TECH OFFER

Intelligent Robot for Food and Beverage Service

KEY INFORMATION

TECHNOLOGY CATEGORY:

Foods - Processes

Infocomm - Robotics & Automation

TECHNOLOGY READINESS LEVEL (TRL): **TRL9**

COUNTRY: **SOUTH KOREA**

ID NUMBER: **TO175431**

OVERVIEW

The key challenges in beverage service include labor shortages, 24/7 demand, and strict hygiene requirements. Workforce Singapore has reported a persistent shortage of workers for lower-skilled roles in the food services sector, increasing manpower costs and limiting operating capacity. At the same time, consumer expectations in Singapore increasingly reflect a "24-hour service culture," with businesses expected to provide convenience beyond traditional operating hours.

This technology is an intelligent foodtech robot that automates beverage preparation, order management, and customer interaction, delivering safe, consistent, high-quality drinks at any time with minimal human input. As an advanced intelligent robot, it represents a new era of robotic food service innovation, combining precision engineering with adaptive AI for seamless operations. Its system can detect spills and reroute to prevent disruption, and its imitation learning capability allows it to acquire new workflows and recipes from virtual demonstrations by humans. The intelligent robot also supports integration across various robotic food service environments, enhancing adaptability and productivity as service requirements evolve.

TECHNOLOGY FEATURES & SPECIFICATIONS

The technical specifications and features of the solution are as follows:

- Design: Modular architecture supports both compact kiosks and larger counter installations

- Robotic Manipulation: Safety-certified collaborative arm with adaptive end-effectors for cup handling, pouring, and capping

- Perception System: Vision cameras with flow and thermal sensors enable precise liquid handling and real-time monitoring

- AI Intelligence Stack:
  - Imitation Learning: Continuously captures and converts human tele-operation data into motion policies, allowing the robot to learn new recipes or routines without manual reprogramming
  - Physical AI: Closed-loop integration of perception, reasoning, and actuation for safe, adaptive, human-like behavior in dynamic environments

- Digital Twin: Cloud-based simulation allows offline validation of recipes, motion sequences, and layouts configuration prior to deployment, reducing downtime and accelerating commissioning

- Performance: 60–120 drinks/hour with ±2–3 mm placement accuracy and taste consistency (SD <5%)

- User Experience: Multi-language kiosk and mobile interface, transparent preparation process, and engaging display animations

POTENTIAL APPLICATIONS

The technology has been tested in office cafés, hotels, and boarding schools, offering a cost-efficient alternative to manned F&B and hospitality businesses.

Future opportunities include deployment in service facilities, smart "robot buildings," and even domestic environments, where robots must safely and naturally collaborate with people. The invention begins by solving urgent needs in F&B, but its architecture and learning framework position it to expand into a wide range of human-centered service applications once the intelligence matures.

UNIQUE VALUE PROPOSITION

This invention stands out from conventional café operations and existing automation systems by delivering:

- Adaptive and Future-Ready Operations: Continuously improves performance and adapts to new recipes, menu updates, and workflow changes through intelligence AI, ensuring long-term relevance in dynamic food and beverage environments.

- Human-Centric Operation: Unlike traditional back-of-house automation, the robot operates safely in shared spaces, creating an interactive, transparent, and inclusive experience that delights customers and builds trust.

- Operational Scalability and Reliability: With a modular footprint and digital twin validation, the robot supports flexible deployment across varying space and demand scenarios, with self-diagnostics, predictive maintenance, and real-time monitoring ensuring reliable, uninterrupted operation.