Connected Care for Elderly Persons Suffering from Dementia

Draft D1.3. Guidance Document Summarising User Requirements and Potential Barriers

Classification: internal

Abstract

The product(s) developed will support people suffering from dementia in the first and second stages of the disease (D1 – D2). Other stakeholders who will also benefit from this product will include the relatives / social network of the people suffering from dementia, as well as their professional caretakers. One of the main products will be a dementia diary where people with dementia and their caretakers can enter new reminders, modify existing reminders, and receive reminders via the actual system. For more information on this product see section 8.1.

History of changes

Date	*Version*	*Editor*	*Change description*
2010-03-02	0.0.0	A. Groß, S. Heß (IESE)	Draft Version of document structure
2010-03-21	0.0.1	I. John, M. Eisenbarth	Initial examples for specification template
2010-04-20	0.0.2	L.Sorokin	Outline restructured, requirements engineering process description included
2010-06-03	0.0.3	L.Sorokin	Outline restructured, Templates added, placeholders for contributions from CCE partners added
2010-06-11	0.0.4	A.Garay	Added personas and scenarios from partners
2010-06-15	0.0.5	A.Garay	Added contributions from UID, MedCom, IESE, and Philips
2010-06-16	0.0.6	A.Garay	Added contributions from IGD, Philips, Medcom, and UK partners
2010-06-21	0.0.7	A.Garay	Added contributions from Hungary
2010-06-22	0.0.8	A.Garay	Added additional contribution from Philips
2010-06-24	0.0.9	A.Garay	Added additional contribution from UK

Table of contents

INTRODUCTION 9
1.1. Motivation 9
1.2. Overview Requirements related documents and differentiation to other Deliverables 9
2. CCE REQUIREMENTS ENGINEERING PROCESS 10
2.1. CCE RE Process 10
2.1.1. Terminology 10
2.1.2. Quality of Requirements 10
2.2. CCE RE Process for User Requirements 10
Chosen methods for the user study 11
Observational study with people suffering from dementia 12
Individual interviews with people suffering from dementia 12
Focus groups with relatives and professional caretakers 12
2.3. CCE RE Documentation for User Requirements 12
2.3.1. General Artefacts 12
2.3.2. Requirement Documentation per Product 12
2.3.3. Persona Template 13
2.3.4. Scenario Template 13
2.3.5. Use Case Template 15
2.3.5.1. Receive information that medication is missing (Sample) 16
3. AS-IS SITUATION 17
3.1. Dementia 17
3.2. As-is Situation in Germany 17
3.2.1. Initial Stakeholder Analysis 17
3.2.1.1. Patient User Group 17
3.2.1.2. Guardian / Caring person User Group 19
3.2.2. Problem Scenarios 20
3.2.2.1. Problem Scenario: Remembering Non-Periodic Situations 21
3.2.2.2. Problem Scenario: Mental Training 22
3.2.2.3. Problem Scenario: Caring person wants more security 23
3.2.2.4. Problem Scenario: Access to doors and hazardous substances 24
3.2.2.5. Problem Scenario: Patient leaves home 24
3.2.2.6. Problem Scenario: Daily schedule 1 26
3.2.2.7. Problem Scenario: Daily schedule 2 27
3.2.2.8. Problem Scenario: Medication reminder 1: Overdose 28
3.2.2.9. Problem Scenario: Medication reminder 2: Medicine Chaos 29
4. USER NEEDS 31
4.1. User needs as elicited in Germany 31
4.1.1. Source 31
4.1.2. List of User Needs: Dementia Sufferers 31
4.1.3. List of Problem Fields: Dementia Sufferers 31
4.1.4. List of Fears: Dementia Sufferers 32
4.1.5. List of User Needs: Dementia Sufferers as seen by Family Members and Professional Caretakers 32

4.1.6. List of User Needs: Family Members 32
4.1.7. List of User Needs: Professional Caretakers 33
4.2. User needs as elicited in UK 33
4.2.1. Source 33
4.2.2. List of User Needs 34

5. PERSONAS 39

5.1.1. Patients 39

6. PRODUCT IDEAS 43

6.1. Dementia Diary 43
6.2. Biography 44
6.3. Daily Reminder 46
6.4. Activity 48
6.5. Medication Dispenser 49

7. SELECTION OF PRODUCT IDEAS 51

7.1. Selection Criteria 51
7.2. Selection Process 51
7.3. Result 52
7.3.1 Desirability 52
7.3.4 Selected Products 56

8. CCE PRODUCTS 58

8.1. Dementia Diary 58
8.1.1. Scenario 58
8.1.2. Use Cases 59
8.1.2.1. Enter Activity 60
8.1.2.2. Confirm Activity 61
8.1.2.3. Check Activity 62
8.1.2.4. Leave Message 63
8.1.2.5. Create Report 64
8.2. Biography 65
8.2.1. Scenario 65
8.2.2. Use Cases 66
8.2.2.1. Digitize Material 66
8.2.2.2. Sequence Material 66
8.2.2.3. Prepare Memory Game 67
8.2.2.4. Prepare Quiz Game 68
8.2.2.5. Play Memory Game 69
8.2.2.6. Play Quiz Game 70
8.2.2.7. Start Reminiscence Session 70
8.2.2.8. Select Media 71
8.2.2.9. Mark Session Event 72
8.2.2.10. Annotate Session Event 72
8.2.2.11. Close/End Session 73
8.3. Medication Dispenser 74
8.3.1. Scenario 74
8.3.2. Use Cases 75
8.3.2.1. Remember To Take Medication 75
8.3.2.2. Overdose Prevention 76

8.3.2.3. Medication Adherence Control & Medication Chaos Prevention 77
8.3.2.4. Alarm Caused By Non Medication Adherence 79
8.4. Digital Corkboard 80

9. POTENTIAL BARRIERS 83

9.1. Risklist 83
9.2. Barriers as indicated by dementia experts in the Netherlands 84
General 84
Dementia diary 85
Biography 86
Medication dispenser 87
9.3. Ethical Aspects 88
9.4. Description of Technology available from CCE Partners 88
9.4.1. Description of Technology available from CCE Partners in Germany ... 88
The Living Room 90
The Kitchen 90
The Bedroom 91
Hardware infrastructure 91
9.4.2. Description of Technology available from CCE Partners in Hungary ... 92
Plogg devices 93
Prototype wireless sensors 94
Home gateways 94
Virtual Private Network technology 94
Prototype WEB based system management infrastructure 95
Prototype WEB based data collection and presentation portal 95
Complex data analyses and alarm algorithms 95
Innomed Home ECG Tele Measuring Head 96
9.4.3. Description of Technology available from CCE Partners in the Netherlands 96
Challenges in the context of CCE 97
9.4.4. Description of Technology available from CCE Partners in UK 98

10. CONCLUSION 100

11. GLOSSARY AND ABBREVIATIONS 101

12. BIBLIOGRAPHY 102

13. ATTACHMENTS: RESULTS FROM USER STUDIES 103

13.1. *NEEDS OF DEMENTIA SUFFERERS (RESULTS FROM SINGLE INTERVIEWS)* 103

***13.2. NEEDS OF DEMENTIASSUFFERERS AS SEEN BY FAMILY MEMBERS AND CARETAKERS (RESULTS FROM FOCUS GROUPS WITH FAMILY MEMBERS AND PROFESSIONAL CARETAKERS)* 104**

***13.3. NEEDS OF FAMILY MEMBERS (RESULTS FROM FOCUS GROUPS WITH FAMILY MEMBERS)* 105**

***13.4. NEEDS OF PROFESSIONAL CARETAKERS (RESULTS FROM FOCUS GROUPS WITH PROFESSIONAL CARETAKERS)* 106**

***13.5. PROBLEM FIELDS AS SEEN BY EXPERT GROUP (MAIN TOPICS MARKED RED)* 107**

List of figures

Figure 1 - Software Quality According to ISO9126 10

Figure 2 - Use Case Diagram for the Dementia Diary 45

Figure 3 - States for activities 46

Figure 4 - Mock up of cork board produced by Centrihealth for suffers of early stage of Alzheimer ... 76

Figure 5 - Floormap of the AAL-Lab at the Fraunhofer IESE 84

Figure 6 - Fraunhofer IGD AAL Laboratory 85

Figure 7 - System Architechture 88

Figure 8 - NetTV showing portals to websites designed in CE-HTML 92

Figure 9 - Philips NetTV CCE service infrastructure 92

List of tables

Table 1: Use Case Template....15

Table 2: Sample Use Case 15

Table 3: Desirability of CCE products as assessed by experts....50

Table 4: Feasibility of CCE products as assessed by experts....**Error! Bookmark not defined.** 51

Table 5: Viability of CCE products as assessed by experts....53

Table 6: Dementia Diary: Enter Activity Use Case ....**Error! Bookmark not defined.**57

Table 7: Dementia Diary: Confirm Activity Use Case 58

Table 8: Dementia Diary: Check Activity Use Case....59

Table 9: Dementia Diary: Leave Message Use Case....60

Table 10: Dementia Diary: Create Report Use Case....61

Table 11: Biography: Digitize Material Use Case....62

Table 12: Biography: Sequence Material Use Case....63

Table 13: Biography: Prepare Memory Game Use Case....64

Table 14: Biography: Prepare Quiz Game Use Case....64

Table 15: Biography: Play Memory Game Use Case....65

Table 16: Biography: Play Quiz Game Use Case....66

Table 17: Biography: Start Reminiscence Session Use Case....67

Table 18: Biography: Select Media Use Case....67

Table 19: Biography: Mark Session Event Use Case....68

Table 20: Biography: Annotate Session Event Use Case....69

Table 21: Biography: Close/End Session Use Case....69

Table 22: Medication Dispenser: Remember To Take Medication Use Case 70

Table 23: Medication Dispenser: Overdose Prevention Use Case....72

Table 24: Medication Dispenser: Medication Adherence Control & Medication Chaos Prevention Use Case....73

Table 25: Medication Dispenser: Alarm Caused By Non Medication Adherence Use Case 74

Table 26: Assisted Living Dementia Corkboard Use Case 76

Table 27: Summaries technology available from UK to develop an electronic cork board for sufferers of early stage of dementia....94

Introduction

1.1. Motivation

The goal of the CCE project is to deliver connected ICT-based assistive living solutions for the elderly, particularly those people suffering from dementia, building on initiatives at the national level while taking account of the different funding mechanisms in EU member states (Social insurance-based; Germany and Hungary, private insurance-based; Netherlands and taxation-based; UK), to develop and assess business models to support the mainstream provision of assistive solutions.

This work package focuses primarily on identifying user requirements for sufferers of dementia, their caretakers, and healthcare professionals in different member states (drawing on national groups) to ensure that the development of mainstream assistive technologies for elderly people is orientated towards the needs and lifestyles of users, and to gain an awareness of barriers to use.

1.2. Overview Requirements related documents and differentiation to other Deliverables

This deliverable can be described as a set of individual health-based scenarios and care models identified by clients for their future needs in interfacing with external services and to control and remain independent within the home will be defined based on feedback from national user groups and input of available and emerging technologies from participating technology providers.

In this document we want to summarize our work from the last months and show how we can address the user needs of persons with dementia with technological solutions. We will describe the requirements engineering process we followed and the templates we used. Then we will describe the as-is situation in the different countries by means of problem scenarios and examples. In chapter 4 we will describe the user needs as elicited from our potential users in the different countries. In section 5 we describe the personas that we use in section 6 to present the product ideas. In chapter 7 we describe which product ideas we selected and then we specify the selected CCE products with more concrete use cases and scenarios. We also look at potential barriers, including project risks and technical constraints.

Deliverable 1.3. focuses on the selection of products and on the functionality of the products. In contrast to this, deliverable 2.1. and 2.2. focus on non-functional aspects like performance and on connection aspects.

2. CCE Requirements Engineering Process

2.1. CCE RE Process

2.1.1. Terminology

-> see Glossary

2.1.2. Quality of Requirements

Quality of requirements is addressed in quality standards like ISO9126. The International Organization for Standardization (ISO) classifies the Non-functional Requirements by building a Software Quality tree as Figure 1 shows. Typically, non-functional are expressed on each of the leaf attributes of the quality trees. For example, the attribute time behavior, which is a sub-attribute of efficiency, is further refined into sub-attributes, one typical is response time. When expressing an NFR, one constraint this quality attribute by stating a value or value domain for the quality attribute, e.g. “The response time for system feature X shall be below 2 seconds”.

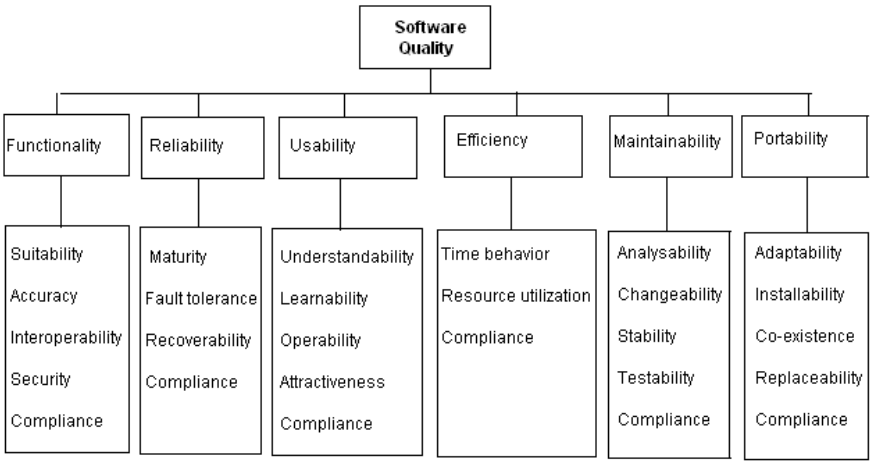


Figure 1: Software Quality According to ISO9126

In the CCE contexts, principally all qualities are important but we see usability, reliability and functionality the top qualities to be addressed in order to cope with the problems that the users with dementia might have.

Additionally we have to address the documentation quality of the requirements documentation (Unambiguity, Understandability).

We will analyze the impact of the qualities on the use cases and on our further development in deliverable 2.1.

2.2. CCE RE Process for User Requirements

User Requirements are all requirements that are elicited directly or indirectly from the users; they can relate to:

- Efficiency
- Functionality
- Maintainability

- Portability
- Reliability
- Security
- Usability and Desirability

There are several methods for the elicitation and specification of user requirements.

UID Design Process

When designing user-friendly products, attention is paid right from the start to individual requirements, to the environment of use, as well as to the tasks and goals of the users. The user-centered design process systematizes the whole process. Based on the User Interface Engineering Model, all phases of user-centered design include the future users in the process.

Analyzing the context of use
In this phase, information on the users is collected including their individual requirements, their tasks and goals and their typical environment of use. Based on the subsequent formulation of use scenarios, the requirements which the interactive system is supposed to meet are defined.

Designing a concept of use
In this phase, requirements become solutions. Based on use scenarios, interaction and design concepts are developed.

Experiencing an interactive product
The interaction and design solutions are made perceivable by early visualization and implementation in a prototype. The prototype is growing from first rough sketches to the detailed preliminary versions of the final product.

Evaluation
The developed interactive and design solutions are continuously evaluated to find out whether they meet the requirements defined before. Both experts and representative users can be involved in these evaluations. Evaluations are performed continuously or at specific stages in the development process.

Why Scenario-Based Design (SBD)?
SBD is an illustrative form of documentation. Relevant personas and scenarios of the most important use cases are used for creating ideas and concepts, and validating ideas, concepts and products via user studies. (Personas are the source of information for defining participant characteristics and scenarios are used to define the tasks of usability tests).

Chosen methods for the user study

Study features were adapted for our particular sample based on the results of the literature review and the interviews with the experts. The three methods used in our study are described below.

Observational study with people suffering from dementia

Observational studies are appropriate when the user group is unable or only partially able to formulate their concerns (Rupp, 2009). Also, they help to grasp the whole system and the research situation in an explorative manner (Bortz & Döring, 1995).
In the observational study, we gained a better understanding of the living situation of dementia sufferers and also gained experience for the development and implementation of the rest of the study. In particular, the compiled communication guidelines from the literature were very useful.

Individual interviews with people suffering from dementia

The needs of people suffering from dementia, their coping strategies for everyday situations, as well as their acceptance criteria and restrictions with handling devices were collected through individual interviews. This allowed the investigator to react with more flexibility to each individual and allowed the participant to fully concentrate. Additional observations and debriefings were carried out with the relatives/caretakers to get an all-rounded measure of the results

Focus groups with relatives and professional caretakers

The needs of relatives and professional caretakers, their acceptance criteria, known products and non-technological solutions were collected through focus groups.

2.3. CCE RE Documentation for User Requirements

2.3.1. General Artefacts

- User Needs
  User needs focus on what people are trying to achieve in a given situation and what they need in order to accomplish those goals.
- Personas
  Personas are descriptions of fictional people as if they were real people with a personality and a background history. These fictional characters are supposed to represent the future users of the product.

2.3.2. Requirement Documentation per Product

- Scenarios
  Scenarios describe the usage of the product via storytelling. There are four types of scenarios: Problem Scenario, Activity Scenario, Information Design Scenario and Interaction Design Scenario. They contain links to the user needs, which shall be directly addressed by the product. (User Needs which are not directly addressed by the products but shall be taken into consideration for detailed design decisions are documented as standalone requirements).
- Main Use Cases
  Use cases refer to the main situations where the product will be used with the intention of completing a specific task. A use case describes how a user

accomplishes a goal from a systems perspective, including all interactions the system has with an actor (which can be the user, or for example a database).
- In more advanced stages of product development, excel lists are created with standalone, detailed requirements containing all attributes (type, criticality, status, author, source type, responsible person, free tags for traceability). In WP3, 4, and 5 user requirements will be translated into Hardware, Software and integration requirements, respectively.

2.3.3. Persona Template

Instructions

- Stick to the findings from the research phase (see Amsterdam and Munich workshop)
- Stick to the essential, each aspect should contain a meaningful information for the product development

<Name>	
Description	**Pictures**
• …	(Picture is NOT from CCE user studies)
Living conditions • …	
Characteristics • …	
Symptoms • …	
Needs • <User Needs to be addressed, from Munich workshop ppt>	

2.3.4. Scenario Template

<Product Name>			
Personas involved			
<User group>: <Name>	<User group>: <Name>	<User group>: <Name>	<User group>: <Name>
<picture>			
Scenarios			**Ids of standalone**

	requirements
<Title Scenario 1 (meaningful short description)> <Text, 1 50-80 words> **<Title Scenario 2 (meaningful short description)>** <Text, 1 50-80 words> <**please make sure NOT to include an hints on input or output devices here**. Scenarios should purely concentrate on the actions and the surrounding. E.g.: The user switches on the light. (If he does that via a button or via a slider does not matter.) An activity scenario should contain: • Which personas are involved • Activities to complete a task • Restriction to ONE specific task • Is the input of the user active or passive (User switches on the light vs. the light is switched on automatically when he enters the room) • Is an action triggered, if so by what? A activity scenario should NOT contain: • No Devices • No Interaction with devices Types of scenarios NOT used here: • no Problem scenario (as-is situation) • no Information scenario (which information is to be exchanged and how) • no Interaction scenario (how does the interaction work) Some more guidelines: Write in 3rd Person, Always simply use “the system” when referring to any part of the product, Describe activities instead of sticking to assumed opinions and feelings of the stakeholders, try to stick to the essential>	<to be included later in CCE process>

Definitions
User needs to be addressed: User needs which shall be directly addressed by the product. (User Needs which are not directly addressed by the products but shall be

taken into consideration for detailed design decisions are documented as standalone requirements).

2.3.5. Use Case Template

In the following, we will describe the CCE system use case template. The use cases describe how users (e.g., patients, caregivers) can work, i.e., interact with the system.

Table 1: Use Case Template

Use Case Number	< Use case 1 etc.>
Use Case Name	<Verb+ noun (e.g. order product)>
Actors	<stakeholder name, role name; if applicable: distinguished as primary actor, secondary actor…>
Version Number + Author	<Version Number and name of author of use case description>
Iteration	<Level of description: draft; reviewed; final>
Summary	<brief description>
Trigger/ intent	<system or user action that starts use case/ user's intent for use case>
Supported goal(s) from User Needs (if applicable)	<described from user perspective, including use context>
Preconditions	<state of the system that is required for the use case to be applicable, e. g. user has to be logged on to the system>
Flow of events: (Main Flow)	<all steps of the interaction between the actor and the system that are necessary for achieving a goal, incl. exchange of information> 1. 2. 3. …
Alternate flows	<e.g. At step 3. ….OR 3a…>
Exceptional flows	<e.g. if user has forgotten password to log on to system>
Assumptions/ rules	<conditions that are necessary for completing the use case successfully>
Displayed information	<information displayed in the GUI and that is necessary for the actor to execute this use case>
Postconditions	<state of the system after use case is finished successfully; corresponding to user's intent>
NFRs	<NFRs specified for this particular use case>
Services Required	<extracted from flow of events; number corresponding to number in system function list>
Relation to other use cases	<e.g. sub-use case>
Open issues	<e. g. What if patient is unconscious?; N/A for iteration "finished">

Example Use Case:

2.3.5.1. Receive information that medication is missing (Sample)

Table 2: Sample Use Case

Use Case Number	UC_ P1
Use Case Name	Receive information that medication is missing (Sample)
Actors	Patient
Version Number + Author	V1.0 Eisenbarth
Iteration	draft
Summary	The patient receives information that a specific medication is missing or has not been taken
Trigger/ intent	The medication dispenser or the CCE Health Hub detects that a specific medication has not been taken so far.
Supported goal(s)	• Patient forgets to take medication
Preconditions	• Medical dispenser device (subsystem) of the patient is switched on • Schedule of required daily medication is stored within the system
Flow of events: Main flow	1. System detects that timer has reached a predefined time value and alarms the patient. The system shows the required medication. 2. The patient opens the medical dispenser and removes the medication. 3. The system displays the current amount. 4. The patient confirms the intake. 5. The system shows status display. The system checks the amount of available remaining medication and schedule.
Alternative flows	N/A
Exceptional flows	5a. The system detects the remaining amount is below critical value and shows alarm. The system informs caregiver on missing medication.
Assumptions/ rules	N/A
Displayed information	• Medication related information: o Current medication (type or name) (s.a. SC2) o Amount of medication left (s.a. SC3) o Time for next intake
Postconditions	The caregiver is informed about critical medication amount so that he/she can provide appropriate help as soon as possible.
NFRs	• Efficiency • (*Response time*): o The system should trigger a reminder immediately (1 second) after the time has reached a critical value o Alarm for missing medication has to be displayed and triggered within 3 seconds • (*Transmission Time*): Alarm and reminder have to be transmitted to caregiver within 3 seconds (Flow of

	events step 5a)
Services	UC_P1_SC1: Reminder Service (Flow of events step 1) UC_P1_SC2: Medication information (Flow of events step 1) UC_P1-SC3: Check medication amount (Flow of events step 5) Etc…
Relation to other use cases	N/A
Open issues	N/A

3. As-is Situation

3.1. Dementia

People with dementia suffer from "gradual memory loss, decreasing ability to perform routine daily living tasks, impaired judgment, disorientation, personality changes, loss of language skills, and behaviour disturbance" (Costa et al., 1996, as cited in Burgener & Twigg, 2002, p. 88). As the disease worsens, dementia sufferers find it more and more difficult to "comprehend language in written and spoken form" (Haak, p. 122). Short term memory problems create further difficulties as they become unable to follow a conversation, forgetting what has been said before. Furthermore, given that they become easily disoriented and distracted, it makes it very difficult to communicate in an area where many people are present and simultaneously speaking.

3.2. As-is Situation in Germany

3.2.1. Initial Stakeholder Analysis

This section deals with a description of the users who are supported by the CCE system. Besides a short description of the role of the, each stakeholder is also described by means of a stereotypical "persona description". These "typical users" are used for the scenario descriptions in Chapter X of this document.

Examples:

3.2.1.1. Patient User Group

	**Role**	senior patient with Dementia
	Name	Paula Falk
	Age	86
	Marital Status	Widow
	Living Situation	Alone, daily visits by her daughter, Susan Falk
	Medical Case	Early dementia combined with senile decay
	Additional context information	Lives in her own house and refuses to go to a nursing home although she fell down at home several times in the last months and feels more and more confused

	**Role**	senior patient with Dementia
	Name	Peter Miller
	Age	82
	Marital Status	Married
	Living Situation	Lives together with his wife Martha
	Medical Case	Medium progressed form of dementia combined with visual impairment
	Additional context information	Lives in his own apartment but felt strange in his own rooms in the last months, his persecution mania has increased a lot in the last weeks

	**Role**	senior patient with Dementia
	Name	Emma Watson
	Age	79
	Marital Status	Widow
	Living Situation	Lives together with the family of her daughter Paula
	Medical Case	Progressed form of Dementia
	Additional context information	Since her husband Bob died 9 years ago, Emma lives in her daughter's house where she has a 3-room apartment. As she is in a progressed state she needs to be supervised all the time.

Role	senior patient with Dementia
Name	Betty Pierce
Age	78
Marital Status	Widow
Living Situation	Alone, occasional visits by grandchildren Tom and Mary. Has a network of friends and relatives.
Medical Case	Early dementia, beginning senility
Additional context information	Mrs. Pierce still lives in her own apartment and thinks she is fully capable of living alone and independently

Role	senior patient with Dementia
Name	Daniel Glover
Age	72
Marital Status	Married to Sarah Glover
Living Situation	Together with his wife in their own two-bedroom semi-detached home
Medical Case	Early dementia
Additional context information	Daniel lives together wih his wife. They have two children and two grandchildren who visit them rather regularly. He is increasingly worried that he loses some of his skills and abilites but can't quite pinpoint the problem, and therefore feels insecure and frightened.

3.2.1.2. Guardian / Caring person User Group

	Role	Guardian / caring person
	Name	Susan Falk
	Age	60
	Marital Status	Married
	Living Situation	Alone,
	Medical Case	Caring person of Paula Falk, Main contact to doctors, administration etc
	Additional context information	Is very concerned about her mother and her mother's security, although she understands her wish to stay at home as long as possible.

	**Role**	Guardian / caring person
	Name	Martha Miller
	Age	80
	Marital Status	Married with Peter
	Living Situation	Lives together with her husband Peter
	Medical Case	Caring person of Peter, Main contact to doctors, administration etc
	Additional context information	Is very concerned about her husband and his security

	**Role**	Relative of patient with Dementia / Guardian, caring person
	Name	Paula Matthews
	Age	33
	Marital Status	Married, 2 children
	Living Situation	Lives with her family and her mother
	Medical Case	-
	Additional context information	Paula lives together with her husband, her two children and her mother. Three days per week she works in a clothes shop for about 5 hours. During that time she organized a caregiver from the care center for Dementia to stay with her mother. In other cases when she has to leave the house, she calls Emma's brother Harry to take care of Emma.

	**Role**	Relative of Patient with Dementia / Guardian, caring person
	Name	Harry Meyers
	Age	69
	Marital Status	Married
	Living Situation	Lives together with his wife Mary.
	Medical Case	-
	Additional context information	Harry is Emma's younger brother and visits her regularly. He also offered Paula to call him in case that she needs someone caring for his sister Emma.

Role	Spouse
Name	Sarah Glover
Age	65
Marital Status	Married to Daniel Glover
Living Situation	Together with her husband in their own two-bedroom semi-detached home
Medical Case	Caring for her husband, but increasingly overburdened by his worsening condition
Additional context information	Is very concerned about Daniel's deteriorating condition. Plans to seek professional help.

3.2.2. Problem Scenarios

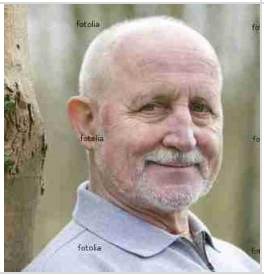
In the following we list the problem scenarios that are seen as essential problem scenarios from the German consortium.

3.2.2.1. Problem Scenario: Remembering Non-Periodic Situations

REMEMBERING NON-PERIODIC SITUATIONS			
Participating Personas			
Patient: Betty Pierce	Grandchildren: Tom & Mary		
Scenarios			
In general, Mrs. Pierce's behavior is not conspicuous or even worrying at all. She is still able to perform her daily activities, such as her morning rituals, regularly meals, consultations or even the shopping. When speaking with her she seems to be well informed about politics (from the daily news in the TV) or news from her region where she lives. But since a fairly long time relatives and friends are noticing slight oddities, memory slips and the like, especially with respect to her short time memory. In the past Mrs. Pierce's grandchildren Tom and Mary often had called her on the phone in the morning, and when they visited Mrs. Pierce in the afternoon a delicious cake was already waiting for them. Mrs. Pierce looked forward to the visit of her grandchildren and used the time to do the shopping and to bake one of the favorite cakes of Tom and Mary. Nowadays when Tom and Mary are visiting their grandmother in the afternoon it seems that she had totally forgotten the telephone conversation in the morning. Of course Mrs. Pierce was glad to see her grandchildren, but unfortunately no cake was prepared. In contrast Tom and Mary got the impression that the announced visit turned into a surprise visit. There were even more situations that were a cause of concern for of Mrs. Pierce's relatives. She missed consultations that were agreed upon and fixed at short notice. Last week the receptionist of Mrs. Pierce's family doctor asked her to come back the next day to discuss the latest examination results. But – even though Mrs. Pierce confirmed this appointment repeatedly during the short talk with the receptionist – she did not appear the next day. Obviously she had forgotten this appointment. But the next week she showed up again for the regular consultation as if nothing happened. By and by Mrs. Pierce's relatives are recognizing that she has some problems remembering facts and appointments that come her way at short notice. Talking to her on the phone and arranging appointments seems to be almost impossible. Regular visits, however, still seem possible. The fact that Mrs. Pierce still can remember regular situations (such as consultations, visits, etc.) quite clearly leads to other difficult situations. It is difficult to cancel or to move appointments. Even when calling her and telling her that an appointment will be delayed (e.g. due to traffic situations) she cannot remember and starts to get angry because she thinks that her			

visit is impolite and will not come. It usually takes a long time until Mrs. Pierce calms down again in those circumstances.

3.2.2.2. Problem Scenario: Mental Training

MENTAL TRAINING			
Participating Personas			
Patient: Daniel Glover	Wife: Sarah Glover		
			
Scenarios			
The first time Daniel Glover confused the names of his grandchildren John and Jason was last year on his birthday party. It was not a big drama, it was easy clarified and no one was angry or even worried about this. But since then the number of mistakes and confusions are increasing. It's not even names, but also anniversaries, places, correlations and relationships that Mr. Glover is mixing up. Some weeks ago he had a long discussion with his wife Sarah about their honeymoon. He was sure that they went to the Lake Garda, but in fact it was Lake Constance. Lake Garda was the site where they went for years after their child were already born. Daniel could be persuaded only when looking at pictures that showed him and Sarah as a young couple in Italy at the lake. He felt sorry, but more than that. He began to worry what might happen with him. And Sarah starts getting worried too. He's never been very good with places, names and their relationships; but this had serious implications indeed. Last week Daniel was in the city to do some shopping and to take care of some errands. Being in the city he could not remember where the photography shop is; even though he has been a regular customer of that shop for years. He walked through the streets but he was not able to remember or to find the shop. He went home frustrated, but he didn't dare to tell Sarah about this. He told her that the shop was closed and that he will go to that shop another day. Later on Sarah find out that the shop was not closed and wondered why Daniel is lying to her. Always a math geek, Daniel used to excel at calculating sums in his head or using the rule of three to solve easy math problems. But no longer: The handling of digits increasingly confuses him. When he tried to calculate the fuel economy of his wife's car, normally an easy task, he			

came up with an impossible result: 68 mpg. He wished he had a car like this! Even worse, he couldn't figure out how to get it right, even after several attempts. Finally he gave up and asked Sarah to do it.

As of late, Daniel is even starting confusing names of neighbors and friends. When he recognizes his errors, he is ashamed or angry depending on the situation. Sometimes he is calling to account other circumstances: new clothes or hairstyles of well known persons that would make it impossible to recognize them immediately; in case of places, missing signs and confusing routes that prevent him from finding what he is looking for.

Being worried about his ever-worsening condition, lately he started talking to Sarah about his memory problems, admitting to her that something is seriously wrong.

3.2.2.3. Problem Scenario: Caring person wants more security

Caring person wants more security			
Participating Personas			
Patient: Paula Falk	Daughter: Susan Falk		
			
Scenarios			
Paula Falk is alone at home and wants to cook something as every noon. Her daughter Susan visited her this morning and had the feeling that she is more fragile than usual but had to leave her alone because of another appointment. She feels very insecure about her mother and calls her every hour because she wants to know if she is ok. Petra starts being a bit annoyed about the phone calls and starts cooking. The phone rings again and an old friend of Paula is on the phone. During the long conversation, Paula forgets her meal on the stove. At the same time, Susan tries to call her mother again and is very concerned as she doesn't get a connection to her mother. She is afraid that she fell down again or something bad happened. Susan leaves her appointment ahead of time in a hurry and drives to her mother's house. She rings the bell but no one opens. When she enters the house through the back door the kitchen is full of smoke and Paula is on the phone, still chatting with her friend. Susan now wants something to change: She either needs more security and control to have a good feeling with her mother being alone at home or Paula has to go to a nursing home or into			

assisted accommodation.

3.2.2.4. Problem Scenario: Access to doors and hazardous substances

Access to doors and hazardous substances			
Participating Personas			
Patient: Peter Miller	Wife: Martha Miller		
			
Scenarios			
Peter is currently alone at home and watches an action movie with a lot of violent content. Afterwards, he listens to a radio program, talking about the increasing violence of younger people and increased incidences of burglaries in his neighbourhood. Due to his strong paranoia, he locks all doors in the apartment and windows, keeping the key inside the lock. He hopes to hinder burglars to enter his home in that way. He has forgotten that his wife is also currently not at home. Later that day, Peter wants to help his wife, who is currently participating at a bridge game with friends, in the household. He wants to clean up the dishes in the sink and opens the cabinet with the cleaning substances. Unfortunately, the cabinet also holds strong substances for bathroom cleaning, containing chemicals like chlorine. He cannot read the labels and caution marks anymore and thus exchanges the dish liquid with the hazardous substance. As he puts too much of the chemical into the water, the substance releases a dangerous gas in the air, leading Peter to fall unconscious to the floor. Later in the afternoon, when Martha arrives at home, she is not able to enter the apartment, as the key left in the lock hinders her to open the door. Unfortunately, she does not know about Peter's situation and health status and it takes a long time until help arrives.			

3.2.2.5. Problem Scenario: Patient leaves home

Patient leaves the house			
Participating Personas			
Patient: Paula Falk	Brother: Harry Meyers	Daughter: Paula Matthews	
			

Scenarios

It's Friday, 21st of august, and it is a very hot day. As it is the last day of the summer vacation, Paula decides to go to the open air pool with her two children Mike and Jason.
As she can't leave her mother Emma by her own, she calls Emma's brother Harry whether he could stay with Emma for some hours. "No problem", says Harry, "I will come by in about half an hour".

It's 3 o'clock in the afternoon and Harry and Emma are sitting together, having a cup of tea and watching pictures from their childhood.
"OK Harry, thank you for the tea! I will go home now!" says Emma. "But you are already at home, Emma. Paula is also coming home soon from her trip to the open air pool."
"Oh, OK" says Emma.

3 minutes later: "OK Harry, thank you for the tea! I will go home now!" "No Emma, you are already at home. Look, we are sitting in your living room. Look at the pictures on the board. They show you and your husband Bob during your trip to Rome several years ago! And here is a picture of your daughter Paula with her family, she is also coming home soon!"
"No Harry, I want to go home!" Emma is getting more and more angry and insists of going home.

Harry knows that further discussion does not help in this situation. Therefore he decides to go for a short walk with Emma, giving her the impression that she walks home.
"OK, I will accompany you. I will just go and take your jacket. Just wait, I will be back in a few seconds."

As soon as Harry left the living room, Emma opens the entrance door and leaves the house. When Harry comes back to the living room, Emma is not there anymore.
While he is looking for her in the house, he suddenly hears some cars blowing their horns on the street in front of the house.

"Oh no!" He runs outside and sees his sister walking in the middle of the busy street. "Stop Emma! Wait for me! Don't walk any further!". Fortunately, Mr. Smith a neighbour of Emma is in the garden. He immediately reacts to the situation, stops the traffic and takes Emma out of the dangerous situation.

"Thank you very much Mr. Smith" says Harry relieved. I left her alone for only two minutes to take her jacket."
"Oh Harry, what are you doing here? I didn't see you for a long time" says Emma, happy to see her brother.
"Yes Emma, you are right. What do you think of having a tea at your home?". "That's a good idea, Harry! And while having a tea, we could watch some pictures from our childhood".

3.2.2.6. Problem Scenario: Daily schedule 1

DAILY SCHEDULE 1			
Participating Personas			
Patient: Helga Schmidt	Care-givers: Kathrina, Hans	Brother Jan	Flatmate: Harald

Scenarios

Actor and Background

Helga Schmidt lives together with eight flatmates in a house in Marburg, which is located in the southern part of Germany. They have a common kitchen, a common living room and best of all: a garden.

Seven years ago she retired from her job as a French teacher. Three years before that, her husband died and she had lived by herself for nearly 10 years. She refused to move into a home for elderly people, because she loves to be independent and she needs her garden. But about a year ago they diagnosed lewy body dementia (LBD) and she started to feel afraid about living alone. So she moved into this group living home for people with dementia.

Problem Scenario

It is Tuesday early morning and she gets up at 6:00 am as usual. She finds the clothes for today prepared by her carer. She puts them on except for the pink sweater which she doesn't like. For a little while she searches the blue one in the closet and, to her surprise, finally finds it lying around on the chair next to her bed. In the bathroom Helga looks into the mirror, she thinks she looks a bit pale. She totally forgets about brushing her teeth, but puts on some rouge and goes down to get the newspaper.

She has a subscription of the Radeburger Tagblatt. Her daughter Jenny is mayor of this small town and it nearly always contains articles about her, which Helga carefully collects. She is very proud of her, but unfortunately Jenny seldom has time to visit.

She starts to set the table for breakfast; soon Harald comes to help her. Or rather impedes her, as he spills all the coffee when pouring it into the cups. She sighs a little and cleans up the mess. The two of them are responsible for daily breakfast, as they both get up very early.

After breakfast she goes to the grocery store, because today is Tuesday, the day when her brother Jan visits her for tea. She always makes sure to prepare pancakes, because they are his favorite dish. When she walks into the store to get the fresh milk and eggs, she is quite

confused, because the milk is not where it used to be anymore. Instead she stands in front of a long row of shampoos, she starts to look around and realizes that she forgot, why she is in here. She is quite embarrassed and is about to leave the store, but the lady in the store keeper knows her and asks her if Jan is not coming today. That little hint is enough for Helga to remember why she went into this store.

When coming home she starts writing a letter to Jenny, but her hands are quite shaky today and it is very exhausting to write in a readable way. So she makes a little pause and goes to the garden. There she forgets all about the letter, as she recognizes, that nearly all the beautiful dahlias are destroyed.

Upset about this she suspects, that her house mate Eva must have done this. She already feels for a long time, that Eva is jealous of her and her beautiful flowers. Helga is very angry and searches for her, finally ending up in the kitchen, where Kathrina the Russian carer is preparing the meal. When Kathrina sees Helga so agitated, she asks her what happened. She listens a bit, tells her that she understands her fears, but that maybe the snails had eaten them. She switches off the oven and suggests to go in the garden and see what they can do about it. Kathrina doesn't have a lot of time, as she has to hurry to have lunch ready in time. It is always served at 12 o'clock, as she has written herself in big white letters on the blackboard of the kitchen. This reminder helps the inhabitants to remember and prevents them from asking over and over again.

In the afternoon Jan is coming to visit Helga, they have the pancakes together and go for a walk and chat about the past.

When Jan has left, she goes back into the garden to water the plants like every evening. She grabs the green plastic bag with the fertilizer. Suddenly she is not quite sure anymore what she has to do with it. But in that very moment Hans, the care giver for the evening is coming and reminds her that it is time for dinner and that the others are all waiting for her.

3.2.2.7. Problem Scenario: Daily schedule 2

DAILY SCHEDULE 2			
Participating Personas			
Patient: Alex			
Scenarios			
Actor and Background Alex is retired and has been living alone at home since his wife passed away. Although he has no children, he has a younger sister, Sara. After Alex was diagnosed with Alzheimer's disease Sara told Alex it would be better if he moved into a nursing home. Sara is unable to take care of him as she has a full time job, a big family, and no additional rooms at home for Alex to move into. However, Alex rejected the idea of the nursing home, but they agreed on him attending a Senior Day Care located in his neighbourhood. This way Sara knows Alex is in a safe place, and Alex is able to keep himself busy throughout the day.			

Problem Scenario

Alex wakes up feeling tired and decides to take a look at his clock. Quickly he realizes that he is late for his morning activity at the Senior Day Care Center. He had trouble sleeping the night before and now he must hurry to get ready. He begins his morning ritual by taking a shower. As he gets ready to turn on the water he stares at the two handles and tries to remember which was for hot water and which was for cold water. He had done this for several years now without thinking about it and now he was confronted with the question. He turns one of the handles. Surprised by the cold water, he quickly turns it off, and turns the other handle. After the shower and getting dressed he heads to the kitchen, quickly grabs a few things, and puts them in his bag. He leaves the house and begins walking to the Senior Day Care Center.

On his way he realizes he forgot where the Center was located. Was it on the first street, or on the second? He decides it must be on the second and continues to walk. He reaches the second street and begins looking for the Center. He doesn't see it. He thinks about it a bit more and suddenly remembers it is on the first street. He walks back to the first street, and finally sees the Center. He is 25 minutes late. As he reaches one of the activity rooms, he finds the room empty. Confused he asks one of the staff members, Alice, why there is nobody in the room. Alice tells him that the activity was cancelled, because they had planned a trip for today. Alex had completely forgotten about the trip.

To make sure he hasn't forgotten any other important events today he takes a look at his calendar. Indeed, today is Sara's birthday and she will come for a visit with her daughters in the afternoon. Alex decides to make a birthday card for her in one of the activity rooms at the Center. In the front of the card he writes "Happy Birthdate, Sara!" He stares at his own handwriting for a moment feeling there is something wrong, but he can't tell what it is. He attempts writing a birthday poem but he is forced to stop several times as he has trouble remembering what words to use. One of his lifetime hobbies has been writing poetry, so now he felt irritated at his lost for words. With his foul mood he gives up on the idea of writing a poem and settles on a simple congratulations letter. That afternoon Alex meets with Sara and his nieces, and then returns to the Center.

Around 6 pm Alex goes home. As he arrives home he feels too tired to cook dinner. He decides to make himself a simple sandwich and goes back into the kitchen. He puts two slices of bread into the toaster and begins looking for some ham and cheese. As he opens the fridge he sees a tomato and wonders whether he should cut a piece to add to his sandwich. He takes the tomato, washes it, and then carefully begins slicing it. Then he goes back to the fridge and takes some ham and cheese. All of the sudden he realizes something smells like it is burning. He turns around and sees smoke coming out of the toaster. He had forgotten to turn it off and the bread had burned. Annoyed, he takes the burned bread out of the toaster, and thinking dinner was too much trouble he goes to sleep.

3.2.2.8. Problem Scenario: Medication reminder 1: Overdose

Medication reminder 1 **OVERDOSE / FORGET TO TAKE THE MEDICATION**			
Participating Personas			
Patient: Alfred Black	Son: Peter Black		

Scenarios

The doctor prescribes medication for the patient Mr. Black and asks him to come back in three weeks.

He has to take Menantina, one half tablet every day the first week, one half tablet two times a day, the second week, etc. We can see the schedule is not easy to remember, if we also take into account all the other medication he has to take.

Back home, Mr Black´s son, Peter adds the new medication to the paper list they have hanging on the refrigerator.

Mr. Black takes his tablets daily, with the help of the nurse and his family.

Today, Peter decides to take a visit to his father. He asks him if he took the medication already that morning. Mr. Black has been having problems with his memory for the last six months.

1) This time he is sure he did not take it, so he takes it now. This action results in Mr. Black taking double dose of the medicine that morning.

This could be an isolated event, or it could occur more times, for several reasons, ending up in an overdose problem.

2) This time he is sure he did take it. This action results in Mr. Black not taking the medicine at all that morning.

This could be an isolated event, or it could occur more times, losing the effect of the medicament.

3.2.2.9. Problem Scenario: Medication reminder 2: Medicine Chaos

1. Medication reminder 2 MEDICINE CHAOS			
Participating Personas			
Patient: Alfred Black	Son: Peter Black		

Scenarios

This week, Mr. Black´s family is on holiday, and the nurse only comes once a day. Mr. Black has dementia problems and therefore he has problems taking his medication regularly. This week is not different.

Sunday evening, Peter comes to check on his father. When he asks if he took all his medicines, Mr. Black does not really know. Peter goes and looks for the box of medicines and he sees there are more than what they should, but he cannot guess how many he did not take.

This is a medicine chaos, not being able to know if the patient really took his medicines or if he did it at the right times.

4. User Needs

4.1. User needs as elicited in Germany

4.1.1. Source

The following results are based on the findings of the research phase, as described in section 2.2.

4.1.2. List of User Needs: Dementia Sufferers

Summary of the needs of dementia sufferers based on interviews with themselves:

- Wellbeing of family members
- Sense of togetherness and solidarity of their family
- Coping with daily life
- Handling devices
- Short term memory
- Word finding
- Orientation
- Finding objects
- Communication
- Money
- Not to be alone
- Organisation (dates, todos)

4.1.3. List of Problem Fields: Dementia Sufferers

Summary of the problem fields of dementia sufferers based on interviews with themselves:

- Calling somebody on the phone
- Using devices (in the household, fotocamera, PC)
- Impaired vision
- Depression
- Short term memory
- Word finding
- Housekeeping
- Defective hearing
- Searching objects all the time
- Orientation
- Fine motor skills
- Coping with daily life
- Motivating oneself
- Does not sleep well, wants to know the time
- Taking medication
- Forgetting dates that are not in the field of activity

4.1.4. List of Fears: Dementia Sufferers

Summary of the fears of dementia sufferers based on interviews with themselves:

- Death/accident of family members
- That the family drifts apart
- Darkness
- Being alone at home
- Not to be able to cope with daily life

4.1.5. List of User Needs: Dementia Sufferers as seen by Family Members and Professional Caretakers

Summary of the needs of dementia sufferers based on focus groups with by family members and caretakers and debriefing with family members after interviews:

- Independence (secured mobility)
- Instruction (familiar and structured processes, familiar and trusted surroundings)
- Orientation (spiritual and spatial order)
- Occupation (distraction)
- Peace and quiet
- Safety (protection from oneself, understanding for the disease, human dignity)
- Love (affection, trust, constant caretaker, contact to trusted people)
- Respect (understanding)
- Emotional safety (security, care)
- Appreciation (feeling of being useful)
- Acceptance/tolerance
- Time/patience
- Support (tools, no technology, regular medication, food)
- Encouragement and speech (participation in daily routine)
- Happiness and fun (joy)
- Motivation and drive

4.1.6. List of User Needs: Family Members

Summary of the most important needs of family members based on focus groups (topics that were mentioned by most or were particularly important to the user groups are highlighted via bold letters):

- **Time for themselves**
- Not feeling guilty
- Good and polite relationship
    - Cooperative behavior
    - Comprehension (for a time plan, situation)
    - Appreciation
- Feeling of success (patient learning something)
- **Safety**
- **Support**
    - Assistive Technology
- Reliability
- Information

4.1.7. List of User Needs: Professional Caretakers

Summary of the most important needs of professional caretakers based focus groups (topics that were mentioned by most or were particularly important to the user groups are highlighted via bold letters):

- **More time**
- **Collaboration** (with colleagues, family caretakers)
  - Handover
- Biographical Information about the patient
- **Appreciation and Understanding** (by Patients, colleagues, family caretakers)
- Trust
- Cooperative behaviour of the patient
- Joy when working with the patient
- Freedom of action
- Legal and ethical safety
- **Patience and Empathy**
- Knowledge
- Training
- Information
- Auxiliary means

4.2. User needs as elicited in UK

4.2.1. Source

Development of a demonstrator of user requirements for assisted Living services in the UK

In 2009 an extensive consolation involving over 100 key stakeholder organisations, such as local authorities, 3rd sector, government departments, hospitals etc. as well as interviews and workshops with over 100 carers and users of assistive living services (aged from 19 to 100 year old) was undertaken to establish the user requirements and future vision of assisted living in the UK. The context against which this consultation was made includes:

- Recognition that the UK population is ageing rapidly and that there is a corresponding rise in the number of people suffering from chronic conditions such as heart disease and diabetes. Changes in lifestyle and in working practices means that there is also a rapid increase in the number of younger people suffering from chronic conditions
- The well-being, financial and other benefits that will flow from people being supported to manage their conditions in the comfort and security of their own homes

- The development and widespread application of ICT technology across the UK as a infrastructure with the capability to support a step-change in service delivery
- The opportunity to support the development of new more, accessible and cost effective models of care across the UK

From this consultation the definition and development of a DAP Demonstrator Toolkit and Scenarios which illustrate the ways in which those suffering from certain common forms of chronic health conditions, including dementia, can be supported by new technology to help them continue to live independently and with confidence in the comfort of their own homes was produced in June 2009 and launched at BRE. The demonstrator can be viewed at (http://www.dapforum.org/page.jsp?id=19). Over 2500 DVDs have been circulated in the UK and globally. The DVD is being used by the UK Department of Health to present a future vision for assistive living.

4.2.2. List of User Needs

Further consultations on user needs for overall assistive living solution requirements and specific requirements for sufferers of early stage of Alzheimer's were undertaken by the UK partners in the project during February and May 2010. As well as the UK CCE partners these consultations involved Bournemouth council; who are developing the dementia standards for the department of Health, the Foundation for Assistive Technology (FAST) and various hospitals.

Based on the feedback from these consultations and the budget available to UK partners for the CCE project the UK partners propose to develop a digital cork board that can be displayed on various types of media, such as TV, laptops etc, that would aid people at the early stage of Alzheimers to lead an independent life.

Centrihealth produced a mock up of a cork board in April 2010, which was presented at a major assistive living event in the UK in April 2010 (see Figure 1 in section 9.1). Over 30 carer organisations expressed interest in the concept and several such as Bournemouth council have requested to purchase the cork board, if it is produce as a commercial product, as part of their care package for people with Alzheimer's that they care for.

The overall performance requirements for an assisted living solution and cork boards based on the UK consultation are given in the sections below.

Overall Performance Considerations
Some basic performance criteria were developed that aim to set the values for implementing solutions for assisted living based on:

Home based performance:

- Solutions must work at any place in the home

- Must work in any home
- Immune from interference from other ambient signals (entertainment, phone, comms networks etc.)

Low cost

- Must aim to minimise the cost of installation in existing homes
- Must minimise the disruption to residents during installation and minimise impact on their fabric and fittings through unobtrusive product design and positioning.
- Must aim to minimise the cost of installation in new homes
- Cost of operation needs to be attractive to all stakeholders.

Future proofing

- Must be capable of altering functionality if a patient's needs change.
- Must be upgradeable so that additional features can be added without obsoleting the installation.
- Must be capable of adding functionality to keep up with the requirements of service provision enhancements.
- Cost of altering functionality must be minimised for all stakeholders.

Environmental

- Must take reasonable steps to minimise the power consumption requirements.
- Batteries and other consumables should be recylable where possible.

Technical Infrastructure

Platform Independence:
User is able to access communications and assistive tools through a variety of user-interface devices.

Performance Elements:

- Assistive functionality not restricted to operating on a single hardware platform, but may be accessed on a number of platforms chosen according to ability, economic means, living circumstances, social needs.
- Where hardware elements are required (for example for physical movement or measurement) then hardware elements capable of communicating for control and status purposes, using standard protocols to more easily interface with a variety of system configurations.

Technology Required:

- Open architectures, platform-independent design;
- Web delivery of solutions
- Open-Standardised messaging protocols
- Open-Standardised security protocols

Panel displays (Corkboards)

Interactive corkboard for personal organiser, web access and communications

Performance Elements:

- Corkboard able to display personal organiser functions (diary, contacts)
- Corkboard able to make voice and video calls
- Corkboard able to browse web and access web-delivered content

Technology Required:

- PC-like functionality
- Internet and high bandwidth communications connections

User able to interact with corkboard by touch:

- Useful for those unable to use a keyboard
- Performance Elements: user can interact with PC, corkboard etc. by touching the screen

Technology Required: - available today: touch screen PC interface

Personalisation, adapting to needs

Programmability of features to meet specific needs of users:

- Users need to be able to personalise technology to suit their needs and preferences.
- Conditions progress over time, leading to changing needs.
- Personalisation may also aid in de-stigmatising or de-institutionalising people, giving them more of a sense of individual value.

Performance Elements:

- End-Users and/or their carers must be able to adjust the behaviour of technology to meet needs.
- Adjustment needs to be simple (e.g. via a simple GUI on the device itself and/or remote web page)
- Availability of as wide a range of parameters as are likely to need adjustment
- Default behaviour (‘out of the box’) must be at least usable.

Technology Required:

- Parameterised design
- User interface;
- Networked control for remote web-configuration

Reminders of overdue tasks

People with early-stage dementia may have difficulty remembering to perform tasks at pre-determined times. Their habits may become erratic. Assistance with remembering may range from useful to essential for sustained independent living
Performance Elements:

- A range of tasks may be programmed into a reminder system by users and/or carers

- Reminders may be issued at the due time and then 'acknowledged' by the user (in which case it is simply assumed they are carried out straight away).
- Reminders of certain tasks may be issued and then monitoring may take place to ensure that the task is carried out, defaulting to subsequent reminders if not;
- Escalation scheme: Increasing severities of reminders/warnings may be programmed such that they can escalate if missed; A programmable message to carer may be issued in the escalation scheme via any available comms channel.
- Logs of reminders issued and user responses should be kept

Technology Required:

- Diary function, either via web/cloud software or on a local server/device.
- Local GUI and/or web interface for programming and log file interrogation

User interfaces

User interfaces should not need to be learned; just used

It should be borne in mind by designers that many end users will suffer from various stages of dementia, and some may have learning difficulties. Training given on one day will be forgotten the next, and patients may have days when they become more easily confused, especially when attempting to operate equipment alone. Therefore the technology should be designed in such a way as to "just work". There should be absolutely no training needed for the user apart from identifying the equipment and instructing the user that they should use it when prompted.
However, training of the equipment is an appropriate solution: Artificial intelligence may be employed to analyse user behaviour over time to adapt to the way a user behaves. Patterns of behaviour that achieve the right result on one occasion could become the preferred or default mode for future occasions.

Performance Elements:

- Technology should always do something sensible even under error conditions.
- no messages should be presented to users that they are unlikely to understand
- controls should be clearly labelled in user-friendly language to clearly identify the function they activate
- the number of controls should be an absolute unavoidable minimum.
- Help should always be quickly available for every step of every activity
- Help should rarely be required.
- When the user is doing something wrongly, a clear corrective action should be communicated.

Technology Required:

- careful design;
- prompt and analyse responses;

Ease of use of internet for older people

Internet technology proceeds at a pace determined by its more advanced audiences, and can leave older or more disadvantaged people behind. Most browsers are suitable for younger people who like to have many options at their fingertips, while older

people find this incredibly confusing. Some accessibility features in browsers or web devices could significantly break down barriers to new users from the less adventurous section of the population.
Performance Elements:

- Internet look-and-feel tailored to remove complexity, distractions such as advertising, popups, menus.
- simple actions for common tasks: e.g.
- start typing without clicking for web search;
- start typing someone's name and offer to write email;
- one button to send a voice message as an email attachment
- tailoring must be much more simple than with today's browsers. Functionality can be added as the user gets more confident.

Technology Required:

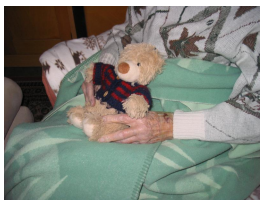
- GUIs much more similar to some mobile phones
- voice activation
- touch screens
- predictive features, predictive help

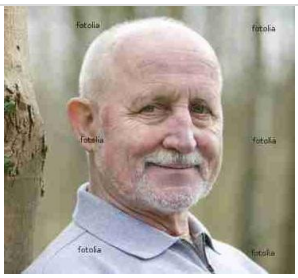
5. Personas

Refined Personas based on User Studies. We focused on the user groups of early and middle stage dementia, as the goal of the project is to support dementia sufferers in living independently. This decision was based on information from user studies and discussion with experts.

5.1.1. Patients

Emma Watson	
Description	**Picture**
• 79 years old • Alzheimer, diagnosed 4 years ago • Middle stage dementia (D2)	 (Picture is NOT from CCE user studies)
Living conditions • Lives in the same house as her daughter, Paula • Her daughter knows a lot about her life, she can help out when her mother no longer remembers earlier events • The house is situated in Frankfurt and has 6 flats • Emmas flat has 2 rooms • She moved in there, when her husband died 9 years ago	
Characteristics • Likes to laugh • Generally a happy person • Feels a bit lonely sometimes • Was always a bit afraid of new technologies and avoided them • Would like to have easy-to-use devices that are familiar to her (washing machine, coffee maker)	
Symptoms • No feeling for time • Ability to judge strongly restricted • Impaired memorization capabilities • Forgot how to use everyday devices • Confuses people except her daughter and her brother • Recognizes her daughter Paula, but partially no longer her	

grandchildren • Unable to keep up daily routine (washing, preparing food) • Needs to be supervised all the time, with few exceptions • Has no orientation of time or place • Lacking differentiated sensory perception (e.g. hot vs. cold) • Problems finding words	
Needs • Emotional Safety • Time and Patience • Assistance • Joy and Fun • Communication and Activation • Positive Feedback • Respect • Orientation	

Daniel Glover	
Description	**Picture**
• 72 years old • Alzheimer Dementia, diagnosed two months ago • Early onset Dementia (D1) • Profession: Senior Engineer	 (Picture is NOT from CCE user studies)
Living conditions • Lives together with his wife, Sarah Glover, in their own two-bedroom semi-detached house • Lives in an affluent suburb of London • Two children • Two grandchildren (John and Jason)	
Characteristics • Healthy and vigorous • Normal appearance at first glance (mentally and physically) • Athletic (sailing, hiking, skiing) • Used to be outgoing and sociable, but increasingly insecure because of his problems. Illness is eating away his self-confidence, so sometimes he feels overwhelmed. • Until recently refused to accept his illness. Finds tips or well-intentioned recommendations to be useless, because they are not challenging him. Sometimes finds them to be ridiculous. • Fears that the family might break apart • Sometimes blames others for mistakes	

Symptoms • Problems finding words (anomia, for him particularly frightening) • Difficulties finding misplaced things • Confusing names, places and events • Orientation problems • Sometimes uses aggressive word choice or gestures	
Needs • Orientation of place • Autonomy • Help to structure life in a useful way, organizational aids • Safety (in own abilities) • Respect • Apppreciation (feeling to be needed) • Training / Brain training	

Alfred Black	
Description	**Picture**
• 81 years old • Alzheimer Dementia, diagnosed a week ago • Early onset Dementia (D1) • Profession: Team Leader	 (Picture is NOT from CCE user studies)
Living conditions • Widower, lives alone since 6 years ago • Quote: “I’m okay, leave me alone” • One child: Peter Black (50, takes care of his father) • Is reasonably mobile, travels by bus and train, but only for short distances • Lives withdrawn and has only a few contacts	
Characteristics • Frail • Has problems with immune system • Beginning senility • Likes to watch TV • Plays chess with neighbor • Refuses to go to a nursing home • A bit distrustful • Afraid to be put in a nursing home	

Symptoms • Memory problems for the last six months • Confuses dates • Listlessness • Depression attacks	
Needs • Assistance (regular medication) • Orientation • Safety that decisions won't be made against his will • Guidance • Respect • Appreciation (feeling to be needed) • Time orientation / Day structure • Social participation • Family (biography)	

6. Product Ideas

Product ideas are described as Activity Scenarios.

6.1. Dementia Diary

Dementia Diary			
Personas involved			
Patient: Emma Watson	In-patient caregiver: Sandro Pepper	Daughter: Paula Matthews	Brother: Harry Meyers
			

Scenarios

System tracks activities

When Emma wakes up in the morning and gets out of bed, the system recognizes that Emma is awake and records ("got up at 8:04"). Afterwards, Emma goes to the bathroom and uses the toilet. The system records the toilet usage activity.

Shortly after, her caregiver Sandro arives, who comes daily. The system records that someone has arrived as well as the preparation of the breakfast.

Caretaker enters daily tasks into the system

Like every day, while Emma eats her breakfast, Sandro enters some activities that Emma should perform during the day into the DementiaDiary, while also modifying the given routine activities: taking a shower, having lunch, having dinner, hygiene before going to bed, cleaning the house, and watering the plants.

Caretaker checks the record

Before leaving, Sandro checks Emma's activity records of the last weeks by printing a report. By reading, he recognizes that Emma's toilet usage has significantly increased in the last 3 weeks. Because of that, he suggests Emma to visit the doctor to check if that abnormality is usual and arranges an appointment for the next day.

Caretaker hands over information to other caregivers via the system

He enters a corresponding activity in the DementiaDiary so that Paula or Harry can read this information and accompany Emma to the doctor. He also adds the report to the entry with the information that Emma should take a print out with her when visiting the doctor.

System retrieves extra information

As soon as Sandro has left the apartment, the system asks Emma whether she wants to enter a short description about her visit. "Hello Emma, do you want to tell me something about your visitor?" "Oh yes, this was Sandro my favourite caregiver. I really like him, he is so gentle! He helped me preparing my breakfast and we had a nice talk. He also said that I should go to Doctor Smith tomorrow."

Patient checks her daily tasks

After that, Emma checks her daily routine and decides to water the plants. She leaves the house through the back door. The system recognizes that Emma left the house and after re-entering, it asks Emma to report what she has done outside the house. “Hello Emma, have you been outside? What did you do?” “I watered the plants in our garden”.

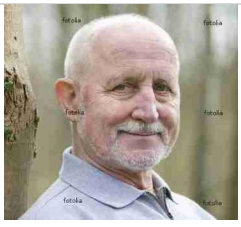
Family member retrieves status via internet
Meanwhile, Paula is at work in a whole day meeting. Fortunately, she can check the activities of her mother at home via a web interface. Doing that, she recognizes that Emma is doing some activities, but didn’t take her medicine in the morning. Because of the meeting, she is not able to call her mother so she creates a message in the system. Furthermore, she reads that Sandro has made an appointment at Emma’s family doctor and calls Harry to ask him whether he could accompany Emma.

Patient receives message for the system
Back at home, Emma continues to use the system doing her daily tasks. While she uses it a message of her daughter Paula appears to take the morning medicine. Therefore Emma checks the medication box and recognizes that the morning medicine is still inside the box. She takes the pills and starts preparing some pancakes for lunch. The system recognizes both activities.

Caregiver and patient enter additional information about daily activities
After the game, they go for a walk to a nearby lake to take some photos of the ducks. When returning to Emma’s house they enter the photos and a short description of their walk into the system.

Family member checks daily activities
After Harry leaves, Emma goes to the garden again, waters the plants a third time and enters the information into the system again, after being demanded by the system.
Paula arrives at 7 PM, prepares dinner for both of them and prints the report of Emma’s daily activities. She recognizes that Emma watered the plants three times and speaks with Emma about what she did.

6.2. Biography

Biography			
Personas involved			
Patient: Daniel Glover	Spouse: Sarah Glover	Technician: Paul Jones	Grandchildren: John and Jason
			
Scenarios			

Preparation
All kinds of media are collected by Sarah Glover, the patient's spouse, her children and grandchildren, as input for the system. A "theme", or label, is chosen for each event and attached to each collection. Sarah and her family then work together closely to arrange an optimal sequence for Daniel to remember events, persons and places, assisted by a specially-trained health care professional who knows about the condition and shares his expertise.
The system then automatically creates a memory game from the provided content and a quiz game in the style of "Who Wants to Be a Millionaire?". The system also features continuous recording of a session and the users' behaviour for later analysis. Sarah receives instruction about this from the technician. After all media has been collected and put in sequence, the technician digitizes the material. During a test run it was shown that Sarah and her children were not exactly sure how Daniel would react to certain events. The technician showed them how they could mark and categorize specific memory sections. They could, for example, assign a category "Important, it's fun" or "Sad!". Then could decide which one to show depending on Daniel's mood.

Demonstration
Sarah shows Daniel how to use the system. Daniel apparently has no problem following Sarah's demonstration, a sequence of pictures of Jason's (their grandson) first day at school. It is a slideshow of pictures, and selecting a particular picture on the device shows even more pictures of the event.
Delighted, Daniel asks for more pictures. The system reminds him of the opportunity to see more pictures at certain points in the slideshow. The slideshow automatically continues, and he takes the initiative and selects pictures at appropriate moments, to see even more pictures. Sarah finally exits the demonstration.

Quiz Game
Daniel starts the game and a picture of his hometown appears. There are only two possible answers. "Of course, that's Brighton! I know my birthplace, don't I?" After choosing the correct word, a short movie of Brighton plays, and familiar melodies are heard. The next round, to Daniel's surprise, Jason, his grandson, appears on-screen and, in a video message, asks his granddad about the height difference between him and his brother John – a maths question. Both brothers appear on-screen in a doorframe to make it possible to estimate the right relation. This time, he wasn't quite right: He chooses "16 cm" as the answer instead of "3 cm". No big deal, after displaying the correct answer, Jason shows his granddad his room in a video tour as a reward.
Daniel finds the game very entertaining, but is ready for something else. Sarah then exits the game. She's now confident that Daniel can manage a game of memory on his own and leaves the room to prepare a meal.

Memory Game
After a brief pause, Daniel is ready for a game of memory. He starts the game. There are 16 cards on the virtual table in a 4x4 grid. Daniel has no problem locating the first pair, a recent picture of John's last birthday party. He selects the first card, then the second card. Both disappear.
The next pair is more difficult: Daniel needed 4 attempts to locate the second pair, a beautiful wedding picture of him and Sarah. After each unsuccessful attempt, the cards flip over again. Finally, the correct pair is selected and disappears.
At the end, after all pictures have been revealed and the board is empty, a short excerpt of Daniel's favourite classical piece, Beethovens moonlight serenade, fills the room. "Very nice, I

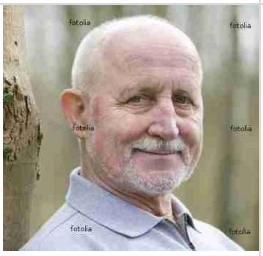
sort of like this thing!" Daniel exclaims spontaneously. Sarah, startled by Daniel's apparent outburst, comes to her husband's side. Both decide to start a reminiscence session.

Reminiscence Session: Childhood
"Take a look at those", Sarah says, pointing with her fingers at a virtual stack of pictures. Following the prompt of his wife, Daniel selects the stack of pictures. An interactive sequence of Daniel's childhood starts playing.
A picture where Daniel is playing soccer catches his attention. "There, that's me, with my brother Alfred", he said. "I never told you, but Alfred was a fantastic soccer player. He even won the school's tournament once". Sarah, anticipating the new information, marks this moment in the continual recording as "important". Later this information will be completed. When someone else goes through this session this picture will be marked as "important" and the new information will be shown together with the picture. Daniel then selects a picture of interest, and even more pictures of that particular event appear. News footage of important events of the time conclude this section, much to the delight of Daniel.

Reminiscence Session: Object
At this moment Sarah places an object on the table, what was chosen previously by her and her children: Daniel's old harmonica. They speack briefly about it to rejoicement of Daniel. As Sarah moves a specific corner of the harmonica, the sound of a harmonica melody begins, which Daniel often used to play. "Amazing", he says.

Reminiscence Session: Sailing trip
After browsing and reminiscing for a while, Daniel comes across a picture where he falls silent for a moment. It is a picture of Daniel's sailboat, with all his crewmates visible, a group shot. It becomes clear that Daniel is silently mourning the passing of two of his closest friends who died long ago. Taking control of the situation, Sarah gently takes Daniel's hand and at the same time moves on to the next section, the birth of their first son.
The session thus ends on a positive note. All in all, Sarah and Daniel are very happy with the application, and Daniel emphatically requests to use it again.

6.3. Daily Reminder

Reminder			
Personas involved			
Patient: Daniel Glover	In-patient caregiver: Sandro Pepper	Spouse: Sarah Glover	Grandchildren: John and Jason
			
Scenarios			

Daniel constantly forgets things:

- he forgets where he left her keys
- he forgets if he turned on the oven
- he forgets appointments…….

His wife Sarah bought him the new reminder system where he can enter his personal settings for things he wants to be reminded of together with Sarah. His caregiver, Sandro, is also allowed to enter reminders for certain events and medical stuff.

Wake up Service
Daniels reminder system wakes him up at seven with his favorite reminder tone giving him a nice wakeup message after a couple of minutes, telling him the date and informs him that he has a doctors appointment today.

Medication Reminder
Daniel stands up and as he sits down for breakfast the system reminds him that it's time for his pills, and he should please take the morning pills in compartment 1 (alternative -> "Intelligente Pillendose"). After 2 minutes the system asks him again for a confirmation if he indeed has taken the pills.

Scheduled Appointment Reminder
Later, when Daniel is reading the newspaper, the system again gives him a reminder that he has a doctor appointment with doctor Myers at 11, and it's time to go soon.

Leaving Home Reminder
The system tells him that he will find his key on the hook right to the front door and that it's cold today, so he will need a coat. Daniel goes to his doctor's appointment.

Reminder configuration
When he comes back, he calls his wife Sarah: "Hi darling… this voice in the background is driving me crazy, can you change it? And I do not want to be reminded of taking a coat or not, I'm not a baby!!!" " OK Daniel, I'll take care of that". Immediately, Sarah opens the interface of the reminder system and changes the reminder voice and the reminder for clothing. She confirms with her password.

Later that day, Daniels caregiver Sandro Pepper comes in. He sees that Daniel has taken the wrong medicine in the morning. He asks Daniel and he complains that he could not find the medication appropriately. So Sandro decides to change the numbers on the pill dose to symbols that are familiar to Daniel and enters the symbols into the reminder system.

Medication reminder (contd.)
In the evening, the reminder system comes up another reminder that it's time for his pills, he finds the evening pills in the compartment with the moon symbol. After 2 minutes the system asks him if he took his pills.

Periodic Events Reminder
The system also reminds him that it's his Grandson Jasons's birthday today. The system asks if it should establish a connection for Daniel.

6.4. Activity

Activity			
Personas involved			
Patient: Emma Watson	Daughter: Paula Matthews	In-patient caregiver: Michael Simmons	Brother: Harry Meyers
			
Scenarios			

Left alone involuntarily

Paula Mathews is tasked to care for her mother Emma on this sunny morning. They sit in the living room, talking about Paula's childhood. All of a sudden, Paula receives a phone call from the nursery teacher. Paula decides to go to the hospital immediately to see her son Mike, that had an accident while playing. Emma, however, needs to be supervised. To make matters worse, her uncle Henry is unavailable and his cell phone seems to be switched off. In her desperation, she calls the caregiver, who promises to arrive in about ten minutes. Paula tells Emma what happened, and switches on the new therapeutic system. Paula is off to the hospital in a hurry.

Reading

Before she left, Paula started the "Reading" function on the system. Emma listens to the story, Winnie the Pooh, intently, vaguely remembering the story from her childhood. She doesn't mind that the voice is a bit artificial; she is absorbed by the story. The system, now and then, makes appropriate gestures, which amuse Emma greatly.

Trying to leave home

After the story finishes, Emma suddenly feels the urge to go outside. The caretaker is a bit late, but should arrive at any moment now. Emma goes to the front door, with the intention of opening it. Shortly after getting up, the system repeats the last sentence. At the door the system reports itself. "Emma," it says, "come here, I have something for you. I am going to sing a song for you. Won't you join me? We can have fun together!"

Singing

The system starts singing "Auld lang syne", a favourite of her. Emma laughs, and hums along. At the end of the first stanza, the system compliments her on her singing and asks her if she wants to hear another tune, or continue with the song.

Just in this moment, the caregiver arrives. Not recognizing the caregiver, a regular visitor, Emma asks "Oh, who are you?" "Hello Mrs. Watson! I have been sent to prepare a meal for you!" "Oh, that's nice, just make yourself comfortable".

Feeding

After a brief period of silence, the system starts chatting. "Now it's time to eat. Come and let's eat something!" Simultaneously, the smell of chicken broth was emitted. Emma, surprised by the system's utterance, exclaims "Oh my! I'm hungry!". She finds already-made food and begins to eat it During irregular intervals the system says "Hmm, that tastes good!" to stop

Emma while she's eating.
In the meantime, The caregiver on the phone apologizes to Paula for the slight delay, and reports what has happened in the meantime. In any way, the system seems to have saved the day.

6.5. Medication Dispenser

Medication Adherence			
Personas involved			
Patient: Alfred Black	Son: Peter Black	Doctor: Margaret Adams	Nurse: Erika Schmidt
			
Scenarios			
Remember to take the medication Last week, Alfred Black was diagnosed with an early stage of dementia. Today, the doctor prescribes Mr. Black with the adequate medication and asks him to come back in four weeks. He adds the new medication to the system. Mr. Black will have to take the prescribed medication one tablet every day the first week, one tablet two times a day, the second week, etc. The schedule is not easy to remember if we add the fact that this is not the only medication he needs to take. Mr. Black takes his tablets daily, with the help of the nurse, his son and the system. The system remembers Mr. Black to take his medications everyday at the right times. This reminder seems to be giving very good results. Despite of this, Mr. Black sometimes forgets to take his medication. One day at midday, Peter decides to visit his father. He asks him if he took the medication already that morning, to what Mr. Black answers yes. Even though Mr. Black is so sure about it, Peter decides to check it in the system and sees hat his father did not take the tablet that morning. Thanks to the system Mr. Black takes the medication now. **Overdose Prevention** Mr. Black took his night tablets one hour ago. He is about to go to bed, but he has the feeling he did not take his medication that night. He goes to look for it, but "the system" does not let him pick up any more pills today, preventing him of taking too much medication. **Medication Adherence control and medication chaos prevention** This week, Mr. Black´s son Peter is on a business trip. Mr. Black has Dementia problems and therefore he has problems taking his medication regularly. Monday morning, Peter comes to check on his father and take him to the doctor. On the way to the doctor, he has a look at the medication dispenser and does not know when and how many			

tablets his father had taken. This is a medication chaos, not being able to know if the patient really took his medicines or if he did it at the right times.
At the doctor´s practice, Mrs. Adams checks on "the system" and gets an overview of the medication adherence of Mr. Black. Apparently he had a good medication adherence this last month; only the last week had he forgotten to take his tablets at the right time a couple of times but nothing worrying.
With the knowledge that Mr. Black is taking his medication correctly is easier to deal with the illness.

Alarm caused by non medical adherence
Mr. Black´s son Peter says goodbye to his father. He will be away for two weeks on a business trip. The medication reminder is not working at all. Mr. Black is not feeling very well and stays in bed most of the days. He forgets taking his tablets about half of the time.

Mrs. Schmidt, Mr. Black´s nurse, gets an alert. This alert is generated because Mr. Black took less than 50% of medication dosages for a week. Mrs. Schmidt takes look on the system to see the case of Alfred Black and his medication pattern. He was having a very good medication adherence lately. She gets worried and therefore decides to call him at home. Mr. Black answers the phone. He is not feeling well. Mrs. Schmidt informs him that Mrs. Adams will a visit him at his home.

7. Selection of Product Ideas

7.1. Selection Criteria

In order to choose the best possible product, it makes sense to take into account the three major product perspectives: Desirability, Feasibility and Viability[1].

Desirability, the design view, aims to understand the activities, desires, and needs of the people for whom a product or service is desired. Usability as well as the focus on a positive user experience is central. In the particular case of CCE, it is evaluated if an idea enhances the well-being of the target group and if it offers a substantial benefit over other (conventional) methods/ideas.

Feasibility, on the other hand, looks at product design from a technology perspective: What are the necessary engineering processes, and how can the product, in the case of a software system, actually be built? Is the necessary technology, in the form of third-party (APIs/Frameworks) or self-developed software, in place or ready to be implemented/developed? Hardware limitations are considered as well.

Viability, finally, introduces a business perspective with regards to markets and economics. Potential markets are considered, and the market potential as well as market impact of a product is evaluated. A look at the competition in the target market sector is also part of the viability perspective.

The challenge is to take each perspective into account sufficiently so that a clear picture for each product idea emerges, also noting problems and shortcomings in one particular area. This way, it is possible to gain a balanced view (and not favoring one idea because it excels in one field, but is sorely lacking in another).

In addition to that, the following criteria are used:

- Existing work/Work to do: Is there any work already done that can be (re)used? This can take the form of existing software or research/papers in a relevant field.
- Challenges/Obstacles: Are there any barriers to maket entry (legal, competition, ethical and the like) that need to be considered? How do they impact the chances for realization of the idea?

7.2. Selection Process

A vital part of user-centered design, focus groups and interviews are invaluable tools to gain understanding of the target group and to test product ideas. The four product ideas laid out in this deliverable have been presented to experts in the field of dementia care, and an expert interview with each caregiver expert, about 2h in length, was conducted. The caregiver experts had a strong background in the eldery domain: A person suffering from dementia, a director of elderly homes, a home care provider, and a Professor of Faculty of Nursing and Health Sciences.

[1] IDEO (Firm). Human-Centered Design Toolkit. Available at: http://www.ideo.com/work/item/human-centered-designtoolkit/

The reasoning why we chose experts instead of approaching dementia patients themselves was because we did not need observational data that at this early stage, but an evaluation of the ideas. The experts, knowing the needs and daily challenges of dementia patients, were in a perfect position to give advice based on their everyday experience.

Technological feasibility was, if not already mentioned during the interviews, evaluated in the light of existing technology present at the Fraunhofer Labs in Kaiserslautern and Darmstadt. Experts from within the project evaluated each idea from a implementation point of view and came up with a list of technology already in place and another denoting future technology that needs to be implemented.

The viability each idea was evaluated using a concise market analysis. Potential markets and price are estimates based on experience in the field of AAL technology. The analysis was done by experts within the project.

After through evaluation of the caregiver expert's statements, a ranked list of ideas was constructed, highlighting preferences as well as dislikes. Separate feasibility and viability studies explore the respective fields. A combined and consolidated matrix is provided in the following section.

7.3. Result

7.3.1 Desirability

The table below summarizes the preferences and dislikes of each expert.

Table 3: Desirability of CCE products as assessed by experts

	Expert 1	Expert 2	Expert 3	Expert 4
Dementia Diary	Strong preference		Strong preference	Preference
Remembrance Application		Strong preference (D1)		
Biography	Dislike		Strong preference	
Activity Enhancement		Strong dislike		Strong preference
Intelligent Pill dispenser	Preference	Preference (D1)		

"D1" denotes dementia patients with an early form of dementia. If not otherwise noted, the particular application is preferred only up to this level of impairment.

As can be derived from the information in this table, "Dementia Diary" is clearly preferred by almost all experts, with no perceivable disinclination by any expert. It is

considered helpful for patients and caregivers alike; one expert mentioned that it is a challenge to implement an interface that is usable for dementia patients. D2 patients (middle stage dementia) would need something like this most, but probably cannot use it. It is also a system rather suitable for pooling information than helping detect problems in every day activities, because there is usually no time for this in a professional caregiver's schedule. All in all, though, it is deemed very valuable to detect long-term trends and to help remember activities of daily life.

The remembrance application got high marks for all associated goals, such as remembering periodic events or locating places of objects. A solution like this will only be accepted if the illness has been embraced as well, remarked one expert. In addition, there's the risk that especially in cases of mild (onset) dementia it might be better to stimulate the patient to get proactive and use his/her own ability rather than relying on an external reminder service. In sum, this idea is considered useful, but perhaps a bit too generic.

"Biography" is strongly preferred by one expert, who clearly sees its potential, because "[for patients] biography is often the only remaining communication subject". Another expert, however, mildly disapproves of this idea, saying that a traditional photo album with its haptic qualities might be better in this case, although for future generations this might change. As many sources as possible (patient himself, siblings, relatives) should be asked in preparation as long as there are memories. All experts agree that the enrichment of an application like this with sound or real tangible objects would be tremendously beneficial.

"Activity", an avatar-like interaction with the patient in order to stimulate and animate, is considered extremely helpful by one expert, but was outright rejected by another. The first argued that stimulation and activation are crucial themes in dementia therapy, especially for patients in a progressed state. The second argued that a real person is indispensable: The patient needs a human counterpart in any case. Another expert especially the aspect of entertaining the patient in case a caregiver can not be present – "it is better than leaving the patient alone altogether".

The intelligent pill dispenser is an idea that is considered useful in all instances. The box, however, will probably not be used by patients with a progressed state of the illness, remarked on expert. On the plus side, the medication dispensing costs are covered by the health insurance (in Germany).

7.3.2 Feasibility

The following table gives an overview of the technical utility and feasibility of the proposed ideas.

Table 4: Feasibility of CCE products as assessed by experts

Application	Preliminary work already available	To do	„Challenges" already identified
Dementia Diary	Fraunhofer IGD: on-body sensors Fraunhofer IESE: off-body activity	Health Hub (collecting and storing data from daily routine of	• User Interaction • Maintenance of Health Hub data

	sensors	dementia patient)	
Biography	Multimedia systems architecture	• Health Hub (here: biography data) • Scanning device	• Gathering of personalized data (from people suffering from dementia) • Biography Ontology (for using biography data for games, memories, etc.)
Remembrance Application		Health Hub (Date, Appointment, personal data)	• User Interaction (addressing of patient) • Feedback! How does the system know that reminding was successful? How to avoid unnecessary reminding?
Activity Enhancement		Haptic (robotic) Avatar	• User and System Feedback • Lots of competitors (in certain market segments)

The intelligent pill dispenser application is not considered in this survey because it is already in a production-ready state and therefore uncritical as far as technical requirements are concerned.

The “health hub” is a central, to-be-done component of three out of four product ideas. It is also a central component of the CCE project proposal[2], integrating different services on one platform. Any application mentioned above could be part of such a central “hub”, either a standalone service on top of a infrastructure, or using available health hub services. The “activity” idea would require creating a robotic avatar from scratch, requiring many technical resources, and deviating from the original plan of having a “health hub” as centerpiece.

Challenges are mainly in the field of user interaction, where it is of vital importance that the needs of the primary target group (dementia patients) are considered.

7.3.3 Viability

[2] CCE Proposal, p.4.

Analogous to the preceding tables, the following table summarises vital criteria, this time from a business perspective.

Table 5: Viability of CCE products as assessed by experts

Application	*USP*[3] and Market	Competition	Price
Dementia Diary	• *Trend analysis and trend visualization (without interpretation)* • *Combination of physical sensors & web diary* • *Semi-automatic Prefilling of data* • *External access and Administration* • Private Homes • Home care providers • Elderly Homes (e.g. Dementia home Kaiserslautern)	• Web Diaries / Blogs (internal use) • Tunstall: Sensor Data gathering (stored into Tunstall server) • Activity Recognition done by external service providers, e.g. Focuscura.nl • Health record (e.g. Fraunhofer ISST) • Sensors: movement recognition, contact sensors (switches), etc., consumption analyzers	*Private homes:* Hardware: 1200 Euro (incl. 800 E (Sensors + Mini-PC; incl. 2 years warranty)) *External Service Providers:* Mini PC plus individual adapted set of sensors; plus monthly service fee (30 EUR / month)
Biography	• *Software toolkit for scanning and editing and photo albums, quizzes and memories* • *Integration of objects via RFID* • *Interactivity and personalization* • *Based on biography work* • Private Homes • Elderly Homes (e.g. Dementia home Kaiserslautern)	• Research Projects: o "Memories of a Life" o "Computer Interactive Reminiscence and conversation aid" • No concrete products; but self-built solutions thinkable (e.g. based on digital picture frames; power point presentations; photo albums; memory box) • Memory training: www.Plejaden.net	Hardware costs: Touch-PC: 500 EUR Software: 99 EUR
Remembrance	• *Multiple reminders*	• Free Web Reminder	*Solutions*

[3] USP: Unique selling proposition. It is defined in a marketing context as any aspect of an object that differentiates it from similar objects.

Application	*possible* • *Pro-active reminding* • *External administration (instead of recording messages)* • Private Homes • Elderly Homes (e.g. Dementia home Kaiserslautern)	(e.g. memotome.com) • Mobile applications (iPhone, Android) • Kind Reminder (Physical Gadget at a necklace; 1-2 minute recording time) • BIME Wander Reminder • Motion Activated Memo Reminder • Reminder Board for Dementia Patients	*without sensors*: Software on internet TV: 99 Euro *Integrated Solution with Sensors (e.g. localisation, movement):* 450 – 600 Euro plus installation costs
Activity Enhancement	• *Activating and stimulating patients* • *Customizable* • *Small solution (avatar only) for minimum recognition of user interaction* • *Big solution for recognizing user interaction within his/her environment* • Private Homes • Elderly Homes (e.g. Dementia home Kaiserslautern)	• Tölzer Würfel • Philips iCAT (prototype research only) • Hasbro iCat • Sony Aibo (ended 2006) • Various electronic pets • Paro mental commit robot	*Small solution*: Physical avatar, Microphone, Accelerometers, orientation sensors, loudspeakers, Monitor, PC (wired): 1000 EUR *Avatar Prototype*: 3000 EUR *Big solution*: Environment sensors: additional 600 – 1000 EUR (integration with activity recognition)

7.3.4 Selected Products

In light of the aforementioned considerations, the following ranking (in order of preference) has been arrived at by the German project partners:

1. Dementia diary
2. Biography
3. Remembrance application

4. Activity

Arguments for or against certain ideas have already been given in the preceding sections. In sum, the following reasons for the rank of a certain idea are given:

- Dementia Diary: Overall the most promising “candidate” that is universally accepted and at the same time feasible. It also has high market potential.
- Biography: More innovative than the “remembrance application”, the biography application also has a high potential and is looked upon favourably by the experts. Although one might think otherwise, no viable solutions are on the market right now. A “service package” (digitalization service plus first-time biography creation) might enhance the solution business-wise. However, real, widespread usage of this fully digital solution might be acceptable only in the future.
- Remembrance application: Universally acclaimed by experts, but competition already exists. Also, the foreseen problems on the user interaction side lead us to regard other ideas a little bit higher, although we clearly see the potential for such an application.
- Activity: Experts are divided on this one. Since there is no unanimous verdict of the experts, and an implementation would essentially mean pushing the project into a significantly different direction, we decided to refrain from further pursuing it. However, we clearly see the emotional impact an application like this could have.

Due to resource constraints within the project, **we plan to implement the dementia diary as our primary application.** Parts of the reminder/remembrance application could be implemented as a service/part of the dementia diary when the (user) need arises. Also, since the medication dispenser has been brought into the project at an advanced state, we plan on implementing it as well.

8. CCE Products

8.1. Dementia Diary

8.1.1. Scenario

Scenarios, described in chapter 6

Product Ideas.

8.1.2. Use Cases

Based on the scenario the following use cases were identified for the dementia diary:

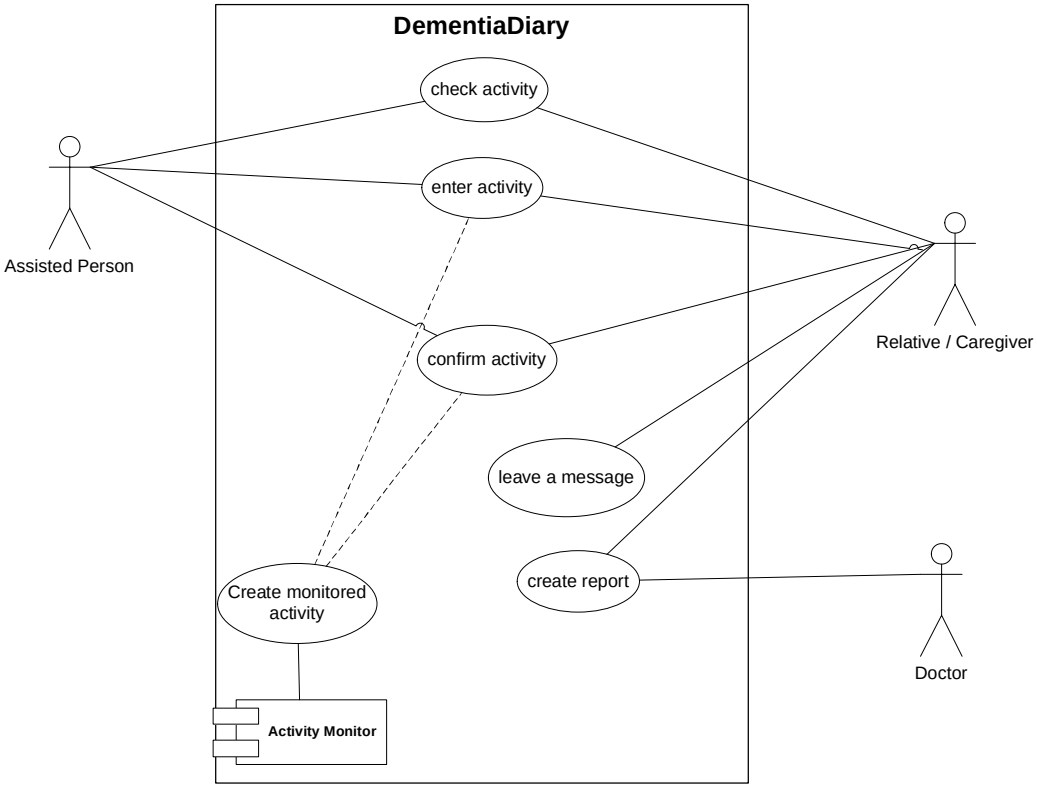


Figure 2 - Use Case Diagram for the Dementia Diary

Each of the use cases is explained in more detail in the use case templates below. The only exception to this is the use case “Create monitored activity” which will basically recognize an activity by analyzing sensor events and save this as a “monitored activity” inside the dementia diary. This is done by the software component “Activity Monitor”. This will then be used as an input for the use cases “confirm activity” and “enter activity”.

The main focus of the diary is that the information about daily activities is stored and detailed by the assisted person. Persons suffering dementia have problems with their short term memory. The dementia diary can help to remember the activities that were monitored and specified by the persons themselves. Furthermore we have three more roles interacting with the dementia diary. The relative and the caregiver that want to check the activities of the assisted person to see if everything is alright and the doctor who wants to have information about activities as a report.

The following flow of states for activities is the basis for the dementia diary:

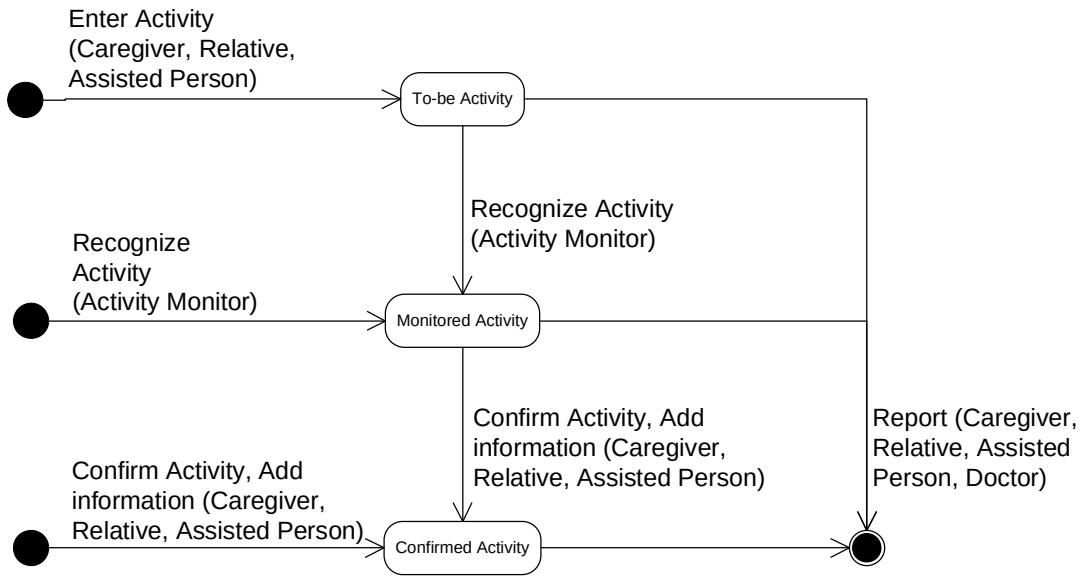


Figure 3 - States for activities

The first step is to enter a to-be activity, which means an activity that should be done in a certain time frame, for example “Cook something every day”. Then the activity “cooking” can be recognized by the system. If this corresponds to a to-be activity then the activity is not only planned but also monitored. By adding additional information to the activity “cooking”, for example by answering the question “What have you cooked today?”, the activity becomes confirmed and detailed. Furthermore, a report can be generated that outlines the to-be, monitored and confirmed activities.

The following use cases describe the interaction between the users and the system in more detail.

8.1.2.1. Enter Activity

Table 6: Dementia Diary: Enter Activity Use Case

Use Case Number	UC_P1.1
Use Case Name	**Enter Activity**
Actors	Caregiver, Relative, Assisted Person
Version Number + Author	V1 Özgür Ünalan
Iteration	Pre-final
Summary	This Use-Case describes the creation of a to-be activity (a activity that should be done, e.g. cooking, in a given time period). For example, the assisted person should cook once every two days.
Trigger/ intent	The caregiver wants to specify activities that should be done by the assisted person
Supported goal(s) from User Needs (if applicable)	detailed information about the planned daily activities is given
Preconditions	Caregiver should be authenticated
Flow of events: (Main Flow)	1. The caregiver chooses to create a to-be activity in the diary 2. The system provides a form for creating a to-be activity

	3. The caregiver fills out the form and adds detail information about the to-be activity (time, activity type, recurrence) 4. The system saves the to-be inside the diary and shows a confirmation that the to-be activity has been saved
Alternate flows	<e.g. At step 3. ….OR 3a…>
Exceptional flows	<e.g. if user has forgotten password to log on to system>
Assumptions/ rules	-
Displayed information	Name and description of to-be activity, time frame (morning, midday, afternoon, etc.), frequency of activity (daily, weekly, other)
Postconditions	The to-be activity is saved
NFRs	- The creation of a to-be activity should take no longer than 1 minute in average
Services Required	This will be added later
Relation to other use cases	-
Open issues	-

8.1.2.2. Confirm Activity

Table 7: Dementia Diary: Confirm Activity Use Case

Use Case Number	UC_P1.2
Use Case Name	**Confirm activity**
Actors	Assisted Person (dementia early and middle stage)
Version Number + Author	V1 Özgür Ünalan
Iteration	Pre-final
Summary	This Use-Case describes the confirmation of an activity (a activity that has been monitored). For example, the system has monitored that the assisted person has cooked. The system asks the assisted person if and what exactly he or she has cooked.
Trigger/ intent	A activity was monitored and the assisted person is ready to give information
Supported goal(s) from User Needs (if applicable)	- get confirmation about monitored activity - get detailed information about activities
Preconditions	An activity needs to be recognized
Flow of events: (Main Flow)	1. The system asks the user if he wants to contribute an activity description into the diary 2. The AP (assisted person) chooses to do so 3. The system displays a list of monitored activities (like cooking) and asks the AP to decribe what he or she has cooked OR displays a possibility to create a new activity that has not been monitored previously (e.g. playing chess or watching tv) 4. The AP provides detailed information (e.g. i cooked noodles) to the activity

	5. The system saves the confirmed activity (cooking of noodles) in the dementia diary. The system continues to ask about other monitored activities.
Alternate flows	2. a The user does not want to add additional information to a task 3. a The system records that the AP did not want to contribute any detailed information
Exceptional flows	
Assumptions/ rules	-
Displayed information	List of monitored activities, possibility to create a new activity, confirmation message that the information has been saved
Postconditions	The user has added additional information to a monitored activity
NFRs	- There should be low cognitive effort to provide detailed information
Services Required	This will be added later
Relation to other use cases	-
Open issues	-

8.1.2.3. Check Activity

Table 8: Dementia Diary: Check Activity Use Case

Use Case Number	UC_P1.3
Use Case Name	**Check activity**
Actors	Caregiver, relative, (assisted person)
Version Number + Author	V1, Özgür Ünalan
Iteration	Pre-final
Summary	This use case describes how the monitored and confirmed activities can be checked by caregivers, relatives or the assisted person themself
Trigger/ intent	The user wants to check the status of the monitored and confirmed activities
Supported goal(s) from User Needs (if applicable)	- get an overview about the activities of the assisted person
Preconditions	The user is authenticated to check the activities of the asssited person
Flow of events: (Main Flow)	1. The actor chooses to check the activities of the assisted person 2. The System asks the actor to provide authentication information (e.g. user name and password) 3. The actor provides their security information 4. The system authenticates the actor and offers different views for the monitored and confirmed activities of the assisted person. 5. The user views the activities by looking at the different views (monitored and confirmed activities,

	chronological view, as-is and to-be activities comparison, etc.) offered by the system. After a while, the user chooses to log out. 6. The system logs the user out.
Alternate flows	
Exceptional flows	2a. The system recognizes a unsuccessful login more than 3 times. 3a. The system sends a message to the person responsible for the administration of the system, that there might be a attempt of breaking the security of the system 4a. The administrator takes countermeasures 5b. If the user does not log out and there is a time-period of 5 minutes of inactivity, the system logs out the user automatically.
Assumptions/ rules	The assisted person has given permission that the caregiver or relatives can check their activities.
Displayed information	List of activities, Confirmed activities monitored activities, chronological view of activities, as-is and to-be activity comparison.
Postconditions	The actor has gained an overview about the activities of the assisted person
NFRs	- this use case should have a high security level. The actor needs to be authenticated
Services Required	This will be added later
Relation to other use cases	-
Open issues	-

8.1.2.4. Leave Message

Table 9: Dementia Diary: Leave Message Use Case

Use Case Number	UC_P1.4
Use Case Name	**Leave message**
Actors	Caregiver, relative, assisted person
Version Number + Author	V1, Özgür Ünalan
Iteration	Pre-final
Summary	This use case describes how the actor can leave a message to an other actor
Trigger/ intent	The actor wants to leave a message to another actor. Mostly this will be between caregiver and relative, since the assisted person is always present.
Supported goal(s) from User Needs (if applicable)	- provide information to another actor
Preconditions	The user is authenticated
Flow of events: (Main Flow)	1. The actor (e.g. caregiver) chooses to leave a message to another actor (e.g. the relative) 2. The system provides input fields to select the recipient of the message and for the message itself.

	3. The user enters the message and chooses the recipient and confirms to save the message 4. The system saves the message and optionally sends an e-mail to the recipients e-mail address. The system shows a confirmation message 5. The next time the recipient logs into the system, the messages that were left for him are displayed by the system.
Alternate flows	
Exceptional flows	4a. The system fails to deliver the e-mail to the recipients e-mail address. 5a. The system notifies the sender of the message, that the e-mail could not be delivered to the recpient
Assumptions/ rules	The use case is not intended to be used as a reminder
Displayed information	Recipient, message text, message status (sent, read, etc.), list of messages
Postconditions	The actor has left a message to somebody else
NFRs	-
Services Required	This will be added later
Relation to other use cases	-
Open issues	-

8.1.2.5. Create Report

Table 10: Dementia Diary: Create Report Use Case

Use Case Number	UC_P1.5
Use Case Name	**Create report**
Actors	Caregiver, doctor
Version Number + Author	V1, Özgür Ünalan
Iteration	Pre-final
Summary	This use case describes how the system provides a report about the activities of the assisted person.
Trigger/ intent	The actor wants get an overview about the activities of the assisted person, in a given period of time
Supported goal(s) from User Needs (if applicable)	- look for unusual behavior that could indicate medical problems
Preconditions	The user is authenticated
Flow of events: (Main Flow)	1. The actor chooses to create a report 2. The system offers configuration possibilities for a new report (name of report, time frame, choice of activities, etc.) or an existing report. (e.g., amount of bathroom usage per day) 3. The actor configures the report according to his requirements and chooses, to save (if new) and generate the report. 4. The system generates the report and displays it to the actor.
Alternate flows	-

Exceptional flows	-
Assumptions/ rules	Reports should not diagnose something themselves, but merely provide raw data
Displayed information	List of available reports, input form to create an report (report name, description, time frame, list of activities)
Postconditions	A report has been created
NFRs	- The report should be easy to understand
Services Required	This will be added later
Relation to other use cases	-
Open issues	-

8.2. Biography

8.2.1. Scenario

Scenarios, described in chapter 6

Product Ideas.

8.2.2. Use Cases

8.2.2.1. Digitize Material

Table 11: Biography: Digitize Material Use Case

Use Case Number	UC_P2.1
Use Case Name	Digitize material
Actors	Relatives, media professional
Version Number + Author	Patrick Röder, v0.1
Iteration	draft
Summary	Relatives of the dementia patient collect relevant material from various different sources (e.g. family albums, objects, audio recordings…) and digitize it using the system
Trigger/ intent	N/A
Supported goal(s) from User Needs (if applicable)	(appended in next revision)
Preconditions	-
Flow of events: (Main Flow)	1. Material is collected and sorted by type 2. Digitzers (A/D converter(s)) are ready 3. material is placed on sensor(s) 4. material is digitized 5. System confirms successful digitalization
Alternate flows	N/A
Exceptional flows	1. Material cannot be digitized (digitizer error) 2. System notifies operator of failure 3. Material is digitized again
Assumptions/ rules	N/A
Displayed information	Successful digitalization along with the digital representation of the material
Postconditions	• Operator is informed about successful digitalization • System acquires new data
NFRs	N/A
Services Required	(appended in next revision)
Relation to other use cases	(appended in next revision)
Open issues	N/A

8.2.2.2. Sequence Material

Table 12: Biography: Sequence Material Use Case

Use Case Number	UC_P2.2
Use Case Name	Sequence material
Actors	Relatives, media professional
Version Number + Author	Patrick Röder, v0.1
Iteration	draft
Summary	Material is put into sequence for the reminiscence application

Trigger/ intent	N/A
Supported goal(s) from User Needs (if applicable)	(appended in next revision)
Preconditions	Digitized material
Flow of events: (Main Flow)	1. System displays “media pool” 2. User selects media item out of a “pool” of items 3. User assigns sequence number to media item 4. System confirms assignment 5. Start again with 1 until all media has been sequenced
Alternate flows	1. User selects media item 2. System displays category list 3. User assigns media item to category 4. System confirms assignment
Exceptional flows	N/A
Assumptions/ rules	N/A
Displayed information	• Available media items • Categories • Media items in sequence (graphical representation)
Postconditions	N/A
NFRs	N/A
Services Required	(appended in next revision)
Relation to other use cases	(appended in next revision)
Open issues	N/A

8.2.2.3. Prepare Memory Game

Table 13: Biography: Prepare Memory Game Use Case

Use Case Number	UC_P2.3
Use Case Name	Prepare memory game
Actors	Relatives, media professional
Version Number + Author	Patrick Röder, v0.1
Iteration	draft
Summary	Images and sounds are chosen for the memory game application
Trigger/ intent	N/A
Supported goal(s) from User Needs (if applicable)	(appended in next revision)
Preconditions	Appropriate images and sound have been digitized
Flow of events: (Main Flow)	1. System asks for grid size 2. User enters grid size 3. System displays sounds from the media pool 4. User chooses sound for background ambience/music 5. User chooses sound for flipping animation 6. System displays images from media pool 7. User chooses a number of image pairs corresponding to grid size

	8. system displays chosen values 9. User confirms values 10. System generates game
Alternate flows	1. (9b) User changes a certain value 2. System confirms value change
Exceptional flows	N/A
Assumptions/ rules	N/A
Displayed information	• Grid size dialog • Music and image selection dialog • Confirmation screen
Postconditions	Memory game file selectable from main menu
NFRs	N/A
Services Required	(appended in next revision)
Relation to other use cases	(appended in next revision)
Open issues	N/A

8.2.2.4. Prepare Quiz Game

Table 14: Biography: Prepare Quiz Game Use Case

Use Case Number	UC_P2.4
Use Case Name	Prepare quiz game
Actors	Relatives, media professional
Version Number + Author	Patrick Röder, v0.1
Iteration	draft
Summary	Questions are prepared for the quiz application
Trigger/ intent	N/A
Supported goal(s) from User Needs (if applicable)	(appended in next revision)
Preconditions	Sufficient material has been digitized
Flow of events: (Main Flow)	1. System asks for number of questions 2. User enters number of questions 3. System asks for title, correct and incorrect answer of first question 4. User enters title, correct and incorrect answer of first question 5. System asks for associated media file from “media pool” (if any) 6. user selects media file (if any) 7. go to 3 until all questions have been entered 8. System displays all questions in a list 9. User confirms list 10. System prompts for a “final” message 11. User enters final message 12. System generates quiz
Alternate flows	1. (7) User aborts data entry 2. System goes to (8) directly 1. (9) User reaarranges question sequence

	2. System displays new sequence
Exceptional flows	N/A
Assumptions/ rules	N/A
Displayed information	• Number of questions dialog • Question data entry screen • Question list screen
Postconditions	Quiz game file selectable from main menu
NFRs	N/A
Services Required	(appended in next revision)
Relation to other use cases	(appended in next revision)
Open issues	N/A

8.2.2.5. Play Memory Game

Table 15: Biography: Play Memory Game Use Case

Use Case Number	UC_P2.5
Use Case Name	Play memory game
Actors	Dementia patient and caregiver/spouse
Version Number + Author	Patrick Röder, v0.1
Iteration	draft
Summary	Patient or caregiver/spouse play a game of memory
Trigger/ intent	N/A
Supported goal(s) from User Needs (if applicable)	(appended in next revision)
Preconditions	Material has been digitized, memory file has been created
Flow of events: (Main Flow)	1. User selects memory game from main menu 2. System starts memory game 3. System asks for number of players (1 or 2) 4. System displays memory board 5. player one selects pair (flipping animation) 6. system removes pair on match, flips cards back on non-match 7. If player two is in the game, he/she selects pair (flipping animation) 8. system removes pair on match, flips cards back on non-match 9. System displays score (number of matches) 10. Sequence continues with 5 until all cards have been removed 11. System displays winning animation and score
Alternate flows	N/A
Exceptional flows	N/A
Assumptions/ rules	N/A
Displayed information	• Number of players dialog • Game board
Postconditions	Last score is kept
NFRs	N/A

Services Required	(appended in next revision)
Relation to other use cases	(appended in next revision)
Open issues	(appended in next revision)

8.2.2.6. Play Quiz Game

Table 16: Biography: Play Quiz Game Use Case

Use Case Number	UC_P2.6
Use Case Name	Play quiz game
Actors	Dementia patient and caregiver/spouse
Version Number + Author	Patrick Röder, v0.1
Iteration	draft
Summary	Patient or caregiver/spouse play a quiz game
Trigger/ intent	N/A
Supported goal(s) from User Needs (if applicable)	(appended in next revision)
Preconditions	Material has been digitized, quiz game file has been created
Flow of events: (Main Flow)	1. User selects quiz game from main menu 2. System starts quiz game 3. first question is displayed 4. User enters answer (one of two choices) 5. If answer incorrect: System shows correct answer 6. System shows media asset (sound, image…) 7. next question is displayed (continue with 4 until all questions have been asked) 8. System displays final message
Alternate flows	N/A
Exceptional flows	N/A
Assumptions/ rules	N/A
Displayed information	• Question screen • Result screen (correct/incorrect) • Final screen
Postconditions	Last score is kept (number of correct answers)
NFRs	N/A
Services Required	(appended in next revision)
Relation to other use cases	(appended in next revision)
Open issues	(appended in next revision)

8.2.2.7. Start Reminiscence Session

Table 17: Biography: Start Reminiscence Session Use Case

Use Case Number	UC_P2.7
Use Case Name	Start reminiscence session
Actors	Dementia patient and caregiver/spouse
Version Number + Author	Patrick Röder, v0.1
Iteration	draft

Summary	Patient or caregiver/spouse start a reminiscence session
Trigger/ intent	N/A
Supported goal(s) from User Needs (if applicable)	(appended in next revision)
Preconditions	Material has been digitized
Flow of events: (Main Flow)	1. User chooses a prepared session from the main menu 2. System starts the session 3. System asks if session is interactive or self-running 4. User selects session type
Alternate flows	N/A
Exceptional flows	N/A
Assumptions/ rules	N/A
Displayed information	• Session screen
Postconditions	Session is loaded into memory, session type set
NFRs	N/A
Services Required	(appended in next revision)
Relation to other use cases	(appended in next revision)
Open issues	(appended in next revision)

8.2.2.8. Select Media

Table 18: Biography: Select Media Use Case

Use Case Number	UC_P2.8
Use Case Name	Select media
Actors	Dementia patient and caregiver/spouse
Version Number + Author	Patrick Röder, v0.1
Iteration	draft
Summary	Patient or caregiver/spouse select media interactively during a reminiscence session
Trigger/ intent	N/A
Supported goal(s) from User Needs (if applicable)	(appended in next revision)
Preconditions	Material has been digitized, session has been started
Flow of events: (Main Flow)	1. If session is non-interactive, user interrupts session flow 2. System displays a list of media associated with current item 3. User selects media from list 4. System displays media 5. at the “end” of media, system continues with main flow
Alternate flows	N/A
Exceptional flows	N/A
Assumptions/ rules	N/A
Displayed information	• Session flow display • Media selection list
Postconditions	Session flow continued
NFRs	N/A
Services Required	(appended in next revision)

Relation to other use cases	(appended in next revision)
Open issues	(appended in next revision)

8.2.2.9. Mark Session Event

Table 19: Biography: Mark Session Event Use Case

Use Case Number	UC_P2.9
Use Case Name	Mark session event
Actors	Caregiver/spouse
Version Number + Author	Patrick Röder, v0.1
Iteration	draft
Summary	Caregiver/spouse marks an event for later annotation during a session
Trigger/ intent	N/A
Supported goal(s) from User Needs (if applicable)	(appended in next revision)
Preconditions	Session has been started
Flow of events: (Main Flow)	1. User pushes trigger during session 2. System marks event and current media 3. System confirms input
Alternate flows	N/A
Exceptional flows	N/A
Assumptions/ rules	N/A
Displayed information	• Session flow screen • Input confirmation
Postconditions	Media and event are marked
NFRs	N/A
Services Required	(appended in next revision)
Relation to other use cases	(appended in next revision)
Open issues	(appended in next revision)

8.2.2.10. Annotate Session Event

Table 20: Biography: Annotate Session Event Use Case

Use Case Number	UC_P2.10
Use Case Name	Annotate session event
Actors	Caregiver/spouse
Version Number + Author	Patrick Röder, v0.1
Iteration	draft
Summary	Spouse/caregiver annotates previously marked events during annotation session
Trigger/ intent	N/A
Supported goal(s) from User Needs (if applicable)	(appended in next revision)
Preconditions	Session closed, event marked
Flow of events:	1. User enters annotation screen/mode

(Main Flow)	2. System displays list of marked events with associated media 3. User selects event 4. System displays event annotation screen 5. User annotates event 6. System confirms annotation
Alternate flows	N/A
Exceptional flows	N/A
Assumptions/ rules	N/A
Displayed information	• Marked event list • Event annotation screen • Confirmation dialog
Postconditions	Events are annotated
NFRs	N/A
Services Required	(appended in next revision)
Relation to other use cases	(appended in next revision)
Open issues	(appended in next revision)

8.2.2.11. Close/End Session

Table 21: Biography: Close/End Session Use Case

Use Case Number	UC_P2.11
Use Case Name	Close/end session
Actors	Dementia patient and caregiver/spouse
Version Number + Author	Patrick Röder, v0.1
Iteration	draft
Summary	Patient or caregiver/spouse end a reminiscence session
Trigger/ intent	N/A
Supported goal(s) from User Needs (if applicable)	(appended in next revision)
Preconditions	Current running reminiscence session
Flow of events: (Main Flow)	1. User triggers end/close of session 2. System displays confirmation dialog 3. User confirms end of session
Alternate flows	1. System comes to the end of session 2. System asks if session should be closed or repeated 3. User confirms choice
Exceptional flows	N/A
Assumptions/ rules	N/A
Displayed information	• Session flow screen • Session end dialog
Postconditions	Session is closed
NFRs	N/A
Services Required	(appended in next revision)
Relation to other use cases	(appended in next revision)
Open issues	(appended in next revision)

8.3. Medication Dispenser

8.3.1. Scenario

Scenarios, described in chapter 6

Product Ideas.

8.3.2. Use Cases

8.3.2.1. Remember To Take Medication

Table 22: Medication Dispenser: Remember To Take Medication Use Case

Use Case Number	UC_P3.1
Use Case Name	Remember to take the medication
Actors	Alfred Black, Patient Peter Black, Son Margaret Adams, Doctor Erika Schmidt, medical secretary
Version Number + Author	V1.0 lsesma
Iteration	draft
Summary	The Doctor prescribes the new medication and programs the Dispenser. The Dispenser remembers the patient to take his medication everyday at the right time It is possible to check the intake of medication just by looking if there are still pills available on the Medication Dispenser
Trigger/ intent	The programmed time of medication has arrived or after x time after the programmed time has passed and the medication has not been taken -> alarm The Medication Dispenser is opened and the medication is removed-> message via GSM
Supported goal(s) from User Needs (if applicable)	-Medication Reminder -Check if the Medication has already been taken (Only possible within the access time)
Preconditions	N/A
Flow of events: (Main Flow)	1. Mrs Adams prescribes Mr. Black the adequate medication. So *Mrs. Schmidt*, the medical secretary adds the necessary medication to the *Medication Dispenser***.** 2. *Mrs. Schmidt* also programs the *Medication Dispenser* via PC - serial link. 3. She also selects the type of alarm to be used: red light, sound, song, text or recorded voice. 4. At home, every time the programmed time of the alarm has arrived, the alarm starts. 5. *Mr. Black* opens the *Medical Dispenser* and removes the medication. He has only access to the medication that corresponds to that intake. 6. The Medical Dispenser records the event and sends it to the Server via GSM.
Alternate flows	At step 5. Mr. Black forgets to take his medication despite the alarm that morning. 5a. When the access time has passed, the Medication Dispenser sends the no intake event to the Server via GSM.

	At step 5. Mr. Black forgets to take his medication despite the alarm that morning. 5b. Two hours later, Mr. Black´s son visits his father and asks him if he took the medication that morning. Mr. Black can´t remember. The access time is not over, so *Peter* tries to open the *Medication Dispenser* and sees that the morning tablets are still there. Thanks to this, he sees that his father did not take the medication and he takes them now.
Exceptional flows	If the battery is low, the Medication Dispenser indicates it with a light. The battery needs to recharge or to be changed. If the medication available will only last for x more days the Medication Dispenser indicates it.
Assumptions/ rules	N/A
Displayed information	Battery state
Postconditions	N/A
NFRs	N/A
Services Required	UC_P3.1_SC1: Programming of Medication Dispenser (Flow of events step 2) UC_P3.1_SC2: Medication Reminder (Flow of events step 4) UC_P3.1_SC3: Communication between Medication Dispenser and Server via GSM. (Flow of events step 6) UC_P3.1_SC4: Check if medication is still available (Flow of events step 5b.) UC_P3.1_SC6: Battery low alert (Exceptional flow) UC_P3.1_SC7: Medication low alert (Exceptional flow)
Relation to other use cases	N/A
Open issues	N/A

8.3.2.2. Overdose Prevention

Table 23: Medication Dispenser: Overdose Prevention Use Case

Use Case Number	UC_P3.2
Use Case Name	Overdose Prevention
Actors	Alfred Black, Patient
Version Number + Author	V1.0 lsesma
Iteration	draft
Summary	Dispenser locks down after medication Intake or access time is over, until next intake is due.
Trigger/ intent	The Medication Dispenser is opened and the medication is removed-> message via GSM The access time is over -> Dispenser locks down
Supported goal(s) from User Needs (if applicable)	-Mr. Black does not have access to all medication in the Dispenser , but he has only access to the relevant compartment for a limited time (access time)
Preconditions	N/A

Flow of events: (Main Flow)	1. *Mr. Black* takes his night tablets from the *Medical Dispenser* 2. The Medical Dispenser records the event and sends it to the Server via GSM. 3. The Medication Dispenser locks down 4. One hour after, he is about to go to bed, but he has the feeling he didn´t take his medication that night. *Mr. Black* tries to open the *Medication Dispenser*, but no pills are available. The Medication Dispenser prevents Mr. Black from taking too much medication.
Alternate flows	N/A
Exceptional flows	N/A
Assumptions/ rules	N/A
Displayed information	N/A
Postconditions	N/A
NFRs	N/A
Services Required	UC_P3.2_SC1: Communication between Medication Dispenser and Server via GSM. (Flow of events step 2) UC_P3.2_SC2: Medication Dispenser locks down (Flow of events step 3)
Relation to other use cases	N/A
Open issues	N/A

8.3.2.3. Medication Adherence Control & Medication Chaos Prevention

Table 24: Medication Dispenser: Medication Adherence Control & Medication Chaos Prevention Use Case

Use Case Number	UC_P3.3
Use Case Name	Medication adherence control and medication chaos prevention
Actors	Alfred Black, Patient Peter Black, Son Margaret Adams, Doctor
Version Number + Author	V1.0 lsesma
Iteration	draft
Summary	Peter is in a business trip and Mr. Black has problems taking his medication this week. When Peter comes back he takes Mr. Black to the doctor appointment. Peter does not know how was his father´s medication compliance this week (Medication chaos) The doctor checks the medication adherence information via web browser. With this information is easier to deal with Mr. Black´s illness Peter can check if his father is taking the medication properly via web browser.

Trigger/ intent	The Medication Dispenser is opened and the medication is removed-> message via GSM
Supported goal(s) from User Needs (if applicable)	Prevention of Medication Chaos The doctor can monitor the Medication Adherence to deal more efficiently with the illness The family can monitor the Medication Adherence to help the patient with his medication
Preconditions	N/A
Flow of events: (Main Flow)	1. This week, Mr. Black´s son Peter is in a business trip and Mr. Black has more problems than usual to take his medication at the right times. The Medication Dispenser records each event (intake or not intake of medication) and sends it to the Server via GSM. 2. Monday morning, Peter is back and goes to check on his father and take him to his doctor appointment. Peter does not know how his father´s medication compliance this week was (Medication chaos). *Mrs. Adams* logs in the *server* with a password *3. Mrs. Adams* checks Mr. Black's medication adherence of the last period on the *web* using the unique ID of his medication dispenser. Apparently Mr. Black had a good medication adherence this last month; only the last week had he missed his tablets a couple of times but nothing worrying. With the knowledge that Mr. Black is taking his medication correctly is easier to deal with his illness.
Alternate flows	At step 2. 2a. Although *Peter* is in a business trip, he can control the medication adherence of this father via *web browser* connecting to the server with a password, and getting Mr. Black´s related information directly without possible access to other patients Information. With this service, Peter is calm and doesn´t have to worry so much 3a. That night *Peter* checks on the *web* if his father took the medication that day. He sees he hasn´t taken the night medication yet so he phones him to remind him on that.
Exceptional flows	N/A
Assumptions/ rules	N/A
Displayed information	Medication Adherence Graphs in the Web Browser, etc
Postconditions	N/A
NFRs	N/A
Services Required	UC_P3.3_SC1: Communication between Medication Dispenser and Server via GSM. (Flow of events step 1) UC_P3.3_SC2: Medication Adherence Control via Web Browser using password and medication dispenser unique ID (Flow of events step 2 and 3) UC_P3.3_SC3: Medication Adherence Control via Web Browser using password and medication dispenser unique ID (Flow of events step 2a and 3a)

Relation to other use cases	N/A
Open issues	N/A

8.3.2.4. Alarm Caused By Non Medication Adherence

Table 25: Medication Dispenser: Alarm Caused By Non Medication Adherence Use Case

Use Case Number	UC_P3.4
Use Case Name	Alarm caused by non medication adherence
Actors	Alfred Black, Patient Peter Black, Son Margaret Adams, Doctor Erika Schmidt, medical secretary
Version Number + Author	V1.0 lsesma
Iteration	draft
Summary	Peter is going on a business trip for two weeks. Mr. Black does not take his tablets more than halve of the times. An alarm is set off, which Mrs. Schmidt gets. This means that Mr. Black took less than 50% of medication dosages for a week. Now Mrs. Schmidt checks on the web the medication pattern of the patient. Usually Mr. Black has very good medication compliance, so she phones him. Mr. Black is not feeling well, so Mrs. Schmidt schedules Mrs. Adams to visit him at home.
Trigger/ intent	The medication adherence for a week was less than the 50% -> alarm to the medical center The Medication Dispenser is opened and the medication is removed-> message via GSM
Supported goal(s) from User Needs (if applicable)	Non medication adherence causes an alarm when less than x. Able to check if something is wrong with the patient.
Preconditions	N/A
Flow of events: (Main Flow)	1. Mr. Black´s son Peter says goodbye to his father; he will be away for two weeks on a business trip. 2. The medication alarm is not loud enough and Mr. Black, who is not feeling well, stays in bed most of the days, forgetting about his tablets more than halve of the times. The Medical Dispenser records each event (intake or not intake of medication) and sends it to the Server via GSM. 3. A week has past, and Mr. Black has taken less than 50% of his medication. The server detects this and sets off and alarm. Mrs. Schmidt gets the alert. 4. *Mrs. Schmidt* checks the medication pattern of Mr. Black on the *web* using a password to connect to the server and the unique ID of the medication dispenser used by Mr. Black. 5. Usually Mr. Black has very good medication compliance,

	so she gets worried and decides to phones him. 6. Mr. Black answers the phone and says he is not feeling very well, that he´s been in bed most of the time. Mrs. Schmidt schedules that Mrs. Adams visits him at home.
Alternate flows	N/A
Exceptional flows	N/A
Assumptions/ rules	N/A
Displayed information	Medication Adherence Graphs in the Web Browser, etc
Postconditions	N/A
NFRs	N/A
Services Required	UC_P3.4_SC1: Communication between Medication Dispenser and Server via GSM. (Flow of events step 1) UC_P3.4_SC2: Alarm caused by non medical adherence. (Flow of events step 3) UC_P3.3_SC3: Medication Adherence Control via Web Browser using password and medication dispenser unique ID (Flow of events step 4 and 5)
Relation to other use cases	N/A
Open issues	N/A

8.4. Digital Corkboard

Centrihealth will produce a digital cork board that can be displayed on several media such as a TV and medical devices from Cirrus technology will send information to an expert assistive living system that will update the cork board, see Figure 4.

The digital cork board that will be produced by Centrihealth will convey information to sufferers with early stage of Alzheimer for an integrated services in an easy to read, uncluttered format. With users consent relatives and professionals can see key information to help assess and co-ordinate service delivery and leave messages, add entries and reminders on calendar.

Figure 4 Mock up of cork board produced by Centrihealth for suffers of early stage of Alzheimer

The UK partners are particularly interested in developing a scenario based on the corkboard with Philips net TV, Medcom's medical dispenser and other CCE services as part of deliverable 5.1. The user case for the corkboard is described in the use case below in Table 26

Table 26: Assisted Living Dementia Corkboard Use Case

Use Case Number	UC_P4.1
Use Case Name	Assisted Living Dementia Corkboard
Actors	Deirdre is an elderly patient with COPD recently diagnosed with dementia. She is cared for by her husband Theodore (diabetes sufferer), her community nurse Rose Bristowe and her son Sam.
Version Number + Author	Version Number 1 Author Ranjit Bassi and Paul Newton
Iteration	Final
Summary	With the onset of Deirdre's dementia, viewing information regarding medication and the management of her drug regime has become difficult, appointments and general wellbeing has also become difficult. A web based expert system that displays the information regarding medication, visitors etc is displayed on a cork board capability to be viewed on a cork board devise, NetTV, PC/ipad providing a very simple iteration of the data and information being collected in a simple touch screen pictorial view covering: - Calendar with appointments - Time (analogue am or pm) - Visitors today - Drugs to be taken and how (pictorial) - Device use and readings to be taken with instruction (pictorial) - Messaging capability The cork displays the information in a format that the user is familiar with, for example the clock is displayed as a clock with

	hands and not as a digital clock.
Trigger/ intent	The activity was monitored and the assisted person is ready to give information or take they medication
Supported goal(s) from User Needs (if applicable)	• Supporting daily regimes for medication etc • Remote support for the patient • Early alerting to potential problems • Reducing the cost in both money and time
Preconditions	NA
Flow of events: (Main Flow)	1. The corkboard is updated by an expert system based on the medication needs of the user and visitors appointment. 2. The patient is reminded to take medication. 3. The patient takes the medication. 4. The expert system updates the information and updates the carer(s) page that the medication has been take,
Alternate flows	Steps 1 to 4 as above 5 If the patient does not take the medication a series of reminders, with increasing in warning levels, are displayed on the corkboard, which will eventual trigger an email or text message to a carer to intervene if the user does not take the medication.
Exceptional flows	NA
Assumptions/ rules	NA
Displayed information	Se figure 1of display on dementia cork board
Postconditions	See
NFRs	NA
Services Required	NA
Relation to other use cases	Dementia Diary and medication dispenser
Open issues	NA-

9. Potential Barriers

9.1. Risklist

This chapter contains a highlevel list of risks. We did a collection of possible risks for the project and found them in the four categories project organization, Technical issues (hardware and software) and user related risks. The risks can be prioritized according to their priority and probability. Additionally, for highly critical risks some remedy actions can be undertaken to prevent the risk from coming up.
In the future, we will fill criticality and probability and identify risk prevention actions for critical tasks.

Area	Description	Criticality	Probability	Remedy
Project Organisation	Poor WP internal interfaces and communication			
Project Organisation	Poor interfaces across WPs			
Project Organisation	Delays in critical components of the work that are required by other tasks or activities			
Project Organisation	Loss of focus on vision, objectives and milestones			
Project Organisation	Partners with unique know-how or role leave the project or under-perform despite management measures			
Project Organisation	Staff changes during project runtime			
Project Organisation	Project Scope too large			
Project Organisation	Project Scope too small			
Project Organisation	No agreement on distribution of implementation can be gained			
Project Organisation	Implementation time too short			
Project Organisation	Pilot sites not appropriate			
Technical Issues (Hardware)	Loss of technical orientation because of lack of internal and external knowledge			
Technical Issues (Hardware)	Initially identified sensors to be used become inappropriate or unavailable			
Technical Issues (Hardware)	Changes or insufficient technical interfaces			
Technical Issues (Hardware)	No appropriate Sensors available			
Technical Issues (Software)	Integration difficulties due to unforeseen complexity			
Technical Issues (Software)	Late identification of missing, critical components			
Technical Issues (Software)	Deployment constraints at pilot sites arise			
Technical Issues (Software)	No clear system design and component specification			
Technical Issues (Software)	unvalidatable application with too many errors			
User	Application not accepted			
User	Interface too complicated			
User	Application not testable by user group			

User	Evaluation with user group not possible			
User	Not enough appropriate test persons found			
User	No meaningful interaction possible due to physical/mental handicap of the users (caused by aging and/or Alzheimer's disease)			
User	User needs & requirements analysis process fails/can't be 100% completed because of limited access to patients/users			
User	Secondary stakeholders (relatives & caregivers) are not considered enough(-> Application not accepted by secondary stakeholders)			

9.2. Barriers as indicated by dementia experts in the Netherlands

The scenarios were discussed with a two dementia counselors and the director of a local dementia counseling organization. The counselors are mainly concerned with people with dementia living at home. Upon reviewing the scenarios, the counselors gave some pointers on designing new solutions for elderly with dementia in general. In addition, they commented on the proposed CCE products. The aim was to validate the proposed CCE products for The Netherlands and to collect feedback for further development of the scenarios.

General

The counsellors gave some insights and some requirements for solutions. Firstly, the following insights were given:

- Often also among people with dementia they believe nothing is wrong with them and they won't accept help. The family wants help and tools
- Every case of dementia is different. Factors of influence are the living environment, involvement of family members and caretakers, and the stage of the illness at a particular moment in time.
- The biggest issue is that there are a lot of tools and applications that are appropriate for people with dementia, but there is no clear overview of all these solutions. The first counsellor tells an anecdote of a patient who couldn't switch on the light and television, simply because she didn't understand the concept. In this case he advised the family to get a sensor light from a hardware store. These low cost solutions are numerous, but neither the counsellor himself nor the family have time to look for them.
- In The Netherlands there are Thuiszorgwinkels, homecare shops that sell appliances to facilitate care at home. These shops unfortunately usually have certain deals with suppliers and therefore their assortment is limited.
- Acceptance of a solution by a person with dementia will be a lot higher if this comes from concerns about burdening family.
- It is a good thing to go and ask people with dementia for feedback on product proposals, this usually doesn't happen.
- The group of people with dementia living alone and independently is getting bigger

- New solutions usually don't work because they are not hardwired in the clients' behavior. For example, personal alarms aren't used because for years a client has had encoded that if anything is wrong to walk to the neighbors'.
- Current solutions include a lot of labels describing what something is in words or pictures. Picture of a toilet on a door to remind that there is a toilet behind the door. Labels on remote controls. Clocks that mention date and time in words instead of numbers.
- Current solutions involve a lot of communication. There are numerous small solutions in behavior that all have to be communicated when a new caretaker gets involved. For example, that all important papers are kept under the carpet on the table (a habit that the clients has had for decades). These small facts and solutions require very specific training of the new caretaker involved.
- About the personas: a lot can be specified, the terms are quite broad, disorientation can occur in various ways. 'Safety' is not a need of the clients themselves, but of the family members. The clients don't experience their behavior as being unsafe. Respect is definitely a need that is very hard to fulfill. Respectful and caring behavior of caretakers is easily misinterpreted. Education within the family is very important in this!
- Education of caretakers and those surrounding the person with dementia is key. For others it is very hard to understand the state of mind the person with dementia is in. This leads to frustration on both sides.

Secondly, the following generic requirements for new solutions were given:

- Any solutions needs to be accessible and out of the box, this is the biggest problem with existing solutions, it is unclear where to find them and how to get them. Costs are of lesser concern.
- Focus on helping people accomplish relatively small tasks like taking medication, food, drinks, hygienic care. People with dementia are most depressed for being dependent on others for these simple tasks.
- Solutions have to be very dynamic. Solutions that work at one instance will not work in three months from then.

Dementia diary

- Up until a certain severity where the person with dementia moves to a carehome, determining location of the person is very important for the family. Knowing that someone is safe and not wandering about.
- Every family has their own solutions; many have a calendar from the shop that they adjusted to make it suitable for their situation.
- A calendar should look like a calendar they are using now though. It takes an average person already trouble to adjust to a new calendar, let alone someone with dementia.
- It would be great if family could 'log on' and discuss the schedule to see who will accompany the person with dementia to the doctor.
- The first counsellor found the part about the system asking where the person had been had to understand for two reasons. Firstly, nobody likes having to report

everything they do. People with dementia will not like this either. It is OK to check with sensors where someone is going, if the person at one point has explicitly given permission to do so, like with medication. However, asking them to report is taking it to far. If the aim is to support caretakers, just a notification is enough; the reason why someone went outside is of lesser importance. Secondly, the counsellor is very doubtful if a person with dementia would have sufficient capacity to deal with language in general to be able to ask a question and to deal with this question. Thirdly, if it were to be a computer voice, the counsellor believes this would scare people off. Although for a next generation, this might not be an issue. His younger patients also use e-mail to contact him.The counselor showed a very similar book, that basically covers aspects of the concept, on paper. Items are to do's, descriptions about events, with the opportunity to include pictures (who, what, when and where), and a description 'what I really want to remember'.

- The book called 'Houvastboek' is one of several commercialized books that have been developed for people with dementia. Other books are more related to biography. A number of books are meant to work in and with, other than just providing reading material.
  The communication aspect, again would only work during a brief timeframe of dementia. A system responding to behavior would be very confusing.
- In The Netherlands privacy and forceful control of people is covered in the 'BOPZ' law (Law Special Commital Psychyatric Hospitals). However, this law only applies to institutionalizations, in the home there is a lot more freedom. The law is unclear about monitoring of people with dementia.
- Would be reassuring for family members. Second counsellor talked very often with family members about wanting to be a fly, just to see what is going on and if everything is alright. Of course privacy is a concern, sensordata, if approved by the client should be OK.
- In the current situation a consequence of behaviours like food intake can be seen (weight loss), but when asked about it, people with dementia will not be able to provide a truthful answer.

Biography

- The first counsellor is partly reserved, partly charmed by this scenario. The reservation is because of it being related to testing. At the daycare centre they do have something called mind fitness, which he explains is different from braintraining. Training implies that you get better at something, which is by far not the case for people with dementia. It is clear that this is not the aim of the scenario, but it is nonetheless a very sensitive topic.
- The first counsellor is very positive about the aspect of old media. We always remember events that have a strong emotion attached to it. This is true for us, and also for people with dementia.
- Puzzles and quizzes depend heavily on the implementation. The first counsellor uses the phrase 'testen is pesten' which translated means testing is teasing. Being asked a question that you just don't know the answer to can be very frustrating, still it happens very often. Family members will ask "don't you remember?" It all depends on the phrasing. People with dementia do like to be challenged, so if done in the right way, this solution can be very promising. Family, and preferably experts need to come up with questions that are in sync with the level of the

person with dementia. The level has to be just right, otherwise it's better to not do it at all.

- People with dementia are sensitive to a level being too high, but also to a level being too low. If they are matched with people with less cognitive functioning (for example during daycare), they will object immediately if they realize they are in better shape. And they are right; they need a completely different treatment.
- The first counsellor expects that people with dementia will not accept being fooled. Getting an answer wrong and still getting the same reward is not how a game works. Some people seem to enjoy the game called rumicub (a game where combinations of letters have to be made to create words, or numbers to create ascending combinations or combinations based on similarity). Also, the second counsellor feels that 'sitting down to look at old pictures and information' as a way of improving someone's mental state can be perceived as belittling by the client and family members.
- In the current situation family member create 'beleefboeken' translated this means 'experience books'. Unfortunately, for many institutionalizations family members are requested to create a book like this. In the end it is hardly used by caretakers. Mainly because they have no time to sit down with the client and refer to what is in the book. Also, family members are too busy taking care of practical issues, preparing food, administration, hygienic care, to sit down with their family member and go through the book. The cause is not just a lack of time, but also difficulties in switches their emotional state, in order to sit down and have a positive state of mind when flipping through the book.
- The stimulus can work for a brief moment. It's an impulse that triggers a positive emotional state, but only briefly.
- Would work for people in an early stage of dementia.

Medication dispenser

- The first counsellor describes anecdote about patient who is obsessively concerned with his medication intake. He asks his wife x times a day whether he has had his medication. At one point their solutions was to leave notes in various locations (kitchen, living room). On each note it said "yes, you have taken your medication". Each time the man would ask they would both sign the note as a reminder that this question was already asked. When this became to cumbersome because still, the man would keep asking, they switched to a voicerecorder. Every time the man would ask, his wife would play a pre-recorded tape.
- Medication is clearly one of the biggest issues. A lot of costs could be saved in this area. It happens a lot that a formal caretaker from a health care organization needs to visit someone purely to hand them the medication. In addition, this needs to be done at specific times, when the visit can't be combined with some other procedure. The first counsellor believes that also pharmacists should study this and come up with less complicated medicine schedules.
- The first counsellor himself uses 'bagsters' a service that is offered by pharmacists. With bagsters all medication is pre-bagged per day and a dispenser organizes the bags. The second counsellor is cricitcal of this system. People with dementia have trouble opening the bags, as a result all pills end up on the floor.
- Reminders have to be provided also when someone is out of the home, for example on a phone or at least something that is carried around. Kind of an 'sms alert'.

- The second counsellor responds positive to the aspect that it allows not only controlling daily intake of medication, but also the time at which it needs to be taken. Using a 15 minute timeframe and after that there should no longer be the possibility to take a particular medicine. Overdose is of much bigger concern than not taking medication! Therefore locking the dispenser at the right time is vital.
- Again the solution can be very useful, but only temporarily in a very specific stage of the illness. Especially notifications/reminders to take medication will not be understood in a more progressed state of the illness.
- The second counselor raises the suggestion of using fingerprint as a way of accessing the medication. You but your finger on the medicine dispenser and if you are the right person and it is the right time, you get your medication.
- Sending notifications to the general practitioner are considered useless by the second counsellor and the director. This will make the number of alerts, be it via phone or other alert systems to big. Already there are waiting lists and the general practitioner will only tell family to bring his client over for a consult.

9.3. Ethical Aspects

Ethical issues involve conflicts between any two or more several ethical principles listed below.

- Autonomy - respecting a consumer's choice and his/her right to self-determination.
- Beneficence - promoting the growth, well-being, and/or legitimate interests of others
- Fidelity - adhering to obligations to others (expressed or implied) and abiding by rules or regulations
- Justice - being fair, rendering to others that which is due, and the equitable allocation of resources
- Nonmaleficence - avoiding intentional harm to others

The ethical issues that the project needs to address are listed below

- Informed consent for pilots
- Conflicts of interest, for example where the family are keen to test the technologies but the person with dementia are reluctant.
- The privacy of participant data is of central importance
  - accumulation of personal information
  -

Ethical issues regarding the project, in particular the pilots, will be looked at in more detail under WP7.

9.4. Description of Technology available from CCE Partners

This chapter contains an overview of available and emerging Technologies. For a highlevel, detailed description, please see CCE Deliverable 2.1.

9.4.1. Description of Technology available from CCE Partners in Germany

IESE:
A pilot lab for Ambient Assisted Living (AAL) was established at the Fraunhofer Institute for Experimental Software Engineering. During the EMERGE and Bel Ami-Projects, this pilot lab was established to implement and evaluate AAL-Systems consisting of sensors and a software platform in a realistic environment. Here we test different kind of sensor technologies as well as software components in order to realize features for AAL. The following figure shows an outline of the AAL-lab:

Figure 5 - Floormap of the AAL-Lab at the Fraunhofer IESE

The figure shows the apartment outline and which sensors and user interfaces exist in each room. The activities of the assisted person are derived by analyzing and aggregating sensor information that is present in the apartment. Our philosophy is to unobtrusively monitor activities of elderly people's situations at home. For this we use nonbody-mounted sensors for environment and activity tracking, building automation facilities, and location tracking. Body-mounted sensors to monitor vital functions are used only if this cannot be done in an ambient way. Sensor fusion combines sensor data from different sources in an intelligent way in order to cope with the inherent imprecision and unreliability of the environmental data.

The following features and technologies are present:

- Integration of different types of sensors and actuators (motion sensors, switches, contacts, etc.)
- Different Applications, e.g. Elderly App, Health Service Provider App, Relatives App, System Management App
- Activity Recognition
- Motionlessness recognition
- Emergency Assistance (Alarming and recognition)

- Social Interaction (Messaging, Video Telephony)
- OSGi based runtime environment
- Usage of different wireless protocols (Bluetooth, Zigbee, Particle)

IGD:

Figure 6 - Fraunhofer IGD AAL Laboratory

The AAL Laboratory at the Fraunhofer IGD in Darmstadt, Germany is built like an apartment with a living room, kitchen and bedroom. In these rooms AAL technologies under current development are set up for demonstration and evaluation in a realistic setting. This set of rooms allows the realization of different scenarios within the AAL system development landscape. In the kitchen, cooking assistance and nutritional support can be developed and tested. The living room provides space for testing environment control and user monitoring solutions. In the bedroom users' sleep behaviour can be monitored and analysed and different lighting solutions can be benchmarked against each other.

The Living Room

The living room is filled with a modern couch and couch table setting. An ambient display shows a meadow and replaces a window view. The living room is equipped with a wide-screen TV-set, cameras aimed at the couch setting and pressure sensors in the couch to measure and react to couch use.

The living room is the main area of the apartment. Couch and table are the dominant furniture. Pressure sensors in the couch allow the registration of the user position and lets systems react to activity in the living room. The system can activate its reactivity to user commands automatically based on the inputs of the pressure sensors in the couch.

The Kitchen

The kitchen space is equipped with a sink as well as a set of cooking plates with a cooking hood. It also contains an oven and a refrigerator and is thus equipped like a normal household kitchen. The kitchen has a modern kitchen table in the middle of the room with chairs. Its lighting as well as the cooking hood are under external control and can be controlled via the KNX protocol.

The Bedroom

The bedroom in the AAL laboratory is equipped with a double-size bed and a flat-screen television set. The bed is equipped with capacitive sensors, which measure people's position in the bed and can thus observe bed usage and sleep patterns.

Sensors in the bedroom allow system reactions like the turning off of domotic devices and lights in the rest of the living lab when the user goes to bed, systems for improving sleep including things like temperature control, ventilation and lighting control.

Also, the monitoring of sleep behaviour available through the capacitive sensory equipment can provide a system with important objective feedback on the effectiveness of developed solutions.

Improving such wellness-related features of a living environment is an important aspect of many AAL systems as it provides both comfort and health benefits for elderly inhabitants thus enabling them a prolonged self-reliant life in their own homes.

Hardware infrastructure

The hardware used in the different rooms of the Living lab has been described above. In addition to the installed hardware, the Living Lab is equipped with an EIB-standard home automation control system. Basically this system allows the control of lighting, heating and domotic devices.

The purpose of Home Automation Systems is the improvement of the interaction and communication between typical domotic devices. Usually, this term is used to refer to small installations in the context of small residences, while Building Automation Systems refer to large buildings like office complexes or health care facilities. The two domains differ in their requirements and complexity, but the handling of data used for device control is a central issue in both system types.

The main application is the control of an environment with the option for integrating other application components. Devices used in the context of these two types of environment control systems can be classified based on their basic functionality as follows:

- Lighting and window blinds
- Safety alarm system
- Brown goods (audio/video or home theatre equipment, game consoles)
- White goods (household appliances), like a washing machine or stove
- Heating, Air conditioning and Ventilation systems (HVAC)
- Communications equipment (intercom system, telephone)
- Security and access control
- Elevators and sundry special domains
- Information processing and presentation equipment (tablet PCs, PDAs, PCs)

In automated homes, to give an example, light can be turned off in a room when there is no one present or switched on once sensors within the room detect the arrival of a human being. HVAC system functions can react to the present temperature, but also

to other factors like the opening or closing of a window. While BAS systems mainly focus on energy savings, the main goal of HAS systems is the increase of comfort and usability.

The implementation of the KNX standard in the Darmstadt AAL Laboratory supports all the usual devices brought under control by this protocol. Included are the room lights, which can be dimmed individually on a room-by-room basis. Furthermore included is energy control, the control of the state of all the different electric plugs available within the confines of the AAL Laboratory, thus giving the KNX-installation complete control over the energy supply of all electric devices requiring a connection to the energy grid. Since the Living room in the Darmstadt AAL Laboratory is equipped with a window and blinds, these are also connected to the KNX control system.

In terms of interaction devices, the lab is equipped with a set of pressure sensors in the couch in the living room and a gesture-recognition system using two cameras above the TV-screen in the living room. A further integration in current development is to deploy capacitive sensing mats in the floor, which allows the localization of people in the lab. In the future, interaction via touchscreen will be possible (touchscreen devices are currently deployed) as well as voice recognition via microphones.

Medcom:

Based on the MedCom ScanNT-Technology, TeleConsult enables its users to perform online and offline medical consultations. A general information exchange over different communication media is possible.

TeleConsult provides thanks to its different functions, the construction of a telemedicine-network. In the connected database, patient and image data can be stored. A client/server-architecture provides the central storage of all data of a telemedicine-center and the access to this data from every PC, which is equipped with the client-software. Moreover a Jabber server based in XMPP protocol is used to which all workstations/users have to register and to connect in order to have online / offline consultations (Point-to-Server connection).

9.4.2. Description of Technology available from CCE Partners in Hungary

The technologies which are offered here has been developed for Silvergate-112 (http://silvergate112.eu/), Assistive Medical and Social Monitoring and Alarm System – An Integrated Approach, and other projects by Budapest University of Technology and Economics, Biomedical Engineering Knowledge Centre and by the Budapest University of Technology and Economics, Department of Measurement and Information Systems. These technologies allow to build a system architecture shown on Figure 1, which depicts the hardware components and their interaction typical in Ambient Assisted Living applications.

The following technologies are available from Hungarian partners:

- Partner BME:
  - PloggZGB electricity meters and remote switches communicating using the ZigBee standard and their required hardware and infrastructure,
  - Prototype wireless environmental sensors with ZigBee communication interface capable of measuring temperature, humidity, barometric pressure, visible light, electronic contatct, etc.,
  - Home gateways using Intel x86, MIPS, ARM, or AVR32 architectures and software running Linux operating system with various, but relatively low power consumption,
  - Virtual Private Network (VPN) based secure and efficient communication infrastructure for home gateway to datacenter communication,
  - Prototype WEB based system management infrastructure for the home gateway and sensor networks in the home,
  - Prototype WEB based data collection and presentation portal for vital and environment data,
  - Complex data analyses and alarm algorithms, such as Bayesian and other techniques.
- Partner Innomed:
  - Innomed Home ECG Tele Measuring Head.

Based on these technologies, we can develop ambient assisted living solutions installed in the home of the dementia patents, and identify and reduce risks, allowing the patient to live in the home for longer time, decrease stress for the family. In addition, the status of the patient can be tracked for long term, making possible to identify the development of the illness.

Plogg devices

PloggZGB electricity meters and remote switches are available from Energy Optimizers Limited, UK (http://www.plogginternational.com/ploggproducts.html). BME has a 20 node prototype system including Ethernet/TCPIP and USB based ZigBee access points (coordinators), software development kit license, etc. The PloggZGB devices provide the following functions:

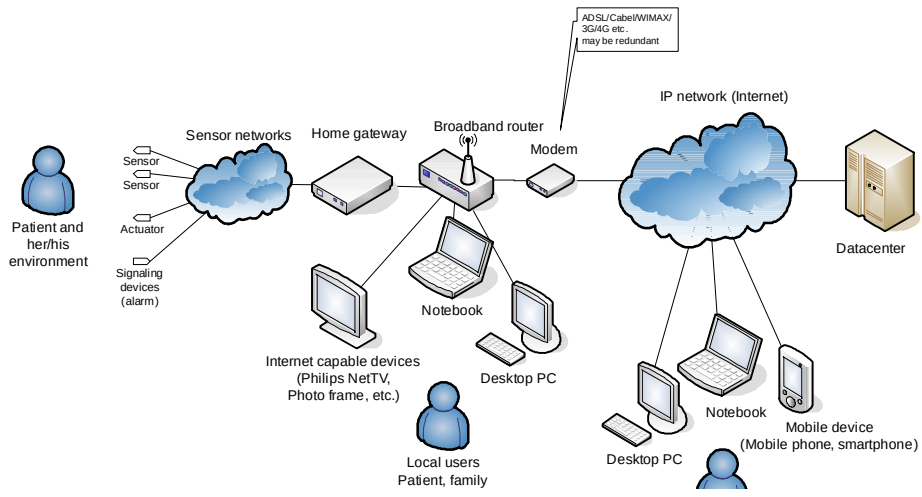


Figure 7 - System Architecture

- Electricity consumption measurement on one phase using a plug-in type device,
- Remote switch on/off function with a built in relay,
- CEE 7/7 (Continental Europe) or BS 1363 (British) socket plug-in device (available with other socket also),
- No licensed technician required for installation (plug-in type device),
- High current electricity meter option (no switch on/off function, licensed technician required for installation),
- ZigBee or ZigBee Pro standard and a proprietary application layer communication protocol (ZigBee Smart Energy Profile compatibility is under development),
- All PloggZGB devices act as ZigBee routers extending the range of ZigBee network,
- They are powered from the measured socket, so no battery change is required,
- Linux software interface is under development to our systems.

Prototype wireless sensors

Wireless sensor nodes developed by BME for prototype systems with the following functions:

- ZigBee and ZigBee Pro standard compatible,
- Sensors are primary MEMS based, including temperature, humidity, barometric pressure, visible light sensors, etc.,
- Contact sensors,
- Access to the low level software functionality,
- Battery powered.

Home gateways

We have developed home gateways using various hardware architectures using Linux. We have experiences with the following HW architectures:

- Intel x86 platform, primarily using Intel ATOM low power processors and standard Linux distribution such as Debian and Ubuntu. The power consumption of this platform is in the range of 20-40W depending on the features and functionality.
- ARM, MIPS (from various manufacturers) or AVR32 (Atmel) based embedded boards using OpenWRT Linux distribution, with limited functionality (less memory and lower performance CPU) but with lower power consumption (2-5W) and smaller size.
- Most of the standard Linux software development environments and programming languages are available (with some limitations on the ARM, MIPS or AVR32 based embedded boards),
- These home gateways are capable of running the client side of the VPN software, which is detailed in the following section.

Virtual Private Network technology

Virtual Private Network allows encrypted and compressed communication between the home and the data center, in essence between various components of the Health HUB. Security here is essential, because the sensitive personal health and environmental information must be protected on the open Internet with sufficient

protection level. In addition they allow passing through broadband routers, which implement firewall and Network Address Translation (NAT) functions limiting Home Gateway connectivity and allowing manageability of these devices from a central location. The properties of our solution are the followings:

- OpenVPN open source, GNU licenced solution, using tried configuration,
- Required relatively limited resources compared to other VPN solutions on both the client and the server side,
- Uses certificates for authentication and authorization of Home Gateways,
- Seamless operation, i.e., VPN is automatically built if the network is connected,
- Redundant connections are supported to increase reliability,
- Communication can path through firewalls and NAT gateways.

Prototype WEB based system management infrastructure

A prototype WEB based infrastructure has been developed at BME for managing and monitoring AAL installations in remote locations (such as in homes). The remote management infrastructure has the following capabilities:

- Remote monitoring of the Home Gateway, such as the processor usage, memory and storage consumption, communication interface utilization and latency, fault conditions, etc. available in the system,
- Sensor network monitoring and management, which allow the tracking of sensor nodes and sensor network topology, and wireless communication properties such as Receive Signal Strength Indicator (RSSI) and Link Quality (LQ),
- Management of power sources, such as batteries and/or energy harvesting devices by measuring available charge, and proposing battery replacement due to exhaustion, or battery wear or low charge states for rechargeable batteries.

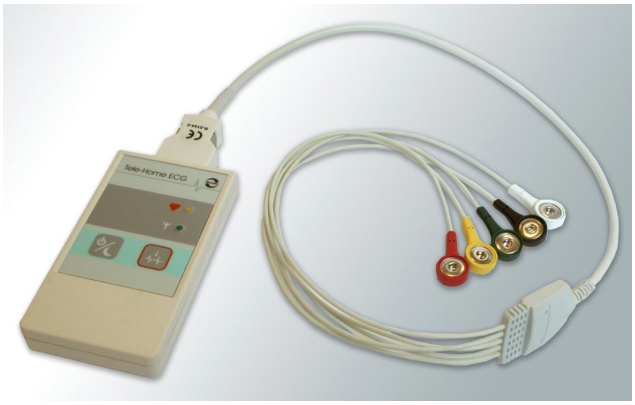
Prototype WEB based data collection and presentation portal

A prototype data collection and presentation infrastructure has been developed at BME to collect vital and environmental data from AAL applications and present it to various stakeholders in their preferred format. The portal has the following properties:

- It is based on the open source, free Drupal portal engine,
- It stores incoming data in relational databases,
- It uses open source visualization functions to present time series and other form of visual data for users,
- Supporting multiple roles for a single user, for example a user can be a patient, a family member, and a physician depending on his or her actual actions.
- It is highly configurable according to the user's specification.

Complex data analyses and alarm algorithms

The prototype WEB based data collection and presentation portal has interfaces and bindings to connect simple and complex analyses engines. For example a simple analyses engine is capable to evaluate a single data coming from a sensor, and may alarm configured users if the measured value is out of range. For example, if the room temperature in the house of a dementia sufferer is under 20 °C or over 30 °C some action is to be made (checking the heating system, windows, doors, etc.). Complex analyses algorithms may use multiple sensors and previous values of these sensors to make decisions. For example, a Bayesian system may be able to learn the typical



behavior of the patient from a large number of available sensors, and identify problems in an early phase. Or for illnesses, such algorithms may be able to detect the long term advancement of the illness, and propose alternative treatments, or at least show the possibility of changes in the status of the patient well before an overloaded physician can identify the same situation.

Innomed Home ECG Tele Measuring Head

The multi-infarct dementia, also known as vascular dementia, is the second most common form of dementia after Alzheimer's disease (AD) in older adults; however, it is the primary cause in Hungary. We can say that people do not live long enough in Hungary to develop Alzheimer's disease, for example, due to cardio-vascular problems. Therefore, it is reasonable to monitor de cardiovascular status of dementia patients. For this task, Innomed has developed an Home ECG Tele Measuring Head, which can be used for long term (weeks) monitoring of cardio-vascular problems, with the following properties:

- Proprietary wireless communication,
- Long term (days or weeks) analyses for people with cardio-vascular problems,
- On device analyses and recording of arrhythmias, only the interesting data needs to be sent on the low speed wireless link,
- On demand upload of ECG time series,
- Supplemental sensors (planned) such as body temperature, etc.,
- Battery powered operation.

The test head is shown on Figure 2; however, the whole system also consists a base station connecting to the Home Gateway using USB, and software components running on the Home Gateway and WEB based data collection and presentation portal.

9.4.3. Description of Technology available from CCE Partners in the Netherlands

Technology that is suitable for the project at hand is the NetTV platform. The NetTV is a platform that a range of Philips televisions is equipped with. A Philips television with NetTV functionality is a network and internet enabled television. This allows for the inclusion of interactive content, internet browsing and external control of content displayed other then television broadcasting. In general, using a television as a tool of communication for people with dementia has several reasons:

- The television has a central place in the home, while the computer is not ubiquitous in households of older generations
- Because of its central location it is easy to attract attention of a user
- Furthermore, the television is a well-known and trusted device
- The television can provide both visual and audio output, making it easier to develop for people with visual or auditory impairments
- Finally, the NetTV platform allows an easy integration. Since it is internet-enabled it can connect to any server around the world and collect various types of information stored in databases. This information can be input from caretakers, but also from sensors.

Figure 8 - NetTV showing portals to websites designed in CE-HTML

Although the NetTV is able to display open internet webpages it uses an Opera browser that supports the coding language CE-HTML (Wikipedia, n.d.). The CE-HTML standard is similar to XHTML, but has some extensions that make it more usable for electronic devices. CE-HTML has a stronger focus on navigation and optimization, since consumer electronic devices such as televisions are not full fletched computers and navigations is not done using the conventional mouse and keyboard.

Challenges in the context of CCE

Choosing any device for an application is always a trade-off. In spite of the reasons for using a television and the NetTV platform, the device also has challenges when it is used in the context of CCE.

Currently navigation on the NetTV is done using a remote control. However, amongst the age group where prevalence of dementia increases, prevalence of impairments of the sensory and motor functions increases as well. Because of this, handling a remote control might not always be easy for the target population. Other input solutions, such as voice input are desirable when it comes down to text input.

In addition, any information that needs to reach the user (e.g., notifications from the medication dispenser, or requests to add diary information) has to follow an information push protocol. It can't be expected from people with dementia to actively check their medication adherence, since their condition is the reason they forget.

However, the NetTV platform is aimed at leaving all control with the user, since this is most desirable for the mainstream user.

9.4.4. Description of Technology available from CCE Partners in UK

The description of the technology available for CCE partners in the UK is described in table 27 below.

Table 27: Summaries technology available from UK to develop an electronic cork board for sufferers of early stage of dementia.

CCE innovation	Provide easy to use helpful daily living support to early onset dementia patients and the carers of those patients suffering from one or more chronic diseases.		
Architectural description	Open standards, Web based SOA architecture.		
Proposed Technology		Partners contributing	Status
Required Hardware	Display device (NetTV / PC)	PCL/iPad	available
	Telehealth/care devices	Medcom/ Cirrusl etc	available
Required Software	CentriHealth Assisted Living Companion	Centrihealth	In progress and available
Required architecture	Broadband connectivity, Display device, integration capability with third party databases and services		available

10. Conclusion

We collected user needs which are also useful for other projects. We found through user research that specific user groups exist for whom it makes sense to develop such technological products and who would find them acceptable. One must create specific products for each group. Thus we will develop products which take these user group differences into account.

11. Glossary and Abbreviations

AAL : Ambient Assisted Living 50
AP : Assisted Person 59
API : Application Programming Interface..... 49
CCE : Connected Care for Elderly..... 9
DAP - Digital Access Provision Forum. A UK-based group of public and private organisations working together to promote the development and increased uptake of integrated digital communication technologies within the built environment. .. 32
Deliverable : A deliverable is a document of a project in which the results are presented 9
FAST : Foundation for Assistive Technology..... 32
GNU : General Public Licence 93
GUI : Graphical User Interface..... 15
ICT : Information and Communication Technology..... 9
ID : Identification number 76
ISO : Internation Organization for Standardiztation..... 10
NFR : Non Functional Requirement 10
RE : Requirements Engineering..... 10
Requirement : A requirement formulates features and attributes that a software system should provide..... 9
SBD : Scenario-Based Design . A design process that is driven by scenarios and personas 11
Scenario : A scenario is a desciption of an example how concrete users behave and interact with the system. Scenarios describe the usage of the product via storytelling. There are four types of scenarios: Problem Scenario, Activity Scenario, Information Design Scenario and Interaction Design Scenario. 9
Stakeholder : A stakeholder is a person or a role that has any kind of interest and role in a software..... 13
UID : User Interface Design 11
use case : A use case describes the interaction between the user and the system..... 9
USP : Unique Selling Point 53

12. Bibliography

Bortz, J.; Döring, N. (1995): Forschungsmethoden und Evaluation. Berlin: Springer-Verlag.

Costa et al., 1996, as cited in “Relationships among caregiver factors and quality of life in care recipients with irreversible dementia” by Sandy Burgener and Prudence Twigg (2002). Alzheimer Disease and Associated Disorders, Vol. 16, No. 2, pp. 88-102)

Haak, N. J. (2002): Maintaining connections: Understanding communication from the perspective of persons with dementia. Alzheimer’s Care Quarterly, Vol. 3, No. 2, S. 116-131.

Rupp, C. (2009): Requirements-Engineering und –Management: Professionelle, Iterative Anforderungsanalyse für die Praxis. 5. Auflage. München: Hanser, S. 289.

Wikipedia. (n.d.). CE-HTML. Retrieved from http://en.wikipedia.org/wiki/CE-HTML.

13. Attachments: Results from User Studies

13.1. *Needs of Dementia Sufferers (Results from Single Interviews)*

Bedürfnisse			
Wohlergehen Familienangehörige			
Zusammenhalt Familie			
Alltag bewältigen			
Gerätebedienung			
Kurzzeitgedächtnis			
Wortfindung			
Orientierung			
Finden von Gegenständen			
Kommunikation			
Geld			
Nicht alleine sein	Tiere		
Antrieb, Anleitung		3 m	Angehörig
Organisation (vergisst Termine, Todos)		1 l	n

Wünsche	Anzahl	Stadium	Qualität (E
Geld		2 l	n, indirekt
Gesundheit der Angehörigen		1 l	n
Haus im Grünen		1 l	n
Haustiere			n
Langsamer und deutlicher Ansagen in der U-Bahn		1 l	n
Besser Beschilderung im Supermarkt		1 l	n
Orientierungshilfe/erleichterungen		2 l	n
Gesundheit		1 m	Angehörig
nichts, zufrieden		1 m	n

Ängste	Anzahl	Stadium	Qualität (E
Tod der Eltern		1 l	n
Dass dem Sohn etwas passiert		1 l	n
Dass die Familie auseinanderdriftet		1 l	n
Dunkelheit		1 m	Angehörig
Alleine zu Hause zu sein		1 m	n
Alltag nicht mehr bewältigen zu können			
		1 l	n

Problemfelder	Anzahl	Stadium	Qualität (E
Telefonieren		2 l	n
Foto		l	n
PC		l	n
Sehschwäche			n
Depression		2 l	n
Kurzzeitgedächtnis		2 m,l	n,b
(Leichte) Wortfindungsstörungen		2 l	n
Gewisse häusl. Tätigkeiten		1 l	n
Hörstörung			
das Bedienen von Geräten		2 l	n
Kranke ist sehr müde und schläft fast die ganze Zeit, deshalb Interview mit		1 m	b
dass ich immer und ständig etwas suche und mich schwer tue, es zu finde		2 l	n
Orientierung		1 l	n

13.2. Needs of DementiaSsufferers as seen by family members and caretakers (Results from Focus Groups with Family Members and Professional Caretakers)

Bedürfnisse Erkrankte	Pfleger 1	Pfleger 2	Angehörige 1	Angehörige 2
Selbständigkeit	4	1	5	3
Orientierung	4			
Beschäftigung	4			
Akzeptanz/Toleranz	3			
Kontakt zu Vertrauenspersonen	8			
Süßigkeiten	1			
Sicherheit	3		2	6
Freude & Spaß	2			1
Liebe	4			
Geborgenheit	4		3	
Gefühl gebraucht zu werden	1			
Vertrauen		2		
Konstante Bezugsperson		2		1
Anleitung		5		
Pflege & Fürsorge		4		2
Hilfmittel		1		
Ordnung (geistig u. räumlich)		3		
Vertraute Umgebung		4		
Zuneigung		1		
Verständnis u. Respekt		3		1
Körperliche Sicherheit		2		
Emotionale Sicherheit		1		
Ruhe		1	3	
Zeit/Geduld		4		1
Gewohnte Abläufe		3		
Unterstützung			3	2
keine Technik			1	
reg. Medikation			1	1
gesicherte Mobilität			1	
Respekt u. Wertschätzung			2	
Geduld			1	
Schutz vor sich selbst			1	
Strukturierte Abläufe			3	
gewohnte Umgebung			1	1
Verständnis für d. Krankheit			1	
Ablenkung			1	
Teilnahme am Alltag			1	1
Zuspruch & Ansprache				5
Bewahrung der menschl.Würde				1
Essen & Trinken				1

13.3. Needs of Family Members (Results from Focus Groups with Family Members)

Bedürnisse Angehörige	Angehörige 1	Angehörige 2
Verständnis (für einen gewissen Zeitplan ... oder Situation)	1	1
"Mitmach"-Wille	1	
Anerkennung	2	
Werschätzung	1	
Unterstützung	3	2
Sicherheit	3	2
Abstand	10	
verlässliche Struktur, zuverlässlichkeit	2	1
kein schlechtes Gewissen zu haben	1	
Geduld	1	
Zeit	2	1
Information	1	3
netter Umgang miteinander		1
"Erfolgs"-Erlebnisse (das Patient auch mal was dazulernt etc.)		1
technische Unterstützung/ Hilfsmittel		1
leichteres Erlangen der höheren Pflegestufe		1

13.4. Needs of Professional Caretakers (Results from Focus Groups with Professional Caretakers)

Bedürfnisse Pfleger	Pfleger 1	Pfleger 2
Hilfmittel	1	1
Kontrolle/Sicherheit	4	
Wertschätzung	3	
Anständigkeit (kein Streit) aktives Mitarbeiten	1	
Freude	2	
Rechtssicherheit	2	
Handlungs Spielraum	2	
Geeignete Räumlichkeiten	1	
Bediengungen Arbeitsvertrag	2	
Mehr Zeit	5	6
Ausbildung d. Betreuer	1	
Mehr Personal	1	3
Mehr biographische Details von Angehörigen	1	2
Schulungen (auch für Angehörigepflicht?)	1	
Zusammenarbeit zw. Betreuern	4	
Weiterbildungen Validation Supervision	1	
Absprache		3
Einfühlungsvermögen		5
Respekt und Verständnis		4
Vertrauen		1
Freundlichkeit		1
Verständnis des Angehörigen für Patienten		1
Wissen		2
Zusammenarbeit		6
Konflikt Menschenwürde vs. Gesetze		1
Gesundheit		1
Ruhe		1
Geduld		1

13.5. Problem fields as seen by expert group (main topics marked red)