

Demonstration Projects

Call for Ideas to Boost the Competitiveness of Estonian Health Technologies Industry

Final Report

Please fill in the Final Report in English
The content of the Final Report is published also in [AIRE GitHub](#)
To be filled by the Lead of the Development Team

Demonstration Project Title

Robot Tegevusjuhendaja rakenduse testimine ja valideerimine eakate heaolu parandamiseks hooldekodudes
RAC – Testing and validating a Robot Activity Coordinator to enhance the well-being of the elderly at the care homes

Company

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Development Team

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Objectives of the Demonstration Project

The goal of this project was to test and validate a customized application for AI-powered TEMI robot assistant in elderly care, focusing on automating routine activity coordination tasks. Rather than replacing human staff, the robot was targeted towards supporting and collaborating with care workers, helping to address workforce shortages and improve service delivery. At Pihlakodu two care homes (Tabasalu and Viimsi), the robot was adapted by RAC application to automate communication tasks and share important information and daily news with residents, support social interaction, especially for less mobile residents and assist with wayfinding for guests and residents. By integrating the robot into daily operations, the project aimed to reduce staff workload, enhance resident engagement, and allow caregivers to focus more on personal interaction. This demo also served as a testing ground for scaling similar robotics and AI solutions across Estonia's elderly care sector.

Activities and results of the Demonstration Project

Challenge addressed (i.e. whether and how the initial challenge was changed during the project, for which investment the demonstration project was provided)

As the population continues to age and the working-age population declines, the care sector is under mounting pressure. Recruiting and retaining qualified care workers is becoming increasingly difficult, while the demand for care services steadily rises. This creates a critical bottleneck that affects both the well-being of residents and the sustainability of care services. Solutions that improve efficiency and assist staff in providing meaningful, person-centred care are essential to ensure the resilience and long-term viability of the sector. Care homes are facing growing staff shortages, making it difficult to provide equal access to information and social engagement, especially for bedridden or cognitively impaired residents. These individuals often miss out on updates and activities due to limited staff capacity to communicate. To tackle this challenge, the project tested an application for TEMI robot assistant that supports care staff by automating routine communication tasks. The usage scenarios for this application were designed collaboratively between the TalTech IT College and the Pihlakodu and the Robot Activity Coordinator application was validated in real-life work processes at Pihlakodu Viimsi and Tabasalu care homes.

Activities implemented and results achieved

To implement the demo project, the following activities were carried out:

July - August 2024:

TalTech selected the most cost-effective **rental offer for two (2) TEMI robots**, including cloud services, for a **9-months** (from August 2024 to the end of March 2025) rental period. Renting the robots, rather than purchasing them, was more cost-effective and sustainable approach. **Usage scenarios for the activity coordinator role were designed collaboratively** by the university and the company, serving as **input for testing and validating the Robot Activity Coordinator (RAC)**. The robots arrived early August to TalTech, underwent technical testing, and the initial version of the RAC application was installed. Both robots were then delivered to Pihlakodu by the end of August. **First-wave training (following the train-the-trainers approach) was provided to Pihlakodu employees both online and on site** - four activity coordinators and four team leaders were the initial group - on implementing the robot and using the RAC application.

September - December 2024:

The RAC application was piloted at Pihlakodu, accompanied by ongoing feedback collection and technical support. The application's first piloted version was concentrated on news, house guide and patrol functions as well as announcement and voice interaction. The project team visited both Pihlakodu facilities (each facility twice per month) and was otherwise engaged in ad hoc communication to gather insights primarily from activity coordinators, aiming to improve and ensure that the application was easy to use. **The design of the RAC was iteratively improved based on the feedback from both staff as well as considering the comments from residents** – menu and daily schedule inserts were added to the RAC interface. Initial versions of short RAC user manuals were compiled and shared with staff.

In October and November, about one-third of Pihlakodu employees at both care homes received **personalized training from the project team**:

1. **Caregivers** were first introduced to the robot by Pihlakodu management when it arrived. In October and early November, they received specific training on robot safety and using the application. These 5–10 minute sessions were held individually or in very small groups (2–3 people) to enhance technology acceptance and understanding of the robot's functionality.
2. **Activity coordinators** received more comprehensive training, covering both the RAC application on the robot and using the backend to support the RAC and various built-in TEMI functions (e.g., video calls, patrol mode, and pre-installed apps). This extra training supplemented their earlier TEMI training in August and focused more deeply on RAC features.

3. **Management** from both care homes also received personalized training on robot use.

December 2024 – January 2025:

Both care homes followed a **weekly routine using the robot to gather comparative experiences:**

1. **Daily announcements** wherein the robot followed a pre-determined route to inform residents about upcoming activities or invited them to mealtimes.
2. **Resident interaction** where the elderly were introduced to the robot, shown how to access the newsfeed (via touchscreen or voice command), menu and activity plan, and guided in using games (such as adapted HP5 educational games that are free to use) adjusted for the robot. Similarly to menu and daily schedule sharing functions, a „Varia“ feature was added to the application wherein text on different topics can be added to entertain both residents, staff as well as guests: daily jokes, short stories or poems, date-based history facts or name day info – the content was open to determine by each care home. The features available could be selected by the staff responsible for the robot, meaning that some days the robot could display on screen the daily activity plan, but on weekends, when such activities do not take place, this feature would be removed from the robot screen if the staff wished to do so.
3. Additional adaptation was also necessary, namely in December, TEMI’s producer added multi-floor navigation option which improved the robot usability, but required adjustments to the robot’s functionality and RAC application (“change floor” feature was added to the RAC).

Throughout this process, weekly feedback was gathered on-site from Pihlakodu staff, and both robots were continuously monitored and updated throughout the project.

February - March 2025:

Piloting continued as described above. **Feedback events for staff and meetings with residents** were delayed due to virus outbreaks and restrictions on visiting elderly care homes. This caused a one-week pause in January and another two-week break from late February to early March when project team visits to care homes were not possible. This aside, project progressed as planned. **Feedback was gathered from staff in two ways: seminars in small groups (one group from 3-6 people, two groups per seminar) wherein staff was asked to perform a SWOT analysis as group work as well as answer a short questionnaire to comprehensively map their experiences.** Results are presented in the short summary below.

The final feedback event took place in mid-March and was followed by the **project’s conclusion:** compiling a final report, creating user story and video, and uploading the application code to GitHub. Preparation of research and popular science articles also began towards the end of the project.

Data sources (which data was used for technological solution)

The Functionality of the Robot Activity Coordinator Application

We used TEMI robot assistant version v3 as a Robot Activity Coordinator. The TEMI robot is an autonomously functioning AI-supported assistant robot that offers various features, such as command recognition, pre-set location storage, and adept navigation. The TEMI robot has the capability to function as a telepresence robot, allowing remote participation through the robot. Crucial element for TEMI is the TEMI Center Pro service, necessary for unlocking the robot’s full functionality. This includes room mapping, mobile application integration, Alexa/Hey functions, video calls, and more. The TEMI Center Pro is also valuable for implementing multi-party calls, scheduling, face recognition, and various applications, thereby enhancing the overall user experience. It can also serve as a personal AI assistant, autonomously interacting with people and performing simple tasks. However, important to note is the fact that the robot functions that require oral commands or language-based interaction do function mainly in English or other large languages, and one necessity of RAC as application was to make the robot easy to use also in Estonian. The Robot Activity Coordinator application for the TEMI robot assistant was programmed

using Android Studio 11.0 Kotlin application, integrating the built-in features of the TEMI. Previously developed initial application and backend solution was adapted to elderly care home requirements as RAC. Temi Robot SDK improvements were also piloted. Whisper AI based ASR/STT system was taken in use.

Adapted functionality:

- * House guide
- * House patrol, with customizable announcement messages
- * Multi floor support
- * Categories of Text-To-Speech articles (menu, schedule, varia)
- * News reader
- * Web based cognitive games
- * Human detection, greeting messages
- * ASR/STT and TTS interface
- * Protected settings activity
- * Backend for app content management.

Description and justification of used AI technology

The application developed in the project utilizes following generally accepted AI algorithms and methods that let TEMI robot assistant to perform its functions:

- Autonomous navigation: TEMI uses an efficient autonomous navigation algorithm to drive and control its movements, enabling it to understand and interact with its environment.
- Voice interaction: TEMI is equipped with Auto Speech Recognition (ASR/STT), far-field voice technology, natural language processing (NLP), speech-to-text, and text-to-speech (TTS) engines. These allow TEMI to hear, identify, understand, and respond to user's voice commands.

Results of testing and validating of the technological solution

This AIRE demo project piloted the use of two TEMI v3 robots – affectionally named Olle and Pipi by the residents at staff at Pihlakodu's Viimsi and Tabasalu care homes. The goal was to test dedicated application of socially assistive robot as activity coordinator in order to enhance resident engagement, reduce information gaps, and support activity instructors, especially considering the less socially active residents. The robots delivered news updates, daily schedules, menus, activity reminders, memory-stimulating games, prompts towards positivity and staying hydrated, and enabled video calls - bringing both joy and improved inclusion to residents and staff. The solution was tested to complement human care, allowing staff to focus on personal interactions and focussing on less mobile residents.

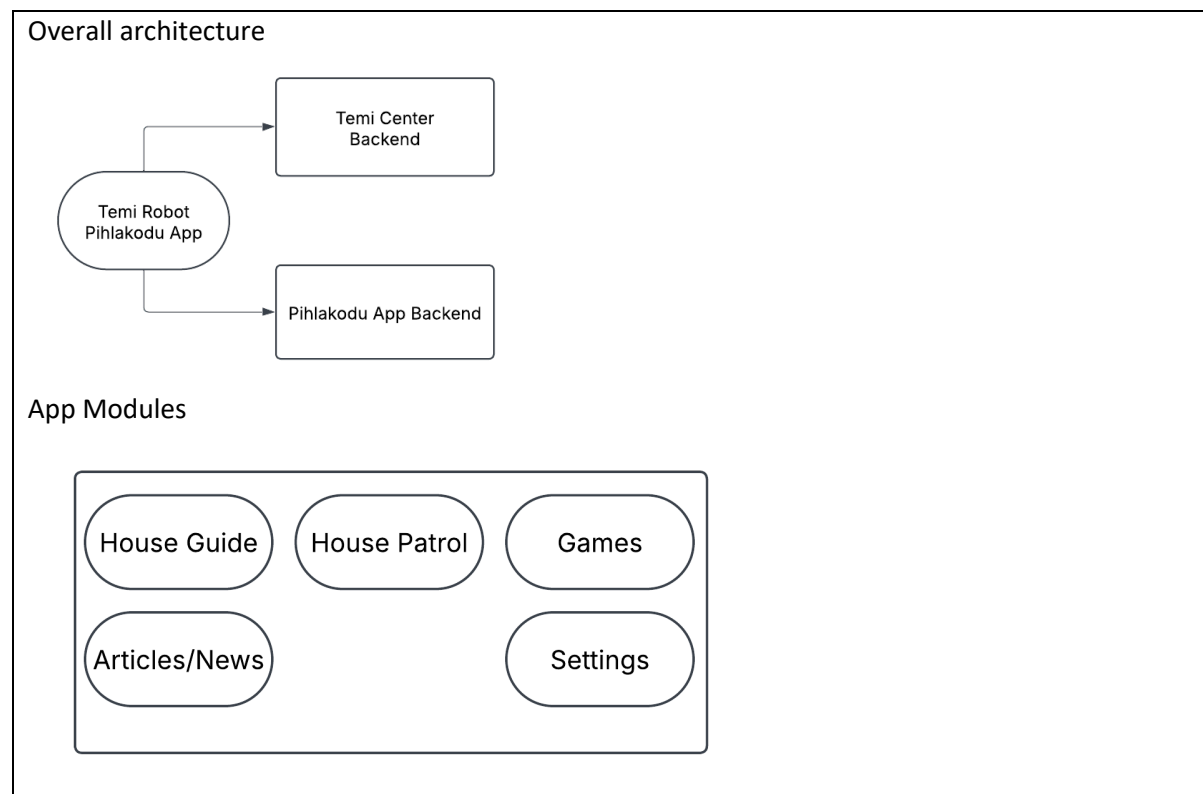
RAC was co-designed and piloted over several months and the results were gathered from staff as SWOT insights:

- **Strengths:** increased resident engagement, improved communication, intuitive interface, positive emotional impact.
- **Weaknesses:** occasional technical glitches and a need for better activity customization.
- **Opportunities:** potential broader use in care homes, depending on refined AI and language interaction, and expanded personalization (such as interaction based on facial recognition).
- **Threats:** tech adoption resistance and funding challenges for scaling and support.

Staff feedback confirmed robots as valuable assistants that have the potential to enhance the overall care experience. The project further highlighted the importance of **natural language interaction and smart design to achieve comfort and trust**. Building on this test-before-invest

experience, Pihlakodu plans to expand robotic integration and further develop AI-assisted features to support the well-being of elderly residents and bring more humanity to care through technology.

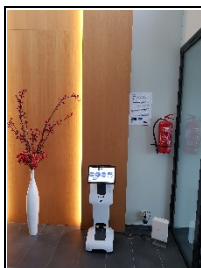
Technical architecture of the technological solution (presented graphically, where can also be seen how the technical solution integrates with the existing system)



Potential areas of use of technical solution

The initial RAC application was demoed during an event dedicated to the socially assistive robots in elderly care in September 2024, <https://cm.taltech.ee/pynt-event-2024> which created a lot of interest from different parties, including other care homes. The immediate plans by TalTech include further piloting of the RAC at Iru Hooldekodu and possibility to the same at Sūdamekodu care homes – here, the necessity to consider the personal needs of each institution is crucial and adaption of RAC requires personalised approach. Therefore, we see this solution as scalable to other service sectors and has the potential for spin-off creation. Consultations with the technology transfer professionals are necessary on this topic after the project ends and TalTech IT College plans to take up these consultations in April 2025.

Description of User Interface (i.e. How does the client 'see' the technical result, whether a separate user interface was developed, command line script was developed, was it validated as an experiment, can the results be seen in ERP or are they integrated into work process)



Our previous software was adapted and enhanced for elderly care use. UI is presented as integral part of robot. Admin access was provided for activity managers to update content used in robot app (readable texts). The following pictures illustrate a) Robot in standby mode in the docking station, RAC is always activated. And b) screenshot of the active app. Please see more about the robot functionality in the project video.



Follow-up activities and plans for future (e.g. developments, potential for scalability, creation of spin-offs)

One TEMI robot will remain at Pihlakodu for an additional test period. The Test-Before-Invest project proved to be very valuable; however, one of the key lessons learned (see below) was that it takes more time than expected to design usage scenarios, test them with end users, and improve the application based on those results - especially when aiming to integrate a new technical solution into everyday work processes. This was also the main challenge for the RAC project: understanding the workflow well enough for the robot to integrate seamlessly into daily life at the care home. TalTech and Pihlakodu will continue working on this in the upcoming months. We plan to use the RAC in other Pihlakodu care homes in 2025 through shorter pilots to gain a clearer understanding of overall acceptance from both staff and residents. This will help Pihlakodu better assess the long-term potential and value of this investment. Additionally, two other large care homes - Südamekodu and Iru Hooldekodu - have shown interest in the RAC and TEMI robot. At Iru Hooldekodu, TalTech plans to conduct a short demonstration pilot in July while Südamekodu cooperation awaits possible new funding opportunities.

Lessons learned

i.e. assessment whether the technological solution actually solved the initial challenge

The Test-Before-Invest demo project provided valuable, real-world insights into deployment and usability of robot assistants in mainly social functions (such as TEMI) in elderly care settings. The project validated robot as assistant, not as a replacement of humans. When designed and implemented thoughtfully, these types of solutions can enhance human interaction, improve workflow efficiency, and support the emotional and social well-being of residents. The project laid the foundation for scaling the RAC solution across other care homes. Interest from other care institutions such as Iru Care Home and Südamekodu Care Home confirms the relevance and potential in this. While the project confirmed many benefits, it also highlighted several practical, technical, and strategic lessons critical for future success and scaling. Important to note is the fact that robots available at reasonable price on the market today do need adapting to and understanding of their limitations.

1. TEMI robots can effectively take over some routine, repetitive tasks such as announcements, reminders, and content sharing, freeing up staff to focus on different tasks and personalized care. When implemented successfully, this change can reduce caregiver workload and thereby enhance the overall resident experience.

2. The RAC solution can increase engagement and access to information for bedridden or less mobile clients, who often miss out on group activities. The ability to receive news, reminders, games, and video calls directly from the robot has the potential to improve their sense of inclusion and quality of life. However, **more personalization and more time with the robot is essential** for

the residents to understand this new technology and accept this not as a novelty, but part of the routine care process.

3. **One of the key lessons was that effective integration takes time.** Embedding new technology into care home routines is complex and must be approached with flexibility and patience. From designing use scenarios to testing them with real users and refining the application, the process depends on sustained collaboration.

4. **Adoption depends heavily on well-planned, personalized training.** Short, **practical** sessions helped caregivers and activity coordinators gain confidence and understand how the robot can support - rather than replace - their work. However, staff would benefit from more comprehensive training on the robot as part of their daily work process as well as inclusion of any new staff. Building acceptance also requires clear communication about the robot's purpose, which may need constant reminder in the implementation process.

5. **A significant challenge is the lack of technical expertise within care homes.** Most facilities do not have dedicated IT staff, making regular maintenance, troubleshooting, and updates difficult. In the RAC project, TalTech provided the company with necessary assistance and advice, however, this is a challenge as well as opportunity for future (for instance, the sellers of such robots in Estonia do not currently provide such support and this might pose a significant challenge for elderly care homes to adopt robots). Ongoing remote and in-person technical support is essential and must be factored into any long-term deployment plan.

6. Care staff at Pihlakodu highlighted **the need for robots to be more adaptable to the specific preferences and changing needs of both residents and staff.** This includes flexible scheduling features, personalized interaction content, and easier ways to tailor announcements or games.

7. **Deploying socially assistive robots in care homes requires a multidisciplinary approach.** This includes programmers and engineers to adapt and maintain the platform considering the specific needs of specific elderly care home (these needs might differ, so no one-solution-fits-all is truly viable). Geriatrics experts must be included to ensure age- and condition-appropriate use, but also game designers and educators are necessary to consult with to provide cognitive stimulation and entertainment as well as train the staff and create capacity to educate the elderly on the use of robot – for social robot such as TEMI, access to entertainment meaning free, localized content such as games and news feeds can significantly increase the robot's perceived usefulness. Finally, quality management to ensure practical alignment with real-world workflows is essential.

8. Overall, **one of the most impactful features and development needs is the integration of an Estonian natural language model**, which allows for intuitive interaction, but which currently needs significant further development that was outside of the timeframe of this project. Many of the staff and elderly “wanted” to have a conversation with the robot in the same manner than they do with another human – something that is not yet possible. Furthermore, the robot has the potential to support multilingual interaction, such as helping Russian-speaking staff learn Estonian through guided conversation. This opens new possibilities for language learning, inclusion, and cultural sensitivity in **diverse work and care environments**.

Projekti lühikirjeldus (AIRE kodulehele, eesti keeles)

Projekti pealkiri, millist väljakutset lahendati, projekti eesmärk, millist tehisintellekti tehnoloogiat valideeriti, projekti tegevused ja tulemused, kuni 10 lauset

AIRE projekt "Robot Tegevusjuhendaja rakenduse testimine ja valideerimine eakate heaolu parandamiseks hooldekodudes" eesmärgiks oli testida robotist abilise rakendusvõimalusi hooldekodu igapäevases töös. Selleks oli vajalik kohandada Pihlakodule sobivaks rakendus, mis aitaks TEMI robot-assistendil tõhusalt hooldekodus ringi liikuda, elanike, töötajate ja külalistega suhelda ning infot jagada. Projekti käigus disainiti Pihlakodu ja TalTech IT Kolledži ühisel koostööl esmalt roboti kui tegevusjuhendaja kasutus-stsenaariumid. Seejärel kohandati vastavalt robotile

vajalik rakendus (RAC), et robot saaks tegevusjuhendajaid nende töös abistada. Oluline selles demoprojektis oligi rakenduse ja roboti põhjalik testimine ja valideerimine Viimsi ja Tabasalu tavapärasel tööl. Robotid nimega Pipi ja Olle jagasid majas ringi liikudes elanikele olulist teavet ja igapäevaseid uudiseid, toetasid huumori ja mängude abil sotsiaalset suhtlust, eriti vähem liikuvate elanike puhul, ning aitasid külalisi ja elanikke asukoha leidmisel. Kasutades robotit tegevusjuhendaja rollis, testis projekt võimalust vähendada robotika ja AI abil hooldekodu töötajate puudusest tingitud väljakutseid - seda eriti just nende eakate hoolduses, kes ei saa erinevatel põhjustel ühistegevustes osaleda ning vajavad personaalsemat lähenemist. Oluline on siinjuures, et robot-tegevusjuhendaja rakenduse eesmärgiks ei ole inimese rolli asendamine, vaid tööprotsessi täiendamine roboti kui abilise näol. Kokkuvõttes võiks RAC demo projekti edu osutada reaalsele võimalusele hetkel kättesaadava AI ja robotika lahenduste kasutamiseks eakate hoolduse parendamises ja pakkuda laiemat huvi hooldekande ja tervishoiusektoris nii Eestis kui mujal, kus elanikkonna vananemise tingimustes otsitakse lahendusi tervishoiu- ja hooldusteenuste kvaliteedi tagamiseks.

Project description (to be published on AIRE webpage, in English)

Project title, what challenge was addressed, aim of the project, what AI technology was validated, project activities and results achieved, max 10 sentences

The RAC project, short for "Testing and validating a Robot Activity Coordinator to enhance the well-being of the elderly at care homes," was to explore the potential use of a robot assistant in the daily operations of a care home. To achieve this, an application suitable needed to be adapted to enable the TEMI robot-assistant to move efficiently within the Pihlakodu care home environment, communicate with residents, staff, and guests, and share information. During the project, usage scenarios for the robot as an activity coordinator were first designed through collaboration between Pihlakodu and TalTech IT College. Following this, the necessary application (RAC) was adapted to enable the robot to support activity coordinators in their work. A key focus of this demo project was the thorough testing and validation of the application and the robot in the day-to-day care work process at the Viimsi and Tabasalu care homes: the robots, named Pipi and Olle, moved around the care home sharing important information and daily news with residents, supported social interaction - especially for residents with limited mobility - through humour and games, and assisted guests with finding their way inside the facility. By using the robot in the role of activity coordinator, the project tested the potential of robotics and AI to address staff shortages in care homes - particularly in the care of elderly residents who, for various reasons, cannot participate in group activities and require a more personalized approach. It is important to emphasize that the goal of the robot as activity coordinator was not to replace the role of the human, but to help and enhance work processes.

The primary objective of the RAC project is to elevate the quality of life for bedridden elderly residents in care homes. By introducing an AI enhanced robot application as an Activity Coordinator, the project aims to alleviate some of the workload of human care staff while enhancing the overall well-being and satisfaction of both the residents and staff. The success of the RAC demo project could prove to be a shift in implementing emerging technologies such as AI and robotics in elderly care, generating interest from other institutions in the healthcare and elderly care sectors, both in Estonia and abroad, where seeking solutions to improve healthcare and care services in the reality of ageing society.