Technology Strategy Board
Driving Innovation

Results of competition: Active ageing - SBRI SILVER (Supporting Independent Living of the Elderly through Robotics)

Total available funding for this competition was £210,000 from the Technology Strategy Board.

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
Alten Nederland B.V. (Lead)	HelpingHand	€ 38,800	€ 38,800

Project Description (provided by applicants)

With increasing age most people will develop limitations in their motor abilities. Even at a rather mild level this results in difficulties and uncertainty in performing basic motor skills. Fear of falling and the risk of actually falling itself may become a reason why daily activities become problematic and lead to the need for human care.

To a certain extent care can be provided at home (extramural care) but from a certain point moving the person to a care facility (intramural care) becomes required to ensure sufficient support in performing everyday activities such as visiting the toilet, washing oneself and moving around.

In general people prefer to live and age in their own home as long as possible. In western European countries the publically funded care system provides support for all who need this, but demographic changes and economic decline forces nations to reconsider the level of care provision. This is another reason why aging in place is to be preferred.

A resulting substantial increase in demand for extramural care will nevertheless create a need for human support that cannot be solved with traditional formal and informal care. The solution proposed in this tender will create substantial health care cost reductions as it will support these elderly and handicapped people to live at home without the need for human care.

The foreseen “HelpingHand” is an intelligent robot arm that provides support on the moment that the person is losing stability and fears falling

or could actually fall. It follows passively all user's movements and gets active (“freezes”) in user's unstable situations; the robotic device then becomes a stiff support. HelpingHand will be designed such that an inexperienced user can make use of the robot intuitively.

It supports in all activities on toilet and completely eliminates the help of a care taker for bathroom visits. To support users during toilet visits, HelpingHand will be fixed on the toilet walls. However, in principle the robotic solution could also be applied in support of other daily tasks in other parts in the house, to solve similar issues with stability.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Bestic AB (Lead)	Mealtime 360	€ 35,050	€ 35,050
Project Description (provided by applicants)			
We propose a completely new type of eating assistive device to embrace a more complete process surrounding the mealtime situation. The mealtime consists of so many different aspects and needs; nutrition intake, social interaction, cultural and traditional aspects, ergonomics in eg. seating, chewing and swallowing properly; appeal to different senses (sight, hearing, smell, touch, taste). Our suggested mealtime solution is a platform that combines these different aspects and integrates them in a modular and adaptable solution. The purpose is to provide nutritive and healthy meals for everybody adapted to the individual needs and enable everyone to have a positive mealtime experience but still not take over any tasks that the individual are capable and willing to do him/herself. The new solution builds on and expands our existing eating assistive device, Bestic. The advantages of that is we already have a well working solution as a platform and from there we can develop a new generation of robotic solutions that takes the whole mealtime in consideration. Our solution encompasses eating, drinking, hygiene, medication reminder and not the least a communication platform between healthcare personnel, the individual and the food delivery and preparation organisation. It is intuitive, adaptive mealtime robot that communicates with the individual and the caregiver. The robot also aims to empower and activate individuals with cognitive disabilities. Through this solution, the group of elderly with mild disabilities will be able to perform more activities in their daily living and manage by themselves the majority of the work that caregivers provide today.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Bioservo Technologies AB (Lead)	Iron Arm	€ 20,000	€ 20,000

Project Description (provided by applicants)

Current assistive robotic systems are bulky pieces of equipment focusing on passive movements based on forced grip and have limited intention detection capabilities. They have been designed mostly for specific heavy duty activities or for therapeutic rehabilitation, and not for supporting activities of daily life.

In contrast, Iron Arm is a light and ergonomic soft robotics device with intention detection sensors and mechatronic actuators that can be used to support personal activities of daily life for elderly users and collect data on their physical activities, allowing them to maintain muscle strength and increase their life expectancy, as well as helping them to recover faster from injuries or other hand mobility impairing diseases.

Iron Arm targets two primary market segments:

• The end-user market, where the device can be purchased by healthy older adults and frail older adults suffering from chronic conditions such as osteoarthritis and rheumatoid arthritis (as much as up to 5 % of the population suffer from weak or painful handgrip) to support activities of daily life.

• The rehabilitation market, where the device can be used during early rehabilitation phases (and later rented out to the patient for use at home). Currently, the number of stroke survivors with disabilities is estimated to be 30 million, and hemiparesis (reduced arm/hand function) is the most prevalent disability (affecting 80% of the patients).

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Delft University of Technology (Lead)	LECOROB	€ 32,148	€ 32,148

Project Description (provided by applicants)

To increase the number of elderly living independently and to improve their quality of life, in this tender we present a novel care robot capable to autonomously assist elderly in performing various daily living activities. In our design we aim to provide the elderly with both physical as well as social support while keeping their privacy and personal space preserved. A large part of our research will also be devoted to investigating safety regulations and making our solution safe for both the elderly and their property. Finally, we plan to adapt our solution to be applicable in case of the elderly suffering from illnesses such as dementia or mobility problems. At first stage of our design process, with our partners from Zuyd University of Applied Sciences that have a long experience in the application of technology in healthcare, we plan to perform a large social study with independently living elderly people to define functional and usability requirements for the care robot design.

Using our previous experience in personal robot design from TU Delft Biorobotics Lab, we propose a very affordable robot with limited complexity but able to perform various household tasks. The robot will be equipped with a head and neck used for information acquisition and sensing, a mobile base, an arm with an underactuated gripper able to grasp almost any object no matter its shape or weight and a sliding torso to be able to manipulate at various heights. To allow for easy transfer for the elderly, the body will be expended with handles so that a robot can be transformed into the autonomous rollator.

Regarding the software functionality, we propose a variety of individual modules responsible for main actions of the robot performing household tasks. These include navigation, manipulation, speech recognition, face recognition, object recognition as well as person tracking and action recognition. Each individual module directly interacts with the low-level control layer. Additional functions for online learning of users and objects are provided to allow the robot to adapt to the novel environment. Also a high level planner will autonomously plan the actions of the

robot dependent of the user behaviour will be provided.

A very intuitive and easy-to-use interface for user-robot interaction is proposed. Both remote control as well as the fully autonomous behaviour will be given and the users can control the robot either through a tablet or speech interface. Special attention will be given to elderly with hearing and visual difficulties. Also special attention is given to the safety of proposed solution.

Finally, with experience of our partner Lobeco we plan to bring the introduced care robot to the large market.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Marsi Bionics S.L. (Lead)	Wearable bionic exoskeletons for safe ambulation	€ 29,950	€ 29,950

Project Description (provided by applicants)

The elderly progressively lose muscle strength, coordination of limb motion, balance and mobility. At the end, the elderly loses autonomy and requires assistance for daily activities. The final impaired mobility of lower limbs can cause several physiological and psychological diseases. Besides, the lack of motion makes the elderly gain weight, and assisting the elderly in functional transfers is a hard work for the caregiver, work which usually requires two people, and that produces back-pain and spinal diseases to these personnel. Psychologically, elderly people often consider themselves a burden to their children and caregivers due to this lack of mobility autonomy.

Marsi Bionics is a company that develops wearable bionic exoskeletons that restore the ambulation function. Using this device no functional transfers are needed, and the person is able to move in a controlled and safe fashion without the need of the wheelchair.

Lower-limb bionic exoskeletons are orthotic devices that fit closely to the person's legs, tightly wrapped around each leg segments from trunk to foot. The device produces a natural gait motion based on a robotic gait motion controller that moves and coordinates each joint to reproduce a natural gait pattern.

Within SILVER project, Marsi Bionics' exoskeletons will be optimised to confer motion to the joints of the elderly, who usually combines the loss of muscle strength with other diseases, such as Parkinson's disease, osteoarthritis, CVA or stroke. These diseases produce tremor, rigidity and osteoporosis, which conventional exoskeletons cannot deal with. Marsi Bionics will develop under the SILVER project exoskeletons that are the best choice for the elderly.

These exoskeletons will absolve the caregivers from functional transfers work, preventing several lumbar diseases and saving more than 1,000 hours of work to caregivers in a city of 100,000 residents.

The project result is a viable commercial product that Marsi Bionics will introduce into the European market making use of a marketing policy focused on approaching the user needs.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Robosoft (Lead)	Kompaï-P	€ 26,700	€ 26,700

Project Description (provided by applicants)

Robosoft has been active in the field of service robotics for over 20 years, and in assistive robotics for dependent persons for nearly 10 years.

We have developed and tested dozens of assistive robots, for both cognitive and physical assistance.

Over the course of the AAL-DOMEO project, which was coordinated by Robosoft, we accumulated over 700 days of experiments with real dependent patients. Through this work and these experiments Robosoft has built up extensive experience in the field of assistive robotics, but we also now have, most importantly, a clear vision for how to approach the market in the short term. In fact, despite robots being very promising, it is still a challenge for potential users to distinguish between the dream and the reality of what is actually possible. Thus we share fully in the fundamental premise of the PCP-Silver project; that robots are likely to be most useful to the assistance professionals themselves.

Dependence is a major issue in today's society, for which a new ecosystem needs to be created. One that brings together all of the industry's professionals. With ever increasing needs and ever scarcer resources (i.e. caregivers), there is a need to provide productivity tools to professionals while improving the quality of life of those affected.

We have based our project on this reasoning by proposing a two-pronged approach:

- A modular robot configured in line with the type and degree of dependence, but one that can also change over time along with the status of the person. This robot includes an autonomous base platform, comprising of a cognitive assistance system and a medication management

carousel system. Expansion modules can be added, such as the walking aid, position change assistance (standing, sitting) and handling systems.

- A communication environment, in the form of a secure website that allows the ecosystem to access the dependent person, but also allowing the dependent person to remain in constant contact, in a simple and effective way. This provides both social links and a sense of security.

We believe that robots are not replacements for people, but are there to help. Work in the dependence field will become more professional, without which it would be impossible to effectively meet the demand. As such, robots will become a productivity tool for caregivers, but also for all stakeholders in the ecosystem.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
University of Groningen (Lead)	DEXTER: the DEXTERous mobile manipulator	€ 27,000	€ 27,000
Project Description (provided by applicants)			
Safety, activity in the home and being able to grasp items are all very important. Assistobot has been working for the past three years on RITA, the Reliable Interactive Table Assistant. RITA is a smart wooden table on the outside, but an intelligent robot on the inside. It is a mobile sensor platform that is able to navigate inside an apartment and monitor clients in a non-invasive manner. The monitoring is used to provide 24/7 safety and behavioural analysis. Also RITA can bring drinks, medicine, carry food and other items around and find items such as a pair of glasses. Besides all this it has all the capabilities that can be expected of a modern computer/tablet, but with an adapted interface tailor-made for the elderly. The first prototype is currently undergoing testing. The RITA wooden table robot provides safety and using serious gaming, also activity. But it has no arms to manipulate the surroundings. The DEXTER project is all about adding that manipulator on an already working robot platform in a cost-effective manner. To assist the persons in their living environment, a commercially available manipulator (arm) will be installed on the RITA. This manipulator equips the RITA with the possibility to grasp objects such as cups, plates, medication, keys and more. The manipulator is controlled through speech and by the use of icons. It can be commanded to grasp objects and using feedback by spoken words it can be instructed which object is wanted and what should be done with it. In the Cognitive Robotics Laboratory at the University of Groningen robot intelligence has been developed where spoken language is used to			

control a robot. This technology is used in the international benchmark for domestic service robots called RoboCup@Home.

The beauty of the DEXTER project is that it combines three very new technologies which are somewhat experimental but well-tested: the RITA robot, the MICO arm from KINOVA and Artificial Intelligence for speech/text processing. The DEXTER project does not research fundamental new technologies, but valorizes what is available, connects the necessary dots and creates a robust and cost-effective solution. Both RITA and MICO are waterproof and the lowest costing solutions in their areas which makes this a viable and safe solution, unlike many very expensive research platforms that can only operate in a robot laboratory.

Because of our 7 year experience with domestic service robots that operate in a household, the RITA has become one of the safest robots around. This experience of safe operation is applied to the MICO arm to deliver an intelligent and safe robot.