



## **MOBISERV – FP7 248434**

An Integrated Intelligent Home Environment for the Provision of Health, Nutrition and Mobility Services to the Elderly

*Deliverable*

### **D8.2: Exploitation plan – Issue III**

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## 2 Exploitation Objects

For the extensive description of the MOBISERV system and services, we refer to project deliverables *D7.3: Final MOBISERV System Prototype* and *D8.4: Technology Implementation Plan*, which include full descriptions of the technical hardware and software components, the services, the future developments, and practical information on how to implement a system like MOBISERV in practice.

While analysing the complete MOBISERV system and services, we have created two major categories of ‘objects’ for future exploitation:

- **Individual exploitable objects:** this class groups individual MOBISERV components that have been created by research and development activities within the project;
- **Composite exploitable objects:** in this class, we have identified a list of exploitable results that are built using a group of the individual exploitable results.

### 2.1 Individual Objects

Based on the final status of the MOBISERV research activities, the individual exploitable objects – per MOBISERV subsystem (PRU, SHACU, WHSU, ORU) – are the following:

#### 2.1.1 Individual exploitable results – Physical Robotic Unit

1. Improved robotic embodiment (hardware)
2. Improved autonomous navigation with obstacle avoidance (low-level software)
3. New end-user services adapted to the context of MOBISERV (high-level software)
4. Multimodal Human-Robot Interaction for primary users, including new Graphical User Interface (high-level software)
5. New system design features with regards to personalisation of the robot’s behaviour and functionalities, based on individual persons’ physical and cognitive needs (high-level software)
6. New interface for secondary users such as family and (informal) carers to use the system (high-level software)
7. Identification of good usability practices, usability faults and safety features of personal robots through extensive user trials

#### 2.1.2 Individual exploitable results – Smart Home Automation and Communication Unit

8. A set of secure communication mechanisms in between the MOBISERV system components, ensuring that communications practices in interface, message ordering, structure or parameterization are usable when transferring deployed technologies to other systems that are currently in use, and vice versa

9. Specific interface for interacting with existing third-party Smart Home infrastructures (including AMX- and KNX-based systems) over TCP/IP

### **2.1.3 Individual exploitable results – Wearable Health Supporting Unit**

10. Smart shirts, vests, and bands for daily health monitoring to acquire vital signs (ECG and respiration), activity (3-axis acceleration) and physiological extracted parameters (heart rate (HR), breathing rate (BR), activity classification (lying, standing, walking, running and others) and moving average mechanical equivalent energy over 45 minutes)
11. Smart pyjamas for nightly health monitoring to acquire vital signs (ECG), skin temperature (Wireless Body Array Network), activity (3-axis acceleration) and physiological extracted parameters (heart rate (HR), breathing rate (BR), activity classification (lying, standing, walking, running and others) and moving average mechanical equivalent energy over 45 minutes)
12. Improved datalogger to monitor, process and store all the data mentioned above (hardware and low-level software)
13. Multi-parameter data acquisition system and reasoning algorithms (high-level software)

### **2.1.4 Individual exploitable results – Optical Recognition Unit**

14. Visual-based eating / drinking activity recognition for older adults, employing a privacy preserving activity representation that is able to summarize the eating/drinking activity of a person in a given time period.
15. The MOBISERV-AIIA Eating and Drinking Activity Recognition Database. This database has been developed in order to facilitate research in several directions relating to nutrition support (e.g., action recognition, person identification, object tracking).
16. Visual-based emotion recognition for older adults, which is able to analyse facial expressions in terms of the seven basic emotions (disgust, anger, fear, happiness, sadness, surprise and neutral), and to summarize the observed emotions in terms of positive/negative emotions.

## **2.2 Composite Objects**

This category represents the MOBISERV exploitable objects consisting of more than one of the individual exploitable objects. We can divide them into the following main classes:

- The full MOBISERV system
- Re-packaged components of the MOBISERV system
- Know-how, concept ideas, and experience gained during the MOBISERV project

### 2.2.1 The full MOBISERV system

The major composite exploitable object is the integrated MOBISERV system prototype, consisting of the 4 subsystems and all individual exploitable results. Due to its modular design, the MOBISERV system can be applied in different contexts – from private homes to large care-taking facilities. Independence of the components allows dynamic deployment of the MOBISERV system, where the applied capabilities can be selected based on the user requirements of the target location and people.

The MOBISERV system will provide a set of user services covering nutrition, health, and well-being, but also social interaction and safety to its end-users (both primary and secondary). The following table gives a short overview of the primary services for these user groups, including their respective benefits.

Function	Benefits	
	For Primary Users	For Secondary Users
<b>1</b> Reminding and encouraging to eat (Nutritional Assistance)	Prevents malnutrition, provides cognitive support.	Supports active malnutrition prevention, creates a log of suggestions and eating activity, which assist the carer with the frequency and timing of reminders.
<b>2</b> Reminding and encouraging to drink (Dehydration Prevention)	Prevents dehydration, provides cognitive support.	Supports active dehydration prevention, creates a log of suggestions and drinking activity, which assist the carer with the frequency and timing of reminders.
<b>3</b> Video communication via robot with friends and relatives (Social interaction)	Supports and encourages social interaction, prevents social isolation and psychological decline.	If needed, monitors the user's social activity level, enabling early interventions.
<b>4</b> A mobile video-intercom for the front door (Safety)	Increases safety, users are able to safely see who is at the front door, and enable opening the door from a distance.	Feeling confident and at ease when leaving the primary user alone for a while.
<b>5</b> Encouraging physical activity and exercising (Health coach)	Supports and encourages physical activity and exercises, keeps the user fit and active, prevents falls.	Enables specific exercises per person and specific schedules, creates a log of physical activities, which assists in organising physical exercises accurately and in regular intervals.

6	Reporting to health professionals (Health coach)	Fast and direct contact with professional carers.	Supports early warnings and fast, direct and efficient contact with clients.
7	Function for a tele-medicine and monitoring (Health coach)	Improves the users' general health and well-being, gives reassurance.	Providing regular and detailed, automated monitoring of clients, enabling better and faster service.
8	Games for cognitive Stimulation (Entertainment / Health)	Improves the cognitive status of the user by allowing a user to play fun games, while doing cognitive exercises.	Possibility to monitor improvement or early signs of decline of the cognitive status.
9	Responding to emergencies (Safety)	Increases safety at home, feeling assured that they will be not alone in case of an emergency.	Fast response in emergency situations; feeling safe and assured that the user can be left alone.

**Table 1: Summary of benefits for primary and secondary users per service**

### 2.2.2 Re-packaged objects

Next to the full MOBISERV system, parts of the project results can be re-packaged and offered as new composite system components. These could be promoted as stand-alone applications, or as components for third-party systems. The foreseen re-packaged objects are:

- *Smart Homes Nutrition Support System*. This is made up of the following individual components:
  - Visual-based eating / drinking activity recognition algorithms;
  - MOBISERV-AIIA Eating and Drinking Activity Recognition Database;
  - New functionalities adapted to the context of MOBISERV.
- *Wearable Health Support System*. This is made up of the following individual components:
  - Smart Shirt and Band for day monitoring (male / female version);
  - Improved DataLogger;
  - Smart Pyjamas for night monitoring (male / female version);
  - New functionalities adapted to the context of MOBISERV.
- *Social Companion Robot*. This is made up of the following individual components:
  - The physical robotic unit;
  - Vision-based facial expression recognition;
  - New functionalities adapted to the context of MOBISERV;
  - Multimodal Human-Robot Interaction for primary users, including new Graphical User Interface.
- *Activities and Exercises for body and mind*. This is made up of the following individual components:
  - A suitable set of activity exercises;
  - Smart Shirt and Band for day monitoring (male / female version);
  - Improved DataLogger;
  - Games for cognitive stimulation.

- *Multi-modal interaction user interface for a companion system*
  - New functionalities adapted to the context of MOBISERV;
  - Multimodal Human-Robot Interaction for primary users, including new Graphical User Interface (high-level software);
  - New secondary user interface for family and (informal) carers to use the system (high-level software);
  - Identification of good usability practices, usability faults and safety features of personal robots through extensive user trials.

### **2.2.3 Know-how, concept ideas, and experience**

Last but not least, the individual and collective know-how acquired by the project partners forms an additional exploitation object of high value. Not only for further research and development, but also for industry and educational activities.

- *Concept ideas:* The ideas generated by the consortium on Human-Robot Interaction, which have been evaluated and redesigned in several iterations form a strong intellectual property for future social robot developments.
- *Evaluation findings:* Three years of evaluation findings with the various versions of prototypes of the MOBISERV (sub)systems now forms a very rich body of findings, lessons learnt, recommendations and best practices for future development, installation, and introduction of systems like MOBISERV.