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Edition 1.0 2020-04

TECHNICAL SPECIFICATION

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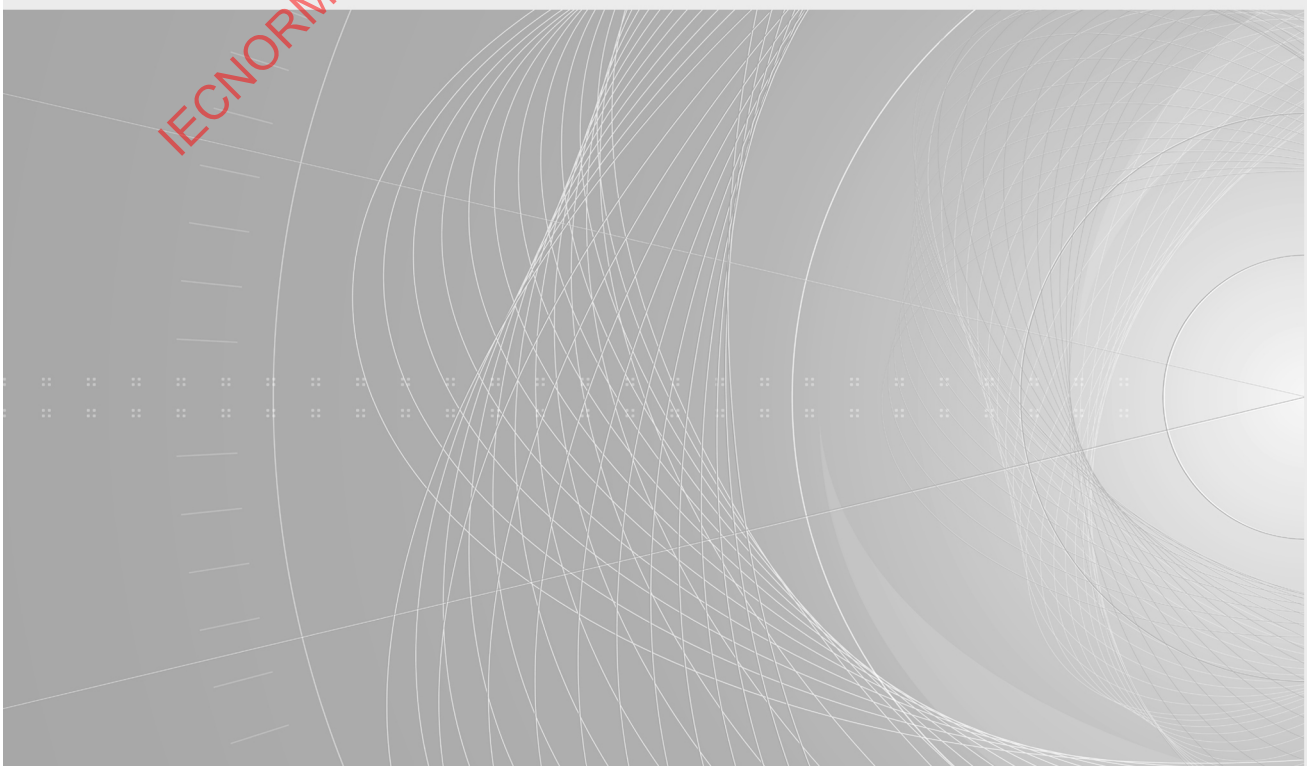
Active assisted living (AAL) use cases



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Active assisted living (AAL) use cases

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ACTIVE ASSISTED LIVING (AAL) USE CASES

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Technical Specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 63134, which is a Technical Specification, has been prepared by IEC systems committee Active Assisted Living.

The text of this Technical Specification is based on the following documents:

Enquiry draft	Report on voting
SyCAAL/152/DTS	SyCAAL/167/RVDTS

Full information on the voting for the approval of this Technical Specification can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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- withdrawn,
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- amended.

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INTRODUCTION

IEC SyC AAL is developing use cases for AAL system standards with a view to identify gaps in standardization.

All selected use cases have a real-world validity. The development of use cases makes it easier to define AAL categories of similar use cases and highlight their commonalities. It was then possible to extract functional requirements from the use cases and make recommendations for future standardization items related to AAL. Collecting the use cases also allowed SyC AAL to validate the proposed AAL reference model and reference architecture.

This document captures the results of a use case input process that began with the call for contributions of AAL use cases in November 2015. The current document reflects contributions and discussions by SyC AAL experts, mirror committees and liaison members. This document also contains material gathered from reports, AAL research projects and group output from the SyC AAL meetings in November 2015 (Tokyo), April 2016 (Wellington), October 2016 (Frankfurt), April 2017 (Beijing), September 2017 (Cleveland), May 2018 (Tokyo) and October 2018 (Seoul), as well as information obtained from the subsequent web calls to the meetings.

As of November 2018, a total of 45 use cases were submitted. To start the project, members of the SyC AAL user focus working group were requested to submit use cases using the IEC template. The use case submissions consisted of the title of the use case, a description and the origin of the use case. The use case template helped to group and categorize the use cases according to the identified functional requirements and needs of users. The former AAL use case template developed in SG 3 AAL was modified in order to capture also wider societal issues including security, risk and privacy, as well as looking at AAL in relation to the Internet of Things (IoT).

Experts from the following national committees, liaison organizations and research projects contributed use cases on AAL: Canada, China, Japan, Germany, Netherlands, South Korea, UK, USA, ISO IEC JTC 1 SC 41 PCHA and Continua and AALiance2.

The target audience for this document includes the following stakeholders who have an interest in the AAL system:

- AAL users and service provider personnel who can learn about AAL user needs and how to operate AAL systems;
- first responders, formal carers, etc. to understand how to respond to an AAL system emergency call;
- CE and ICT device manufacturers who want to understand AAL devices and interface and interoperability requirements;
- AAL care recipients who are interested in the usability, accessibility and performance of the AAL system;
- AAL operators to understand the system requirements;
- regulators who are responsible for developing and supervising AAL and related regulations.

ACTIVE ASSISTED LIVING (AAL) USE CASES

1 Scope

This document identifies AAL scenarios and use cases based on real-world applications and requirements. The use cases provide a practical context for considerations of interoperability and standards based on user experience. Use cases provide a context for utilizing existing standards and identifying further standardization work. User requirements have also been identified.

This document also highlights potential areas for standardization in the AAL environment to ensure safety, security, privacy, ease of operation, performance and interoperability.

Lastly, this document is a contribution to the IEC use case management repository, the purpose of which is to collect, administer, maintain, and analyse use cases.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-871, *International Electrotechnical Vocabulary – Part 871: Active assisted living (AAL)*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-871 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.2 Abbreviated terms

AAL	active assisted living
ADL	activities of daily living
AMM	advanced medication monitoring
BAN	body area network
ETA	enhanced terminal accessibility
IADL	instrumental activities of daily living
IoT	Internet of Things
km	kilometres
UCMR	use case management repository

4 General

4.1 Overview

Clause 4 provides a general overview of the structure of the document and the use case development stages.

Clause 5 describes the AAL use case template with its annexes.

Clause 6 provides the use case analysis based on the use case categories.

Clause 7 presents considerations related to user requirements.

Clause 8 is the summary of the standards gap analysis.

Clause 9 describes the conclusions and recommendations

Annex A includes the AAL use case template

Annex B describes the complete representative use cases.

Annex C contains the user requirements analysis

Annex D contains extractions of user requirements of the 10 representative use cases.

4.2 Objectives

The intent of this document is to capture representative use cases in a consistent manner in order to categorize products, services and systems of AAL technologies in such a way to assist system developers and service providers to develop solutions that address the AAL user needs. These include user requirements of safety, security and privacy.

Use cases provide input into the development of AAL scope definition, reference architecture and conformity framework. Use cases will also be used to validate the scope and architecture.

Use cases are a common technique for gathering requirements in systems and in this case provide a better understanding of the user's needs and functional requirements of AAL systems (what, not how) as well as requirements for safety, security (cyber and physical), privacy and data protection. Use cases describe typical scenarios that an AAL user may experience when interacting with a system to achieve a goal. Use cases are a well-known tool for expressing requirements at a high level with real-life relevance.

4.3 Use case development stages

When developing AAL use cases, the following steps were considered which reflect the guidelines provided by the System Resource Group of IEC to develop the use case management repository (UCMR).

The modelling framework is needed to manage the complexity, structure the analysis, guide experts and automate the generation of a standardized textual template, as described in IEC 62559-2 and adapted to consider the people aspects of AAL.

4.4 AAL architecture model

The AAL architecture model is illustrated in Figure 1.

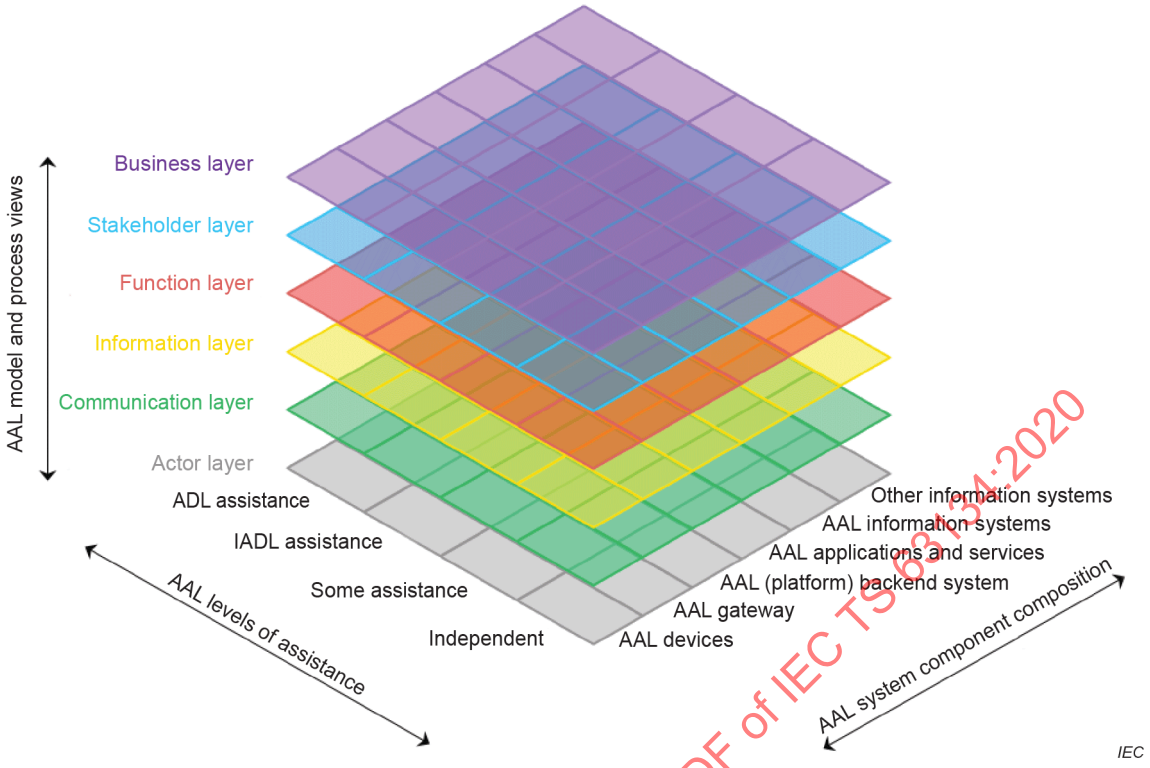


Figure 1 – AAL architecture model

The x-axis of Figure 1 describes AAL levels of assistance (also referred to as user domains in use cases):

- Independent (level 0)

  In this user domain, AAL users are not dependent on assistive technology. AAL services are used for comfort, wellbeing, wellness, fitness, entertainment, social interaction (socialization) or security.

- Some assistance (level 1)

  In this user domain, AAL users need some assistance by assistive technology. This includes some assistance at some points in time or some assistance that is continuously needed.

- IADL assistance (level 2)

  In this user domain, AAL users need assistance with instrumental activities of daily living. These activities are not essential for fundamental functioning but allow an individual to live independently in a community. They include but are not limited to housework, preparing meals, taking medications as prescribed, managing money, shopping for groceries or clothing, use of telephone or other form of communication, transportation within the community.

- ADL assistance (level 3)

  In this user domain, AAL users need assistance with basic self-care tasks that include but are not limited to functional mobility, bathing and showering, dressing, self-feeding, personal hygiene and grooming.

The y-axis of Figure 1 describes AAL system component composition, which is further described in 5.7.

The z-axis of Figure 1 describes AAL model and process views, defined as follows:

- Actor layer

  Layer of an architecture model in which the content is derived from the use case information on actors

- Communication layer

  Layer of an architecture model that describes protocols and actions for the interoperable exchange of information between the actors of a use case

- Information layer

  Layer of an architecture model that describes the information that is being used and exchanged between functions, services and actors

- Function layer

  Layer of an architecture model that represents the functions described in the use cases

- Stakeholder layer

  Layer of an architecture model that represents the different stakeholders involved in providing the applications and services described in the use cases

- Business layer

  Layer of an architecture model that represents the business models, including business

5 Definition of AAL use case template

5.1 Overview

The use case template, included in Annex A, provides sections to include a description of the use.

The intent is to have these annexes map directly into the AAL reference model and architecture model.

For easier mapping into the AAL reference model, a use case diagram and a sequence diagram are added to each use case.

5.2 Description of use case

The use case is described in a short narrative of three sentences. In addition, a long description of the use case is requested, which includes the actors and their roles as well as their task in the AAL system and relationship with the care recipient.

5.3 AAL levels of criticality

The level of criticality refers to an estimate of the severity of injury that a system could permit or inflict, either directly or indirectly, on a client, patient or operator as a result of device failures, design flaws, or simply by virtue of employing the system for its intended use.

- Major

  Level of criticality is Major if a failure or latent design flaw could directly result in death or serious injury to the client, patient, or operator. The level of criticality is also Major if a failure or latent design flaw could indirectly result in death or serious injury of the client, patient or operator through incorrect or delayed information or through the action of a care provider.

- Moderate

  Level of criticality is Moderate if a failure or latent design flaw could directly result in minor injury to the client, patient or operator. The level of criticality is also moderate if a failure or latent design flaw could indirectly result in minor injury to the client, patient or operator through incorrect or delayed information or through the action of a care provider.

- Minor

  Level of criticality is Minor if failures or latent design flaws are unlikely to cause any injury to the client, patient or operator.

5.4 Levels of assistance (user domains)

Four levels of assistance are defined from "minimal assistance (level 0)" to "fully assisted (level 3)" that correspond with "no automation" to "full automation".

a) Level 0: able to live independently with minimal assistance.

b) Level 1: able to live independently but some assistance is needed periodically (part time).

c) Level 2: assistance is needed with IADL (part time and/or full time).

d) Level 3: assistance is needed with ADL (full time).

NOTE 1 Stages of ageing are identified in ISO/IWA 18:2016.

IADL (instrumental activities of daily living) includes, for example, the use of transportation, answering the telephone, shopping (plus cooking, housekeeping, cleaning, medication management, and monetary management), etc.

ADL (activities of daily living layer) includes the most basic human activities like walking and moving around, going up a few steps of stairs, bathing (plus eating, clothing, continence, grooming), etc.

NOTE 2 Medical assistance may be needed at any level.

NOTE 3 Annex B of the use case template is the x-axis of the AAL architecture model.

The key distinction between level 2 and level 3 is as follows.

- In level 3, the AAL system performs all tasks automatically without the supervision of the AAL user, so the user does not need to respond or intervene.
- In level 2, the AAL user has to perform some tasks and has to respond and supervise the AAL system which is not fully automated.

In level 1, the AAL user may perform many of the tasks himself or herself and only periodically needs assistance, whereas in level 0 the AAL user may use one of more parts of the AAL system, but is able to perform or control the remaining tasks. Level 0 has the highest level of independence.

Figure 2 presents an overview of AAL user domains.

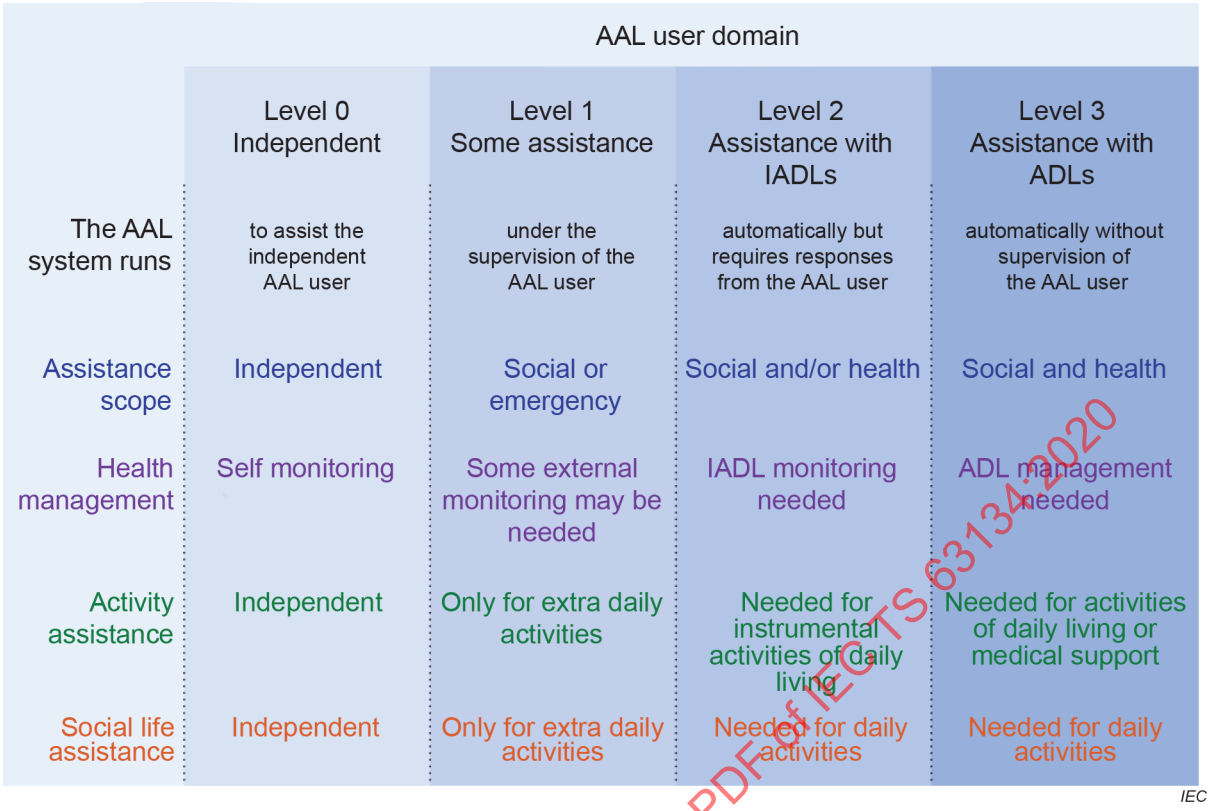


Figure 2 – Overview of AAL user domains

5.5 Use case categories

AAL use cases are categorized to align with the function layer of the AAL architecture model in order to clarify the scope and to highlight exceptional scenarios.

- Prevention and management of chronic long-term conditions:
  - Prevention, early detection and efficient management of chronic long-term conditions.
  - Provide AAL solutions for persons with identified risk factors and/or chronic conditions.
  - Improve medical prescriptions and adherence to treatment by providing accurate information to the professional.
  - Enable the wellbeing of people with chronic conditions and their communities (family, caregivers, neighbourhood, service providers, care system, etc.).
- Social interaction:
  - Enable people of all ages to be active, content and socially connected in the society, from both a societal and personal perspective, effectively contributing to their health, overall quality of life and to social inclusion.
  - Denotes all systems for social connections and networking as well as the possibility for knowledge transfer.
- Mobility:
  - Enable people's mobility (orientation and navigation) in terms of moving in the home and domestic environment.
  - Transportation and travel activities.
  - Encompasses all systems that are useful for mobile processes, e.g. mobility aid, safety and security on the move, transport or information of outdoor conditions.
- Health and wellness:
  - Better management of health and wellness.

  - Prevent functional decline and frailty.
  - Enable assisted living and support sustainable care models.
- (Self-)management of daily life activities at home:
  - Enable assisted living and sustain persons to continue managing their daily activities in their home.
  - Live independently for longer, meaning with as little (professional) help as possible and with choice and control over the decisions, equipment and assistance.
  - Live actively in the sense of staying in charge of their own lives and participating in society the way they want.
  - Denotes all techniques and systems which help and support the user during daily life (like a managing system, a calendar or reminder or other support systems).
  - Denotes all technical support including fall detection and prevention, ambient sensors or actuators, alarm systems and localization.
  - Support care givers to give assistance.

AAL use case categories are illustrated in Figure 3.

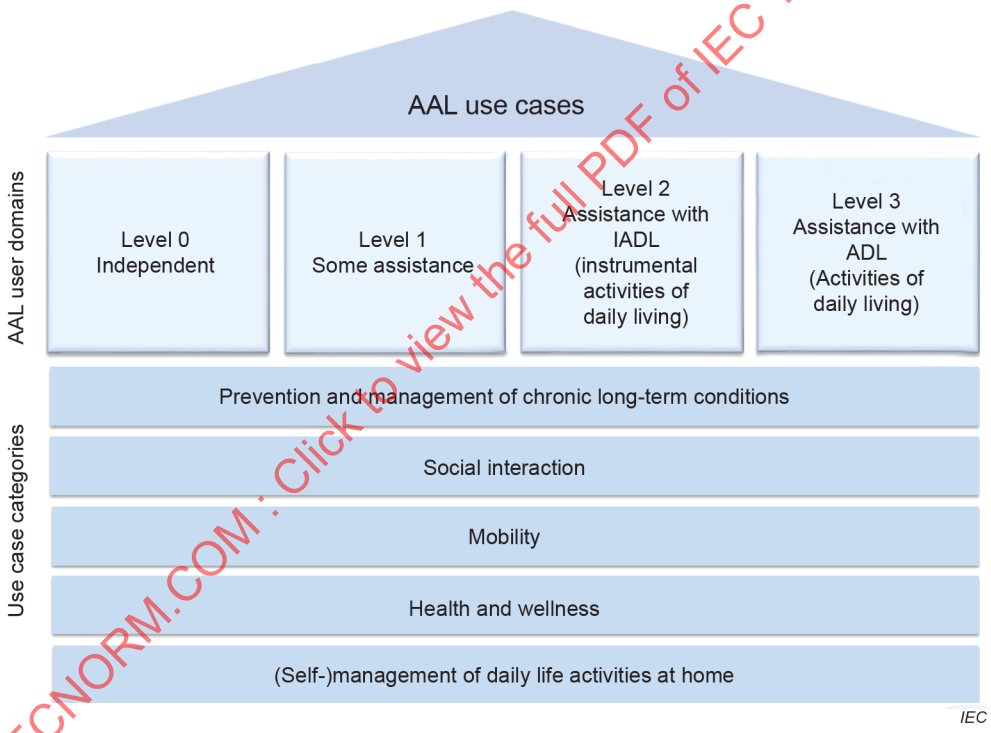


Figure 3 – AAL use case categories

5.6 Context of use

- Global

  The outdoor environment including transportation – automobile, bus, train, airplane, etc.

  EXAMPLE 1 Normally an uncontrolled environment in terms of weather, population, animal, etc.

- Public buildings

  Includes all other relevant indoor environments that may or may not be designed for accessibility required by AAL users.

  EXAMPLE 2 Including devices like the ones referred to under "home", but this can be expected to be a different selection and with a different mix of enabling functions and applications.

- Personal mobile and personal vehicle

Includes personal mobile devices that can control devices, communicate and save the information data. Personal vehicles designed for elderly and/or handicapped are included.

EXAMPLE 3 Normal cars or vehicles designed for elderly people, whether hand-operated (stability aids) or engine powered (electric bikes and scooters, ...), etc.

- Home (IEC 60050-871)

  Place of residence.

  EXAMPLE 4 Flat, apartment, single-family house, townhouse, sheltered housing.

  NOTE Care homes, retirement homes and other facilities with nursing services are not included in this definition.

- Body and personal

  Includes the body and the immediate area around the body.

  EXAMPLE 5 Includes devices like sensors and actuators worn in or on the body, hand carried and personal devices typically taken along by one individual (music player, smartphone, tablet).

- Workspace

  Denotes the area of the workspace outside of the home, e.g. office, factory, etc.

  EXAMPLE 6 Environmental sensors and home automation sensors/actors to monitor the workplace of employees and detect dangerous situations (air pollution, gas leak).

5.7 System component composition

The system component composition is described in the AAL architecture model y-axis.

- AAL devices

  Device (IEV ref 151-11-20: material element or assembly of such elements intended to perform a required function) used in an AAL service (871-01-04).

  AAL gateway (IEV ref 732-01-17: A gateway is a functional unit that connects two computer networks with different network architectures and protocols)

- AAL (platform) backend system

  System that houses a number of components (functionalities) in order to collect the data from AAL gateways or AAL devices over a network connection. The system may also implement components for the remote management of AAL gateway and/or AAL device (e.g. firmware update) and components for interfacing with AAL information systems and/or other information systems.

  In the client-server model, the server is usually considered the backend.

  Platform maybe a smartphone platform (e.g. IOS, Android), a server platform (e.g. Linux) or an IoT platform (IoT cloud service).

- AAL application and services

  Program or application that interacts with the AAL users or within the network infrastructure to transmit or exchange data and information in the network

  Action or function of an AAL system creating an added value for customers.

- AAL information systems

  A collection of technical and human resources that provide the storage, computing, distribution, and communication for the information required by an AAL service.

- Other information systems

  A collection of technical and human resources that provide the storage, computing, distribution, and communication for the information not specific to AAL services.

5.8 Actors

5.8.1 General

An actor is a 1) person, 2) technical component, or 3) organization that plays a role in one or more interactions within a use case or a combination of use cases.

An AAL user is considered a "Person Actor". There are three role categories of AAL users:

- a formal "Person Actor" user who formally applies AAL functions and services to the AAL care recipient ('Health Care Professional' e.g. a nurse);
- an informal "Person Actor" user ('AAL lay informal carer') who applies informal AAL functions and services to assist the AAL care recipient (e.g. family member) who can also be trained (e.g. through related education);
- the care recipient "Person Actor" user who, if capable, applies AAL functions and services in a self-managed manner to himself or herself (e.g. a person who self-manages his or her condition or impairment).

5.8.2 Persons

AAL user (IEC 60050-871:2018, 871-02-05) is a person who uses or benefits from AAL devices, systems or services. The AAL user may be the following persons:

- AAL care recipient is a person who receives and consumes AAL care services.
- AAL care assistant (IEC 60050-871:2018, 871-02-10) is a person providing care services to the AAL service recipient:
  - AAL formal carer is a person who provides formal personal or homemaking services to the AAL care recipient;
  - AAL informal carer is a person who provides informal (or lay) services to the AAL care recipient.
- healthcare professional (IEC 60050-871:2018, 871-02-14) is a service provider in the healthcare system who carries out training, therapy, health promotion and consultations.

  AAL service provider personnel are employees, contractors and agents of an AAL service provider organization.
- AAL operator (IEC 60050-871:2018, 871-02-04) is a person handling or using, or handling and using an AAL system for the benefit of an AAL user.
- AAL technical assistant (IEC 60050-871:2018, 871-02-03) is a person supporting AAL users and AAL operators with the installation and continued support of AAL devices and systems and with technical and other advice.
- consultant for medical devices (IEC 60050-871:2018, 871-02-11) is an expert informing members of healthcare professions or the healthcare industry and of healthcare facilities about medical devices and advising them on their use.

5.8.3 Technical components

The technical components are described in 5.7.

5.8.4 Organizations

Two examples of organizations as actors are given:

The service provider (IEC 60050-871:2018, 871-02-01) may be an AAL service or healthcare service provider. The other example is a research organization that conducts research into new or modified health treatments and their efficacy.

5.8.5 Relationship between actors

Figure 4 shows the relationship between AAL actors.

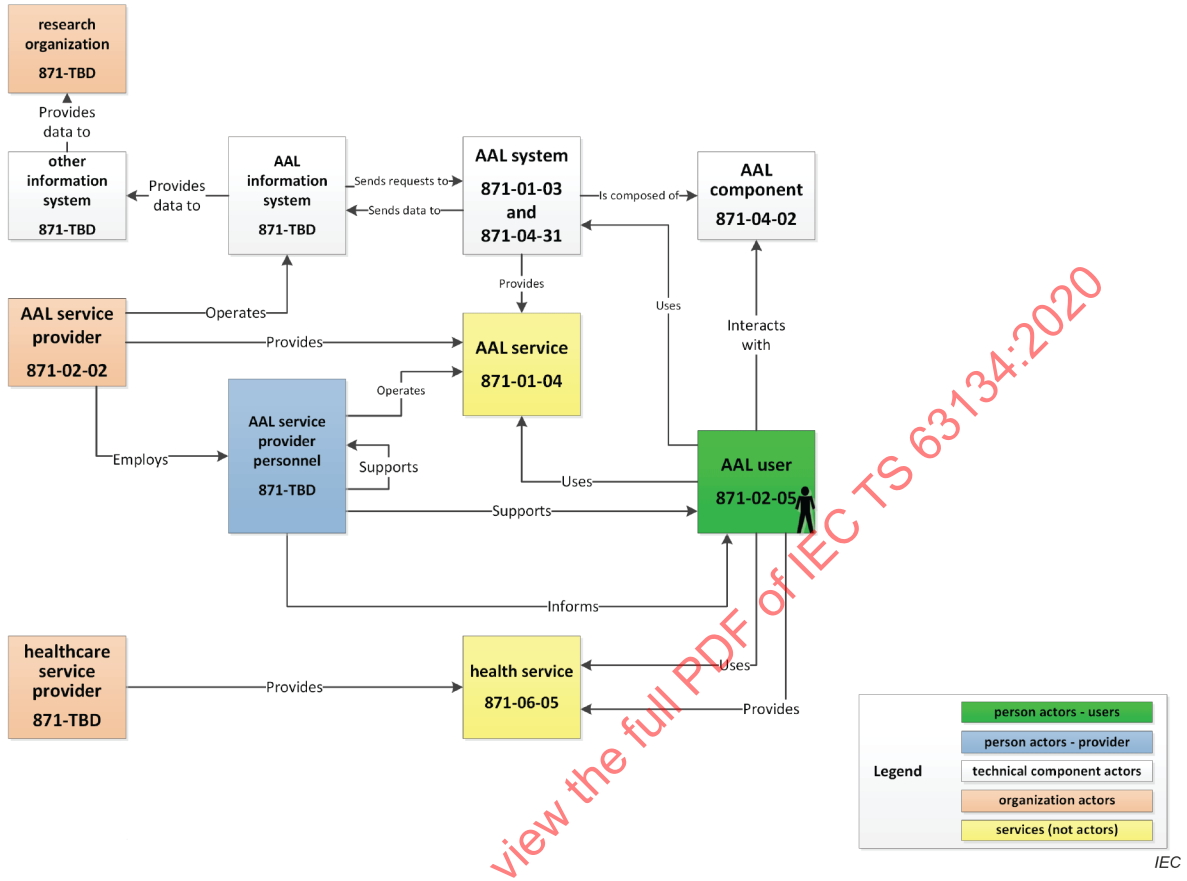


Figure 4 – Relationship between actors

6 Use case analysis

6.1 General

Subclauses 6.2 and 6.3 discuss the use case analysis based on representative use cases and the functional requirements of the AAL system. Therefore, there is an interrelation with the user's requirements as described in the use cases and the reference architecture.

6.2 Overview and representative use cases

6.2.1 General

IEC SyC AAL has collected a total of 45 use cases. Titles and short descriptions of the use cases are listed in Table 1. Eleven representative use cases are included in Annex B. Some of the other use cases will be made publicly available when the system is ready.

The use cases are grouped according to the categories below. The classification (see 5.5) is based on claims found in each use case.

Use case categories:

1) prevention and management of chronic long-term conditions;
2) social interactions;

3) mobility;
4) health and wellness;
5) (self-)management of daily life activities at home.

Table 1 – Titles and categories of use cases

Use case number	Title of use case	Use case category				
		1	2	3	4	5
1	Personal Health Check	X		X	X	X
2	Advanced Medication Monitoring (AMM)	X			X	
3	Enable Social Interaction with Care Providers	X	X		X	X
4	Social Interaction with Smart TV		X			X
5	Smart Wheeled Walker – Guidance to return home			X		
6	Improve communication between user and equipment by ETA (Enhanced Terminal Accessibility)			X		
7	Health-Care in the Senior Citizens Welfare Centre				X	X
8	Personal Trainer	X			X	
9	Behaviour Monitoring	X			X	X
10	Shopping and Nutrition Planner					X
11	Intelligent lighting system					X
12	Remote Health Monitoring/ Fall Detection	X				X
13	Telemonitoring				X	X
14	Acquired brain injury – at home alarm support					
15	Objective Remote Health Monitoring	X				X
16	Query sensors and switches for status [Different template]					X
17	Remotely monitor Parkinson s patient to prevent falls and manage medication titration	X				
18	Continuous blood glucose monitoring with remote assistance	X				
19	Enable the upload of measurement data on the WAN interface	X			X	X
20	Controlled Information Sharing	X				X
21	Patient reported outcomes measures (PROMS)	X				X
22	Transmitting questions and related answer response/selection, or instructional material, in a telemonitoring system via WAN-IF	X				X
23	Epilepsy detection/acquired brain injury – at home alarm support	X				X
24	Fall Detection Functional Neurological Disorder – at home alarm support					
25	Smart solutions for the elderly care community			X	X	X
26	Information Security	X			X	X
27	Data Protection	X			X	X
28	Information Reliability and Device and Patient Authenticity	X				X
29	Building-integrated notification system	X	X		X	X
30	Standardized Data Exchange of Regular Medical Check-up Record	X			X	X
31	Mobility Assistant	X		X		X
32	Calendar Service				X	X

Use case number	Title of use case	Use case category				
		1	2	3	4	5
33	At home medication and alarm support	X				
34	Environmental Health Monitoring and Alarms at Work	X			X	
35	Home alarm and service provider – example of alarm activation response					X
36	One stop emergency service using Lifetag				X	
37	Heat stroke prevention system in home					X
38	Air bag system in stairway					X
39	Bathtub drowning prevention system				X	
40	Overturn detection and alert system for home garden					X
41	Minor user mistakes lead to undesirable results					X
42	Use of general equipment leads to malfunction of the system					X
43	Home Assistant Robot				X	
44	AAL exoskeleton robot	X		X		X
45	AAL Care service provided by trained working person	X			X	X

NOTE The use cases were renumbered after analysing and combining common use cases. The first number is the new number of the use cases after consolidation.

The distribution in Table 1 shows that many use cases fall in three categories: 1 "prevention and management of chronic long-term conditions", 4 "health and wellness" and 5 "(self)-management of daily life activities". This shows that mainly support is needed for physical conditions and daily life. Urgent and/or critical conditions are dealt with in these three categories.

Fewer use cases are claimed to be classified in the other two categories: 2 "social interaction" and 3 "mobility". The two categories should be recognized as integral part of AAL, as social interaction and mobility are indispensable factors for sustaining an independent life of the older person. Lack of mobility and social interaction could lead to negative impacts on physical strength and cognitive abilities.

The following are representative use cases for categories as described in 5.5. The complete use cases are included in Annex B. The cases were chosen based on the criteria below:

1) use cases that are easy to read and to grasp the scope of AAL;
2) two use cases for each category: one with general description and the other with a focus on specific functions.

As for category 5, (self-)management of daily life activities at home, three representative use cases are selected. This is because the category covers a wide range of situations and various use cases have been submitted. Use Case 11 is chosen as an additional representative use case as it is mentioned in an International Standard that is being developed in IEC SyC AAL: IEC 63168-1, *Cooperative multiple systems in connected home environments – Functional safety of electrical/electronic safety-related systems – AAL aspects – Part 1: General requirements for design and development*.

6.2.2 Prevention and management of chronic long-term conditions

6.2.2.1 Use case 1 personal health check

Chiyoko is a 73-year-old woman, living independently with her husband. She wears a small on-body sensor that remotely and wirelessly monitors her conditions. The detected biometric

measurements including vital signs are sent to a healthcare service centre and stored there so that medical doctors can analyse the data. The doctors generate a monthly health report for Chiyoko. The reports are shared with her family chemists at a drugstore near Chiyoko's house. The chemists give advice to Chiyoko based on the health report as well as her health conditions.

In this use case, person actors are Chiyoko, medical doctors and chemists. Chiyoko is an AAL care recipient, while medical doctors and chemists are healthcare professionals. The AAL care recipient is maintaining independent living, and falls on either level 0 (independent) or level 1 (some assistance) of the AAL user domains. The data is stored in a cloud server so that other AAL actors can share it and make professional intervention when necessary.

6.2.2.2 Use case 2 advanced medication monitoring

Bernice is 84 years old and lives on her own. Her doctor has prescribed multiple medications for Bernice. She uses a medication monitoring system that reminds her when to take which medicine. The system also records her medication adherence. Her daughter, one of her informal carers, may be notified when her mother's medication non-adherence is detected.

This use case deals with level 2 (assistance with IADL) of the user domain. The advanced medication monitoring (AMM) system sends reminders to the AAL care recipient, provides physicians with information on medication and the patient's compliance, and can send notification to relevant informal carers when irregularities are detected. The AMM may be programmed by trained AAL operators.

6.2.3 Social interaction

6.2.3.1 Use case 3 social interaction with caregivers

Bernice lives on her own but has medical, physical and cognitive issues. The problems limit her mobility and it is difficult for her to visit other people to interact with and maintain connections with them. Her problems sometimes prevent attendance at regular medical appointments. She can maintain social interaction with family members, friends, and care providers through text-based interaction (E-mails, instant messaging), as well as voice and audio interaction.

This use case mainly focuses on AAL users at level 2 of the user domain, where many people have difficulty going out of their homes. In such situations, keeping social relationships becomes a challenge. Lack of social connection should be avoided as much as possible, as it could lead to depression and have further negative impacts on physical or cognitive abilities of the older person.

6.2.3.2 Use case 4 smart TV

Peter, who is 83 years old, lives alone. His son lives in a city about 200 km away. Peter uses a smart TV as a communication device to stay in contact with his family, friends, carers, medical doctors and others. He has his smartphone connected to a TV set to use the phone as a remote controller. A panic button with localization function is installed in the smartphone. When he pushes the button, a formal carer at a local nursing service will respond and make necessary arrangements. The smart TV can be used to order groceries from local supermarkets.

The AAL care recipient needs some assistance (level 1) in the area of social interaction. This is because the user's mobility is limited due to some health condition such as illness, frailty, and so on. The system helps him enjoy remote communication without physically moving to a different place to see his family and friends.

6.2.4 Mobility

6.2.4.1 Use case 5 smart wheeled walker – guidance to return home

Mrs. Appletree uses a smart wheeled walker to stabilize her walk. The device is even more helpful when she goes outside. The walker guides her not only inside her flat, but also to chosen

destinations outside via her preferred routes. It can help her when she gets disoriented. The walker is like a friend with whom she can talk; it answers back, offers information and advice. It also has a reminder function, so she does not miss her appointments.

The AAL care recipient is getting forgetful, and she is at either level 1 or level 2 of the user domain. The user's mobility increases as the walker helps her not only physically but also in terms of orientation and selection of efficient routes for her. The walker is equipped with sensors and internet connection. It serves as a digital assistant to the user.

6.2.4.2 Use case 6 communication between user and equipment by ETA (enhanced terminal accessibility), 'VISIT to JAPAN'

Bob, a 70-year-old British man, recently travelled to Japan. He had had enhanced terminal accessibility (ETA) installed on his smartphone. So even in a foreign country, Bob was able to enjoy his stay to the fullest: he could easily spot a ticket-vending machine by checking a map on his smartphone. He could get prepaid ticket-data smoothly from the ticketing machine into his smartphone. When he wanted to eat something, he obtained restaurant information by downloading menus, the language of which was automatically translated to English by ETA. Information relating to his specific allergy was automatically provided as well.

ETA is useful for AAL care recipients who need some assistance in the area of communication. ETA is helpful in communication both with other people and equipment. Adding personal information on users' special needs (e.g. allergy) improves accessibility of the man-machine interface.

6.2.5 Health & wellness

6.2.5.1 Use case 7 intelligent apartment for the elderly

Konrad lives in an intelligent apartment equipped with a tele-monitoring system that helps him monitor his biometric data. Routine monitoring ranges from health checks to house security. An intelligent drug cabinet monitors medication adherence as well. In the case of irregularities, alarms go off and inform both his family and the head office of the living quarters. A short response time is guaranteed through an excellent organizational infrastructure.

The user needs assistance with IADL in many areas of daily life. In the intelligent apartment, where his activities are monitored, he can manage his appointments, home security, etc. Household chores are also managed by the staff at the apartment house. He can consult with healthcare professionals via video conferencing.

Many actors appear in this use case: AAL users along with AAL care recipient, AAL service providers, and various kinds of devices, etc. This is because the setting (intelligent apartment for the elderly) comprehensively takes care of all kinds of daily life activities of senior citizens.

6.2.5.2 Use case 8 personal trainer

Frieda is getting a little weaker these days. It has become harder for her to be active during the day. Housework tasks are sometimes a big burden for her. Her doctor gave her a little wearable device that tracks her physical activity, along with a small box. Her son connected the box to her PC at home. The box shows videos that give tips to simplify household tasks and daily activities. It also suggests tailored workout training for her. A few months later, Frieda found herself fitter and safer when she performs her daily activities.

The user gets some hints to make household tasks easier for her. At the same time, regular exercise helps her stay fit. A body activity sensor collects data and the AAL application determines appropriate activities and exercises for the user. As it is difficult for the AAL care recipient to set the device herself, an informal carer, her son, comes in to help her.

6.2.6 (Self-)management of daily life activities at home

6.2.6.1 Use case 9 behaviour monitoring

Jane is 85 years old and suffers from mild cognitive impairments. She uses an AAL system which detects potentially dangerous situations for her and changes in her behaviour patterns. For example, if Jane leaves a pan on the stove in the kitchen unattended for a certain period of time, the system notifies her by displaying a message on the TV, which she is likely to be watching. Should she ever fall at home and not be able to get up, then the system automatically notifies an emergency call service. When her daily activity patterns changes, a notification will be sent to her daughter so that she can look for appropriate support.

The AAL care recipient maintains independent living though she is getting forgetful and needs reminder and notification assistance for some of the daily activities. This AAL care recipient falls on the category of either level 1 or level 2 of the user domains. Sometimes she fails to do what is necessary to keep herself and her residence safe and secure. Various sensors are utilized to monitor home safety and the user's body movement, so that formal and informal carers can respond to the situation and/or change.

6.2.6.2 Use case 10 shopping and nutrition planner

Michael is 72 years old and lives alone. He suffers from mild cognitive impairment and often has problems with healthy diet and related shopping tasks. That's why his son installed a new shopping assistant on Michael's smart TV and mobile phone. Michael can use the system for organizing his shopping list. For example, the assistant recommends him to add more fruits to his shopping list. He can use the system for online ordering, too. The items he bought are delivered to his home. The system also knows that the stock of sparkling water is running out and adds some bottles to the shopping cart as well.

The AAL care recipient lives alone but needs assistance in managing a healthy diet, as well as doing grocery shopping. His son, an informal carer, installed a system that helps the AAL care recipient assemble shopping lists, as well as arranging on-line shopping with door-to-door delivery service. Connected with intelligent storage system, it can report low stock of certain foodstuffs; for example, an intelligent fridge. It can also be connected with a home automation infrastructure to issue reminders if the user has assembled a shopping list but failed to actually go shopping.

6.2.6.3 Use Case 11 intelligent lighting system

Takuji, 68, doesn't see well in dark places. He sometimes visits his son Mamoru's house, which has an intelligent lighting system installed. After dark, the light automatically turns on when the sensor of the system detects human presence. The residents can also control On/Off via their smartphone, and the conventional switch on the wall is used only secondarily. One day, the sensor somehow didn't work when Takuji went upstairs. Because it was getting dark, Takuji wanted to turn on the light. He used the normal On/Off switch on the wall, but it did not work. He was at a loss. It is very difficult for him to go downstairs safely without lighting. His grandson Shota downstairs could not fix the problem either, because he didn't have a smartphone. They had to call Mamoru, who operated the system remotely using an App on his smartphone.

This use case presents a possible problem that AAL users could encounter when a system does not work properly. The problem would be especially serious for those who are not familiar with the operation. In this use case, the system automatically determines operation based on the information from the sensors and the user does not know how he can choose different operation manually. Operation options available in such situations should be considered beforehand. Visualization of the system status would be also helpful for the users.

6.3 Functionalities that appear in each use case

Various types of functionalities are found in the collected use cases. The elements are sorted into five groupings with ten sub-groupings (see Table 2).

- General

  Use cases 18, 19, 25, 26, 27, 29 deal with the management of information and data. They should be taken into consideration and be applied to other individual use cases as much as possible.

- Monitoring

  The functionality mainly covers two kinds of monitoring: emergency (fall, fire, etc.) and long-term health issues (vital signs, medication adherence, etc.). Consultation is also included in this functionality as part of monitoring process.

- Communication support

  This functionality covers various types of communication: communication with people such as family members, friends, medical staff, etc. Transactions and interaction with systems (e.g. smart shopping) are also included in this functionality.

- Activity support

  This functionality deals with miscellaneous activities ranging from activities such as exercise and games, and also smart home management such as use of lighting systems. Reminder function (excepting medication-related matters) is also included in this functionality.

- Mobility support

  Factors in this functionality aim at facilitating and assisting mobility of AAL care recipients, in terms of both movement and orientation.

Table 2 – Categories and functionalities of use cases

Functionalities		Use case number				
		Use case category				
		1	2	3	4	5
General (Data protection, privacy, etc.)		18, 19, 25, 26, 27, 29				
Monitoring	Emergency	**9**, 12, 23, 31, 33, 34	**4**	25, 31	**7**, **9**, 13, 24, 25, 31, 34, 36, 39	**4**, **7**, **9**, 12, 13, 23, 25, 31, 35, 40, 42
	Vital data, activity level, etc.	**1**, **8**, **9**, 12, 15, 17, 18, 21, 31		**1**, 25, 31	**1**, **7**, **8**, **9**, 13, 25, 31	**1**, **7**, **8**, **9**, 12, 13, 15, 21, 25, 31, 42, 45
	Medication	**2**, 17, 33			**2**, **7**, 32, 45	**2**, **7**, 32
	Consultation	**1**, 13, 25, 31, 45	**4**	**1**, 25, 31	**1**, **2**, **4**, **7**, 25, 31	**4**, 13, 31, 45
Communication support	General	**1**, **3**, 33	**3**, **4**, 29	**1**, **6**, 25	**1**, **3**, **7**, 25, 39, 43	**1**, **3**, **4**, **7**, 25, 45
	Transactions	**10**	**4**	**6**, **10**		**4**, **10**
Activity support	Reminders	**2**, **7**, 29, 33	29	**5**	**2**, **5**, **7**, 25, 29, 32	**5**, **7**, **10**, 25, 29, 32
	Miscellaneous	**7**, **8**, **9**		**5**	**5**, **8**, **9**, 32, 43	**5**, **7**, **8**, **9**, **10**, **11**, 32, 37, 38, 41
Movement support	Disorientation			**5**	**5**, 31, 36	**5**, **10**, 35
	Walking support	31, 44		**5**, 31, 44	**5**, 31	**5**, 31, 38, 44
Representative use cases are shown in bold.						

7 Considerations of user requirements

7.1 General

Based on the previous use case analysis, the major user requirements are identified. AAL users may or may not be professionally trained in the use of AAL systems. As a result, AAL systems should be designed and implemented with the interaction of the needs, preferences and capabilities of the actors (persons, technical and organizational) and the context of use (environments) in mind.

For demonstrating the user requirements of AAL use cases, SyC AAL has developed Figure 5. There is no hierarchical structure of user requirements; the user requirements should be considered on an equal basis. The user requirements are interconnected; however, the technical implementation of each requirement is independent.

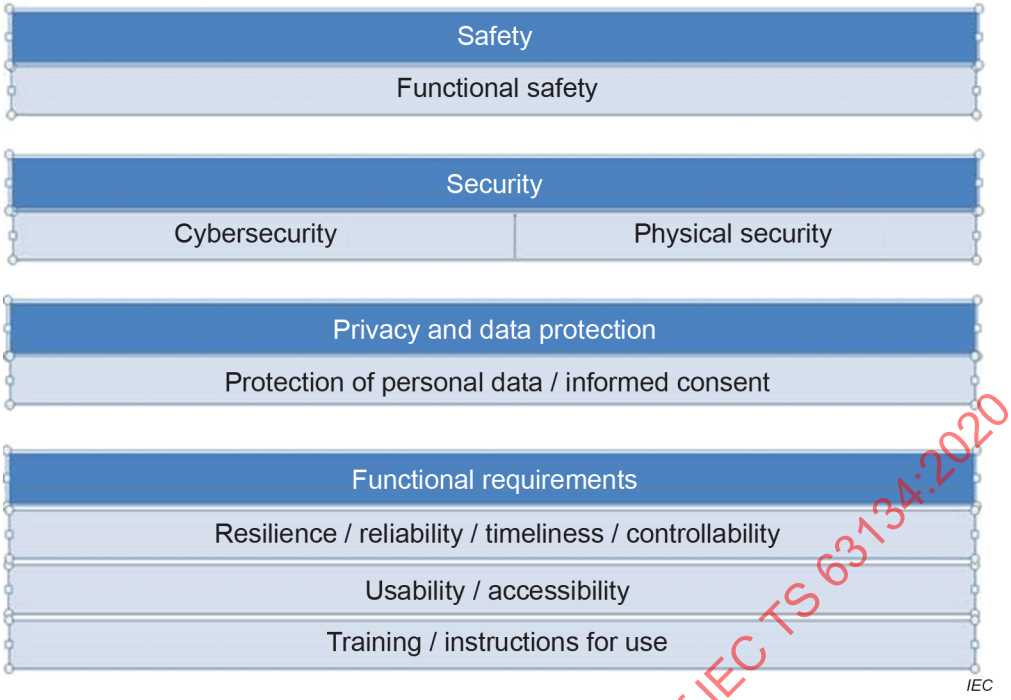


Figure 5 – Overview of user requirements

According to ISO/IEC 30141, the characteristics of IoT systems comprise trustworthiness, architecture and functional characteristics. Trustworthiness is defined as the degree of confidence a stakeholder has that the system performs as expected with characteristics including:

- safety;
- security;
- privacy and data protection;
- functional requirements;

  Additional characteristics for AAL systems were identified which are of operational and functional nature of the AAL system.

- usability, see also ISO 9241-11:2018;

  It is important that the AAL user has an understanding of how the AAL system operates. AAL systems should be designed so that each category of AAL user understands the part or parts of the system in which they interact. All aspects of usability, including effectiveness, efficiency and user satisfaction, can either increase or decrease safety.

  NOTE See also the dialogue principles as defined in ISO 9241-110:2006.

- accessibility, see also ISO/IEC 29138-1.

7.2 Definition of user requirements

7.2.1 General

The AAL use cases were classified according to the care recipient viewpoint (see 6.3) and use case categories (see 5.5). Similar to the AAL architecture model, SyC AAL mapped the AAL use case classification by use case categories (x-axis), care recipient viewpoint (y-axis) and user requirements (z-axis). Figure 6 aims to provide a three-dimensional view of user requirements, use case categories and user's viewpoint. The user requirements are extracted from Figure 5. For easier reading, only some user requirements are placed on the z-axis.

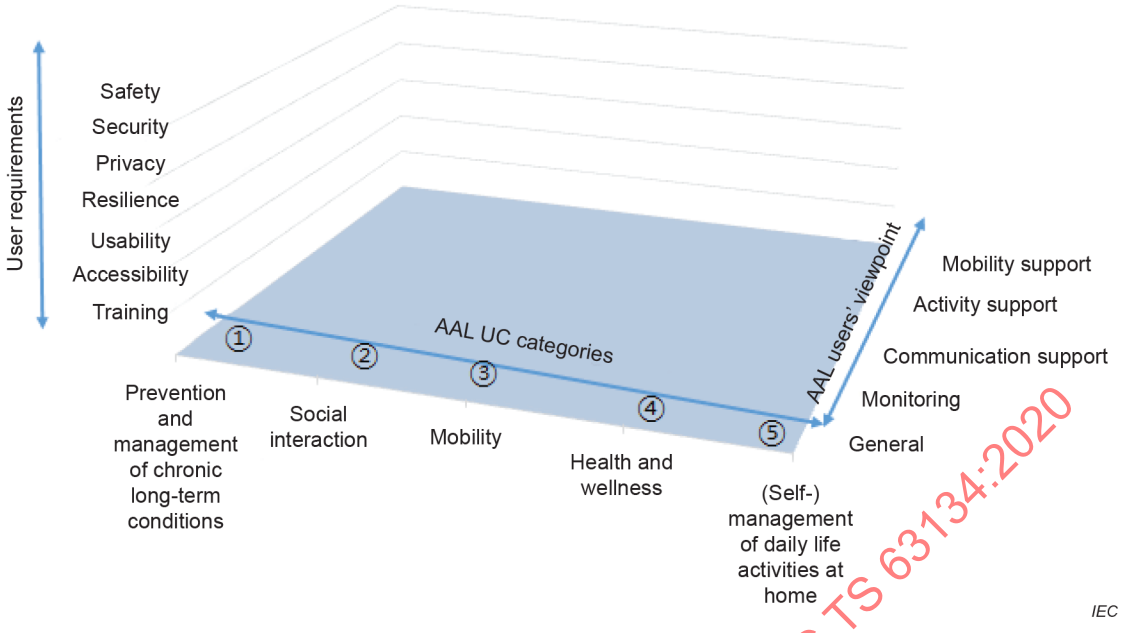


Figure 6 – AAL use case classification

7.2.2 Safety

Safety, as user requirements has implications for the design, development and operation of AAL products, services and systems.

The AAL system should be responsive and spot risky behaviour and hazardous situations and intervene in a timely manner.

AAL components should meet the applicable conformance testing standards and regulations to ensure that these are safe to operate by AAL users. As the environmental conditions (e.g. temperature, humidity, mechanical stress, electromagnetic interference, mains power reliability, etc.) may be uncontrolled in certain contexts of use AAL components should be chosen to ensure that they operate properly in these cases.

The context of use (environments) should be evaluated to ensure that AAL users are capable of performing daily tasks safely.

AAL systems should be designed to be as low risk as possible. Design considerations should take into account the physical, sensory, cognitive and emotional state of the AAL user – including those users who are at risk of being excluded, for example due to a disability or who are vulnerable – and the environmental conditions of the context of use.

Functional safety (IEC 60050-351:2013, 351-57-06) is part of the overall safety that depends on functional and physical units operating correctly in response to their inputs. It means keeping residual risk to user, operator, and environment to an acceptable level.

7.2.3 Security

Security is defined freedom from unacceptable risk to the physical units considered from the outside (IEC 60050-351:2013, 351-57-07).

Data security (cybersecurity) means should be incorporated into AAL systems in order to reduce the risk of AAL system failure or compromised functionality. According to Regulation (EU) 526/2013, on Information and Communication Technology cybersecurity certification ("Cybersecurity Act"), cybersecurity comprises all activities necessary to protect network and information systems, their users, and affected persons from cyber threats.

7.2.4 Privacy and data protection

Privacy of personal data regulations are in place globally. AAL systems should comply with the applicable regulations to protect the personal data of AAL users.

ISO/IEC 24775-2:2014, 3.1.45 defines privacy as the right of an entity (normally an individual or an organization), acting on its own behalf, to determine the degree to which the confidentiality of their private information is maintained.

According to Art. 4 of the General Data Protection Regulation, personal data means any information relating to an identified or identifiable natural person ('data subject'); an identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person.

Consent, as defined in the General Data Protection Regulation, of the AAL care recipient means any freely given, specific, informed and unambiguous indication of the data subject's wishes by which he or she, by a statement or by a clear affirmative action, signifies agreement to the processing of personal data relating to him or her.

7.2.5 Functional requirements

According to ISO/IEC 30141, reliability and resilience should make the AAL system robust in the face of environmental disruptions, human errors, system faults and attacks.

Timeliness and controllability are additional characteristics important for AAL systems. Timeliness in the sense of a system's response to a user's input could be subsumed under the dialogue principle "controllability", see 4.7 in ISO 9241-110:2006. A dialogue is controllable when the user is able to initiate and control the direction and pace of the interaction until the point at which the goal has been met. The requirement of "timeliness" is a requirement that is not directly related to the user, whereas "controllability" is from a user-centric point of view.

Additional important characteristics for AAL systems were identified which are of operational and functional nature of the AAL system.

- Usability, see also the dialogue principles as defined in ISO 9241-110:2006.

  It is important that the AAL user has an understanding of how the AAL system operates. AAL systems should be designed so that each category of AAL user understands the part or parts of the system in which they interact. All aspects of usability, including effectiveness, efficiency and user satisfaction, can either increase or decrease safety.

- Accessibility, see also ISO/IEC 29138-1.

  Each context of use should be evaluated to determine the physical, sensory and cognitive accessibility needs of each category of AAL user. In particular, design considerations and accommodations should take into account possible impairments regarding the human functions described in Clause 7 of ISO/IEC Guide 71:2014, and ISO/IEC 29138-1.

- Training and instructions for use.

  Training is critical to the safe operation of an AAL system. Training should be developed for the three role categories of AAL users in the appropriate context of use. Training materials should be accessible in compatible formats.

  The instructions for use for the untrained AAL user should be simple to read and easily understood. The instructions for use for the trained AAL user can contain additional AAL system information required for the setup, troubleshooting, and maintenance of the AAL system. Instructions for use should contain information identifying the organization to contact in case of any issues or questions. Instructions should be made accessible by using accessible formats that are available on accessible systems in accessible environments.

8 Summary of standards gap analysis

IEC SyC AAL has developed an inventory of standards and directives covering electric safety, EMC, sustainability, usability, data protection, privacy and security among other areas. The relevant technical committees have also been identified.

SyC AAL is in the process of identifying the relevant standards and directives for each use case including where these fit into the architecture model layers.

SyC AAL invites the national mirror committees, technical committees in liaison and liaison bodies to review the information to determine the accuracy and completeness of the inventory.

SyC AAL also invites national mirror committees, technical committees in liaison and liaison bodies to review identified standards for any potential gaps in applying these to a typical SyC AAL user and the SyC AAL environment of use as described below.

SyC AAL care recipients are aged or disabled members of the population with related issues such as lack of mobility, vison and/or hearing problems, lack of muscle strength, memory and cognitive issues. SyC AAL operators are usually family member caregivers that can be under stress owing to caring for the SyC AAL user. SyC AAL users may have a limited education or not be a native language speaker. As a result, devices and systems need to be designed with easy-to-understand instructions and user interfaces.

The SyC AAL environment is uncontrolled in terms of temperature, humidity, ambient lighting, noise, unreliable AC mains connection and could be susceptible to power outages. In which case, devices and systems need to be designed to take into account the limitations of the SyC AAL user and for operation in an uncontrolled environment of use.

9 Conclusions and recommendations

The process for developing use cases for AAL systems was presented in this document. Input to use cases are the AAL system architecture, AAL user needs and the context (environment) of use.

Use cases for AAL systems are based on real world situations and the outcome of these is to identify products, services and systems of AAL technologies in such a way as to assist system developers and service providers to develop solutions that address the AAL user's needs.

Owing to the complexity of AAL systems (diverse user population, different levels of assistance required, wide context of use; and education levels of users), AAL system components must be designed to meet the usability needs of users as well as to operate in uncontrolled environmental conditions.

Another outcome from the use cases is to identify standards, directives, and regulations required to develop a compliant AAL system in terms of safety, security (cyber and physical), privacy and data protection as well as functional requirements.

IEC SyC AAL encourages national mirror committees, technical committees in liaison and liaison bodies to review the standards, directives, and regulations inventory to identify any gaps in these that would need to be filled in order for AAL system components to meet the needs of the AAL user.

Annex A
(informative)

AAL use case template (version 1.10)

A.1 Level of criticality (see 5.3)

Major	Moderate	Minor

A.2 Name of use case

ID	Name of Use Case	AAL Levels of assistance Level 0: independent Level 1: some assistance Level 2: assistance with IADL Level 3: assistance with ADL See 5.4

A.3 AAL function and service layer

AAL Function and Service Layer (=Use Case Categories) See 5.5	Context of use See 5.6

A.4 AAL system component composition

AAL system components See 5.7

A.5 Version management

Changes / Version	Date	Name Author(s) or Committee	Approval Status draft, for comments, for voting, final

A.6 Basic information to use case

Source(s) / Literature	**Link**	**Conditions (limitations) of Use**
Maturity of Use Case – in business operation, realized in demonstration project, , realized in R&D, in preparation, visionary		
Generic, Regional or National Relation		
View – Technical / Business/…		
Health indications		
Threshold conditions		
Further Keywords for Classification		

A.7 Scope and objectives of use case

Scope and Objectives of Use Case

A.8 Narrative of use case

Narrative of Use Case
Short description – maximum 3 sentences
Complete description

A.9 Actors: people, components, systems, integrated systems, applications and organizations

Actor Name (see 5.8)	**Actor Role**	**Actor Description**	**Actor Interactions** (Transactions between Actors)

A.10 Issues: legal contracts, legal regulations, constraints and others (including regional regulations)

Issue – here specific ones	**Impact of Issue on Use Case**	**Reference –** law, standard, others

A.11 Referenced standards and/or standardization committees

Relevant Standardization Committees	Standards to be considered in the Use Case	Standard Status

A.12 Relation with other known use cases

Known use case	Source	UC Status

A.13 General remarks

General Remarks

A.14 Data security and privacy

Data Security and Privacy

A.15 Conformity aspects (common international assessment methodology/critical requirements) (to be completed by IEC SyC AAL

Conformity

A.16 User requirements and interactions with other actors

User Requirements and Interactions

A.17 Drawings or diagrams depicting the use case

Drawing or Diagram of Use Case – e.g. graphic depiction of use scenarios, and/or "use case diagram" and/or "sequence diagram", …

Annex B
(informative)

Representative use cases

B.1 Use case 1 personal health check

B.1.1 Level of criticality (See 5.3)

Major	Moderate	Minor
	X	

B.1.2 Name of use case

ID	Name of Use Case	AAL user domains Level 0: independent Level 1: some assistance Level 2: assistance with IADL Level 3: assistance with ADL See 5.4
01	Personal Health Check	Level 0: independent Level 1: some assistance

B.1.3 AAL function and service layer

AAL Function and Service Layer (=Use Case Categories) See 5.5	Context of use See 5.6
Prevention and management of chronic long-term conditions Mobility Health & Wellness (Self-)management of daily life activities at home	Public buildings Personal mobile and personal vehicle Home Body and personal

B.1.4 AAL system component composition

AAL system components See 5.7
AAl Devices
AAL gateway
AAL (Platform) Backend system
AAL Applications & services
AAL & other information systems
Health information systems

B.1.5 Version management

Changes / Version	Date	Name Author(s) or Committee	Approval Status draft, for comments, for voting, final
1.10	Jan. 12, 2017	Hiro Tanaka	For comments

B.1.6 Basic information to use case

Source(s) / Literature	Link	Conditions (limitations) of Use
Maturity of Use Case – in business operation, realized in demonstration project, realized in R&D, in preparation, visionary		
realized in demonstration project		
Generic, Regional or National Relation		
Generic		
View – Technical / Business/…		
Technical		
Key medical and alarm condition		
Chemist gives user health check report including medical condition.		
Further Keywords for Classification		
Health monitoring, wearable vital sensor		

B.1.7 Scope and objectives of use case

Scope and Objectives of Use Case
• Prevention and Management of Chronic Conditions • (Self-)management of Daily Life Activities at Home • Care for the future • Living actively and independently at home

B.1.8 Narrative of use case

Narrative of Use Case
Short description – max 3 sentences
Mrs. Chiyoko, 73 years old, wears wearable vital sensors for collecting her vital signs. The collected vital signs are stored in a server and a medical doctor makes her health report by checking her vital data. At the drug store, a chemist reads Mrs. Chiyoko's health report and gives advice to her.
Complete description

Mrs. Chiyoko likes walking and tries to go out every day. At 9:00 her husband left for a day-care service facility and he will return at about 16:30. At 9:30, she went to her drug store for her health check. Mrs. Chiyoko attaches some very small wearable vital sensors that remotely/wirelessly monitor her conditions. The detected vital signs are sent to a healthcare service centre and stored for her health checking. A medical doctor analyses her vital data. In his analysis, oral health check sheets created at the drug store are also used for his analysis. The medical doctor generates Chiyoko's monthly health check report. At the drug store, her chemist who has knowledge and licence of health consultation reads Chiyoko's monthly health check report and gives advice to her about her health conditions. The chemist may suggest to her to go to the doctor if necessary. After the health consultation, she purchased a package of cold medicine and left the drug store.

Table 1 Mrs. Chiyoko's profile

Name	Chiyoko
Sex	Female
Age	73
Living town	Western suburbs of Tokyo
Family	Husband in need of nursing care, 80 years old, is living together with Mrs. Chiyoko. A daughter, 45 years old, is married and living in Yokohama with her husband and her child. A son, 42 years old, is not yet married and is working for a company in Osaka.
Household income	160 000 JPY per month (approx. 1 230 EUR, 1 EUR = 130 JPY)
Savings	20 million JPY (approx. 153 850 EUR)

B.1.9 Actors: people, components, systems, integrated systems, applications and organizations

Actor Name (See also 5.8)	**Actor Role**	**Actor Description**	**Actor Interactions** (Transactions between Actors)
Chiyoko	AAL User	A 73-year-old woman	
Chemist	Assistive person	Health consultant	
Medical doctor	Advisor for assistive technologies	Makes a health report	
Wearable sensor	Devices	Daily vital sign collection	
Cloud server	Application server	Stores Chiyoko's vital data	

B.1.10 Issues: legal contracts, legal regulations, constraints and others (including regional regulations)

Issue – here specific ones	**Impact of Issue on Use Case**	**Reference –** law, standard, others

B.1.11 Referenced standards and/or standardization committees

Relevant Standardization Committees	Standards to be considered in the Use Case	Standard Status

B.1.12 Relation with other known use cases

Known use case	Source	UC Status

B.1.13 General remarks

General Remarks

B.1.14 Data security and privacy

Data Security and Privacy
• The users' privacy should be appropriately handled in the communication networks, cloud server, medical doctor and chemist. • The detected data by the vital sensors is to be secured in the communication networks and cloud server.

B.1.15 Conformity aspects (common international assessment methodology/critical requirements) (to be completed by IEC SyC AAL)

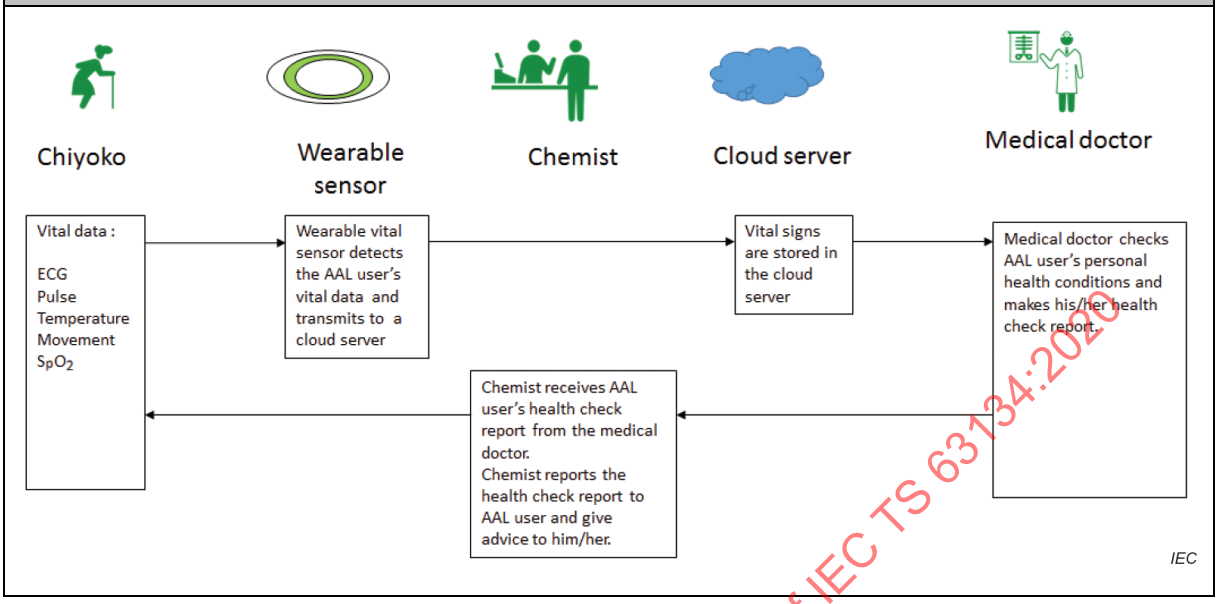
Conformity
The system has to be sufficiently reliable in all aspects, e.g. dependability, latency, etc.

B.1.16 User requirements and interactions with other actors

User Requirements and Interactions

B.1.17 Drawings or diagrams depicting the use case

Drawing or Diagram of Use Case – e.g. graphic depiction of use scenarios, and/or "use case diagram" and/or "sequence diagram", ...



B.2 Use case 2 advanced medication monitoring

B.2.1 Level of criticality (see 5.3)

Major	Moderate	Minor
X		

B.2.2 Name of use case

ID	Name of Use Case	AAL Levels of assistance Level 0: independent Level 1: some assistance Level 2: assistance with IADL Level 3: assistance with ADL See 5.4
02	Advanced Medication Monitoring (AMM)	Level 2 – assistance with IADL (Medication management and adherence is considered an IADL)

B.2.3 AAL function and service layer

AAL Function and Service Layer (=Use Case Categories) See 5.5	Context of use See 5.6
Prevention and management of chronic long-term conditions Health and Wellness	Home

B.2.4 AAL system component composition

AAL system components See 5.7
Pharmaceutical dispenser – AAL Device
Communication interface to control system – AAL gateway
Medication monitoring/reminders – AAL Service
Advanced Medication Monitoring Control system – AAL & other information systems
AMM Control system infrastructure (server, network, etc.) – AAL backend systems
Hospital or Physician Electronic Medical Record system – Health Information system

B.2.5 Version management

Changes / Version	**Date**	**Name Author(s) or Committee**	**Approval Status** draft, for comments, for voting, final
Template 0.9	20160525	SyC AAL; Paul Boissonneault (editor)	Draft
1.10	20170109	Paul Boissonneault (editor)	Draft

B.2.6 Basic Information to use case

Source(s) / Literature	**Link**	**Conditions (limitations) of Use**
Continue Health Alliance 2008		
Maturity of Use Case – in business operation, realized in demonstration project, realized in R&D, in preparation, visionary		
Visionary		
Generic, Regional or National Relation		
Generic		
View – Technical / Business/…		
Business		
Key medical and alarm condition		
One or multiple prescribed medications		
Further Keywords for Classification		
Medication_compliance; medication_adherence; medication_monitor		

B.2.7 Scope and objectives of use case

Scope and Objectives of Use Case
The objective of this use case is to improve medication compliance (also known as medication adherence) with prescribed medications, particularly in situations where the users have been prescribed multiple medications. As a side benefit, a record of medications taken will also be created.

B.2.8 Narrative of use case

Narrative of Use Case
Short description – max 3 sentences
And older lady, using multiple prescribed medications and living on her own, uses the AMM system to remind her when to take each medication and record when she has done so appropriately. Her daughter, one of her informal carers, may be notified if she does not take her medication as prescribed so that she may intervene as required.
Complete description
Bernice K. is dealing with a number of health challenges, but they don't stand in the way of her leading a full and active life, which includes weekly bridge games and dance classes. Women such as Bernice, who lives on her own but with a daughter living elsewhere in the same city and son in a distant city, face unique challenges as they age. Since women typically live longer than men, they are more likely to suffer from multiple occurring chronic conditions such as arthritis, diabetes and heart disease. The 84-year-old great-grandmother and former laboratory technologist and travel agent has two artificial knees, has dealt with a bout of skin cancer and copes with atrial fibrillation and arthritis. Each condition requires ongoing visits to specialists, including a dermatologist, rheumatologist, orthopaedic surgeon, cardiologist and respirologist. Multiple chronic health conditions also tend to require an arsenal of medications and the advanced medication monitoring program offers a supporting service to ensure patients are taking the right drugs at the right times of the day. "As patients get older they have more conditions, they see more specialists and they can end up being on many different medications that cause side-effects and prompt yet another medication to be added on – it's a prescribing cascade," says Lisa, a clinical pharmacist. "Patients may not know why they are taking certain medications or if the drugs they are on are interfering with each other, which can result in hospitalization," she explains. The advanced medication monitor improves Bernice's medication adherence by: • reminding the patient to take medication; • collecting and storing data about when medication is removed from the dispenser or when a reminder is missed; • collecting additional data in the form of a questionnaire which can be used to reinforce correct behaviour (e.g. take dissolved in water) or detect side-effects (i.e. headaches) which might indicate need for an intervention; • communicating stored data for further analysis to a remote server via which the data may be analysed to generate interventions from a healthcare specialist, call centre or one of Bernice's informal carers (Daughter or Son); • data can also be read by a local device for the direct benefit of the patient or informal carer. The AMM is designed for use by the Patient or Primary Informal Carer. At initial setup, Patients bring in all their medications – some are on as many as 20 – and a Pharmacist goes through each of them, ensuring the patient knows what it's for, how it should be taken, whether side-effects are occurring and whether the drug needs to be stopped, reduced or continued. The Pharmacist or a designated AMM Operator will enter instructions in the AMM for the dispensing of the specific medications to suit the individual patient circumstances and treatment including the medication name, unit dose, alert times such as "take before 6 p.m.", and any specific instructions such as "crush and take with water". The user may also program in a set of notifications to be sent to one or more of the patient's informal carers if the medication is not dispensed in accordance with the schedule.

The AMM is expected to consist of (among other components) one or more pharmaceutical dispensers (PD) which will contain the medication. The pharmacist will load the PD portion with the prescribed medications.

Once programmed, the reminder function and data storage capabilities are embedded with the PD to enable it to work stand-alone (execute a reminder program and collect data independently) even when the network is out of range. As programmed, the PD can do the following.

- It executes the medication dispensing reminders using an audible and/or visual notification.
- When the User removes the medication from the PD, the medication(s), dose, and time are automatically recorded.
- In cases when the medication should be taken in a prescribed way after removal from the package – for example, crushed in water or taken before/after meals – the user may be reminded to confirm compliant behaviour by activating a sensor to record yes/no answers to the questions displayed on the PD or medication package.
- In cases when the patient's subjective experience of their health should be captured, for example when side-effects are suspected or may otherwise help in diagnosis and treatment, the user may be reminded to capture specific data by answering specific questions or selecting options presented to them.
- In cases when medication is to be taken as needed, the reminder function may not be present but the act of opening the medication dispenser will be automatically recorded.

If a prescribed medication dose is not taken as required, one or more of the informal carers will be notified of the situation including the specific medication, dose and indicated time. The informal carer may remotely access the AMM to determine additional information about the missed medication (e.g. what the pills look like, how many, etc.) then would be expected to contact the patient to encourage them to take the missed medication. In critical cases when phone compliance is ineffective, the carer may have to travel to the patient's location and assist them with taking the medication.

For patients with no informal caregivers to take on the role above, an AAL Service provider may receive the notification and place the reminder call to the patient. In critical cases, the AAL service provider may dispatch a nurse to administer the medication.

The data from the PD is uploaded to a component of the AMM located on a remote server. The data can then be analysed for compliance patterns and, depending on the answers to questions, indications regarding the outcomes, side-effects, etc. can be obtained. This compliance data will be available to the formal caregiver team including the primary care physician, specialist physicians, and/or the pharmacist at subsequent medical appointments to assist with ongoing care and medication reconciliation and management.

Furthermore, the data collected from the PD/AMM will likely be combined with other time-stamped data from physiological monitors, for example a blood pressure monitor, to provide the formal caregivers with a rich source of information on which to base follow-ups and interventions.

While not wanting to restrict system implementations, the Advanced Medication Monitor is typically expected to have the following features:

- a pharmaceutical dispenser (PD) containing unit doses of medication – for example, a blister pack of pills, a carded blister pack, or approved pill dispenser;
- sensors to detect when a unit dose is dispensed;
- timer to enable events to be time-stamped;
- memory to record the dispensing events and associated information;
- battery to enable mobile usage and retain data;
- reminder indicators (buzzer, LED, other device);
- program to store and execute dispensing reminders;
- communications capability to transfer information to and from a host system.

The PD is typically a portable device which may often be used out-of-range from the network. For this reason, it will be able to execute a reminder program and collect data independently. Stored data may be subsequently exchanged with a controller when in-range and a communication session is initiated.

Multiple medications: 40 % of patients take more than one medication, rising to over 65 % for patients over 75 years of age. These situations may be handled in one of two ways:

- When each medication has a different schedule and different related issues, more than one PD/AMM will be supplied. These may be physically packaged in the same package, have different reminder schedules, sets of questions, etc.
- When the medications may be taken simultaneously, the AMM may be packaged with the relevant pills which can be taken together. In this case a 'dose' consists of more than one drug and the stored data will associate one event with multiple medications.

Changing the reminder program: in some cases the prescribing authority may wish to change the medication dose and reminder program after the PD is delivered to the patient. A 'nice to have' feature is the ability to have the current instructions and PD contents updated by the pharmacist to AAL operator on demand. The fallback position is that a new PD should be configured and dispensed with the appropriate medications.

B.2.9 Actors: people, components, systems, integrated systems, applications and organizations

Actor Name (See 5.8)	**Actor Role**	**Actor Description**	**Actor Interactions** (Transactions between Actors)
• Bernice K	AAL user (primary) / AAL beneficiary	Older adult with multiple medications	
• Daughter	AAL user / assistive person	Primary informal carer	
• Son	AAL user / assistive person	Secondary informal carer	
• Pharmacist	AAL care provider	Provider of prescription medications	
• Primary care physician	AAL care provider	Formal trained medical care provider	
• Specialist physicians	AAL care provider	Formal trained medical care providers who prescribe medications	
• AMM operator	AAL operator	Trained specialist user who may program the AMM	

B.2.10 Issues: legal contracts, legal regulations, constraints and others (including regional regulations)

Issue – here specific ones	**Impact of Issue on Use Case**	**Reference –** law, standard, others
Informed consent of user required		
Connections to monitoring call centres must be secure	Defines technology requirements	

B.2.11 Referenced standards and/or standardization committees

Relevant Standardization Committees	**Standards to be considered in the Use Case**	**Standard Status**

B.2.12 Relation with other known use cases

Known use case	**Source**	**UC Status**
UC 35 Calendar Service		

B.2.13 General remarks

General Remarks
• Generating a reminder and recording of the action of dispensing of the medication by the patient is no guarantee that the patient has actually taken the medication. The dispensed medications may be dropped, lost, discarded, etc. prior to consumption.
• While this will assist some patients with mild cognitive impairments, patients must be of sufficient competency to be able to follow instructions.

B.2.14 Security and privacy

Data Security and Privacy
• Prescribed medications and their use are considered sensitive personal health information and the data must be stored securely and have access limited to the Patient's circle of care (medical personnel/formal caregivers and designated informal family or other personal carers). • The AAL beneficiary/AAL user should be able to designate who may become a member of the circle-of care or rescind membership. • In some emergency situations where the AAL beneficiary's health is at significant risk, other health care personnel (e.g. Emergency Room physicians) not designated within the circle-of-care should be allowed access to the medication records to determine appropriate treatment. If this happens, the AAL Beneficiary should be notified of this access. • As health information all records from the AMM are the property of, and should be available to, the AAL beneficiary and/or their designated family carers (who may or may not be AAL Users).

B.2.15 Conformity aspects (common international assessment methodology/critical requirements) (to be completed by IEC SyC AAL)

Conformity

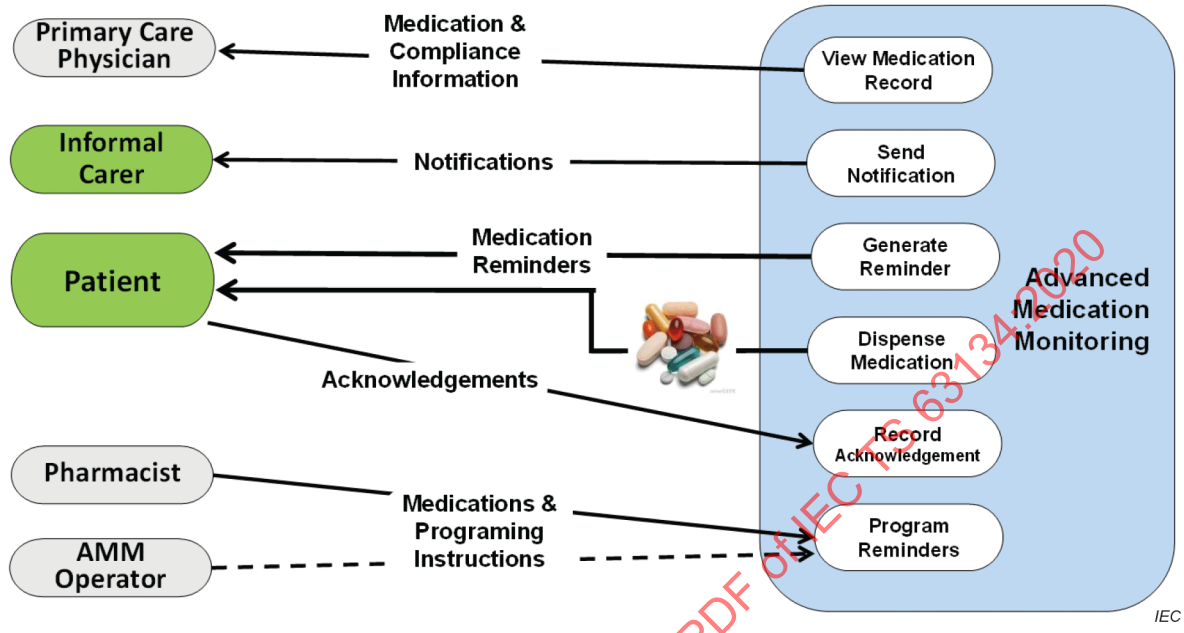
B.2.16 User requirements and interactions with other actors

User Requirements and Interactions

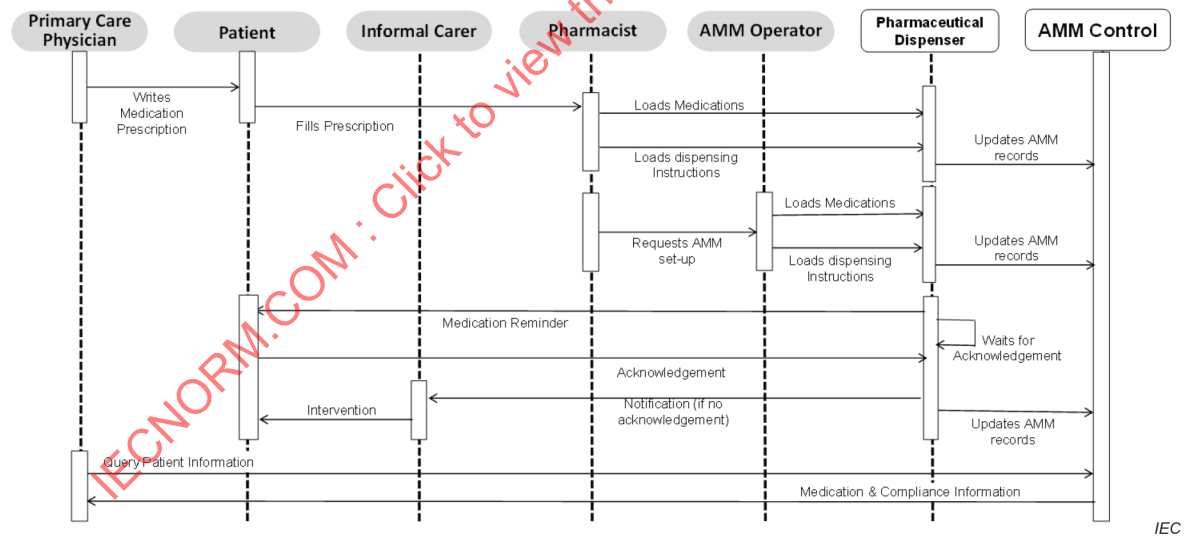
B.2.17 Drawings or diagrams depicting the use case

Drawing or Diagram of Use Case – e.g. graphic depiction of use scenarios, and/or "use case diagram" and/or "sequence diagram", ...

Actor diagram



Information Flow Diagram



B.3 Use Case 3 enable social interaction with care provider

B.3.1 Level of criticality (see 5.3)

Major	Moderate	Minor
	X	

B.3.2 Name of use case

ID	Name of Use Case	AAL user domains Level 0: independent Level 1: some assistance Level 2: assistance with IADL Level 3: assistance with ADL See 5.4
03	Enable Social Interaction with Care Providers	Level 2 Note: Applicable for any level but of most importance when the user is home bound or mobility limited.

B.3.3 AAL function and service layer

AAL Function and Service Layer (=Use Case Categories) See 5.5	Context of use See 5.6
Prevention and management of chronic long-term conditions (dementia) Social interaction Health and Wellness (Self-)management of daily life activities at home	Home

B.3.4 AAL system component composition

AAL system components See 5.7
AAL Device – End user communications terminal, typically with (i) audio and video communications, (ii) Text messaging functionality; or (iii) both. AAL Gateway – typically a communications gateway to either a private network or the public Internet. AAL Application – the call control (directory, connect, call teardown) software and/or the message routing software application.

B.3.5 Version management

Changes / Version	Date	Name Author(s) or Committee	Approval Status draft, for comments, for voting, final
02	20160527	SyC AAL; Paul Boissonneault (editor)	draft
03	20161219	Paul Boissonneault (editor)	Draft

B.3.6 Basic information to use case

Source(s) / Literature	Link	Conditions (limitations) of Use
Continue Health Alliance 2008		
Maturity of Use Case – in business operation, realized in demonstration project, realized in R&D, in preparation, visionary		
Visionary		
Generic, Regional or National Relation		
Generic		
View – Technical / Business/…		
Business		
Key medical and alarm condition		
One or multiple conditions which limited mobility; mild cognitive impairment		
Further Keywords for Classification		
Socialization		

B.3.7 Scope and objectives of use case

Scope and Objectives of Use Case
The objective of this use case is to enable the AAL user to engage in interaction with formal care providers, informal carers, family and friends in a generic and standardized way. Examples of interaction are messaging, chatting, audio calling and video calling.

B.3.8 Narrative of use case

Narrative of Use Case
Short description – max 3 sentences
An older lady, living on her own, with medical issues (physical and/or cognitive) which limit her mobility and ability to visit, interact with, and maintain a connection with others. These issues may also prevent attendance at regular medical appointments and check-ins. This lack of social connection can lead to depression and further negative impact on the physical or cognitive impairments.
Complete description
Bernice K. is dealing with a number of health challenges that have begun to stand in the way of her leading a full and active social life. She is no longer able to attend her weekly bridge games and dance classes and has lost contact with several long-standing friends. Bernice lives on her own but with a daughter living elsewhere in the same city and son and grandchildren in a distant city, and faces increasing isolation. The 84-year-old great grandmother is a former laboratory technologist and travel agent so, while not overly knowledgeable, is comfortable with the use of information and communications technology. She has two artificial knees, copes with atrial fibrillation and arthritis, recently she has begun to show minor cognitive impairments and has recently had to deal with a bout of skin cancer. Each condition requires ongoing visits to specialists, including a dermatologist, rheumatologist, orthopaedic surgeon, cardiologist and respirologist; however, Bernice has begun to miss appointments recently owing to her mobility limitations. Jane, a second person and potential AAL user and AAL beneficiary, has recently been diagnosed with skin cancer which has left her with a difficult time dealing with her new life as she undergoes treatment. She needs treatment every few days and in the beginning didn't know what to expect. Luckily, her health care service provider has a support group that can not only meet in person but can connect over the internet to get help, share stories or just chat when she is feeling down or lonely. Jane no longer feels alone as she is going through treatment, and can share her experiences, both good and bad, with others in real time or by posting messages. As potential AAL users and AAL beneficiaries, the social interaction for both Bernice and Jane can be enabled through: • text interaction in non-real-time (e.g. email, chat boards) – for interaction with friends and family, – for interaction with formal care providers which includes the secure exchange of personal health information; • text interaction in real-time (e.g. instant messaging) – for interaction with friends and family, – for interaction with formal care providers which includes the secure exchange of personal health information; • voice and audio interaction in real-time – for interaction with friends and family, – for interaction with formal care providers which includes the secure exchange of personal health information; • video and audio interaction one-on-one in real-time (e.g. video conferencing) – for interaction with friends and family, – for interaction with formal care providers which includes the secure exchange of personal health information; • video and audio interaction with several parties in real-time (e.g. multi-party video conferencing). The social interaction platform(s) are designed for use by the AAL user, but some AAL users may not be capable of configuring the system (e.g. finding, entering friends account names to place a call) and/or have difficulty setting up connections. So several supporting features are suggested: A designated informal carer and (secondary) AAL user would take on the role of AAL assistant and be able to set-up a directory of people the AAL beneficiary can call. The designated informal carer/AAL assistant may limit who can communicate with the AAL user/AAL beneficiary. In cases when the patient's physical or cognitive impairments limit their ability to answer an incoming communication, one or more designated users should be able to 'force' the creation of a connection. The designated informal caregiver/AAL assistant may be required to set up a connection between the patient and a formal health care services provider (e.g. a tele-medicine appointment) and remain on-line during the communication session. The AAL Service Provider (e.g. the AAL system administrator users) should have access to relevant management (e.g. call statistics, messaging statistics, individual users and their usage, etc.).

B.3.9 Actors: people, components, systems, integrated systems, applications and organizations

Actor Name (See 5.8)	**Actor Role**	**Actor Description**	**Actor Interactions** (Transactions between Actors)
• Bernice K	AAL user (primary) and AAL beneficiary	Older adult with mobility issues and mild cognitive impairment	
• Daughter	AAL user (secondary) and AAL assistant	Primary Informal carer – takes on the role of 'family administrator'	
• Son	AAL user (secondary)	Secondary Informal carer	
• Jane	AAL user (primary) and AAL beneficiary	Adult undergoing cancer treatment	
• Primary care physician	AAL user and AAL care provider (health care services)	Formal medical care provider	
• Cancer physician	AAL user and AAL care provider (health care services)	Formal medical care provider who provides specialized health care services	
• User communications device	Devices	End user device for sending messages and/or communicating with audio or video	
• Call control mechanism	Application server	Controls the call/connection set-up between the parties; Contains the repository and executes routing of messaging.	
• System administrator	AAL user and representative of the AAL service provider	Provides administrative services for the AAL services such as availability monitoring, traffic (call volume) management and system growth planning, etc.	

B.3.10 Issues: legal contracts, legal regulations, constraints and others (including regional regulations)

Issue – here specific ones	**Impact of Issue on Use Case**	**Reference –** law, standard, others
Secure sharing of personal health information	Encryption of textual information	
Real time Connections to medical personnel must be secure	Encrypted audio and/or video communications channel	

B.3.11 Standards and/or standardization committees

Relevant Standardization Committees	**Standards to be considered in the Use Case**	**Standard Status**

B.3.12 Relation with other known use cases

Known use case	Source	UC Status

B.3.13 General remarks

General Remarks
• User interface design and accessibility are critical and should take into account limitations in manual dexterity (e.g. to initiate or answer a call), visual acuity (size and readability of images/icons on the device(s)). • Limited AAL user anonymity should be allowed for some functions, but all communications should be trackable by the AAL system administrators in case of unacceptable use by any party.

B.3.14 Data security and privacy

Data Security and Privacy
• All transmission of medical/personal health information must be done securely and information retained privately with limited/controlled access by medical personnel. • Privacy auditing functions should be available to ascertain who has viewed a patient's medical information. • Outside parties should be restricted from setting up communications with a patient without the express consent of a competent patient or designated informal caregiver.

B.3.15 Conformity aspects (common international assessment methodology/critical requirements) (to be completed by IEC SyC AAL)

Conformity

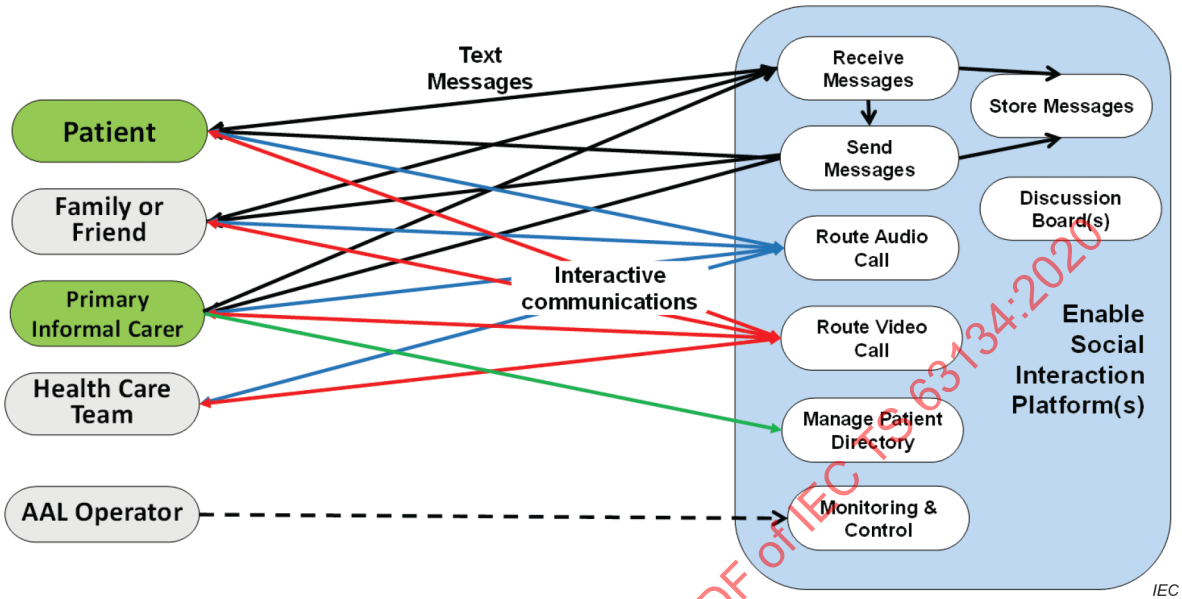
B.3.16 User requirements and interactions with other actors

User Requirements and Interactions

B.3.17 Drawings or diagrams depicting the use case

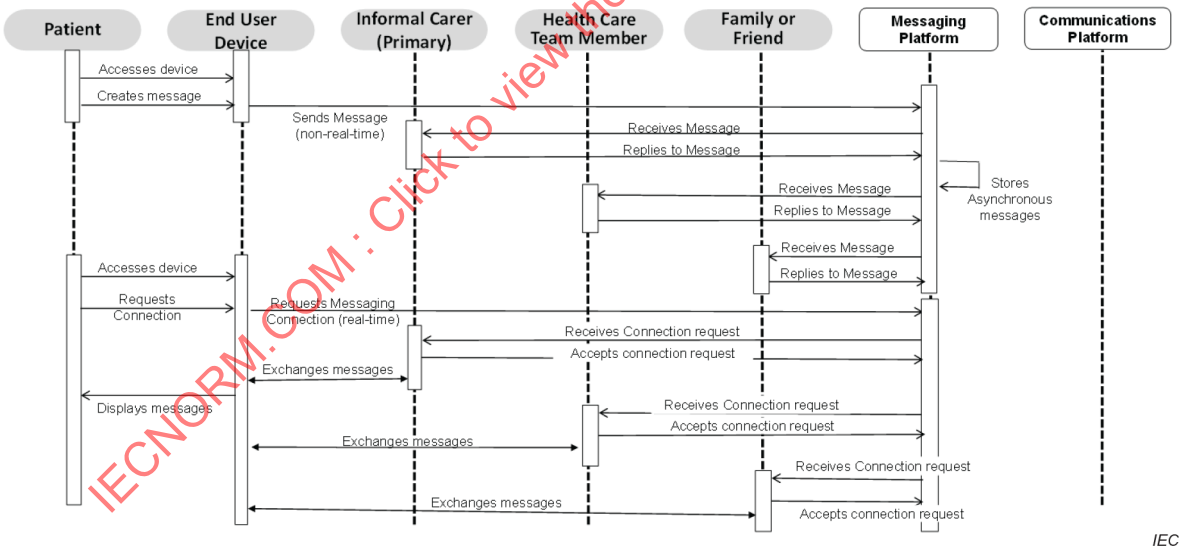
Drawing or Diagram of Use Case – e.g. graphic depiction of use scenarios, and/or "use case diagram" and/or "sequence diagram", ...

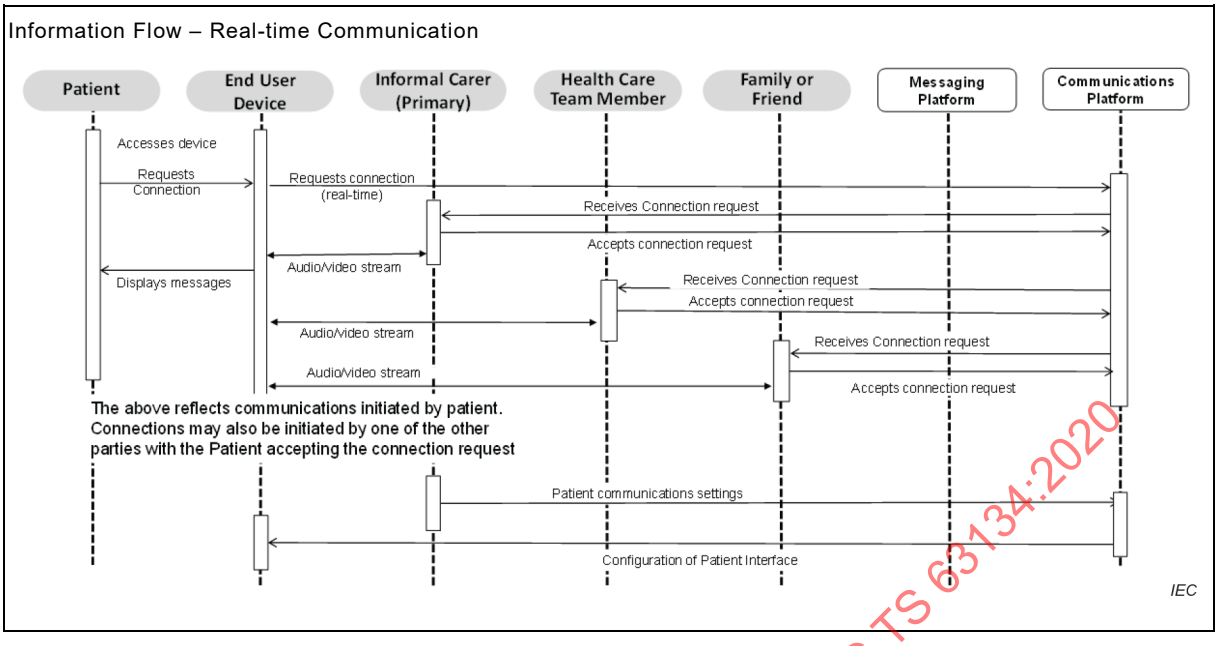
Key Actors Diagram



Information Flow Diagram

Information Flow – Messaging





B.4 Use case 4 social interaction with smart TV

B.4.1 Level of criticality (see 5.3)

Major	Moderate	Minor
		X

B.4.2 Name of use case

ID	Name of Use Case	AAL user domains Level 0: independent Level 1: some assistance Level 2: assistance with IADL Level 3: assistance with ADL See 5.4
04	Social Interaction with Smart TV	Level 1

B.4.3 AAL function and service layer

AAL Function and Service Layer (=Use Case Categories) See 5.5	Context of use See 5.6
Social interaction (Self-)management of daily life activities at home	Home

B.4.4 AAL system component composition

AAL system components See 5.7	
AAL Devices	Mobile device
AAL Gateway	Smart TV
AAL (Platform) Backend system	Smart TV
AAL Applications & Services	Video conference system Chat system Game server Notification receiver
AAL & other information systems	-
Health information systems	-

B.4.5 Version management

Changes / Version	**Date**	**Name** **Author(s) or Committee**	**Approval Status** draft, for comments, for voting, final
v. 0.9	2013-12-06	AALJP, Marco Eichelberg, Lars Rölker-Denker (editor)	draft

B.4.6 Basic information to use case

Source(s) / Literature	**Link**	**Conditions (limitations) of Use**
AAL-JP Action on Standards and Interoperability – D2	Link	Freely available
Maturity of Use Case – in business operation, realized in demonstration project, realized in R&D, in preparation, visionary		
Visionary		
Generic, Regional or National Relation		
Generic		
View – Technical / Business/…		
Business		
Key medical and alarm condition		
Further Keywords for Classification		
#uman_communication, #key_enabling_technology:communication_functions		

B.4.7 Scope and objectives of use case

Scope and Objectives of Use Case
Social Interaction (Self-)management of daily life activities at home Assistive technology can help older adults to stay in contact with friends, family and carers despite limited mobility by offering advanced communication functions such as easy-to-use video telephony. Smart TVs, smartphones and tablets are devices that are well suited to this type of application.

B.4.8 Narrative of use case

Narrative of Use Case
Short description – max 3 sentences
An older adult uses a smart TV and a smartphone as communication device to stay in contact with family, friends, carers and medical doctors.
Complete description
Peter is an 83-year-old person living in the suburbs of a big German city. His wife died 4 years ago and his son Michael has moved to another city about 200 km away. He is suffering from lung cancer, frailty and is not good on his feet anymore. In the past he never got used to computers and mobiles, but since the new generation of smartphones and tablets with touch screen have been available, he is keener on technology. In addition, he owns a new smart TV with some additional functions such as video conferencing, internet browsing and online gaming. His smartphone is connected to the TV and can be used as remote control and game controller, but also has a "panic button app" installed, which he can use in emergency situations inside and outside his home. A nursing service nearby is hosting this service. Peter loves to use video conferencing in the evening to chat with his son Michael and his wife Julia as well with his three grandchildren. Sometimes he calls his good friend Horst who has moved to Spain, and they talk about the good old times or play cards. Today Peter has a video call with his general practitioner to talk about his latest laboratory results. Since there is no need for any other examination they both agreed on this video call. After the call Peter decides to buy some food in the supermarket up the road. He picks up his walker and uses the elevator. As the weather is very good today, he takes the route through the park. While he is walking along the little lake, he feels dizzy and he decides to take a rest on his walker. He takes out his smartphone and presses the panic button. After a few seconds a carer responds to his emergency call. As the smartphone has a localization application installed, the carer can see where Peter is and speaks to him. Since Peter is complaining of dizziness and seems to start panicking, the carer sends out an ambulance to pick him up. As he is already feeling better by the time the ambulance arrives, they bring him back home. With the help of his smart TV, he orders his food from the supermarket's shopping service. In the evening, Peter calls his son Michael and tells him about the incident in the morning. Michael decides to give his father a visit at the weekend.

B.4.9 Actors: people, components, systems, integrated systems, applications and organizations

Actor Name (see5.8)	**Actor Role**	**Actor Description**	**Actor Interactions** (Transactions between Actors)
Peter	AAL user	Older adult	
Michael	Assistive person	Informal carer / relative	
Horst	AAL user	Friend	
Emergency call centre	AAL operator	Call centre for emergencies when mobile	
Smart TV	Device	First AAL system described in this scenario	
Smartphone	Device	Second AAL system described in this scenario	

B.4.10 Issues: legal contracts, legal regulations, constraints and others (including regional regulations)

Issue – here specific ones	**Impact of Issue on Use Case**	**Reference –** law, standard, others
Connections to emergency call centres may be affected by national regulations		

B.4.11 Referenced standards and/or standardization Committees

Relevant Standardization Committees	**Standards to be considered in the Use Case**	**Standard Status**
CLC TC79 WG 4 social alarms	FprEN 50134-7:2017	

B.4.12 Relation with other known use cases

Known use case	**Source**	**UC Status**
The transmission of an emergency notification to a notification receiver (such as a call centre) is a function appearing in multiple use cases.		

B.4.13 General remarks

General Remarks

B.4.14 Data security and privacy

Data Security and Privacy
Having a Smart TV with the described communication functions, there might always be the danger that people get isolated from real physical contacts and only have social contacts in the digital world. This ethical aspect should be considered during the development of additional communication features for Smart TVs. The availability of the communication system over which the "behaviour/alarm notification" transaction is sent, as well as the availability of the notification received, should be considered. If high-priority messages (such as notifications about emergency situations) are transmitted, then the notification receiver must be able to react 24 hours a day, 7 days a week. Furthermore, in these cases a redundant communication infrastructure with two independent transports (such as cabled internet and GSM wireless) should be considered, in order to maximize the overall availability of the system.

B.4.15 Conformity aspects (common international assessment methodology/critical requirements) (to be completed by IEC SyC AAL)

Conformity

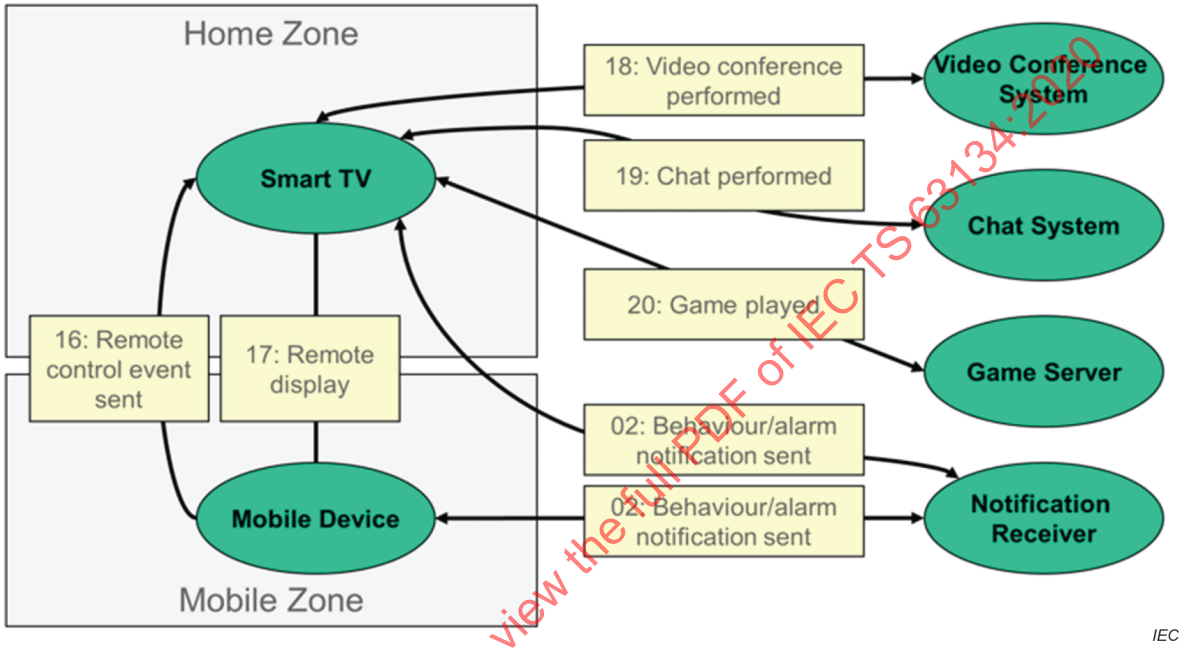
B.4.16 User requirements and interactions with other actors

User Requirements and Interactions

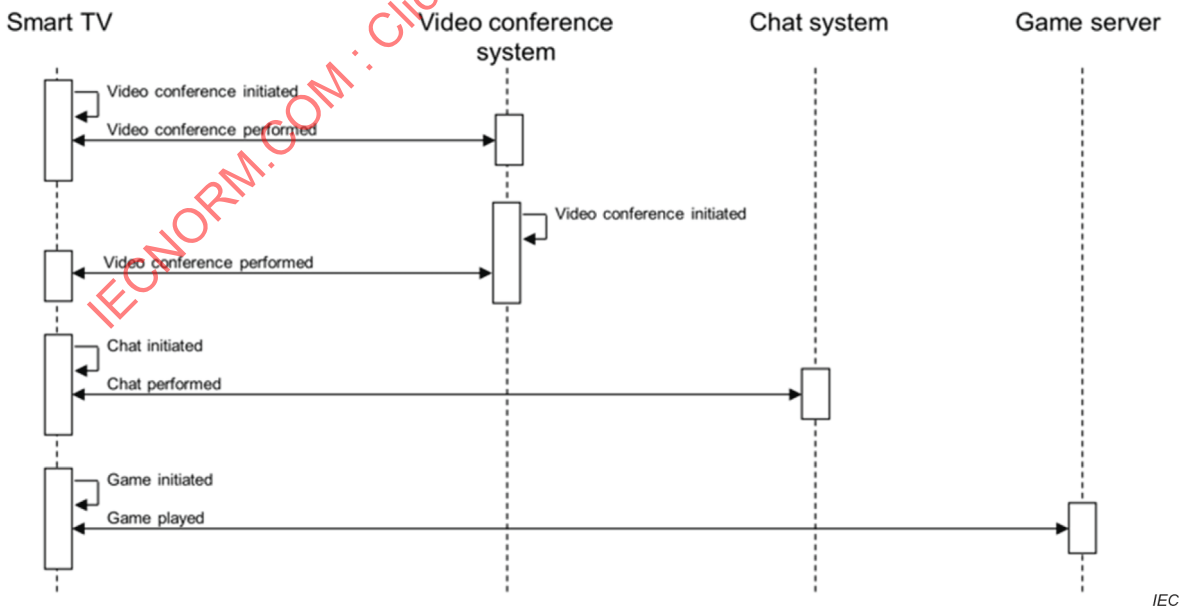
B.4.17 Drawings or diagrams depicting the use case

Drawing or Diagram of Use Case – e.g. graphic depiction of use scenarios, and/or "use case diagram" and/or "sequence diagram", …

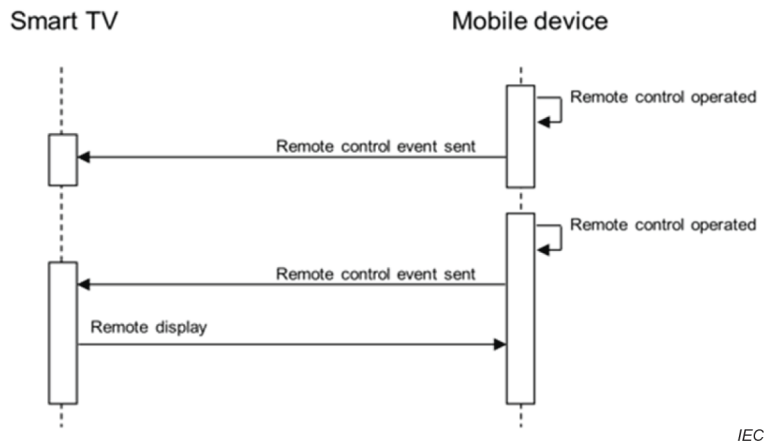
Key actor diagram



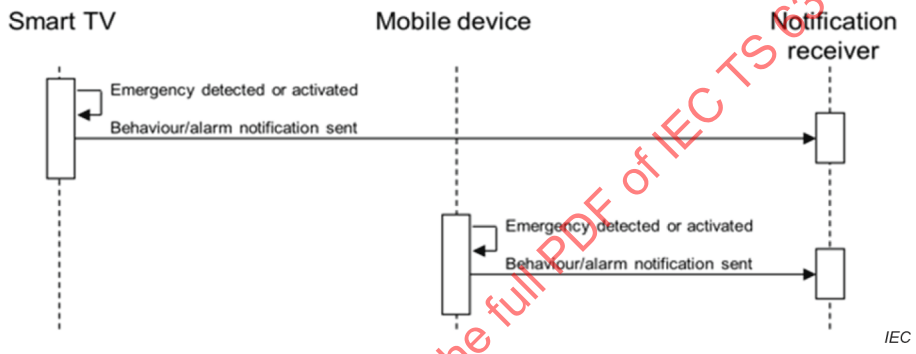
High level flow process diagram



High level process flow – example 1: social interaction with the smart TV



High level process flow – example 2: interaction between smart TV and mobile device



High level process flow – example 3: Alarm notification using smart TV or mobile device

B.5 Use case 5 smart wheeled walker

B.5.1 Level of criticality (see 5.3)

Major	Moderate	Minor
X		

B.5.2 Name of use case

ID	Name of Use Case	AAL levels of assistance Level 0: independent Level 1: some assistance Level 2: assistance with IADL Level 3: assistance with ADL See 5.4
05	Smart Wheeled Walker – Guidance to return home	Level 1; Level 2 User triggered, fully assisted; service level Automatic or manual initiated activation of stroller's "find back home" function. As required, send alarm signal to designated carer or service. Continuous monitoring of position or GPS system status with alarm signal to designated carer or service on failure. Status indicator on power and communication status prior and during use.

B.5.3 AAL function and service layer

AAL Function and Service Layer (=Use Case Categories) See 5.5	Context of use See 5.6
Mobility	Personal mobile and personal vehicle

B.5.4 AAL system component composition

AAL system components See 5.7
AAL device (Wheeled walker equipped with sensors, internet connection) Gateway/Cloud Based Integration Server AAL service (navigate user home service)

B.5.5 Version management

Changes / Version	Date	Name Author(s) or Committee	Approval Status draft, for comments, for voting, final
0.1	2016-01-16	Alastair Ramsey,	draft
0.3 Template v. 0.9	2016-05-26	J.-Uwe Meyer,	for comments
v. 1.10	2016-11-18		

B.5.6 Basic information to use case

Source(s) / Literature	Link	Conditions (limitations) of Use
The "Mrs Appletree sometimes forgets" scenario, Prof. Dr. Bernd Krieg-Brückner (DFKI)	DKE, Germany, 2016	
Maturity of Use Case – in business operation, realized in demonstration project, realized in R&D, in preparation, visionary		
Visionary		
Generic, Regional or National Relation		
International in concept with regional implementations and certification		
View – Technical / Business/…		
Technical (component, communication, information, function & services)		
Key medical and alarm condition		
No severe medical conditions, possible medical condition: light form of dementia, no life-threatening alarm conditions, forgetfulness, confusion, hearing difficulties, poor mobility		
Further Keywords for Classification		
Self-Management IT-Services, Personalized assisted IT-Services, Remote Surveillance IT Services, IoT, Cloud Services Intelligent (navigating) wheeled walker, wheeled walker as personal assistant, position-finding service, route planner, shopping assistant, walking stick		

B.5.7 Scope and objectives of use case

Scope and Objectives of Use Case
Mobility: • Enable people's mobility in terms of moving in the home and/or outside the home • Orientation and navigation

B.5.8 Narrative of use case

Narrative of Use Case
Short description – max 3 sentences
The Smart Wheeled Walker helps Mrs. Appletree to stabilize her walk but also guides her around the flat and the residence, along her preferred routes and to her chosen destinations (and back), and even outside in the park where she usually finds it difficult to distinguish one tree from another. Her personal assistant always knows where they are and never gets lost.
Complete description
Mrs Appletree sometimes forgets things, if only little things. Recently, however, when she was visiting her friend, Mrs Peach, in the residence where both their apartments are, she had trouble finding her way back to her flat and had to ask Mr. Scrub for directions. She felt embarrassed and thought he might go around telling everyone that she is getting old. Every now and then Mrs Appletree has a bad day where she runs the risk of stumbling and falling. This only happens occasionally. As such, it amounted to something of a welcome miracle when her daughter Heather presented her with a special wheeled walker that would become her personal assistant. It not only helps her to stabilize her walk but also guides her around the flat and the residence, along her preferred routes and to her chosen destinations (and back), and even outside in the park where she usually finds it difficult to distinguish one tree from another. Her personal assistant always knows where they are and never gets lost. She remembers how her daughter once called her during her morning walk and she subsequently didn't know where she was. Mrs Appletree has decided to call her new little helper "Max". He is like a friend with whom she can talk; he answers back, offers information and advice, clarifies queries, and occasionally even reminds her to visit Mrs Peach, like today at 5 o'clock, as she had promised her. Last week, when her favourite walking path in the park had been blocked by a fallen tree, Max showed her a new route which she had never before walked, leading her just as well to the pavilion by the lake. Max also helps her at the neighbourhood shopping centre. How confusing it is when new shops seem to spring up every two weeks and familiar ones suddenly disappear! In the supermarket, she often wonders how difficult it is to find the things one is looking for (and how embarrassing it is to always have to ask). Max guides her to the right product shelves. He even takes a particularly short route which he has calculated beforehand with reference to the shopping list compiled in advance by her. This saves her on walking distance, which is crucial because of her weak knee. Max reminds her not to forget to get her favourite brand of coffee which she often finds tough to recognize as all the packets look so similar from the outside and it seems she may have forgotten her reading glasses this time. Max even advises her on which brand is cheaper today or why a certain new brand is supposed to be better (though he also can't say what "improved crema" means!). In his basket, all her shopping can be comfortably carried home, on her (his) very own wheels!

B.5.9 Actors: people, components, systems, integrated systems, applications and organizations

Actor Name (See 5.8)	**Actor Role**	**Actor Description**	**Actor Interactions** (Transactions between Actors)
Mrs. Appletree	AAL User	Beneficiary of "smart" mobility aid; Beneficiary of "guidance" mobility aid – Mrs Appletree	
Smart Wheeled Walker	Device / Application	Wheeled walker equipped with sensors, internet connection and attached smart user front-end, which serves as a digital assistant; Smart Walker – Mobility aid with guidance function	Personal Area Network (PAN), d) e) g)1, Front-end device and GUI, utilizing HTML5/JavaScript technologies, browser-based technologies;
Systems Application Hub and IT Services Delivery Engine	Application Server	Cloud-based IT-Service Integration Server	g) Cloud based gateways and system integration platforms,
AAL IT Service Center	AAL Service Provider	AAL IT service delivering organization	f) Repository of authorized and delivered IT Services

1

d) wireless connected devices/systems and wireless network protocols,

e) internet connected devices/systems and protocols,

g) cloud-based gateways and system integration platforms

B.5.10 Issues: legal contracts, legal regulations, constraints and others (including regional regulations)

Issue – here specific ones	**Impact of Issue on Use Case**	**Reference –** law, standard, others
User Authorization	strong	User Access Management (UMA), OAuth2 standard, national privacy law
Legal contract between user and AAL Service Provider including Service level agreement (SLA)	strong	No particular law or standard, solved individually between parties; Conditions of service level of "alarm service" provided

B.5.11 Referenced standards and/or standardization committees

Relevant Standardization Committees	**Standards to be considered in the Use Case**	**Standard Status**
ISO/IEC	ISO/IEC 20000 (all parts)	released
ISO/IEC	ISO/IEC 25437	released
IETF Oauth2 WG	RFC 6749 https://tools.ietf.org/html/rfc6749	released

B.5.12 Relation with other known use cases

Known use case	**Source**	**UC Status**
#6 Guidance to return home with intelligent (navigating) wheeled walker	Alastair Ramsay	

B.5.13 General remarks

General Remarks
This use case was analysed viewing the middle layer "Services Entity" and the upper layer "User Application". An analysis of the lower layer "Physical Network" was not included. Functionality of guidance home common to other functions required including guidance within home, guidance to other locations and guidance around public areas such as shops.

B.5.14 Data security and privacy

Data Security and Privacy
Privacy issues relate to the national privacy laws and to policies, trust and authorization issues between the owner of private data and the authorized IT service provider organization. They are addressed in "Services Entity" and "User Application" views. Security issues are viewed in all the layers: "Physical Network", "Services Entity", and "User Applications". • Sensor / location data – privacy and security to be defined between stakeholders and restricted to authorized persons. • Sensor / location data – level of detail / data parameters to be defined between stakeholders and restricted to authorized persons.

B.5.15 Conformity aspects (common international assessment methodology/critical requirements) (to be completed by IEC SyC AAL)

Conformity

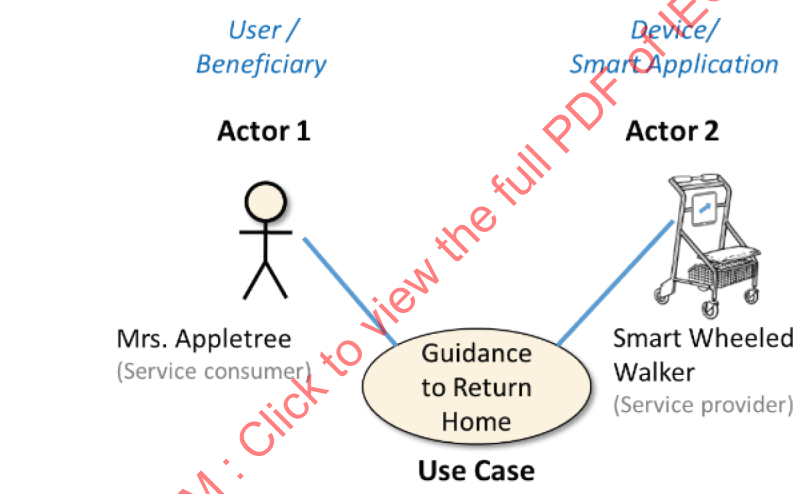
B.5.16 User requirements and interactions with other actors

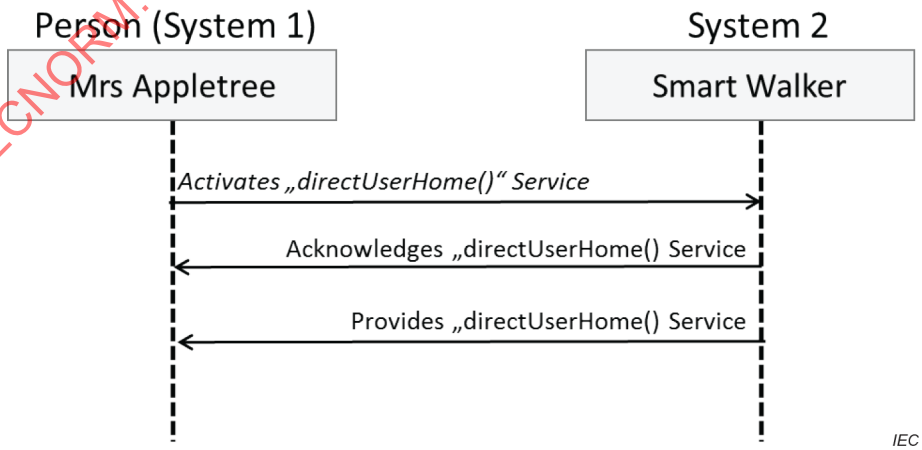
User Requirements and Interactions
See B.5.17 b) Interaction between equipment and user critical to ensure safe and correct implementation of "find back home" action. Same level of criticality needed in communicating operational status of equipment. Interaction must take account of medical conditions of users included restricted mobility, restricted sight and hearing.

B.5.17 Drawings or diagrams depicting the use case

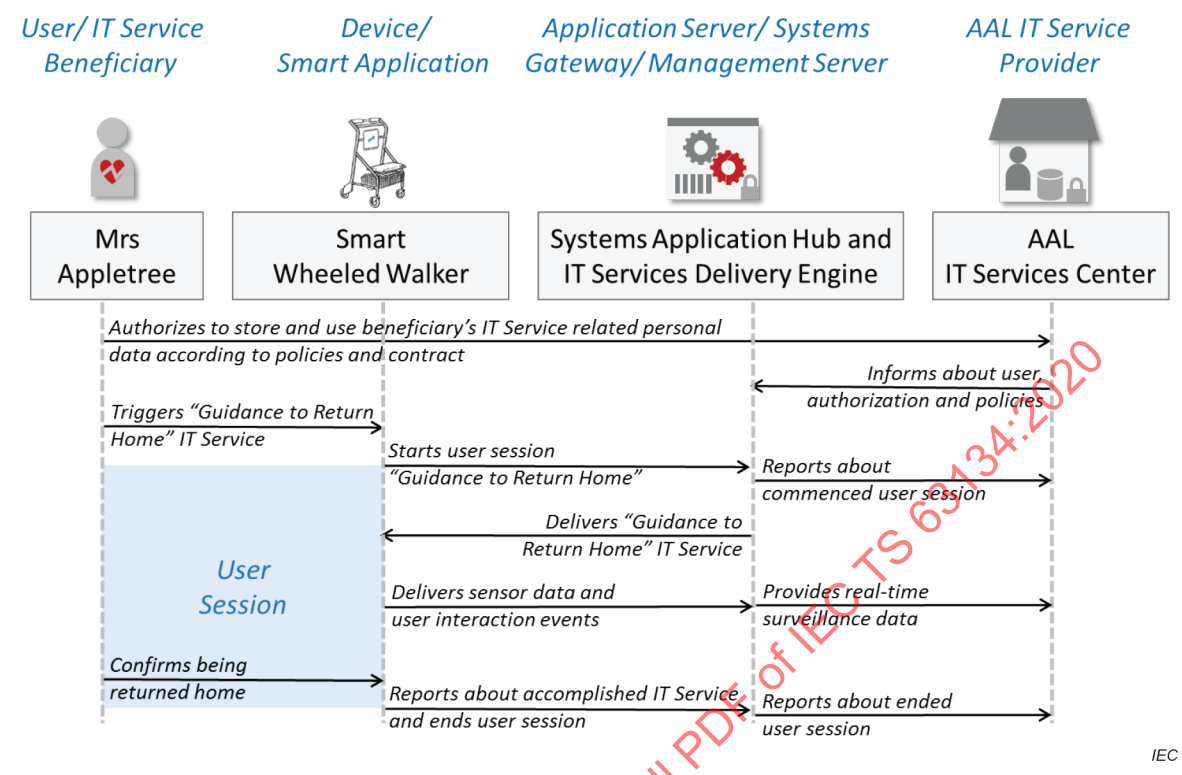
Drawing or Diagram of Use Case –e.g. graphic depiction of use scenarios, and/or "use case diagram" and/or "sequence diagram", …

a)





b)



B.6 Use Case 6 enhanced terminal accessibility

B.6.1 Level of criticality (see 5.3)

Major	Moderate	Minor
	X	

B.6.2 Name of use case

ID	Name of Use Case	AAL user domains Level 0: independent Level 1: some assistance Level 2: assistance with IADL Level 3: assistance with ADL See 5.4
06	Improve communication between user and equipment by ETA (Enhanced Terminal Accessibility) 'VISIT to JAPAN'	Level 1: some assistance Level 2: assistance with IADL

B.6.3 AAL function and service layer

AAL Function and Service Layer (=Use Case Categories) See 5.5	**Context of use** See 5.6
Mobility:	Global; Public building; Home (IEC 60050-871); Body and personal; Work space

B.6.4 AAL system component composition

AAL system components See 5.7
AAL device; AAL gateway; AAL backend system; AAL application & services; AAL & other information systems

B.6.5 Version management

Changes / Version	**Date**	**Name** **Author(s) or Committee**	**Approval Status** draft, for comments, for voting, final
v. 0.9	2016-07-22	Yoshikazu Yorimoto (JBMIA)	For comment
v.1.10	2016-11-07	Yoshikazu Yorimoto (JBMIA)	For comment

B.6.6 Basic information to use case

Source(s) / Literature	**Link**	**Conditions (limitations) of Use**
– User sets his/her preferences to his/her smartphone. – Equipment with ETA – reads the special needs and changes its man-machine interface settings so as to fit user preferences.		
Maturity of Use Case – in business operation, realized in demonstration project, realized in R&D, in preparation, visionary		
Development work in progress. Demonstration at IEC Tokyo meeting on 2014. And also SONY/DENTSU at suburb of Paris on 2014.		
Generic, Regional or National Relation		
Generic		
View – Technical / Business/…		
Technical		
Key medical and alarm condition		
Senior, person with disability and foreigner. Non-alarm condition.		
Further Keywords for Classification		
Supports with special needs for each person's condition.		

B.6.7 Scope and objectives of use case

Scope and Objectives of Use Case
• Automatic setting of the individual's exclusive use accessibility feature by smartphone with personalized special needs information. It can switch man-machine interface of equipment to make it more friendly. • non-stress, the safety and the privacy on communication with equipment.

B.6.8 Narrative of use case

Narrative of Use Case
Short description – max 3 sentences
Bob is a 70-year-old British man who came to travel in Japan. He was afraid of travelling in Japan because of amblyopia and egg allergy; but he remembered that he had set up the ETA on his smartphone to help himself. He enjoyed his stay in Japan with the help of 'equipment with ETA'.
Complete description
Bob is a 70-year-old British man, and he came to travel in Japan. He was afraid of travelling in Japan because of his amblyopia and egg allergy. So, he set up the ETA in advance on his smartphone to help himself. The ETA uses the same system as the AAL system at his home. ETA is based on ISO/IEC 12905, which intends to improve the man-machine interface and can be commonly used in all over the world. He also registered his credit card information into his smartphone. When he arrived at Tokyo Haneda airport, he was able to find the subway ticketing machine by the map of airport information on his smartphone. He could get easily the prepaid ticket-data from the ticketing machine into his smartphone as follows: • The ticketing machine reads his special needs from his smartphone. • The information of display screen was changed to enlarge in English instead of Japanese. • The cost of the prepaid ticket could be paid from the credit card on his smartphone. The prepaid ticket could be used on all trains and buses in the Tokyo area. • He could get the event information for the Tokyo area into his smartphone by service download at the same time. Next, he needed to obtain cash in Japanese yen. He located the ATM by the information on his smartphone. He had registered the credit card information into his smartphone. He could get the cash easily by ETA. He felt hungry, and he looked for a good Japanese restaurant. The restaurant had a menu to download, so he downloaded the menu to his smartphone. The menu was translated to English automatically by ETA. He had a particularly good impression at the restaurant: a menu with a warning about the allergy was automatically provided. When he was exploring town, he felt thirsty. There are a lot of vending machines for soft drinks everywhere in the Japanese town. When he bought a drink, the machine recommended particular drinks (anti-allergy) to him in an English voice when he touched his smartphone to the reader of the machine. He chose one of the drinks recommended by the machine, and paid with the prepaid money on his smartphone. He was perfectly comfortable with using a vending machine in a foreign country. Bob enjoyed the benefit of ETA throughout his stay in Japan: equipment at airport, railway station, restaurant, entertainment, bank, hotel, department store, retail shop, duty free shop, information centre and so on. He thought that every person, including senior persons with disability, could have a good travel experience, if there were equipment with ETA all over the world.

B.6.9 Actors: people, components, systems, integrated systems, applications and organizations

Actor Name (See 5.8)	**Actor Role**	**Actor Description**	**Actor Interactions** (Transactions between Actors)
1. Bob	User	Old man that needs assistance system for communication with equipment.	
2. Smartphone	Special needs on it.	User requirement for using application by assistance of special needs	
3. Equipment	• vending machine • ATM • Menu of restaurant	User can operate equipment by the assistance of special needs.	
4. Cloud server	Application server/systems gateway/management server. The server may have some ETA-special-needs function on it.	Runs the cloud healthcare application that manages remote monitoring system set-up and operation. ETA-special-needs function may be used for assisting user communication.	

B.6.10 Issues: legal contracts, legal regulations, constraints and others (including regional regulations)

Issue – here specific ones	**Impact of Issue on Use Case**	**Reference –** law, standard, others
ETA (special needs) shall be included for AAL.	Communication shall be important for every person.	ISO/IEC 12905:2011

B.6.11 Referenced standards and/or standardization committees

Relevant Standardization Committees	**Standards to be considered in the Use Case**	**Standard Status**
ISO/IEC 12905:2011 (ISO/IEC JTC1/SC17)	The creating of "implementing guidebook" for the application including AAL. Adding new special needs which are requested by society.	IS
JIS X 6905	The content of JIS X6905 is the same as ISO/IEC 12905, translated to Japanese.	JIS
CEN EN 1332-4 (CEN TC 224)	Annex A (coding of special needs) in ISO/IEC 12905 is backward compatible with CEN EN 1332-4.	EN

B.6.12 Relation with other known use cases

Known use case	**Source**	**UC Status**
Improve communication between user and equipment by ETA N0.2 "Support to general social life"	Takeshi Uesugi (FUJITSU FRONTECH LIMITED)	

B.6.13 General remarks

General Remarks
ETA should be useful for AAL environment, in case of communication between user and equipment or others. Personalized information about accessibility (special needs) can change equipment to offer a friendlier man-machine interface automatically. In most cases, users need to use switches or other functions to change interface setting of a device. ETA is a simpler and more convenient way to realize user-friendly interfaces. ETA cards automatically choose a specific user's preferred setting of equipment interface. The ETA mechanism, not necessarily in a card format, can be applied to cell phones, personal computers and other devices as well.

B.6.14 Data security and privacy

Data Security and Privacy
User privacy is provided as follows: • The terminal shall not retain the data elements or objects (special needs) stored on the card. • A set of the data elements of special needs which are used for user preference should not be used for personal identification purposes. It may be linked to the personal information or it may be used without such a link. • The data elements which are defined in this document are not intended as a description of any or all of the obstacles faced by cardholders. • The UCI shall always be available. • Modification of UCI preferences data by user shall require the permission of the cardholder.

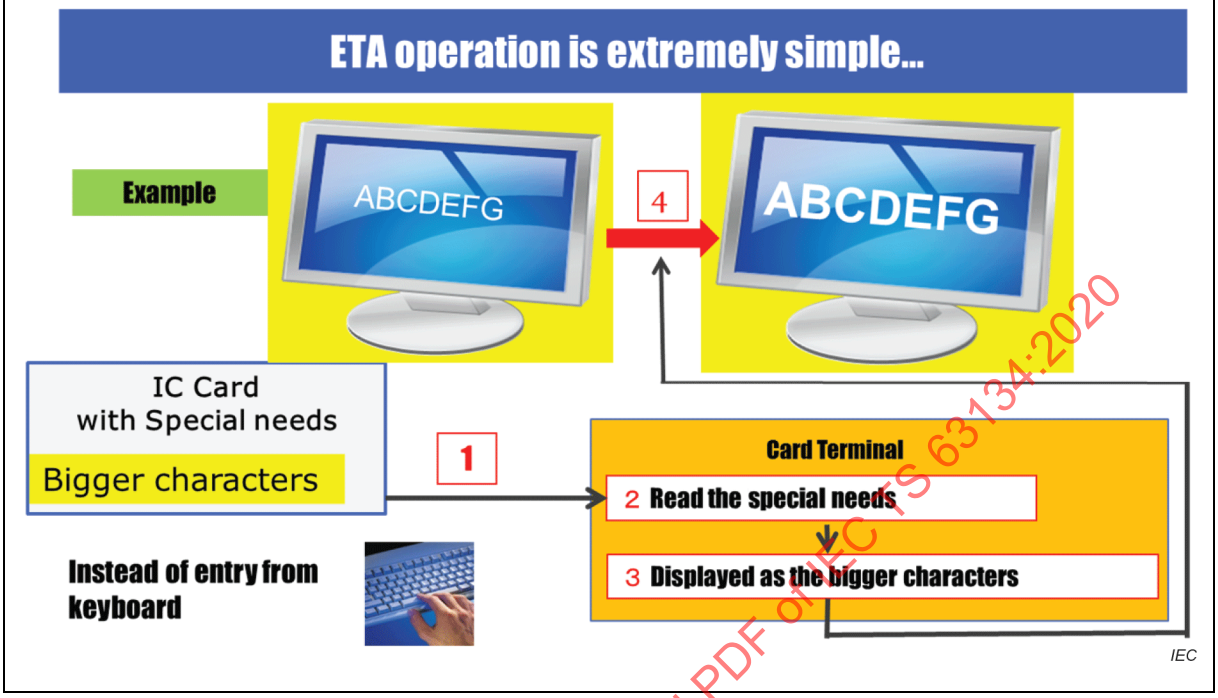
B.6.15 Conformity aspects (common international assessment methodology/critical requirements) (to be completed by IEC SyC AAL)

Conformity
The system shall be reliable and inter-operable in all aspects, for example: • Each media should be coded and recorded for special needs as shown by the method in ISO/IEC 12905. • Each equipment can read correctly special needs in the media as shown by the method in ISO/IEC 12905.

B.6.16 User requirements and interactions with other actors

User Requirements and Interactions
Solution "ISO/IEC 12905, ETA" NOTE The following explanation used a card for recording special needs as an example. Any media or cloud can be used for it. The way of using ETA: • User sets his/her preferences to his/her cards. • At card terminals, the terminal reads the special needs and changes its interface settings so as to fit the preferences. Using cards with personal preference request (special needs), the card terminal can offer a more suitable man-machine interface.

B.6.17 Drawings or diagrams depicting the use case

Drawing or Diagram of Use Case – e.g. graphic depiction of use scenarios, and/or "use case diagram" and/or "sequence diagram", …


B.7 Use case 7 intelligent apartment

B.7.1 Level of criticality (See 5.3)

Major	Moderate	Minor
X		

B.7.2 Name of use case

ID	Name of Use Case	AAL user domains Level 0: independent Level 1: some assistance Level 2: assistance with IADL Level 3: assistance with ADL See 5.4
07	Intelligent apartment Healthcare in the senior citizens' welfare centre	Level 2 Fully assisted, automatic/user monitored

B.7.3 AAL function and service layer

AAL Function and Service Layer (=Use Case Categories) See 5.5	**Context of use** See 5.6
Health & Wellness (Self-)management of daily life activities at home	Home Body & Personal; Global

B.7.4 BAAL system component composition

AAL system components See 5.7	
AAL Devices	fall recognition sensors, motion detectors, intelligent lighting system, television set, video conference link (camera/video call system), intelligent drug cabinet, intelligent housekeeping system
AAL Gateway	intelligent housekeeping system
AAL (Platform) Backend system	
AAL Applications & Services	
AAL & other information systems	
Health information systems	electronic file

B.7.5 Version management

Changes / Version	**Date**	**Name** **Author(s) or Committee**	**Approval Status** draft, for comments, for voting, final
v. 0.9	2016-01-18	Janina Laurila-Dürsch (Original Source: Working Group 'Communication' in the BMBF/VDE Partnership for Innovation, AAL, "Collection of Material and Scenario Outlines")	draft
v.1.10	2016-12-12		

B.7.6 Basic information to use case

Source(s) / Literature	Link	Conditions (limitations) of Use
AAL-Anwendungsszenarien	https://www.dke.de/resource/blob/846816/cb41e7588e697cd2a12abb3100d8dc57/aal-anwendungsszenarien-data.pdf	None
Maturity of Use Case – in business operation, realized in demonstration project, realized in R&D, in preparation, visionary		
Generic, Regional or National Relation		
Generic		
View – Technical / Business/…		
Technical		
Key medical and alarm condition		
Further Keywords for Classification		
Identification, location, fall detection, managing vital signs, video call systems, logistics, medical equipment, conference systems, monitoring (systems) [vital signs, medication intake compliance], health file, communication elements, services, electronic health file		

B.7.7 Scope and objectives of use case

Scope and Objectives of Use Case
Video conference link, doctors' appointments and physiotherapeutic treatments. Intelligent apartment equipped with state-of-the-art technology such as fall recognition sensors, motion detectors, intelligent lighting systems, as well as a telemonitoring system that helps the patient to monitor his vital signs. In case of irregularities, alarms go off.

B.7.8 Narrative of use case

Narrative of Use Case
Short description – max 3 sentences
Konrad N. lives in an intelligent apartment equipped with a telemonitoring system that helps him to monitor his vital signs. Via a video conference link, doctors' appointments and physiotherapeutic treatments can be carried out.
Complete description
Ms M.'s father lives around 200 km away. In recent times, Gabriele M. has been increasingly worried about his health. Her father, Konrad N., has been suffering from diabetes mellitus and severe circulatory disorders in his legs for several years. For this reason, his gait has become increasingly unstable. Moreover, Ms M. feels that he seems to become increasingly forgetful. Indeed, his doctor has diagnosed him with an early stage dementia, an additional health challenge for Mr. N. as well as an added responsibility for Gabriele M. She is happy that her father moved to an area with a comprehensive and well-organized living quarters concept five years ago. As part of this concept, residents can receive assistance by means of modern technology and a wide range of services. His apartment has state-of-the-art technology, equipped with fall recognition sensors, motion detectors, intelligent lighting systems and much more. In case of irregularities, alarms go off and inform both Ms M. and the head office of the living quarters. The head office of the living quarters is located in a service centre of a senior citizens' welfare provider which offers an extensive and easily accessible range of services around the clock. These services include everything from sports and fitness to housekeeping services such as laundry service and gastronomy. The offered services can be used independently to meet the individual needs. Short response times can be guaranteed by the excellent organizational infrastructure. If Konrad N. wishes, he can also contact a digital nutritionist who advises him on an individually tailored diet. Thanks to the technical assistance systems, both the residents of the service centre as well as persons in need of help and care in the wider domestic sphere can be cared for. Services include everything from routine health checks to security functions. Thanks to these services, elderly persons such as Ms M.'s father can live with a high degree of security and independence at home. Telemedicine and telecare make this possible. Technical assistance systems also play a major role in prevention and rehabilitation. Owing to his early stage dementia, Mr. N. needs more and more help to manage activities of daily living. This is why, for example, he gets a "morning call" from the residential headquarters on his television set every morning. Nurse Hildegard from the headquarters appears on the monitor and enquires about his wellbeing. She also checks whether he takes his medicine. The reason to check his adherence to his medication regime is to ensure that Mr. N. regularly takes his medication but does not overdose. However, he doesn't need nurse Hildegard to check on him because his intelligent drug cabinet also serves this function. The residential headquarters merely serve as a second line of verification to ensure his safety. His health parameters such as blood sugar levels and type of medication are saved in his electronic file. Nurse Hildegard also reminds him that he has a video conference appointment with his doctor today at 11 o'clock. She asks Mr. N. whether he wants her to join the video session because she has noticed that his blood sugar levels have been fluctuating considerably in the recent period. Mr. N. agrees to that. The virtual appointment also serves to discuss other issues, such as the recommendation to exercise to enhance the blood circulation in Mr. N.'s legs. This is why the doctor prescribes physiotherapeutic treatment. Mr. N.'s homework includes gymnastic exercises which can be observed and analysed by specialists in real time. New types of training visualizations derived from classic video analyses including analysis and feedback in real time offer entirely new possibilities. Trainees can check themselves whether they are performing the exercises correctly and are not excessively exhausting their bodies. They also have the option of having their therapist join the video session, either as a discreet observer or as a virtual guest coach. The exercises at home can then be discussed and evaluated during the next therapy session. Like many other people, Mr. N., however, also suffers from another chronic disease which has become rather common these days: pollen allergy. Because he only has a light pollen allergy, it can be managed by a simple feature of his intelligent housekeeping system: Sensors in his flat detect pollen in the air and automatically initiate a closing of the windows if allergic irritants in the air reach a certain maximum value which is predefined by the doctor.

B.7.9 Actors: people, components, systems, integrated systems, applications and organizations

Actor Name (See 5.8)	**Actor Role**	**Actor Description**	**Actor Interactions** (Transactions between Actors)
• Gabriele M.	AAL user	Person (daughter of beneficiary)	
• Konrad N.	Beneficiary, Patient, AAL user	Person with diabetes mellitus and severe circulatory disorders in his legs, early stage dementia	
• Nurse Hildegard	AAL service provider	Person, Nurse	
• Head office of the living quarters is located in a service centre of a senior citizens' welfare provider	AAL service provider	Provides AAL services to residents	
• Television	Devices	System to interact with other actors	
• Camera/ Video Call System	Devices	System to interact with other actors	
• Fall recognition sensors	Devices	Sensors to recognize falls	
• Motion detectors	Devices	Sensors to detect motion	
• Intelligent lighting system	Devices	Intelligent lighting system	
• Housekeeping system	Gateway	Housekeeping system	
• Digital nutritionist	AAL service provider	Advises beneficiaries on individually recommendable or required diets	

B.7.10 Issues: legal contracts, legal regulations, constraints and others (including regional regulations)

Issue – here specific ones	**Impact of Issue on Use Case**	**Reference –** law, standard, others
Legal regulation – right of personality (national)	Camera, motion detection, fall recognition sensors	law
Legal contracts – contract in the care context (national)	Service provider/Service centre	Contract, nursing care insurance
Legal regulation – data security (national)	Transmission of data	law

B.7.11 Referenced standards and/or standardization committees

Relevant Standardization Committees	**Standards to be considered in the Use Case**	**Standard Status**
CLC TC 79 (WG 4)	EN 50134-xx	published
CLC TC 205 (HBES)	EN 50497-xx	published

B.7.12 Relation with other known use cases

Known use case	Source	UC Status
UC 22 UHome (China); UC 29 building integrated notification system (KR)		

B.7.13 General remarks

General Remarks
When the system is in operation all sensors work automatically without any user interface. The television as well as the camera need an input by the User. Here the User interface must be easy to understand and easy to handle. The actors are connected with the cloud, which can connect the service that is required like a connection to the doctor or the input from the sensor to the actor depending on whether the light has to be changed. The used technology depends of course on the business model that is used as well as the situation where the system is set up (new house, existing building, …) The data transmission has to be secure and the data protection has to be considered.

B.7.14 Data security and privacy

Data Security and Privacy
1. Data security 2. Privacy 3. Information security

B.7.15 Conformity aspects (common international assessment methodology/critical requirements) (to be completed by IEC SyC AAL)

Conformity

B.7.16 User requirements and interactions with other actors

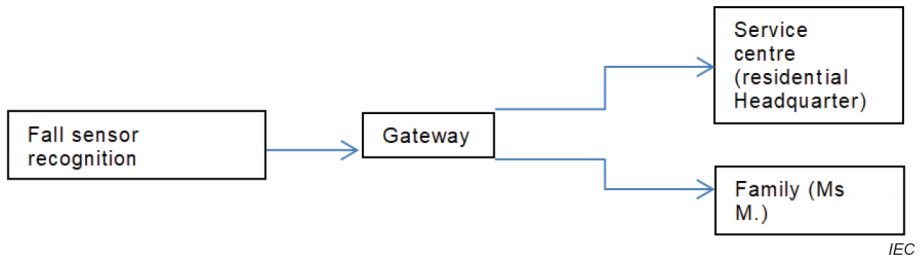
User Requirements and Interactions

B.7.17 Drawings or diagrams depicting the use case

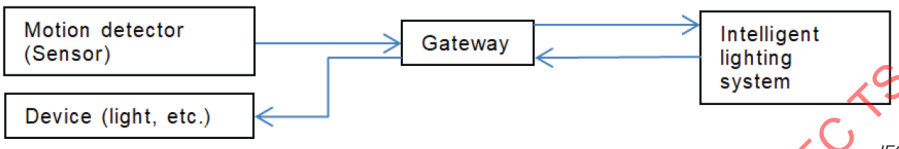
Drawing or Diagram of Use Case – e.g. graphic depiction of use scenarios, and/or "use case diagram" and/or "sequence diagram", ...

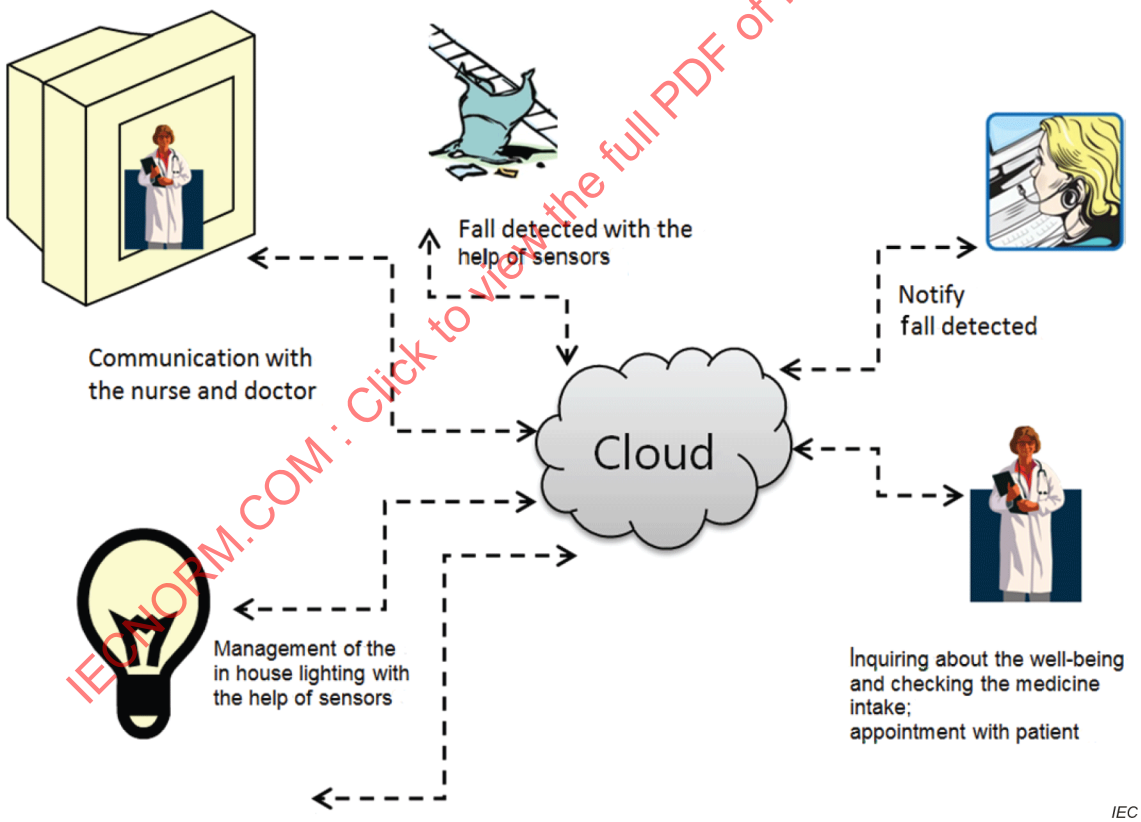
Information flow diagram

Example for Fall detection



Example for contacting the digital nutritionist





B.8 Use case 8 personal trainer

B.8.1 Level of criticality (see 5.3)

Major	Moderate	Minor
		X

B.8.2 Name of use case

ID	Name of Use Case	AAL levels of assistance Level 0: independent Level 1: some assistance Level 2: assistance with IADL Level 3: assistance with ADL See 5.4
08	Personal Trainer	Level 1

B.8.3 AAL function and service layer

AAL Function and Service Layer (=Use Case Categories) See 5.5	Context of use See 5.6
Prevention and management of chronic long-term conditions Health & wellness	Home

B.8.4 AAL system component composition

AAL system components See 5.7	
AAL Devices	Body area sensor
AAL Gateway	Personal health record
AAL (Platform) Backend system	Personal health record
AAL Applications & Services	Activity determination Training/gaming device
AAL & other information systems	Personal health record
Health information systems	Electronic health record

B.8.5 Version management

Changes / Version	Date	Name Author(s) or Committee	Approval Status draft, for comments, for voting, final
Template v. 0.9	20131206	AALJP, Marco Eichelberg, Lars Rölker-Denker (editor)	draft
Template 1.10	20161213		

B.8.6 Basic information to use case

Source(s) / Literature	Link	Conditions (limitations) of Use
AAL-JP Action on Standards and Interoperability – D2	Link	Freely available
Maturity of Use Case – in business operation, realized in demonstration project, realized in R&D, in preparation, visionary		
Visionary		
Generic, Regional or National Relation		
Generic		
View – Technical / Business/…		
Business		
Key medical and alarm condition		
Further Keywords for Classification		
#vital:cardiovascular; #vital:respiratory; #neuromusculoskeletal:muscle; #neuromusculoskeletal:movement; #learning; #general_tasks:daily_routine; #mobility:walking; #self_care:dressing; #self_care:washing; #self_care:looking_after_ones_health; #domestic_life:household_tasks; #life_areas:education; #stakeholder:primary; #stakeholder:secondary:relatives; #stakeholder:secondary:relatives; #stakeholder:secondary:doctors; #purpose:safety:fall_prevention; #purpose:safety:disease_prevention; #purpose:safety:disease_rehabilitation; #key_enabling_technology:mobile_devices; #key_enabling_technology:communication_functions; #key_enabling_technology:telemedicine; #key_enabling_technology:health_information;		

B.8.7 Scope and objectives of use case

Scope and Objectives of Use Case
• Maintain or recover the physical performance of ADLs: amyotrophy, cardiovascular weakness and cardiovascular diseases are big challenges, which lead to fragility and the reduction of physical activities. The system tracks the physical activity of the user and combines it with medical information to create a personalized training plan and to show learning media like video tutorials to the user.

B.8.8 Narrative of use case

Narrative of Use Case
Short description – max. 3 sentences
An older lady becomes more certain and secure in the performance of ADLs with a personalized workout and training programme.
Complete description
Frieda has become a little fragile in recent years. She feels that it is harder to be really active during the day. Many household activities slowly became a big burden for her. Her doctor said that she should continue her activities as long as she can. So, the doctor gave her a little device that she wears on her wrist and that tracks her physical activity. Her doctor also gave her a small box which is connected to her TV. She doesn't know anything about this technical stuff, but her son Hubert installed the box for her. Hubert told her that the box helps her to get help whenever she needs it. The box also shows her videos with little tricks which she can apply to make it simpler to perform household activities and her activities of daily living (e.g. dressing herself). It also suggested special workout training. She already bought herself a bicycle ergometer which she can now use to drive her personal training plan. Also, the box plays some small games with her, which is exhausting but fun. She tried this stuff for a few months and soon she realized that she became fitter and even more secure when she performs her daily activities.

B.8.9 Actors: people, components, systems, integrated systems, applications and organizations

Actor Name (See 5.8)	**Actor Role**	**Actor Description**	**Actor Interactions** (Transactions between Actors)
Frieda	AAL user	Older fragile adult.	
Son: Hubert	Assistive person	Informal carer	
Doctor	Healthcare professional	Doctor	
Body Activity Sensor	AAL Device	Collects sensor data for activity determination purposes	
Activity Determination	AAL Applications & Services	Combines sensor data to determine the activity (e.g. in kilojoules).	
PHR	AAL Gateway; AAL (Platform) Backend system; AAL & other information system	Personal health record (PHR) stores health related information in a non-professional setting and offers the opportunity to share this information with other systems and persons	
EHR	Health information system	Electronic health record (EHR) stores health related information in a professional setting and offers the opportunity to share this information with other systems and persons	
Training / Game Device	AAL Applications & Services	Devices that support the physical training of the user	
Body Area Sensor	AAL Device	Sensor to catch vital parameters during a physical training session.	

B.8.10 Issues: legal contracts, legal regulations, constraints and others (including regional regulations)

Issue – here specific ones	**Impact of Issue on Use Case**	**Reference –** law, standard, others
Informed consent of user required		

B.8.11 Referenced standards and/or standardization committees

Relevant Standardization Committees	**Standards to be considered in the Use Case**	**Standard Status**

B.8.12 Relation with other known use cases

Known use case	**Source**	**UC Status**

B.8.13 General remarks

General Remarks

B.8.14 Data security and privacy

Data Security and Privacy
• The term "personal training device" already implies that the processed data is of a personal nature. However, the recorded activity data is processed on the smartphone of the user. So, the user takes the responsibility to secure the phone when he or she decides to install the activity determination application on his or her device. However, the transmission between the body area activity sensor and the Activity determination has to be encrypted and the device has to use a secure (e.g. PIN-based) pairing mechanism. Data should be stored encrypted and after being processed the raw data should be deleted. The higher aggregated data reflects only the physical activity without the chance to derive other information than these. Nevertheless, the user should be informed about the data processing and has to accept the transmission to the personal health record. • The use of a personal health record and the data exchange between the PHR and the electronic health records is critical, as personal identifiable health information is transferred. The user has to sign an informed consent, when he or she uses the system to exchange data with an EHR. Furthermore, the PHR-system has to provide the possibility for the user to review his or her own health information before it is transmitted and every transmission has to be accepted by him or her, explicitly. The PHR-system has to store the data and time when the user accepted the transmission. Furthermore, the application has to log every activity that is related to health data that is stored in the PHR. The system should inform the user that he or she is responsible for data loss, e.g. due to a hard disc crash. Further data protection mechanisms should be considered depending on national laws. The electronic health record is under the control and protection level of a professional healthcare system and the associated national laws. Data transfer to this system should be secured as well as data storage and access. As well as in the PHR-system, protection from data loss is an important point. • The training/game device should store as little health related information as possible. As training results can be stored in the PHR, the system should be designed to clear the complete memory when a training session is completed, and the training report has been transmitted to the PHR system. The body area sensor should also use a secure pairing mechanism and encrypted data transmission.

B.8.15 Conformity aspects (common international assessment methodology/critical requirements) (to be completed by IEC SyC AAL)

Conformity

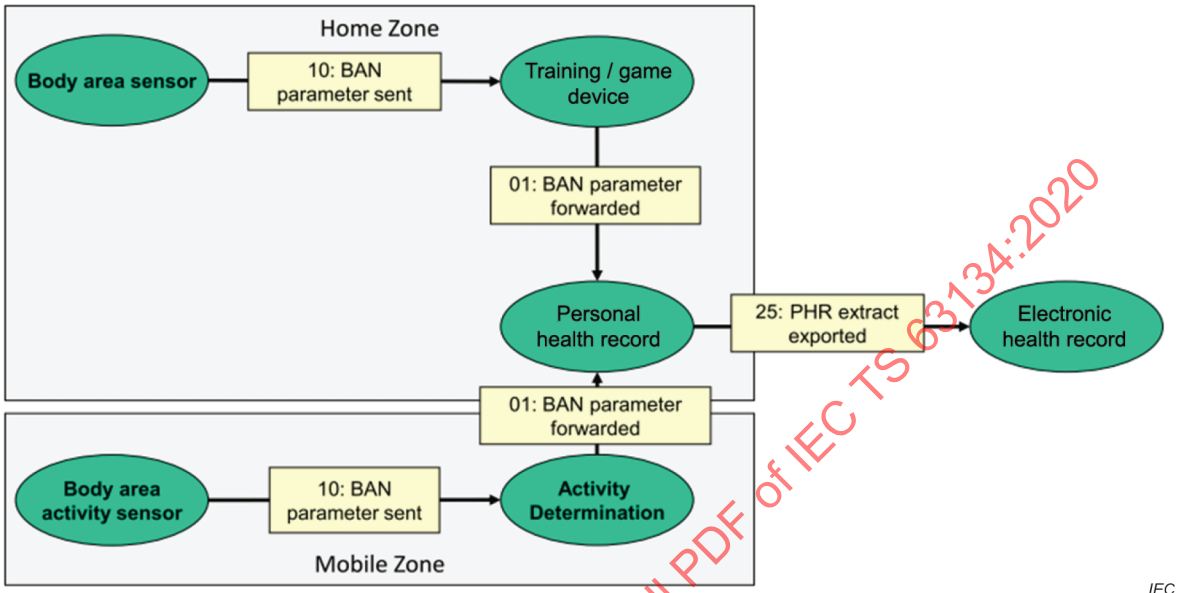
B.8.16 User requirements and interactions with other actors

User Requirements and Interactions

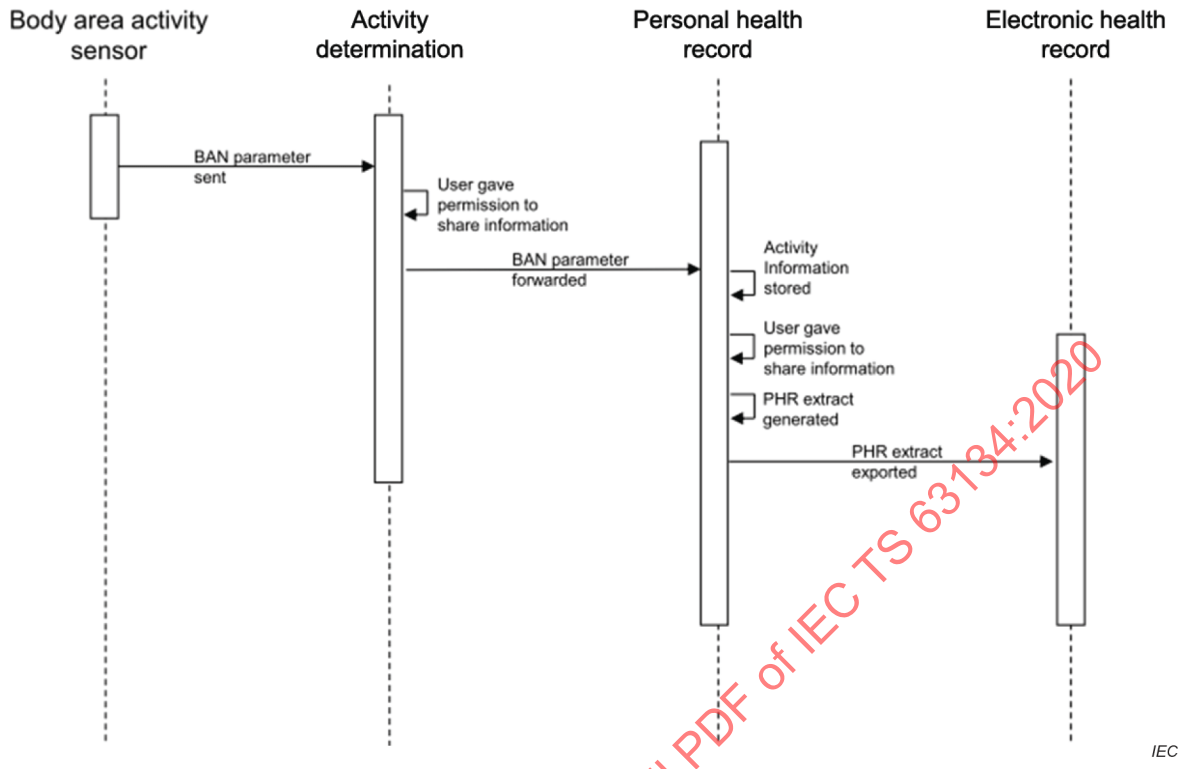
B.8.17 Drawings or diagrams depicting the use case

Drawing or Diagram of Use Case – e.g. graphic depiction of use scenarios, and/or "use case diagram" and/or "sequence diagram", …

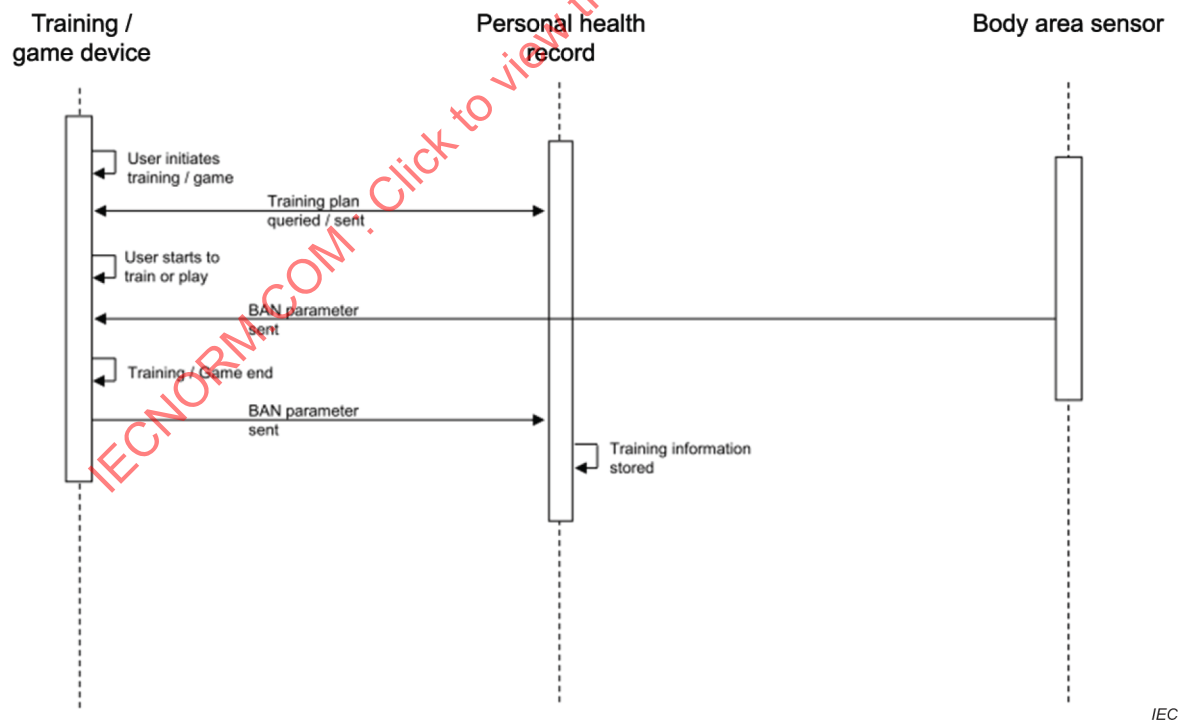
Key actors diagram



High Level Process Flow Diagram(s)



High level process flow – example 1: Recording personal health data, collecting it and sharing with an electronic health record



High level process flow – example 2: Performance of a personalized training session

B.9 Use case 9 behaviour monitoring

B.9.1 Level of criticality (see 5.3)

Major	Moderate	Minor
X		

B.9.2 Name of use case

ID	Name of Use Case	AAL user domains Level 0: independent Level 1: some assistance Level 2: assistance with IADL Level 3: assistance with ADL See 5.4
09	Behaviour Monitoring	Level 1 Level 2

B.9.3 AAL function and service layer

AAL Function and Service Layer (=Use Case Categories) See 5.5	Context of use See 5.6
Prevention and management of chronic long-term conditions (dementia) (Self-)management of daily life activities at home Healthcare and wellness Safety, security and privacy at home	Home Body and personal

B.9.4 AAL system component composition

AAL system components See 5.7	
AAL Devices	Home automation actuator Home automation sensor Smart appliance Optical sensor Indoor localization sensor Body area sensor
AAL Gateway	Home automation gateway BAN gateway
AAL (Platform) Backend system	Behaviour monitor
AAL Applications & Services	Notification receiver
AAL & other information systems	-
Health information systems	-

B.9.5 Version Management

Changes / Version	Date	Name Author(s) or Committee	Approval Status draft, for comments, for voting, final
v.0.9	2013-12-06	AALJP, Marco Eichelberg, Lars Rölker-Denker (editor)	For comments
1.10	20161128		

B.9.6 Basic Information to Use Case

Source(s) / Literature	Link	Conditions (limitations) of Use
AAL-JP Action on Standards and Interoperability – D2	Link	Freely available
Maturity of Use Case – in business operation, realized in demonstration project, realized in R&D, in preparation, visionary		
Visionary		
Generic, Regional or National Relation		
Generic		
View – Technical / Business/…		
Business		
Key medical and alarm condition		
Further Keywords for Classification		
#mental, #purpose:safety:fall_detection, #purpose:safety:disease_detection, #purpose:security, #key_enabling_technology:home_automation, #key_enabling_technology:ambient, #key_enabling_technology:body_area, #key_enabling_technology:vital_parameters, #key_enabling_technology:environmental_parameters, #localization:indoor		

B.9.7 Scope and Objectives of Use Case

Scope and Objectives of Use Case
Daily life support: Dementia or cognitive impairment is a disease that often progresses slowly over many years. In order to maintain as much independence for the patient as possible, while preventing disease-related accidents, behaviour monitoring tries to identify the activities of the user at home, to provide warnings to the user in dangerous situations, or notifications to carers if indications of a progress of the disease are measured that indicate an increased need of support.

B.9.8 Narrative of use case

Narrative of Use Case
Short description – max 3 sentences
An older lady with mild cognitive impairment uses the system, which recognizes dangerous events and changes of behaviour patterns and, depending on the type of event, either notifies the user or calls for help.
Complete description
Jane Miller is an 85-year old lady who still lives independently in her own apartment. Since her husband passed away a few years ago, she lives alone. Her children live some 50 km away, close enough to see her once or twice a week, but not every day. Despite several chronic diseases that require her to take many different drugs three times a day, she is doing relatively well. However, recently she has started to forget things and make mistakes that were unheard of before. The family doctor has diagnosed her with a mild cognitive impairment, i.e. an early form of dementia that may or may not worsen over time. A few months ago she switched on the cooker, forgot about it, and went shopping. The cooker caused a fire in the kitchen that could well have burned down the house – fortunately it was discovered and extinguished quickly, before serious damage could occur. Since then her family is worried that a similar accident could happen, and with her consent had a "behaviour monitoring" system installed in her home. The system consists of several sensors that are mounted on the walls, and a small computer that processes the sensor data. Most of the time the system is silent, but it monitors her activities and notifies her if something that is potentially dangerous happens. Last week she again started cooking, but since the water took rather long to boil, she went to the living room, switched on the TV, and forgot about the kitchen. 15 minutes later the system displayed a message on the TV reminding her of the cooking water. When she opens the front door in order to leave the house, the system reminds her if windows are still open, electrical appliances in the kitchen still switched on, etc. There is also a new switch next to the front door that allows her with one press to bring the house into a "safe" configuration, with everything switched off and electrical lighting reduced to a safe minimum. Should she ever fall at home, and not be able to get up, then the system would automatically notify an emergency call service, which would then first try to call her on the phone, and then send somebody to look after her. The system can be extended with some sensors worn on the body, in which case the fall detection would also work outside, but she prefers not to use this at the moment. Finally, the system recognizes when there are changes in her daily activity patterns that indicate an increased need for support, such as an overall reduction of physical activity, or lack of certain activities of life, such as cooking. In this case a notification would be sent to her daughter, who could then look for appropriate support.

B.9.9 Actors: people, components, systems, integrated systems, applications and organizations

Actor Name (See 5.8)	**Actor Role**	**Actor Description**	**Actor Interactions** (Transactions between Actors)
• Mrs. Smith	**AAL user**	Older adult with mild cognitive impairment	
• Daughter	**AAL user**	Informal carer	
• Emergency Call Centre	**AAL service provider**	Call centre for emergencies at home	
• Behaviour monitoring system	**AAL (Platform) backend system**	The main AAL system described in this scenario	
• Sensors	**AAL devices**	Various sensors: home automation, body area, location, optical, smart appliances	
• Actors	**AAL devices**	Home automation and smart appliances actuators that enable a safe "everything off" setting for the apartment	

B.9.10 Issues: legal contracts, legal regulations, constraints and others (including regional regulations)

Issue – here specific ones	**Impact of Issue on Use Case**	**Reference –** law, standard, others
Informed consent of user required		
Connections to emergency call centres may be affected by national regulations		

B.9.11 Referenced standards and/or standardization committees

Relevant Standardization Committees	**Standards to be considered in the Use Case**	**Standard Status**

B.9.12 Relation with other known use cases

Known use case	**Source**	**UC Status**
AAL Use Case 15 Controlled Information Sharing	Continua/Asim Muhammad	
AAL Use Case 26 Privacy, Data Protection, Information Security related to AAL	Pat Cunniffe, Ulrike Haltrich	
AAL Use Case 27 Information Reliability and Device and Patient Authenticity	Continua/Asim Muhammad	

B.9.13 General remarks

General Remarks
• While this use case defines no requirements concerning the permitted false positive and false negative detection rate of the behaviour monitor, these will certainly be important in practice. In particular, the behaviour monitor must be able to correctly handle situations in which more than one person is present in the apartment, leading to sequences of sensor measurements that may seem "abnormal" otherwise. • Finally, the availability of the communication system over which the behaviour and alarm notification is sent, as well as the availability of the notification received, should be considered. If high-priority messages (such as notifications about emergency situations) are transmitted, then the notification receiver must be able to react 24 hours a day, 7 days a week. • Furthermore, in these cases a redundant communication infrastructure with two independent transports (such as cabled internet and GSM wireless) should be considered, in order to maximize the overall availability of the system.

B.9.14 Data security and privacy

Data Security and Privacy
• Information about activities of daily living, and in particular information from which a possible cognitive impairment of the user can be derived, must be considered as very sensitive personal data. This profile has been designed such that the "raw" data never leaves the behaviour monitor, only notifications do. If the behaviour monitor is located inside the user's home, appropriate measures need to be taken to secure the transmission of the notifications (transaction 02) from unauthorized eavesdropping or tampering. Furthermore, the behaviour monitor as such needs to be protected from unauthorized access, especially from a remote location. • Should an implementor decide to locate the behaviour monitor (or parts thereof, such as the signal data processing algorithms) outside the home environment, e.g. implement them as a cloud resource, then additional data protection requirements arise, as in this case additional personal data would leave the home and be potentially subject to unauthorized eavesdropping or tampering. • A behaviour monitoring system cannot be installed and used without the informed consent of the user, or in the case of users who are unable to give informed consent, their legal guardians. It is furthermore desirable that the user has the ability to turn off the system temporarily (e.g. when visitors are in the home or in situations where the user wants to be unmonitored), and it should be possible for the user to determine whether the system is currently in "activated" or "deactivated" status.

B.9.15 Conformity aspects (common international assessment methodology/critical requirements) (to be completed by IEC SyC AAL)

Conformity

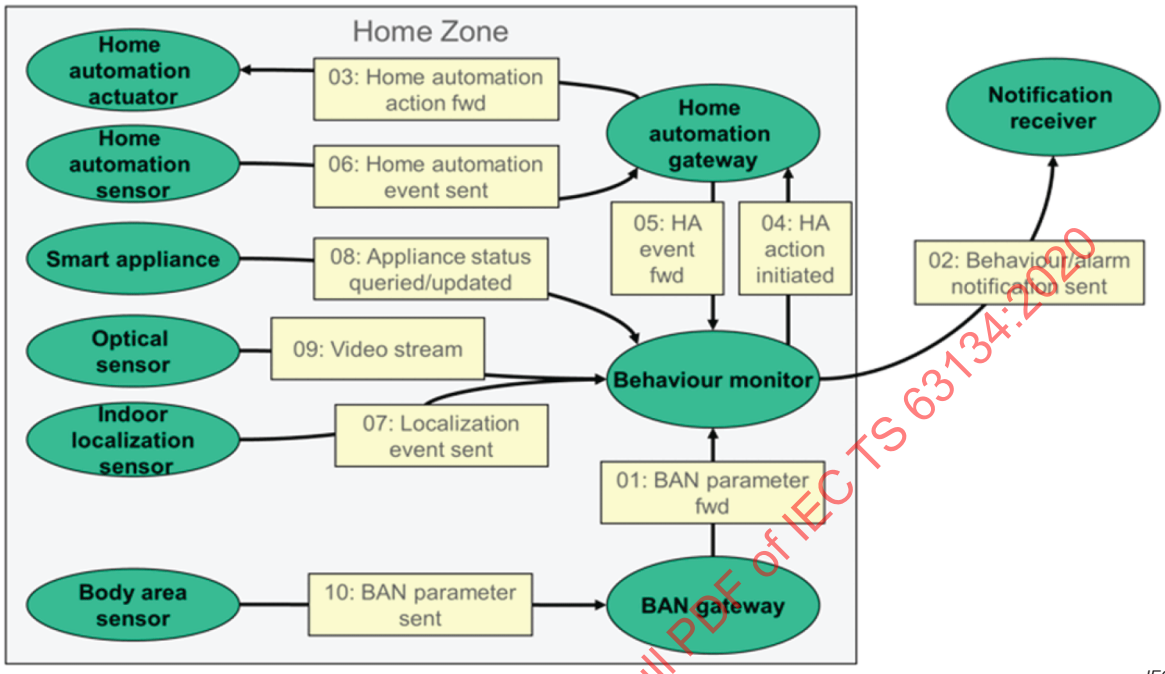
B.9.16 User requirements and interactions with other actors

User Requirements and Interactions
• Ability to turn off/deactivate system in case of visitors. • Ability to turn off/deactivate system in case of privacy wish. • UI to report status of monitoring system: is it activated or not? • Communication channel between service provider and inhabitant in case of emergency.

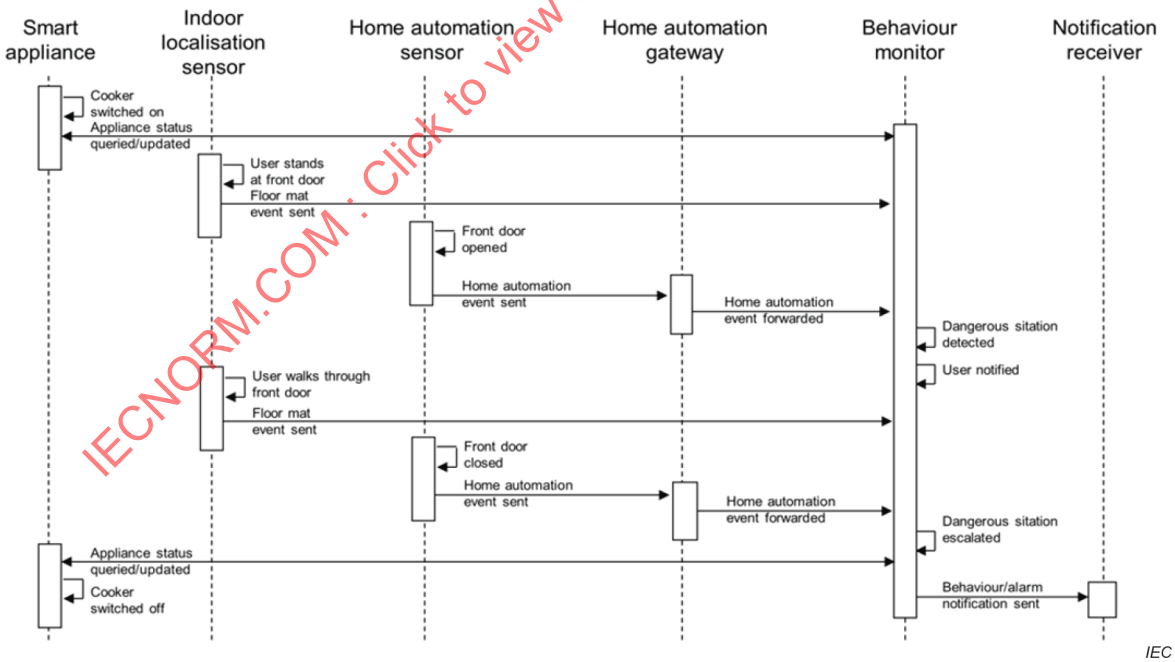
B.9.17 Drawings or diagrams depicting the use case

Drawing or Diagram of Use Case – e.g. graphic depiction of use scenarios, and/or "use case diagram" and/or "sequence diagram", ...

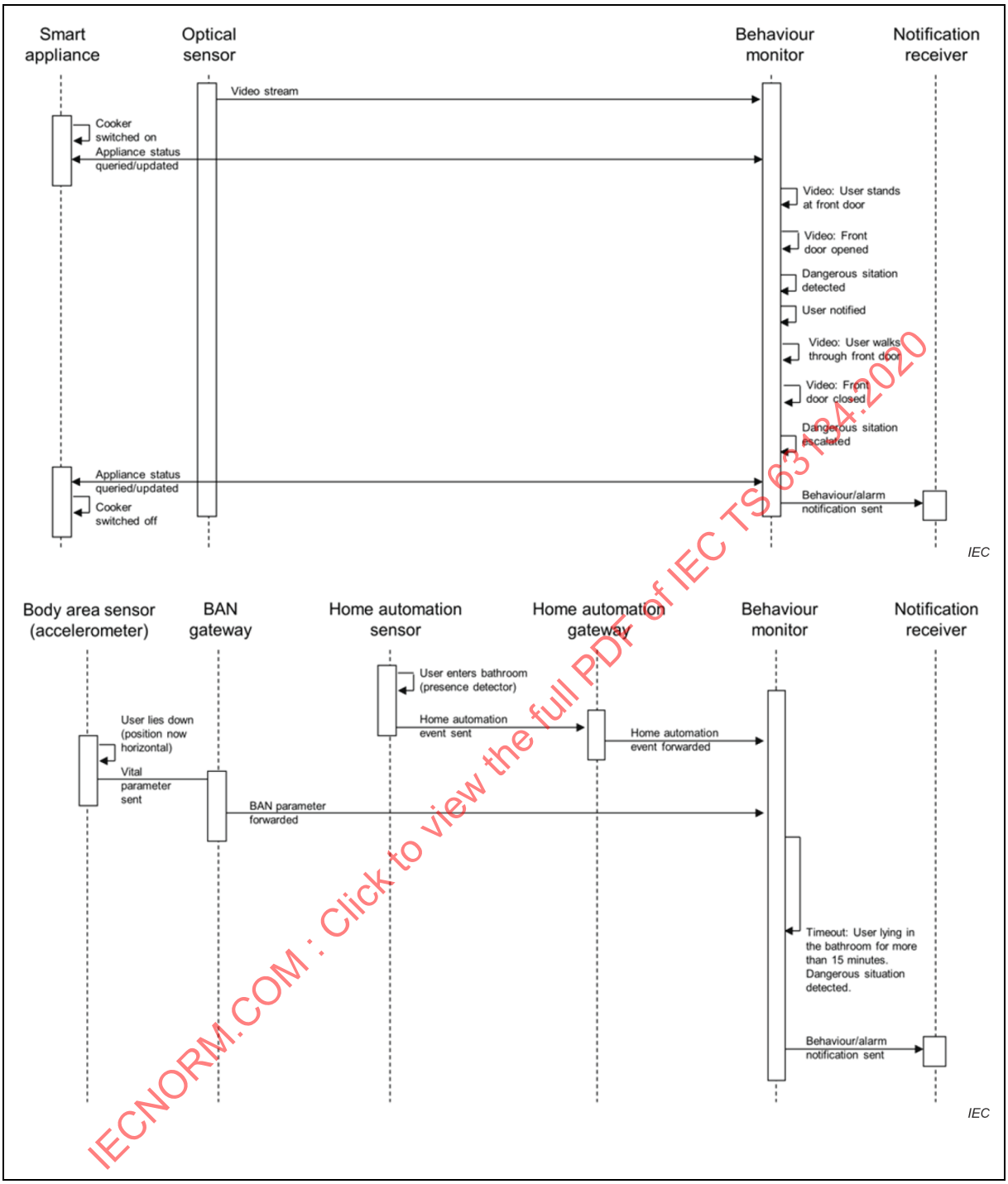
Key Actors Diagram



High Level Process Flow Diagram



High level process flow – example 1: dangerous situation detected using home automation sensors



B.10 Use case 10 shopping and nutrition planner

B.10.1 Level of criticality (see 5.3)

Major	Moderate	Minor
		X

B.10.2 Name of Use Case

ID	Name of Use Case	AAL Levels of assistance Level 0: independent Level 1: some assistance Level 2: assistance with IADL Level 3: assistance with ADL See 5.4
10	Shopping and Nutrition Planner	Level 1 Automatic/user monitored

B.10.3 AAL function and service layer

AAL Function and Service Layer (=Use Case Categories) See 5.5	Context of use See 5.6
(Self-)management of daily life activities at home	Home

B.10.4 AAL system component composition

AAL system components See 5.7	
AAL devices	Home automation sensor Storage system
AAL gateway	Home automation gateway
AAL (platform) backend system	Shopping and nutrition planner
AAL applications & services	Shopping assistant Delivery service
AAL & other information systems	Shopping and nutrition planner
Health information systems	-

B.10.5 Version management

Changes / Version	Date	Name Author(s) or Committee	Approval Status draft, for comments, for voting, final
0.9	2013-12-06	AALJP, Marco Eichelberg, Lars Rölker-Denker (editor)	draft
1.10	2016-12-27		

B.10.6 Basic information to use case

Source(s) / Literature	Link	Conditions (limitations) of Use
AAL-JP Action on Standards and Interoperability – D2	Link	Freely available
Maturity of Use Case – in business operation, realized in demonstration project, realized in R&D, in preparation, visionary		
Visionary		
Generic, Regional or National Relation		
Generic		
View – Technical / Business/…		
Technical		
Key medical and alarm condition		
Further Keywords for Classification		
#domestic_life:shopping, #key_enabling_technology:home_automation, #key_enabling_technology:mobile_devices		

B.10.7 Scope and objectives of use case

Scope and Objectives of Use Case
Shopping is one of the activities where the transformation of the industrialized countries into "self-service societies" can be felt most. Supermarkets with relatively small staff and little human support for older customers are the norm, not the exception, today. However, the ability to purchase one's goods for daily living is an important aspect of participation and independence for older adults, and, furthermore, a typical outdoor activity that is important to keep people active and mobile. Malnutrition and dehydration are frequent problems in older adults, so any assistive system for shopping purposes should also be able to support and advise the user to buy food adapted to the user's personal health situation. Finally, not all goods may be available in shops sufficiently close for a walk, and some goods (e.g. drinks) may be too heavy. Therefore, shopping service with door-to-door delivery should also be supported. The Shopping and Nutrition Planner is an assistive system for nutrition planning and shopping. Both "home shopping" with door-to-door delivery and the assembly of a shopping list for conventional shopping are supported. The system furthermore supports connections with storage systems that can automatically report low stock of certain goods ("intelligent fridge"), and it can be connected with a home automation infrastructure to enable reminders if the user has assembled a shopping list but forgotten to actually go shopping.

B.10.8 Narrative of use case

Narrative of Use Case
Short description – max 3 sentences
An older adult uses an assistive system comprised of a shopping planner, online ordering, and a mobile shopping assistant for conventional shopping.
Complete description
Michael is 72 years old, lives on his own and suffers from mild cognitive impairment (MCI). Due to MCI he often has problems with healthy nutrition and related shopping tasks. A few weeks ago his son Klaus installed the new shopping assistant on Michael's smart TV and mobile phone. The shopping assistant can be used for home shopping as well as for the assistance of normal shopping. There are also some upgrades available, one is on malnutrition and one with reminder functions. Michael is able to plan his shopping trip with the smart TV sitting on the couch or with his smartphone at any place. The shopping assistant recommends more fruits for Michael and puts some apples and bananas on his shopping list. The system also knows that the stock of sparkling water is running out. As Michael is not able to carry heavy beverage crates anymore, the system sends an automated order to the next beverage store. As Michael is not leaving his home (a door contact is monitoring the front door) the shopping assistant reminds him about his shopping trip. Michael leaves his home and the shopping assistant is on standby to navigate if Michael leaves his normal route for a long period of time. In case of bad weather or feeling discomfort, Michael can use the home shopping application from his living room. The home shopping application includes several regional providers of food, clothes and other articles of daily use. Michael places his order in the system and, depending on time of the day, within 6 hours the items are delivered.

B.10.9 Actors: people, components, systems, integrated systems, applications and organizations

Actor Name (See 5.8)	**Actor Role**	**Actor Description**	**Actor Interactions** (Transactions between Actors)
Michael	AAL user	Older adult with mild cognitive impairment	
Klaus	Assistive person	Informal carer	
Beverage store	AAL service provider	Delivery service accepting online orders	
Shopping assistant	Gateway	The main AAL system described in this scenario	
Smart TV	Device	Runtime platform for the planning component of the shopping assistant	
Smartphone	Device	Runtime platform for the mobile component (navigation and electronic shopping list) of the shopping assistant	
Door contact	Device	Home automation sensor	

B.10.10 Issues: legal contracts, legal regulations, constraints and others (including regional regulations)

Issue – here specific ones	**Impact of Issue on Use Case**	**Reference –** law, standard, others
Connections to emergency call centres may be affected by national regulations		

B.10.11 Referenced standards and/or standardization committees

Relevant Standardization Committees	Standards to be considered in the Use Case	Standard Status

B.10.12 Relation with other known use cases

Known use case	Source	UC Status

B.10.13 General remarks

General Remarks

B.10.14 Data security and privacy

Data Security and Privacy
Since the transaction "Shopping order sent" will cause a legally binding contract to be closed between the user and the online shop, this transaction needs to be protected from inadvertent activation due to user error or software errors. Furthermore, a means of cancelling orders (if need be by means of human communications) should be established. As recommendations concerning healthy nutrition may have an influence on the health status of the user, the set of facts and rules used by the shopping and nutrition planner should follow the state of the art in nutritional science and should be updated from time to time to follow current knowledge.

B.10.15 Conformity aspects (common international assessment methodology/critical requirements) (to be completed by IEC SyC AAL)

Conformity

B.10.16 User requirements and interactions with other actors

User Requirements and Interactions