Goal3 Realization of AI robots that autonomously learn, adapt to their environment, evolve in intelligence and act alongside human beings, by 2050.

Here begins our new MIRAI
MOONSHOT RESEARCH & DEVELOPMENT PROGRAM

Smart Robot that is Close to One Person for a Lifetime

Project manager

(selected in 2020)

SUGANO Shigeki

Professor, Faculty of Science and Engineering, Waseda University

Leader's institution

Waseda University

R&D institutions

・Waseda University
・Meijo University
・National Institute of Advanced Industrial Science and Technology (AIST)
・National Center of Neurology and Psychiatry (NCNP)
・Japan Advanced Institute of Science and Technology(JAIST)
・The University of Edinburgh
・HITACHI, Ltd.
・Kobe University
・Tokyo Women's Medical University
・The University of Tokyo
・Tokyo Denki University

Summary of the project

This project aims to establish robot evolution technology that combines flexible machine hardware and unique AI that can understand many kinds of tasks. Our final goal is to build a human-robot symbiotic society by introducing a general-purpose AI robot that can work with people not only in housework and customer service but also in welfare and medical fields where human resources will be in short supply by 2050.

Invasive medical work

Nursing care including emotional communication

Milestone by year 2030

We will develop smart robots equipped with emotional interaction functions that enable them to serve customers, perform housework such as cooking and wipe cleaning, nursing care such as walking assistance and buttocks wiping, and some medical services such as nursing and ultrasound diagnosis. As a result, we will realize smart robots that assist humans by using AI to perform multiple tasks with a high degree of difficulty in public facilities, general residences, nursing homes and hospitals.

Non-invasive medical work

Assistance with human contact

Milestone by year 2025

We will develop smart robots that closely resemble human bodies such as the circulatory system and muscles, equipped with assistance functions of laundry work such as folding clothes, cooking work such as stirring with kitchen tools, transfer work between wheelchair and bed, and health monitoring work with emotional communication that gives people peace of mind.

Cooking Assistance

Laundry Assistance

Project Structure

Application

R&D Goal 1
Body and control system for smart robots

R&D Issues
- Soft robot hardware that can physically support humans with contact
- Robot middleware (OS) for smart robots
- Development of a compiler-coordinated low-power-consumption AI processor that realizes the brains of smart robots

PM Shigeki SUGANO Waseda University

Kenichi OHARA Meijo University
Keiji KIMURA Waseda University

R&D Goal 2
AI systems for smart robots

R&D Issues
- Flexible interaction with dynamic environment by smart robots
- Infrastructure development and demonstration for expanding the experience of smart robots
- Mathematical approach to AI for smart robots
- Multimodal dialogue interaction platform for smart robots that cooperate with humans
- Hierarchical motion planning framework for realizing long-horizon tasks
- Basic model construction of smart robots for transfer learning

R&D Goal 3
Technologies for welfare and medical care with smart robots

R&D Issues
- Practical application of robots that can be introduced into welfare and medical sites
- Quality assurance and international standardization of welfare and medical robot design
- Risk management of welfare and medical robot design
- Practical application of a robot hand system that can be introduced into welfare and medical sites
- Functional enhancement and implementation evaluation of smart robots that can be introduced to welfare and medical sites

Sub PM Tetsuya OGATA Waseda University/AIST

Yukiyasu DOMAE AIST
Yuichi YAMASHITA NCNP
Shogo OKADA JAIST
Sethu Vijayakumar The University of Edinburgh
Naoaki NOGUCHI HITACHI, Ltd.

AI Innovation
- Imitation learning of high-difficulty tasks.
- Understanding AI
- Emotional communication

Robot Innovation
- Dry-wet hybrid hardware
- Soft body structure
- Hydraulic actuator

Social Needs Analysis
International comparison of social acceptability of AI and robots

Social implementation
Support and automation of customer service, housework, welfare, medical care etc.

Sub PM Yoshihiro MURAGAKI Kobe University

Etsuko KOBAYASHI University of Tokyo
Kenta KUWANA Tokyo Denki University
Hiroyasu IWATA Waseda University
Ken MASAMUNE Tokyo Women's Medical University

Feedback

Technology Selection

R&D Goal 4
Practical measures for smart robots

R&D Issue
International evaluation of the needs and social acceptability of smart robots from the viewpoint of ELSI

Sub PM Toshie TAKAHASHI Waseda University

Technological collaboration
AIST
Alan Turing Institute

Social research collaboration
Stanford University
University of Cambridge