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Florence

**Multi Purpose Mobile Robot for
Ambient Assisted Living**

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1 PROJECT INFO

General Info	
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2 VISION

The aim of the Florence project is to improve the well-being of elderly (and that of their beloved ones) as well as improve the efficiency in care through Ambient Assisted Living (AAL) services, supported by a general-purpose mobile robot platform. The Florence project will investigate the use of such robots in delivering new kinds of AAL services to elderly persons and their care providers. Florence will put the robot as *the* connecting element between several stand alone AAL services in a living environment as well as between the AAL services and the elderly person. Through these care, coaching and connectedness services, supported by Florence, the elderly will remain much longer independent.

A key aspect for Florence is user acceptance. Florence aims to improve the acceptance of AAL (robotic) services by providing both assistance and fun oriented lifestyle services via the same means. The ambition of Florence is that the elderly should be proud of having a Florence robot. This increase of user-acceptance will greatly alleviate the need for personal care for elderly, and therefore provide for significant cost-savings.

The Florence system will support lifestyle and AAL services in the following categories:

- *Family involvement:* Florence will provide a non-obstructive, intuitive way of asynchronous communication with family members by sending pictures to the family members' mobile phones or emails or getting pictures from the family members to Florence robot's screen. This example application enables both sides to say "I am thinking of you" without forcing a direct answer.
- *Video telephone:* Implementing a video communication possibility enables the elderly person to participate in the family life e.g. by seeing the grandchild or daughter.
- *Home observation:* The Florence robot can be sent to other rooms to take a picture to see what is going on. Open windows and cupboards could be detected and lost objects can be found.
- *Emergency Intervention:* In case of an emergency situation, e.g. a detected fall, a mobile robot has the advantage that it is able to move towards the person. The robot can talk to the person first, and then take a picture, send it to caregivers and initiate an alarm. Furthermore, the fallen person could call the robot for help. The robot is able to bring communication means directly to the user and initiate a call to family members or caregivers.
- *Direct coaching:* Florence will be able to monitor several sensory data items. One possible application for coaching is to give advices for wellness or activities.
- *Remote coaching:* Remote diagnosis is an example application of remote coaching. The collected data from the monitoring, together with answered questions on the phone and symptoms shown via a video conference system, will lead to a clearer diagnosis of a remote caregiver or doctor.
- *Communication among caregivers:* Florence will support a blog-like system that enables caregivers to maintain a diary about their activities. This is especially useful in cases of mild dementia, where communication with the elderly themselves is not always reliable.

3 PROBLEM STATEMENT

The background for the development of the Florence system is the slow but constant demographic change. There is an increasing number of elderly people, while the number of younger people remains constant or even declines. Due to the advances in health treatment, a lot of previously fatal diseases have been turned into chronic diseases. This leads to an increasing demand for care, especially for elderly. In addition to that, new family structures and more job-mobility make it more and more difficult to rely on volunteer care for elderly at home by family members. Hence, costs for both the society and the care provider are growing, which, at the end, may lead to potential undersupply of health care. Beyond the financial aspect, another problem is the increasing lack of social inclusion due to less stable social networks, which leads into increasing loneliness of the elderly with negative impact on their health and safety.

Ambient Assisted Living (AAL) is an umbrella term used for projects and initiatives that address these problems. Today, most of the AAL scenarios that are demonstrated to alleviate these problems rely on the existence of a comprehensive infrastructure of sensors and actors in the home. However, in privately owned homes, such infrastructures rarely exist, and there is no indication that this will change within the near future.

User acceptance is another important barrier for AAL services and products by the elderly. First, there is the fear of being stigmatized by having and needing (robotic) AAL services at home. This even more applies to robots. Robots could be considered as a 'device for handicapped' with the fear of stigmatization if they are used for well-being purposes. Secondly, ease of use is of critical importance for AAL services, and the complexity of the services and products device should be shielded from the elderly user.

4 OBJECTIVE

The objective of Florence is to research and investigate the role robots can play for assisting and improving the well-being of elderly and to increase the efficiency in elderly care. More specifically, Florence will investigate and develop the following lifestyle and AAL services for the elderly:

- *Coaching*, by giving feedback on specific activities like physical exercises, and advise on activities of daily living.
- *Social inclusion*, by supporting access to the social networks, including web-2.0 and synchronous communication means.
- *Safety*, by using Florence as additional ears and eyes in comfort or safety situations, controlled by service providers or the elderly themselves (crisis or emergency detection, smoke detection, personal alarm, water-damage ...).

For the caregivers, Florence will also develop *care support services*, for example, by maintaining a log of care-related activities at home that can be shared among (professional and volunteer) care-providers.

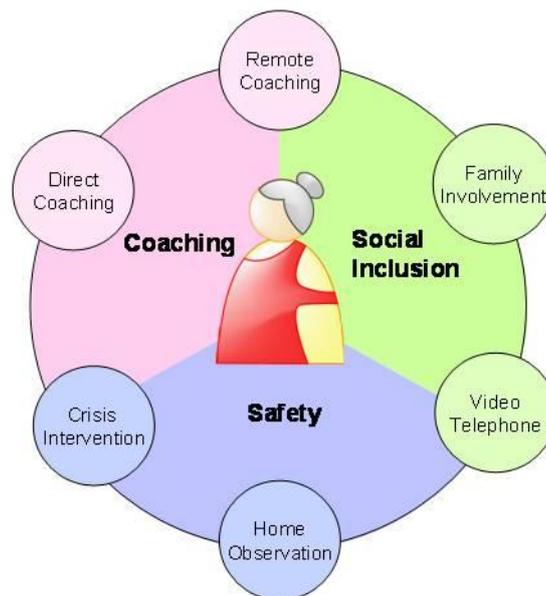


Figure 1 Florence service categories

Another key objective is to make this concept acceptable for the users and cost effective for the society and care providers. Florence aims to improve the *acceptance of AAL services and robots* by also providing social and fun oriented services. The Florence robot is positioned as an autonomous lifestyle device. By using the same interaction mechanisms for both lifestyle services and AAL services, Florence aims to improve the adoption of AAL services by elderly. Florence will also investigate human-robot interaction modalities to increase the ease of use and hide the complexities of a multi-purpose robot.

5 APPROACH

The Florence project will adopt a highly user centric approach by executing rapid design cycles that start with focus group sessions, interviews and Wizard-of-Oz experiments, and continues with cycles of developments and evaluations at the partners' sites and living labs.

Florence will leverage recent results in the smart environments and service robotics field and will enable pervasive services to interact with elderly using robots. Florence puts the robot as *the* connecting element between several stand alone AAL services in a home environment as well as between the AAL services and the elderly person, as depicted in Figure 2. Via the care and coaching services supported by Florence, the elderly will remain much longer independent.

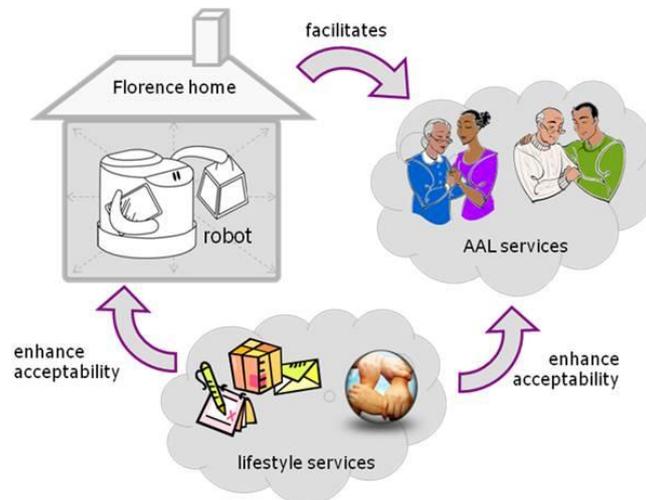


Figure 2 The Florence robot providing lifestyle and AAL services

Florence will use an off-the-shelf robotic platform that would require minimum modifications in order to be functional in a domestic environment and to be able to interact with its environment and with human people. The Florence robot consists of a mobile platform on top of which a touch screen is mounted.

The project adopts a service-oriented approach in order to support the seamless integration of capabilities provided by the robot, the home, and any required remote service providers. The OSGi services platform technology is used for the interoperability and interaction of the different services not inside the robot platform, and on the residential gateway that connects both to the robot platform and the outside world.

6 EXPECTED RESULTS

The results of the Florence project consist of

1. Improved insights in how multi-purpose robots can contribute to well-being and independent living
2. A robotic service platform, and
3. A number of AAL services on top of this platform.

These results will be captured in scientific papers, contributions to standardisation forums (e.g. 3GPP, OSGi, ETSI), prototype software, and end-user evaluations.

6.1 Robotic Service Platform

The Florence project will build a robotic service platform that makes it easy to develop services on. This platform will support a number of generic building blocks that integrate features from the robot and the home, making this transparent for the application and service developers. The following specific building blocks are foreseen:

- *Context Management.* The robot will be equipped with sensors, and together with the potentially available sensors in the home and other context sources, augmented information about the user's current situation can be determined. The Context Management (CM) building block will collect this information and make it available to the Florence AAL services. It provides a unified interface and thus makes the heterogeneous access technologies and underlying networks transparent to the services. The CM also provides context-fusion mechanisms.
- *Activity Detection.* By using advanced reasoning techniques based on context-information fusion, the Activity Detection component will assess what a user is currently doing. These activities can, for example, be used for coaching, for emergency detection or for long term assessment of the elderly health state.
- *Privacy Management.* This component will provide easy control mechanisms for privacy control and enforcement to gain user acceptance.

6.2 The AAL robotic services

A number of AAL services will be researched and prototyped in Florence. These services support caregivers, motivate elderly to comply with their activity scheme, assist in critical situations, and provide them tools for keeping in touch with others.

These services will be implemented on top of the robotic service platform into one demonstrator. Two iterations of this demonstrator will be built.

Besides technical validation, demonstrator will be used for end-user validation. The user evaluation will take place in two steps. The first iteration of the Florence robot prototype will be tested with elderly in a controlled home lab environment. The results of this first end-user evaluation will be taken into account for developing the second iteration. This second prototype will be evaluated in a living lab environment, i.e. with elderly in their own homes.

7 IMPACT

Prolonged independence of elderly people

The key service provided by Florence for improving independence is that of *coaching*. Coaching services will give feedback to elderly at appropriate moments and situations. These coaching services hint on activities that elderly might do and give them support in their day-to-day activities by reminding what to do and how. Effective coaching will eventually reduce the demand for care and improve the quality of life.

Increased efficiency of care for care providers

The Florence system is targeted towards elderly that live independently. Two types of care providers can be distinguished: voluntary care providers and professional care providers. The Florence system will include features for supporting both groups:

- *Voluntary care providers*: a service will be developed that provides information about activities carried out by voluntary carers (*activity diary service*). This is intended to support communication between voluntary care givers without involving the elderly themselves. This is highly relevant, in particular for elderly suffering from mild dementia.
- *Professional care providers*: The Florence *safety service* is intended to provide additional eyes and ears for alarm-type of services. In case of an alarm, the service centre will be able to remotely control the Florence services, including the Florence robot. We expect that this will significantly reduce the effort spent on following-up false alarms.

Quality of life for elderly people

Florence will improve the quality of life of elderly by supporting them in their day-to-day communication needs. The social connectedness services will provide them with easy means to contact their relative and friends, share content, and also access Internet content. They will give them access to the same social networks that their beloved ones participate into, in a way that is accessible to them. The interaction modalities will be consistent across each service to lower the barrier for acceptance of robots and AAL services.

Strengthening the global position of the European Industry in service robotics

Taking a long-term perspective, say 10-15 years from now, domestic robots may well have started a diffusion process similar to that which the PC, mobile telephone or the Internet have had in recent years. The current global market of service robots, however, consists of very dedicated robots that, for example, help people getting out of bed, do home activities like vacuum cleaning or (un)pack dish washers. Florence envisions that robots, with human like capabilities, (to execute multiple physical tasks like washing, cleaning, etc) are not within reach in the near future. For this reason, the research on the technological developments of such advanced robot technologies is not the focus of the Florence project. Florence, instead, focuses on combining results in technologies for ambient assisted living with existing autonomous general-purpose robots. The Florence consortium believes that this combination is the fast track towards market adoption of affordable and functional robots as well as successful AAL services in the near future.