

D1.1a Initial user and domain requirements

Project	SWELL
Project leader	Wessel Kraaij (TNO)
Work package	WP 1
Deliverable number	D1.1a
Authors	Steven Bosems (UT), Marten van Sinderen (UT), Mihai Marin-Perianu (UT), Saskia van Dantzig (Philips)
Reviewers	Mihai Marin-Perianu (UT), Saskia van Dantzig (Philips), Wessel Kraaij (TNO)
Date	01-05-2012
Version	201200501rev6
Access Rights	PP (restricted to other program participants)
Status	Living

This is a living document. As such, it is subject to constant changes.

SWELL Partners:

Ericsson, NCSI, Noldus, Novay, Philips, TNO, Radboud Universiteit Nederland Nijmegen, Roessingh Research and Development, Universiteit Twente

Editor

Steven Bosems
University of Twente
Faculty of Electrical Engineering,
Mathematics and Computer Science
E-mail: s.bosems@utwente.nl

About this document

This document is deliverable D1.1a: Initial user and domain requirements of the COMMIT Smart reasoning for well-being at home and well-being at work (SWELL) project.

This document was inspired by IEEE Std 830-1998, IEEE Recommended Practice for Software Requirements Specification. [1]

Summary

Summary of content

This document describes the high-level requirements that apply to well-being support, as understood by the project at the time of writing. It includes:

1. Definitions of concepts for well-being support.
2. Contextual assumptions on the well-being support to be developed in the project.
3. Descriptions of personas and scenarios that were developed to help elicit the requirements.
4. A list of requirements.

Summary of status

This is a 'living' document, in the sense that new insights and project-level decisions on the scope and direction of the project will be reflected in future versions of the deliverable.

The personas and scenarios on which the requirements in the current version are based were initially developed in a Requirements Workshop held on 15 December 2011. All partners were invited to contribute or comment on this version of the deliverable. The author list includes the names of persons that provided textual input. The feedback from the review resulted in a number of editorial improvements which are implemented in the final version. In addition, action points were identified that are taken up when preparing the next version:

1. Add an additional persona, "Happy Worker", and extend the scenarios and requirements accordingly
2. Annotate the requirements with a weight value indicating the relative importance of the requirements for the project (e.g., a value "0" would indicate "out of scope", and a low value that the requirement will only be considered in a next design cycle if at all).
3. Prioritize the scenarios to guide the development of demonstrators.

Besides consideration of these action points, future versions will also incorporate requirements validation results based on (i) collecting expert opinion on requirements (through consulting employees of Noldus), and (ii) sanity checks from refinement activities and bottom-up knowledge (e.g., through the Architecture Workshop, held on 24 April 2012).

Contents

- 1 Introduction** **1**
 - 1.1 Purpose 1
 - 1.2 Scope 1
 - 1.3 Definitions, acronyms, and abbreviations 1
 - 1.4 Rationale 2
 - 1.5 Overview 3

- 2 Description** **5**
 - 2.1 System environment 5
 - 2.2 System perspective 9
 - 2.3 User characteristics 12
 - 2.4 Assumptions and dependencies 12

- 3 Specific requirements** **15**
 - 3.1 External interface requirements 15
 - 3.2 Functional requirements 16
 - 3.3 Design constraints 18

- A Personas** **21**
 - A.1 Marieke 22
 - A.2 Richard 24
 - A.3 Karel 26
 - A.4 Annet 27

- B Use cases** **31**

- List of Requirements** **51**

List of Figures

- 1.1 Double-loop learning 4
- 2.1 Stakeholders 5
- B.1 High level use case diagram 31
- B.2 Use case diagram 32

List of Use Cases

- 1 Configure treatment plan 31
- 2 Monitor patient treatment 33
- 3 Provide feedback 34
- 4 Bill patient for treatment 36
- 5 Monitor treatment goals 36
- 6 Receive health care professional feedback 37
- 7 Configure self-management goals 38
- 8 Monitor self-management goals 39
- 9 Receive self-management feedback 40
- 10 Provide travel information 41
- 11 Show relevant documents 42
- 12 Prevent free time interruption 43
- 13 Provide recipe information 44
- 14 Facilitate grocery list 45
- 15 Provide diet information 46
- 16 Prioritize tasks 47
- 17 Report data to health care professional 48

1 Introduction

1.1 Purpose

The purpose of this document is to present user and domain requirements of the COMMIT SWELL system. It discusses the purpose of the system from the user perspective, gives definitions with regard to the system and its domain of application, , describes the stakeholders and the intended users of the system, and identifies and elaborates on their requirements of the system. This document is intended for all COMMIT SWELL Work Packages.

1.2 Scope

The final COMMIT SWELL demonstrators as described in [2], from this point on called *the system* or *the SWELL system*, will be designed to improve and support the well-being of knowledge workers; we will refer to these knowledge workers as *the users*. The overall goal of the system is to reduce welfare diseases and sick leave of the users, and improve the work-life balance. In order to accomplish this goal, health care professionals may use the system to aid the users. Both the knowledge workers and the health care professionals will be using the system, however, the term *user* shall in this document only be used for knowledge workers. Persons using the SWELL system to aid others into becoming healthier shall be referred to as *health care professionals*.

The system will consist of sensors that ubiquitously monitor the user, reasoning algorithms that use this sensor data, and personal digital assistants that will help the user to maintain a healthy work and lifestyle.

1.3 Definitions, acronyms, and abbreviations

Domain	The field in which the system operates, including the physical location, the stakeholders, other systems, and terminology.
Domain requirements	The demands for the system that are caused by properties of the domain.
Goals	A desired state of the user or stakeholder in the future. Goals drive the elicitation of user- and system requirements.
Health care professional	A person who provides health care to others as part of his job.
Knowledge worker	An employee, whose primary product is knowledge for the company. The output of a knowledge worker can be diverse. [3]
Patient	A user who is under treatment by a health care professional.
Portable device	A computing device that can be carried with the user at all times. These include, but are not limited to, cell phones,

	smart phones and Personal Digital Assistants. The portable device has the capability to communicate wirelessly with different sensors. Tablet devices, which have become increasingly popular lately, are not regarded as portable devices, as they can not be carried with the user at all time.
Sensor	A device used to obtain information from the user context. This information may include vital signs of the user, but also location information, and audio/visual data. As such, a webcam or microphone is also regarded as a sensor.
Stationary device	A computing device which primary usage scenario consists of it being stationary and operated by the user. These devices include desktop computers and laptops.
Stakeholders	Those real or legal persons who might be affected by the system.
System requirements	The hard- and software demands of the stakeholders that hold for the system.
User	A person using the SWELL system, not being a health care professional.
User requirements	The demands a user has regarding the functionality of the system.
Well-being	“The state of being comfortable, healthy, or happy.” [4]
Well-working	Being able to perform labor in a good or proper manner, while respecting one’s state of being happy and healthy. [5]

1.4 Rationale

The Dutch Labour Inspectorate publishes a yearly report [6] that lists the current state of the Dutch workforce. Listed in this report are, among others, how the work force is distributed among age groups, how people work in a time and location independent way, and what the lifestyle of the Dutch employees is like. When focusing on this last point, we find that the average Dutch worker is not living a healthy lifestyle. 50% exercises too little, 44% copes with overweight, 28% smokes, of which over 82% smokes more than 10 sigarets or cigars per day, 17% does not have breakfast, and 5% abuses alcohol.

These unhealthy habits result in physical and psychological problems. These are also discussed in [6] and are listed in Table 1.1. This table lists the problems experienced among the working population, the percentage of the whole population coping with these problems and the percentage of the working population with an unhealthy lifestyle coping with the problems. We can see from this table that chance of a person having health related issues is higher if they have an unhealthy lifestyle. Although the percentages do not seem to differ by much, an increase of 1% indicates that 86,440 people¹ more are coping with these problems.

¹ According to [7], 8,644,000 people were employed in 2010.

Problem	Average	Unhealthy lifestyle
Bad state of health (as experienced)	9.5%	11%
Musculoskeletal problems	32%	35%
Sick leave	4%	4–5%
Work related accidents	3%	4%
Conflicts with colleagues	26%	27–31%

Table 1.1: State of health

From these numbers, we can conclude that an unhealthy lifestyle can cause issues for the employee, the employer and society at large. In this project, we aim to improve lifestyle in order to reduce these problems.

As work forces are always under pressure to deliver more results in less time, they should be supported in their tasks. Manual laborers have been getting this support with the introduction of mechanization and automation. Knowledge workers are nowadays supported by word processors, databases and knowledge banks, they are not supported at a higher, more abstract level, on which human judgment, expertise and self-management is required in order to prevent losing focus and fragmentation of work. Providing this level of support is the second aim of this project.

In order to support people in obtaining and maintaining a healthier lifestyle on the one hand, and work in a more efficient and more effective way on the other, we can design a context-aware system that fulfills the role of a personal coach or assistant while not hindering the users in their daily activities.

1.4.1 Double-loop learning

Introduced by Argyris and Schön in [8], double-loop learning entails a higher level of learning: instead of only altering actions based on results, underlying assumptions are also re-thought. This model is depicted in Figure 1.1. Originally developed for organizational learning, this model can also be used to study the change in behavior of people themselves. In SWELL, we aim to achieve this level of learning. The Chinese proverb “*give a man a fish and you feed him for a day; teach a man to fish and you feed him for a lifetime*” also applies here: if we only teach our prospective user the “how” of the change, and disregard the “why” aspect, we only hand him the proverbial fish. However, if we also include the “why” part of the equation, the user will be able to alter his behavior himself.

1.5 Overview

This document is structured as follows:

Chapter 2 - Description This chapter discusses the functionality of the system with relation

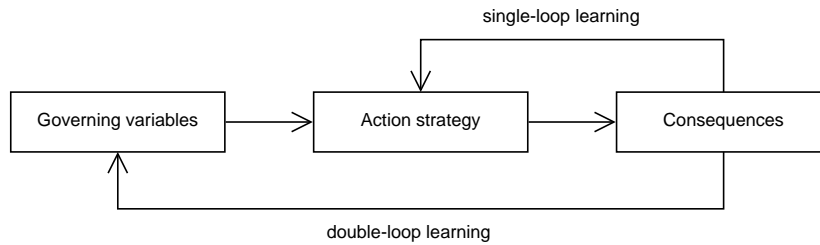


Figure 1.1: Double-loop learning

to external interfaces, the user characteristics, constraints with relation to development options are given, assumptions are made, and dependencies are discussed.

Chapter 3 - Specific requirements In this chapter, discusses the user requirements in detail. The intended audience for this chapter are developers who will be implementing the system as described in this report.

Appendix A - Personas This appendix lists the personas defined during the SWELL workshop on December 15th, 2011. These personas are the archetype users of the system.

Appendix B - Use cases The use cases that were used as a basis for the functional requirements are given in this appendix.

2 Description

2.1 System environment

This section describes the environment the system will operate in. A stakeholder analysis is performed to identify which people will benefit from the SWELL system, or are otherwise involved. The environment in which the system shall operate is also discussed.

2.1.1 System stakeholders

The system can work according to two principles: a self-management system which fully aids the user and no professional from the health care domain is needed, or a system that brings a patient and a health-care professional together to fulfill a treatment plan. Depending on the situation in which the system is used, additional stakeholders may exist.

Our stakeholders consist of two types. The first encompasses natural persons or roles a person might have. The second consists of person groups or organizational stakeholders. The relations between these stakeholders are depicted in Figure 2.1. The arrows indicate the relations in the domain of the SWELL system.

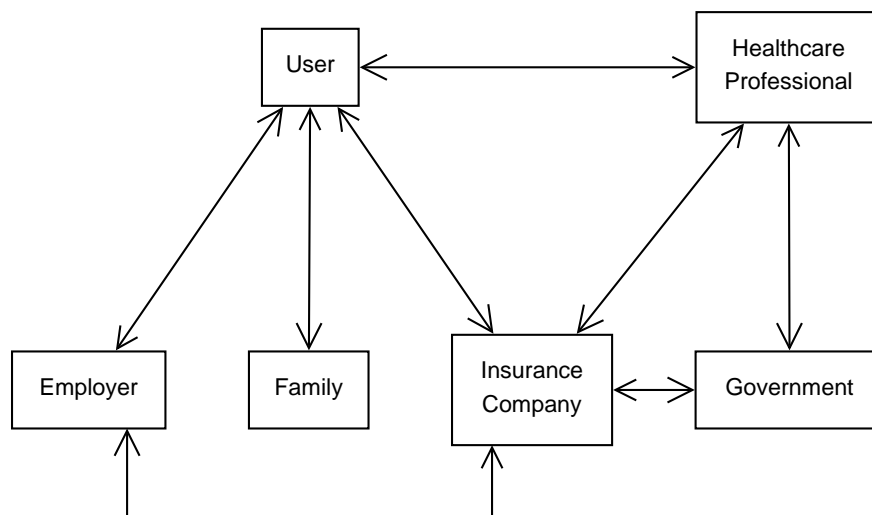


Figure 2.1: Stakeholders

2.1.1.1 Persons

User

Description The user is a person using the system for the purpose of improving or supporting his well-being. The user has a social life and is typically employed at a company as a knowledge worker. During both his free time and his working hours, he wants to be supported by the system.

Goals While trying to be as effective and efficient as possible, the user wants to have the feeling of being “in control”: he wants to have the right information at the right time, know how his time is spent during the day [9] and be able to perform his work in a place and time independent fashion.

Furthermore, another goal that exists is the desire to feel comfortable and at ease: have a feeling of well-being. Being healthier is one way to attain this goal. The means used to become healthier is not a goal itself.

On average, the user will not be willing to sacrifice everything in order to become more healthy and obtain a feeling of well-being.

Relations and potential conflicts

Employer	The user works for the employer to earn his wages.
Health care professional	The user may be under treatment by a health care professional.
Family	The user may or may not have a family.
Insurance Company	The user can have an insurance against misfortunes at an insurance company. Dutch citizens are required by law to have health insurance, as noted in Chapter 2, Section 2, Paragraph 1 of the Health Insurance Law (“Zorgverzekeringswet”). [10]

Health Care Professional

Description A health care professional is anyone who provides health care to others as his job. Health care professional can be, among others, doctors, nurses, surgeons, and psychotherapists.

Goals Helping people with their health and ailments is the primary goal of this stakeholder. This goal is not a personal goal, rather, it is the goal of the role as a professional.

While helping patients, the health care professional will want to be able to have as much information about the patient as possible, such that the treatment plan can be tailored to the patient’s needs. Additionally, the health care professional wants to monitor his patient’s progress and be able to intervene in the treatment when deemed necessary.

Relations and potential conflicts

User	The health care professional provides health care services for users. They treat the users for ailments. In the context of a treatment, the user is referred to as a patient.
Insurance Company	The health care professional is paid by the insurance company, and as such has an employee/employer relation with the this company.
Government	The government implements laws and regulations to which the health care professional should adhere.

2.1.1.2 Groups**Employer**

Description The employer is the company which employs the user. This company may have its core business in any field and can be of any size.

Goals As with any company, the primary goal of the employer is to make profit. As such, the employer would like its employees to work as hard as possible, to deliver as much of the sold product or service they can. Also, the employer will want the employees to stay motivated, happy, and healthy.

Relations and potential conflicts

User As an employee, the user performs tasks for the employer that benefit the company. In return, the employer pays the user a salary.

Family

Description The family of the user may consist of a partner, children or other individuals. Their ages, sexes, personalities and jobs are irrelevant for our purpose.

Goals Being related to the user, the family wants him to be healthy and be able to spend time with him.

Relations and potential conflicts

User A family consists of family members. One or more of these members can be users.

Insurance Company

Description This specific type of company provides insurance to companies and natural persons alike. This company employs people, however, in our domain no employment relationship exists between it and a user.

Goals As with other companies, the insurance company's primary goal is to make profit. It does so by selling insurance policies. At the same time, the company wants to pay its clients as little as possible in order to increase profits. Prevention of situations in which money has to be paid by the company, should thus be encouraged. As such, the insurance company is likely to promote the use of preventive techniques and applications.

Relations and potential conflicts

User	The insurance company can provide a user with an insurance policy which gives the insured rights to a refund on certain costs, to be paid by the insurance company. In return, the insured pays a fee to the insurance company. In The Netherlands, the insurance company is required by law to accept anyone who wants to get insured for health care costs ¹ , and a Dutch citizen is required to have such an insurance.
Health care professional	The insurance company pays the health care professional on behalf of the insured. The amount paid depends on the type of procedure performed.

Government

Description A democratic government consists of representatives of the inhabitants of a country. The government creates, implements and enforces legislations to which all natural and legal persons operating in a country should adhere.

Goals The overall goal of a government is to make sure the country is run in a proper way, in order to be competitive in the international market. Furthermore, the government aims to protect the quality of life of the inhabitants.

Relations and potential conflicts

Health care professional	The government regulates what a health care professional can and can not do.
--------------------------	--

2.1.2 Operation environment

The operation environment of the system can be divided into the home environment and the work environment. The system supports knowledge workers to work better and healthier in his work environment, may that be at an office, on the road, or at a home office. The system also supports the user to live a healthier life at home.

¹This is described in the Health Insurance Law Chapter 2, Section 3, Paragraph 1. [10]

2.2 System perspective

This section describes how the system interfaces with other systems, presents itself to the user, and puts it into perspective with related systems. This section discusses possible implementations, no hard requirements are described here.

2.2.1 Possible system interfaces

Since the system will support multiple parts of the user's life, parts of the system will run on handheld hardware, for example a cell phone. These parts of the system will communicate wirelessly with other components.

The system should use (wireless) sensor technology in order to measure vital signs of the user, and obtain additional context information. Non-proprietary wireless communication technologies should be used in order to facilitate for this feature as this will allow future utilization of additional sensors and prevent a vendor lock-in.

2.2.2 User interfaces

Due to the nature of the system, the user should not be hindered in his daily routine by the system. This would cause the user to get agitated about the system, disregarding it and compromising the overall project goal. The interface should encourage the user to live and work in a better and healthier way.

The interfaces described in this section are not required to be implemented, rather, they are ideas for the user interface of the SWELL system based on current commercial products.

2.2.2.1 Portal

A web portal that allows the user to view his goals, progress toward these goals, and current and previously received feedback from both the SWELL system and the health care professional (if applicable), would be the minimally required interface to be supported by the system.

Users are used to interacting with software systems through web interfaces, as these are the primary way of gathering information and news in every day life. No additional hard- or software is required from the user's point of view to interact with the system or to communicate with his health care professional.

2.2.2.2 Program/App

The front-end could be implemented in the form of a regular desktop application or an application for a mobile system, like an iOS or Android application. The advantage is that the end users are familiar with the user interface of the platform. A disadvantage is that end users of other platforms are not considered. Cross-platform development of applications is possible with the appropriate programming languages and tools.

2.2.2.3 Social network

Using existing networks Many people use social networks these days. According to Facebook [11], more than 845 million users are active on the networking site, of which more than 80% logs on at least monthly. This is a large group and the chance that the user of SWELL is also a Facebook or other networking site user is quite high.

The Facebook statistics also mention that an average user has 130 “friends”. If we are able to reach a single user, he will influence [12] others around him, causing a potentially growth in the users of the SWELL system.

APIs are available in order to develop applications that interact with the social networking platform. Using these APIs, small applications running on the user’s devices can interact with the social network, allowing us to publish information to the profile of the user, sharing that information with his contacts.

An advantage of using existing social networks as a front-end is that the potential group of users is very large. As they are already a member, no new login information has to be requested from the end user, which adds to the user friendliness.

A disadvantage of this method of working is that we are potentially giving our collected data to third parties. Users might be reluctant to provide these third parties with this information.

2.2.2.4 Game

Games are powerful tools to make users change their behavior. [13] Due to a competitive factor, the user might be driven to work better and healthier, just to be better than his coworkers. This can be a strong motivator to use the system and keep using it.

The type of game that can be used is yet unclear. A passive ranking system, displaying how well² the user is doing compared to others might be stimulating for some users. However, less competitive users might not like this interface and could experience it as unpleasant.

Other types of games are more in line with those available for game systems like the Nintendo Wii [14] and the Microsoft Kinect [15]. Here the user is actively interacting with the system, instead of statistical data being used to create a ranking.

2.2.3 Hardware interfaces

The way the system software interfaces with the system hardware depends on the hardware and software used. The software may interface with the hardware using the provided hardware drivers, thus new software that directly speaks with the hardware might not have to be developed³.

²The definition of “good” in context of this work is to be defined through the help of (medical) professionals.

³This depends on the components used.

2.2.4 Software interfaces

The software the SWELL system is to interface with is to be determined, as this will depend on the operating system platform, interface to the user and hardware devices used. Software interfaces will be determined by Work Packages 5 and 6.

2.2.5 Communications interfaces

As mentioned in Section 2.2.1, the system should make use of non-proprietary wireless communication technologies. These can be Zigbee [16], Bluetooth [17], or other ways of communicating specifically designed for this purpose.

Communication between portable and stationary devices shall also be through wireless technology, thus not hindering the user while data is synchronizing between the two. If available, wireless LAN (WLAN), wireless wide area networks (WWAN) or other high speed cellular telecommunications technologies should be utilized.

2.2.6 Memory constraints

2.2.6.1 Portable device

A portable device is highly limited in both primary and secondary memory. Although the amount of storage has increased in the last few years, current day portable devices can not rival their stationary counterparts in this field.

The amount of primary memory required by the system will depend on the number of sensors used, as device descriptions of these will all have to be stored in the primary memory. Also, the algorithms used to reason about the gathered data will determine the required amount of memory. The secondary memory may limit the amount of data gathered from these sensors. How much data can be stored, depends on the sensor types used, the amount of raw sensor data and the way the processed data is stored.

2.2.6.2 Stationary device

Stationary computing devices are less limited with regard to primary and secondary memory than their portable counterparts. Again, the amount of memory used depends on the exact sensors and algorithms used.

2.2.7 Operations

The system can be used in two ways: the user might decide for themselves to buy a device or devices equipped with the SWELL system and set their own goals, or a health care professional can advise the user to start using the SWELL system, allowing the health care professional to monitor the user and provide him with advice through the SWELL system.

2.2.7.1 Self-management mode of operations

When the user has bought a device which supports the SWELL system, he has a certain goal with it in mind. He can, as such, configure the SWELL system in order to attain this goal.

In this mode of working, the user of the system is provided with advice through smart reasoning algorithms. No human intervention is required in order to give the advice. The responsibility for monitoring goal progress and setting new goals is with the user.

The mode of working may be elevated to “treatment mode” if the condition of the user requires this. In this state, the system will no longer be operating autonomously.

2.2.7.2 Treatment mode of operations

If a potential user visits a health care professional in order to receive treatment, the health care professional might require his patient to start using the SWELL system. In this case, the “treatment mode” will be used.

Unlike the previous mode, in which the SWELL system provided all advice through reasoning algorithms, in the treatment mode, the system will relay advice from a health care professional to the user. Monitoring of the user’s vitals will be done by both the user and the health care professional, as well as the goal progress. Usage goals shall be set by the health care professional to aid treatment.

If the treatment of the user is successful, the degree to which the health care professional monitors the user may be decreased, and the user may be allowed to set his own goals, while the health care professional still monitors him. This process can be continued until all responsibilities are given back to the user and the system continues in the self-management mode.

2.3 User characteristics

The typical user of the system is a knowledge worker. As such, the user is likely to have a high degree of education [6], however, this can not be guaranteed.

Knowledge workers frequently use information technology, since it helps them to obtain the information required for their jobs and manage their time more efficiently. [18]

The user is likely to exercise too little, and cope with overweight. [6] He might also smoke, skip his breakfast in the morning and could abuse alcohol. These unhealthy lifestyle choices could result in an experience of having bad health and musculoskeletal problems.

Personas have been defined for the scope of the SWELL project. These persona descriptions can be found in Appendix A.

2.4 Assumptions and dependencies

The requirements in this document are based on literature surveys, workshops and experience of practitioners. However, due to the nature of context-aware computing, the system

requirements can change based on usage of the system while testing it in real user contexts.

3 Specific requirements

Based on the requirements formulated in the previous chapters and on the personas and use cases described in the appendices, a list of concrete user requirements can be created. In this chapter, these requirements are listed and, where applicable, their origin is indicated. The requirements are specified in accordance with RFC 2119 [19]:

Shall	This word indicates an absolute requirement.
Shall not	This phrase indicates an absolute forbiddance.
Should	This word indicates a recommendation. Ignoring requirements containing this word has to be carefully weighted.
Should not	This phrase indicates a requirements or practices that are not recommended. As with “should”, ignoring these requirements should be weighted.
May	This keyword indicates optional requirements.

3.1 External interface requirements

This section discusses all requirements with regard to the inputs into and outputs from the system. Firstly, we look at the inputs received from and provided to the user. Secondly, requirements on interfaces to hardware systems are listed. Thirdly, we look at interfaces to other software systems. Finally, communication interfaces are discussed. When not mentioned specifically, the requirements were derived from descriptions in Chapter 2.

3.1.1 User interfaces

- R1 The system shall not require the user to have to intervene in order to operate successfully.
- R2 The system shall adapt or allow adaptation of the interface to fit the user's preferences.
- R3 The system shall encourage the user to live and work healthier and better.

The following five requirements are derived from Section 2.2.2 on page 9.

- R4 The system shall provide the user with a web interface, as described in SWELL Deliverable D1.3a.
- R5 The system may be presented to the user as a mobile phone app.
- R6 The system may include social media.
- R7 The system may be presented to the user as a game.
- R8 The system may combine information about users anonymously and present it to all the users in the form of an appliance.

This last requirement may present privacy issues. If implemented, an opt-in or opt-out mechanism should be implemented.

3.1.2 Hardware and software interfaces

The hardware and software the SWELL system shall interface with is to be determined by the work packages that will build the SWELL demonstrators. However, some general, non-technical requirements can be derived which should be supported by the SWELL system.

- R9 The system shall support the use of multiple devices.
- R10 The system should consist of either a mobile or a stationary part, or a combination of both.
- R11 The system shall contain consistent data on all devices used.

3.2 Functional requirements

The functional requirements specify the actions that should be supported by the system. These requirements were derived from the persona scenarios in Appendix A and the use cases in Appendix B. These requirements are divided into two groups; the first encompasses the requirements taken from the users, the second are requirements that hold for the health care professional.

3.2.1 User

- R12 The system shall aid the user in order to gain insight in their activities and attain a healthier and more informed life.
- R13 The system shall use smart reasoning algorithms to provide the user with advice regarding his goals.

The following requirement was derived from Use Case 7 on page 39.

- R14 The system shall allow the user to set his own self-management goals.
- R15 The system shall ask the user questions in order to establish a baseline for the reasoning algorithm.

The following three requirements were derived from Use Case 8 on page 40.

- R16 The system shall show the user his own self-management goals.
- R17 The system shall show the user his progress in his self-management goals.
- R18 The system shall allow the user to alter his self-management goals.

The following requirement was derived from Use Case 5 on page 37.

- R19 The system shall show the user his progress in a treatment plan.

The following four requirements were derived from Use Case 6 on page 38.

- R20 The system shall deliver feedback from the health care professional to the user.
- R21 The system shall show the user feedback from his health care professional.
- R22 The system should ask the user for read confirmation.
- R23 The system shall send read confirmation to the health care professional.

The following requirement was derived from Use Case 10 on page 42.

R24 The system may show the user travel information based on his calendar.

The following requirement was derived from Use Case 11 on page 43.

R25 The system may show the user documents relevant to a meeting.

Personas

The following requirements are based on the solution scenarios of the personas described in Chapter A.

Marieke

R26 The system should inform the user about impending calendar items.

R27 The system may be integrated in car navigation devices.

R28 The system should prevent the user's free time to become fragmented.

The following two requirements were derived from Use Case 12 on page 44.

R29 The system may withhold e-mails from the user based on given criteria.

It is understood that not all users will like this feature. As such, if implemented, the user should be able to override it.

R30 The system should allow for task management.

Richard

R31 The system shall show the user nutritional information on food.

R32 The system shall help the user to compile a healthy meal.

R33 The system should help the user to create a shopping list with healthy food.

R34 The system shall track physical activity.

R35 The system should advise the user on meals.

R36 The system should interface with services that provide nutritional information about food.

R37 The system should provide a cookbook functionality.

R38 The system may aid the user in creating a workout program.

Karel

R39 The system may pre-selection tasks for the user.

R40 The system shall track user work activity and workload.

The following requirement was derived from Use Case 16 on page 48.

R41 The system may prioritize tasks for the user.

Annet

Requirements derived from Annet's solution scenario have already been discussed in Richard's scenario.

3.2.2 Health care professional

The following requirement was derived from Karel's solution scenario.

- R42 The system shall notify a health care professional if vital values of the patient are outside a predefined range.

The following four requirements were derived from Use Case 1 on page 33.

- R43 The system shall allow the health care professional to configure a treatment plan.
- R44 The system shall show a list of patients currently under treatment by the health care professional.
- R45 The system shall inform the patient of changes made to his treatment plan.
- R46 The system shall allow the health care professional to register a new patient.

The following requirement was derived from Use Case 2 on page 34.

- R47 The system should allow the health care professional to monitor the patient.

The following three requirements were derived from Use Case 3 on page 35.

- R48 The system shall allow the health care professional to send messages to the patient.
- R49 The system may allow the health care professional to send non-message feedback to the patient.
- R50 The system may allow the health care professional to save unsent messages for future use.

The following requirement was derived from Use Case 4 on page 36.

- R51 The system should provide ways to bill a patient using the treatment specification and details.

A way to fulfill the previous requirement, can be found in the implementation of Application Programming Interfaces (APIs) which can be used by existing billing software.

3.3 Design constraints

3.3.1 Standards compliance

- R52 The system shall inter-operate with other devices that adhere to the same standards regarding wireless communication.

3.3.2 Reliability

The user will have to trust the system. As such, informations and suggested proposed by the system should always be correct. If no complete certainty can be given regarding the provided information, more data should be gathered to support the data before an advice is given.

- R53 The system should always provide the user with accurate data.
- R54 The system may provide the user with indicators how confident it is about the given advice.

3.3.3 Availability

A self-management or teletreatment system should be available to the user as much of the time as possible. However, due to the multiplicity of parties involved, such as software providers, internet providers, service providers, and even electricity providers, it is not possible to indicate one single availability level.

- R55 The system shall adhere to the service level agreements made with the stakeholders.

A Personas

During the SWELL workshop on December 15th, 2011, as organized by Work Package 1, four situations in which a system user might be have been described. These can be divided over two categories of ailments, namely physical and psychological. The health problems can be in either of two stages. A person can be at risk of a certain problem, or can already be sick. If the person is *at risk*, he is not yet experiencing problems or is not showing signs of an ailment. However, he will suffer problems if his lifestyle is unchanged. A *sick* person is experiencing problems caused by the illness, or is exhibiting symptoms of said disease. A sick person is likely to be under active treatment of a health care professional.

During the workshop, a cross section was not made based on the situation of the user, i.e. either at work or at home, rather it was decided that the system under development has to be able to support a user throughout his entire day, regardless of location. As such, the type of problem and the severity were used as a basis for the cross section.

Using these cross sections, we have defined four personas. These personas are not “the” user, rather, they are users who might be using the SWELL system¹.

The personas described have been given names, background information, context information, a description of the problems as experienced by themselves and the reason why they have not solved these problems on their own, that is: why do they need an external intervention? Furthermore, two scenarios have been created for each persona: the first gives an impression of the current life of the persona, the second illustrates how this life is changed when using the SWELL system. In the table below we have listed the persona names.

Type of problem	At risk	Sick
Psychological	Marieke	Karel
Physical	Richard	Annet

This table is to be read in the following way: a persona has an ailment and a severity of this ailment. For example, Marieke is at risk with regard to psychological problems, and Annet is physically sick. These personas are discussed in the following sections. Firstly, the properties, context, problems experienced and the reason why the persona does not solve their own problem are discussed. Secondly, a problem scenario is described, illustrating the current problematic situation of the persona. Finally, a solution scenario is discussed, in which the persona is incorporating the SWELL system in their daily routine.

The “Karel” and “Annet” personas were not defined during the workshop mentioned above.

The persona descriptions in this section are preliminary and subject to change.

¹“A persona is a profile of a typical user; it is a description of an archetypal user [...] and includes a name, a social history, and a set of goals that drive the design of the product or web site.” [20]

A.1 Marieke

A.1.1 Properties

Marieke is an ambitious 32 year old female knowledge worker and project manager. She likes to have her affairs in order, has high moral values, and feels responsible to always obtain the best result. She uses IT for her work and, in order to work time and place independently, has a laptop computer and a smartphone.

A.1.2 Context

Marieke is currently dealing with a changing family situation. Together with her husband, she is planning to have their first child, which causes stress in her private situation. At work she is coping with a changing, dynamic work situation which includes customers with ever changing demands and uncertain working conditions in the projects she is the manager of.

Even though the situation at work is dynamic, Marieke is not able to adapt her working routine to this. Customers demand her to be available during regular working hours, but still she has to work evenings. As a result, she has no private time to relax with a hobby or sports.

A.1.3 Problems experienced

With the pressure from both her work and her personal situation, Marieke starts to feel she is not in control. She is no longer able to finish all of her work, and she has no time for her personal life. She is tired a lot and is easily agitated. Meanwhile, she feels guilty for, in her opinion, failing at everything.

A.1.4 Why these are not solved by the persona

Due to the strict limitations to her working schedule, Marieke is unable to alter her working days in order to make time for herself. Even though she would like to, she is not able to offload some of her responsibilities to team members. She also has trouble prioritizing tasks, marking everything as important.

While she is struggling with her problems, Marieke does not receive support from her partner into solving some of her issues. Her colleagues do not know Marieke is coping with the stress caused by pressure from her customers, boss, and employer.

A.1.5 Problem scenario

Marieke has to get up early in the morning. Her commute is lengthy and traffic is always busy. When she gets up, her husband complains she is waking him, as his alarm clock will not sound for an other hour.

Marieke takes a quick breakfast and gets into her car. While driving to work, and standing in traffic jams, she listens to the current news on the radio. In her head, she is thinking about her schedule for the day and what meetings she will have.

Just in time for her first meeting, she arrives at work. She checks her smartphone what meeting room she should go to. The customer she is to meet with is not happy with the progress Marieke's team is making for the project. She apologizes and thinks of ways she can improve the way the project team operates.

When she returns to her office, she sees in her digital calendar that she is late for an other appointment. She has to rush to the meeting room, and apologizes for her late arrival. Some colleagues remark that she has been late for the last few meetings too. Marieke feels she is losing her grip on her calendar.

At the end of the working day, she arrives home, only to find her husband waiting for her to cook. He is cross with her, as she is again home late, remarking that this will not be possible anymore once they have a baby. Marieke starts to doubt whether they should have a child at all.

After dinner, Marieke retires to her home office to work on her laptop for a few more hours. She knows she will have an other busy day the next day and nobody to help her with this work.

Marieke tries to get a bit of relaxation at the end of the evening. She wants to read a book, but, just like the other evenings she wanted to read, her head is still busy with her tasks for her job.

A.1.6 Solution scenario

After getting up in the morning, Marieke has breakfast alone. Her husband does not get up with her, as he does not have to commute as far as she does. This, however, is fine with her, as it gives her time to prepare for work. During her breakfast, her tablet pc informs her about her meetings this day and where they are. The system uses both her calendar, her current position and traffic information to inform her. When it is time for her to leave, her tablet notifies her of this.

While she is commuting by car, the SWELL system in her navigation device notifies her of a route that can prevent her ending up in a traffic jam. She decides to follow this advice and arrives at her work early, leaving time for her first meeting. The system on her desktop computer presents her with the documents she has to read through to prepare for the meeting. These documents have been selected by the smart reasoning algorithm, which has linked their usage to the upcoming meeting.

At the end of the day, Marieke her SWELL equipped smartphone notifies her it is time to go home. This notification is giving in order to prevent her from overworking and getting a burnout. As she is leaving, her boss compliments her on her work on the previous project.

As Marieke arrives home, her husband has made them dinner. Over the course of their meal, they discuss their days.

In the evening, Marieke can relax and have some time for herself. She knows she can not work anymore, as SWELL is preventing company e-mail to interrupt her evening. She

has enabled this feature herself, and can disable it if she wishes to. She can read a book to get her mind off work, knowing that SWELL will present her tasks for the next day when she is having breakfast the next morning.

A.2 Richard

A.2.1 Properties

Richard is a 42 year old male. He is married and has three young children. He does not like to exercise, but does like to cook. He is critical about his surroundings and perfectionistic about his work, but not so much about himself. Richard likes technology and gadgets. During his free time, he is a Scout leader for the Scouting group his kids are in.

A.2.2 Context

Richard's family is one of a dual income. He and his wife both work four days per week, of which two from home. His work and private life are both busy, but do not motivate him as much as he would like. Although he likes cooking, it is often a burden during the week, requiring the meal to be cooked quickly.

For his work, he has to travel abroad at least once per month. When traveling to his office, Richard always takes the car, even though he could arrive faster at work if he went by bike.

A.2.3 Problems experienced

With his lack of physical activity, Richard's physical condition has declined over the years. He has little energy, is tired a lot, and is starting to develop overweight. With his day completely filled up, he has little time to completely relax. He, however, does not blame this on his way of living, rather, he tends to blame it on being temporarily busy at work.

A.2.4 Why these are not solved by the persona

Although he has some health complaints, Richard does not yet recognize the need to change his lifestyle. His wife tries to urge him in to exercising more, but still he retains the sedentary lifestyle his daily routine forces him in. With too much to do each day, he does not feel like changing anything at all.

A.2.5 Problem scenario

After a night of flying from his last business trip, Richard arrives at the airport early in the morning. Hungry, as he did not like the airplane food, he exits the plane and goes to the nearest fast-food restaurant. After he has eaten some fries, he goes to the parking lot, stepping into his car to drive home.

When arriving home, Richard knows he still has a business day ahead of him. He is greeted by his wife, who is just getting ready for her working day too. Richard changes his clothes and gets back into his car, leaving for work.

Arriving at work, Richard sits down behind his desk, where he remains for the majority of the morning. When it's time for lunch, he remembers he forgot to take something to eat from home. He has to admit to himself that he rarely takes a sandwich from home, which would be healthier for him. He shrugs it off, and buys something in the canteen. While picking his meal, he is tempted to add a fried snack to his lunch. "What harm can it do," he justifies his choice to himself.

In the afternoon, Richard has a few meetings. In between, he works at his desk, focused on finishing his project on time.

After a commute by car back home, he makes a quick diner. Although he likes cooking, he feels like he does not have time for this. "At least it's not a microwave diner," he thinks to himself. Richard has just finished cooking when his wife arrives home.

In the evening, Richard decides to work an additional hour to finalize one of his projects. "Why can't you spend as much time exercising as you are working at home at night?" his wife asks jokingly, patting him on his stomach. Richard laughs and goes to work in the study until it is time to go to bed.

A.2.6 Solution scenario

As his day begins, Richard has a healthy breakfast. He started using the SWELL system not long ago, but now he uses it to pick out his groceries. These items are all healthier than his previous breakfast ingredients.

Kissing his wife and kids goodbye, Richard gets on his bicycle and peddles to work. He laughs at the traffic jam he passes, knowing he was in those jams a few weeks ago. His smartphone, which is equipped with the SWELL system, monitors his route and calculates the amount of calories used for later visualization.

As with any other day, his morning is busy with meetings and activities. When it is time for his lunch, Richard checks his desktop computer which items he should buy in the canteen. The SWELL system contacts the company servers and retrieves a list of healthy meals, compiles a lunch for Richard and shows it to him.

At the end of the day, Richard rides home again. Arriving home, his wife has already made diner using the recommended recipes in the SWELL app on the family's tablet pc. The application takes all the family members into account, making sure the diner is well balanced.

Richard decides to go to the gym in the evening. His SWELL system advises him to go twice per week. His workout is compiled for him, being shown on the screen of his smartphone. He is already noticing the benefits of his working out: his physical condition is improving and he is losing weight.

A.3 Karel

A.3.1 Properties

Karel is a 56 year old manager. He has had a good working life and is now at the position he will be at until his retirement in a few years. He works at a financial company and is at middle management level. He has a son and a daughter, age 23 and 20, who both study at a university and live on campus.

A.3.2 Context

Due to the financial crisis, Karel's company is under a lot of pressure and is firing people to reduce costs. This causes stress among all employees and in people with Karel's age in specific. He knows that it will be difficult to land a new job if he gets fired, as he is highly specialized in his field and at this specific company. He is also too young to retire already. He is forced to prove himself every day, but is not given the resources to successfully finish all tasks assigned to him.

A.3.3 Problems experienced

Karel feels as if he is unable to decide about his own future. Not able to even see what is going to happen in a months time, he lives in constant uncertainty. As a result, he has trouble sleeping, is angry, even at his family and friends, and he is working all day, every day. As a result, he no longer has time for his family and friends.

A.3.4 Why these are not solved by the persona

Working is currently the only solution to any problem Karel knows. He fears for his job, so he wants to make himself invaluable to the company. Because he can only focus on his work, he can not see the bigger picture. He knows he should get help, but as he thinks this will cost him more money and time than it brings him, he opts not to go to a specialist. His wife does encourage him to go, but he ignores this advice.

A.3.5 Problem scenario

When Karel enters his office in the morning, the first subject of conversation with his colleagues is the imminent cut in personnel by MoneyBank, the company Karel works at. He has been an employee for nearly 15 years now, but despite this, he knows his job may also be on the line. He can almost feel his hair getting gray.

After his initial chat with his coworkers, Karel has a meeting with his boss. There he is told that the new reorganization will be executed faster than initially anticipated. 20% of the people in Karel's department will have to be let go. Karel is shocked by this news and frustrated as his boss tells him he cannot inform his coworkers about this.

Depressed about the news, Karel quickly goes back to his work. He wants to make sure he is not in the 20% that is going to be laid off. When it is time to have lunch, he continues working, not accepting his colleague's invitation to go out and buy lunch.

In the afternoon, he has to finish a project plan for an upcoming product. The plan is due the same afternoon, but Karel has been too busy to complete it. Throughout the process, he keeps being interrupted by colleagues, all wanting his opinion or feedback on work. At the end of the day, the project plan is all but finished. Karel phones to his wife, explaining the situation and that he has to remain at work until the plan has been completed. She responds understandingly, but Karel knows she does not like it when he works late. This is the second week in a row that he has not been able to join her for dinner in the evening, and he knows many more days like this will follow.

A.3.6 Solution scenario

When Karel gets to work in the morning, he is one of the first to arrive. It has been a tough few months. After the reorganization, he was so stressed that his doctor recommended him to stay at home for a while. Two weeks ago, his doctor decided he could start working again, but not yet full time. Before last week, Karel had not worked in half a year. He started working again in a new department with a new boss.

Entering his office, he starts off with some smalltalk with his colleague, who is already present in their shared room. Starting up his computer, the system shows him his tasks for today. They are presented and ordered in such a way that they pressure Karel as little as possible. As such, not all tasks are shown, rather, a specific set is selected for the day, the rest is saved for the rest of the week.

His computer activity is tracked throughout the day and a report of this is sent to Karel's therapist. His general practitioner suggested Karel to visit one when he first started to exhibit burnout symptoms. He also made sure Karel started using the SWELL system. Now, both his doctor and his therapist can keep an eye on him to make sure his treatment plan is effective.

Throughout the day SWELL monitors Karel's way of working and his physical state. If any of the parameters, as set by the therapist, are crossed, the system alerts Karel of this. This notification is targeted at Karel's specific needs and demands.

At the end of the afternoon, Karel first goes to his therapist before heading home. Together, they analyze the data collected by SWELL and decide on how to continue the treatment plan. Karel's therapist is content with the progress Karel is making and encourages him to keep it up.

A.4 Annet

A.4.1 Properties

Annet is a 48 year old secretary at a large multinational company. She has been working there for the past 5 years. Before that, she was a full-time stay-at-home mother for her two

sons, now 17 and 19. When the boys were at an age they could take care of themselves, Annet wanted to start working again.

A.4.2 Context

A few years ago, Annet was busy all day, performing labor around the house. This kept her active. These days, however, Annet's lifestyle has become increasingly sedentary. She no longer cycles, and she sits behind her desk all day. She has a cookie jar on her desk to share with her colleagues, but the majority of the contents gets eaten by herself.

A.4.3 Problems experienced

Annet knows her weight is starting to cause problems at the moment and even more so in the future. Already she has difficulties to find nice clothes as most of the fashion she likes is only available in smaller sizes. On the streets, children have started to laugh due to her size.

Annet knows her lifestyle might lead to type 2 diabetes. She is, however, afraid to go to the doctor to find out if she might already have the disease. She has knee problems and as such, never takes the stairs, even though her office is on the second floor.

A.4.4 Why these are not solved by the persona

The gaining of weight has been a slow process and it is not until recently that Annet is really noticing that she has indeed gained a lot over the past few years. At this point, she does not know where to start her new, healthier life.

A.4.5 Problem scenario

Before going to work, Annet has a bowl of cereal and a muffin as breakfast. She thinks this is a pretty good start of the day, even though it is not. The cereal is sweetened, containing a lot of sugar, so does the muffin. Annet exits the front door and enters her car.

When Annet arrives at work, she has trouble getting out of the car. She blames it on her bad back, her age and her work, but her problems are in fact caused by her bad lifestyle. At 1.64m, she is of average height, but with a weight of little under 90 kilograms, she is much heavier than most women her height and age.

She greets the janitor as she enters the office building. She walks up to the elevator and presses the button to go up. She looks at the display, which indicates the elevator has to come from the 12th floor. She has to wait quite a while for the car to arrive. She walks in and presses the button for the second floor. The elevator brings her just one story up, which she could have traveled much faster if she had taken the stairs.

As she sits down behind her desk, she refills the cookie jar with some new snacks she brought from home. Somehow, the jar keeps emptying, even when not a lot of colleagues visit her on a day. She starts up her computer and as she waits, takes a cookie from the jar.

At the end of the day when Annet returns home, she decides she has had enough of her ailments and decides to call the doctor to make an appointment. She does not yet know

how she is going to be helped, but she is determined to get her health back. Annet does not know it, but the doctor will want her to use the SWELL system in order to help and monitor her. Her appointment is in three days.

A.4.6 Solution scenario

It has been three weeks since Annet's first visit to her general practitioner. He quickly recognized her problems and was even quicker with a solution. He forwarded Annet to a dietitian, but not before requiring her to start using the SWELL system. Through it, both the doctor and the dietitian can track Annet's treatment progress.

Instead of taking the car to work, Annet goes by bike. It takes her slightly longer, but her journey is getting shorter as her condition improves. SWELL tracks her daily commutes and the time required for the trip. Annet can see this visualized in the application. She likes seeing her cycle times getting shorter every day.

When she arrives at work, she takes the stairs up one floor to her office. The doctor gave her instructions on how to improve her physical condition and stamina. Taking the stairs and commuting by bike were the first advices Annet had to take.

When it is time for lunch, Annet checks her SWELL system what her dietitian has advised her to eat. The system presents her with a suggestion, which is the combination of the diet advice and the current menu at the canteen.

As Annet returns home at the end of the day, she checks her SWELL dashboard on her computer. Here, she gets a visual representation of her total activity during the day and the amount of activity she should be undertaking. She sees she has not yet reached her goal for the day, so she decides to take a long walk before dinner.

B Use cases

Using the persona descriptions from Appendix A, we have created use case scenarios that describe how an actor might interact with the SWELL system. A use case description contains the following elements:

Goal	The overall goal of the use case: what is to be accomplished by executing this case.
Actor	Who is interacting with the system? In the current use cases, the actor is either a user, as defined in Section 1.3 on page 1.
Precondition	The constraints that have to hold before a use case can be executed.
Post condition	The result of the use case.
Trigger	The event that causes the use case to be executed.
Main flow	The primary set of steps that cause the scenario to be executed successfully.
Alternative flow	Some scenario's might contain alternative steps. These are described in the alternative flow.

In the 'Main flow' and the 'Alternative flow', we distinguish the actions performed by the actor and by the system by printing the actor actions in a regular font, and *the system actions in an italic font*. The structure as used is based on the use case templates described in [21].

The general structure of how the users interact with the system is depicted in Figure B.1. This figure illustrates that the user can be either under treatment or he can use the system in a self-management setting.

Figure B.2 is more detailed, explaining how the two general use cases are structured.

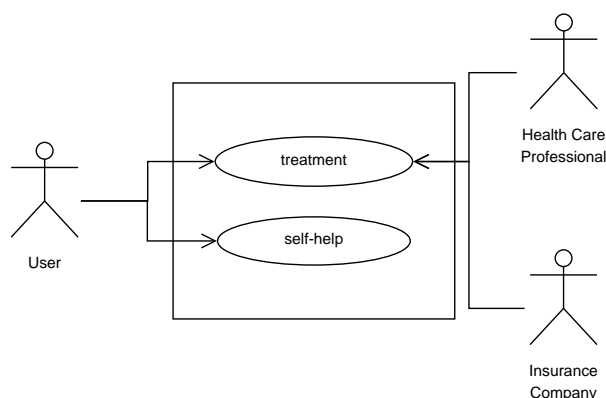


Figure B.1: High level use case diagram

Use Case 1**Configure treatment plan**

<i>Goal</i>	The health care professional configures a treatment plan for a patient in the system.
<i>Actor</i>	Health care professional
<i>Precondition</i>	-
<i>Post condition</i>	The treatment plan is configured in the system.
<i>Trigger</i>	The patient visits the health care professional for the first time.
<i>Main flow</i>	<ol style="list-style-type: none">1. The patient and health care professional decide upon a treatment for the patient's ailment.2. The health care professional logs into the SWELL system.3. <i>The SWELL system shows a list of patients for the health care professional.</i>4. The health care professional selects the patient.5. <i>The SWELL system shows the current treatment plans for the patient.</i>6. The health care professional configures the treatment plan for the patient.7. <i>The SWELL system shows the new treatment plan.</i>8. <i>The SWELL system sends a confirmation to the patient.</i>
<i>Alternative flow</i>	New patient <ol style="list-style-type: none">4. The health care professional registers the patient in the system.
<i>Derived from</i>	"Sick" persona scenarios.

Use Case 2
Monitor patient treatment

<i>Goal</i>	The health care professional gets insight into the daily activities of the user.
<i>Actor</i>	Health care professional
<i>Precondition</i>	At least one treatment plan is configured for the user.
<i>Post condition</i>	The health care professional has insight in the state of the user.
<i>Trigger</i>	The health care professional wants to monitor the user and possibly pose an intervention.
<i>Main flow</i>	<ol style="list-style-type: none">1. The health care professional logs into the SWELL system.2. <i>The SWELL system provides a list of users who are currently under treatment of the health care professional.</i>3. The health care professional selects the user he wants to monitor.4. <i>The SWELL system shows the vital signs, activity, and current treatment progress of the user.</i>
<i>Alternative flow</i>	-
<i>Derived from</i>	"Sick" persona scenarios.

Use Case 3**Provide feedback**

<i>Goal</i>	The health care professional provides the user with feedback.
<i>Actor</i>	Health care professional
<i>Precondition</i>	The health care professional is logged in and monitoring the patient.
<i>Post condition</i>	A feedback message is sent to the user.
<i>Trigger</i>	In order to successfully complete the treatment plan as configured in the system, the user requires feedback from the health care professional.
<i>Main flow</i>	<ol style="list-style-type: none"> 1. The health care professional indicates to the system he wants to send feedback to the patient. 2. <i>The SWELL system shows a feedback form, which allows the health care professional to indicate the type of feedback and a message. Predefined messages are also available.</i> 3. The health care professional selects he wants to send a new message, fills out the form and confirms he wants to send it. 4. <i>The SWELL system sends the message to the patient and confirms this to the health care professional.</i>
<i>Alternative flow</i>	<p>Cancel feedback (storing message)</p> <ol style="list-style-type: none"> 3. The health care professional cancels sending his feedback. 4. <i>The SWELL system asks the health care professional if he wants to save the message for future use.</i> 5. The health care professional answers this question positively. 6. <i>The SWELL system stores the message and returns to the monitoring page.</i> 7. <i>The SWELL system shows the stored message on the monitoring page, allowing the health care professional to send it if needed.</i> <p>Cancel feedback (discarding message)</p> <ol style="list-style-type: none"> 3. The health care professional cancels sending his feedback. 4. <i>The SWELL system asks the health care professional if he wants to save the message for future use.</i> 5. The health care professional answers this question negatively. 6. <i>The SWELL system discards the message and returns to the monitoring page.</i>
<i>Derived from</i>	"Karel" persona scenario.

Use Case 4**Bill patient for treatment**

<i>Goal</i>	A patient is under treatment by the health care professional and has to be billed for this.
<i>Actor</i>	Health care professional, insurance company
<i>Precondition</i>	The patient is under active treatment by the health care professional
<i>Post condition</i>	A bill has been sent to the patient's insurance company.
<i>Trigger</i>	The patient's payment is due.
<i>Main flow</i>	<ol style="list-style-type: none"> 1. The health care professional logs into the system. 2. <i>The SWELL system shows a list of current patients under treatment.</i> 3. The health care professional selects a patient. 4. <i>The SWELL system shows a list of current treatments.</i> 5. The health care professional selects the treatment for which payment is due. 6. <i>The SWELL system sends a message to the insurance company, stating the treatment and the fee which is due.</i> 7. <i>The SWELL system confirms to the health care professional that the message has been sent.</i>
<i>Alternative flow</i>	-
<i>Derived from</i>	Stakeholder analysis.

Use Case 5**Monitor treatment goals**

<i>Goal</i>	The user wants to gain insight into his self-management goals.
<i>Actor</i>	User
<i>Precondition</i>	At least one treatment goal is configured.
<i>Post condition</i>	The user has insight into his current progress in his treatment.
<i>Trigger</i>	The user wants to gain insight into his progress in his treatment plan.
<i>Main flow</i>	<ol style="list-style-type: none">1. The user logs into the SWELL system.2. <i>The SWELL system shows a list of current treatments.</i>
<i>Alternative flow</i>	Display details <ol style="list-style-type: none">3. The user indicates he wants to see the details of a specific treatment plan.4. <i>The SWELL system shows the details of the indicated plan, including the feedback sent by the health care professional.</i>5. The user indicates he has seen the details and wants to return to the main screen.6. <i>The SWELL system returns to the list of goals as in step 2.</i>
<i>Derived from</i>	“Sick” persona scenarios.

Use Case 6**Receive health care professional feedback**

<i>Goal</i>	The user receives feedback from the health care professional.
<i>Actor</i>	User
<i>Precondition</i>	The treatment plan is configured in the system, the health care professional has sent feedback through the SWELL system.
<i>Post condition</i>	The user is provided with feedback from the health care professional.
<i>Trigger</i>	The health care professional has monitored the user and wants to pose an intervention.
<i>Main flow</i>	<ol style="list-style-type: none"> 1. <i>The SWELL system notifies the user of a new feedback message from his health care professional.</i> 2. The user reads the message. 3. The user acknowledges he has read the message. 4. <i>The SWELL system sends the acknowledgment to the health care professional.</i>
<i>Alternative flow</i>	<p>Unacknowledged message</p> <ol style="list-style-type: none"> 3. The user does not acknowledge the message. 4. <i>The SWELL system shows the message until the user has acknowledged he has read it.</i>
<i>Derived from</i>	“Sick” persona scenarios.

Use Case 7
Configure self-management goals

<i>Goal</i>	The user has bought the SWELL system in order to attain a healthier lifestyle.
<i>Actor</i>	User
<i>Precondition</i>	-
<i>Post condition</i>	The self-management goals are configured.
<i>Trigger</i>	The user has bought the system.
<i>Main flow</i>	<ol style="list-style-type: none">1. The user registers the system.2. <i>The SWELL system presents the user with a short questionnaire, which is needed in order to establish a baseline.</i>3. The user fills out the questionnaire.4. The user logs into the system.5. <i>The SWELL system provides the user options for self-improvement.</i>6. The user selects an option.7. <i>The SWELL system requests specific goals.¹</i>8. The user sets his goals.9. <i>The SWELL system confirms the goals.</i>
<i>Alternative flow</i>	-
<i>Derived from</i>	"At risk" persona scenarios.

Use Case 8**Monitor self-management goals**

<i>Goal</i>	The user wants to gain insight into his self-management goals.
<i>Actor</i>	User
<i>Precondition</i>	The user has at least one self-management goal configured.
<i>Post condition</i>	The user has insight into his current state and progress toward his goals.
<i>Trigger</i>	The user wants to gain insight into his personal goals.
<i>Main flow</i>	<ol style="list-style-type: none"> 1. The user logs into the SWELL system. 2. <i>The SWELL system displays a list of current goals and their progress</i>
<i>Alternative flow</i>	<p>Display details</p> <ol style="list-style-type: none"> 3. The user indicates he wants to see the details of a specific goal. 4. <i>The SWELL system shows details of the indicated goal.</i> 5. The user indicates he has seen the details and wants to return to the main screen. 6. <i>The SWELL system returns to the list of goals as in step 2.</i> <p>No goals set</p> <ol style="list-style-type: none"> 2. <i>The SWELL system indicates no current goals are set and provides the user with means to set one.</i> <p>Adjust a goal</p> <ol style="list-style-type: none"> 2. The user indicates he wants to adjust a set goal. 3. <i>The SWELL system provides the user a way of changing the goal settings.</i> 4. The user changes the desired goal parameters and confirms the changes. 5. <i>The SWELL system confirms the changes and shows the user the list of goals as in step 2.</i>
<i>Derived from</i>	“At risk” persona scenarios.

Use Case 9**Receive self-management feedback**

<i>Goal</i>	The user receives feedback from the SWELL system regarding his self-management goals.
<i>Actor</i>	User
<i>Precondition</i>	At least one self-management goal is configured.
<i>Post condition</i>	The user is informed about his current status and how changing it can benefit progress toward his self-management goal.
<i>Trigger</i>	The reasoning system of SWELL has generated feedback for the user.
<i>Main flow</i>	<ol style="list-style-type: none">1. <i>The SWELL system notifies the user of a new self-management feedback message.</i>2. The user reads the message.
<i>Alternative flow</i>	-
<i>Derived from</i>	"At risk" persona scenarios.

Use Case 10
Provide travel information

<i>Goal</i>	The SWELL system provides the user with travel information based on several factors.
<i>Actor</i>	User
<i>Precondition</i>	The SWELL system has access to the user's calendar and travel websites.
<i>Post condition</i>	The user is informed about which means of travel to use.
<i>Trigger</i>	It is time for the user to undertake a journey, based on his calendar and travel times.

<i>Main flow</i>	<ol style="list-style-type: none"> 1. <i>The SWELL system knows when the next meeting for the user will be and where the user has to be at that time.</i> 2. <i>The SWELL system calculates travel times, based on knowledge of the user's possible ways of transportation.</i> 3. <i>The SWELL system notifies the user at the first time needed to start a journey. The system will notify the user it is time to leave when the current time is the amount time required for the trip by the slowest means of transportation before the meeting starts. $t_{alarm} = t_{current} - \Delta t_{required_{slowest}}$.</i> 4. <i>The SWELL system shows the possible means of transportation, starting with the one requiring the most time.</i> 5. <i>The user selects the first means of transportation.</i> 6. <i>The SWELL system provides travel information.</i>
------------------	--

<i>Alternative flow</i>	<p>Alternative means of transportation</p> <ol style="list-style-type: none"> 5. <i>The user selects an other than the first means of transportation.</i> 6. <i>The SWELL system recalculates the journey.</i> 7. <i>The SWELL system re-notifies the user when it is time to start the travel, showing the travel information for the selected means of transportation.</i>
-------------------------	--

Calorie counter

4. *The SWELL system shows the possible means of transportation, starting with the one requiring the most time. The system additionally shows the amount of activity undertake when using this form of transportation, allowing the user to select the healthiest option.*

<i>Derived from</i>	"Marieke" persona scenario.
---------------------	-----------------------------

Use Case 11**Show relevant documents**

<i>Goal</i>	Before a meeting, the user might want to prepare. The system can provide the documents relevant to the meeting to the user.
<i>Actor</i>	User
<i>Precondition</i>	The user has marked documents to be relevant to a meeting and the SWELL system has access to the user's calendar.
<i>Post condition</i>	The user has access to relevant documents.
<i>Trigger</i>	A meeting is scheduled in the calendar.
<i>Main flow</i>	<ol style="list-style-type: none">1. <i>The SWELL system shows the user a meeting is nearing.</i>2. <i>The SWELL system presents the user with documents related to the meeting so the user can prepare for the meeting.</i>3. The user starts reading the documents.4. The user finishes reading the document.5. <i>The SWELL system marks the document as read.</i>6. <i>The SWELL system shows the list until all documents have been read.</i>
<i>Alternative flow</i>	The user does not want to read the documents <ol style="list-style-type: none">3. The user indicates he does not want to read the documents.4. <i>The SWELL system stops showing the list of documents.</i>
<i>Derived from</i>	"Marieke" persona scenario.

Use Case 12**Prevent free time interruption**

<i>Goal</i>	Users that are under stress and want to reduce their work pressure, might not want to be interrupted by work related e-mails and phone calls when they are at home.
<i>Actor</i>	User
<i>Precondition</i>	The user is at home and the current time is not considered work time.
<i>Post condition</i>	The user is shielded from undesired work e-mail and telephone calls.
<i>Trigger</i>	The user is e-mailed.
<i>Main flow</i>	<ol style="list-style-type: none"> 1. <i>The SWELL system intercepts e-mail or call sent to the user.</i> 2. <i>The SWELL system verifies if the sender e-mail address or phone number is that belonging to a business contact of the user or that the receiving e-mail address is the company address of the user.</i> 3. <i>The SWELL system stores the e-mail to be shown the next business day, phone calls are redirected to the voice mail box of the user.</i>
<i>Alternative flow</i>	<p>White-listed or personal</p> <ol style="list-style-type: none"> 3. <i>The SWELL system has verified that the sender or caller is on the user's white-list or the e-mail or phone call is not business related.</i> 4. <i>The SWELL system shows the e-mail or phone call to the user.</i> 5. The user can open the e-mail or answer the phone call.
<i>Derived from</i>	"Marieke" persona scenario.

Use Case 13**Provide recipe information**

<i>Goal</i>	The system contains information about healthy recipes or can interface to services that provide such information. The user can use these in order to obtain a better lifestyle.
<i>Actor</i>	User
<i>Precondition</i>	-
<i>Post condition</i>	The user is provided with recipe information.
<i>Trigger</i>	The user wants to cook a healthy meal.
<i>Main flow</i>	<ol style="list-style-type: none">1. The user indicates he would like recipe information.2. <i>The SWELL system provides the option to select one or more ingredients.</i>3. The user selects an ingredient.4. <i>The SWELL system shows a list of recipes that contain the ingredients.</i>5. The user selects a recipe.6. <i>The SWELL system shows the recipe details.</i>
<i>Alternative flow</i>	Intelligent refrigerator <ol style="list-style-type: none">2. <i>The SWELL system provides a list of recipes that can be created using the items currently in the refrigerator.</i>3. The user selects a recipe.4. <i>The SWELL system shows the recipe details.</i>
<i>Derived from</i>	“Richard” persona scenario.

Use Case 14
Facilitate grocery list

<i>Goal</i>	In order to aid the user in attaining a healthier eating habit, the SWELL system can create a grocery list for them.
<i>Actor</i>	User
<i>Precondition</i>	-
<i>Post condition</i>	The user is provided with a list of groceries.
<i>Trigger</i>	The user indicates he wants a generated grocery list.
<i>Main flow</i>	<ol style="list-style-type: none"> 1. <i>The SWELL system uses information about the user, his family and his daily required calorie intake to generate a list of recipes.</i> 2. <i>The SWELL system decomposes the recipes into ingredient lists.</i> 3. <i>The SWELL system sorts the ingredient list based on their location in the supermarket.</i> 4. <i>The SWELL system shows the list to the user, allowing the user to add additional groceries or print the list.</i> 5. The user prints the list.
<i>Alternative flow</i>	<p>Add groceries</p> <ol style="list-style-type: none"> 5. The user indicates he wants to add groceries to the list. 6. <i>The SWELL system indicates a field that allows the user to input the groceries.</i> 7. The user inputs the groceries 8. <i>The SWELL system sorts the groceries according to their location in the supermarket.</i> 9. <i>The SWELL system shows the list to the user.</i> 10. The user prints the list.
<i>Derived from</i>	“Richard” persona scenario.

Use Case 15

Provide diet information

<i>Goal</i>	To aid the user in attaining a healthier lifestyle, the SWELL system can advise the user on what to eat.
<i>Actor</i>	User
<i>Precondition</i>	Diet goals are configured.
<i>Post condition</i>	The user has diet information.
<i>Trigger</i>	The user wants to have a meal.
<i>Main flow</i>	<ol style="list-style-type: none"> 1. The user indicates he wants to have a meal. 2. <i>The SWELL system provides a list of possible meals, based on context information and the user's diet goals.</i> 3. The user selects one of the meals. 4. <i>The SWELL system provides information about the meal.</i>
<i>Alternative flow</i>	<p>Diet information provided by health care professional</p> <ol style="list-style-type: none"> 2. <i>The SWELL system knows of the user's dietitian's advice.</i> 3. <i>The SWELL system uses the advice to present possible meals.</i> 4. The user selects a meal. <p>Have lunch at the canteen</p> <ol style="list-style-type: none"> 2. <i>The SWELL system knows the user is at work.</i> 3. <i>The SWELL system connects to the website that shows the current canteen menu.</i> 4. <i>The SWELL system shows meal suggestions based on the current menu.</i> 5. The user selects a meal to get more information.
<i>Derived from</i>	"Physical problem" persona scenarios.

Use Case 16
Prioritize tasks

<i>Goal</i>	The system should support the user in making decisions on which task to perform first.
<i>Actor</i>	User
<i>Precondition</i>	The user has set tasks in his calendar and the SWELL system is configured to reduce stress.
<i>Post condition</i>	The user is provided with tasks that are to be performed the same day.
<i>Trigger</i>	Task deadlines are nearing.
<i>Main flow</i>	<ol style="list-style-type: none"> 1. <i>The SWELL system retrieves a list of all tasks from the user's calendar</i> 2. <i>The SWELL system makes a prioritized list of the tasks, based on their priority and amount of time left before the deadline.</i> 3. <i>The SWELL system shows the user the shortened list of tasks.</i> 4. The user starts working on the tasks.
<i>Alternative flow</i>	<p>Finish task</p> <ol style="list-style-type: none"> 5. The user has finished a task, and he marks it on the list. 6. <i>The SWELL system removes the task from the list.</i> <p>Finish task list</p> <ol style="list-style-type: none"> 7. The user has finished all tasks on the list. 8. <i>The SWELL system does not allow the user to perform additional tasks, as this could increase work pressure for the user.</i>
<i>Derived from</i>	"Karel" persona scenario.

Use Case 17**Report data to health care professional**

<i>Goal</i>	To make monitoring and treatment of the patient possible, the SWELL system sends regular messages with data to the health care professional.
<i>Actor</i>	Health care professional
<i>Precondition</i>	The user has authorized the system to send data without intervention.
<i>Post condition</i>	The health care professional has the obtained data in a summarized form.
<i>Trigger</i>	A temporal event occurs, e.g. a week has passed.
<i>Main flow</i>	<ol style="list-style-type: none">1. <i>The SWELL system aggregates the collected data which is selected as useful for the health care professional.</i>2. <i>The SWELL system summarizes the data.</i>3. <i>The SWELL system shows a new message on the portal page of the health care professional.</i>4. The health care professional indicates he wants to read the new message.5. <i>The SWELL system shows the summarized data to the health care professional.</i>6. The health care professional verifies the data.7. The health care professional indicates he wants to return to the portal screen.8. <i>The SWELL system stores the data in the patients dossier.</i>
<i>Alternative flow</i>	-
<i>Derived from</i>	"Sick" persona scenarios.

List of Requirements

R1	The system shall not require the user to have to intervene in order to operate successfully.	15
R2	The system shall adapt or allow adaptation of the interface to fit the user's preferences.	15
R3	The system shall encourage the user to live and work healthier and better.	15
R4	The system shall provide the user with a web interface, as described in SWELL Deliverable D1.3a.	15
R5	The system may be presented to the user as a mobile phone app.	15
R6	The system may include social media.	15
R7	The system may be presented to the user as a game.	15
R8	The system may combine information about users anonymously and present it to all the users in the form of an appliance.	15
R9	The system shall support the use of multiple devices.	16
R10	The system should consist of either a mobile or a stationary part, or a combination of both.	16
R11	The system shall contain consistent data on all devices used.	16
R12	The system shall aid the user in order to gain insight in their activities and attain a healthier and more informed life.	16
R13	The system shall use smart reasoning algorithms to provide the user with advice regarding his goals.	16
R14	The system shall allow the user to set his own self-management goals.	16
R15	The system shall ask the user questions in order to establish a baseline for the reasoning algorithm.	16
R16	The system shall show the user his own self-management goals.	16
R17	The system shall show the user his progress in his self-management goals.	16
R18	The system shall allow the user to alter his self-management goals.	16
R19	The system shall show the user his progress in a treatment plan.	16
R20	The system shall deliver feedback from the health care professional to the user.	16
R21	The system shall show the user feedback from his health care professional.	16
R22	The system should ask the user for read confirmation.	16
R23	The system shall send read confirmation to the health care professional.	16
R24	The system may show the user travel information based on his calendar.	17
R25	The system may show the user documents relevant to a meeting.	17
R26	The system should inform the user about impending calendar items.	17

R27	The system may be integrated in car navigation devices.	17
R28	The system should prevent the user's free time to become fragmented.	17
R29	The system may withhold e-mails from the user based on given criteria.	17
R30	The system should allow for task management.	17
R31	The system shall show the user nutritional information on food.	17
R32	The system shall help the user to compile a healthy meal.	17
R33	The system should help the user to create a shopping list with healthy food.	17
R34	The system shall track physical activity.	17
R35	The system should advice the user on meals.	17
R36	The system should interface with services that provide nutritional information about food.	17
R37	The system should provide a cookbook functionality.	17
R38	The system may aid the user in creating a workout program.	17
R39	The system may pre-selection tasks for the user.	17
R40	The system shall track user work activity and workload.	17
R41	The system may prioritize tasks for the user.	17
R42	The system shall notify a health care professional if vital values of the patient are outside a predefined range.	18
R43	The system shall allow the health care professional to configure a treatment plan.	18
R44	The system shall show a list of patients currently under treatment by the health care professional.	18
R45	The system shall inform the patient of changes made to his treatment plan.	18
R46	The system shall allow the health care professional to register a new patient.	18
R47	The system should allow the health care professional to monitor the patient.	18
R48	The system shall allow the health care professional to send messages to the patient.	18
R49	The system may allow the health care professional to send non-message feedback to the patient.	18
R50	The system may allow the health care professional to save unsent messages for future use.	18
R51	The system should provide ways to bill a patient using the treatment specification and details.	18
R52	The system shall inter-operate with other devices that adhere to the same standards regarding wireless communication.	18
R53	The system should always provide the user with accurate data.	19
R54	The system may provide the user with indicators how confident it is about the given advice.	19
R55	The system shall adhere to the service level agreements made with the stakeholders.	19

Bibliography

- [1] *IEEE Recommended Practice for Software Requirements Specifications*, IEEE Software Engineering Standards Committee Std. 830.1998, 2009. [Online]. Available: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=720574>
- [2] W. Kraaij, "COMMIT Projectplan, Workpackages, Deliverables, Budget User Centric Reasoning for Well-working (P07)," TNO, Project planning, 2011.
- [3] A. Kidd, "The marks are on the knowledge worker," in *Proceedings of the SIGCHI conference on Human factors in computing systems: celebrating interdependence*, ser. CHI '94. New York, NY, USA: ACM, 1994, pp. 186–191. [Online]. Available: <http://doi.acm.org/10.1145/191666.191740>
- [4] Oxford Dictionaries. (2010, April) Oxford Dictionaries. Oxford University Press. [Online]. Available: <http://oxforddictionaries.com>
- [5] Merriam-Webster. (2011) Merriam-Webster.com. [Online]. Available: <http://www.merriam-webster.com>
- [6] W. Hooftman, J. K. Hesselink, J. van Genabook, N. Wiezer, and D. Willems, "Arbobalans 2010: Kwaliteit van de arbeid, effecten en maatregelen in nederland," TNO, Tech. Rep., 2011.
- [7] Centraal Bureau voor de Statistiek. (2012, June) Arbeidsrekeningen; arbeidsvolume naar bedrijfstak en geslacht. StatLine. Centraal Bureau voor de Statistiek. [Online]. Available: <http://statline.cbs.nl/StatWeb/publication/?VW=T&DM=SLNL&PA=81108NED&D1=a&D2=0&D3=a&D4=0&D5=1,11,21,31,36-41&HD=110628-1651&HDR=G1,G2,T&STB=G3,G4>
- [8] C. Argyris and D. Schön, *Organizational Learning: A theory of action perspective*. Addison-Wesley, 1978.
- [9] S. Koldijk, M. v. Staalduinen, S. Raaijmakers, I. v. Rooij, and W. Kraaij, "Activity-logging for self-coaching of knowledge workers," in *IAPMA 2011: 2nd Workshop on information access to personal media archives*, 2011.
- [10] Ministerie van Volksgezondheid, Welzijn en Sport, "Zorgverzekeringswet," March 2012, BWBR0018450. [Online]. Available: http://wetten.overheid.nl/BWBR0018450/geldigheidsdatum_06-03-2012
- [11] "Fact sheet," March 2012. [Online]. Available: <http://newsroom.fb.com/content/default.aspx?NewsAreaId=22>
- [12] D. Crandall, D. Cosley, D. Huttenlocher, J. Kleinberg, and S. Suri, "Feedback effects between similarity and social influence in online communities," in *Proceeding of the 14th ACM SIGKDD international conference on Knowledge discovery and data mining*,

- ser. KDD '08. New York, NY, USA: ACM, 2008, pp. 160–168. [Online]. Available: <http://doi.acm.org/10.1145/1401890.1401914>
- [13] T. Baranowski, R. Buday, D. I. Thompson, and J. Baranowski, “Playing for real: Video games and stories for health-related behavior change,” *American Journal of Preventive Medicine*, vol. 34, no. 1, pp. 74 – 82.e10, 2008. [Online]. Available: <http://www.sciencedirect.com/science/article/pii/S0749379707006472>
- [14] “Wii - Official Website at Nintendo.” [Online]. Available: <http://www.nintendo.com/wii>
- [15] “Kinect - Xbox.com.” [Online]. Available: <http://www.xbox.com/en-US/kinect>
- [16] “Zigbee specifications.” [Online]. Available: <http://www.zigbee.org/Specifications.aspx>
- [17] “About Technology.” [Online]. Available: <http://www.bluetooth.com/Pages/about-technology.aspx>
- [18] W. W. Prince. (2011, September) Knowledge workers. Encyclopedia of Management. eNotes.com. [Online]. Available: <http://www.enotes.com/management-encyclopedia/knowledge-workers>
- [19] S. Bradner, “Key words for use in RFCs to Indicate Requirement Levels,” RFC 2119 (Best Current Practice), Internet Engineering Task Force, Mar. 1997. [Online]. Available: <http://www.ietf.org/rfc/rfc2119.txt>
- [20] C. Perfetti, “Personas: Matching a design to the users’ goals,” August 2001. [Online]. Available: <http://www.uie.com/articles/personas/>
- [21] M. Neerincx, J. Lindenberg, N. Smets, T. Grant, A. Bos, A. Olmedo-Soler, U. Brauer, and M. Wolff, “Cognitive engineering for long duration missions: human-machine collaboration on the moon and mars,” in *Space Mission Challenges for Information Technology, 2006. SMC-IT 2006. Second IEEE International Conference on, 2006*, p. 7 pp.