VTT

Needs and opportunities for robotics in Finnish health & wellbeing sector

4.2.2021 Business Finland Future Watch

Marketta Niemelä, PhD, Principal Scientist
marketta.niemela@vtt.fi

04/02/2021   VTT – beyond the obvious

Outline

- Needs for assistive technology
  - Hospitals, pharmacies
  - Care personnel
  - Rehabilitation
  - Older people

- About designing interactive robots in healthcare
- Opportunities

Hospitals and pharmacies

Hospitals

- Process optimization
  - Automated and on-demand transportation and delivery robots
  - Automated cleaning and disinfection
  - Lab and pharmacy automation
- COVID-19 and social distancing
  - Telecare
  - Customer service and assistance robots
- Automated health assessment or pre-check robot kiosk for patients in waiting rooms
- Tools to provide care and rehabilitation at home

Pharmacies

- Currently storage automation in appr. 1/3 of Finnish pharmacies
- Extending business to new spots
  - Automation enables compact pharmacy size
- COVID-19 and social distancing
  - Customer service robots
- Medicine deliveries: drones?

Care personnel

- By 2030, 30% of home care workers, 25% of nurses, almost 50% of nursing aids will retire in Finland
  - by 2040, 50-70%

- Support for heavy patient work
  - Patient transportation and lifting
  - Robot that enables immobilized patients to have independency, e.g. retrieve objects
  - Automated postural care to prevent harm from stationary position of the patient
  - Patient lifting support (exoskeletons)

- Reducing secondary tasks
  - Transporting, delivering supplies:
    - Project case study: practical nurses in a care home used 17% of their work time to assist residents in eating; half of that to carry meal trays by feet

- Improved tools for care work
  - Rehabilitation and therapy

VTT

Rehabilitation

- Physical rehabilitation
  - Robot assisted walking rehabilitation
    - Lokomat fixed robots used in 13 organisations, with promising results and experiences.
    - Indego wearable exoskeletons in 4 organisations. Independent/supported walking and upright position brings physiological and social benefits to the user
  - Upper limb rehabilitation: robot for training movement and gripping
- Motivation: game-connected rehabilitation
- Other: Smart gym devices to e.g. residential care facilities
- Rehabilitation at home
  - Walking/mobility support to be used at home
  - Home nursing and rehabilitative care at home

Older people at home or assisted living facilities

- Half of people aged 85+ live at home with**out** regular care service. Half of people aged 75+ live alone, 10% feel lonely

- Main reason to use services: memory problems
  - 200 000 Finnish citizens persons have memory disease; 14 500 more is affected every year

- Independent life and functioning capability
  - Safe moving indoors and outdoors: physical walking support + orientation, reminders + remote help service
  - Even 30 % of homecare customers would benefit from automated medicine dispenser and reminder – different models needed
  - Telepresence robot, integrated to home control-automation system, for the family
  - Support for social connectivity and decreasing loneliness
  - Technology that helps preventing dementia and physical decline – physical game robots

- Other needs:
  - nutrition, cooking, eating, hygiene, dressing, rehabilitation, excercing, getting up from bed, fetching objects; more flexible going to shopping etc with autonomous vehicles

- Needed: solutions that are *preventive and affordable*

New interactive and collaborative robots in healthcare

VTT

Robots should be

- Easy to use by non-experts, plug and play use

- Able to operate and move safely in dynamic, unpredictable enviroments

- Mastering natural interaction (speech interaction, joint attention, use of gaze, proximity, smooth and predictable moving, emotion recognition)
  - Conversational AI coming fast to social and healthcare services, Finnish speech data is being collected https://lahjoitapuhetta.fi/

- Tolerant to noisy perceptions and inaccurate human actions

- Able to manipulate non-rigid objects

- **Connected to the system**: the robot as the physical part of the healthcare service and information systems

Opportunity

Combining physical and social robotics, AI and machine learning to analyse and predict human wellbeing and provide interventions
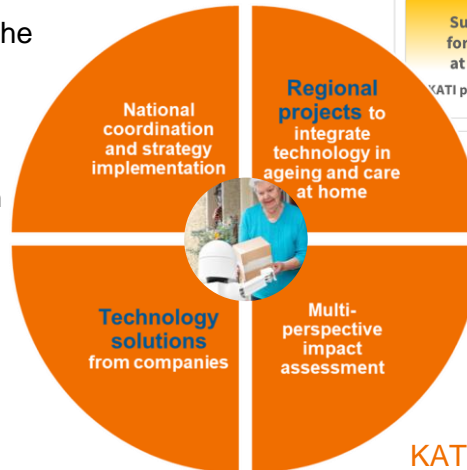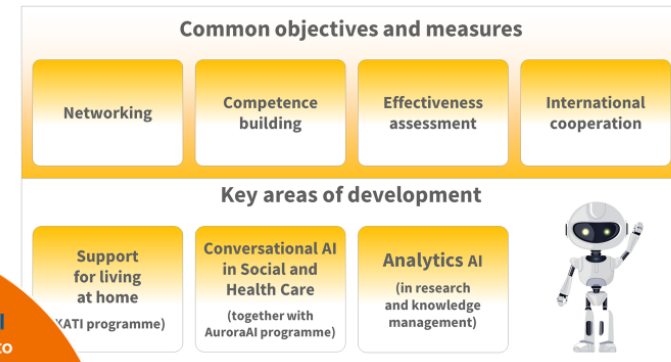
- Sensing solutions and AI to understand human behaviour and interaction

- Robot as a data collecting instrument: speech, gesturing, mobility, social interactive behavior

- Robots may promote adherence to change of behavior due to social presence - not well understood yet

Opportunities for developing and introducing robots

- **Hyteairo programme (2018-2021)**
  - support for networking and co-operation for all involved in robotics & AI for health and wellbeing

- **KATI programme (2020-2023)**
  - Promoting piloting and adopting new technologies for living and ageing at home
  - Regional projects starting in spring 2021

- **Digi-HTA assessments** to prove the applicability of the product to healthcare services

- **Future Health and Social Services Centres programme**
  - More digital and mobile services, focus to prevention

- **AuroraAI programme**
  - Access to social and health (advisory) services through conversational AI / chatbots

- Co-creation and piloting environments, testbeds and Living Labs

The well-being and health sector's artificial intelligence and robotics programme (Hyteairo)

Common objectives and measures

| Networking | Competence building | Effectiveness assessment | International cooperation |

Key areas of development

| Support for living at home (KATI programme) | Conversational AI in Social and Health Care (together with AuroraAI programme) | Analytics AI (in research and knowledge management) |

National coordination and strategy implementation

Regional projects to integrate technology in ageing and care at home

Technology solutions from companies

Multi-perspective impact assessment

KATI programme

HIPE vision draft

There is a great need in society and business to understand human behaviour and emotional experiences in public spaces.

Technology developed at VTT identifies biosignals and micromovements in crowds of people and interprets prevailing emotional states.

WHAT IF… based on this information, using a cross-segment platform solution, it is possible to modify your solution/service, and in so doing, to improve the experience of using a space or service, as well as safety, workplace well-being and productivity?

Source:
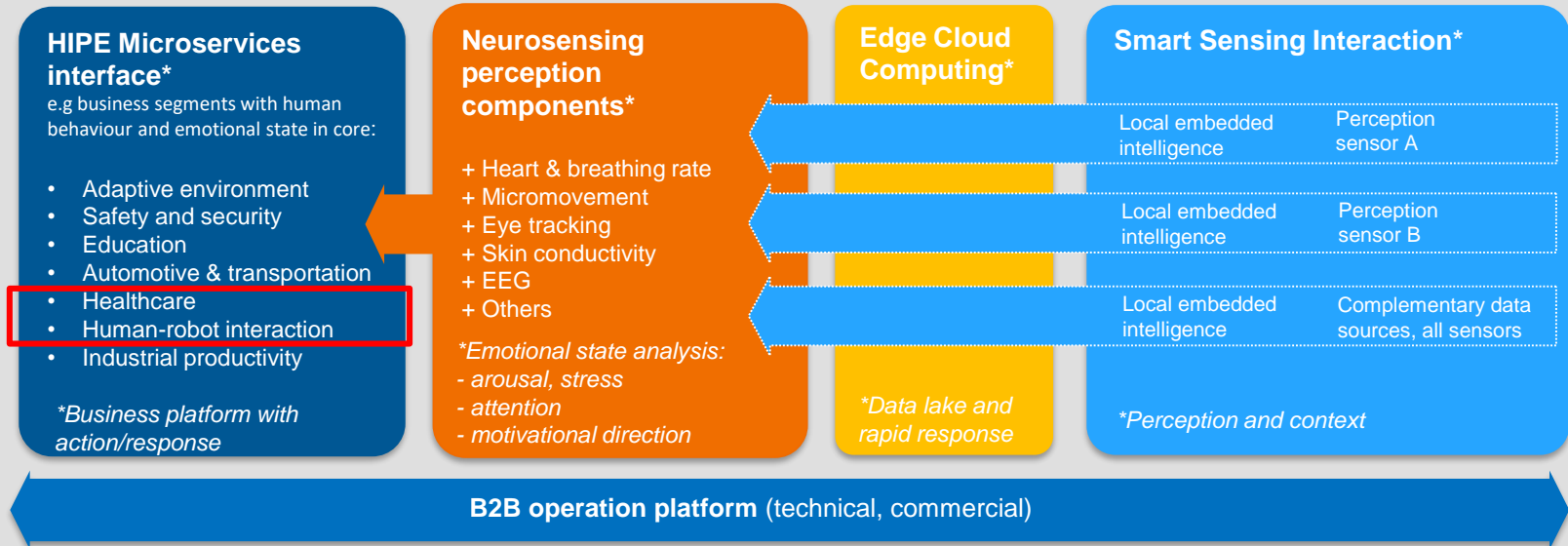https://www.vttresearch.com/en/news-and-ideas/emotion-radar-brings-empathy-environment

Video:
https://youtu.be/gzltGhvASro

HIPE co-innovation concept

Artificial Emotional Intelligence as multi-segment platform business

HIPE project scope and future distributed intelligence & business value chain

HIPE Microservices interface*

e.g business segments with human behaviour and emotional state in core:

- Adaptive environment
- Safety and security
- Education
- Automotive & transportation
- Healthcare
- Human-robot interaction
- Industrial productivity

*Business platform with action/response

Neurosensing perception components*

+ Heart & breathing rate
+ Micromovement
+ Eye tracking
+ Skin conductivity
+ EEG
+ Others

*Emotional state analysis:
- arousal, stress
- attention
- motivational direction

Edge Cloud Computing*

*Data lake and rapid response

Smart Sensing Interaction*

Local embedded intelligence	Perception sensor A
Local embedded intelligence	Perception sensor B
Local embedded intelligence	Complementary data sources, all sensors

*Perception and context

B2B operation platform (technical, commercial)

VTT

- Co-innovation consortium project management
- Tech & business development research
- IP asset licensing

- Jointly funded common research project
- Links to parallel research (EU, BF KEKO, BF MURO, ECSEL Next Perception, etc)
- Potential for neurosensing platform as a separate business entity set up by VTT

For further information

- marketta.niemela@vtt.fi
- VTT HIPE:
  markku.kivinen@vtt.fi

- Digi-HTA:
  jari.haverinen@ppshp.fi

- Hyteairo programme:
  - https://thl.fi/hyteairo
  - katja.pulli@thl.fi
- KATI programme
  - https://thl.fi/kati
  - katja.pulli@thl.fi