# ELF@Home

## Elderly sELF-care based on sELF-check of health conditions and sELF-fitness at home

# D1.2b Yearly Project Report


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**Reviewer: John Waterworth (UMU)**


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|---|---|
| Deliverable nature: | Report (R) |
| Dissemination level: (Confidentiality) | Public (PU) |
| Contractual delivery date: | 2015/05/31 |
| Actual delivery date: | 2015/05/29 |
| Version: | 1.0 |
| Total number of pages: | 18 |
| Keywords: | elderly, health, activity, fitness, yearly report |

# Abstract

The ELF@Home project is a research and innovation project running from June 1st 2013 to May 31st 2016 and co-funded by the Ambient Assisted Living Joint Programme (AAL JP) and National Authorities in Spain, Sweden and Germany. The ELF@Home project relies on the use of the proven advantages of elderly fitness to develop a self-care solution based on self-check of health conditions and self-fitness at home. The project uses information and communication technologies (ICT) to build an autonomous fitness system targeting healthy or pre-frail elderly people aged over 65 and living independently at home.

All the activities carried out during the second year of execution of the ELF@Home project (from June 1st 2014 to May 31st 2015) are summarised in this report. The milestones achieved and the lists of tasks executed for each work package are described focusing on the general objectives of the project.

# Executive Summary

The ELF@Home project is a research and innovation project running from June 1st 2013 to May 31st 2016 and co-funded by the Ambient Assisted Living Joint Programme (AAL JP) and National Authorities in Spain, Sweden and Germany. The ELF@Home project relies on the use of the proven advantages of elderly fitness to develop a self-care solution based on self-check of health conditions and self-fitness at home. The project uses information and communication technologies (ICT) to build an autonomous fitness system targeting healthy or pre-frail elderly people aged over 65 and living independently at home.

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# Document Information

| | |
|---|---|
| **Acronym** | ELF@Home |
| **Full Title** | elderly sELF-care based on sELF-check of health conditions and sELF-fitness at home |
| **Project URL** | http://www.elfathome.eu/ |
| **Document URL** | http://elfathome.eu/results/public-deliverables |

| | | | | |
|---|---|---|---|---|
| **Deliverable** | **Number** | D1.2 | **Title** | Yearly project report |
| **Work Package** | **Number** | WP1 | **Title** | Project management |

| | | | | |
|---|---|---|---|---|
| **Date of Delivery** | **Contractual** | M24 | **Actual** | M24 |
| **Status** | version 1.0 | | final X | |
| **Nature** | prototype □ report X demonstrator □ other □ | | | |
| **Dissemination level** | public X restricted □ | | | |

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|---|---|---|---|---|
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| | |
|---|---|
| **Abstract (for dissemination)** | The ELF@Home project is a research and innovation project running from June 1st 2013 to May 31st 2016 and co-funded by the Ambient Assisted Living Joint Programme (AAL JP) and National Authorities in Spain, Sweden and Germany. The ELF@Home project relies on the use of the proven advantages of elderly fitness to develop a self-care solution based on self-check of health conditions and self-fitness at home. The project uses information and communication technologies (ICT) to build an autonomous fitness system targeting healthy or pre-frail elderly people aged over 65 and living independently at home.<br>All the activities carried out during the second year of execution of the ELF@Home project (from June 1st 2014 to May 31st 2015) are summarised in this report. The milestones achieved and the lists of tasks executed for each work package are described focusing on the general objectives of the project. |
| **Keywords** | elderly, health, activity, fitness, yearly report |

| **Version Log** | | | |
|---|---|---|---|
| **Issue Date** | **Rev. No.** | **Author** | **Change** |
| 2015/05/10 | 0.1 | Juan Luis Carús | First draft |
| 2015/05/12 | 0.2 | Sonia García | Content added |
| 2015/05/14 | 0.3 | Daniel Tantinger | Content about WP5 added |
| 2015/05/14 | 0.4 | Johan Olsson | Content about WP3 added |
| 2015/05/14 | 0.5 | Rainer Diebold | Content about WP3 added |
| 2015/05/14 | 0.6 | Juan Luis Carús | First final version |
| 2015/05/25 | 0.7 | John Waterworth | Review version |
| 2015/05/25 | 1.0 | Juan Luis Carús | Final version |

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# Abbreviations

**CMU:** Central Management Unit

**DoW:** Description of Work

**ICT:** Information and Communication Technologies

**WP:** Work Package

# 1 Introduction

This report covers the period from the month M13 (June 2014) to M24 (May 2015) of the lifetime of the project. Figure 1 shows the Gantt diagram of the project for the reported period. WP1, WP3, WP4, WP5 and WP6 have been executed during this period. WP3, WP4 and WP5 have just finished in this month M24 (May 2015). No milestones are included in this period according to the DoW.

| | | | | Y2 (2014) | | | | | | | Y3 (2015) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | J | J | A | S | O | N | D | J | F | M | A | M |
| ID | Title | Start | End | M13 | M14 | M15 | M16 | M17 | M18 | M19 | M20 | M21 | M22 | M23 | M24 |
| **WP1** | **Project management** | **1** | **36** | | | | | | | | | | | | |
| T1.1 | Technical and administrative assistance | 1 | 36 | | | | | | | | | | | | |
| T1.2 | Official meetings (consortium & AAL) | 1 | 36 | | | | | | | | | | | | |
| T1.3 | Coordination of technical and financial reports | 1 | 36 | | | | | | | | | | | | |
| T1.4 | Quality assurance and risk management | 1 | 36 | | | | | | | | | | | | |
| **WP3** | **Sensing platform** | **10** | **24** | | | | | | | | | | | | |
| T3.1 | Bio-medical sensors | 10 | 17 | | | | | | | | | | | | |
| T3.2 | Wearable activity sensor | 10 | 17 | | | | | | | | | | | | |
| T3.3 | Communication gateway | 18 | 21 | | | | | | | | | | | | |
| T3.4 | Early sensor tests | 22 | 24 | | | | | | | | | | | | |
| **WP4** | **Fitness box - TV interface and computer vision** | **10** | **24** | | | | | | | | | | | | |
| T4.1 | Motion and gesture recognizer | 10 | 15 | | | | | | | | | | | | |
| T4.2 | TV and voice interface | 13 | 18 | | | | | | | | | | | | |
| T4.3 | Fitness exercise engine | 16 | 21 | | | | | | | | | | | | |
| T4.4 | Fitness box hardware | 19 | 21 | | | | | | | | | | | | |
| T4.5 | Early tests | 22 | 24 | | | | | | | | | | | | |
| **WP5** | **Intelligent service platform** | **10** | **24** | | | | | | | | | | | | |
| T5.1 | Design and specification of the platform architecture | 10 | 14 | | | | | | | | | | | | |
| T5.2 | Implementation of the communication interfaces | 16 | 22 | | | | | | | | | | | | |
| T5.3 | Evaluation of the health status | 16 | 22 | | | | | | | | | | | | |
| T5,4 | Activity management and fitness plan | 16 | 22 | | | | | | | | | | | | |
| T5.5 | System integration and testing | 22 | 24 | | | | | | | | | | | | |
| **WP7** | **Dissemination, Exploitation and Business Plan** | **1** | **36** | | | | | | | | | | | | |
| T7.1 | Launch of the project web site | 1 | 3 | | | | | | | | | | | | |
| T7.2 | Diffusion and dissemination of project results | 6 | 36 | | | | | | | | | | | | |
| T7.3 | Development of business and exploitation plans | 13 | 36 | | | | | | | | | | | | |

**Figure 1. Gantt diagram from the reported period**

# 2 Work progress and achievements during the period

This section describes each work package executed during the reported period. The objectives, work and the deliverables are described for each work package focusing on the reported period. Table 1 shows the list of deliverables in the reported period. Every deliverable has been sent to the CMU on time and before the due date.

| Deliverable number | Deliverable name | Due date | Responsible partner | Delivery date |
|---|---|---|---|---|
| **D5.1** | Specification of the service platform | 2014/09/30 | IIS | 2015/09/29 |
| **D7.3a** | Business and exploitation plan v1 | 2014/11/30 | INNO | 2014/11/26 |
| **D5.2** | Intelligent sensor data knowledge base | 2015/03/31 | IIS | 2015/03/30 |
| **D3.3** | Bio-medical platform prototype | 2015/05/31 | CHE | 2015/05/29 |
| **D3.4** | Wearable activity sensor prototype | 2015/05/31 | 2DD | 2015/05/29 |
| **D3.5** | Early user tests report | 2015/05/31 | UMU | 2015/05/29 |
| **D4.2** | TV interface and computer vision prototype | 2015/05/31 | CTIC | 2015/05/29 |
| **D4.3** | Fitness box hardware specification and selection report | 2015/05/31 | IZER | 2015/05/29 |
| **D4.4** | Early user tests report | 2015/05/31 | UMU | 2015/05/29 |
| **D5.3** | Service platform prototype | 2015/05/31 | IIS | 2015/05/29 |
| **D5.4** | Service platform documentation | 2015/05/31 | IIS | 2015/05/29 |
| **D1.2b** | Yearly project report v2 | 2015/05/31 | CTIC | 2015/05/29 |
| **D7.2b** | Scientific and technical contributions in conferences and seminars v2 | 2015/05/31 | INNO | 2015/05/29 |

**Table 1. List of deliverables from the reported period**

## 2.1 WP1 – Project management

Table 2 shows the summary of WP1 according to the DoW for the reported period. This WP extends from the start to the end of the project. It is executed throughout the lifetime of the project to control and guarantee the quality of the work.

| | | | |
|---|---|---|---|
| **WP number** | **1** | **WP duration:** | *M1 – M36* |
| **WP title** | **Project Management** | | |
| **Activity type** | *Management* | | |
| **Leader** | **CTIC** | | |
| **Participants** | **CTIC, IZER, SGGPA, UMU, CHE, SKO, IIS, INNO, 2DD** | | |
| **Objectives of the WP**<br>This work package is about the management and co-ordination activities of the project. It will be running all along the project lifetime. Its main objective is to ensure a successful completion of the project goals on time, within budget and with quality standards adequate for European Projects. This general objective is comprised of the following more specific ones:<br>• Detailed project planning, monitoring and reporting | | | |

| |
|---|
| • Definition and implementation of the communication procedures to be followed within the project and with external agents.<br>• Scheduling and organising project meetings |
| **Description of work**<br>Task 1.1. Technical and administrative assistance: Financial control, formal revision and submission to the AAL of progress reports, supervising and informing all participants about the project, day to day assistance to the overall Project Management.<br><br>Task 1.2. Consortium meetings: Arrangement of required resources for project meetings and teleconferences.<br><br>Task 1.3. Coordination of technical and financial reports (progress and final reports): Preparing and managing, with the support of the members of the project, the reports, documents and project results and in particular documents required by the AAL or its representatives.<br><br>Task 1.4. Quality assurance and risk management: Quality control on development and implementations by constantly contrasting results with project specifications. Recovery activities. Project failures have been considered in the Risk Management tables<br><br>**Role of partners:**<br>• All partners: All partners are involved in the management and project monitoring |
| **Deliverables of the WP:**<br>• D1.1. Project Handbook (M3)<br>• D1.2a Yearly Project Report (M12) |

**Table 2. Summary of "WP1 – Project management"**

During the reported period the coordinating person changed on 2014/10/22 from Rodrigo García to Juan Luis Carús. The contact persons of the project are now Juan Luis Carús and Sonia García.

The partner Explizit (EXP) filed for bankruptcy during the second half of 2014. CheckUp AB (CHE) has replaced Explizit in the consortium. This change was communicated on 02/12/2014 to the CMU and NCPs. The consortium agreement and the DoW of the project were amended and sent on 09/01/2015 to make the change official at consortium level.

The third consortium meeting of the project was hosted by CTIC on the 17th and 18th of December in Gijón (Spain). During this meeting, the mid-term review was held. A representative person from each partner attended to this meeting.

The consortium meeting was held on the 17th of December. The objective of this meeting was to discuss all the pending issues related to the WP3, WP4 and WP5 work and make the rehearsal of the mid-term review. During this meeting, a Spanish workshop of the ELF@Home project was organized and the first version of the prototype was discussed.

The mid-term review was held on the 18th December at 09:00. Norma Zanetti and Altamiro Costa-Pereira were the reviewers with Jerome de Barros as CMU representative. No NCP representatives were present in the meeting. The assessment was "very good progress". A Mid-term review action was designed in response to the suggestions and recommendations of the Mid-term project review report.


**Figure 2. Picture taken during the third consortium meeting**

| Name | Partner | Contact |
|---|---|---|
| Juan Luis Carús | CTIC | juanluis.carus@fundacionctic.org |
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| Daniel Tantinger | IIS | daniel.tantinger@iis.fraunhofer.de |
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**Table 3. List of attendants to the third consortium meeting**


**Figure 3. Picture taken during the mid-term review**

| Name | Partner | Contact |
|---|---|---|
| Juan Luis Carús | CTIC | juanluis.carus@fundacionctic.org |
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**Table 4. List of attendants to the mid-term review**

During the reported period, twenty-two teleconferences have been held by the consortium to discuss all issues related to the project (see dates on Table 5). CTIC, as coordinator, managed all the follow-up meetings sending reminders to all the partners, designing the agenda, taking minutes and sending the minutes after the meeting to the general mailing list.

| | Date | | Date |
|---|---|---|---|
| **1** | 2014/06/04 | **12** | 2014/12/11 |

| | | | |
|---|---|---|---|
| **2** | 2014/06/18 | **13** | 2015/01/15 |
| **3** | 2014/07/09 | **14** | 2015/01/29 |
| **4** | 2014/08/06 | **15** | 2015/02/12 |
| **5** | 2014/09/04 | **16** | 2015/02/26 |
| **6** | 2014/09/23 | **17** | 2015/03/12 |
| **7** | 2014/10/07 | **18** | 2015/03/26 |
| **8** | 2014/10/21 | **19** | 2015/04/16 |
| **9** | 2014/11/04 | **20** | 2015/04/30 |
| **10** | 2014/11/19 | **21** | 2015/05/13 |
| **11** | 2014/12/02 | **22** | 2015/05/27 |

**Table 5. Follow-up meeting held by teleconference**

The mid-term review questionnaire was sent to the CMU on 02/12/2014 and the annual progress report was sent to the CMU on 2015/02/25 by CTIC with all the technical and financial information gathered from all the partners involved in the project.

## 2.2 WP3 – Sensing platform

Table 6 shows the summary of WP3 which started on January 2014 and will finish in May 2015.

During the reporting period, CHE provided the first kit to be tested with end-users in accordance with the requirements described in D2.1 (Task 3.4). After user tests, CHE has continuously implementing changes in the Communication Library to improve the usability of the sensor's use. According to comments given during the mid-term review, CHE has decided to implement the standardized communication protocol for medical instruments known as the "continua protocol". This implementation will allow the addition of new instruments in the market. In addition to the initial list of sensors, the sensing platform has been designed to add a glucose meter if it is required.

In parallel with CHE's work, 2DD has finalized the second prototype of the Activity Sensor (AS) during the reporting period. The AS is now able to record and check the parameters of outdoor activities. The communication with the Fitness Box is ready to implement the "continua protocol" suggested by CHE.

| | | | |
|---|---|---|---|
| **WP number** | **3** | **WP duration:** | *M10 – M24* |
| **WP title** | **Sensing platform** | | |
| **Leader** | **CHE** | | |
| **Participants** | **CHE, SGGPA, UMU, SKO, 2DD** | | |
| **Objectives of the WP**<br>The objective of this workpackage is the design and development of the health related sensors needed to acquire a health profile of the end-users. Two types of sensors are needed: general bio-medical sensors (weight scales, blood pressure sensors, pulse oximeters, heart rate sensors, etc.) and a wearable activity sensor. The approach for the biomedical sensors will be the integration and/or adaptation of existing commercial devices (CHE) while the wearable activity sensor will be completely designed and developed from scratch (2DD). Both types of devices will be integrated with a communication platform able to send the data to the intelligent service platform (WP5). | | | |
| **Description of work**<br>Task 3.1. Bio-medical sensors: CHE in collaboration this SGGPA will determine the set of medical sensors necessary to acquire end-user health status and to personalize fitness exercises. CHE will develop and/or | | | |

integrate the necessary sensors.

Task 3.2. Wearable activity sensor: 2DD will design and develop the wearable activity sensor based on the usability requirements of the end-users and the requirements of the intelligent platform system (WP5). This activity sensor will be based on accelerometers and its design will have into account usability restrictions such as size or battery maintenance.

Task 3.3. Communication gateway: In order to send the data acquired by the sensors to the intelligent service platform 2DD and EXP will design and develop a communication gateway. This gateway will work completely autonomous in order to simply user intervention. To simplify installation the gateway will support mobile internet access.

Task 3.4. Early sensor tests: Early prototypes will be presented to end-users in order to assure requirements fulfilment.

**Role of partners:**

- CHE: work-package coordination
- CHE: T3.1, T3.3, T3.4
- 2DD: T3.2, T3.3, T3.4
- SGGPA, SKO and UMU will take part in requirements gathering and early tests.

**Deliverables of the WP:**

- D3.3. Bio-medical platform prototype (M24)
- D3.4. Wearable activity sensor prototype (M24)
- D3.5. Early user tests report (M24)

**Table 6. Summary of "WP3 – Sensing platform" for the reported period**

## 2.3 WP4 – Fitness box – TV interface and computer vision

Table 7 shows the summary of the WP4 started in March 2014 and that will finish in May 2015.

During the reporting period, CTIC implemented the ELF@Home TV application (Task 4.2) that will be run on the fitness-box, using the TV interface design that had been done with the collaboration of INNO and UMU. In addition, CTIC developed a fitness exercise engine (Task 4.3) based on the findings of the motion and gesture recogniser (Task 4.1) that is able to recognise the execution of the indoor exercises that will be supported by the solution. This fitness exercise engine has been included in the TV application in order to provide a complete exercise monitoring platform.

As the implementation of the application was progressing, different prototypes were sent to UMU, who tested them with the end-users to find errors or improvements that should be made (Task 4.5).

Finally, all the requisites of the different components that will be connected to the fitness-box were used to define which hardware platform should be used for the fitness-box (Task 4.4).

| WP number | 4 | WP duration: | *M10 – M24* |
|---|---|---|---|
| **WP title** | **Fitness Box - TV interface and computer vision** | | |
| **Leader** | **CTIC** | | |
| **Participants** | **CTIC, IZER, SGGPA, UMU, SKO, INNO** | | |

**Objectives of the WP**

The main interface to the end-user will be a TV-based application that will be controlled using natural interaction modes (speech and gestures). The interface will guide end-users through the use of biomedical sensors and will also work as a fitness assistant. The fitness assistant will show to the end users the exercises to do and will check the execution of them. This component will be based in computer vision techniques and the special attention will be paid to elderly requirements.

**Description of work**

Task 4.1. Motion and gesture recognizer: The objective of this task is to design a computer vision module able to recognize user movements and to identify gestures. The gesture recognition will be used as the main interaction channel of the system with the user. The recognizer will be able to identify complete body movements and the position of arms and legs in order to check fitness exercise execution. Different computer vision techniques will be applied and the necessary algorithms will be developed.

Task 4.2. TV and voice interface: The objective of this task is to design a usable and useful user interface based on a TV screen. This interface will guide the user in the use of the biomedical sensors and will present the fitness exercises. Special attention will be paid to usability and accessibility questions as well as to the metaphor of the user interface. In addition to the gesture based control this task will research the inclusion of voice interaction.

Task 4.3. Fitness exercises engine: This module will receive the fitness program from the intelligent service platform and present it to the user while checking exercise execution with the motion and gesture recognizer.

Task 4.4. Fitness box hardware: The objective of this task is to integrate all the components developed in previous tasks in a hardware device. It is expected to use a commodity PC for this purpose.

Task 4.5. Early tests: Early prototypes will be presented to end-users in order to ensure requirements fulfilment.

**Role of partners:**

- CTIC: work-package coordination and technical research and development in T4.1, T4.2 and T4.3.
- IZER: T4.2 and T4.4
- INNO, SGGPA, UMU: T4.5

**Deliverables of the WP:**

- D4.2. TV interface and computer vision prototype (M24)
- D4.3. Fitness box hardware specification and selection report (M24)
- D4.4. Early tests report (M24)

**Table 7. Summary of "WP4 – Fitness box, TV interface and computer vision" for the reported period**

## 2.4 WP5 – Intelligent service platform

The tasks and work defined in WP5 for the reported period can be seen in Table 8. This work package started in March 2014 and ran until the end of May 2015.

By the end of August 2014 the design and specification of the intelligent service platform was finalized with the deliverable D5.1: "Specification of the service platform" (Task 5.1). During the next months all the technical components were implemented by the technical partners: IZER and IIS. Within task 5.2 the communication interface was realized, which contains the web server and the corresponding integration services. Furthermore, the database was set up with regards to the scheme defined in D5.1. In order to administrate all the exercises a web-based caregiver interface was realized.

The evaluation of the health status and the calculation of the indoor and outdoor fitness plans (Task 5.3 and 5.4) were done in parallel. This work was based on the input from the medical experts from SGGPA and the outcome of the requirements analysis done in work package WP2. Besides this, the classification of the outdoor activities was implemented and the algorithms ported on the microcontroller of the activity sensor developed by 2DD within work package WP3. The functionalities of this component were described in the deliverable D5.2: "Intelligent sensor data knowledge base" which was delivered by the end of March 2015.

The last two months of WP5 were used to integrate, test and optimize all the above mentioned components into the so-called Intelligent Service Platform (Task 5.5).

| **WP number** | **5** | **WP duration:** | *M10 – M24* |
|---|---|---|---|
| **WP title** | **Intelligent service platform** | | |
| **Leader** | **IIS** | | |
| **Participants** | **IIS, IZER, SGGPA, CHE, 2DD** | | |
| **Objectives of the WP**<br>The objective of this work package for the reported period is to design and specify a service platform which is able to receive and to evaluate the information coming from all the sensor devices. Based on the gathered sensor data sophisticated knowledge-based methods should be developed to generate personalized fitness plans according to end-user's health status. | | | |
| **Description of work**<br>Task 5.1. Design and specification of the platform architecture: In cooperation with the relevant partners IIS will determine the specification and design of the service platform in order to generate fitness plans according to the end-users health status and activity profile.<br><br>Task 5.2. Implementation of the communication interfaces: The objective of this task is to implement the interface between the intelligent service platform and the sensing platform (WP3), as well as the interface between the service platform and the Fitness Box (WP4). Assessment of several communication standards (e.g. ISO/IEEE 11073, etc.) will ensure a secure and standardized communication of the vital sings.<br><br>Task 5.3. Evaluation of the health status: The objective of this task is to establish a knowledge base in order to generate a meaningful health status of the end-user. This will be the basis for the generation of the personalized fitness plans performed in T5.4 and on the direct user feedback gathered from the TV interface (WP4).<br><br>Task 5.4. Activity management and fitness plan: Based on the input sensorial input from the sensing platform, the activity management will utilise historical data of user's activity profile from the long and the recent past. This indicator will be mostly combined with the user's physical signals (vital parameters) from WP3, to provide a reliable predication. Based on the health status (T5.3) and the activity profile the system generates individual fitness plans for the end-user according to the user's profile.<br><br>Task 5.5 System integration and testing: Early prototypes will be produced in order to assure requirements fulfilment and improvement based on iterative testing.<br><br>**Role of partners:**<br>• IIS: Work package coordination, T5.2, T5.3, T5.4<br>• IZER: T5.2, T5.5<br>• SGGPA: T5.4<br>• Sensors providers (2DD, EXP): T5.2,<br>• All work package partners will be involved in T5.1 | | | |

**Table 8. Summary of "WP5 – Intelligent service platform" for the reported period**

## 2.5 WP7 – Dissemination and exploitation

Table 9 shows the summary of WP7 according to the DoW for the reported period. WP7 spans from the start to the end of the project and it is executed during all the lifetime of the project to disseminate all the results of the project and develop a useful business plan.

The webpage of the project was used during the reported period to upload news about the project and all the public deliverables. All the dissemination and exploitation activities of the first project year are reported and described in detail in the public deliverable D7.2b.

The first version of the Business and Exploitation Plan (D7.3a) was released on 2014/11/30. This document will be improved during this year according to the expert's guidelines given during the mid-term review and the recommendation from the AAL2Business Alliance. During the fourth consortium meeting (on June 2015) an AAL2Business workshop will be held.

| **WP number** | **7** | **WP duration:** | *M1 – M36* |
|---|---|---|---|
| **WP title** | **Dissemination and exploitation** | | |
| **Leader** | **INNO** | | |
| **Participants** | **INNO, CTIC, IZER, SGGPA, UMU, CHE, SKO, IIS, 2DD** | | |
| **Objectives of the WP**<br>The objectives of this work package are:<br>• To coordinate and carry out dissemination of project results. The aim is to promote and empower the dissemination, transfer, assessment and adoption of the project results to the target audience and stakeholders.<br>• Development of the business plan. The plan will cover key product achievements as well as the identification of target markets and potential target customers for the partners. The aim is to maximise project impact and exploitation opportunities. | | | |
| **Description of work**<br>Task 7.2. Diffusion and dissemination of project results: This task will define a dissemination and diffusion plan with conferences, seminars and events in order to send scientific and technical contributions.<br>Task 7.3. Development of business and exploitation plans: Development of the business plan specifying the customers to be addressed and the service model to be implemented mainly by consortium business members.<br>**Role of partners:**<br>• INNO: Work package coordination<br>• IZER, EXP, 2DD, INNO: Business and exploitation plans (T7.3)<br>• CTIC, UMU, IIS: Diffusion and dissemination of results (T7.2)<br>• SKO: Contribution to business plan as a public administration (T7.3) | | | |
| **Deliverables of the WP:**<br>• D7.1. Web page of the project. (M3)<br>• D7.2. Scientific and technical contributions in conferences and seminars (M12) | | | |

**Table 9. Summary of "WP7 – Dissemination and exploitation" for the reported period**

# 3 Conclusions

This yearly report describes all the work carried out during the second year of the ELF@Home project (from 1st June 2014 to 31st May 2015).

The project is progressing in line with the valid description of the work sent to the CMU on 2013/08/16 and amended on 2015/01/09 with the change of partner from EXP to CHE.