THE STATE OF ART OF SMARTHOMES

Ubiquitous technologies for the health and assistance of the elders.

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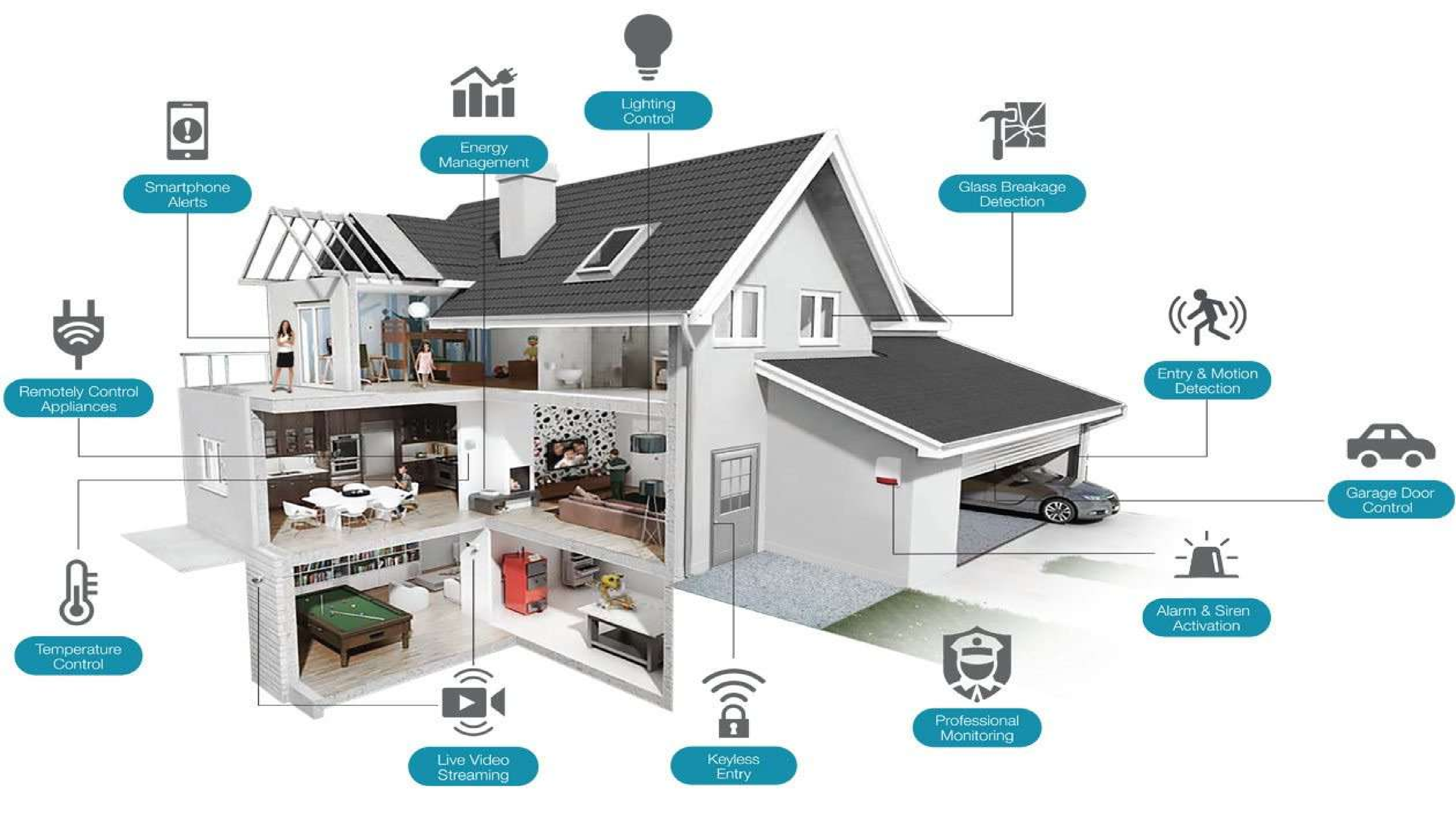
INTRODUCTION

“Smart Home refers to the enrichment of a living environment with technology in order to offer improved habitual support to its inhabitants and therefore an improved quality of life for them.”

Source:State of the art of smart homes "- Liyanage C. De Silva,Chamin Morikawa, Iskandar M. Petra.


Smartphone Alerts
Energy Management
Lighting Control
Glass Breakage Detection
Remotely Control Appliances
Entry & Motion Detection
Garage Door Control
Temperature Control
Alarm & Siren Activation
Live Video Streaming
Keyless Entry
Professional Monitoring

SMARTHOMES ELDERCARE TECHNOLOGIES

Technology Integrated Health Management for Dementia (TIHM)

WHAT IS TIHM

TIHM is a health monitoring and managing system that gathers informations about individuals and their environment using a network of internet-enabled devices, like sensors, monitors and trackers, installed in the home.

THE MAIN GOALS

SAFETY

Keeping people with dementia safe in their homes

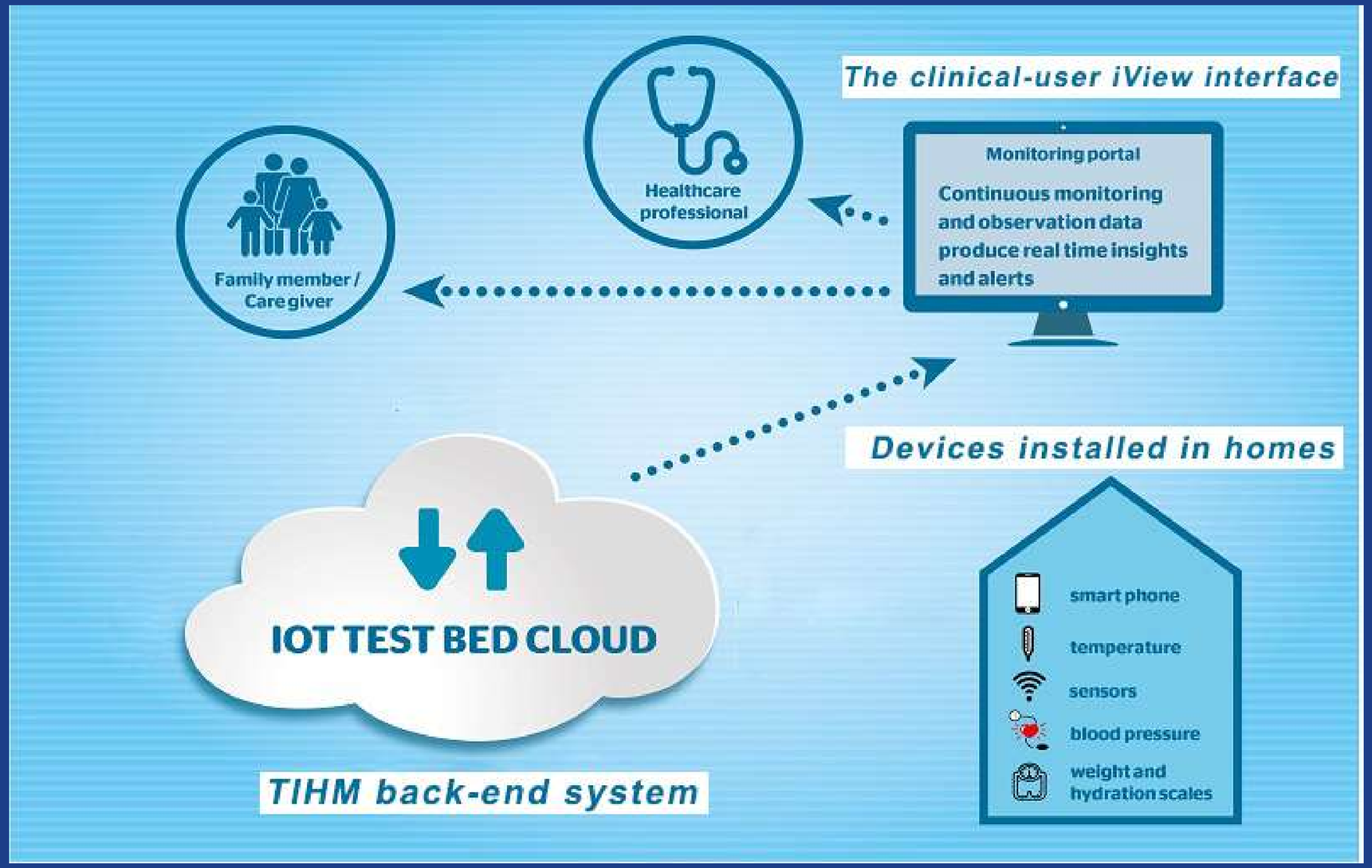
PREVENTION

Reducing the number of unplanned hospital admissions

SUPPORT

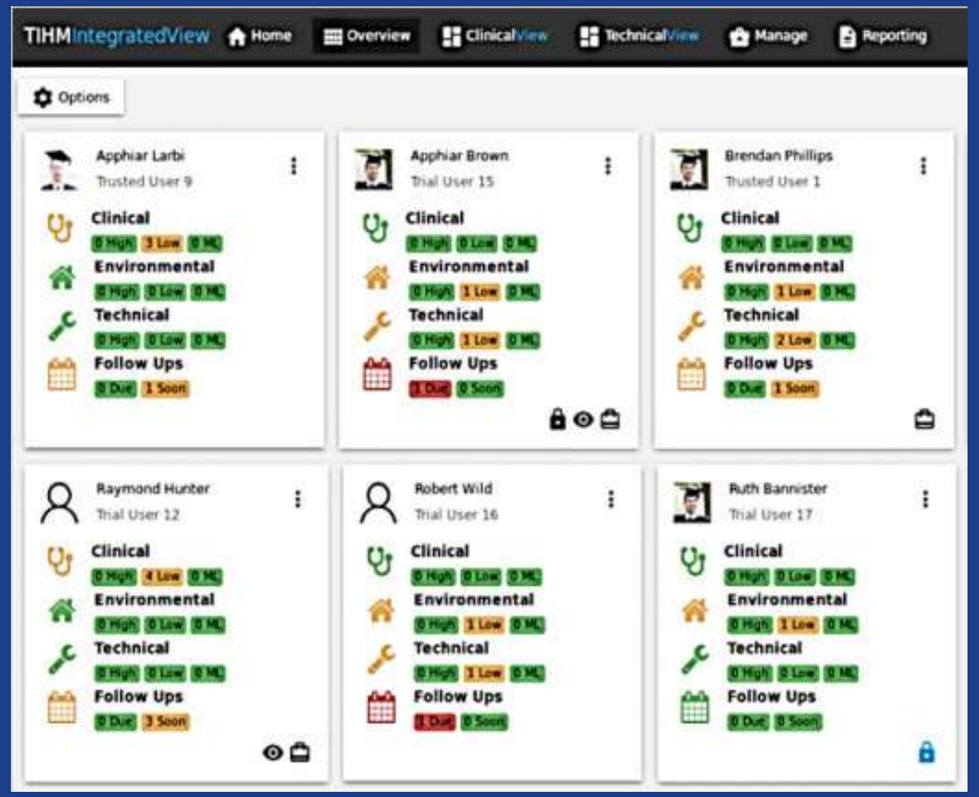
Relieving the burden on carers

HOW IT WORKS

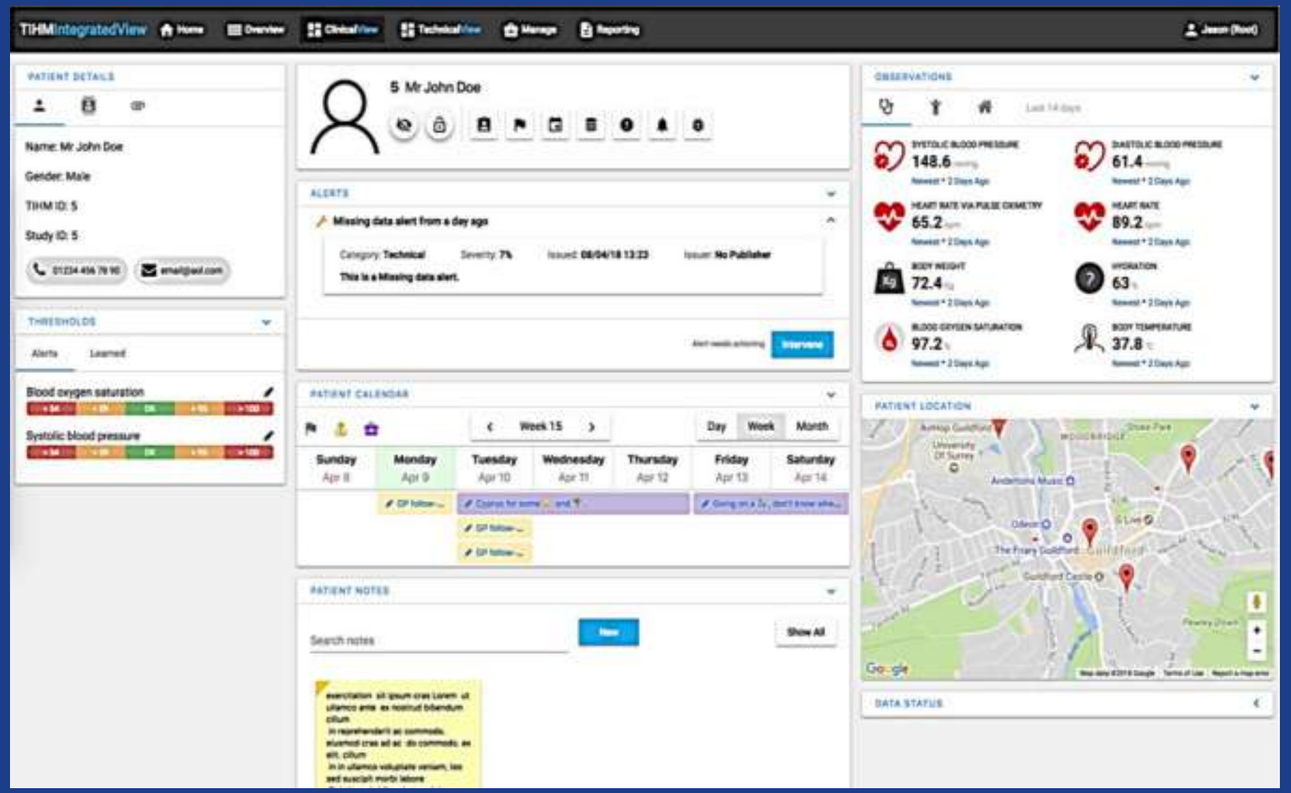


- sensors
- vital sign monitors
- GPS tracker

IVIEW INTERFACE



iView Front Screen



iView personal information screen

CASE STUDY: WALKING AND GETTING LOST

PARTECIPANT DETAILS

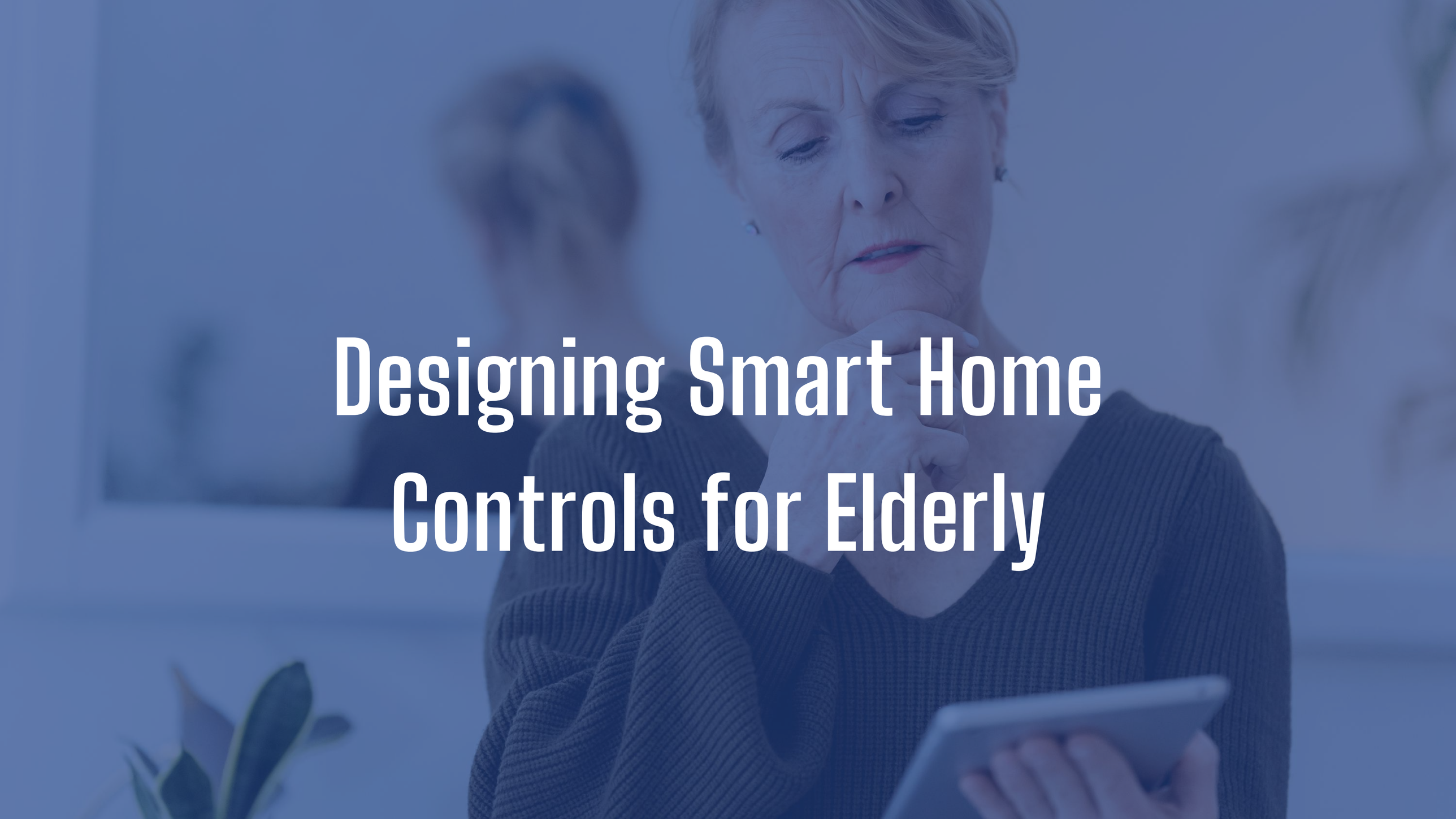
Mr. White is 77 years old and lives with his wife, his main carer.
He suffers from dementia, and has a pre-established history of walking from his home and is at high risk of falls.

MISSING PERSON ALERT

Mr. White left home unannounced.
The monitoring team received a GPS alert and contacted Mrs. White.
The monitoring team then worked with Mrs. White and the police to locate her husband using the GPS tracker.

24-HOUR FOLLOW-UP

A 24-hour follow-up phone call was organised as part of the routine to discuss Mr. White's health conditions.
The monitoring team made a referral to Social Services for a carer's assessment and an occupational therapy home assessment for Mr. White.



Designing Smart Home Controls for Elderly

EXISTING SOLUTIONS

Apps on smartphone, laptop and tablet

Keeping up with new devices is hard for old people: touch screens and menus are regarded as too complicated.

Speech and gesture recognition

Possibility of the Smart Home to interpret words as commands that are not meant as such, and misunderstandings and confirmations by the system add a delay to the desired outcome.

Smart objects

Smart Home Controls designed and built for elderly based on their special requirements.

INTANGIBLE DESIGN

Multiple obstacles, like the increasing impairment of visual or motor functions.

Interface items on desktop and mobile apps tend to grow smaller as their complexity increases, which further hinders adoption by the elderly.

VS.

TANGIBLE DESIGN

Using tangible user interfaces introduces a haptic element to a user interface.

Elderly have been shown to accept and adopt tangible user interfaces more readily due a high perceived ease of use and learning.

FUNCTIONALITY SELECTION

ROTATING

Changing a setting that has several possible values on a discrete or continuous scale, like the volume of a radio, is done via a rotation-based input.

PRESSING

Toggling the power for any kind of device, like lights or TV, is normally done via a switch-off button.

"THE CUBE"

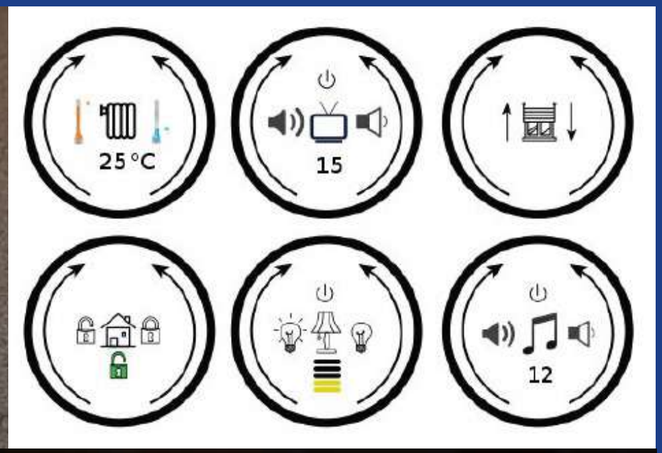
Each of the six sides represents one device

After choosing a device, the user can issue a command by either rotating the topmost ring or by pressing down on the middle part

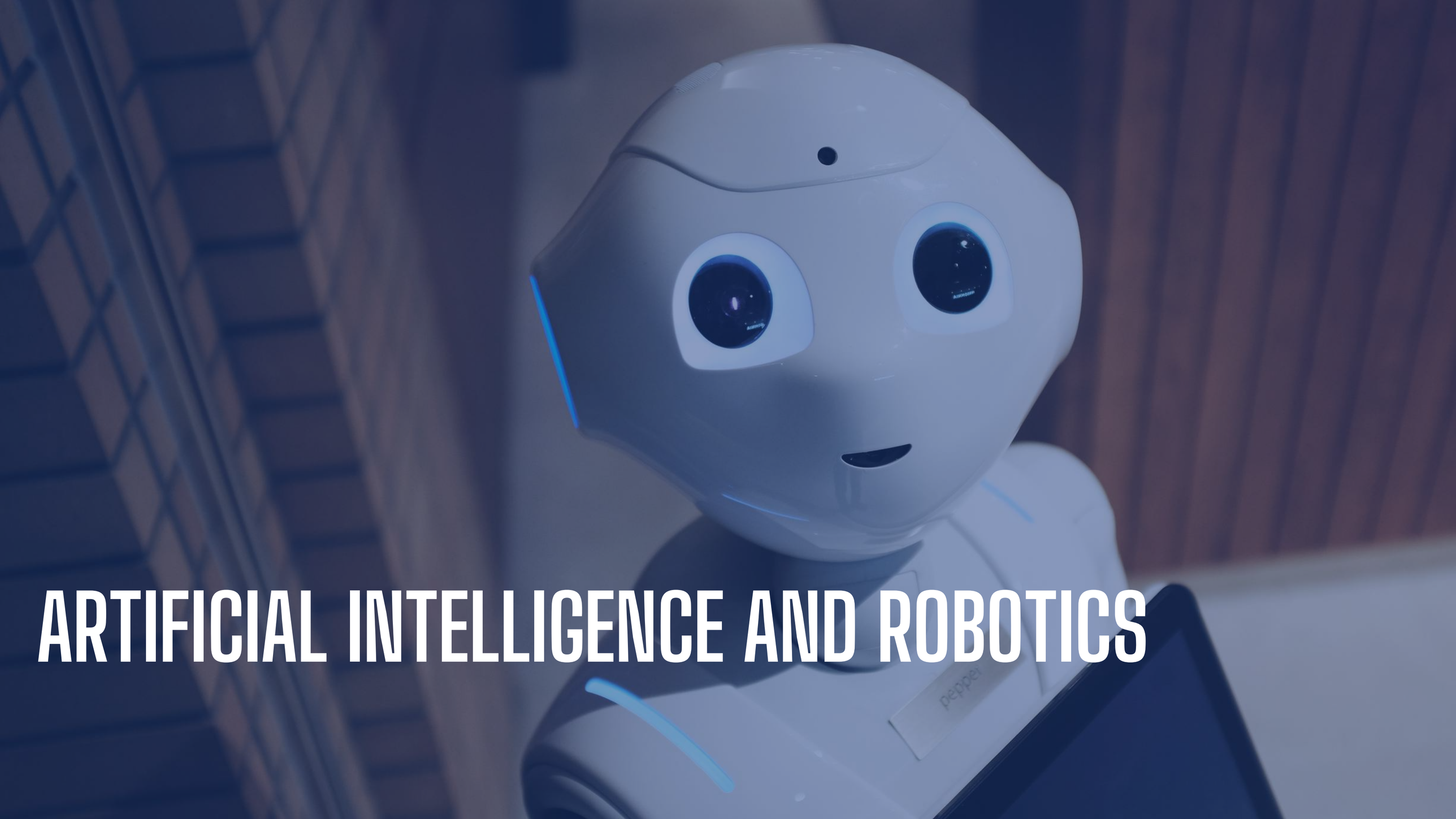
Feedback is handled via vibration and changes on the display

Final prototype with rotating rings, a small screen on one side and a USB connection on the bottom

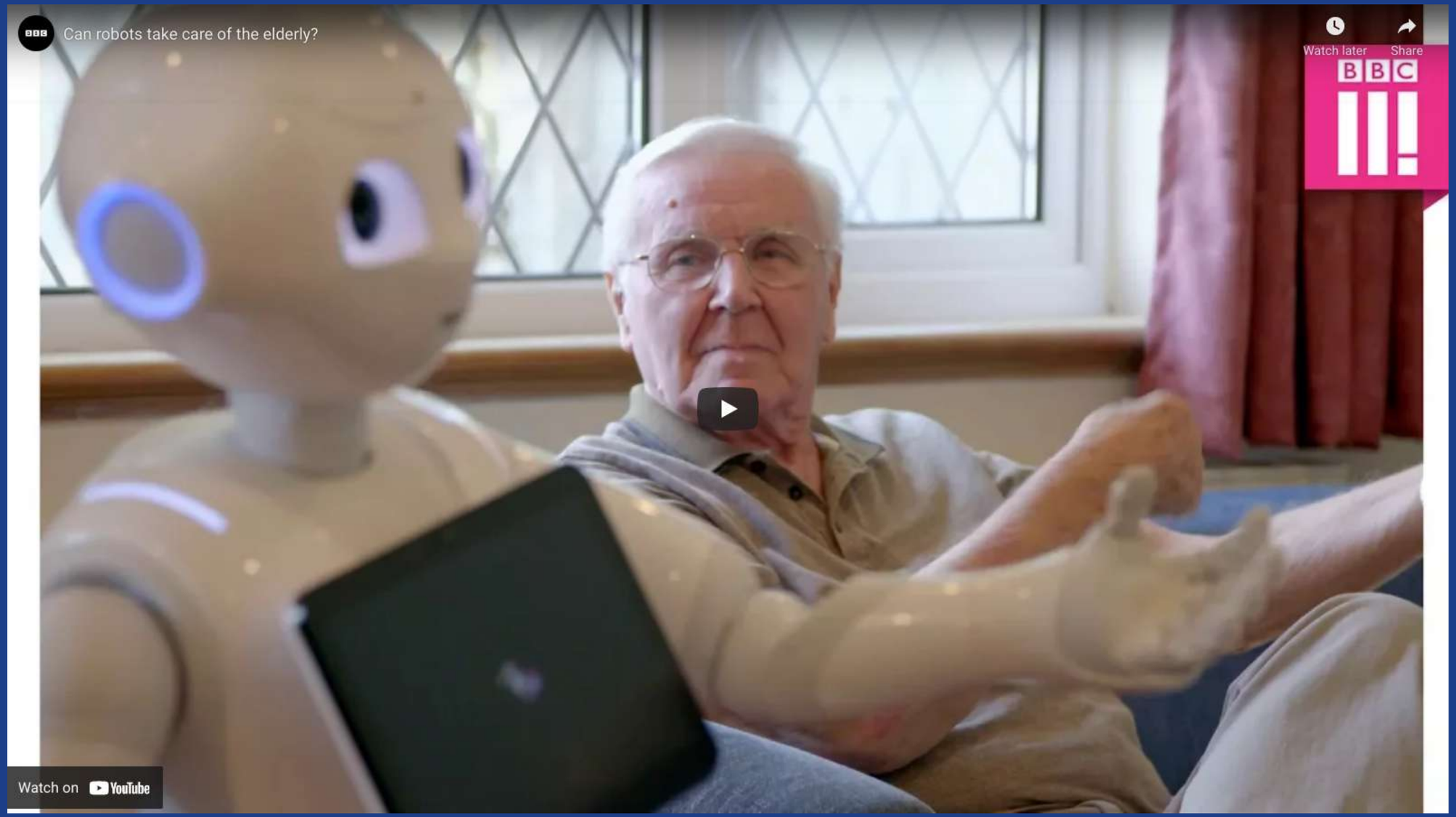
Labels that were glued on the sides of the cube mock-up



Non-functional mock-up of cube remote control concept



ARTIFICIAL INTELLIGENCE AND ROBOTICS



Source: BBC

https://youtu.be/XuwP5iOB-gs

CAN ROBOTS TAKE CARE OF THE ELDERLY? AND CAN IA TECHNOLOGIES BE INTEGRATED IN A MORE COMPLEX UBIQUITOUS SYSTEM?

THE ROBOCARE PROJECT

An Italian research project aimed at developing and studying the applicability of AI techniques for the care of the elderly.

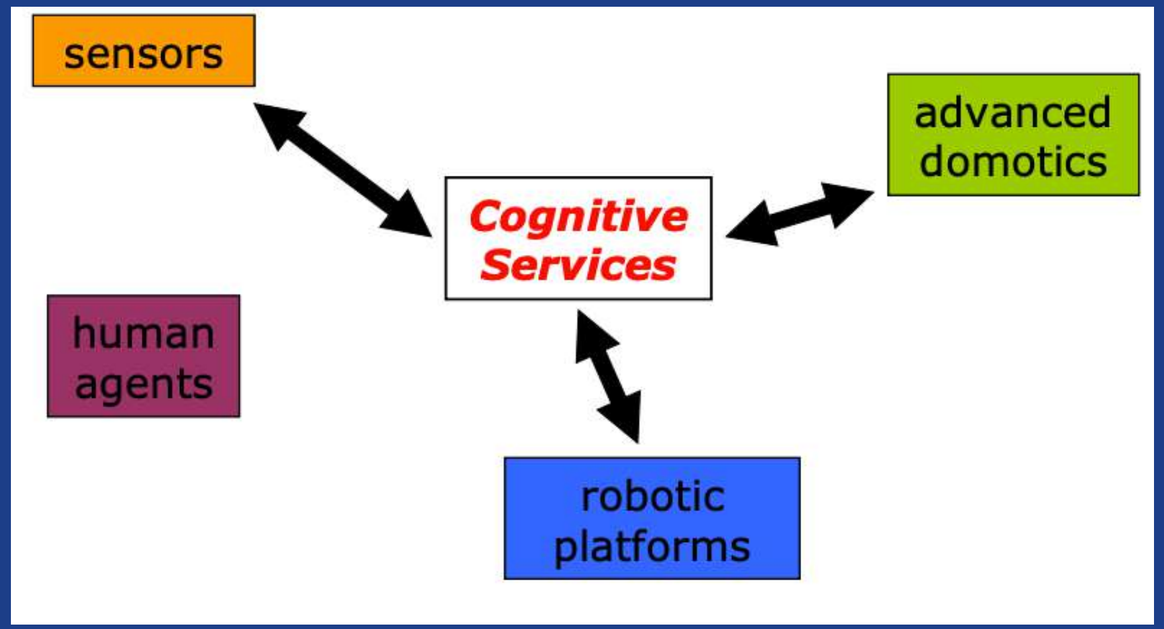
MAIN POINTS

The development of the enabling **domotic components** for deployment in the target scenarios

Development of **distributed systems** which **software** and **robotic agents** contribute to the common goal of generating active services in environments in which humans may need assistance and guidance.

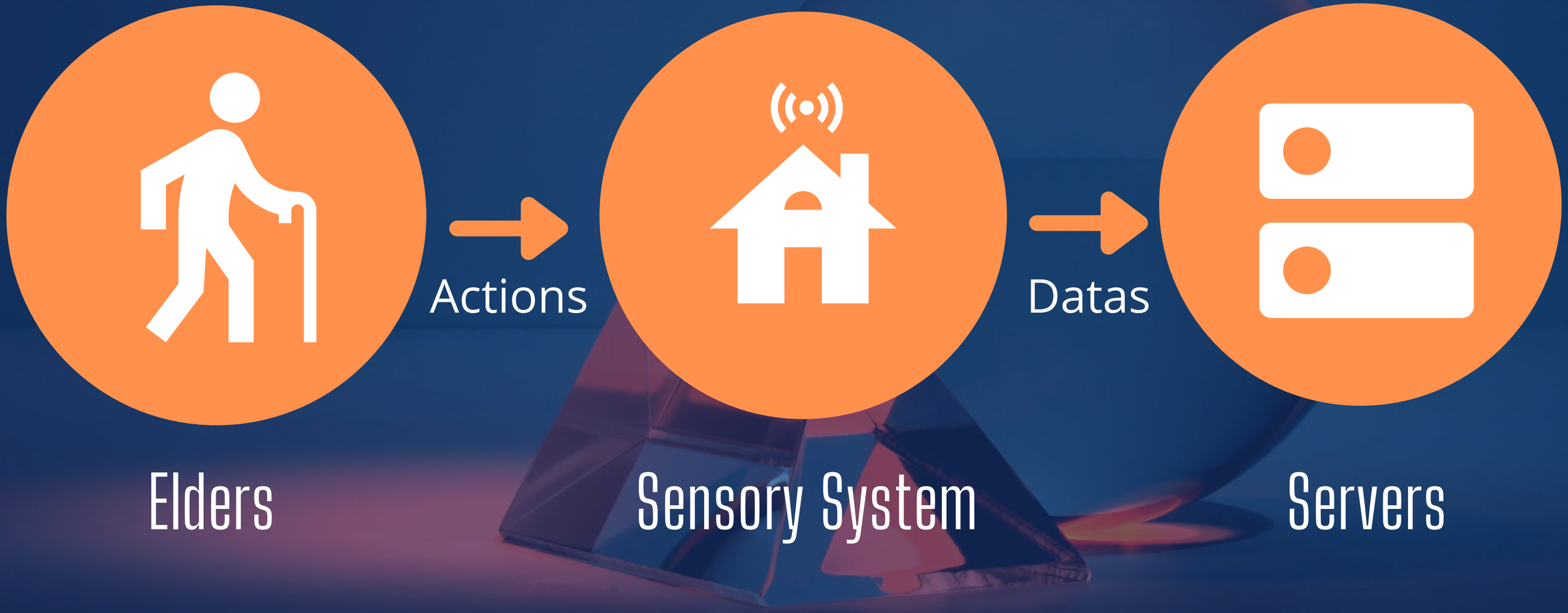
Integration of robotic, **sensory** and automated reasoning components into the domestic and scenario.

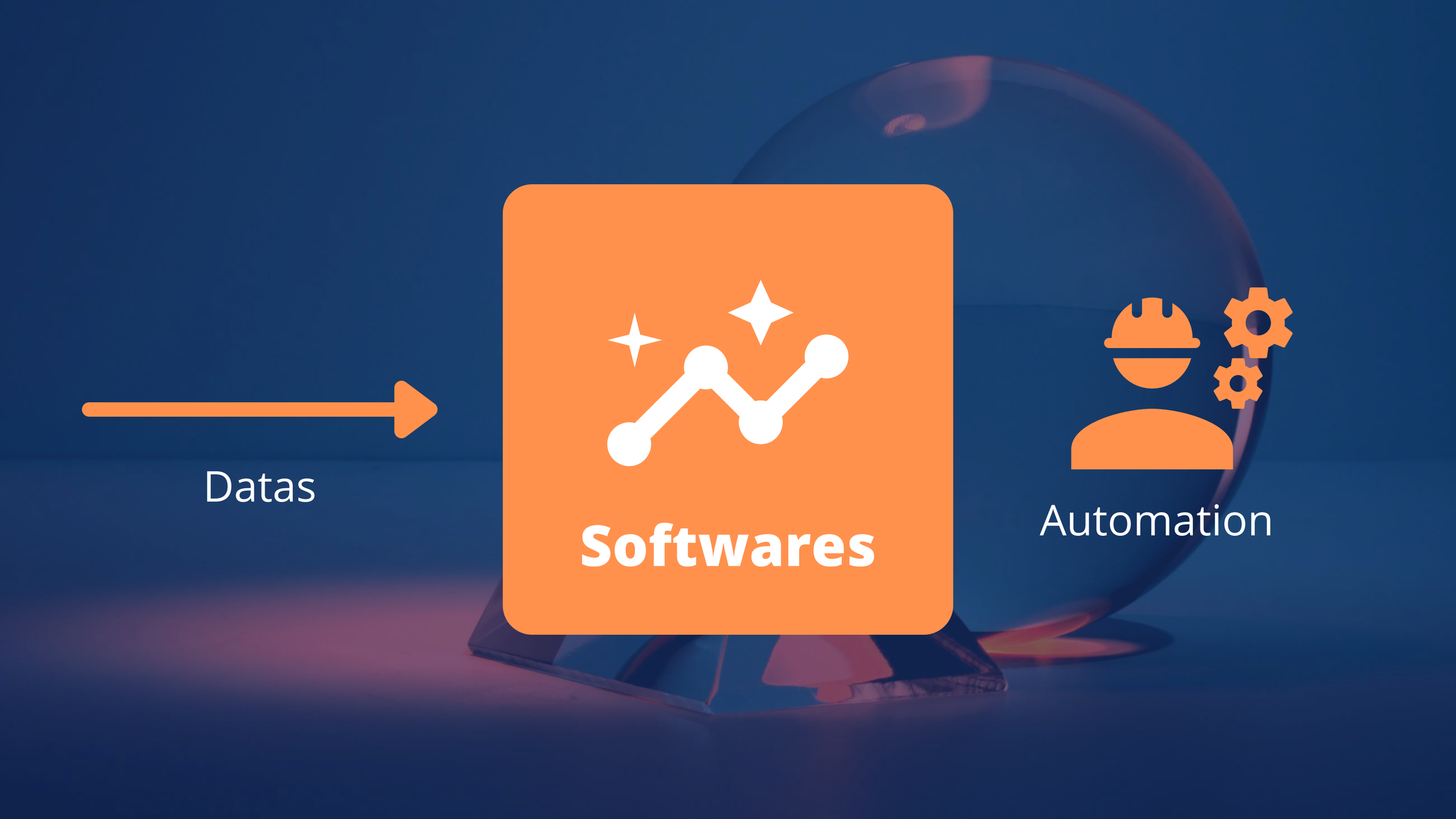
Active Supervision Framework



Some of the robotic platforms employed in the RoboCare Project

A SUMMARY

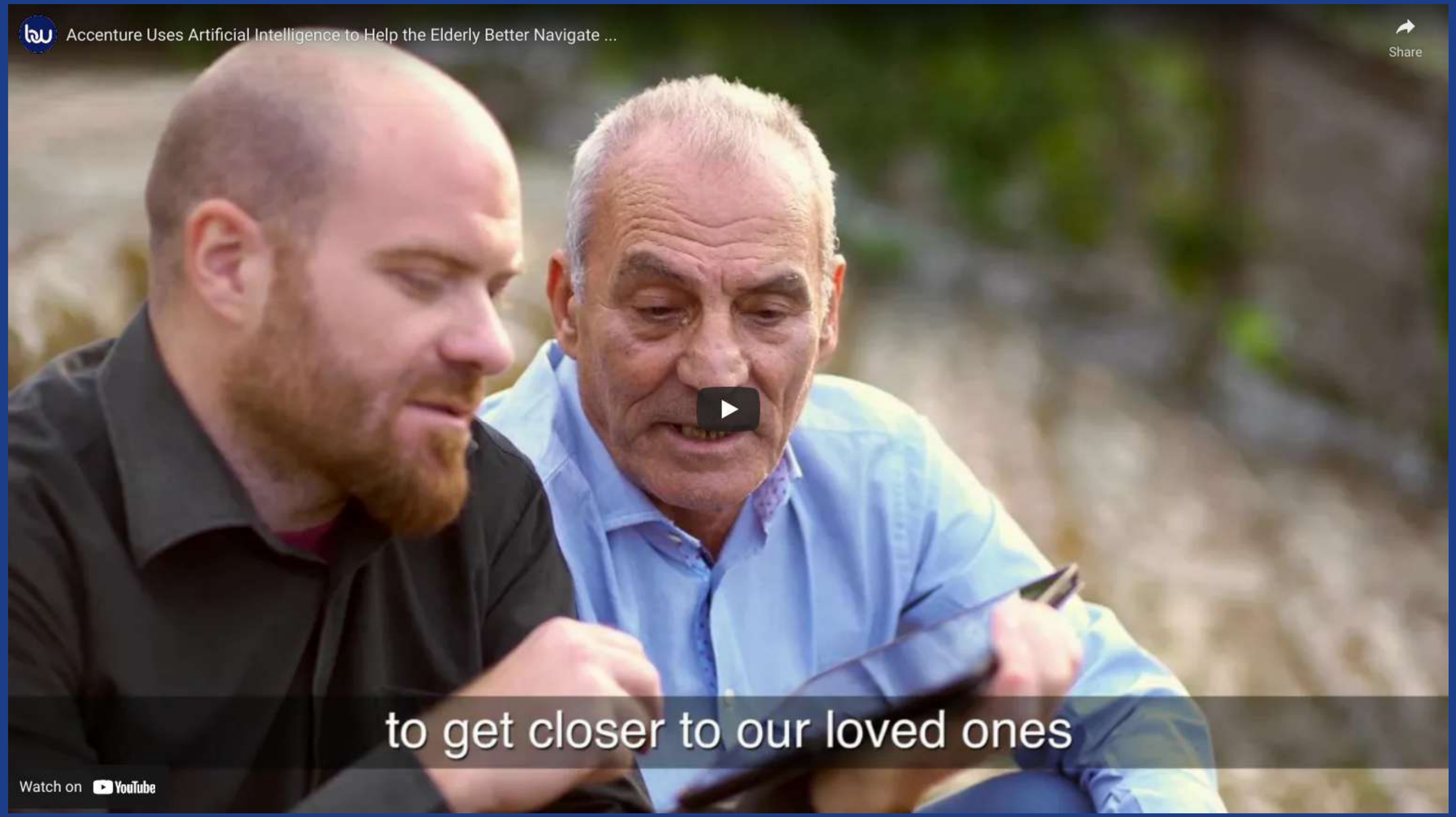



Datas
Softwares
Automation

"In the domestic environment, we envisage a proactive support for the elderly person, thanks to which he or she can count on a set of tools (robotic assistants, intelligent sensors and so on) which provide a cognitive (as well as physical) support. These supporting functionalities range from “intelligent” reminding to automation of routine tasks."

Source: "The RoboCare Project
Cognitive Systems for the Care of the Elderly"

ACCENTURE ELDER CARE PILOT

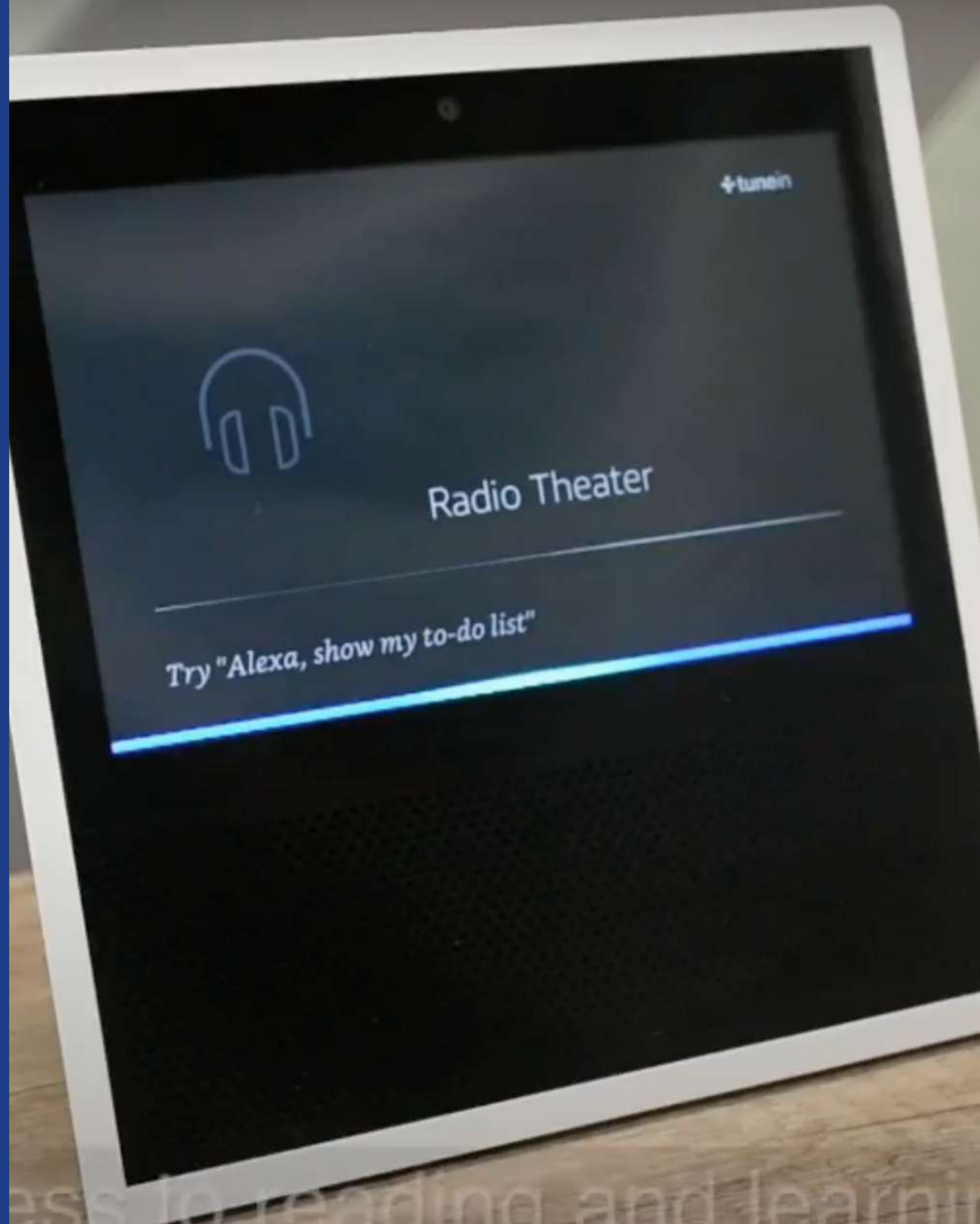


Source: Youtube

https://youtu.be/eFaKCKz6Yzg

"Accenture has completed a pilot program that uses artificial intelligence (AI) and the ease of voice to help older people manage the daunting challenges of navigating their care delivery and well-being. The Accenture Liquid Studio in London developed an AI-powered platform (the Accenture Platform) that can learn user behaviors and preferences and suggest activities to support the overall physical and mental health of individuals ages 70 and older."

Source:www.businesswire.com



CLOUD TECHNOLOGY

Source:
https://commons.wikimedia.org/wiki/File:Accenture.svg

Source:
https://commons.wikimedia.org/wiki/File:Amazon_Web_Services_Logo.svg

Homecare Application

- Detect Anomalies
- Cognitive Empowerment
- Tasks Automation

FUTURE PERSPECTIVES

WHAT OLDER PEOPLE WANT

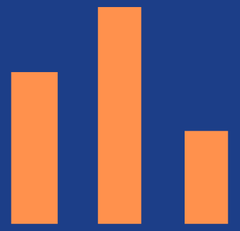
SOCIAL IMAGE AND AUTONOMY

PRIVACY AND TRUST

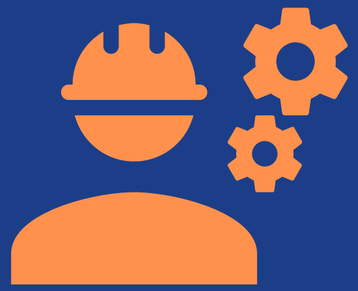
CUSTOMIZATION AND AFFORDABILITY

SOCIAL INTERACTIONS

THE FUTURE IS WEARABLE AND CONTEXT AWARE



Systems that perform data transmission or processing without human intervention.



Components with ‘intelligence’ in the sense of context awareness or decision support properties.

Wearable, portable, or implantable devices,
Mobile or stationary devices, such as sensors, actuators or other.

SMARTHOMES AS PART OF THE HEALTH CARE NETWORK

Teleconsultations, virtual and home visits by professionals

Hospital-based management only for acute illness or investigations which cannot be undertaken at home.

Devices providing support for making decisions and diagnoses

HOME IS WHERE THE SMART IS.

Bibliography and Sitography

- "*State of the art of smart homes* "- Liyanage C. De Silva, Chamin Morikawa, Iskandar M. Petra.
- "*The ROBOCARE Project: Intelligent Systems for Elder Care*" Amedeo Cesta and Federico Pecora.
- http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.100.4054&rep=rep1&type=pdf-**The Robocare Project**
- "*Smart homes — Current features and future perspectives*."- Marie Chan, Eric Campo, Daniel Estève, Jean-Yves Fourniols.

Bibliography and Sitography

- "*Technology-integrated dementia care: trial results.*" - Helen Rostill, Ramin Nilforooshan, Payam Barnaghi, Amanda Morgan.
- "*Technology integrated health management for dementia.*"- Helen Rostill, Ramin Nilforooshan, Amanda Morgan, Payam Barnaghi, Emma Ream, Theti Chrysanthaki.
- "*The effectiveness of smart home technologies to support the health outcomes of community-dwelling older adults living with dementia: A scoping review*" - Wendy Moylea, Jenny Murfield, Katarzyna Liona.

Bibliography and Sitography

- "*Designing Smart Home Controls for Elderly.*" - Silvia Rus, Florian Kirchbuchner, Stefan Helfmann, Arjan Kuijper
- *“Home is where the smart is”? Evaluating smart home research and approaches against the concept of home."* - Kirsten Gram-Hanssena, Sarah J. Darbyb.
- https://www.businesswire.com/news/home/20171128006565/en/Accenture-Artificial-Intelligence-Elderly-Navigate-Care-Improve