Food for Life Project
Robotic assistive device with multi-grip tools and vision system for frail elderly’s independent life

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Collaborated with
Karlstad University, Sweden
Camanio Care AB, Sweden
Tokyo Institute of Technology, Japan
Waseda University, Japan
Leave a Nest Co. Ltd., Japan

Today’s Content | OUTLINE

• Background
  • Social and Elderly-care Context

• Focus Issues and Milestones
  • Practicality
  • Goal-oriented Management

• PHASE 1 | R&D and Other Progress
  • Practicality and Innovativeness
  • Significance of Bilateral Cooperation

• PHASE 2 | Our Strategy for Social Implementation
  • Innovativeness
  • Significance of Industry-academia Collaboration

• Future Society thorough “Food for Life Project”
  • Overall Purpose
  • Goal-oriented Management
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### Background | Social Context

**Projections Aged Population (1950 – 2100)**

**Sweden: Population (Age 60+)**
- Increase continuously

**Japan: Population (Age 60+)**
- Peak out around 2040

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The population projections are based on the probabilistic projections of total fertility and life expectancy at birth, based on estimates of the 2017 Revision of the World Population Prospects. These probabilistic projections of total fertility and life expectancy at birth were carried out with a Bayesian Hierarchical Model.
Background | Care Context for Frail Elderly

**Elderly Society: Risk of Low Nutrition**

**Nutrition vs. Type of care for the person in Sweden**

![Graph showing the percentage of people in different care settings and their nutritional risk levels.]

- **Low nutrition**
- **Risk of low nutrition**
- **Good Nutrition**


**Nutrition vs. Nursing Care Level in Japan**

![Graph showing the percentage of people in different nursing care levels and their nutritional risk levels.]

Source: Center for Gerontology and Social Science (2013)

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**Background | Care Context for Care-givers**

**Care-givers Demand**

**Sweden**

![Graph showing caregiver availability and demand in Sweden.]

Source: Statistics Sweden (2002)

**Japan**

![Graph showing caregiver availability and demand in Japan.]


**Care-givers Available/Demand ratio:**

**Sweden**

- **64%** in 2010 → **39%** in 2020

**Japan**

- **98%** in 2015 → **87%** in 2025
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Problems and Motivation |

Status quo: Elderly Care of Meal Assistance in Aging Society

@ Japanese Care Facility

Meal time of both elderly and caregiver is not pleasant
Envisioned Results and R&D Focus of Our Project

Why bilateral cooperation?

- Making **world-wide use case** by applying technology developed in the welfare state, **Sweden** to solve the emerging challenges in the most aging society, **Japan**

R&D Focus

- Technology & Services (PHASE 1 & 2)
  - To decrease burdens of frail elderly & care givers
- Community Support (PHASE 2)
  - To realize community-level care model
  - Incl. elderly, care-giver, hospital, local-government, etc...

Human friendly aid system for supporting frail elderly’s independent life and meal experience

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Food for Life Project from R&D to Social Implementation

Human friendly aid system for supporting frail elderly’s independent life and meal experience

**PACE I**

- **<R&D of AT Robot>**
  - Tokyo Tech.
  - Waseda Uni.
  - Camanio Care
  - Karlstad Uni.

- **<Service Design>**
  - Leave a Nest

**PHASE II**

- **<User Test on Site>**
  - Kakegawa city
  - Karlstad city

- **<Service Design>**
  - Leave a Nest

- **Market-entry / Initial starting point**
- **Define market penetration points for “Food for Life Pj”**
- **Demonstration experiment for community care w/ IoT system**
- **Prototype development in accordance with user needs**
- **Development of multi-gripper and vision system**
- **Evaluation of functionality/usability of feeding assistive robot**
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Practicality | User Centered Process
Work Process in Phase 1

Iteration process for technology development

Prototyping → User Input → Concept Making

Our concept:
Human friendly aid system

Nutrition-Aid Device

Vision-based control
Multi-grip
**Nutrition-Aid Device: Automatic Food Intake Report**

**USER INPUT**

- Significance for the users living at home (living at care centers)
  - Identified undernutrition or risk of undernutrition.
  - Scanning for identify risk of undernutrition.

- Significance for the municipalities
  - Evaluation of the distributed lunchboxes.
  - Analysis of correlation between nutrition and other data.

**CONCEPT MAKING**

To collect the first and last picture of every meal eaten at the tablemat during one month time.

**PROTOTYPING**

(Current Progress)

Vision system + IoT (CASE 2018, Germany)

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**Vision-based Control: Automatic Localization of Food**

**USER INPUT**

- Significance for the users living at home (living at care centers)
  - Frail elderly who are being fed today and have problem to control Bestic.

- Significance for the municipalities
  - Further reducing the working load for caregivers.

**CONCEPT MAKING**

To identify the location of the meal on the plate and to make a prototype a camera holder.

**PROTOTYPING**

(Current Progress)

Identification of food's location with vision system (MECATRONICS 2018, U.K.)
Innovativeness | Multigrip tool: Expanding the usability of Bestic

**USER INPUT**

- Significance for the users living at home (living at care centers)
  - Bestic users who wish to be independent in other daily live activities
- Significance for the municipalities
  - Further reducing the working load for caregivers in other daily live activities

**CONCEPT MAKING**

To do other daily live activities with Bestic as result from the user inputs

**PROTOTYPING**

(Current Progress)

Preliminary grasping test with the Multigrip (MEDER 2018, Italy)


- **Publications**
  - National conferences: 1 (Sweden), 1 (Japan)

- **Exchange students**
  - From Japan to Sweden: 3 (1 week)
  - From Sweden to Japan: 1 (3 months)

- **Exchange agreements**
  - 1 (MoU between Karlstad University and Tokyo Institute of Technology under process of signature to facilitate the exchange of students)

- **Press Media**
  - Radio: 2 (Sweden)
  - TV: 1 (Sweden)
  - Newspaper: 3 (Sweden); 3 (Japan)
Significance of Industry-academia Collaboration | Service Development in Phase 2: Business Model

Nutrition Aid Device for Market Entry

- What if we automate the process of collecting and analyzing the individual nutrition status of frail person?
  ✓ This solution reduces the work load of caregivers, &
  ✓ It will also help the nutrition status of frail person.

Key features:
- Less burden for caregivers
- Expanded use for persons with need of knowing their nutrition status, e.g. healthy seniors, etc.
- Easier to understand the health status of frail persons
Significance of Industry-academia Collaboration |
Service Development in Phase 2: Business Model (2021?)

- Robot system
- Sell/Lease
- Food Intake Data
- Data analysis
- $\$/Food Intake Data
- Care Facility
  Home Caregiver
  Hospital
- Food Intake Database
- Feedback to develop robot/service

Significance of Industry-academia Collaboration |
Service Development after Phase 2: Business Model (2023?)

- Robot system
- Sell/Lease
- Food Intake Data
- Data base driven consulting/advice
- $\$/Food Intake Data
- Care Facility
  Home Care Giver
  Hospital
  Food Company
  Insurance Company

Automatic System for gathering of data
- For Individual perspective
- For caregiver perspective
- For food delivery company

Health Care System
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Overall Purpose | Envisioned Results and R&D Focus of Our Project

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Expansion of frail elderly’s life boundary through human friendly aid system and community support
Food for Life Project
Support for frail elderly’s independent life and for meal experience through human friendly aid system

Thank you for listening!