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Technical requirements (B)

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V 01	15.10.2013	Bia/HSL	First version (structure)
V02	13.11.2013	Bia/HSL	First definitions of requirements
V03	07.01.2014	Bia/HSL	Update of requirements
V04	25.04.2014	Bia/HSL	Update of requirements, change of template
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Relaxed Care Consortium

RelaxedCare (AAL 2012-5-199.) is a project within the AAL Joint Programme Call 5. The consortium members are:

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Table of Contents

Abbreviations and web-links

Abbrev.	Description
AP	
APP	
HOMER	HOMe Event Recognition system, an OSGi-based software platform
IC	End-user, informal caregiver
NFC	near field communication
Product backlog	https://dev.arcsmed.at/trac/relaxedcare/backlog/Product%20Backlog
PIR	passive infrared sensor
PT	Prototype
PT1	Prototype 1 (result of 1st iteration of project)
PT2	Prototype 2 (result of 2nd iteration of project)
RC	RelaxedCare
TCP	Transmission control protocol
UI	User interface

Executive Summary

The technical system requirements are derived from the RC-system product backlog. Based on this backlog, the use-cases were developed (D2.5A), and the technical requirements presented here.

It should be emphasised that the technical requirements originated in the early phase of the project, but have been updated regularly. This is especially evident when comparing it with D2.5A, which contains system concepts and designs, which are considered obsolete, now. For the purpose of documentation, those concepts and designs remained in D2.5A, but were removed from this document.

The technical system requirements were deduced in two steps. In the first step the scenarios, epics and user-stories given in the product backlog were translated, divided or joint and reordered to provide a system overview from a slightly more technical perspective (see chapter 2). From there, the functional and non-functional technical system requirements were derived, which are given in chapters 3 and 4 respectively.

D2.4B is based on D2.4A with some changes based on findings from APs and ICs interviews, technical changes during project lifeline and pilot trials and reviewed from end-of-project time perspective. Based on collected feedback we minimized a functionality and focused a prototype to real-user needs.

1 About this Document

1.1 Role of the deliverable

Although the technical requirements represent a key document, it shall not be seen as the only truth. Instead it shall be perceived as a complementary document, extending other documents and linking all the other specification documents from within the project.

As agreed within the consortium, an agile approach is to be utilized to achieve the planned results in the project. Therefore, this document can be subject to changes in the future.

1.2 Purpose

The main purpose of this technical system requirements document is to establish the basis for the agreement between all partners of the consortium on the functionality of the RelaxedCare system. This ensures the members of the consortium to work collectively on the same product focus their efforts and improve their efficiency in collaboration.

1.3 Product Perspective & Functions

"Is my mum doing fine just at this moment?" Answering this question, in a quick comprehensible way without the need of calling or passing by could relieve a lot of stress from informal caregivers. The "RelaxedCare System" aims to build a solution upon an existing AAL platform that uses a multi-level pattern recognition approach to detect the actual state of an assisted person and communicates it in a pervasive and unobtrusive way (i.e. lava lamp, smartphone widget), to the caregiver. User organisations, researchers, designers and companies work closely together to create a highly accepted, well-designed, working and market-orientated "AAL-System in a Box" fo

For deeper understanding of the technical system, the most current system architecture can be found at the RC wiki at https://dev.arcsmed.at/trac/relaxedcare/wiki/req_wp3f100.

1.4 Relationship to other Relaxed Care deliverables

Through-out the RelaxedCare project workflow, there are the following work-packages, which include more particular specifications:

WP3 (Platform and Service Development)

WP4 (Behaviour Pattern recognition Modules)

WP5 (Pervasive in-/output Modalities)

WP7 (Lab and Field Trials)

It is not the task of this document to be a substitute of the specifications in the above mentioned work-packages. The technical system requirements have to be understood as a roof above all the other specifications. A borderline case are the technical requirements defined in https://dev.arcsmed.at/trac/relaxedcare/wiki/RelaxedCareSpecification/SoftwareHardwareRequirements, which represent concise definitions on hard- and software that are difficult to distinguish from top level specifications.

The deliverable is related to the following Relaxed Care deliverables:

Deliv:	***Relation***
D2.5A	RelaxedCare use cases and scenarios
D3.2A	Specification of platform use and further developments
D4.2A	Specification of behaviour pattern recognition models A

D5.4A Specification of new user interfaces

2 The product backlog: Scenarios, user-stories, epics

In style of the SCRUM project management principles, the end-user input mined in previous tasks (mainly Task2.2 – End-user requirements) was translated in scenarios, user-stories and epics. To make this collection manageable, they were put in the SCRUM product backlog. To allow all consortium partners access and process the same product backlog, they were entered in an online platform (https://dev.arcsmed.at/trac/relaxedcare/backlog/Product%20Backlog). Deliverable D2.5A and this document are based on the product backlog.[1]

Deriving the system requirements is done in several steps. In the first step, as discussed in this chapter, the entries from the backlog are ordered thematically. Additionally, the scenarios/user-stories/epics are translated into a formulation suitable for technical abstraction - where appropriate. The result is presented in Table 1.

Table 1: First translation of the backlog to derive the technical requirements in another, proceeding step.

Module	Content of scenario/user-story/epic	Product backlog ID	Prio PT1	Prio PT2
RC system	The RC system provides the information on activity (social contacts, physical activity, aspects of life) in a way that changes from the usual patterns can be recognised.	#38	M	H
	The RC system is able to display the activity level changes occurred during a day.	#37	M	H
	The user interested (IC) in physical activity, social contacts and aspects of life and trends/history thereof, can chose whether the representation is in absolute numbers, image or chart representation.	#44	L	H
	The user interested (IC) in physical activity, social contacts and aspects of life and in trends/history thereof, can get the information via web or smartphone.	#43	H	H
	It is possible to compare the overall statuses (and sublevels) over time	#29	H	H
	It must be possible to connect motion detectors (PIR sensors) with the RC system.	#183	H	H
	The RC system is able to cope with a maximum rate of events / second (tbd.).	#183	L	H
	The RC system stores all events in a database.	#183, #164	H	H
	The system can provide the history of single aspects (i.e. physical activity, social contacts, and aspects of life).	#45	M	H
	During the development phase, a logger will be available to simplify debugging.	#184	H	H
Object	The object must be able to output 3 different colours.	#21, #26	H	H
	The object must be able to receive, process and react to commands from a server.	#21, #120, #182	H	H

[1] Hence the IDs given in Table 1 are the same across D2.5, D2.4 and the product backlog.

	There are commands addressed to the object, to change and switch on/off the light.	#120, #178, #182	H	H
	The object can retrieve default colours for defined states.	#21, #181, #182	H	H
	Small devices (“action tiles”) can be brought in vicinity of object, to initiate a type of communication. Possible actions are comprised on communication level: - send message from object to other object or a smartphone - confirm message - decline message - timeout - not received (“grey zone status”)	#13, #15, #14, #17, #16, #11	H	H
	The content of communication comprises the messages: - request help - different requests (e.g. shopping)	#15, #10, #14, #13	H	H
App	App is able to display overall status. Different statuses can be shown in different colours.	#21, #27, #121, #179, #182, #36	H	H
	The output of the overall status is done in at least 2 different ways.	#21, #27, #121	M	H
	App is able to receive overall status message from server and act accordingly (change of overall status, switch overall status on/off).	#121, #179, #182, #36	H	H
	The application must be able to display details (i.e. not only overall status, but also more information on social interaction, physical activity, aspects of life)	#23, #39	M	H
Picture-frame *Deprecated, changed with a Cube	The overall status should be visible on a Cube	#21	L	L
	The picture displaying the overall status must be easy comprehensible	#21, #28	L	L
	The Cube displays different activities by different colours	#23, #35, #39		L
	The Cube is controlled by NFC tags	#25	L	L
	Messages can be shown on the Cube with different colours.	#25	L	L
	There are several NFC tags available (happy smiley, frowny face, heart image, etc.) to send to the remote Cube or smartphone app for means of expressing one’s mood.	#46	L	L

Server	A server is needed, which controls all the slave devices in the system.	#118, #21	H	H
	Simulator to set overall status, and further features via a GUI.	#118	H	H
	GUI can be used to create from various inputs (NumberOfCalls and contact sensor events) a new variable for use in new pattern recognition.	#165	L	H
Fall detection connector	3rd party fall detection systems can be connected to RelaxedCare system in a way, that alarms of the fall detection can be handled by RelaxedCare.	#18, #19	L	L
	The RelaxedCare system can combine the input of 3rd party fall detection with intrinsic values.	#18	L	L
	The RelaxedCare system provides a way for indicating that the fall detection generated a false alarm.	#20	L	L
	The RelaxedCare system sends a “everything is fine” message, when the fall resulted in no harm for the user, and the user does not forbid this information to be sent.	#18	L	L
Social interaction monitoring	The overall status shown by the RC system (object/app) considers also the social contacts of the AP. The system provides also an overall status for social contacts of AP	#22, #33	H	H
	The RC system detects when and for how long the AP is talking to friends and family on the mobile phone. This information is stored on a database and accessible from the server.	#31, #164	L	H
	The RC system can save information about the phone call in a database. Furthermore, a notification is sent to a developer,	#164	L	M
	The RC system detects, whether there are visitors at the AP’s place.	#32	M	H
	The RC system detects, how often and how long AP leaves his place. Measured are average values only when the time spent outside is greater than 10 minutes.	#30, #82, #83	L	H
	The RC system provides the possibility to show how often AP left the building in the last 2 days.	#81	L	H
	User is able to configure, who can get the information on user leaving building.	#86	L	H

Physical activity monitoring	The RC system measures physical activity of the user (AP), processes the information and utilises the information for deriving the overall status. Additionally, the processed activity information can be output to the information via app (or object).	#23, #34, #36, #39	L	H
	The RC system utilises an activity wrist watch (smart bracelet, e-textile, Jawbone, nymi smart bracelet,…) with emergency button.	#23	L	H
	The RC system measures how “quick and active” the user is during the day, and if the user gets up in the morning.	#23	L	H
	Sensors in the environment should be utilised, for the user (AP) does not want to wear any devices.	#41	L	H
Aspects of life	The system can provide information on different aspects (routinely performed activities, leisure time activities, work, social integration, health).	#24	L	H
Privacy	The user (AP) can select which information is seen in the output devices (app and object).	#40	L	H
	User is able to configure, who can get the information on user leaving building.	#86	L	H
	A user can only gain access to information on activities (social contacts, physical activities, aspects of life) in form a summary.	#24	L	H
	The assisted user (AP) has to agree and accept that certain others get summarised information (social contacts, physical activity, aspects of life).	#24	L	H
	The assisted user (AP) has the option to decide what information the others (IC) can get insights on.	#42	L	H

Description: The column “Module” contains the title for the thematically collection given in the column “Content of scenario/user-story/epic”. The column “Product Backlog ID” lists the IDs utilised in the product backlog (https://dev.arcsmed.at/trac/relaxedcare/backlog/Product%20Backlog). “Prio PT1” and “Prio PT2” represent the priorities of the scenario/user-story/epic content for prototype 1 and 2 respectively, with L/M/H meaning low, middle and high.

3 Technical Functional Requirements

3.1 Introduction

In the following the technical system requirements are based on the information given in Table 1. Contradictions between the entries of Table 1 are resolved in a way to preserve as much of the basic idea of each item. Further technical requirements were added, when the technical need was foreseeable but not to find in Table 1.

3.2 Core system: Server / Workstation

3.2.1 UC Sensor-node workstation

Use-Case	
Primary actor	Sensors, workstation, related to #38, #118, #21, #22, #33
Normal flow:	All sensors attributed to one user (e.g. AP or IC) send their data to the sensor-node called “workstation.”
Alternative flow:	Sensors can connect through a dedicated gateway to the workstation (e.g. mobile phone).
Postconditions:	All sensor data attributed to one user are accessible only via the workstation.

3.2.2 UC All sensor events in database

Use-Case	
Primary actor	Workstation
Normal flow:	Each event generated by a sensor and sent to the workstation is saved in a database and after sending deleted originator
Alternative flow:	If no space is left on device the oldest data is overwritten.
Postconditions:	A database is available, which contains sensor events. One data record of an event contains at least type of sensor, sensor value and timestamp.

3.2.3 UC Database processing

Use-Case	
Primary actor	Workstation / related to #38
Normal flow:	The workstation accesses and processes the sensor-event-database by application of algorithms. The algorithms are modular and executed locally on the workstation.
Alternative flow:	-
Postconditions:	As result of the internal processing a statement on whether pattern changes have taken place is used for deriving the information to be displayed by GUIs.

3.2.4 UC Algorithms as modules

Use-Case	
Primary actor	Workstation / Cloud
Normal flow:	Algorithms to be executed by the workstation can be downloaded from the cloud server before execution.
Alternative flow:	-
Postconditions:	Updates of algorithms are obtainable.

3.2.5 UC Status over time

Use-Case	
Primary actor	Workstation, webinterface, smartphone / related to #43, #29, #45, #33, #22, #23, #24, #34, #36, #39
Normal flow:	The results of the pattern recognition algorithms for each day, concerning the overall status, physical activity, social contacts and aspects of life (i.e. routinely performed activities, leisure time activities, work, health), are stored on the workstation. This allows connected UI devices to output trends / history of statuses.
Alternative flow:	
Postconditions:	Webinterfaces and smartphones connected to the workstation can retrieve this data in order to display it.

3.2.6 UC Information about last 2 days

Use-Case	
Primary actor	Workstation, webinterface, smartphone / related to #43, #29, #45, #33, #22, #81

Normal flow:	Summarized information on the following events is stored in the database and provided by the workstation to the cloud server in order to allow connected UI devices to output them. The events are: - Number of AP having left home By providing the information (e.g. number of times leaving home) over the period of the past 2 days (and not the notification every time the AP leaves the house), the IC shall not be able to have complete surveillance on the AP. Each day, the IC receives once such summarized information (instead of single events).
Alternative flow:	
Postconditions:	Webinterfaces and smartphones connected to the workstation can retrieve this data averaged over 2 days in order to display it.

3.2.7 UC Workstation controls UIs

Use-Case	
Primary actor	Workstation, object, Smart-phone, webinterface / related to #118, #21, #22, #33
Normal flow:	An RC-UI-device connects to the workstation. Afterwards the workstation is able to control the output of the UI-device.
Alternative flow:	A smartphone connects through the RC-cloud service and obtains information on what to display.
Postconditions:	Regardless of the output modality the UI-device is able to utilize, after connection to the workstation, it controls the output of the UI.

3.2.8 UC Cloud server

Use-Case	
Primary actor	Cloud
Normal flow:	Data exchange between the workstations of AP and IC is established and performed via a cloud server.
Alternative flow:	With smart-phones there is the option to connect to the cloud server directly.
Postconditions:	Workstations can connect to their cloud server to obtain various services.

3.2.9 UC Cloud server system-wide preferences

Use-Case	
Primary actor	Cloud, workstation, smartphone / related to #21, #181, #182
Normal flow:	System-wide preferences are stored on the cloud-server. The cloud-server offers the preferences for download by workstations. The system-wide distribution to UI-objects is conducted via the workstation.
Alternative flow:	Smartphones, which connect directly to the cloud-server of one RC system can retrieve the system-wide preferences without having to connect to a workstation.
Postconditions:	A device connected to the RC system is able to retrieve the system-wide preferences.

3.2.10 UC Workstation: currency of system-wide preferences

Use-Case	
Primary actor	Cloud, workstation / related to #21, #181, #182
Normal flow:	The workstation checks, whether connected devices need initial or refreshed system-wide preferences.

Alternative flow:	
Postconditions:	All devices connected to the workstation receive a request for updating their preferences, when new settings (applicable to the type of device connected) are available.

3.2.11 UC Motion detector connectivity

Use-Case	
Primary actor	Workstation, sensors / related to #183, #23, #34, #36, #39
Normal flow:	PIR based motion detectors are connected via a gateway to the workstation.
Alternative flow:	
Postconditions:	The workstation receives data from the motion detectors (installed in the living space of the user) for further processing.

3.2.12 UC workstation performance

Use-Case	
Primary actor	Workstation / related to #183
Normal flow:	The workstation performs several tasks quasi parallel (sensor readout, data storage and analysis, control of Uis, communication with cloud). In the specification, the computational power of the workstation has to be selected accordingly. Therefore a maximum rate of events / second has to be defined in the specification.
Alternative flow:	
Postconditions:	Regardless of the tasks the workstation is processing, it does not miss any sensor events.

3.2.13 UC Workstation data logger for development

Use-Case	
Primary actor	Workstation, developers / related to #184
Normal flow:	Developers can access log-files of the workstation to increase efficiency of debugging. The log-files can contain sensor data and software outputs.
Alternative flow:	
Postconditions:	In case of a software related error, developers can download log-files for the purpose of debugging. Privacy issues need to be addressed.

3.2.14 UC Workstation data logger notifications

Use-Case	
Primary actor	Workstation, developers / related to #184, #164
Normal flow:	A developer configures in a conf-file for what events he wants to receive notifications, containing event-type and time stamp. The notifications are available only on the workstation.
Alternative flow:	
Postconditions:	After an event occurred the developer receives a notification. Privacy issues need to be addressed.

3.2.15 UC Workstation data logger lifetime

Use-Case	
Primary actor	Workstation, developers / related to #184
Normal flow:	Data logging (other than storage of sensor events and results of the analysis of the statuses) can be disabled by developers.
Alternative flow:	
Postconditions:	After logging has been disabled, no log-files can be accessed and no log-files are generated.

3.2.16 UC Simulator

Use-Case	
Primary actor	Sensors, Uis, workstation, cloud server, developer / related to #118
Normal flow:	Devices (esp. sensors, Uis) that are to be connected with the workstation (esp. via TCP/IP) are connected to a PC running a workstation simulator. For the devices, the simulator behaves as a workstation. This allows a developer to read and analyse the communication between device(s) and simulate-workstation. Furthermore, the developer can inject commands, which are sent from the workstation to the device(s).
Alternative flow:	
Postconditions:	The developer can set the overall status display of a device via the simulator.

3.2.17 UC Event generator

Use-Case	
Primary actor	Uis, workstation, developer / related to #165

Normal flow:	The developer uses a software tool that allows him to generate a history of sham events and overall statuses over time. As a consequence, Uis capable of displaying a history of overall statuses and events are initialised and their output shows something.
Alternative flow:	
Postconditions:	For demonstrations, a newly installed smartphone app can be primed with events.

3.2.18 UC Connecting fall detection system

Use-Case	
Primary actor	User, workstation, fall detection / related to #18, #19
Normal flow:	The user connects a 3rd party fall detection device, approved for utilisation with RC to the RC system. The RC system has appropriate drivers that support the handling of this fall detection system. The RC system recognizes the fall detection and includes.
Alternative flow:	
Postconditions:	The RC system is aware of the state (e.g. alarm) of the fall detection.

3.2.19 UC Connecting false alarm of fall detection

Use-Case	
Primary actor	workstation, fall detection, user / related to #18, #19, #20
Normal flow:	The workstation is prepared to handle false alarms of a RC approved fall detection system. This means, the RC system does not only output an alarm, but also provides an UI to inform the system that the current state of the fall detection is a false alarm.
Alternative flow:	
Postconditions:	The user is able to change an alarm to a false alarm without the need of interacting with the 3rd party fall detection system.

3.3 Sensors

3.3.1 UC Motion detectors

Use-Case	
Primary actor	Workstation, sensors / related to #183, #23, #34, #36, #39, 4.1.1

Normal flow:	PIR based motion detectors are installed in the home of the AP and are connected to the workstation. Their event-signals serve as an input for the behavioural pattern recognition algorithm.
Alternative flow:	
Postconditions:	Movement of the AP in his home can be detected.

3.3.2 UC Mobile phone call duration

Use-Case	
Primary actor	User, smart-phone / related to #31, #164
Normal flow:	The user speaks on his mobile with a friend or with family. The duration of the call is determined by the RC system. This information is treated by the RC system equal to all other events.
Alternative flow:	
Postconditions:	The RC system finds the duration of the calls in the database on the workstation.

3.3.3 UC Detection of present persons

Use-Case	
Primary actor	User, visitor, sensors / related to #31, #164, #32, #30, #82, #83
Normal flow:	The user lives alone. When there are further persons in the living space of the user, the RC system is able to detect the number, stay-duration and time of the visit. This information is treated equal to other sensor signals (storage, analysis).
Alternative flow:	The sensors detect when and for how long the user leaves the house (i.e. no person present in the living space). Durations shorter than 10 minutes are ignored.
Postconditions:	The number of visitors and the time of visit as well as the duration of their stay are in the RC database on the workstation.

3.3.4 UC Activity tracker

Use-Case	
Primary actor	Workstation, user, sensors / related to #23
Normal flow:	The workstation receives activity data with time stamps from an activity tracker (e.g. activity wrist band, activity wrist watch, smart bracelet, e-textile, Jawbone, nymi smart bracelet, smart phone …) worn by the user. Data from the activity tracker is uploaded daily to the database.

Alternative flow:	The activity tracker is streaming data to the workstation (e.g. via smart phone) where the data is stored in a local database. When the emergency button of the activity tracker is pressed, an alarm message is sent to the workstation (or to the cloud server if tracker is used outdoors). The workstation / clod server informs the connected IC(s) about the alarm.
Postconditions:	The user has worn his activity tracker all day and its data is uploaded to the workstation automatically when the tracker is being recharged.

3.3.5 UC Contact sensors

Use-Case	
Primary actor	Sensors, algorithm / related to #23
Normal flow:	Among others input events, the behavioural pattern recognition algorithm resorts to signals from contact sensors. The contact sensors are installed mainly at doors (refrigerator, rest-room, entrance, etc.).
Alternative flow:	
Postconditions:	The algorithm can use the signals to recognize routinely performed activities of the user (e.g. as part of the “aspects of life”), and for activity recognition in general.

3.3.6 UC Detection of user getting up

Use-Case	
Primary actor	Workstation, user, sensors / related to #23
Normal flow:	The workstation receives a signal each time the AP gets up from his bed. This signal including a time stamp is stored in the local database of the workstation. This event can be used in the behavioural pattern recognition analysis.
Alternative flow:	
Postconditions:	An event was generated and sent to the workstation when the user left his bed.

3.4 Administration interfaces

3.4.1 UC Admin GUI

Use-Case	
Primary actor	user, webinterface / related to #118, #165, #18, #81
Normal flow:	The user uses a webinterface for 1) The basic configuration and installation of the RC system. 2) Displaying the history/trends of events (overall status, physical activity, social contacts, aspects of life and how often the user left the house within the last 2 days (in average)) in various ways. 3) To define new variables from various inputs (e.g. NumberOfCalls, NumberOf SMSs and contact sensor events, or 3rd party fall detection information) for utilisation by pattern recognition.
Alternative flow:	
Postconditions:	The user has configured his RC system via the admin webinterface, and all the information available to the Uis is also accessible via the webinterface.

3.4.2 UC Simulator GUI

Use-Case	
Primary actor	Developer, workstation, webinterface, devices / related to #118, #20, #18, #19
Normal flow:	The developer wants to debug or verify the communication between his device and the workstation. Therefore he connects the device under test to the PC and starts the workstation simulator. The GUI of the webinterface shows a form, where the developer can configure certain parameters (e.g. IP address of simulator). Another part of the form enables the developer to to inject commands in the communication between simulator and device. Finally, the form has a separate area in which all communication can be viewed by the developer.
Alternative flow:	
Postconditions:	The IP address and other parameters of the simulator have been configured, and the communication can be viewed after the device has been connected to the PC running the simulator.

3.5 Furniture like user-interface

3.5.1 Object UI: Visual output modality

Use-Case	
Primary actor	Furniture like object / related to #21, #26, #120, #178, #182

Normal flow:	The object is able to provide visual output. The light is switched on or off, or can be changed between 3 different colours based on the control signals of the workstation.
Alternative flow:	
Postconditions:	Depending on the status to be displayed by the object, it is showing one of 3 possible colours.

3.5.2 UC Object UI: control by workstation

Use-Case	
Primary actor	Object like UI, workstation / related to #21, #120, #182
Normal flow:	The object is connected to the workstation, only. The object receives high-level commands from the workstation ("e.g. overall status is good"). The interpretation and driving of the output modalities the objects resorts to is performed by the object.
Alternative flow:	When a user-message is initiated by manipulating the UI of the object, the object becomes pro-active and sends the message to the workstation.
Postconditions:	While the workstation communicates with the object via predefined high level commands.

3.5.3 UC Object UI: Periodization of preferences

Use-Case	
Primary actor	Workstation, cloud, furniture like object / related to #21, #181, #182
Normal flow:	The workstation informs the object when new preference information is available from the cloud server. This allows the object to obtain data from the user preferences, such as for example "overall status good has colour green." The object stores the latest preferences internally.
Alternative flow:	If no preference data is available (or preference data is incomplete), the object will request configuration data. If no preferences are available, the object will resort to the settings of the internal preferences.
Postconditions:	Preferences stored on the cloud server are available for the object.

3.5.4 UC Object UI : Action tiles

Use-Case	
Primary actor	Furniture like object, action tiles, user / related to #13, #15, #14, #17, #16, #11, #15, #10, #14, #13
Normal flow:	A small device ("action tile") is brought in vicinity of the object. Then a message (corresponding to the meaning of the action tile) is sent to the remote user. While further meanings can be defined, at least "request for help" and "help with shopping" should be available.

Alternative flow:	
Postconditions:	After the user brought an action tile in the vicinity of the object, this request is sent to the remote user.

3.5.5 UC Object UI: Action tiles communication level specification

Use-Case	
Primary actor	Furniture like object, action tiles, communication protocol / related to #13, #15, #14, #17, #16, #11
Normal flow:	Requests initiated by action tiles comprise on communication level: - send message from object to other object or a smartphone - confirm message - decline message - timeout - not received
Alternative flow:	
Postconditions:	All devices in the communication chain from one object to the remote object (workstations and cloud-server) are able to handle (or at least convey) these types of messages.

3.6 Smartphone application

3.6.1 UC App communication with cloud server

Use-Case	
Primary actor	App, cloud server / related to #121, #179, #182, #36
Normal flow:	The app connects to the cloud server. From it, the app receives information on the current overall status, on the social interaction, physical activity and aspects of life. Furthermore, commands can be sent via the cloud to the app. The app has to act accordingly. This comprises the handling of user-initiated messages (send/receive) and switching the display of the overall status on or off.
Alternative flow:	
Postconditions:	The user starts the app and in the background the app receives the newest information on the statuses.

3.6.2 UC App displays overall status

Use-Case	
Primary actor	App, cloud server / related to #21, #27, #121, #179, #182, #36, #22, #33, #23, #34, #36, #39
Normal flow:	The app receives the statuses from the cloud server. The status (overall, physical activity, social interaction and aspects of life) is displayed. To address also users with colour blindness, each status is not only represented by a dedicated colour, but also by another modality (e.g. form/shape/text).
Alternative flow:	
Postconditions:	After the overall status has changed, the new status is displayed in a different colour. Colour blind users are able to recognise the status by other means than colour coding.

3.6.3 UC App displays information on last 2 days

Use-Case	
Primary actor	App, cloud server / related to 3.2.6
Normal flow:	The app is able to receive via the cloud server summarized data from selected events on the last two days. The app offers the user the option to display this information.
Alternative flow:	
Postconditions:	Besides displaying the main information (overall status, etc.) the IC can select to see the summary on certain variables over the past 2 days.

3.7 Cube

3.7.1 UC Cube connectivity

Use-Case	
Primary actor	Cube, workstation / related to #21
Normal flow:	The Cube is connected to the workstation. The workstation sends status or message information to the Cube, which it has to notify a user.
Alternative flow:	
Postconditions:	After the Cube is switched on, it automatically connects to the workstation and displays the statuses (at the IC's, APs place.

3.7.2 UC Cube status display

Use-Case	
Primary actor	Cube, workstation, IC / related to #21, #28, #23, #35, #39, #22, #33
Normal flow:	At the IC's place, all statuses (i.e. overall, physical activity, social interaction and aspects of life) are displayed, must be simple to comprehend and nice to look at
Alternative flow:	
Postconditions:	By looking at the picture within the Cube, the IC can see at a glance all statuses.

3.7.3 UC Cube NFC tags

Use-Case	
Primary actor	Cube, user / related to #25
Normal flow:	The user can put a different NFC tags on a Cube and the operating system can detect each NFC tag and send a corresponding message.
Alternative flow:	
Postconditions:	The Cube has reading capabilities.

3.7.4 UC Cube messaging functionality

Use-Case	
Primary actor	Cube, workstation, AP / related to #25
Normal flow:	When a message from a relative arrives, the Cube show a status of message.
Alternative flow:	
Postconditions:	The AP is informed about the message.

3.7.5 UC Cube mood reporting

Use-Case	
Primary actor	Cube, user / related to #46
Normal flow:	The user of a Cube sends a message based on predefined NFC tag to the other RC system participants to express his mood. E.g. happy smiley, frowny face, heart image, etc.). The RC system recognizes these messages and utilises the information in its derivation of the overall status.
Alternative flow:	
Postconditions:	The user can expressed his mood and the RC system is able to exploit this information.

4 Non-Functional Requirements

4.1.1 UC Sensors in the environment are to be preferred, indoors

Use-Case	
Primary actor	Sensors, user / related to #41
Normal flow:	Indoors, the RC system relies on sensors installed in the environment of the user.
Alternative flow:	Sensors designed for being worn outdoors are can also be used indoors.
Postconditions:	The design of the RC system considers, that the quality of life is increased, when the AP does not have to resort to body worn sensors.

4.1.2 UC Sensor data protected at home

Use-Case	
Primary actor	Workstation
Normal flow:	Sensor data is not sent to destinations outside the living space. The system has to be configured in a way that access to the sensor data from outside the living space is forbidden.
Alternative flow:	Exceptions are (sensor) signals utilized for end-user to end-user communication (see assistance request, I think of you, etc.).
Postconditions:	Sensor data can not be accessed from outside the workstation.

4.1.3 UC Only summarized data is accessible

Use-Case	
Primary actor	Workstation, cloud server, IC / related to #24, 3.2.3, 4.1.2
Normal flow:	All users of the workstation (UI devices, cloud server, AP, IC) can only get summarized data from the workstation. It is not possible for these users to access single events in the database. Pre-condition for any user accessing the processed data (i.e. e.g. output of behavioural pattern analysis) is that this user was granted the access rights beforehand.
Alternative flow:	Messaging functionalities are excluded from this requirement.
Postconditions:	No UI, cloud server, sensor, or smart phone connected to the workstation is able to access other data than the processed data.

4.1.4 UC User selects circle of receivers

Use-Case	
Primary actor	User, UI / related to #86, 4.1.5, 4.1.6
Normal flow:	The user of the RC system is aware, that sensors are used to derive information e.g. his overall status. It is possible to have several other users (e.g. ICs) who are connected to the cloud server / the RC system. The system provides the user a low barrier, easy to understand and easy to use way to select, which person is allowed to receive the processed data from its own database.
Alternative flow:	
Postconditions:	The user, being an AP was able to select which person (e.g. IC) is allowed to get access to the local database. Therefore, no technical support in form of other persons or support by other means was necessary.

4.1.5 UC User selects output information

Use-Case	
Status:	~~To be implemented~~
Primary actor	User, UI / related to #86, #40, #42, 4.1.6, 4.1.4
Normal flow:	The user of the RC system is aware that the IC can obtain information on the (1) overall status, (2) physical activity, (3) social contacts and (4)aspects of life (i.e. (4a) routinely performed activities, (4b) leisure time activities, (4c) work, (4d) health). The system provides the user a low barrier, easy to understand and easy to use way to select, which information (1 - 4d) is accessible for others (ICs).
Alternative flow:	
Postconditions:	The AP has selected what information he is willing to share and no IC is able to access more information via the cloud server.

4.1.6 UC User accepts and confirms privacy settings

Use-Case	
Primary actor	User, other pserons, UI / related to #24, #42, #86, 4.1.4, 4.1.5
Normal flow:	Each time the user (AP) sets or changes the configuration on who is allowed to receive what information, he is prompted to agree and accept the decision.
Alternative flow:	If the user can recognise the settings without need for further prompting (e.g. by UI design of highly self-explanatory usability), the agreeing and accepting may be neglected. Instead measures must be introduced, which avoid the unnoticed changes in configuration by other persons (visitors, grandchildren, IC).
Postconditions:	The AP has selected what information he is willing to share and no IC is able to access more information via the cloud server.

4.1.7 UC Only summarized data is accessible

Use-Case	
Primary actor	Workstation, cloud server, IC / related to #24, 3.2.3, 4.1.2
Normal flow:	All users of the workstation (UI devices, cloud server, AP, IC) can only get summarized data from the workstation. It is not possible for these users to access single events in the database. Pre-condition for any user accessing the processed data (i.e. e.g. output of behavioural pattern analysis) is that this user was granted the access rights beforehand.
Alternative flow:	Messaging functionalities are excluded from this requirement.
Postconditions:	No UI, cloud server, sensor, or smart phone connected to the workstation is able to access other data than the processed data.

4.1.8 Req Error handling

Requirement	
Related to:	User, PT1, PT2
Requirements:	- The user must be able to determine, whether the communication chain of his RC system is intact (i.e. whether there is access to the network for all system components (UIs, cloud server, workstation, etc).
Alternative requirement:	
Note:	

4.1.9 Req Installation

Requirement	
Related to:	Developer, PT1, PT2
Requirements:	- The RC system does not require available internet access at the AP's place. - The installations of test systems is only performed by trained personal.
Alternative requirement:	
Note:	

4.1.10 Req Data representation and storage

Requirement

Related to:	Developer, PT1, PT2
Requirements:	In general for the software development: for data representation and storage available data formats shall be employed. - Databases shall comply to MySQL standard - Variables to be communicated via an interface shall be JSON compatible
Alternative requirement:	
Note:	

4.1.11 Req Casing

Requirement	
Related to:	Developer, PT1, PT2
Requirements:	PT1: As PT1 is run with supervising trained personal, only, there are no special requirements on the casing to protect the electronics.
Alternative requirement:	
Note:	

4.1.12 Req Documentation

Requirement	
Related to:	Developer, PT1, PT2
Requirement:	- The specification of software components and modules shall be done in an online wiki for reasons of flexibility. - Further specifications must be available in Word format, or in the wiki. - To allow other partners to set-up the system (-components) a brief installation guide is to be written.
Alternative requirement:	
Note:	

4.1.13 Req Ethics

Requirement	
Related to:	PT2, Development
Requirements:	The RC system must comply to the privacy and safety regulations of the European Union.

Alternative requirement:	
Note:	

4.1.14 Req Licensing

Requirement	
Related to:	Marketing, Development
Requirements:	Product license: tbd
Alternative requirement:	
Note:	