry

Participants can ask the judges to terminate the demonstration to retry the task if the system malfunctions and continuing the demonstration is deemed difficult.

However, the clock will continue to run while the demonstration is stopped. The participants can decide in what state to resume the task.

4. Specifications and Restrictions

4.1. Simulated Convenience Store

The convenience store will be approximately 4 m x 5 m. The store is equipped with display cases and a casher counter, which can be used for demonstrations. The layout of the store and the functions within the store can be set up according to the participants' demonstrations.

4.2. Products

Participants shall prepare the products to use in the demonstration.

4.3. Mobile Robot and Infrastructure Restrictions

4.3.1. Hardware Restrictions

- There are no restrictions on the number of mobile robots.
- Each mobile robot must occupy less than 1 m x 1 m of floor space and all of the mobile robots must fit into a 2 m x 2 m area.
- Infrastructure can be installed anywhere inside the convenience store but different restrictions apply according to the area of the store. Please see the documents provided separately for more information.

4.3.2. Software Restrictions

- The robots and infrastructure must operate autonomously after the start of the task. However, participants may monitor the internal status remotely in order to know the state of their system.
- Mobile robots are prohibited from moving outside of the convenience store.

4.3.3. Energy Source Restrictions

- Participants should provide an energy source for their robots.
- A power supply within AC100V/1500W is planned as the energy source for participants to use.
- Any energy source deemed to be dangerous or inappropriate for use will not be allowed.

4.3.4. Venue Restrictions

- Participants are prohibited from intentionally dirtying or damaging the convenience store.

- Infrastructure must be able to be removed immediately after the task ends to return the venue to its original state.
- The convenience store has no ceiling or walls.

4.3.5. Safety Restrictions

- Systems must have an emergency stop switch.
- The emergency stop switch must be separate from the switch used to start the system.
- The emergency stop switch must be located in a place where it can be safely pressed while the system is in motion, or activated remotely.
- When activating the emergency stop remotely, only a wired push-button emergency stop switch may be used, and it must be located more than 1.5 m away.
- If the emergency stop switch is pressed, all of the movable parts included in the system must immediately stop operating.
- The design must prevent the system from tipping over at all times, including during an emergency stop.
- Measures must be taken to shield any area with a danger of pinching the arms and legs of people in the vicinity.
- Hot areas and sharp edges must not protrude.
- Energy sources utilizing fire or high temperatures are prohibited.
- Any laser used in the system must be class 1 or lower.
- Products and parts of robots must not eject anything.

5. Other

This rulebook is subject to change without notice.