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Top -level research and data

- Research on human-symbiotic robot design through active interaction between human and AI robots
- Research on AI robot and its human interface design that emerge human-robot co-creation
- Research on robot intelligence, learning, dexterity, and communication

(Representative papers)
- Design of human symbiotic robot TWENDY-ONE
  Hiroyasu Iwata, Shigeki Sugano
  Proceedings - IEEE International Conference on Robotics and Automation　580 - 586　2009
- Utilization of Image/Force/Tactile Sensor Data for Object-Shape-Oriented Manipulation:
  Wiping Objects With Turning Back Motions and Occlusion
  Namiko Saito, Takumi Shimizu, Tetsuya Ogata, Shigeki Sugano
  IEEE Robotics and Automation Letters 7（2）968 - 975 2022 [peer-reviewed]

Keyword

- Human-symbiotic AI Robots
- Human-Robot interaction
- Dexterous manipulation
- Physical interaction
- Passive compliance
- Mechanical impedance adjustment
- Collision safety
- Safety and Security
- Coordinated actions
- Impedance control

Deployment targets (sites, materials, etc.)

Soft robots,Soft actuators,Soft sensors,Tactile display,Tactile interface,Machine intelligence (e.g., imitation learning, motor–language integration, human–machine cooperation, and multimodal active perception), etc.

Features (implementation means, etc.)

Realization of AI-driven Robot for Embrace and Care (AIREC), which is a smart robot that can autonomously perform business, housework, care, nursing, and treatment （Moonshot R&D Project）

Aiming to develop a general-purpose smart robot that can learn and autonomously perform a variety of highly difficult tasks not only in customer service and housework but also in welfare and medical settings. Aiming to achieve the goal of customer service in business by 2050; housework tasks such as cooking, washing, cleaning, etc.; long-term care tasks such as transfer support, cleaning, meal assistance, etc.; nursing tasks such as providing inspection information and replacing intravenous fluids; and diagnosis and treatment support tasks such as automated inspection, surgical support, etc.

		Techniques to be achieved (tangible and intangible aspects)	Activities needed for social implementation
By 2050	Realization of AI robots capable of autonomously performing a variety of housework, nursing care, and nursing tasks. Diagnosis and treatment are also conducted under the supervision of a doctor.	Communication through language and contact. Semi-mobilization of acts that directly support humans	Proposals for a symbiotic society of humans and robots based on international agreements
By 2040	AI robots that can perform customer service, housework, care, nursing, and some medical procedures are active in society.	Execution of tasks through simple language commands from humans. Simple conversation. Automation of tasks that involve physical contact with people	Penetration of various services into society.
By 2030	Completion of the AI robot that can perform some housework tasks and some low-risk long-term care / nursing tasks.	Execution of multiple tasks using sensor feedback. Simple conversation. Execution of tasks that involve physical contact with people.	Increased efforts for gaining international consensus on the need for AI robots.
By 2025	Realization of some cooking and cleaning assistance, safe human-contact cleanup assistance, and safe human-contact long-term care / nursing assistance with robots	Soft robotics control using AI. Innovations in natural language processing. Data cloud collection of daily activities.	Survey on the acceptance of AI robots and understanding of needs.

Realization of scenarios through this project

【Research and development in the field of science and technology】
▸Hardware: development of delicate yet powerful hardware that can be used for human contact
▸Manipulation: development of technologies for controlling articulated robots and interacting with the environment, as well as technologies for gently and appropriately handling flexible objects, including humans
▸Communication: development of technologies that realize mutually guided communication where humans and robots can trust and empathize with each other
【Research and development in social sectors】
▸Application of AI robot technologies to long-term care, nursing, and medical settings, and establishment of social consensus
▸Establishment of industry–academia collaboration for social implementation
▸Discussion of AI responsibility and improvement of AI robot literacy based on ELSI

Associated proprietary technologies

・Leading / following an action planning system for autonomous mobile service robots（特開2022-60801）

Autonomous mobile robots that perform tasks such as leading moving objects (e.g., pedestrians) to a predetermined destination and following the moving objects for baggage transportation, security, etc., as well as an action planning method that is related to this robot's control device and control program and has the characteristic ability to continue service tasks while responding to various unexpected situations that may occur in a crowded space.

・Pedestrian movement prediction technologies and a mobile robot route planning algorithm based on these technologies（特開2022-13038 ）

Proposal of a route planning algorithm that aims to make trajectory planning more robust by considering the measurement error of a person's velocity vector and retention possibility, which indicates whether the future velocity vector will maintain its current value. Determination of the timing of action that accounts for the measurement error and retention possibility of the human velocity vector, adjustment of the amount of avoidance needed for humans and robots to avoid each other, and restriction of actions as a framework for safely avoiding people.

・Robot approach / contact movement technologies in crowded environments based on multi–person movement predictions（特開2021-189508 ）

Building a movement prediction model that includes surrounding humans, etc., and is suitable for generating routes for autonomously moving robots in crowded environments. Providing robots that can generate optimal movement routes while considering the movement efficiency of the robot and the burden on the surrounding people, etc., movement route generation device and its program, and movement prediction device.

Expected outcome/ applications

Human-symbiotic robots as social infrastructure in the fields of daily life support, medical care, long-term care, welfare, public services, etc.

Associated SDGs