	SEVENTH FRAMEWORK PROGRAMME Information and Communication Technologies
<b>Grant agreement number</b>	FP7-611650
<b>Project acronym</b>	DOREMI
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<b>Deliverable Number:</b>	D1.3.1 - revised version
<b>Title of Deliverable:</b>	Interim Progress Report (Period 2)
<b>WP related to the Deliverable:</b>	WP1
<b>Dissemination Level: (PU/PP/RE/CO)*:</b>	PU
<b>Nature of the Deliverable: (R/P/D/O)**:</b>	R
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<b>Contributor(s):</b>	All partners

\*Dissemination Level:

PU=Public

PP=Restricted to other program participants  
(including Commission Services)

RE=Restricted to a group specified by the consortium  
(including Commission Services).

CO=Confidential, only for members of the consortium  
(including Commission Services).

\*\*Nature of Deliverables:

R=Report

P=Prototype

D=Demonstrator

O=Other

**List of Beneficiaries**

No	Participant organisation name	Short name	Country	Project entry	Project exit
				month	month
1	Consiglio Nazionale Delle Ricerche	CNR	IT	1	36
2	Università di Pisa	UNIFI	IT	1	36
3	TSB Real Time Location Systems SL	MYSPIERA	ES	1	36
4	AIT Austrian Institute of Technology GmbH	AIT	AT	1	36
5	Fundació per a la Universitat Oberta de Catalunya	UOC	ES	1	36
6	The Extracare Charitable Trust	Extra	UK	1	36
7	Imaginary Srl	IMA	IT	1	36
8	De Montfort University	DMU	UK	1	36
9	Age Platform Europe AISBL	AGE	BE	1	36
10	SI4LIFE – Scienza e impresa insieme per migliorare la qualità della vita srl	SI4LIFE	IT	1	36
11	Accord Housing Association Ltd	Accord	UK	1	36

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## 1. PUBLISHABLE SUMMARY

### 1.1 Summary description of project context and objectives

The DOREMI Scientific and Technological objectives of this period is:

- Development of preliminary version for the WSN environment, smart environment for context awareness and gamified environment (MS4, M18)

### 1.2 Work performed since the beginning of the project and the main results achieved so far

The work performed during the first six months (Period 2) of project activities has been directed to the achievement of milestone MS4 (Month 18).

The progress towards the achievement of this milestone passed through a devised and well-coordinated execution of tasks and sub-tasks under the relevant WPs, namely WP2, WP3, WP4 and WP5.

Considering the relevant dependency of the technical development work packages (WP3, WP4 and WP5) with the main scientific model and target user work package (WP2), the scientific and technical coordinators have agreed to follow a WP interaction approach based on an iterative instead of a sequential method.

For this purpose the progress of work in WP2, leading to the main objective of the Active Ageing Lifestyle Protocol definition, has been constantly reported to the dependent technical WP leaders (as demonstrated by several meetings between the medical and technical partners) and, in parallel, several technological constraints have been taken into consideration by the clinical partners in the selection of the more appropriate set of protocols. The main result of this constructive interaction is the common definition and design agreed by both clinical and technical partners of the Active Ageing Lifestyle Protocol of the DOREMI project, described in D2.3 (submission March, 31<sup>st</sup>): its structural elements are the matching areas between monitoring parameters available by the use of the technology and the items of the protocols needed to provide the evaluation scales

WP3 was focused on the development of WSN environment and the auto configuration system. These elements were developed gathering requirements in coordination with WP2 and WP4. In particular, in WP3 was:

- selected most appropriate sensors and devices and started designing and development of sensors and devices foreseen in the project (bracelet) or integrated in commercial solutions (smart carpet);
- performed a data collection and retrieval layer necessary for data processing and interoperability with the smart environment (WP4);
- developed the auto configuration system and the integration of sensors in WSN environment.

WP4 has worked on the identification of computational learning tasks of Activity Recognition and its requirements investigating machine-learning solutions for both explorative and predictive data analysis.

In particular, WP4 has:

- contributed to the design of high-level DOREMI system architecture throughout a close integrated activity between clinical requirements and technical specifications;
- released a requirement analysis and a specification of the services implemented by the smart environment system, an analysis of the computational methodology adopted for the activity recognition and reasoning components;
- generated a first set of data for physical activity recognition and its integration in reasoning system in close collaboration with WP2 and WP3
- produced the guidelines for the collection of annotated training data in WP6.

Object of WP5 was the development of the overall gamified active ageing support environment for older users.

In particular, WP5 work was focused on:

- design and development of the game-based environment.
- development of a preliminary set of cognitive games prototypes
- development of a preliminary version of physical activity app

The focus of the WP6 is the validation of the DOREMI system both at lab and pilot site. The main activities, performed during the first 4 months of WP were based on:

- collection of data produced by smart carpet functionalities to test the hardware and feed the DOREMI reasoning system: this system, once in pilot sites, will perform the daily users' evaluation of balance assessment.
- pilot site preparation, with the preliminary activities by medical partners of recruitment and enrolment of participants
- discussion between technical partners on aspects regarding the integration and testing of the system and its time schedule during the Living Lab of Valencia.

WP7 was focused in this one and a half year to define the communication strategy of the project.

Main activities were:

- development of the competitive analysis of the alternative products to DOREMI and understanding of market positioning for its components and whole solution (D7.3.1)
- development of tools for dissemination activities (website, social network and blog)
- participation to events for dissemination and exploitation activities

### **1.3 The expected final results and their potential impact and use (including the socio-economic impact and the wider societal implications of the project so far)**

According to the prescription of the EIP AHA working group on the **Action Plan A3: “Prevention and early diagnosis of frailty and functional decline, both physical and cognitive, in older people”**, applying ICT and e-health to services is expected to be effective in the prevention and treatment of functional/cognitive decline, and to increase the independence and self-reliance of older people. This may result in better quality of life and a reduction in the use of health care services due to increased independent living.

DOREMI expected final result is a platform made of **3 modular building blocks**. The modularity includes not only the possibility of a “combination” of all the three building blocks or only two of them (within the monitoring environment the building block n°2, will always have a pivotal and foundational role as explained in the appropriate paragraph), but also a possibility of combination and activation of selected services within each building block, depending on the market segment addressed, the budget availability of the buyer, or the main functional or behavioral aspect that the customer wants to monitor and improve (e.g. giving more relevance to physical activity and socialization or physical activity and diet, or any other possible combination).

#### **DOREMI ‘Building Blocks’:**

1. **Social and gamified environment:** Games whose primary purpose is not necessarily entertainment, but where the goal is to engage, train, motivate, educate users. Games are used to stimulate and encourage compliance with active ageing lifestyle ‘protocols’, which have been assigned by specialist. The motivational games for physical and social activity are associated to sensors (the monitoring environment) to track daily activities and collect relevant parameters for self-evaluation of lifestyle protocols and reports for specialist. The

cognitive games are not associated to any sensor and the performance is measured by the score level of the user. The diet games are associated to a diet application reported in the monitoring environment (provided by the third party software producer METEDA, together with the DOREMI consortium now pursuing an exploitation alliance). All the games will run in specific tablet applications to increase the level of usability, user experience and interaction thanks to the touch screen.

2. **Monitoring Environment.** The monitoring environment is made up of environmental, wearable sensors, a diet app, a smart carpet aimed at collecting, in the less psychologically and physically intrusive manner in order to respect to the privacy and self-esteem of the subject monitored, either raw data and more elaborated information from a set of sensors (e.g. Internet of Things paradigm) or from applications running on the tablet (Internet of People paradigm), where the user is reminded to enter the data.
3. **Context-aware smart system.** The context aware smart system is made up by i) Human Activity Recognition (HAR) models needed to recognize and contextualize the user's daily activities monitored by the sensor and their relevance for the DOREMI protocols ii) a reasoning system that aggregates the output from the serious games and activity recognition components, and to predict the most appropriate lifestyle protocol given the specificity of the environment and of the user.

The initial estimation of the potential market for DOREMI solutions and services, impacts two typologies of health care systems that are considered as most promising in terms of a potential market. They are:

- Countries with a continental health care systems, where the most promising markets would be Germany, France and Belgium. Together they represent more that 30% of the overall European population, with about 30 million individuals aged 65+ that constitutes the biggest market for DOREMI products, especially if it is considered that the higher aged population in these countries has a low level of HLY (between 5 and 10 as described in paragraph 4.3), a significant degree of media literacy and a high percentage living alone (see also paragraph 4.3).
- Nordic, NL and UK countries, representing the second best market for DOREMI products with about 15 millions of individuals aged 65+ years, only considering the most relevant countries that belong to this type of health systems such as UK, The Netherlands, Denmark and Finland. Also for this market the higher aged persons have a low level of HLY, a significant level of media literacy and a large part of them living alone.

## 1.4 The address of the project public website

<http://www.doremi-fp7.eu>

## **2. CORE OF THE REPORT FOR THE PERIOD: PROJECT OBJECTIVES, WORK PROGRESS AND ACHIEVEMENTS, PROJECT MANAGEMENT**

### **2.1 Project objectives for the period**

The project objectives achieved in the period are reported below and extensively described at WP level in section 2.3.

- a) Definition of Active Ageing Lifestyle protocol, definition of inclusion/exclusion criteria for the study entry, main parameters related to the impairments to be evaluated, operationalization of different phases (baseline, training, treatment, final evaluation) of the DOREMI protocol. The entire work is detailed described in D2.3.
- b) Selection of the complete set of parameters needed to be monitored according to the:
  - Selection of the most appropriate group of sensors and devices that will be employed in the Active Ageing Lifestyle Protocol, as a result of the interaction between WP3 and WP4 based on WP2 specifications. The hardware will be both off-the-shelf or prototype-developed by partners
  - Specifications of the activity recognition models, developed by WP4, based on WP2 requirements
  - Definition of the high level and logical architecture for module identification, dependencies and data flow hypothesis.
- a) Development of the auto configuration system and the integration of sensors in WSN environment (WP3).
- b) Generation of a first set of data for physical activity recognition and its integration in reasoning system (activity of WP4 in close collaboration with WP2 and WP3)
- c) Development of preliminary version of cognitive games and physical activity app with the scientific partners (result of interaction between WP2 and WP5)
- d) Development of competitive analysis for market positioning of DOREMI products during WP7 activities.

### **2.2 Summary of recommendations from previous reviews (in any)**

The first review meeting took place on 9th December 2014. Recommendations concerning future work included:

R1 - Development of the wristband should be speed up and the project team should provide a clearer understanding of the smart environment, sensor network and data generation to engage elderly in their lifestyle management and especially social inclusion in “normal life” circumstances.

R2 - Some criteria have to be reviewed such as “nursing home” residents, which do not fit with project objective of having people autonomous with their food.

R3 - Consortium should demonstrate how DOREMI user group with all the selection criteria and the conditioned pilot environment would represent a significant and profitable market.

R4 - Baseline period is heavy in terms of tests. Older people are easily tired and stressed because of tests especially for the elderly with mild cognitive impairment. A baseline period protocol should be set in order to avoid any error in assessment in D2.2.

R5 - Rewarding system for gamified environment should be designed in order to motivate elderly without referring to school marks or such type of evaluation.

R6 - Gamified interface has to be designed in order to adapt to elderly to needs in term of accessibility (contrast, size of letters...).

R7 - Consortium should consider different targets and differentiate end users (older people), payers (older people, social security, insurance, residence home...), it should as well evaluate different B2B, B2B2C or B2C approaches to build exploitation plan.

R8 - Consortium should reconsider involving third parties especially when considering entering French



and German markets from which none of the consortium member is native.

R9 - Consortium should evaluate future cost of the system and potential price per user for future exploitation. This will help identify payers' target.

R10 - For future implementation, the exploitation plan should consider the elaboration of a simplified concept based on the selection of key data and key sensors deriving from experimentation results. Process should prove the benefit of each sensor and data to project objective.

R11- We recommend that a project review be organised quickly after resubmission of the deliverables D3.1 and D4.1 and before the start of the pilot phase to demonstrate that all necessary devices and software (wristband, WSN and games) are operating according to DOW.

R12 - Clearly define the added value of the DOREMI concept based on a proper benchmark of existing or emerging solutions.

Reviewers requested also resubmission of D3.1, D4.1 and D7.3.1 and raised further questions regarding effects of DOREMI on malnutrition (email of the PO dated 20<sup>th</sup> March 2015).

Reviewers expressed their satisfaction with the information provided for the effects of the project on malnutrition and confirmed appropriateness of the participants' autonomy at the validation site, and saw significant improvements in the resubmitted deliverables that were all approved.

The consortium is currently addressing all recommendations listed above. Some comments have been included in the relevant WPs sections of this document; a comprehensive description on how all recommendations are addressed will be included in the Annual Project Report for Period 2.

## 2.3 Work progress and achievements during the period

In the section below a detailed description of work progress and achievements by work package is provided.

### 2.3.1 WP1 Project Coordination and Management

Please see section 2.4

### 2.3.2 WP2 End user profile and Active Ageing Lifestyle protocol development

The main goal of WP2 was to define and implement the Active Ageing Lifestyle protocol based on a well target user profile.

Activities were focused on:

- analysis of literature of most recent and important studies for the three impairments (Sedentariness, Malnutrition, Cognitive decline) in older population and their relation with a series of pathologies (cardiovascular impairments, metabolic alterations, osteoporosis, cancer);
- inputs for game environment development in WP5 (in collaboration with IMA);
- definition of set of parameters and scales for impairment evaluation and quantification (MNA, BMI, PASE, MMSE);
- definition of a set of psychosocial variable and scale to evaluate the effects of DOREMI on the target population (PAM, Lubben scale; MOSS-S; MTUA scale; SF-36 scale)
- definition of user selection process, included selection criteria (inclusion and exclusion criteria);
- procedures for DOREMI user profiling;
- elaboration of Active Aging Lifestyle protocols focused on nutrition, physical activity and cognitive stimulation;
- identification of expected improvement levels for each impairment after DOREMI treatment;
- identification of key performance indicators (clinical, social and technical) for Active Aging Lifestyle Protocol;
- elaboration of final Validation Plan (D2.3) in collaboration with medical and technical partners;
- Contribution to the definition of the evaluation protocol reports to be approved by the UK and Italian local committees.

#### ■ Objectives

- Investigate, through literature analysis and knowledge provided by the partners (Task 2.1), the target users' needs as fundamental input to both the protocol development and the games scenarios. For the latter, the identification of lifestyle profiles will allow a selection of generic games scenarios suitable for easy personalization.
- Identify the criteria for the selection of the elderly people sample to be enrolled in view of the validation activities.
- Select the complete set of parameters needed to be monitored according to the Active Ageing Lifestyle protocol
- Define the protocol rules needed for the development of the reasoning system (Task 4.4)
- Develop a validation plan including four sub-set specifically designed for the clinical validation plan of the services, the technical validation plan of the platform, the usability plan of the platform as guideline for the validation to be performed in WP6 and the statistical approach for the evaluation of DOREMI platform effectiveness
- Contribute to the definition of the evaluation reports to be approved by the UK and Italian local committees.

- Summary of progress towards objectives and details for each task

#### Task 2.1 Target users definition, literature analysis and survey for scenarios of use (CNR-IFC) – M1-M6

Completed

#### Task 2.2 Active Ageing Lifestyle protocol development (CNR) – M2-M8

Completed

#### Task 2.3 Validation Plan ( UOC) – M9-12

UOC is the task leader. CNR IFC, SI4LIFE, DMU, Extra and Accord are the main partners involved in this task.

Activities of Task 2.3 are focused on the elaboration of Deliverable 2.3 (D2.3), sent in a draft version to European Commission during 2014 (November, 25<sup>th</sup> 2014). This is based on the findings of the previous deliverables D.2.1 and D.2.2. Deliverable D2.3 has reorganized and systematized all the tests and procedures described in the previous deliverables produced under WP2 activities, has designed the whole validation process of DOREMI solution, and has prepared all documents necessary for study protocol submission to the local Ethics Committees in UK and IT.

The task participants have structured the validation process in three main steps: sample selection and composition of the treated and control groups (Figure 1); site preparation, baseline data collection and training activity (Figure 2); trial data collection and final evaluation (Figure 3).

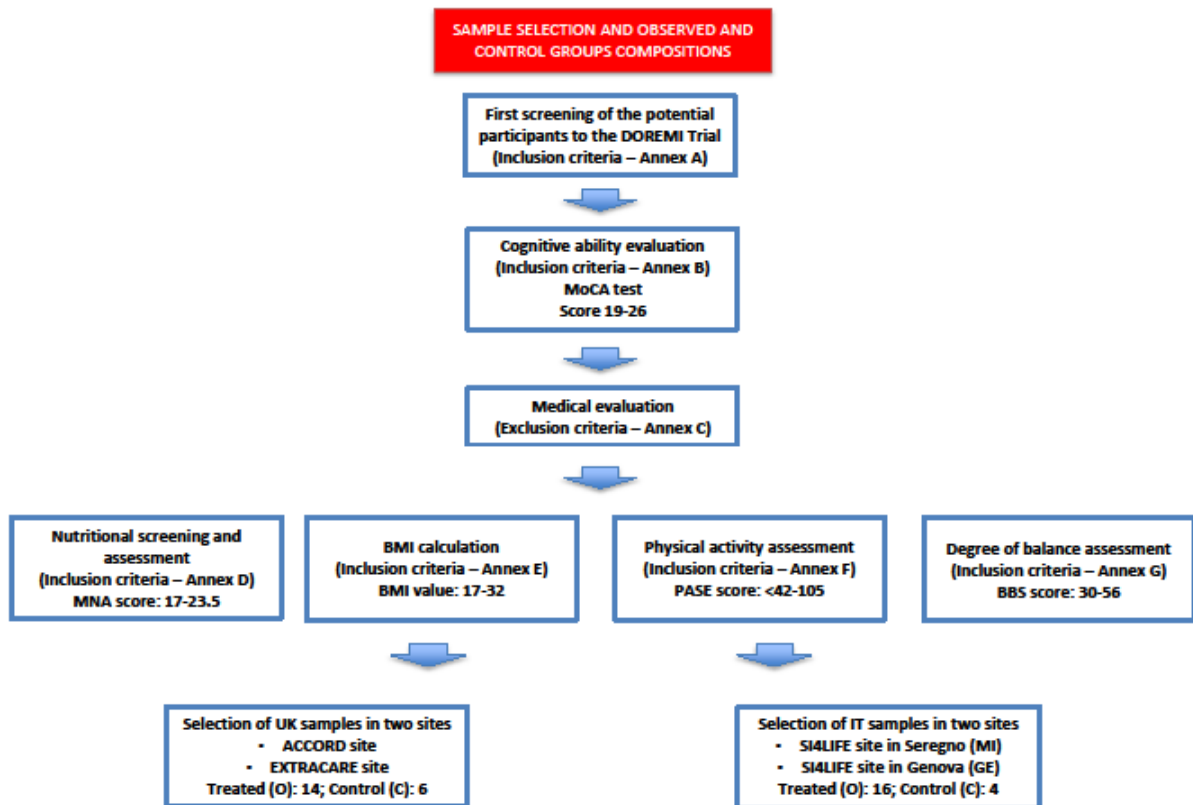


Figure 1: Participants' selection criteria and selection process

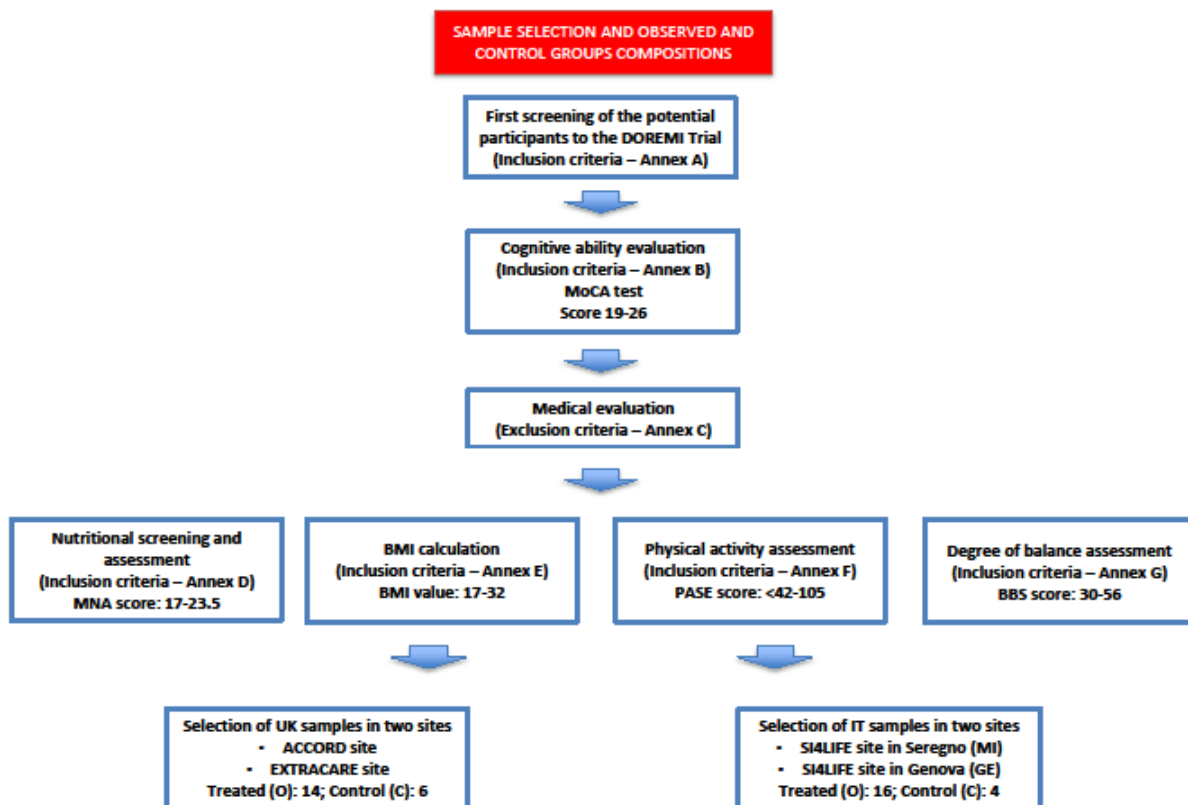


Figure 2: Site preparation, Baseline data collection process and training activity

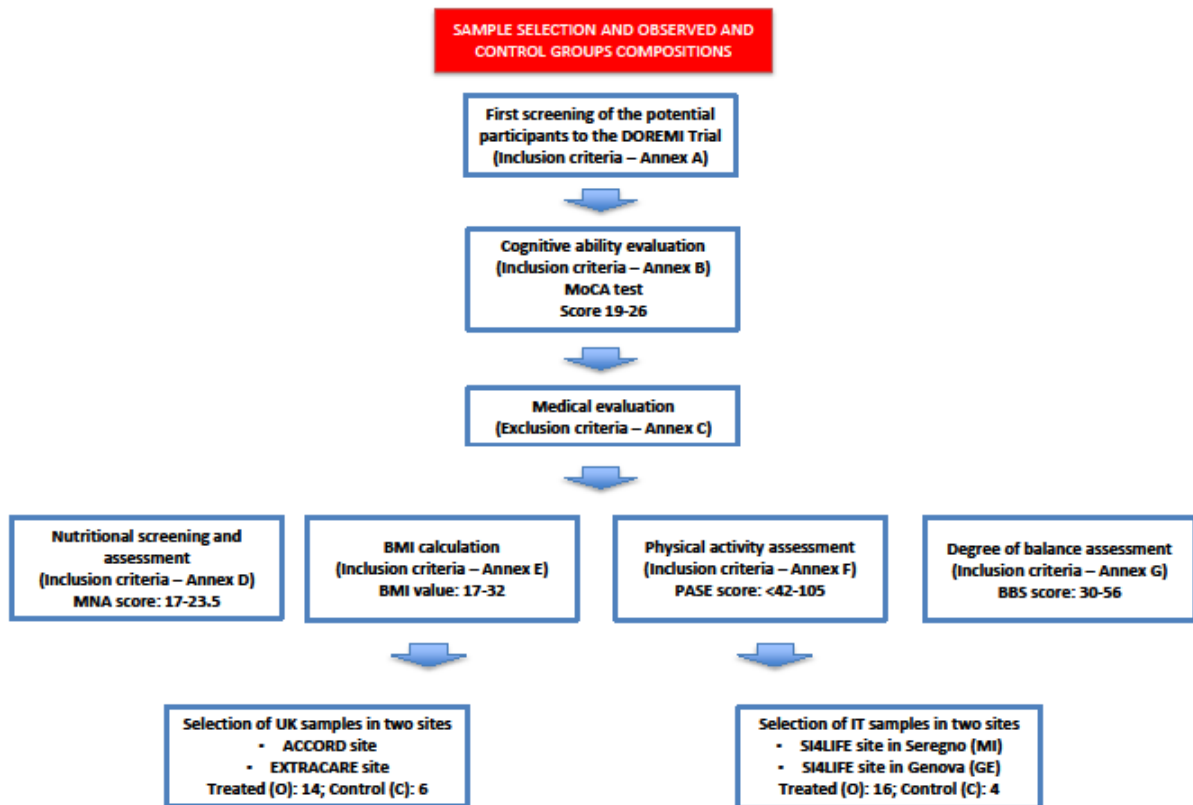


Figure 3: Intervention and final evaluation activity

UOC has organized and coordinated the efforts of all the Task 2.3 participants to achieve an integrated and agreed detailed description of the activities that would be carried out in each step of the validation process. To this end, various contributors have provided their expertise and capabilities to finalize the deliverable. In particular:

- SI4LIFE and DMU have designed all the tests and protocols related to the evaluation of the cognitive ability of the participants to the validation process of DOREMI solution. They have also defined the inclusion criteria related to cognitive ability of the potential participants to the project trial as well as the set of data related to the degree of cognitive ability of the treated and control groups that would be collected at the baseline and at the end of the trial. For what concern the use of the cognitive games that will be part of the gamified environment of DOREMI solution, they have designed the training activities for the trial participants to start using these games through tablets and they have also provided a detailed description of the daily routine of the participants to the trial for what concern the cognitive games use. They have also set up an evaluation protocol for comparing two cognitive ability tests (MMSE and MoCA). This protocol was applied in a testing carried out on November and December 2014, to assess which of the two tests is the most suitable for being used in DOREMI validation process (see deviation of the plan described below). After this campaign, MoCA was the selected test for mild cognitive impairment evaluation (see D2.3). SI4LIFE and DMU have also submitted the entire documentation to local ethical committees receiving their approval.

- CNR IFC has designed all the tests and protocols related to the evaluation of the eating behavior and the physical activity of the participants to the validation process of DOREMI solution. It has also defined the exclusion criteria related to the medical evaluation of the potential participants to the trial as well as the set of data related to physical ability and eating behavior of the treated and control groups that would be collected at the baseline and at the end of the trial.
- CNR IFC has worked on the development of exergame with IMA (part of the gamified environment of DOREMI solution), designed to provide a detailed description of the daily routine for the participants in the trial for doing physical exercises. Moreover, in collaboration with IMA, it has defined the training protocol for using METADIETA software as well as the daily routine of the trial participants in respect to the monitoring of their eating behavior.
- UOC has designed all the tests and protocols related to the evaluation of the social inclusion of the participants to the validation process of DOREMI solution. It has also contributed to the design of the inclusion criteria related to the evaluation of the capability of use of a computer and Internet of the potential participants to the trial. It has also defined the set of data related to the degree of social inclusion of the treated and control groups that would be collected at the baseline and at the end of the trial. The social interaction functionalities that will be part of the gamified environment of DOREMI solution outline the training activities for the trial participants to start using the gamified environment and it has also provided a preliminary description of the daily routine of the participants to the trial for social inclusion activities. This preliminary description was developed in collaboration with IMA, DMU and the technical partners (see below in the deviation of the plan).

To the purpose of providing a comprehensive description of the validation process, other DOREMI project partners have contributed to the completion of this deliverable. In particular:

- CNR ISTI has contributed to the description of how the test sites will be set up before the trial activity. CNR ISTI, UNIFI and CNR IFC have collaborated with other partners on the identification of parameters to be monitored for the system validation. CNR ISTI produced preliminary data flow process diagrams describing which DOREMI subsystems generate and process data in order to provide patient evaluation support.
- Extra and Accord, together with SI4LIFE have assessed the whole validation process described in the deliverable, as they are charged with the recruitment of the potential participants and of the hosting of the trial activities. In addition Extra and Accord have provided their input, expertise and comments and edits to various drafts of the D2.3 validation plan, as well as the ethical submissions made by DMU, which fall under the D2.3 validation plan.
- IMA has contributed to the design of the eating behaviors validation process providing suggestions for the definition of the training activities related to this specific module of DOREMI solution as well as for the specification of the daily activities of the trial.
- Finally, the technical partners AIT, CNR ISTI, UNIFI and MYSPHERA, together with the partners responsible of the tasks, have contributed to the design of the “daily treatment diagram” (Annex P of the deliverable) and of the typologies of data that will be collected during the daily trial activity.

#### ■ Significant results

Significant results of D2.3 are:

- The overall validation plan of DOREMI solution, including:
  - ✓ Detailed description of the validation process
  - ✓ Timing, Tasks and responsibilities for conducting the evaluation
  - ✓ Scale and metrics for evaluation
  - ✓ Preliminary data elaboration schema
  - ✓ Input for the validation plan for local Ethical Committee approval in UK and IT

✓ Input for technical partners

■ Deviations from Annex I and their impact on other tasks as well as on available resources and planning (if applicable)

At the time of submission of D2.3 in draft form, three essential points for Ethics Committees application were not yet solved:

1. The choice of the most accurate test for measurement of Mild Cognitive Impairment (MCI).
2. The criteria and technical tools to be used to quantify Social Interaction through the DOREMI Gamified environment.
3. The design of the statistical evaluation process that will be applied on the collected data.

In particular:

1. In D2.1 and D2.2, the MMSE test was identified as the main selection and evaluation criteria for MCI. This test is commonly used in the definition of cognitive impairments but, after a first set of tests performed by UK partners, it appeared that this test does not show a high sensitivity in identifying mild levels of cognitive decline. DMU has performed a second run of the test on a population with characteristics similar to those of the DOREMI users during November and December 2014 (M13-M14) to compare differences between the MMSE and the Montreal Cognitive Assessment (MoCA) tests. This latter showed a higher sensitivity for the recognition of MCI in our population. On the basis of this assessment, MoCA was selected as screening test for selection of trial's candidates as described in the following chapter.

SOLUTION: DMU ran a simple comparison exercise, inviting residents aged 65-80 at ExtraCare to complete the two measures (along with some demographic questionnaires). Twenty-six participants aged 65-80 were tested (mean age 72.23, SD= 4.94). Twenty-one of the participants were female and 5 were male. The mean scores for MMSE and MoCA were 28.38, SD=1.83 and 22.42, SD=4.35 respectively. Of the participants surveyed, 17 were eligible for DOREMI based on Nasreddine's (2005) recommended grading criteria for MCI (a score of 18-26 using the MoCA) compared with just 3 participants who met the 22-26 cut off scores on the MMSE. On the basis of the scientific evidence cited earlier and our pilot study, which showed that the MoCA-defined MCI can produce 5x more participants than MMSE-defined MCI, DOREMI consortium members decided that the MoCA replace the MMSE as the screening and outcome measure for the DOREMI system validation (for further information, please see D2.3, §2 and §4)

2. Social interaction is one of the parameters, together with MCI, Sedentariness and unhealthy dietary habits, to monitor in the DOREMI project. Monitoring and quantification of social interaction activities by using DOREMI environment have raised technical and privacy issues; for instance the use of audio/video systems (e.g., cameras, ambient microphones) is not ethically acceptable. Discussion on how to sort out this problem is still going on although the consortium has a propensity for evaluating the time spent at home by the DOREMI users, making use of interpolated data obtained through the project specific bracelet and environmental sensors. Moreover, the measurement of virtual social interaction of the target population of DOREMI solution is still under discussion because of it depends on how the gamified environment of DOREMI solution will be designed and which level of virtual social interaction through the DOREMI solution will be considered feasible for the target population.

SOLUTION: At the moment it was chosen to register logs files of the daily activity done by the individual virtually interacting with the other trial participants through the gamified environment focusing on: the daily persons virtually encountered; the amount of time spent in virtual socialization. We also plan to measure the max and average number of people



virtually encountered in a day and max and average number of minutes spent with them during the period of the intervention. Finally we also plan to use the Avatar of the gamified environment to periodically assess (every 2-3 days) the mood of the participants to the trial in relation to: perception of wellbeing; perception of health status; perception of degree of loneliness; perception of social support (for further information, please see D2.3, §2, §4 and §5).

3. The Validation process foreseen to collect a large amount of data that have to be used to demonstrate the effectiveness of the DOREMI solution in changing health status and the habits of the older population. To this end we need to design a robust statistical evaluation process that can be fully defined when we will have a complete picture of the data that we could collect during the Trial. These data are under discussion and also depend on the point 1 and 2 above. Therefore we plan to provide the details of the statistical evaluation process of the data we are going to collect during the trial in the final version of this deliverable. SOLUTION: we expect to perform a transparent and robust statistical multivariate analysis. In this regard we will use several data analysis techniques including multiple regression analysis, discriminant analysis and conjoint analysis. The degree of application of these techniques will depend by both the number of dependent variables and the type of measurement scale employed in the variables that we will finally decide to measure during the trial implementation (for further information, please see D2.3, §2 and §7)

The delay in D2.3 submission was necessary to define different aspects of DOREMI Validation plan and didn't impact on other tasks, in particular on the beginning of Validation activity (T6.4), as also on resources and other planned activities.

- **Reasons for failing to achieve critical objectives and/or not being on schedule and explain the impact on other tasks as well as on available resources and planning (if applicable)**

The delay in finalizing D2.3, due to the reasons explained above, did not affect the development of the other activities. On the contrary, to reach the current level of detail of the validation process that is described in the final configuration of the deliverable, has forced the partners to also improve and anticipate the discussion related to the development of the technical solution. At the same time it has also reduced the time in the preparation of the validation reports to be approved by the local Ethical Committee in UK and Italy.

- **Explain deviations (if any) between actual and planned person-months (per beneficiary)**

The delay in D2.3 finalization did not produce any deviation from the plan.

- **Corrective actions**

Corrective actions are already described above in the plan and they are related to the activities for completing the D2.3. In particular:

1. DMU has tested MMSE and MoCA tools during November and December 2014, and the final choice was defined in January 2015.
2. UOC together with the other partners in charge for the Validation plan have already planned meetings to define the statistical elaboration process of the data that will be collected during the Validation activities of DOREMI solution. Its detailed description is included in the final version of the D2.3.
3. During early 2015 Accord, Extra and SI4LIFE have provided the specifications that each local Ethics Committee requires to run a clinical trial. DMU and SI4LIFE have prepared all the documentation for, respectively, UK and Italian Ethics Committee, receiving in the end of February their approval.

### **Recommendations of Reviewers and their reply.**

**R2** - Some criteria have to be reviewed such as “nursing home” residents, which does not fit with project objective of having people autonomous with their food.

**Reply:** potential users were selected considering their living situation (people living alone in the identified residential retirement communities and private houses) and their capability to have autonomous control on their diet. In the retirement communities, users have access to a private kitchen or to a refectory, where it is offered a wide variety of foods to be chosen.

**R4** - Baseline period is heavy in terms of tests. Older people are easily tired and stressed because of tests especially for the elderly with mild cognitive impairment. A baseline period protocol should be set in order to avoid any error in assessment in D2.2.

**Reply:** After a discussion with DMU, SI4LIFE and CNR IFC, tests and their required effort were reduced to users as much as possible during the baseline phase to avoid an overload of activity and stress conditions. Furthermore, during baseline period, users will be continuously supported by Extra, ACCORD and SI4LIFE personnel with the direct assistance of CNR-IFC physicians.

### 2.3.3 WP3 Development of WSN environment and auto configuration system

The period between month 13 (November of 2014) and month 18 (April of 2015) has been an intense period of time in this work package, since two releases (one release scheduled in the DoW and a previous intermediate release agreed with the collaborating partners) have been delivered.

For the end of this period, a milestone of the project is scheduled in the DoW: *MS4 Preliminary version for the WSN environment, smart environment for context awareness and gamified environment*. WP3 collaborates in this milestone with the preliminary version for the WSN environment, which is reported in the Deliverable D3.2 – Wireless sensor networks, integration middleware and system configuration, which release is also scheduled in this period, for the 30<sup>th</sup> of April.

The execution of the tasks planned for this period is satisfactory and no significant deviations have been detected. The next six months period is the last period of execution of this work package and it is expected to deliver the final version of the WSN in time and, afterwards, perform configuration, maintenance and support tasks within the tasks belonging to the Work Package 6.

The main goal of WP3 is to develop the WSN environment and auto configuration system by a set of coordinated tasks.

#### ■ Objectives

- Selecting the most appropriate group of sensors and devices that will be distributed in the preferred environment of the elderly person. These sensors and devices will be both off-the-shelf or prototype developed by the partners.
- Design and development of the devices and sensors that will be developed in the project (e.g. bracelet/wristwatch) or integrated by the use of commercially available sensor or devices (as in the case of the
- intelligent carpet
- Realize a data collecting and retrieval layer that will support the data processing and the interoperability with the smart environment developed in WP4
- Design and develop an auto configuration system
- Integration of the full set of sensors into the WSN monitoring environment

#### ■ Summary of progress towards objectives and details for each task

##### Task 3.1 Requirements, parameters and sensor selection (MYSPHERA) – M3-M9

Completed

##### Task 3.2 Sensors development and production (MYSPHERA) – M6-M24

This period has covered two important releases in the WP3 that have been affected directly by this task.

A first laboratory version of the wearable wristband was developed by the end of January (month 15). It was actually released the first week of February and its availability was communicated to the rest of involved partners in order to allow the beginning of the preliminary data collection or integration tests. This prototype, henceforth called *lab prototype* is composed by the union of all hardware development modules of each component, integrated in a single device able to send the data gathered from sensors to a main beacon prototype. The components and boards have been integrated in a standard box to allow the mobility of the *lab prototype*. This device has standard micro-USB power connector and it has a finger-clip heart rate sensor (given that it is the sensor provided by the SoC manufacturer to hardware development and, in practise, it is impossible to fit the lab prototype to a wrist).

Measurements and signals are received in the prototype of the main beacon and sent to the back-end software provided by MYSPHERA to calculate location, adapt the signals and measurements and eventually introduce the valid information in the middleware.

In the period between February and the end of April it has been developed a second prototype of the wristband, meeting the schedule planned in the DoW and the milestones. The second prototype is a fully functional wearable wristband including the full set of sensors planned for the final release. The size, battery life and firmware are at a first version and are planned to be revised and improved in the final version available at the end of the month 24 (October of 2015). Besides the development and integration of the electronic components, a provisional casing has been designed and produced with 3-D printing to enable the preliminary tests and data collection. The final casing will be produced using plastic injection in a mould, improving the size, materials and overall perception of the user.

As previously mentioned, an advanced prototype of main beacon has been developed as well, including all the functional features specified in D3.1, including data reception, ping transmission and network management. The status of the development of this element is not 100% finished because an appropriate casing must be acquired or designed and some bugs or requests for changes can appear during the firmware refinement scheduled for the next six month period (and last development phase of this task and work package).

In addition to the main beacon, an advanced 100% functional prototype of the RTLS beacon has been released. This element, which was not initially indicated in the Dow, has been developed to fit the pilot sites requirement of having as less wiring as possible and the impossibility of wiring with Ethernet the users apartments. This version of location beacons communicate between themselves and with the wristband using exclusively Bluetooth Low Energy (BLE), so that no data wiring is required and the beacon can be located near a power socket minimizing the visible wires in the user's house. The devices are not 100% finished waiting to be correctly encapsulated in an adequate case, commercial or specially produced for DOREMI. Moreover, few modifications could be made during the next few months, depending on the revisions in the wristband.

MYSPHERA, together with ACCORD and EXTRACARE, have performed an in-site analysis for UK pilots: further details are described in T6.1 (WP6).

CNR-ISTI collaborated, together with UNIPI, on the development of software components and tools that support the preliminary data collection process regarding the smart carpet (Wii Balance Board). CNR-ISTI brought several performance refinements to the device java driver and produced software components that allows to record data produced by the device on-the-fly on a database instance.

CNR IFC has developed the user scenario of use for balance board, has defined its requirements and, together with CNR ISTI and UNIPI, during several sessions (Viareggio 28/11/2014, Pisa, 18/03/2015, 27/03/2015, 24/04/2015), this balance was tested on a user population similar (23 users) to those of the DOREMI trial. In particular, three tasks of BERG balance scale (nr. 6, 7 and 10) were replicated with the use of balance board and data obtained will be correlated with the individual balance score, feeding the reasoning system (WP4).

CNR IFC with CNR ISTI and UNIPI has organized during this period 3 meetings to coordinate WP3 work (Pisa, 04/11/2014, 09/01 and 25/02/2015).

CNR IFC will organize during May 2015, in collaboration with CNR ISTI, UNIPI and MYSPHERA, a series of tests to collect data (heart rate, blood pressure, blood oxygen saturation, accelerometer data) for activity recognition of Physical Activity exercises, foreseen during the DOREMI intervention.

### Task 3.3 Sensor Integration and Middleware (CNR-ISTI) – M6-M20

CNR-ISTI continued the development of Sensor Weaver Middleware reaching version 2.0 in December 2014. Documentation of the Java API, a brief description of the architecture and a guide for developers and administrator was released along with the software artifacts and made available to partners through public websites (SVN code repository, maven nexus repository, wiki for documentation).

CNR-ISTI developed a first working version of the integration layer for the balance board (smart carpet) that can be used in the pilot.

During the last month of the reporting period, CNR-ISTI started to collaborate with MYSPHERA on the integration of Z-Wave environmental sensors.

For the outdoor scenario, the system will require a smartphone to store and forward the data of the wristband (see D3.1), during this period, a first version of the smartphone application has been released by MYSPHERA. This software is able to receive data coming from the wristband and stores it until it sends it back to the main beacon.

### Task 3.4 Auto configuration system and calibration (AIT) - M9-M24

AIT's HOMER (Home Event Recognition System) was chosen to play the role of the auto configuration system within DOREMI. HOMER is developed in JAVA and based on the OSGI framework KARAF. This allows HOMER to be configured individually in terms of adding or removing functionality by adding or removing so-called bundles which are modular and capsuled pieces of software.

HOMER supports the configuration of smart environments via a graphical user interface, the storage of sensor data and has standardized interfaces for third parties to retrieve current status or the configuration of the environment.

A virtual machine (VM) was setup at AIT premises to run the auto configuration (and probably other) system as part of the DOREMI installation. The VM runs an UBUNTU server which is made accessible from remote via secured connection (SSH).

HOMER was screened for further improvements to fulfil the DOREMI requirements and necessary adoptions have been made. This are enhanced graphical configuration possibilities, enhanced third party interfaces (REST, Websocket, RabbitMQ) and enhancing the reliability.

#### ■ Significant results

- Laboratory prototype of the DOREMI custom wristband with all sensors integrated.
- Preliminary version of the Wireless Sensor Environment including; custom wristband, environmental sensors, RTLS location system with wireless communication beacons, DOREMI gateway and smart carpet.
- First version of smartphone application (v1.0).
- First integration of RTLS back end and DOREMI Middleware.
- First version of Middleware (v2.0) available to integration partners with documentation
- First working version of the Smart Carpet Integration Layer
- Virtual machine at AIT premises running the auto configuration system.
- HOMER improved to meet DOREMI requirements.

- Deviations from Annex I and their impact on other tasks as well as on available resources and planning (if applicable)

There are no significant deviations.

The intermediate lab prototype was released one week after the internally agreed date, but that didn't have consequences since its use was not requested.

The release of the contribution of WP3 for milestone 5 of the project (MS5) will end this period in the following status (according to the MS5 objectives):

- Middleware: finished.
- DOREMI gateway: finished.
- Smartphone gateway: finished.
- Wristband: designs sent to manufacturer (production will take 21 days at most).
- Smart carpet: finished.
- Environmental sensors: finished.
- Autoconfiguration tool: finished.
- MYSPHERA backend – middleware integration: finished.
- Indoor network
  - ✓ Main beacon: finished.
  - ✓ Wireless beacons: working with bugs (it can be used for integration and preliminary tests). Fix to 100% finished will take an estimated time of 2-3 weeks.

These deviations of maximum 3 weeks are considered as acceptable, since they don't produce a delay in the rest of work packages or the project planning.

- Reasons for failing to achieve critical objectives and/or not being on schedule and explain the impact on other tasks as well as on available resources and planning (if applicable)

Not applicable. There are not critical failures.

- Explain deviations (if any) between actual and planned person-months (per beneficiary)

See Section 2.4 "Project management during the period"

- Corrective actions

The most noticeable deviation, which has been produced by the manufacturing, time has been introduced in the plan for the next period, so that is foreseen a 21 days period to have the units available since the finalization of the design.

### 2.3.4 WP4 Development of a Smart Environment for Context Awareness

The main goal of WP4 is to define and implement the DOREMI Context Awareness and Activity Recognition system.

During the period of interest, WP4 partners have collaborated to identify the implementation level details of the Context Awareness and Activity Recognition system, including deployment details, technical interfaces and communication mechanisms as well as information storage systems. The implementation activities have progressed as planned, with the development of: pre-processing components (Task 4.2) already integrated in the DOREMI middleware provided by WP3; supervised activity recognition component (Task 4.3) implementing a reservoir computing approach as well as a number of prototypes of alternative learning models to perform a thorough experimental comparison with the reservoir computing approach; a preliminary version of the dashboard (Task 4.4) based on the KIOLA system. Additionally, during the reference period WP4 partners have collaborated to the revised version of deliverable D4.1, whose amendments have been considered successfully by the project Reviewers who have ultimately approved the revised D4.1. version (March 2015). In summary, the revised deliverable deeply extends the report on the background analysis for the exploratory and predictive methods for activity recognition and provides an up-to-date description of the computational learning and reasoning tasks that will be addressed by WP4, following changes in the clinical requirements and on a revised specification of the DOREMI lifestyle protocols. The deliverable includes a completely novel section, which is a key contribution of the new document, providing a detailed description of the Activity Recognition and Reasoning software system, including its high-level architecture, the information flow between the components of the system and an implementation level description of the system being implemented. Further, preliminary experimental results concerning the assessment of some of the components of the system have been reported.

The activities of the WP4 coordination team have continued as planned, with monthly physical and virtual meetings with the project management (CNR-IFC) and the clinical stakeholders.

#### ▪ Objectives

This WP investigates machine-learning solutions for both explorative (Task 4.2) and predictive (Task 4.3) data analysis. Explorative approaches typically rely on unsupervised learning models and are useful both as a preliminary pre-processing step, e.g. to filter, segment and cluster relevant sensor data, as well to discover some informative grouping of the sensor data, when little supervised expert information exists. Predictive approaches, on the other hand, usually rely on supervised learning models, and are tailored to acquire robust predictive models of a process for which there is insufficient background knowledge to set up a procedural algorithmic solution, but a sufficient set of real-life supervised example data is available. These latter models will be used, in Task 4.3, to learn a short term activity recognition/classification system from expert labeled data that will support a more high level reasoning service on long-term user data in Task 4.4.

#### ▪ Summary of progress towards objectives and details for each task

##### Task 4.1: Data preparation and models assessment specification (UNIFI) – M1-M8

Task not active during reference period.

##### Task 4.2: Activity recognition: explorative data analysis (CNR ISTI) – M6-M30

CNR-ISTI during the reference period implemented the data preparation layer for the predictive activity recognition tasks by building on the state-of-the-art on exploratory data analysis techniques

produced in the first year. After a first prototyping version written in Matlab, It has been realized as a set of filtering utilities by means of OSGi modules integrated in the middleware developed in the WP3. The layer gathers sensory data by means of the middleware utilities, splits the data into epochs, applies mean, standard deviation, kurtosis and skewness on it, and populates the relative collections of the raw data MongoDB instance. Thus, once raw data are available, the filtered data and the features extracted from them will be ready to be used by the predictive machine learning tasks. The layer has been tested for functionality on data collected by the smart carpet designed by UNIPI and CNR ISTI, and it is ready to receive data from the bracelet designed by MYSPHERA. As part of the Task activities, it has been designed also techniques to produce aggregated data from environmental sensors and the GPS embedded in the smartphone used in the outdoor scenario. These modules will produce aggregated values for daily outdoor covered distance, daily steps performed by the user, and outdoor DOREMI socialization levels.

Another activity involved in Task 4.2 is represented by the application of unsupervised approaches to long-term user behaviour discovery by means of environmental sensors. In order to be ready for the actual deployment of the module in the real test sites, an indoor mobility model is under deployment to simulate indoor mobility traces and the time series related to the environmental sensor activations. Unsupervised models to be applied on these synthetic traces are under development and preliminary results based on a “stigmergic” approach have been reported in the revised version of the deliverable D4.1.

#### Task 4.3: Activity recognition: predictive machine learning approach (UNIPI) – M6-M30

During the period of interest, UNIPI has progressed in the software implementation activities, throughout the refinement of the Java API implementing the learning components of the supervised activity recognition subsystem. In particular, it has been produced, first, an implementation of the reservoir computing models that are ready to be assessed on DOREMI activity recognition tasks using real-world data coming from the DOREMI smart carpet prototypes, from preliminary data on user home visits collected in the MYSPHERA lab site, and from further data coming from the MYSPHERA bracelet. Preliminary tests of such software using filtered data from smart carpet have been successfully conducted, as reported in the revised version of the deliverable D4.1. Besides the reservoir-based models, UNIPI has also progressed in the development of prototypes for other classes of learning models that will be considered in the experimental and model selection phase to ultimately select the recognition components that will be deployed in the final pilot sites. For instance time-delay neural networks approaches have been compared to the reservoir computing approach in a paper submitted for journal publication.

Members of the UNIPI team contributed to the organization, with CNR IFC and ISTI, and they have participated to preliminary measurement campaigns targeted at collecting preliminary balance-related data from the Wii smart carpet, in relation to the “Balance Assessment” computational learning task. In this respect, UNIPI has also developed and progressively refined a Graphical User Interface (GUI) that facilitates the process of data gathering and annotation. The balance-related gathering process has been developed in successive stages, during several measurement campaigns at ISTI CNR, involving healthy DOREMI staff, as well as at ISI "Piaggia" (Viareggio) and ASL5 in Pisa, under the CNR-IFC coordination, involving elder people with various degrees of physical impairments. UNIPI has conducted preliminary experimental analysis on such data, which has also contributed to a progressive refinement of the protocol adopted for the measurements. In this context, in cooperation with CNR-IFC, new user scenario involving three exercises in the Berg Balance Scale (i.e. exercises number 6, 7 and 10) test have been identified as suitable for the smart carpet measurements. Accordingly, the scripts for the balance-related measurement campaign have been updated by UNIPI and CNR-IFC.

UNIPI has also contributed to the refinement of the scripts for the preliminary data gathering process, to be performed at MYSPHERA lab, and related to the computational learning task “Person meeting the user at home”.



During the reference period, meetings of the WP4 coordination team have been held with CNR IFC and ISTI (04/11/14, 09/01/15 and 25/02/15, Pisa), discussing, among the other topics, the experimental campaign for the collection of data associated to the Balance assessment and Physical Activity protocol, including the identification equipment needed and the requirements for the DOREMI bracelet. Additionally, it has been identified the necessary technical equipment for the pilot site and the requirements in terms physical activity level assessment. One skype-call meeting has taken place on the 26/02/2015, including members of CNR ISTI, CNR IFC, UNIPI and AIT (27-28/10/2014) to discuss the physical deployment of the DOREMI raw and high-level databases and server for computation (which will be hosted by AIT), as well as the details of the deployment of the software components of the Context Awareness and Activity Recognition system, together with the associated computational, interfacing and communication requirements.

#### Task 4.4: Reasoning system and Personalization (AIT) – M10-M30

During the period of interest the core components of the DOREMI dashboard and the reasoning system have been specified with the support of clinical partners (SI4LIFE). The first version of the user interface has been designed and a first draft of the Application Programming Interface (API) for data submission by sensors has been specified. The first version of the dashboard has been deployed on a test server and has been made available to partners for system integration tests. System integration with the game server as provided by Imagine has been successfully conducted.

#### ■ Significant results of WP4

The key features of the software system for learning in intelligent sensor networks, developed as part of WP4 activities, have been presented at the third Italian Workshop on Machine Learning and Data Mining (MLDM) during the XIII AI\*IA Symposium on Artificial Intelligence, held in Pisa on 10-11 December 2014.

The preliminary results obtained in the application of semi-supervised stigmergic-based techniques on testing datasets have been described in a paper accepted for publication in the *Pervasive and Mobile Computing* journal by Elsevier [1].

An experimental assessment of the learning models, including a comparison between different neural networks architectures, using benchmark human activity recognition data, has been described in a paper accepted for journal publication [2].

A paper [3] describing WP4 system architecture and discussing the exploitation of human activity recognition and reasoning to monitor the elderly and to empower them to follow a lifestyle protocol for active aging, has been submitted (and accepted) at the XVII Portuguese Conference on Artificial Intelligence (EPIA2015), thematic track on “Artificial Intelligence in Medicine”.

[1] P. Barsocchi, Mario G.C.A. Cimino, E. Ferro, A. Lazzeri, F. Palumbo, and G. Vaglini. "Monitoring elderly behavior via indoor position-based stigmergy". To Appear on *Pervasive and Mobile Computing*, Elsevier.

[2] F. Palumbo, C. Gallicchio, R. Pucci and A. Micheli. Human Activity Recognition using Multisensor Data Fusion based on Reservoir Computing. Accepted for *Journal of Ambient Intelligence and Smart Environments*. IOS Press.

[3] D. Bacciu, S. Chessa, C. Gallicchio, A. Micheli, E. Ferro, L. Fortunati, F. Palumbo, O. Parodi, F. Vozzi, S. Hanke, J. Kropf, K. Kreiner, Smart environments and context-awareness for lifestyle

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management in a healthy active ageing framework, accepted at EPIA 2015 - Seventeenth Portuguese Conference on Artificial Intelligence – thematic track on “Artificial Intelligence in Medicine”, September 2015.

- Deviations from Annex I and their impact on other tasks as well as on available resources and planning (if applicable)

Not applicable

- Reasons for failing to achieve critical objectives and/or not being on schedule and explain the impact on other tasks as well as on available resources and planning (if applicable)

Not applicable

- Explain deviations (if any) between actual and planned person-months (per beneficiary)

See Section 2.4 “Project management during the period”.

For timing deviations see D1.2.2 – Annual Periodic Report Period 1.

- Corrective actions

Not applicable

### 2.3.5 WP5 Development of Social and gamified environment

Work package 5 is dedicated to the design and development of the overall gamified active ageing support environment to the different impairment of users involved.

The definition of the gamified active ageing protocol that is the main objective of the T5.1 was conducted together with WP2 during Year1. In D5.1 the gamification of the medical protocols important inputs for the game environment design and development was presented.

To design and develop the game-based active ageing environment (T5.2), the user-centered design activities went on with older people, with the aim to validate the gamified protocols step by step and to obtain an app with good standard regarding usability and acceptance. The whole methodological approach, first results and the activity plan have been presented in D5.2, already delivered.

Furthermore, in this period also T5.3, T5.4 started (M14). While T5.5, that should be started in M14 started in M10, starting to design and obtain a first prototype of a cognitive game, so that next activities (in T5.3, T5.4 and T5.5) can already benefit from user feedback and testing.

Several meetings were organized, in particular between WP4 and WP5 started a strong collaboration with the aim to describe data formats and attributes as input to reasoning system, as described in D5.2. Other meetings were organized with clinical partners, that fine tuned the medical protocols (WP2) to obtain a common and shared view, in design activities, about the gamification of specific areas.

First prototypes were designed and developed for each of these areas (at least physical and cognitive at the time of writing this report), furthermore, starting from the first gamified environment mock up and from feedback collected during the first focus groups in UK and in Italy, a new prototype has been designed and is being developed.

#### ▪ Objectives

- The generation of multi-parametric flexible serious games both for physical and cognitive stimulation and motivation
- Dynamic aggregation all the components and services that need to be presented to users, offering elderly people with a coherent and consistent virtual/augmented highly-interactive environment that can be used to access all the available features, providing a guide to both the DOREMI solution usage and the active ageing gamified environment (including training on daily life aspects) also by means of an intelligent virtual companion
- Promote the development of social communities addressing the areas of engagement proposed in DOREMI (e.g. diet, physical activity, leisure etc.) aiming at stimulating real life social interaction through a proper use of selected and developed game-based/networking/communication services.
- Integrate the game platform with the Web 2.0 services developed in task 7.4 and animated by the involvement of ageing communities

#### ▪ Summary of progress towards objectives and details for each task

##### Task 5.1 Gamified active ageing protocol definition (DMU) – M3-M8

Completed

## Task 5.2 Game-based active ageing environment (IMA) – M6-M14

Game-based active ageing environment should be closed on M14, but as explained in D5.2, according to the methodological approach that we chose and according to the key role of this environment in WP5, we couldn't close all the activities by this month.

User centered design activities went on, collecting feedback with users, in UK and in Italy, and modifying and improving different prototypes, to collect new feedback.

In particular, the main aims in the first groups were:

- to find a definitive metaphor to be used in the environment to motivate and engage users
- to collect feedback about the first cognitive game, to define important aspects regarding graphics, look & feel and usability, to be adopted also for all the other atomic elements of the environment (i.e physical exercises area).

The design of the game environment, with the new metaphor is almost ready, and also the development started. Starting from the first mock up (presented in D5.2), in the gamified environment each user has to walk the dog around a path (where each path represents a level), based upon aggregate scores from all areas. Each path represents a city. For example, the user could walk the dog around Paris, as they reach milestones along the path, they unlock a postcard reward e.g. a picture of the Eiffel tower.

The main interface of the game environment was fine tuned and is ready to be implemented in the application.

At the time of writing this document, all the parts of the application (described below) are considered as a standalone application, that after this phase will be integrated in a unique environment (see also D5.2 for a detailed description). This game environment will be used to motivate, engage and support users in their 'new' health behaviours and lifestyle, suggested by the DOREMI protocols, regarding cognitive training, physical and social activities and nutrition.

## Task 5.3 - Exergames development (IMA) - (M13–M24)

CNR IFC organized a meeting (03/02/2015, Milan) to work with IMA on the Physical Activity app, necessary to show to DOREMI users the exercises to perform during the intervention. In this meeting the user interface, user interaction modalities and type of data to be collected were discussed. Starting from these initial specifications and from the iOS DOREMI PA app, in-house developed by CNR IFC, IMA designed and developed an Android application, ready to be tested with users during the same test sessions organized for PA activity recognition (WP3 and WP4): these sessions will start on M19 and users will test the user interface usability and interaction, furnishing feedback for its development.. All the videos recorded by CNR IFC (representing the 21 validated exercises included in the clinical protocol) were used and integrated in the application, where everything was fine tuned considering both the clinical aspect and the main element of the whole application.

Even if it is not integrated yet, everything is working as it would real communicate game and clinical data from and to the server.

## Task 5.4 - Social games development (UOC) - (M13–M24)

Social elements of the application are not implemented yet. Nevertheless they are under study, to be designed and developed soon. Different ideas have been proposed, but they have to be discussed with users, with the aim of collecting feedback and decide which are the most effective, usable and engaging techniques.

### Task 5.5 - Cognitive games development (IMA) - (M13–M24)

As presented during the first EU project review, beginning of T5.5 was anticipated at M10, starting to collect feedback about the first prototype.

SI4Life provided an in-depth description of the games' characteristics and scenarios needed to assess and improve the older person's functionalities in some outlined domains (memory, language, attention, calculation, orientation, visual-spatial functioning and praxis). Starting from the collected feedback, during first focus groups round (M11), a first set of cognitive games about some of this impairment was designed and developed.

A second round of focus groups has been conducted at M13 in Italy (SI4LIFE) and UK (DMU, Accord). To design cognitive games based on user needs and requirements, during the second round of focus groups subjects with MCI have been involved. The results of these focus groups have been analyzed and used to refine and modify the first set of cognitive games and to design and develop new ones. By the end of M18 a third round of focus groups is planned to test and refine all the games already designed and developed.

In particular, the games available at the moment are designed to train memory, calculation and attention, and they are developed in 3 different ways, according to the impairments and in 3 different difficult levels (for further information, please see D5.2).

#### ▪ Significant results

D5.2 was delivered.

The 2<sup>nd</sup> round of focus groups has been conducted at M13 in Italy and UK. The first focus group of the 3<sup>rd</sup> round has been performed on April 29, 2015.

A preliminary set of cognitive games prototypes was designed and developed. It has been tested through the user centered design and usability testing activities in Italy and UK. At the end of M18, considering different difficult levels and different impairment versions, there are 27 'atomic' cognitive games, already working.

A preliminary version of the exercise area, to present all the physical protocol, was designed and developed.

#### ▪ Deviations from Annex I and their impact on other tasks as well as on available resources and planning (if applicable)

Not applicable

#### ▪ Reasons for failing to achieve critical objectives and/or not being on schedule and explain the impact on other tasks as well as on available resources and planning (if applicable)

Not applicable

#### ▪ Explain deviations (if any) between actual and planned person-months (per beneficiary)

See Section 2.4 "Project management during the period"

#### ▪ Corrective actions

Not applicable

### 2.3.6 WP6 Validation driven system integration at lab and pilot site

WP6 has the main aim to validate the driven system integration both at lab and pilot site. The validation will permit a progressive validation of the sensors developed in WP3 the serious games in WP5 and activity recognition tasks developed in WP4. The data collected to validate the solutions will be conducted involving eligible persons according to the inclusion and exclusion criteria defined in WP2.

Activities of T6.1 have aim at involving subjects to test and validate the solutions developed during the project. The data obtained through tests and focus groups will be useful to modify the solutions based on requirements, including balance board, the DOREMI reasoning system, cognitive games, social games and Physical activity games. During this task the pilot site preparation is planned.

During T6.2 a validation study in the CIAMI living lab in Spain will be conducted to integrate WSN and Contact aware system. This will be the first step for the validation of the interoperability of the gamified environment and the sensor network, feeding with activity recognition and the reasoning components. During the T6.2 it's planned the deployment of the user interface receiving feedbacks of clinical experts.

Based on validation protocol described in D2.3 will be conducted.

From M20 to M30 3 experiment sessions from M20 –M27 will be conducted, involving 20-30 subjects to validate social and gamified environment. During these experiments information about the behavior style will be collected. A multiregressive model will be build, based on data obtained during these experiments to measure the impact of independent variable observed during the experiments on behaviors. These data will permit to identify the condition that makes effective the gaming intervention.

During T6.4 starting at M27, the validation of the integrated system will take place and refined by means of a multicentre longitudinal case control study. In the three enrolling centres (SI4life, Extracare and Accord) 40 subjects will be involved according to the inclusion and exclusion criteria defined in D2.3. All the collected data will be organized in a database suitable for statistical analysis. Parameters correlated with cardiovascular performance, cognitive abilities, social functioning, nutrition and physical activities will be collected.

#### ■ Objectives

- The collection of annotated data base/datasets during the lab activities needed by WP4 to sustain and improve the quality level of the activity recognition and behavioral analysis system development.
- Perform lab validation of the WSN and smart environment enabling their integration and preparing to include the data provided by the validated serious games
- A virtual lab validation of the serious games performed by exploiting the community of users involved though the dissemination activities
- Set up the pilot site in Italy and UK for proof the concept of the fully integrated system in a real scenario of use

#### ■ Summary of progress towards objectives and details for each task

##### Task 6.1 Data Collection and pilot site preparation (CNR IFC) – M14-M25

The task is focused on the collection linked with DOREMI intervention areas, including physical activity (PA), dietary support and cognitive training. These data, obtained by means of different campaigns of tests and focus groups are reported in accordance with requirements of sensors developed in WP3, of activity recognition system in WP4 and gamified environment in WP5.

CNR IFC has dedicated its effort in this task to the Physical Activity (PA) data collection. This task was focused on two main items: balance board tests and PA environment. The work on balance board has foreseen a strong integration and collaboration with UNIPI and CNR ISTI. CNR IFC has worked with CNR ISTI on balance board development and modification in accordance with requirements of DOREMI protocol. CNR-ISTI collaborated with UNIPI on the development of a software tool that allows to annotate smart carpet data being recorded on the db and visualize it as it is transmitted by the device. During the reference period, UNIPI has participated to the preparation of the data collection process, with the aim of guiding the phases of data gathering and annotation, through a progressive refinement of the scripts concerning the computational learning tasks “Person Meeting the user at home” and “Balance Assessment”. In this work UNIPI was also involved for activity recognition activities and CNR IFC has collaborated to define the user scenario.

These components are already employed in the context of the preliminary data collection concerning the balance evaluation. CNR-ISTI developed tools that allow curation and extraction of smart carpet data from the database. The procedures produce datasets according to WP4 requirements in terms of annotated data and data format.

During this reference period tests with balance board were focused on the evaluation of a series of items derived from Berg balance scale test. CNR IFC has selected 23 potential users presenting an age between 60 and 85 and with Berg value between 21 and 56 (the class between 1 and 20 was a priori excluded falling in the exclusion criteria of DOREMI; see D2.3, Annex C). These users were visited by a CNR IFC clinician and subjected to Berg scale evaluation to define their balancing rate. In 4 different sessions (Viareggio 28/11/2014, Pisa, 18/03/2015, 27/03/2015, 24/04/2015), the selected users were subjected to Balance board tests, replicating items 6, 7 and 10 of Berg scale (see D2.2, §11.5): these three items presented the major difficulties to find a stable position for users. The data were collected by CNR ISTI to test the hardware and by UNIPI to feed the DOREMI reasoning system: this system, once in pilot sites, will perform the daily users’ evaluation of balance assessment.

CNR IFC has focused also its work on PA environment. CNR IFC has defined the entire PA protocol and its clinical performance indicators, presenting also the entire documentation to CNR Bioethics Committee obtaining its approval (16/02/2015). Furthermore, CNR IFC has recorded PA exercises videos necessary to show, via app, the entire protocol to users and has developed an alpha in-house version (iOS version) of app. CNR IFC has organized a meeting (03/02/2015, Milan) to work with IMA on the PA app, which will be integrated in DOREMI environment (Android version). In this meeting the user interface, user interaction modalities and type of data to be collected were discussed. CNR IFC will support the development version testing the app during PA test sessions (M19), jointly organized for project activities of WP3 and WP4. In these sessions, potential users will perform the entire PA protocol collecting their data (heart rate, blood pressure and oxygen concentration, accelerometer data) and testing app user interface usability and interaction.

Pilot sites partners expressed safety concerns regarding the placement of the smart carpet at the side of the bed. The resulting discussion brought to a change in the smart carpet usage scenario for the pilot. Partners decided to discard the sitting-to-standing scenario and adopt a new one where the user steps on the device, while standing, to perform some BERG test exercises. Preliminary data collection scripts were modified accordingly.

The second part of task is dedicated to the pilot site preparation, the preliminary activities of recruitment and enrolment of participants.

IMA and SI4life are working together by exploiting serious games designed during the WP5 Task 5.5 to test them. During the activities carried out to design the Cognitive Games based on user requirements, testing sessions of the cognitive games prototypes have been conducted. To test them has been involved o people aged 65-80 that comply with the inclusion/exclusion criteria described in D2.3.

Based on data collected and feedback from users, several modifications has been implemented in the refinement of the games. SI4life and IMA are working on data recording and visualization for the users.

Maps, blueprints and pilot sites information has been gathered in order to perform a preliminary design of the installations in the different pilot sites. The distribution of devices was agreed between WP3, WP4 and WP6 teams to optimize the data availability and the user acceptance.

There was a physical meeting in UK between MYSPHERA and the partners responsible for the UK pilots (Accord and Extra), where there were discussed details about the site preparation, it was performed an in-site analysis of the users routines and needs and also were assessed the technical details of the installation of the devices. All this has been conveniently documented in minutes and reported to the involved partners.

The results of the information obtained from the partners in charge of pilots have been processed and discussed in several WP3 and WP4 meetings. Part of the conclusions of this work have been written down in the deliverable D3.1 resubmission (February of 2015).

DMU have been involved in meetings with ExtraCare and Accord to plan recruitment activities for the UK trial. Awareness raising activities will begin at M20 and will involve: presentations at meetings; posters; letters; and one to one targeted recruitment of suitable participants. Actual recruitment will start in M24 and will involve a dedicated staff member at each site

SI4life has conducted internal meeting to plan the activities to prepare the pilot sites and the recruitment of subjects, due to the characteristics of the sample, the recruitment of the subjects will be started at M28 that proceed the start of the Italian pilot study M31 and Awareness raising activities will begin at M24.

### Task 6.2 Living lab validation and integration of WSN and Context aware system (CNR ISTI) – M18-M25

At the end of the reporting period, CNR-ISTI, MYSPHERA and AIT started to discuss aspects regarding the integration and testing of the system and a time schedule. AIT agreed to provide computational resources for hosting services needed for the infrastructure (e.g.: sensor database) and the partners started to collect requirements for computing resources. CNR-ISTI estimated the amount of data that will be collected by the system in pilot sites by performing simulations. CNR-ISTI and MYSPHERA started to collaborate on the task of environmental sensor integration with the Sensor Weaver Middleware.

Tests in the Valencia Living Lab have been performed simulation a set of social situations. A first experience was done during the past period (October, month 12), meeting MS3: Preliminary dataset. Once the sensors and algorithms development has advanced, a second experience has been performed, to produce a valid dataset to feed the algorithms developed in WP4. These tests have consisted in the performance of a sequence of activities according to given scripts (prepared by WP4 partners) simulating social interaction situations. The sensors installation set up for these tests will be maintained for the scheduled Living Lab integration and validation tests that will take part just after the end of this period.

### Task 6.3 - Validation of Social and gamified environment through behavioral analysis (UOC) - (M20–M30)

To be started at M20

### Task 6.4 - Validation of integrated system and refinement (SI4LIFE) - (M27–M36)

To be started at M27

- Significant results



- 
- Developed tools for preliminary data collection for balance analysis
  - Preliminary balance data collection has started
  - Preliminary cognitive games data collection

- Deviations from Annex I and their impact on other tasks as well as on available resources and planning (if applicable)

For timing deviations see D1.2.2 – Annual Periodic Report Period 1

- Reasons for failing to achieve critical objectives and/or not being on schedule and explain the impact on other tasks as well as on available resources and planning (if applicable)

Not applicable

- Explain deviations (if any) between actual and planned person-months (per beneficiary)

- Not applicable

- Corrective actions

Not applicable

### 2.3.7 WP7 Exploitation, Dissemination and IPR

The work package 7 is aimed at upscaling at EU level the results achieved by the project.

In the first period of the second year of the project development the WP7 activities were concentrated on the development of the competitive and market analysis of the alternative products to DOREMI and in the understanding of DOREMI component and of the whole solution market positioning. Moreover we have fine-tuned the dissemination and exploitation channels with relevant stakeholders as well as we have worked in defining a dissemination protocol to address the various target audiences that we identified with a more personalized dissemination plan, that is under development during this period.

#### ▪ Objectives

- To assess the expected impacts of the project at EU27 level in relation to the emerging trends of the ageing population in EU Member States;
- To disseminate the project outcomes in EU27 at large through social media and targeted actions;
- To design and to set up an exploitation process of the project results in line with the specificity of the DOREMI consortium members and the characteristics of the Ageing Marketplace in EU27.

#### ▪ Summary of progress towards objectives and details for each task

This work package includes the dissemination and exploitation activities of the DOREMI project and will be implemented with the contribution of all project partners under the leadership of CNR, which is in chief of both the dissemination and exploitation tasks. In this reporting period the partners mainly focused their WP7 activity on the analysis of the competitors and of the potential market of DOREMI product. In parallel we have fine-tuned the dissemination plan and related activity to support the diffusion of the project's results and their exploitation as well.

A list of dissemination events organised or attended by the partners is also provided.

#### Task 7.1 - Development of exploitation and dissemination plan (UOC) – M3-M5

Completed

#### Task 7.2 – Market assessment and outline of the business plan (UOC) - (M10-M15).

UOC has coordinated the revision of the D7.3.1 (“Updated Exploitation plan and business plan – IPR rules”). The revision of the Deliverable was aimed at including the “Competitive analysis” of the existing and /or emerging products that other organizations competitors of DOREMI consortium have already on the market or they are planning to launch in the marketplace during the DOTREMI project timeframe.

This revision was necessary to reply to the 1st review report item R12 - Clearly define the added value of the DOREMI concept based on a proper benchmark of existing or emerging solutions.

To this end UOC and CNR- IFC in collaboration with the technical partners updated the D7.3.1, by adding an additional chapter (namely “Chapter 7 – Competitive analysis”) where the reviewers indications were addressed.

While, Regarding the item R9 - Consortium should evaluate future cost of the system and potential price per user for future exploitation. This will help identify payers' target, considering the current stage of the project (prototypes are not ready yet) an accurate price analysis and benchmark with the market available solutions cannot be performed. The price analysis and benchmark will be provided in the second exploitation plan D7.2.1, as anticipated in D7.2 conclusions

The core activities that were deployed to complete the Chapter were: internet search and technical partners interviews to identify a competitors' list for the different components of DOREMI solution;

detailed analysis of the characteristics of the identified products through company websites, phone calls and review of the promotional and technical material; definition of the methodological approach for the evaluation of the products' performances and their comparison amongst them and with DOREMI solution; definition of the evaluation criteria for the comparison; collection of data from the producers; definition of the "magic quadrant of Gartner" for each group of products in relation with each component of DOREMI solution; analysis and validation of the results; reporting.

### Task 7.3 – Impact assessment on Health Care system and on society at large (UOC) - (M10-M15;M23-M24; M35-M36)

UOC has further developed the literature review on the typologies of health care systems existing in EU28 in order to classify impact indicators that are currently used by MSs in assessing the performances of their health system. These indicators will be used in the second period of the activity (M23-M24) to start defining the impact evaluation framework that will be used to assess the impact of DOREMI solution up-scale on the European health systems.

### Task 7.4 – Dissemination activities (CNR-IFC) – M3-M36

CNR-IFC together with UOC and AGE platform has improved the dissemination plan of the project with the definition of concrete collaboration protocol amongst the partners to maintain an active presence of the project interim outcomes on the main on-line social network (Facebook and Twitter). Moreover they have worked for the definition of more personalized dissemination activities in relation to the various target audiences that would be interested to DOREMI solutions and achieved results. Finally they have updated the dissemination activities done during the period. All these activity will be included in D7.6 (Dissemination activity report) due for the M18.

#### ▪ Significant results

##### **Dissemination**

- Project website publicly available; dissemination activity report (D7.6) in progress, to be completed on M18.

Detailed dissemination activities per partner since the beginning of the project are presented in D7.6 - "Dissemination activities report" that will be submitted during the first week of May 2015.

##### **Exploitation**

- Revision of D7.3.1 by including competitive analysis of DOREMI solution's components and their positioning in the Gartner's Magic Quadrant.
- Presentation of DOREMI balance assessment and Physical Activity protocol to Nintendo Italia for potential collaboration and development of products
- Reinforcing the collaboration with NU-AGE, FP7-KBBE funded project, by skype or email exchange of information on projects' progression between the two coordinating teams. DOREMI and NU-AGE are interacting to find out common goals and link between the results of NU-AGE trial (design a new food pyramid for those over 65 years old to meet the nutritional needs of the elderly; assess the influence of correct diet on inflammation, one factor in the development of age related diseases such as atherosclerosis, type 2 diabetes and neurodegeneration leading to cognitive decline) and DOREMI pilot study that will be conducted at the beginning of 2016 (WP6).
- On February 2015, CNR IFC, as project coordinator and responsible for nutrition and sedentariness tasks in DOREMI, agreed to open a collaboration with DEDIPAC KH project (Determinants of Diet and Physical Activity Knowledge Hub; [www.dedipac.eu](http://www.dedipac.eu), University of Limerick leader), currently developing a compendium of all European datasets and studies focusing on determinants of diet, physical activity and sedentary behaviour. The dataset of

DOREMI pilot study has been requested by DEDIPAC coordinating team, to be included in the European compendium.

- By February 2015, the project coordinator made request to the Action Groups of EIP-AHA-A3 Nutrition- to join the Group on Area 1: Screening and assessment of malnutrition as a risk factor for active and healthy aging. CNR IFC committed in the following tasks:
  - ✓ 5.1 Objective: Manage frailty and functional decline through targeted intervention: Develop physical exercise training programs and physical activities tailored to older frail people and with functional decline.
  - ✓ 5.2 Objective: Manage frailty and functional decline through targeted intervention: Develop nutritional and hydration plans, and cognitively, physically and intellectually stimulating social activities to improve independent daily living and mental wellbeing in target populations.
  - ✓ 5.3 Objective: Manage frailty and functional decline through targeted intervention: Software program and ICT devices for feeding and food related tasks. CNR IFC is now engaged in the activities of AG A3, through the nutritional and physical activity protocols developed in DOREMI project.

- Deviations from Annex I and their impact on other tasks as well as on available resources and planning (if applicable)

No deviation from the plan has been registered.

- Reasons for failing to achieve critical objectives and/or not being on schedule and explain the impact on other tasks as well as on available resources and planning (if applicable)

Not applicable.

- Explain deviations (if any) between actual and planned person-months (per beneficiary)

No deviation between actual and planned person-months.

- Corrective actions

No corrective actions have been done during the period.

## 2.4 Project management during the period

- Project Management has carried out monitoring activities to ensure that:
  - the research activities are carried out according to the settled time schedule and budget;
  - the project objectives are efficiently achieved;
  - the project is managed according to the contract between the DOREMI Consortium and the EC, maintaining a continuous link with the EC;
  - overall legal, contractual, ethical, financial and administrative management of the project have been respected.
  
- Consortium management tasks and their achievement

We are now at 18 months of the project. During the last six months (from M12 to M18) management activities have been intense by both the project coordinator as well as the individual participants. The management activities that have been performed in this period has kept at best all these means and infrastructures that are required for the efficient communication and collaboration among the partners, as well as among the project, the EC and the external community. Highlights of activities that have been performed by the consortium in this reporting period can be summarised as follows:

- Submission of deliverables due in the period and resubmission of rejected deliverables (D3.1, D4.1, D7.3.1);
- Drafting and submission of reports on project advancement (annual and Interim);
- Collection of consortium's financial information for period 1 (forms C, CFS);
- Distribution of the interim payment for Period 1 (€ 763.660,00) to all partners;
- Organisation of the project's rehearsal meeting in Brussels (8<sup>th</sup> December 2014) for the review meeting at the Commission (9<sup>th</sup> December 2014);
- Maintenance and continuous update of the project's mailing lists ([doremi-fp7@ifc.cnr.it](mailto:doremi-fp7@ifc.cnr.it), [technicalcoordinator@doremi-fp7.eu](mailto:technicalcoordinator@doremi-fp7.eu), [wpleaders@doremi-fp7.eu](mailto:wpleaders@doremi-fp7.eu), [info@doremi-fp7.eu](mailto:info@doremi-fp7.eu));
- Amendment of the Consortium Agreement to reflect changes of legal representatives
- Constant update of the project's web-based collaboration tool and repository, operating in the framework of the website as a secure-access private area for consortium members only. The collaboration area is administered with the responsibility of the project coordinator and populated with the contributions of all consortium members;
- Quality check and submission of deliverables to the Commission;
- Constant communication between the consortium members;
- Regular communication and update provided by the project coordinator to the PO.

The table below shows the status of the project tasks.

Table 1: Status of the project tasks

WP no	WP name/ tasks	Leader	Start month	End month	Status
<b>WP1</b>	<b>Project Coordination and Management</b>	<b>CNR</b>	<b>1</b>	<b>36</b>	
Task 1.1	Project Management	CNR-IFC	1	36	Active, in progress
Task 1.2	Administrative Management	CNR-IFC	1	36	Active, in progress
Task 1.3	Risk Management and Quality assurance	CNR-IFC	1	36	Active, in progress
<b>WP2</b>	<b>End user profile and Active Ageing Lifestyle protocol development</b>	<b>CNR</b>	<b>1</b>	<b>12</b>	
Task 2.1	Target users definition, literature analysis and survey for scenarios of use	CNR-IFC	1	6	Completed
Task 2.2	Active Ageing Lifestyle protocol development	SI4LIFE	2	8	Completed
Task 2.3	Validation Plan	UOC	9	12	Completed
<b>WP3</b>	<b>Development of WSN environment and autoconfiguration system</b>	<b>MYSOPHERA</b>	<b>3</b>	<b>24</b>	
Task 3.1	Requirements, parameters and sensor selection	MYSOPHERA	3	9	Completed
Task 3.2	Sensors development and production	MYSOPHERA	6	24	Active, in progress
Task 3.3	Sensor Integration and Middleware	CNR-ISTI	6	20	Active, in progress
Task 3.4	Auto configuration system and calibration	AIT	9	24	Active, in progress
<b>WP4</b>	<b>Development of a Smart Environment for Context Awareness</b>	<b>UNIPI</b>	<b>1</b>	<b>33</b>	
Task 4.1:	Data preparation and models assessment specification	UNIPI	1/20	8/30	Completed
Task 4.2:	Activity recognition : explorative data analysis	CNR-ISTI	6	30	Active, in progress
Task 4.3:	Activity recognition: predictive machine learning approach	UNIPI	6	30	Active, in progress
Task 4.4:	Reasoning system and Personalization	AIT	10	30	Active, in progress
<b>WP5</b>	<b>Development of Social and gamified environment</b>	<b>IMA</b>	<b>3</b>	<b>24</b>	
Task 5.1	Gamified active ageing protocol definition	DMU	3	8	Completed
Task 5.2	Game-based active ageing environment	IMA	6	14	Active, in progress
Task 5.3	Exergames development	IMA	13	24	Active, in progress
Task 5.4	Social games development	UOC	13	24	Active, in progress
Task 5.5	Cognitive games development	IMA	13	24	Active, in progress
<b>WP6</b>	<b>Validation driven system integration at lab and pilot site</b>	<b>SI4LIFE</b>	<b>20</b>	<b>36</b>	
Task 6.1:	Data Collection and pilot site preparation	CNR-IFC	14	25	Just started
Task 6.2:	Living lab validation and integration of WSN and Context aware system	CNR-ISTI	18	25	Just started
Task 6.3	Validation of Social and gamified environment through behavioral analysis	UOC	20	30	
Task 6.4	Validation of integrated system and refinement	SI4LIFE	27	36	
<b>WP7</b>	<b>Exploitation, Dissemination and IPR</b>	<b>UOC</b>	<b>3</b>	<b>36</b>	
Task 7.1 -	Development of exploitation and dissemination plan	UOC	3	5	Completed
Task 7.2 –	Market assessment and outline of the business plan	UOC	10	15	Active, in progress
Task 7.3 –	Impact assessment on Health Care system and on society at large	UOC	10/23/35	15/24/36	Active, in progress
Task 7.4 –	Dissemination activities	CNR-IFC	3	36	Active, in progress

- Problems which have occurred and how they were solved or envisaged solutions

The DOREMI project started to implement its quality and risk management procedures on January 2014 by implementing the D1.1 Project Management Plan to ensure consistency on internal processes, procedures, and outcome generation. The **Scientific and Quality Manager (SQM)** of DOREMI has monitored compliance of the project progress with the work plan on the basis of quarterly progress reports provided by each Work Package Leader and project guidelines defined for quality control and quality assurance.

The Scientific and Quality Manager and the Execution Manager (EM) are responsible for the Risk management related activities, namely assessment and contingency. Deliverable D1.5.1 – Quality and Risk Management report, submitted on 11<sup>th</sup> November 2014, has outlined achievements in Quality and Risk Management in 2014. The report includes all the results of the project execution review process carried out among the project coordinator and the WP leaders.

No contingency plan for management activities was necessary during the period under consideration.

- Changes in the consortium (if any)

Not applicable.

- List of project meetings, dates and venues

Table 2: List of project meetings

	Type of Meeting	Date	Venue	Participants	
D1.3.1 Interim Periodic Report (Period 2)	1	Skype conference on WP2-WP5	05/11/2014	N/A	SI4LIFE, DMU, IMA
	2	Skype conference on WP2-WP6	05/11/2014	N/A	SI4LIFE, DMU
	3	Skype conference on WP6	12/11/2014	N/A	SI4LIFE, DMU, Extra, Accord
	4	Technical Meeting on WP5	02/12/2014	Milan, Italy	CNR IFC, IMA
	5	Rehearsal and Review Meetings	08-09/12/2014	Brussels, Belgium	All partners
	6	Technical Meeting on WP6	06/01/2015	Rowley Regis, UK	DMU, Extra, ACCORD
	7	Technical Meeting on WP4	09/01/2015	Pisa, Italy	CNR IFC, CNR ISTI, UNIPI
	8	Technical Meeting on WP5	05/02/2015	Milan, Italy	CNR IFC, IMA
	9	Technical Meeting on WP3 and WP6	05/02/2015	Birmingham, UK	DMU, EXTRA CARE, ACCORD, MySphera
	10	Technical Meeting on WP4	25/02/2015	Pisa, Italy	CNR IFC, CNR ISTI, UNIPI
	11	Skype conference on WP3 and WP4	26/02/2015	N/A	ISTI, AIT, MYSPHERA, UNIPI
	12	Skype conference on WP4 and WP5	27/02/2015	N/A	DMU, AIT, IMAGINARY, SI4LIFE
	13	Skype conference on WP4	28/04/2015	N/A	AIT, IMA, DMU, SI4LIFE
	14	Skype conference on WP3	29/04/2015	N/A	MYSPHERA, SI4LIFE

- Project planning and status

The project is progressing in accordance to the specified work plan and timetable as described in the Annex.

Deviations in WP2, WP3 and WP6 described in the period 1 Project Report are now all absorbed or sorted out. In particular:

- WP2: Deliverable D2.3 – Validation Plan was submitted to the EC according to the new deadline (M17);
- WP3: Task 3.3 – Sensor Integration and Middleware – is underway (to be completed at M20 instead of M24);
- WP4: Task 4.4 initiated at M10 (instead of M20) by partner 03 AIT, in collaboration with partners 02 UNIPI, 01 CNR ISTI, and CNR IFC is running;
- WP4: indoor physical activity, as developed in protocols included in T4.2 (not described in the DOW), has started at M14 and is in progress. This activity is expected to end at M24.
- WP6: Task 6.1 data collection and pilot site preparation has started with data collection at M14 (instead of M25);
- WP6: Task 6.2 living lab validation and integration of WSN and context aware system has recently taken up (M18 instead of M20).

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Project planning with regard to the overall management and coordination includes the continuation of the regular activities ensuring the smooth implementation of the project, i.e.:

- constant communication and collaboration between project participants
- constant communication with the commission's PO
- maintenance and update of the project mailing list, website and collaboration tool
- regular reporting for the efficient follow-up of the project's progress and partners' performance
- organisation of the next plenary meeting, scheduled to take place in Vienna (Austria) at end of September/early October 2015, hosted by partner AIT.
- Organization of the next project review to be held in Brussels (December 2015/January 2016)

### **Effort**

Total effort spent in the reporting period corresponds to 18 % of the total project effort. Table 3 below gives a breakdown of the effort spent per work package and per partner in the reporting period and in relation to the total effort in the DoW

Total effort spent since the beginning of the project corresponds to 51% of the total project effort, which is in line with the project timeline; Table 4 shows the effort spent per work package and per partner from the beginning of the project.



Table 3: Breakdown of the effort spent per work package and per partner in the reporting period

Workpackage	WP1		WP2		WP3		WP4		WP5		WP6		WP7		TOTAL per Beneficiary	
	ACTUAL	PLANNED	ACTUAL	PLANNED	ACTUAL	PLANNED	ACTUAL	PLANNED	ACTUAL	PLANNED	ACTUAL	PLANNED	ACTUAL	PLANNED	ACTUAL	PLANNED
<b>EFFORT SPENT PER WP AND PER PARTNER IN THE REPORTING PERIOD (1/11/2014 - 30/04/2015)</b>																
Beneficiary 1- CNR-IFC	2,10	12,20		9,00	0,20	0,00	0,40	1,00	0,60	1,00	0,80	6,00	0,95	3,00	5,05	32,20
Beneficiary 1- CNR-ISTI	0,10	0,50		1,00	5,80	22,50	3,00	17,00			1,00	8,00	0,10	0,50	10,00	49,50
<b>Beneficiary 1 - CNR</b>	<b>2,20</b>	<b>12,70</b>		<b>10,00</b>	<b>6,00</b>	<b>22,50</b>	<b>3,40</b>	<b>18,00</b>	<b>0,60</b>	<b>1,00</b>	<b>1,80</b>	<b>14,00</b>	<b>1,05</b>	<b>3,50</b>	<b>15,05</b>	<b>81,70</b>
Beneficiary 2 - UNUPI	0,42	2,00		1,00	0,68	2,00	7,63	34,00			0,87	8,00	0,30	1,20	9,90	48,20
Beneficiary 3 - MYSPHERA	0,12	1,50		1,00	14,75	41,00					1,96	12,00	0,63	3,00	17,46	58,50
Beneficiary 4 - AIT	0,10	1,50		1,00	2,03	17,00	1,20	10,00				4,00	0,44	2,00	3,77	35,50
Beneficiary 5 - UOC	0,22	1,50		5,00					3,73	12,00		11,00	1,78	7,60	5,73	37,10
Beneficiary 6 - Extra	0,02	1,50		7,00	0,15	2,00		2,00	0,35	3,00	0,15	14,00		1,50	0,67	31,00
Beneficiary 7 - IMA	0,16	2,50	0,04	1,00					11,98	30,00		6,00	0,46	3,00	12,64	42,50
Beneficiary 8 - DMU	0,29	1,50	0,05	1,00					5,54	29,00		8,00	0,34	1,50	6,22	41,00
Beneficiary 9 - AGE	0,22	1,80											1,02	12,30	1,24	14,10
Beneficiary 10 - SI4LIFE	0,17	1,00	1,00	12,00	0,20	2,00	0,10	2,00	2,75	8,00	1,70	29,00	0,13	1,50	6,05	55,50
Beneficiary 11 - Accord	0,28	1,50	0,88	4,00	0,51	1,00			1,20	2,00		7,00		1,50	2,87	17,00
<b>TOTAL</b>	<b>4,20</b>	<b>29,00</b>	<b>1,97</b>	<b>43,00</b>	<b>24,32</b>	<b>87,50</b>	<b>12,33</b>	<b>66,00</b>	<b>26,15</b>	<b>85,00</b>	<b>6,48</b>	<b>113,00</b>	<b>6,15</b>	<b>38,60</b>	<b>81,60</b>	<b>462,10</b>

Table 4: Effort spent from the beginning of the project

Workpackage	WP1		WP2		WP3		WP4		WP5		WP6		WP7		TOTAL per Beneficiary	
	ACTUAL	PLANNED	ACTUAL	PLANNED	ACTUAL	PLANNED	ACTUAL	PLANNED	ACTUAL	PLANNED	ACTUAL	PLANNED	ACTUAL	PLANNED	ACTUAL	PLANNED
<b>EFFORT SPENT PER WP AND PER PARTNER IN YEAR 1 (1/11/2012 - 31/10/2014)</b>																
Beneficiary 1- CNR-IFC	5,60	12,20	12,70	9,00	1,80	0,00	1,45	1,00	1,90	1,00		6,00	1,50	3,00	24,95	32,20
Beneficiary 1- CNR-ISTI	0,20	0,50	1,00	1,00	11,50	22,50	6,51	17,00				8,00		0,50	19,21	49,50
<b>Beneficiary 1 - CNR</b>	<b>5,80</b>	<b>12,70</b>	<b>13,70</b>	<b>10,00</b>	<b>13,30</b>	<b>22,50</b>	<b>7,96</b>	<b>18,00</b>	<b>1,90</b>	<b>1,00</b>	<b>0,00</b>	<b>14,00</b>	<b>1,50</b>	<b>3,50</b>	<b>44,16</b>	<b>81,70</b>
Beneficiary 2 - UNUPI	0,66	2,00	1,00	1,00	0,91	2,00	12,29	34,00				8,00	0,44	1,20	15,30	48,20
Beneficiary 3 - MYSPHERA	0,48	1,50	1,01	1,00	13,73	41,00						12,00	0,50	3,00	15,72	58,50
Beneficiary 4 - AIT	1,17	1,50	0,97	1,00	2,46	17,00	2,48	10,00				4,00	0,17	2,00	7,25	35,50
Beneficiary 5 - UOC	0,50	1,50	5,01	5,00					4,46	12,00		11,00	3,67	7,60	13,64	37,10
Beneficiary 6 - Extra	0,33	1,50	6,20	7,00	0,13	2,00		2,00		3,00		14,00		1,50	6,66	31,00
Beneficiary 7 - IMA	0,90	2,50	0,47	1,00					12,59	30,00		6,00	1,44	3,00	15,40	42,50
Beneficiary 8 - DMU	0,20	1,50	1,13	1,00					14,75	29,00		8,00	0,02	1,50	16,10	41,00
Beneficiary 9 - AGE	0,52	1,80											1,16	12,30	1,68	14,10
Beneficiary 10 - SI4LIFE	0,33	1,00	9,00	12,00	1,00	2,00	0,10	2,00	2,50	8,00		29,00	0,20	1,50	13,13	55,50
Beneficiary 11 - Accord	0,58	1,50	3,01	4,00	0,46	1,00			0,60	2,00		7,00	0,20	1,50	4,85	17,00
<b>TOTAL</b>	<b>11,47</b>	<b>29,00</b>	<b>41,50</b>	<b>43,00</b>	<b>31,99</b>	<b>87,50</b>	<b>22,83</b>	<b>66,00</b>	<b>36,80</b>	<b>85,00</b>	<b>0,00</b>	<b>113,00</b>	<b>9,30</b>	<b>38,60</b>	<b>153,89</b>	<b>462,10</b>

Figure 4 shows the effort spent from the beginning of the project (51%) in relation to the effort planned in the DoW per WP.

Submission of deliverable D2.3 at M17 has definitively closed WP2 activities with 101% of the planned effort used. Management (WP1) activities have absorbed 54% of the effort; WP5, WP4 and WP3 have used 74%, 53% and 64% respectively of the effort so far. WP6 has recently started and used 6% of effort. For WP7, dedicated to dissemination and exploitation activities, percentage is 40%.

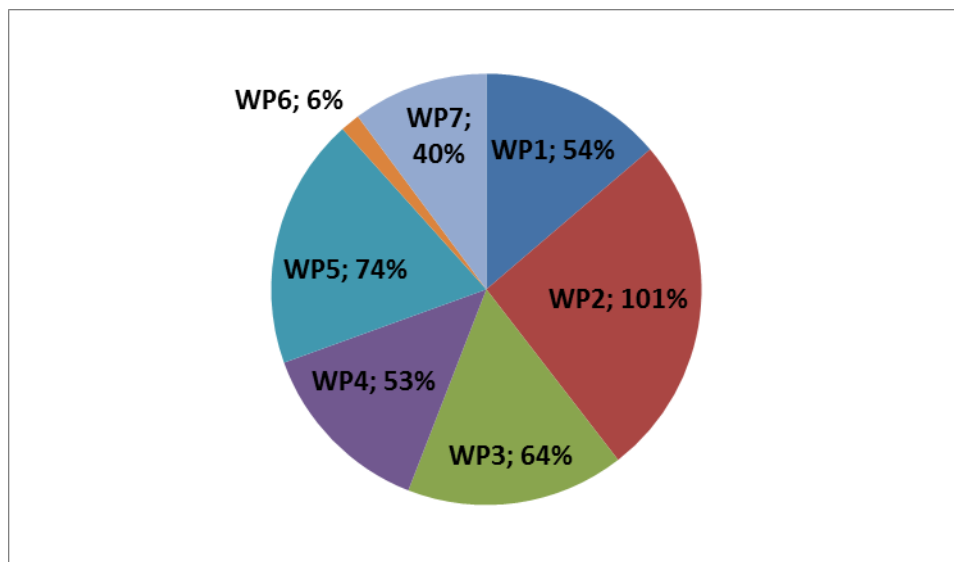


Figure 4: Effort spent per WP over DoW from M1 to M18

Effort spent per partner is consistent with work activities carried out from the beginning of the project. However, some partners reviewed the effort assigned in light of work performed to carry out project activities. Partners listed below claim more effort although they do not expect to receive more funding than their allocation.

WP2 activities were completed at M12, but after agreement with the Commission, the Consortium was allowed to postpone the submission of D2.3, under Task 2.3, at M17. A number of partners involved in the submission of this deliverable have therefore claimed some effort in Task 2.3 under the current period.

### P01 - CNR IFC

CNR participates in the project with two Institutes: CNR IFC and CNR ISTI. CNR effort in WP5 (1 PM) was erroneously allocated in the DoW to CNR ISTI instead of CNR IFC. In addition CNR IFC has claimed effort in the following Work Packages:

WP3: 0,20 PMs for the smart carpet development and collaboration with technical partners on this matter;

WP4: extra PMs allocated to process the necessary ethical committee application for the physical activity protocol and for performing the activity recognition together with partners CNR ISTI and UNIPI;

WP5: extra time was required to create a Video with an exercise science professor showing physical activities for the exergames. In addition, some of the researchers involved in WP5 activities retired, and were replaced by younger staff that had to be trained to take over these activities.

## P11 - ACCORD

Task 2.3 has taken a considerable bulk of Accord's time over the last months, which has led to Accord needing to go over the 1 person month allocated for this task. Accord has been actively participating in all discussions with the partners, as well as contributing to and reviewing all of the draft documentation, pertaining to the development of the of the validation plan and ethical review submissions. Accord's Head of Research and Intelligence was the main Reviewer for D2.3 for which there were 7 versions issued. Reviewing the draft and final documents, and participating in many discussions has taken up a great deal of time due to the sheer amount of detail and the many issues involved with the complex detail and planning for the field trials (validation). This work was absolutely essential in order to ensure that Accord has a viable research plan to take to the residents for recruitment, and one that is not only ethically and methodologically sound but one that is going to make running the field trials as feasible and successful as possible. Therefore ACCORD will move effort underuse from task 2.1 (now closed) to task 2.3.

### Costs

As shown in the figure below, total costs incurred by the consortium in the period under consideration (M12-M18) amounts to € 355.697 excluding indirect costs, which represents about 14% of the total project budgeted costs and 40% of the total project cost when cumulated with the first year. Breakdown of the costs shows that expenditure relates mainly to personnel costs (94%).

Table 5: Personnel and other major direct costs per partner incurred during the period

n.	Short name	Personnel costs	Other direct costs	Subcontracting Costs	Total costs
	CNR IFC	€ 21.720	€ 3.782	€ 920	€ 26.422
	CNR ISTI	€ 32.596	€ 1.200	€ 0	€ 33.796
1	<b>CNR</b>	<b>€ 54.316</b>	<b>€ 4.982</b>	<b>€ 920</b>	<b>€ 60.217</b>
2	<b>UNIFI</b>	€ 46.815	€ 1.660	€ 0	€ 48.475
3	<b>MYSHERA</b>	€ 40.808	€ 1.932	€ 0	€ 42.741
4	<b>AIT</b>	€ 37.339	€ 2.584	€ 0	€ 39.923
5	<b>UOC</b>	€ 31.567	€ 1.141	€ 0	€ 32.708
6	<b>Extra</b>	€ 4.900	€ 690	€ 0	€ 5.590
7	<b>IMA</b>	€ 52.196	€ 1.163	€ 0	€ 53.359
8	<b>DMU</b>	€ 23.652	€ 533	€ 0	€ 24.185
9	<b>AGE</b>	€ 6.560	€ 306	€ 0	€ 6.865
10	<b>SI4LIFE</b>	€ 21.684	€ 4.324	€ 0	€ 26.008
11	<b>Accord</b>	€ 15.491	€ 134	€ 0	€ 15.626
	<b>Total</b>	<b>€ 335.328</b>	<b>€ 19.449</b>	<b>€ 920</b>	<b>€ 355.697</b>

- Impact of possible deviations from the planned milestones and deliverables (if any)

Not applicable

- Changes of the legal status of any of the beneficiaries (if any)

No changes in the legal status of the partners occurred.

The Director of Partner 05 UOC has changed as of 13<sup>th</sup> November 2014: Antoni Cahner Monzo is now in charge and has replaced Mireira Armengol Almaraz.

- Development of the project website (if applicable)

The DOREMI project has established and operates its official website ([www.doremi-fp7.eu](http://www.doremi-fp7.eu)) since mid-April 2014 under the responsibility of the Coordinator, CNR IFC. The internal area can be accessed by the project members only, and operates as a web-based collaboration tool and repository, collecting all project materials and information so that they can be easily retrieved and downloaded by the partners. Additional functionalities may be implemented in the time-course of the project.

The website is constantly updated.

- Co-ordination activities during the period (communication between beneficiaries , possible co-operation with other projects/programmes)

DOREMI is outward-looking and welcomes expressions of interest in collaboration. Over the first 18 months of activity several contacts in terms of possible collaborations with other consortia took place.

1. Progress in the collaboration with NU-AGE, an FP7-KBBE funded project that seeks to demonstrate how, by dietary means, it could be possible to counteract and/or slow down the process of ageing, including decline of cognitive function, officially started in September 2014, took place. In particular DOREMI and NU-AGE are interacting to find common goals and links between the results of the NU-AGE trial (design a new food pyramid for those over 65 years old to meet the nutritional needs of the elderly; assess the influence of correct diet on inflammation, one factor in the development of age related diseases such as atherosclerosis, type 2 diabetes and neurodegeneration leading to cognitive decline) and the DOREMI pilot study that will start at the beginning of 2016 (WP6).
2. Following a contact of the DEPIDAC Data Pooling Taskforce, Prof. Parodi, in quality of coordinator and responsible for nutrition and sedentariness tasks in DOREMI, agreed in February 2015 to start a collaboration with the DEDIPAC KH project (Determinants of Diet and Physical Activity Knowledge Hub; [www.dedipac.eu](http://www.dedipac.eu), University of Limerick leader) that is currently developing a compendium of all European datasets and studies focusing on determinants of diet, physical activity and sedentary behaviour. The DOREMI pilot study dataset will be included in the European compendium of DEPIDAC.

The DOREMI coordinator has requested the Action Groups of EIP-AHA- A3 Nutrition- to join the Group on Area 1: *Screening and assessment of malnutrition as a risk factor for active and healthy aging*. CNR IFC is committed in the following tasks:

- 5.1 Objective: Manage frailty and functional decline through targeted intervention: Develop physical exercise training programs and physical activities tailored to older frail people and with functional decline.
- 5.1 Objective: Manage frailty and functional decline through targeted intervention: Develop nutritional and hydration plans, and cognitively, physically and intellectually stimulating social activities to improve independent daily living and mental wellbeing in target populations.
- 5.1 Objective: Manage frailty and functional decline through targeted intervention: Software programme and ICT devices for feeding and food related tasks.

CNR IFC is now engaged in activities of AG A3, through the nutritional and physical activity protocols developed in DOREMI project.

There are permanent discussions between all members of the Project Coordination Committee.

### 3. DELIVERABLES AND MILESTONES TABLES

#### 3.1 Deliverables

Table 6: List of deliverables

DELIVERABLES										
Del. no.	Deliverable name	Version	WP no.	Lead beneficiary	Nature	Diss. level <sup>1</sup>	Delivery date from Annex (Project month)	Actual/ Forecast delivery date	Status Not submitted / Submitted	Comments
D4.1	Data preparation and models assessment specification	Re-submitted after rejection	4	2	R	PP	8	20/02/2015	Submitted	<i>Re-submitted (The version submitted on 07/07/2014 was rejected by the Commission)</i>
D3.1	Specification of Wireless	Re-submitted	3	3	R	PU	9	20/02/2015	Submitted	<i>Re-submitted</i>

<sup>1</sup> **PU** = Public

**PP** = Restricted to other programme participants (including the Commission Services).

**RE** = Restricted to a group specified by the consortium (including the Commission Services).

**CO** = Confidential, only for members of the consortium (including the Commission Services).

**Make sure that you are using the correct following label when your project has classified deliverables.**

**EU restricted** = Classified with the mention of the classification level restricted "EU Restricted"

**EU confidential** = Classified with the mention of the classification level confidential " EU Confidential "

**EU secret** = Classified with the mention of the classification level secret "EU Secret "

	Sensor Network for LifeStyle Protocol implementation	after rejection									<i>(The version submitted on 31/07/2014 was rejected by the Commission)</i>
D7.5	Dissemination activities toolkit	1	7	5	O	PU	12	4/11/2014	Submitted		
D1.5.1	Quality and risk management report	1	1	1	R	CO	12	17/11/2014	Submitted		
D7.3.1	Updated Exploitation plan and business plan	1	7	5	R	CO	12	11/11/2014	Submitted		
D1.2.2	Annual Periodic Report (Period 1)	DRAFT	1	1	R	PU	12	5/12/2014	Submitted		<i>Submitted as draft</i>
D1.2.2	Annual Periodic Report (Period 1)	FINAL	1	1	R	PU	12	23/12/2014	Submitted		<i>Final version</i>
D7.3.1	Updated Exploitation plan and business plan	Re-submitted after rejection	7	5	R	CO	12	20/02/2015	Submitted		<i>Re-submitted (The version submitted on 11/11/2014 was rejected by the Commission)</i>
D2.3	Validation plan	DRAFT	2	5 UOC	R	PU	12	25/11/2014	Submitted		<i>Submitted as draft</i>
D2.3	Validation plan	FINAL	2	5 UOC	R	PU	12	31/03/2015	Submitted		<i>Final version (submitted as draft version on 25/11/2014)</i>
D5.2	Game-based active ageing environment	1	5	7	R	PP	14	06/02/2015	Submitted		
D3.2	Wireless Sensor Networks, Integration Middleware and System Configuration	1	3	1 CNR (IST)	P	PU	18	30/04/2015	Submitted		
D7.6	Dissemination activities report	1	7	1 CNR (IFC)	R	PU	18		Not Submitted		<i>To be submitted by the first week of May</i>

### 3.2 Milestones

Table 7: List of milestones

MILESTONES							
Milestone no.	Milestone name	Work package no	Lead beneficiary	Delivery date from Annex I	Achieved Yes/No	Actual / Forecast achievement date	Comments
MS4	Preliminary version of the WSN environment, Smart environment for Context awareness and gamified environment to kick off the living and virtual labs	WP3, WP4, WP5	1 CNR	Month 18	Almost achieved*	30/04/2015	<ul style="list-style-type: none"> <li>* -Middleware: finished.</li> <li>-Wristband: designs sent to manufacturer (production can take about 20 days).</li> <li>-Smart carpet: finished.</li> <li>-Environmental sensors: finished.</li> <li>-Auto-configuration tool: finished.</li> <li>-Smartphone gateway: finished.</li> <li>-DOREMI gateway: finished.</li> <li>-MYSPHERA backend – middleware integration: finished.</li> <li>-Indoor network: main beacon finished and wireless beacons debugging (estimated 2-3 weeks to be finished).</li> </ul>

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**END OF DOCUMENT**

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