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Requirements and Design of a Platform for Internet- and Mobile-based Interventions

Bachelor Thesis at Ulm University

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Abstract

Mental health and the therapeutic care of patients is a topic that is applied daily. Whether mental or physical health, usually everyone can complain about something. Due to digitalisation, the topic of mental health must also be raised to a higher level. The eSano system represents a platform that explicitly deals with the concept of e-health in order to provide online support for therapeutic care. The online therapy is provided via so-called *Internet- and Mobile-based interventions* (IMIs), which are carried out by the patients. The basic principle is that an eCoach accompanies the patient through guided interventions, but the patient also has the possibility to carry out an unguided intervention in a self-guiding manner. As a result of the possibility to perform the interventions on the mobile phone at any time, the use is very flexible, independent of location and can be easily integrated into everyday life. In addition to an application for patients and therapists, there is also a platform for intervention creation and editing, which is the beginning of the development of IMIs for psychological support. In this bachelor thesis the requirements and the conceptual design of the eSano platform are identified and presented. The functional and non-functional requirements to be realized in the final system form the basis of the design concept. Starting with the basic architecture of the platform, creating and participating in interventions and the implementation of individual modules of the therapy, this thesis presents the connection and communication between the systems and roles involved. Furthermore, aspects such as distribution of rights, privacy and security are addressed and basically defined. Due to the realization of a requirements engineering process of the complete eSano system, the results of this thesis form a good basis for any further work with the project.

Contents

1 Introduction

The Institute of Psychology and Education, Department of Clinical Psychology and Psychotherapy at Ulm University, which intensively researches online therapy and especially the work with interventions, founded a project in which the concept of online therapy will be implemented, called eSano [2]. In the following a short motivation of the realization of e-health is the given, as well as the approach and the structure of this thesis.

1.1 Motivation

Each of us may one day have physical, emotional or psychological complaints. Through changes in our thinking and acting these problems can be improved or even eliminated. For any kind of personal restriction, e.g., back pain, depression or anxiety disorders, there should be online modules that are specially adapted. In order to be able to implement these changes, continuous and individual care is necessary. Some people do not have the courage to contect a psychotherapist or are not willing to undertake a weekly practice. For beginners as well as patients who have been in care for a long time, the eSano project will offer support. This platform should not only provide support for patients, but also for therapists and intervention editors. Patients can be guided and treated by online therapists. Besides that, the therapists can use the facility to treat and care for their patients easily. Its is a user-friendly E-Mental Health platform, with a versatile product catalogue of online modules, diaries and interventions. Further, patients can join different studies through which they can participate in interventions that are either unguided or guided by an online therapist, also called eCoach. It is said, that online interventions work for many conditions, have long-term effects and can be as effective as face-to-face therapy. The mobile app for patients also offers a feeling of independence of place and time.

1.2 Purpose

The eSano mobile app created for patients should be seamlessly integrated into a patient's everyday life, thus creating comfortable and flexible usage. Also for therapists

the application should offer advantages like a good overview of their patients as well as a digitalized version of all tasks a patient has done and especially how they manage them. In addition, the progress should be easily tracked and related persons should be easily integrated via the platform. In order to be able to offer this patient overview, a system is required which can manage a lot of data and also treat it confidentially. Studies should be created and managed for specific groups of patients and diseases by therapists. The individual online interventions that a patient performs should be created in the content management system (CMS) and should there be managed and also edited. To finally offer such a software product good requirements and design specifications are needed.

1.3 Approach

To get an introduction to the existing project, I met with all the people responsible for the respective subsystems. Weekly meetings in which all participants were represented and additional individual meetings depending on the current topic were held throughout the entire project. In order to get an exact idea of the system design and a specification for the requirements, many mockups, drawings and ideas had to be discussed. Many new improvements of various aspects were made throughout the project, including existing requirements as well as completely new designs. Also individual meetings with the responsible psychologists of the University of Ulm of the eSano project were informative, since they acted as clients. They always had the health technology perspective, so that the specifications never lost sight of the goal. On the other hand, they were also open to technical suggestions from the computer scientist's point of view in order to stand out from the similar systems already in existence. All in all, many suggestions to improve the existing system and the question how to bring it to its goal were thought through and then written down in requirements and design proposals. The results of these meetings therefore the requirement specification is summarized in this thesis.

1.4 Structure of the thesis

This thesis gives an overview of the project requirements and describes its functionality and purpose. In Chapter 2, it will be explained into which subcomponents the system is divided and what they do in detail. Furthermore, all roles involved in the system and their interaction with each other and with the system itself are described. The communication is explained in Section 4.4. The focus is on the functional and non-functional requirements presented in Chapter 3 which must all be fulfilled by the final system. The second main aspect of this work is the conceptual design, which deals with the realisation of all requirements. In Chapter 4, particular reference is made to certain

aspects such as communication and organisation between the users of the system. In addition, a number of processes are presented, in which the most important interactions of the users involved are described.

2 Fundamentals

In the following the basic boundary conditions are summarized and explained to get a first insight and a good understanding of the system that should be implemented.

2.1 Glossary of terms

The following tables will explain crucial individual technical terms, which are needed for a better understanding of the requirements.

Name	**intervention**
Description	Interventions, also known as training, in coaching to provide the client with the appropriate tools to achieve his or her self-chosen goal or to support him or her in a certain phase of life. They consist of individual lessons and are either unguided or guided by an eCoach.

Name	**training**
Description	Training describes the interventions that can be carried out by patients without guidance. So-called unguided interventions.

Name	**study**
Description	Studies are groups created by eCoaches on the eCoach platform to treat a particular area. This is where the actual guidance between patient and eCoach takes place through an intervention.

Name	**guidance**
Description	The guidance refers to the assignment of a patient to an intervention accompanied by an eCoach. All parameters are defined, which are valid for each patient as an individual at his guidance with his eCoach per intervention.

Name	**lesson**
Description	Interventions consist of individual lessons, also called modules, which consist of various pages with lesson elements. For example, an element in a lesson can be of the following type: • Text (pictures are also possible here) • Media (including pictures, videos, audio files, etc.) • Questions (yes/no, slider, multiple choice, etc.) Lessons may be time-dependent, which means that the patient has a certain amount of time to process the lesson to move on to the next lesson.

Name	**eCoach**
Description	An eCoach is an online therapist who cares for patients. He is participant of special groups or studies. He is the first point of contact for patients.

Name	**editor**
Description	An editor is a user of the system who can create the interventions in the CMS. He can also edit and assign the interventions to studies.

Name	**mentor**
Description	The relationship between patient and eCoach can be described in that each patient has one eCoach as mentor per intervention.

2.2 Structure of the system

There are different roles in the system such as editors, eCoaches and patients, therefore it is necessary to provide an adapted representation of the eSano system for the respective user. For this reason, the system is essentially divided into four parts, three of which represent the platforms of the respective users.

The eCoach platform

The eCoach platform is a work environment for therapists that supports the monitoring and feedback processes and simplifies the management of studies, groups, interventions, and training for patients and other therapists. With components and external tools to observe and evaluate patients' activities, messages, and answer sheets, it allows therapists to provide better care, manage ongoing interventions and take preemptive measures to intervene in cases of emergency.

The patient app

The patient platform embodies the patient's access point to the system. It shows interventions of the patient and provides all functionalities to be able to participate in them and grants the possibility to interact with the corresponding eCoach. This module can be used by any kind of user. A mobile app is also available helping to integrate the application even more into everyday life.

The content management system

The content management system (CMS) allows its users to create and manage interventions and their corresponding lessons. This module will only be available to editors and admins. Interventions or individual lessons can be created and modified in this part of the system. Editors can also assign rights those who have access to individual interventions. Furthermore, all administrative tasks are controlled from here.

The backend

The backend is a web server that provides and manages all data used by the other system parts. All data generated by the other three parts is stored on the backend and can be exchanged through it. Communication takes place exclusively through the backend. The data is sent to the backend and from there to the corresponding platform. For the storage of the account data and all other important data, a database is available which is connected to the backend. More details about the architecture can be found in chapter 4.

2.3 Actors

The following section describes the actors of the system. Actors are the different user roles describing capabilities, duties and restrictions for different parts of the system.

Actor	**eCoach**
Role	The eCoach is a therapist for patients providing tasks and monitoring the progress of such. The therapist can assign interventions to patients and monitor their progress. He stays in contact with the patients and thus represents the connection from patient to the therapy.

Actor	**editor**
Role	The editor can create or modify interventions in the content management system. When he creates an intervention he becomes the owner of such and can only modify those of which he has got the editing rights or those that are contained in the workgroups of which he is a member of. For his own interventions he can further enable other editors to edit.

Actor	**patient**
Role	Is the most basic user of the system. Patients can facilitate the system to complete therapeutic measures and interact with eCoaches. One can register for studies and receives assigned interventions from the responsible eCoach. He can also participate in guided or unguided interventions.

Actor	**admin**
Role	Admins administers the system and assigns roles such as the manager status to users. He can login to the content management system and the eCoach platform. He has full control of the system and also takes care of the IT support as well as help requests.

For the final system, it is intended that a user who has an editor and also an eCoach account, that it is possible to change the platform and the role easily. So it should be

explicitly possible that an editor creates an intervention in a workgroup in the CMS and assigns it directly after publishing to a study in which he wants to have this intervention.

2.4 Related Work

E-therapy is initially understood as the interaction between a person and a therapist via the Internet. Help is to be offered in conjunction with a structured web-based program for medical psychological care. In the field of mental health there are a numerous systems that already offer this in the form of internet based interventions (IMIs). A few of these are presented below. By digitizing the therapy, progress can be recorded and observed in digital form. This has advantages for both patient and therapist. In addition, there are no restrictions with regard to the disease or age groups. The problems to be treated range from physical illnesses such as back pain to psychological problems like exam nerves or depression. For each topic there are different studies, in which one can get support in the form of individual modules, also called interventions. The interventions can be either guided or unguided. The possible guidance by a supervising eCoach is an advantageous feature of IMIs. Since the concept of online support carries a great deal of health responsibility, some guidelines must be followed on the psychological as well as on the implementation side. These include, for example, the confidential handling of data and the Medical Devices Act, which must be observed during programming [22]. On the whole, the integration of the system into the everyday life of the patient offers many advantages but also new difficulties that arise compared to the outdated face-to-face approach.

Internet- and mobile-based interventions

Internet- and mobile-based interventions, also called IMIs, are applications based on an instructive online program, which are provided on a website or as part of an app. They are used by people seeking health-related assistance [12]. Usually the interventions consist of individual lessons with different types of elements. These lessons are individual modules consisting of questionnaires and media, which can be used flexibly and individually, regardless of time and place. Feedback from the mentor after the completion of the lessons is an important process to show the patient's individual progress. Further benefits for patient care, especially for monitoring safety, progress and outcomes, as well as input for research purposes are also provided [3]. For unguided interventions the control of the modules is in the hands of the patient. In itself, the internet version of the therapy is associated with a lot of self-initiative and self-discipline. The difference in the effect between guided and unguided interventions is less pronounced than assumed, but studies show that results of guided interventions

were significantly superior to those of unguided interventions [3]. If all study participants are conducted in a uniform manner, progress can also be seen depending on the therapist, although the qualification of the eCoaches seems to be less important [6]. Even though a smartphone use is more likely to be associated with younger people, but the concept also has potential for older age groups, these are generally less likely to seek psychological treatment [11]. Furthermore, not only older people have an inhibition to seek support for their complaints. Through the anonymity that the internet offers, the gap between treatment and demand is reduced, e.g., patients who may have been left untreated for many years can now receive psychological treatment adapted to their needs through the internet and health management [29]. Through apps patients are actively enabled to participate in the decision how their health or illness is to be managed, even for those who have not been able to obtain specialist care due to financial constraints [29, 28]. The concept of internet addiction, which is common among young people today, suggests that online therapy is not advisable in these cases. However, studies have shown that here too, interventions can be helpful to divert excessive concentration on certain activities of the young people and thus influence their behaviour in a positive way [7]. Another advantage in addition to flexibility in the execution of the tasks is the cost-benefit effect. There is no need to actively consult a therapist and further the support is intensified. Evidence of the cost-utility of self-guided interventions were also found [11]. Also evidence to date shows that these treatments often produce results similar to those of face-to-face psychotherapy and that they are cost-effective [3]. A comparison between face-to-face treatment and IMIs, reported in some studies, revealed small trends in the direction of the effectiveness of assisted interventions [5, 3, 28]. In any case, the doctor-patient relationship is changing radically as a result of digitization in the health care system. Effects on the relationship are a stronger autonomy of the patient as well as a better protection of the doctor [29]. Despite the multifaceted nature of online care, some diagnoses cannot be made without face-to-face contact. In some cases, this type of Internet-based treatment can also be seen as a supportive accompaniment [3]. Even those diseases that cannot be supported by IMIs will be supported by automated reminders and similar solutions in the future, which will lead more and more hospitals to offer such services as part of their regular health care. The question in how far internet interventions can best be integrated into existing services and in how far optimal strategies for combining interventions and drugs are possible is becoming more and more topical [3]. Taking into account the health aspects to be considered, we now turn to the implementation of such a system.

Requirements engineering

At the start of a software project, the requirements of the system are always collected first. Requirements define what properties and functions are expected from the software

system as a whole [4, 20]. Requirements engineering can be seen as a combination of three simultaneously running and interacting processes: finding knowledge, ensuring the validity of this knowledge and formally specifying the problem. An important approach here is the thorough discussion of requirements in an agile process [20, 26]. Weekly discussions of upgrades and emerging issues, as well as discussions with clients and final system users, are essential to the engineering process. A common concept is user-centered design, in which the user is at the center of attention in order to make the final product as good as possible [15]. The focus is on constant reconciliation and discussion with the end user so that the end system cannot miss the target [1]. It is difficult to define the requirements for a software product and then evaluate them as well, because the requirements have a certain dynamic [20]. In the information system context they are characterized as soft and ambiguous, which usually leads to qualitative data [14]. In order to define goals, visions and framework conditions, the distinction between non-functional and functional requirements is a standard procedure. How to ensure that all relevant stakeholders are consulted or how to better involve users in development is of paramount importance. Attention should be paid to an adequate, timely and effective consultation of relevant stakeholders in the engineering process [9]. While functional requirements, as the name suggests, describe the functions of the system, non-functional requirements go beyond these and describe the system more qualitatively in how far the functional requirements should be implemented. The way of representation in an accompanying document should be carried along with the software development process and should be formulated uniformly and clearly understandable [16, 4].

Following such a requirement analysis process also offers further advantages for generating test cases, simulating usability, generating traditional text-based use cases and refining design ideas [31]. An integrated usability engineering process can add valuable activities to the existing development processes, such as a cost-benefit analysis or an analysis of the environmental conditions of the end users [25]. Since the quantity of demands usually quickly becomes substantially large, a classification, as well as prioritization and grouping is in demand [16]. Besides a good overview of the requirements themselves, the roles of the system involved, a exact description and dependencies among themselfs should be annotated.

The dynamics of the system requirements mentioned above is a challenge for all those who are involved in the project. Early discussion and specification of the design is necessary to avoid errors at an early stage. Another important procedure is the creation of scenarios to group the requirements based on these scenarios. Mockups, user stories and other flowcharts can be used to define clear design specifications [31, 21]. These are then uniformly implemented by the respective programmers in their parts of the system.

Once the system has implemented all requirements it is of utmost importance that it is possible for everyone to use the system trouble-free. This means that the system must run on different platforms, keyword: cross-platform programming. In the mobile-app context there are now more than five major platforms on which the application should run. Unfortunately some functions are not equally usable on all platforms, which emerged into a challenge for both professionally and financially aspects [17, 8]. Since the smartphone development is so far advanced, certain applications can be accessed just as well and quickly on it as on a computer. This means that the qualitative aspect remains the same and we have the advantage of a flexible usage [8].

Systems that use IMIs

One of the best known platforms on the market is probably the *minddistrict* system. This system is currently also used by the University of Ulm at the Institute of Psychology. Minddistrict understands E-health as the application of digital aids, which is mainly to support people on their way to recovery. Here, in the field of mental health care, personal therapy conversations with online therapy elements are used [24].

A further app called *mental health intervention* provides, according to its own statements, a supplement accompanying a therapy. The therapist can follow the patient's well-being through mood pictures, diaries and voice recordings [23].

The platform *youper* is a mental health application. With undirected interventions it mainly supports self-help. It was created by physicians and psychologists to offer a long-lasting and durable support through the internet. However, they also warn that this app does not replace a doctor in that sense and cannot make diagnoses [32].

Another anonymous free study offers online training to strengthen mental well-being: *ICare Prevent*. The focus of the inventors of the app is on coping with fear and sadness. They want to support the patient in dealing with their feelings and offer background information on how they arise in the first place. They conducted studies in various areas, such as depression, anxiety disorders, stress management, sleep disorders, alcohol abuse and procrastination [19].

As can be seen from all systems, the use of a mobile app has become indispensable for integrating the therapy into everyday life. From the lower part of these already existing platforms some functions are inspired by, which the eSano project should also be able to execute. For this we have included our own experiences and studies to get an even better system that uses the advantages of all these and can do even more than is possible today. Some features such as tracking your own learning progress and including your private environment like family members and friends take online therapy to a higher level. Additionally, playful learning and an attractive design will be offered for use by patients and therapists as well as content creators.

3 Requirements

Besides the functional requirements, non-functional requirements are also necessary for every software system. While the functional requirements refer to the implementation of the product purpose and define the exact functionalities, the non-functional requirements rather refer to the qualitative requirements like usability and user experience for the system and related quality assurance measures like tests or developer/user documentation [4]. The non-functional requirements are more oriented towards the quality in which the required functionality has to be provided [9]. The requirements cover all subsystems and refer to the entire project. As the project has been running for some time, some requirements have already been implemented, whereas some are currently being implemented and some will only be needed in later versions of the system. These have therefore lower priority as can be seen in the individual requirements. The already existing requirements were extended, categorized and specified with the main responsible persons of the respective subprojects. In addition, several meetings were held with persons responsible from the psychological side, who act as clients here. In the context of this work, all requirements, whether already implemented or still in prospect, are listed and evaluated, as well as connected to each other through dependencies.

3.1 Functional requirements

A functional requirement (FA) is the requirement whose implementation directly serves the intended purpose of the product [4, 16]. They are usually precisely described functions that make the best possible use for the end user. The representation of requirements can logically be done in many ways, but a table construction with different properties is chosen here. In most cases, the actors involved are added to the properties of the requirement, but this has been realized here by the individual subsystems, since the individual actors can perform the same functions per platform in most cases independent of their status. For a better overview, the requirements are divided into categories, which are: Accounts, Groups, Interventions, Therapy, Further features. The characteristics chosen to obtain a detailed description of the FA are the following. The FAs can be uniquely assigned using an ID. A Description (DES) describes the requirement. In Addition, the motivation (MOT) behind the FA is described and the dependencies (DEP) to other requirements are also linked. Besides, each FA has a

priority (PRIO) that indicates how important it is for the working system. The scale goes in ascending importance from -,0,+ and ++. The requirements are also assigned to the individual subprojects (SUBP).

3.1.1 Accounts

This section describes how to start the system and how to log in and register for all users. It also describes all settings concerning the administration of accounts. In particular, the individual dashboards that can be accessed per actor are described in detail.

ID	**FA-A 1**
DES	Sign up to the patient application
MOT	When a patient gets invited to an intervention/study or in general to the application via email, patients are able to sign up using their email address and a secure password. There should be the opportunity to register to the application by automatically opening the app.
DEP	FA-A 4, FA-G 5
SUBP	patient application
PRIO	++

ID	**FA-A 2**
DES	Login
MOT	Every user is able to login to the platform using their email address and password. After logging in, users will be redirected to the dashboard of their platform.
DEP	FA-A 8, FA-A 9, FA-A 10
SUBP	patient application, eCoach platform, CMS
PRIO	++

ID	**FA-A 3**
DES	Reset password
MOT	All users of the system have the possibility to reset their password if they forget it or if they want to change it. If their login fails, they can reset their password using their email address to create a new password. Also, the password can be changed at any time in the settings.
DEP	FA-A 6
SUBP	patient application, eCoach platform, CMS
PRIO	++

ID	**FA-A 4**
DES	Create account
MOT	The eCoaches can create other eCoach accounts in the eCoach platform and editors can create other editor accounts in the CMS. More specifically, editors and eCoaches prefill a form that creates an account. However, an admin must confirm and activate this account creation. In addition, admins can create eCoach, editor and other admin accounts and promote users to specific roles per group. Patient accounts can only be registered via the invitation of an eCoach and the following registration.
DEP	-
SUBP	patient application, eCoach platform, CMS
PRIO	++

ID	**FA-A 5**
DES	Delete account
MOT	Patients are able to delete their account, so that their private data is deleted from the entire system. After deletion, only the anonymous data remains in the system. Other users like an editor or eCoach are also able to delete their account. Admins can also delete any accounts.
DEP	-
SUBP	patient application, eCoach platform, CMS
PRIO	++

ID	**FA-A 6**
DES	Profile
MOT	Registered users can create a personal profile including their name or a username, birth date, a profile picture and personal description. You can also make visual adjustments, such as changing the color of the platform (design templates). The profile can be designed by yourself and can be set up as anonymous as desired.
DEP	FA-A 6, FA-A 7
SUBP	patient application, eCoach platform, CMS
PRIO	+

ID	**FA-A 7**
DES	Personal settings
MOT	Any user can access a settings page where he can make system settings, edit his profile or set various features. Additionally, the users can change some settings regarding notifications. This is also the location where the saved files from lessons and the personal activity log can be found.
DEP	FA-A 6
SUBP	patient application, eCoach platform, CMS
PRIO	+

ID	**FA-A 8**
DES	Dashboard for patients
MOT	On the home page a user can find the lessons that need to be edited at the moment. With the menu button you can get to the following pages: • Home • My Lessons (the own to be done) • Interventions (all, here the user can filter and search for new interventions) • Chat (messages and feedback) • Favorites (all saved media) • Diary • Notifications • Settings (my profile, language, my activity log, etc.)
DEP	FA-A 2, FA-A 6
SUBP	patient application
PRIO	++

ID	**FA-A 9**
DES	Dashboard for eCoaches
MOT	On the start page the user will find a navigation bar at the top of the following subpages: • Home • My Groups/Studies • Patients (my patients, search for patients, send invitations, etc.) • Tasks • Feedback (all ever created) • Catalogue (search for groups or interventions) • Chat (messages and feedback) • Notifications • Settings (my profile, language,my activity log, etc.)
DEP	FA-A 2, FA-A 6
SUBP	eCoach platform
PRIO	++

ID	**FA-A 10**
DES	Dashboard for editors
MOT	In the CMS a user can navigate through the following pages: • Home • My Workroups • Interventions (lesson editor, create lesson, intervention preview, search for groups or interventions, ..) • Chat • Notifications (intervention requests, workgroup activities, etc.) • Settings (my profile, language, my activity log, ...)
DEP	FA-A 2, FA-A 6
SUBP	CMS
PRIO	++

3.1.2 Groups

The following requirements give a list of all groups and their most important functions and settings as well as restrictions and actors per group type. These groups form the most important architectural grouping of users and interventions to be able to carry out online therapy.

ID	**FA-G 1**
DES	Groups
MOT	There are various groups in the system that can be divided into three types: organisationgroup, study and workgroup. The workgroups are in the CMS, where the editors have special access rights to the same interventions to create and edit them. There is at least one editor manager with increased rights who manages this group. The organisationgroups are located on the eCoach platform in order to group departments and subject areas of eCoaches that belong together anyway.
DEP	FA-G 4,FA-G 5
SUBP	patient application, eCoach platform, CMS
PRIO	++

ID	**FA-G 2**
DES	Create groups
MOT	In CMS an editor can create a workgroup and thus automatically become the editor manager of it. An organisationgroup can be created mainly by admins, or in special cases by a request similar to an account creation form by eCoaches. Studies are always created by eCoaches on the eCoach platform. An admin can create any of the three group types from within the CMS.
DEP	FA-G 1, FA-G 3
SUBP	patient application, eCoach platform, CMS
PRIO	++

ID	**FA-G 3**
DES	Studies
MOT	Studies are groups that can be created by eCoaches. These can invite patients or other eCoaches and they can add interventions. The owner is then the person who created the study and can also turn other eCoaches into eCoach managers of the group and assign rights. At this point the care of the patient takes place.
DEP	FA-G 2,FA-G 4, FA-G 5
SUBP	patient application, eCoach platform
PRIO	++

ID	**FA-G 4**
DES	Group information
MOT	Each group has certain information that can be accessed via an information button. This includes: • Name, description, picture, meta data • Participants and their roles • Forum • Settings
DEP	FA-G 1, FA-G 5
SUBP	patient application, eCoach platform, CMS
PRIO	++

ID	**FA-G 5**
DES	Group settings
MOT	Each type of group (organisationgroup/study/workgroup), no matter on which platform, has its own settings in which certain properties can be defined and changed. That includes: (depends on the platform) • Access type • Whether a member can leave a group independently • Group messages/forum • Visibility • Notification settings • Members
DEP	FA-G 1, FA-G 4, FA-G 9
SUBP	eCoach platform, CMS
PRIO	0

ID	**FA-G 6**
DES	Participate in a study
MOT	A user has several possibilities to become a participant of a study. This includes the following options: • Request • Self-enrollment (with or without password) • Invitation (from an eCoach manager) This applies to eCoaches as well as to patients. If a user applies for the participation this request gets forwarded to the corresponding eCoach manager, who decides whether to accept the request. The eCoaches can also send requests to participate in studies or they are invited/added. Every patient receives an ecoach when entering a study.
DEP	FA-G 1, FA-G 3, FA-A 1, FA-I 8
SUBP	patient application, eCoach platform
PRIO	++

ID	**FA-G 7**
DES	Participation in a organisationgroup/workgroup
MOT	Users of the system can always make a request to join a group. This means an editor can send a request to be included in a workgroup or an eCoach can request to be part of a organisationgroup. In most cases, however, they are simply added.
DEP	FA-G 1, FA-G 4, FA-G 5
SUBP	patient application, eCoach platform
PRIO	++

ID	**FA-G 8**
DES	Study forum
MOT	There should be group forums, possibly anonymously, in which different patients can exchange information according to their complaints. When creating the study, it can be specified whether the study wants this feature. Afterwards this property can be changed in the study settings.
DEP	FA-G 1, FA-G 4, FA-G 5
SUBP	patient application, eCoach platform
PRIO	0

ID	**FA-G 9**
DES	Activity log of a group
MOT	The eCoach platform provides an activity log that displays any activities that are performed by their patients or any member of the study or the interventions in it. This log can only be seen by eCoaches and not by patients. The workgroups and organisationgroups have also activity logs. Also, they have the possibility to see when their patients were last online.
DEP	FA-G 5
SUBP	eCoach platform, CMS
PRIO	+

ID	FA-G 10
DES	Group rights
MOT	In organisationgroups and workgroups there is always at least one eCoach manager/editor manager who has extended group rights by his role. This person can assign these rights to other eCoaches/editors in the group. These rights can also be controlled by admins. These extended rights of a manager include: • Nominate other managers • Edit settings • Answer requests • Add and remove members In workgroups there is another difference besides the normal editor and the editor manager, namely there are read-only or edit rights per intervention. The editing rights also include the permission to copy certain interventions or lessons.
DEP	FA-G 4, FA-G 5
SUBP	eCoach platform, CMS
PRIO	+

3.1.3 Interventions

The most important function of the system is the care of patients through participation in IMIs. This section lists the functional requirements from creating such interventions to assigning them to patients.

ID	FA-I 1
DES	Create Interventions
MOT	An editor is able to create an intervention in a workgroup he is enrolled in. After creation, the intervention is initially only visible in the workgroup and not activated. All editors of the workgroup can now edit this intervention and the lessons in it. Once the intervention has been processed to the point where it can be used with patients, it can be activated. This intervention can only then be assigned to studies.
DEP	FA-I 2, FA-I 3
SUBP	CMS
PRIO	++

ID	**FA-I 2**
DES	Copy lessons/interventions
MOT	Entire interventions, individual lessons and certain elements can be copied to be used for multiple interventions. If an editor has read-only permissions, he can request permission to copy. This request goes to the editor managers of the workgroup.
DEP	FA-I 3, FA-I 4, FA-G 10
SUBP	CMS
PRIO	++

ID	**FA-I 3**
DES	Intervention settings
MOT	There are interventions that can be "guided", “unguided” and both simultaneously. The matter of the intervention can be chosen at the time of creation in the CMS. The state of "guided", “unguided” or both must be set to one value when publishing the intervention. All interventions have default configurations that can be set during creation. Some properties should only be set later, when the intervention is executed with patients.
DEP	FA-I 1, FA-G 10, FA-G 10
SUBP	CMS
PRIO	++

ID	**FA-I 4**
DES	Lesson elements
MOT	An intervention consists of several lessons. There can be different elements in each lesson: • Heading • Text (pictures are also possible in here) • Question • Media : including pictures, videos, audio files • File upload Questions can be further subdivided into: yes/no, exactly one answer, potentially several answers, slider, date, short text, long Text, table.
DEP	FA-I 3, FA-I 5

SUBP	CMS
PRIO	++

ID	**FA-I 5**
DES	Preselect folder of media
MOT	When creating interventions or lessons, there should be a selection of already used media that can be quickly reused in this way.
DEP	FA-I 2, FA-I 3, FA-I 4
SUBP	CMS
PRIO	+

ID	**FA-I 6**
DES	Preview for interventions
MOT	The preview for an intervention shows lessons and the related elements. It is intended to give an overview. In the CMS admins and editors can get previews for created interventions. In the eCoach platform, eCoaches can get a preview for interventions they want to assign to their patients.
DEP	FA-I 3, FA-I 4
SUBP	eCoach platform, CMS
PRIO	++

ID	**FA-I 7**
DES	Assign interventions to a study
MOT	An eCoach manager should be able to assign interventions to his study. When searching for interventions he can send a request to the workgroup of the intervention to have a copy of the intended intervention in his study. The other possibility to assign an intervention to a study is to assign the intervention directly from an editor manager in CMS.
DEP	FA-I 3, FA-G 3, FA-G 6
SUBP	patient application, eCoach platform, CMS
PRIO	++

ID	**FA-I 8**
DES	Guidance
MOT	When a patient is added to a study, he automatically gets an eCoach assigned to him, so the eCoach is his mentor and first point of contact. Care takes place within studies. The eCoaches then assign interventions to their patients and the guidance mainly represents the accompainment by feedback on answer sheets. The allocation from patient to eCoach can be adjusted by eCoach managers.
DEP	FA-A 1, FA-I 11, FA-G 6
SUBP	patient application, eCoach platform
PRIO	++

ID	**FA-I 9**
DES	Participate in an intervention
MOT	A patient has several possibilities to become a participant of an intervention. If the intervention is guided, then he will be mostly invited/assigned by an eCoach. The entry into an intervention depends on the access type.
DEP	FA-A 1, FA-I 8, FA-I 10
SUBP	patient application, eCoach platform
PRIO	++

ID	**FA-I 10**
DES	Invitation for interventions/studies
MOT	An eCoach can invite his own patients and also via e-mail patients who do not yet have an account. If a patient already has an account, the invitation to an intervention should be visible inside the app and the patient should have the possibility to accept the invitation inside the app. If he doesn't have an account, the invitation is sent by e-mail.Then he can follow the link and create an account. After that he has the possibility to confirm the link to the intervention/study.
DEP	FA-A 1, FA-I 9
SUBP	patient application, eCoach platform
PRIO	++

ID	**FA-I 11**
DES	Assign an intervention
MOT	An eCoach can arbitrarily assign their patients to any available training or intervention. Training (unguided interventions) can be activated or deactivated by the respecting eCoaches for certain patients. When assigning, certain parameters are set such as the order of the lessons and the default time until the next lesson is available. Using the guidance settings, these parameters can be adjusted later if desired.
DEP	FA-I 3, FA-I 8, FA-I 9, FA-I 1, FA-G 6
SUBP	patient application, eCoach platform
PRIO	++

ID	**FA-I 12**
DES	Filter function for interventions
MOT	In the list of all interventions all users of the system should be able to filter this list with given keywords like e.g. “depression”, “tinnitus”, “eating disorder”. This is useful to find specific interventions and not to have to go through each one to find fitting ones.
DEP	-
SUBP	patient application, eCoach platform, CMS
PRIO	++

ID	**FA-I 13**
DES	Intermediate storage
MOT	If a patient only partially completes a lesson, the current state of the answers should be saved. If the processing time of a guided lesson is running out and the whole lesson has not yet been processed, the incomplete lesson will be returned to eCoach. In addition, the feedback of a therapist should also be cached and if an editor creates a new content in CMS, it should also be cacheable.
DEP	FA-I 9, FA-T 1, FA-T 2
SUBP	patient application, eCoach platform, CMS
PRIO	++

3.1.4 Therapy

Based on the interventions, an online therapy can now be offered through the implementation of the guidance principle. Individual lessons can thus be guided by an eCoach or completed independently by a patient. In each case, the patient receives individual feedback and sees the progress of the therapy.

ID	**FA-T 1**
DES	Answer sheet for a lesson
MOT	After a patient has finished a lesson, an answer sheet is sent to his eCoach. An answer sheet contains the patient's answers to each lesson. If a lesson is only partially completed, it will be cached. If the lesson is finished and has not been completed, the accompanying eCoach will be informed and an answer sheet with partial solutions will be sent.
DEP	FA-I 8, FA-I 9, FA-I 13
SUBP	patient application, eCoach platform
PRIO	++

ID	**FA-T 2**
DES	Feedback for a lesson
MOT	Once a patient finishes a lesson, the eCoach has access to their answers and can provide feedback by commenting and rating the answersheet. At the end of the feedback, an eCoach can control whether their patient • Can unlock the next lesson • Has to repeat the same lesson again • Skip next lesson • Has to wait until the eCoach manually unlock the next lesson (the eCoach can set an exact time and date when the next lesson is available) of course depending on the default config settings per guidance. Before sending the feedback he can set a date and time when the patient should receive the feedback. As soon as the eCoach has sent the feedback, the patient receives a notification. This procedure allows the possibility of a guided intervention.
DEP	FA-I 9, FA-I 8, FA-T 1
SUBP	patient application, eCoach platform
PRIO	++

ID	**FA-I 14**
DES	Activity log of a user
MOT	Each member of the system has his or her own activity log. The system provides an activity log that displays any activities that are performed by a user (e.g. for a patient is logged “X logged in”, “X finished training Y”). Each user can see his/her own acitivity log. The supervising eCoach of an patient can see the activity log of them, too.
DEP	FA-I 8, FA-G 6, FA-G 7
SUBP	patient application, eCoach platform, FA-A 7
PRIO	++

ID	**FA-T 3**
DES	Confidentiality of patient information
MOT	By default, eCoaches are only allowed to see the activities of their own patients. Exceptions are representations or emergencies. In addition, eCoaches can see all patients who are in a group/study with them, but not their exact activities.
DEP	FA-G 8, FA-T 4, FA-A 7
SUBP	eCoach platform
PRIO	++

ID	**FA-T 4**
DES	Release patient files
MOT	On request, patients can be given access to data for third parties, for example for further eCoaches or possibly relatives of the patient. This request goes to the responsible eCoach, who has to process it. The patient is informed about the passing on of the data.
DEP	FA-A 7
SUBP	eCoach platform
PRIO	0

ID	**FA-T 5**
DES	Messages
MOT	The patient and eCoach can communicate via sending messages or chatting inside the system. The messages should be instant with a maximum delay of 10 seconds. This enables the communication between patient and eCoach. These messages include feedback from lessons for the patient and other messages that are related to the lesson and normal messages between the patient and an eCoach.
DEP	FA-G 8,FA-I 9
SUBP	patient application, eCoach platform
PRIO	++

ID	**FA-T 6**
DES	Embedded video calling
MOT	There should be the possibility to request a video call with a therapist in the message chat. If the eCoach does not answer the call or vice versa, he will be notified by e-mail that he has been called. The video must be reliable and in real time.
DEP	FA-G 8
SUBP	patient application, eCoach platform
PRIO	0

ID	**FA-T 7**
DES	Flexible lesson activation
MOT	It should be possible to activate lessons individually and flexibly, even afterwards. The eCoaches are able to unlock the next lesson for their patients independently of the feedback and other lessons.
DEP	FA-I 9, FA-T 2
SUBP	patient application, eCoach platform
PRIO	+

3.1.5 Further features

In the last section, general features were collected that are not explicitly essential to the basic functioning of the system. Rather, the following requirements complement the final system to a user-friendly system and lay out special features. Therefore, most requirements are rather less prioritized.

ID	**FA-F 1**
DES	Tutorial
MOT	When a new user logs in, a small tutorial should be available to make it easier for them to get started by showing them how to use the app.
DEP	FA-A 1
SUBP	patient application
PRIO	0

ID	**FA-F 2**
DES	Export data
MOT	Individual lessons or individual media can be exported to a pdf file, a csv file or printed directly from within the app. E.g. the answer sheets can be exported to a csv format for further utilization in other statistical programs like SPSS or for excel.
DEP	FA-I 4
SUBP	patient application, eCoach platform, CMS
PRIO	+

ID	**FA-F 3**
DES	Languages
MOT	The system should be available in different languages and you can choose at any time which language you want to have displayed. Further, individual interventions and their lessons should be easily translated into other languages as they are created. It is always displayed in which language the respective lesson is available.
DEP	FA-A 7
SUBP	patient application, eCoach platform, CMS
PRIO	+

ID	**FA-F 4**
DES	Reporting function for inappropriate contents
MOT	If a user reads inappropriate content, he can report it. The complaint goes to an admin.
DEP	-
SUBP	patient application, eCoach platform, CMS
PRIO	-

ID	**FA-F 5**
DES	Gamification
MOT	There should be rewards, visual feedback (medals, goals, etc.), possibly groups for successfully completed lessons/interventions that serve for social reinforcement.
DEP	FA-I 9
SUBP	patient application
PRIO	+

ID	**FA-F 6**
DES	Adaptive intervention proposals
MOT	Based on the course of the patient, new interventions should be proposed. This automated recommendation of interventions also applies to eCoach accounts.
DEP	FA-A 7, FA-I 14, FA-T 3
SUBP	patient application, eCoach platform
PRIO	+

ID	**FA-F 7**
DES	Chatbot
MOT	The provision of a chat bot should be available to all patients. E.g. in unguided interventions, the patient should receive an automatically generated personalized feedback. Personalized means, for example, to enter the patient's name in the feedback.
DEP	-
SUBP	patient application
PRIO	-

ID	**FA-F 8**
DES	Spell checker
MOT	There should be a spell checker that you can use to check whether something you have written contains spelling mistakes.
DEP	FA-T 1, FA-T 2, FA-T 5
SUBP	eCoach platform, CMS
PRIO	0

ID	**FA-F 9**
DES	Progress overview
MOT	A certain illustration like a graph or some statistical pictures should enable the patient and his mentor to follow the progress. This serves to encourage the patient.
DEP	FA-I 9
SUBP	patient application, eCoach platform
PRIO	0

ID	**FA-F 10**
DES	Diary
MOT	The user has the possibility to write a diary entry. In this diary he can look at, as desired and write new entries. The diary can have the following elements: • Text • Scales (slider, multiple choice) • Media He can look at this diary at will and write new entries and then upload them. The diary can have different focuses, such as a mood diary. The eCoach is able to unlock the diary and follow the entries.
DEP	FA-I 8, FA-I 9, FA-A 7
SUBP	patient application
PRIO	+

ID	**FA-F 11**
DES	Calendar
MOT	Between patient and eCoach there should be an easy possibility to arrange personal appointments. A view of the free appointments of the therapist should allow the patient to choose an appointment that suits him.
DEP	FA-I 8, FA-I 9, FA-A 7
SUBP	patient application, eCoach platform
PRIO	0

ID	**FA-F 12**
DES	Emergency button
MOT	The emergency button should be permanently visible everywhere and by clicking the button a window should open with a confirmation question. To ensure quick help for the patient, further emergency information is displayed. The patient's emergency will be forwarded to a separate email with a contact person available at all times.
DEP	-
SUBP	patient application
PRIO	+

ID	**FA-F 13**
DES	Contact IT support
MOT	For all users of the system there should be the possibility to contact the IT support. This can be done via the help function of the system.
DEP	-
SUBP	patient application, eCoach platform, CMS
PRIO	0

ID	**FA-F 14**
DES	Attach media to messages
MOT	For all users of the system there should be the possibility to attach some media at the end of a message like a picture or video.
DEP	FA-I 5, FA-T 1, FA-T 2, FA-T 5
SUBP	patient application, eCoach platform
PRIO	0

ID	**FA-F 15**
DES	Store data
MOT	Individual media can be stored. This means that the file can be found quickly in a folder of the saved files. This function is intended to assist the patient in viewing past media again.
DEP	FA-A 7, FA-I 5, FA-T 1, FA-T 2, FA-T 5
SUBP	patient application
PRIO	+

ID	**FA-F 16**
DES	Reportings
MOT	Different types of reportings should be available. These can be divided into the following groups: • General reportings (e.g., like ID and date export) • All parameters for the patient's access to the platform such as the initial contact between the patient and his therapist. • Intervention execution and the associated parameters for, among other things, each lesson • Guidance (e.g., like the number of messages between patient and eCoach during the intervention)
DEP	FA-F 2, FA-I 1, FA-T 2, FA-T 4, FA-T 5
SUBP	eCoach platform
PRIO	+

ID	**FA-F 17**
DES	Notifications
MOT	The platform should be able to deliver notifications depending on the user role and platform. Notifications are prioritized and can be basically divided into the following groups: • Chat Message • Group • Guidance • Reminder • System
DEP	FA-A 7, FA-T 5, FA-T 6, FA-T 2, FA-I 10, FA-G 5, FA-F 18
SUBP	patient application, eCoach platform, CMS
PRIO	++

ID	**FA-F 18**
DES	Email reminder
MOT	If a message is sent while the user is not online, a setting can ensure that the user receives a reminder mail. These reminders via email are possible for all types of notifications and can be set individually.
DEP	FA-A 7, FA-F 17
SUBP	patient application, eCoach platform, CMS
PRIO	++

3.2 Non-Functional requirements

The next part describes the non-functional requirements (NFA). These are requirements that address specific areas such as security aspects but also basic functionalities that should facilitate the use of the software. They are usually recorded in the form of workflow notations to form a task flow model of the system. This in turn provides a framework for the collection and appropriate recording of non-functional requirements [31, 9].

Most NFA's are interlinked, so for example, NFA usability cannot exist without NFA correctness. Further dependencies can be read in the tables. In addition, the following requirements are similar to the FAs presented in the previous section. Besides a description and motivation, a priority is also defined here, whereby these can only assume the two levels + and ++. The priority here also does not describe the importance of the implementation for the final system itself, but rather the order of implementation of a variant of the system.

ID	**NFA 1**
DES	Maintainability
MOT	The maintainability of the software should be ensured. In case of important changes or adjustments afterwards, it should be possible to easily edit the system without losing functionality.
DEP	NFA 11, NFA 12
PRIO	++

ID	**NFA 2**
DES	Integrity
MOT	The data sent through the system should not be able to be accidentally or maliciously altered, stolen or destroyed. Data integrity ensures a consistent and secure system.
DEP	NFA 6, NFA 8, NFA 10, NFA 11
PRIO	++

ID	**NFA 3**
DES	Time performance
MOT	The system time performance, in particular the response time performance, describes the data transmission rate in the components involved, including the waiting time and the processing time of messages. This time performance should take place within an appropriate time frame.
DEP	NFA 5
PRIO	+

ID	**NFA 4**
DES	Comprehensibility
MOT	In order to be able to reach its goal, the presentation should be structured in an understandable way. The system should also provide visible feedback and it should be clearly arranged to avoid confusion.
DEP	NFA 3, NFA 5, NFA 11
PRIO	++

ID	**NFA 5**
DES	Usability
MOT	In addition to all functions of the system, these should also be usable in a way appropriate to the task. A good usability aims to ensure that the task to be performed in the platform can be mastered efficiently and satisfactorily. Good usability also prevents incorrect use and supports the user in case of incorrect entries or questions on the operation.
DEP	NFA 3, NFA 4, NFA 6, NFA 7, NFA 8, NFA 9, NFA 10
PRIO	++

ID	**NFA 6**
DES	Reliability
MOT	The whole system should be reliable and react appropriately in case of failures and provide feedback to the user. The reaction of the system should therefore always meet expectations.
DEP	NFA 3, NFA 4, NFA 5, NFA 7, NFA 11
PRIO	++

ID	**NFA 7**
DES	Compatibility and Flexibility
MOT	The system should run flawlessly on all operating systems and any mobile devices like Android, iOS, Windows, macOS and Linux. Furthermore, the platforms should be compatible with all browsers (e.g., Google Chrome, Firefox, Microsoft Edge,...).
DEP	NFA 5, NFA 9, NFA 12
PRIO	+

ID	**NFA 8**
DES	Robustness
MOT	The application should be designed to be robust, especially against misbehaviour from a technical point of view and also against incorrect input from system users. A system crash should be prevented in any case.
DEP	NFA 1, NFA 11, NFA 12
PRIO	++

ID	**NFA 9**
DES	Reusability
MOT	All parts of the system should be redundancy-free, reusable reusable and as atomar as possible. This is especially true for internal reusability as well as for passing on to external software projects.
DEP	NFA 11, NFA 12
PRIO	+

ID	**NFA 10**
DES	Privacy and security
MOT	All personal data that is transported through the application and also stored in the database should be safely stored and protected against attacks. All account data is kept encrypted. On all platforms, each user should be able to set how much of his profile he wants to share with others.
DEP	NFA 2, NFA 6
PRIO	++

ID	**NFA 11**
DES	Correctness
MOT	The correctness of the given data is of utmost importance. Any type of communication and data transmission in the system must be transmitted and displayed correctly.
DEP	NFA 2, NFA 6, NFA 10
PRIO	++

ID	**NFA 12**
DES	Scalability/Extensability
MOT	The system should be well scalable and able to cope with large growth. Any expansion should be possible so that the system can continue to function without errors.
DEP	NFA 1, NFA 8, NFA 11
PRIO	+

Now that the requirements for the software have been specified, classified and prioritized, they will be converted into a design concept, whereby the functional and non-functional requirements will be related to each other.

4 Design

The requirements just listed are now set in connection with the design. It is explained to what extent the individual parts of the system need to be adapted or redesigned to meet all requirements, from the architecture to the exact specification of the functions the system must have. The structure of the system is first of all explained by the rough architecture, so that one can see all systems involved and how they are connected to each other. In addition, the roles that a user can take on are described in more detail. It is explained how they can interact with the software and other users. Through interaction diagrams, the most important processes in the platform can be shown, so that all work processes and the necessary requirements can be brought into connection [4]. Furthermore, the communication channels are demonstrated and supported by examples of use. The data structure of the groupings, users and all user rights required for the implementation of all functions are also indicated, which are supported by some graphics. It is important to know that the software architecture is only superficially presented here to show the complete software concept. Some deeper insights are also given into communication, roles and group rights, notifications and security aspects. In summary, basic rules and data concepts are presented which are observed by all parts of the system when implementing the whole functional and non-functional requirements.

4.1 Architecture

The different components patient application, eCoach platform and CMS communicate with each other via a backend as already described in the introduction. One can see the rough architecture as shown in Figure 4.1. The individual platforms are connected by the backend, which is represented by the API and the database. All system-relevant data is safely stored here. Data access is given for retrieval with valid authorizations, which is matched via the database. In the CMS, the creation of an intervention begins through the work of an editor. In addition, all administrative work is initially controlled from the CMS. The eCoach platform is the place where an online therapy is planned and where the therapists organize themselves and the studies. The patient application, which should be available as a website and a mobile phone application, is the interface where the patient should be able to interact with any time and any place. Therefore it is important that the software runs on different operating systems and browsers.

Basically, a client-server architecture is chosen, whereby the server holds the data and the clients make requests via an internet connection within a network. This is about an REST- interface. The individual parts of the system can perform services at the server, which then distributes the information [10]. The extended connections between the subsystems that can be used for communication are described in Section 4.4.

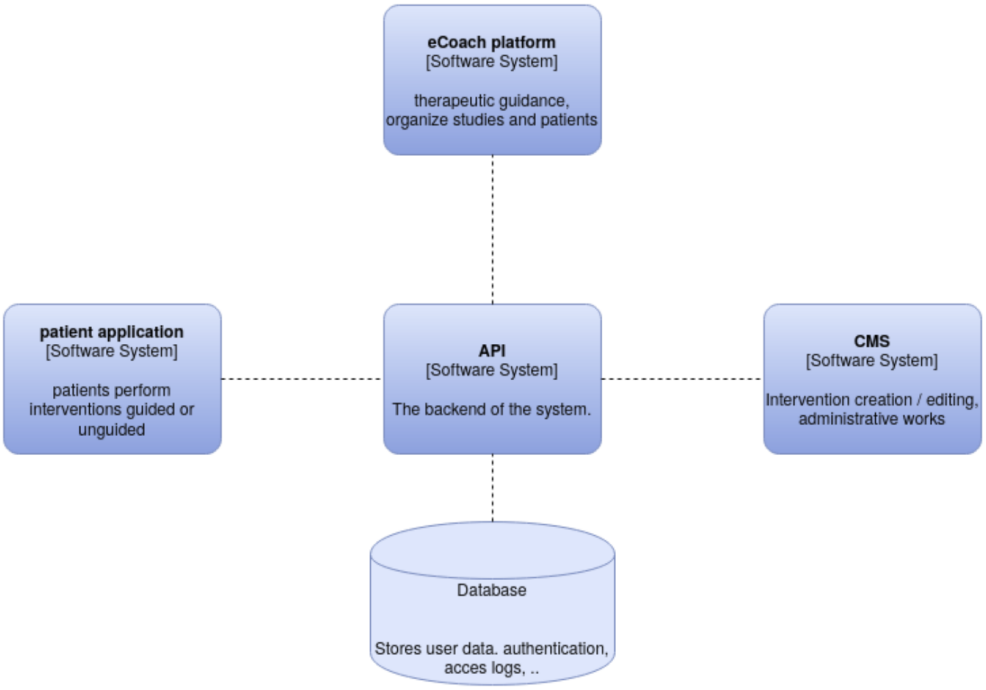

Figure 4.1: The basic architecture of the software.

4.2 Groups, roles and rights

For the organization of grouping of users together there are different types of groups per platform as already mentioned. In the CMS there is a workgroup to organize and structure the editors belonging together. In workgroups the interventions can be created and edited. On the eCoach platform, similar to the workgroups, there are organisationgroups in which exclusively eCoaches are organized and grouped together for example for departments in the university. That means there are no patients included here. Each eCoach can create a study, which is the third type of group in the system. When creating the study, the eCoach automatically has eCoach manager rights in this study and he can invite other eCoaches and organize the study. Furthermore, all eCoaches with manager rights can add interventions and patients or other eCoaches to

a study. Groups can be created at different places in the system. One also need a role that has the authority to create it.

The conceptual level of the *ANSI/SPARC architecture* is used to explain the importance of a logical data model in relation to the implementation of all requirements. A conceptual model can be translated into a logical model that corresponds to a data specification implemented in the database system [13]. In order to get an overview of how the groups are related to the platforms, the three groups are shown graphically in Figure 4.2 realized by an extended ER diagram. The following grouping data model illustrates the functional requirements from Chapter 3.1.2.

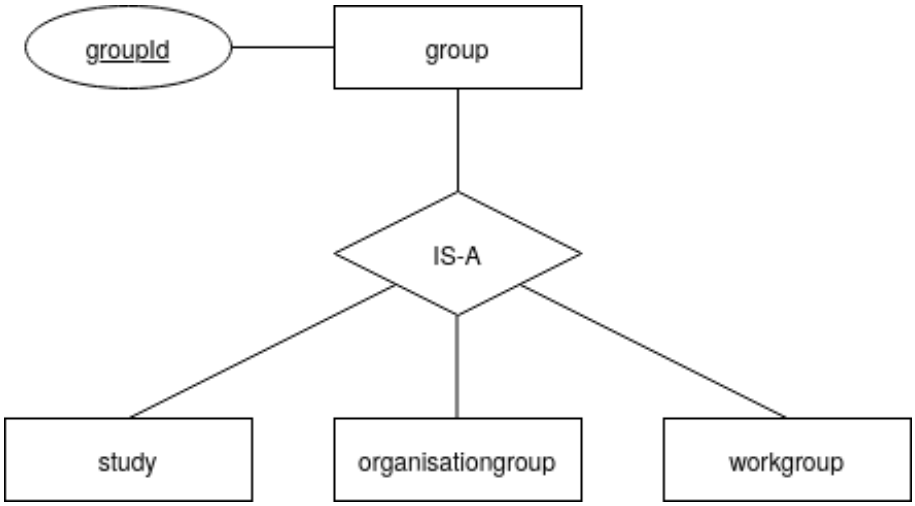

Figure 4.2: The extended ER diagram of the group types.

There are no other attributes mentioned except the ID, but it can be assumed that each type of group has a number of properties which must be observed during implementation. The workgroups are specifically designed for CMS and are used to group editors and interventions. The organisationgroups are the counterpart to this on the eCoach platform. Different departments and therapy groups are organized right here. These two groups have a similar data structure and are therefore represented in the same way internally. In the studies, there are patients and their supporting eCoaches grouped together. Besides these three roles there is also the admin role as shown in Figure 4.3.

Figure 4.3: The different types of actors.

The guidance between patients and eCoaches is established in the studies. In difference to the organisationgroups, this group also contains users with patient roles as can be seen in Figure 4.4. The admin role is assigned to the CMS, since this role acts from here in the current system. This division of the groups is especially important when it comes to the allocation of group and intervention rights.

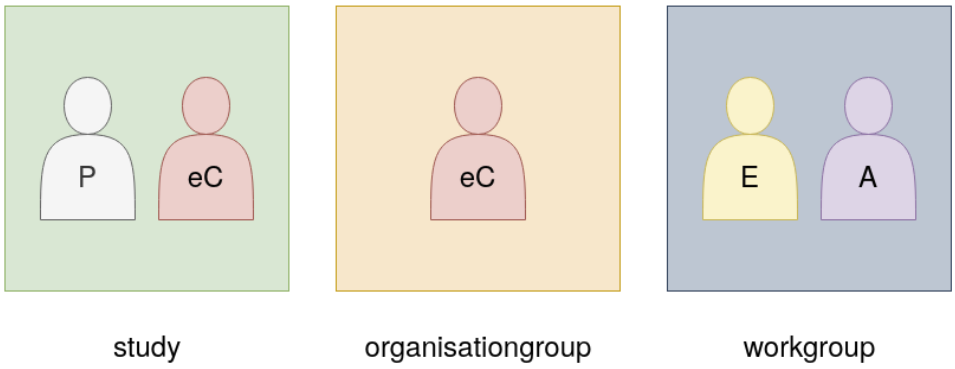

Figure 4.4: The types of groups with the allocated actors.

In addition to the four technical actors, special statuses are added for two roles in the mapping into our system. Per group, extended rights can be assigned to eCoaches or editors.

The **eCoach manager** role is a status that an eCoach can have per group. This role is passed on hierarchically to the interventions in the study group. He manages the group, eCoaches and patients as required by the therapy. He also has the possibility to assign the eCoach manager role to other eCoaches. So there can be more than one eCoach manager per group. The eCoach managers stand hierarchically above the eCoaches and have special rights. The extended rights that the eCoach manager status brings with include:

- edit group settings
- add users to the group

- grant manager status to other eCoaches
- making intervention copy requests for a study

The manager role applies exclusively at group level and can therefore apply to eCoaches in organisationgroups and in studies. This means that even if an eCoach does not have the manager status in an organisationgroup, he can have it in a study, or vice versa.

Similar to the eCoach manager, the **editor manager** has a higher position with more rights. This status is valid per workgroup and can be distributed to other editors through the manager role. The most important tasks are the organization of the workgroup and its editors as well as the answering of intervention requests to add the interventions to studies. If an editor has a manager role in a workgroup, he has the following extended rights:

- edit workgroup settings
- add editors to the group
- grant manager status to other editors
- grant intervention copy rights
- respond to intervention copy requests for a study
- adding interventions to a study

When an eCoach or editor creates his own study or a workgroup he is automatically the first member of this group and has manager status. The following Figure 4.5 shows a graphical representation of the roles with extended rights and they are indicated graphically below by a black hat.

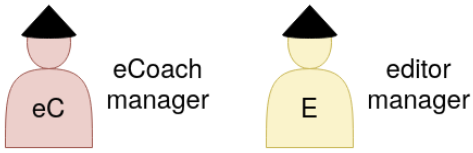

Figure 4.5: The actors with manager status.

In each group there must be at least one user with extended rights to manage the group as shown in Figure 4.6. Each groups have their own settings regarding notifications and access restrictions. All group types can be created from the CMS by an admin. In addition, groups and accounts can be requested by eCoaches and editors via a form, which an admin has to edit. Since the admin role is a special one, it is not directly listed in a workgroup.

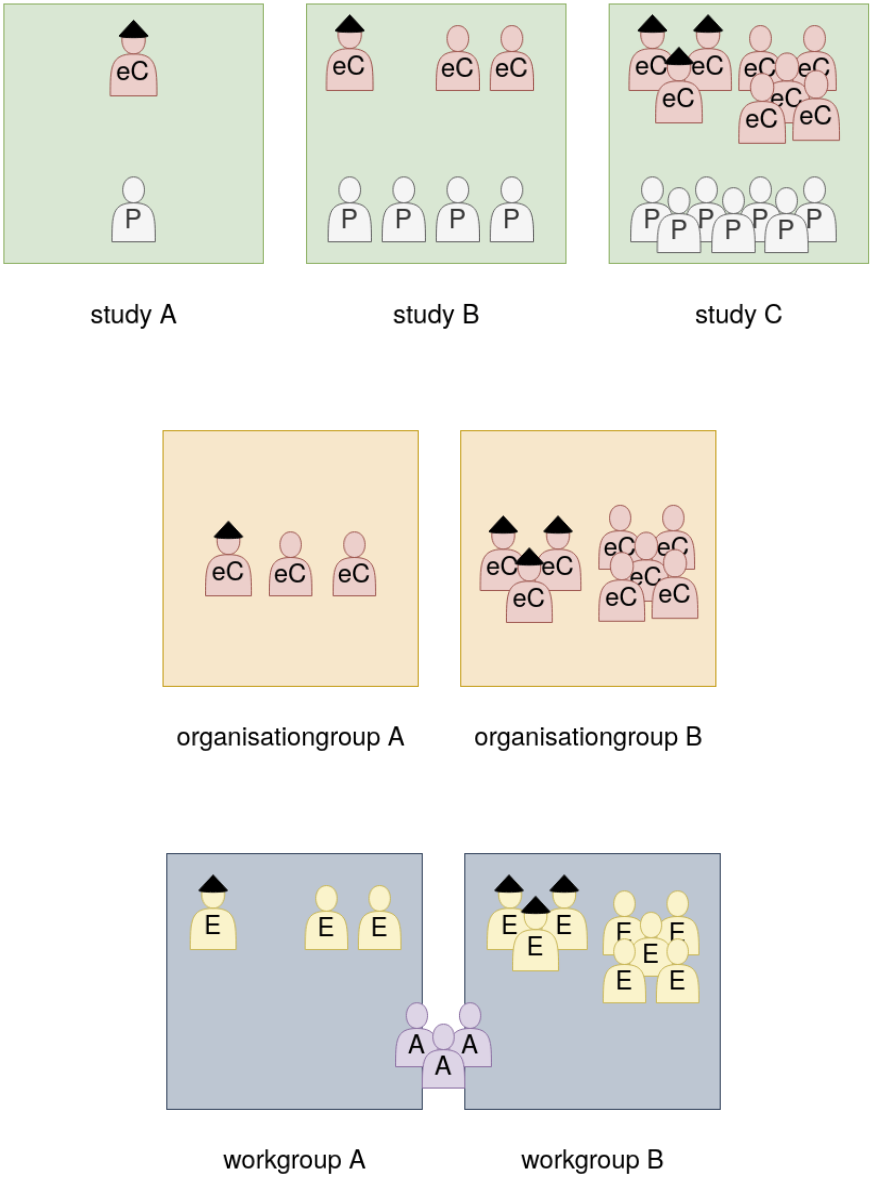

Figure 4.6: Possible compositions in the groups.

4.3 Data Model

The next logical step is to integrate the interventions to perform an IMI. The main entities of the project are now represented by a semantic data model through an ER diagram, as this graphical representation provides a good overview of the facts and is also a template for modeling the database [4].

In Figure 4.7, it can be clearly seen that the connection of all components is characterized by the interventions. The detailed attribute descriptions that the entities have are omitted here for reasons of clarity. For example, each group should implement the group settings explained in Section 3.1.2. Further, each user has an account with various settings as listed in the requirements in Chapter 3.1.1, too. The functions that an eCoach or editor can perform on the basis of his manager status were also ignored here.

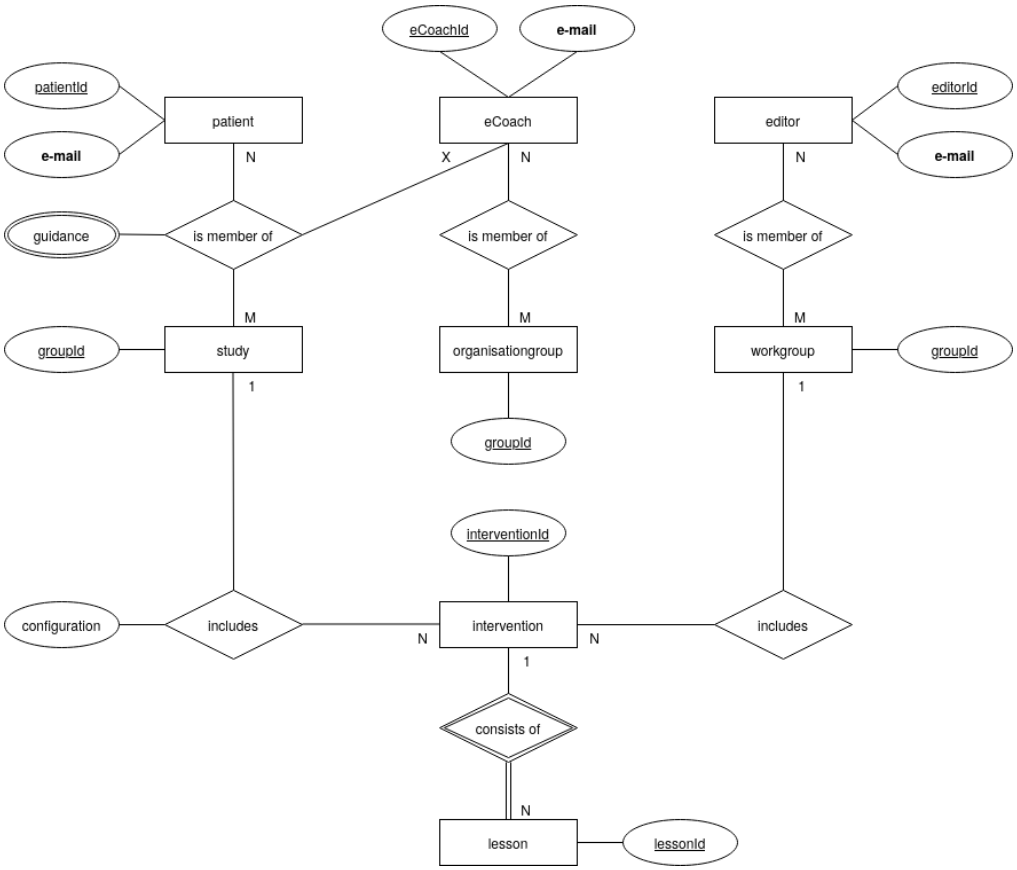

Figure 4.7: ER diagram of the basic components of the system.

The lesson entity has a full participation in the intervention entity. There is a weak relationship that describes a dependence of the lessons on the interventions. The used entities are the basis of the data model of the end system which enables the functionality of IMIs. Since an intervention can be included in different studies and used there adapted to the patients, there is an extra configuration per assignment. In detail even an extra configuration per patient, which is not considered here.

Interaction diagrams

To go more into detail, the functional requirements included in Chapter 3.1 are now grouped by and represented in diagrams. The interaction of all users and the respective platforms can be presented by scenarios realized in interaction diagrams.

First, the requirements of Section 3.1.1 *Accounts* are presented in scenarios. After creating an account, the system can be used depending on the role. These accounts can be created in several ways as described above. In Figure 4.8 we can see the representation of the registration via an invitation. If the patient already has an account, the eCoach will see the nickname of the patient and the adding process runs without the registration. If a patient or eCoach has an account, they can join any study depending on the access types.

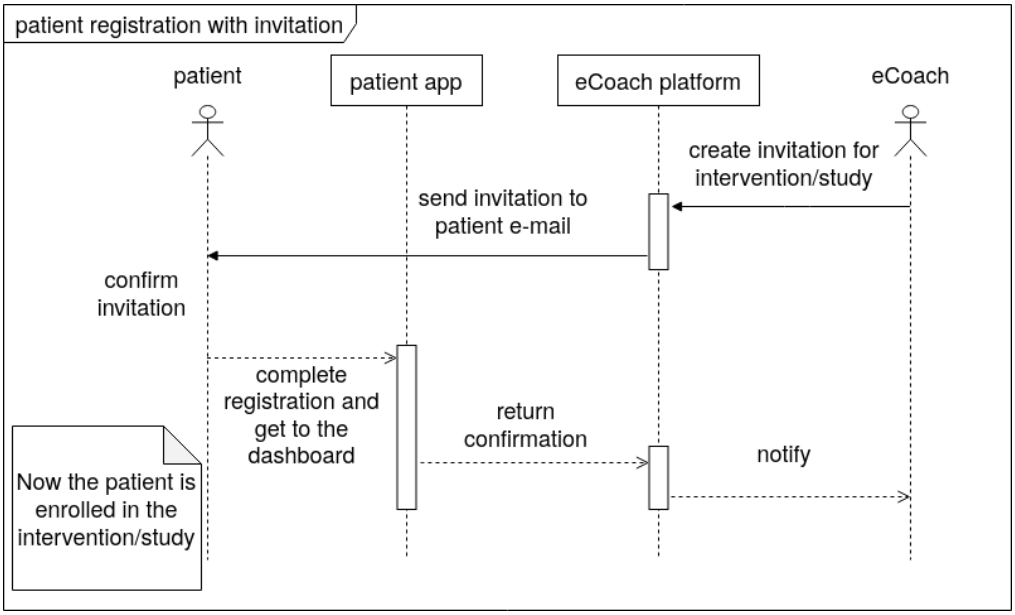

Figure 4.8: Patient registration through an invitation by an eCoach.

Another way to create an account is via a form. If, for example, an eCoach wants to create an account for another therapist, the eCoach can fill out a form. This will be

forwarded to an admin. Then the admin checks this request and rejects the form or confirms it and so submits the data into the database. The communication before an account is created is done via email traffic, as we can see in Section 4.4 *Communication channel*. With this procedure of filling out a form, organisationgroups can also be requested by eCoaches.

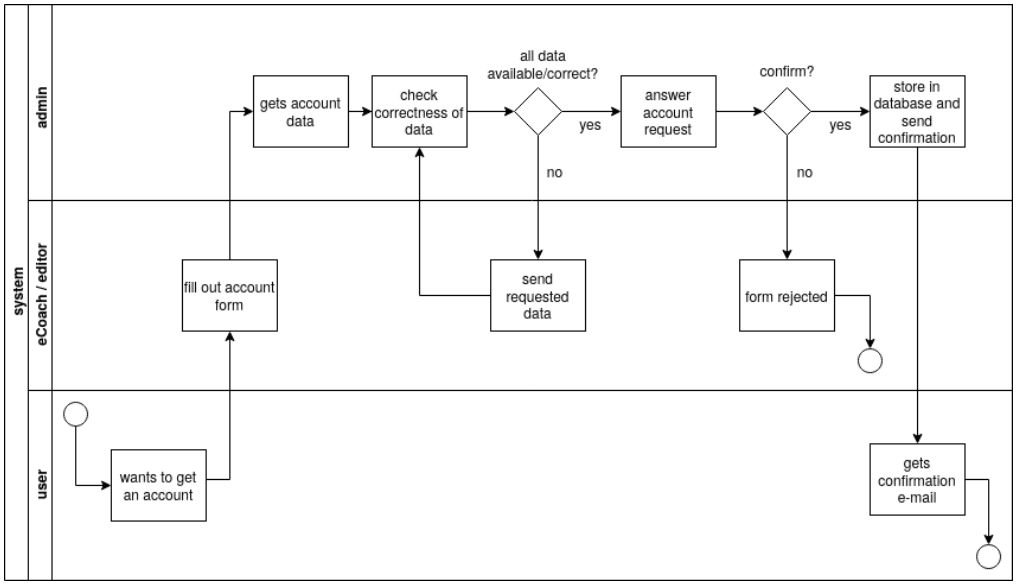

Figure 4.9: Account creation through a form.

The example of a patient's login in Figure 4.10 shows how this process can be transferred to all other roles and their respective platforms. That specific roles cannot login to certain platforms is regulated by the backend and can be read in the Chapter 4.5. The authentication data is requested from the backend on the platform. The maintenance of the connection is controlled by so-called tokens, which are sent with every interaction of the user and stored in the backend. These tokens prevent the user from having to login again when you return to the software after a short pause and prevent the user from staying logged in unintentionally after he has forgotten to log out. The use of tokens is also an important issue in terms of security and it is controlled by the backend.

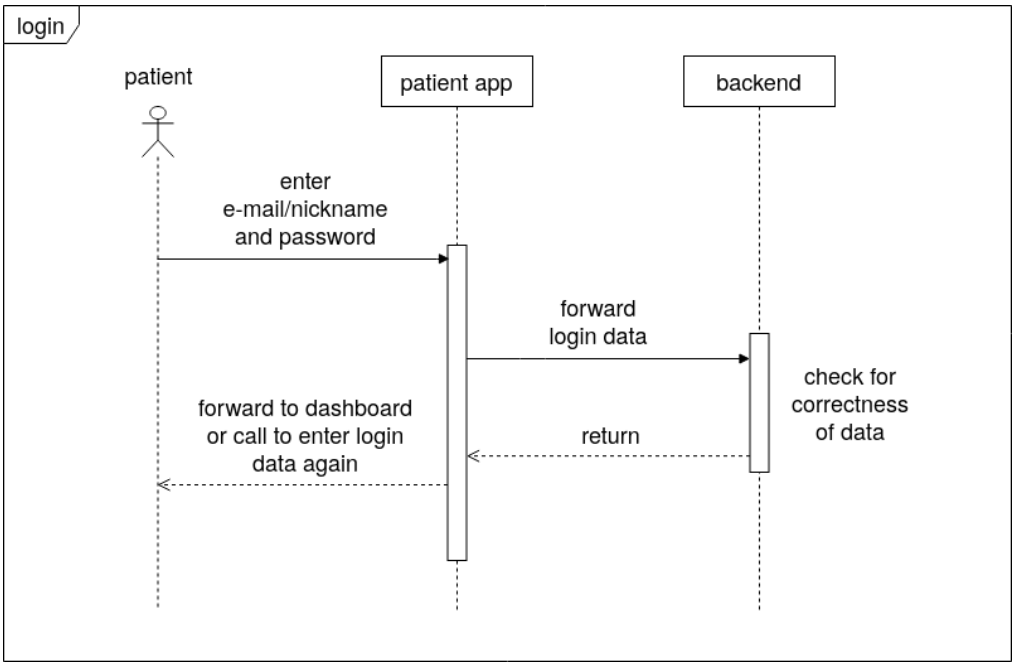

Figure 4.10: Standard login of a user on his platform using the example of a patient.

In the next Figure 4.11, several functions running in the same way are processed using the example change settings. These are mainly requirements from the *Accounts* section, such as *FA-A 3 Reset Password*, *FA-A 7 Personal Settings*, and any kind of system changes like *FA-G 5 Group settings*. Starting from the user, the command is passed to the backend via the corresponding platform. If the changes the user wants to make have an impact on other groups and users, the changes are passed on and updated from the backend. Deleting data in itself is not an easy task in this system, as the data must be kept very confidential. Certain data security aspects have been established for this purpose, which are shown in more detail in Chapter 4.5. The system may only keep the data anonymously or must delete it completely. This creation is also intercepted by the confirmation of an admin. The process of such a deletion is similar to the functions just mentioned, with the addition that further actions must be performed in the backend.

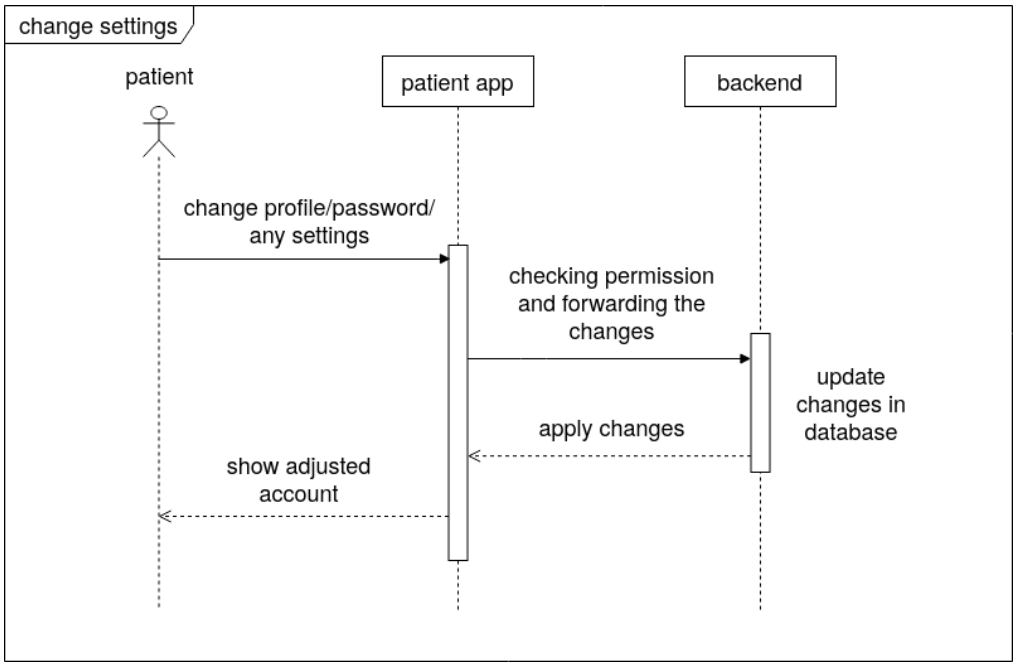

Figure 4.11: The procedure for changing settings.

The creation of organisationgroups is handled by the admin, but editors can create workgroups and eCoaches can create studies themselves. As shown in the diagram in Figure 4.12 a therapist can create a study on the eCoach platform. To do so, he has to provide all information of the study and then he can add members. This procedure works exactly the same in the CMS where an editor is able to create a workgroup. Afterwards everything is stored in the database, so every member can get the study information. When IMIs are created in a workgroup, a default configuration is created for it. Certain settings, e.g., which rights other editors have for the intervention, can also be set. The intervention data and that of the individual lessons are stored in the backend. If editors edit the intervention before it is published, the changes in the database will be adjusted. A published intervention cannot be changed anymore after taking it into use, as it will be added to studies as it was published.

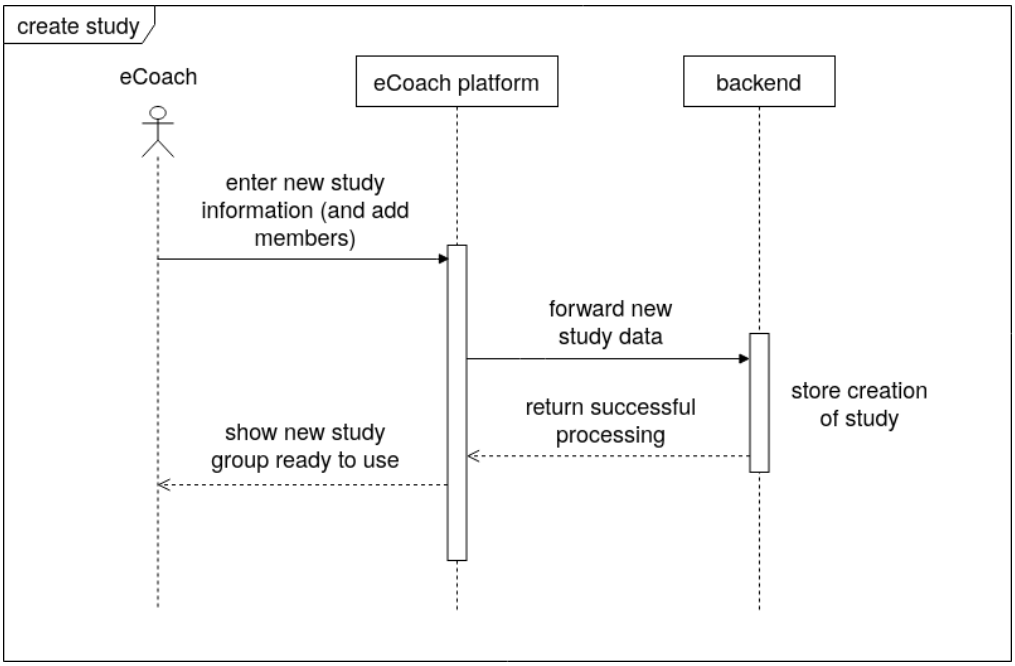

Figure 4.12: The creation of a study.

There are two ways in which an intervention finds its way into a study. First, an eCoach can request an intervention. This request is forwarded to an editor who is responsible for this intervention and who is the editor manager in the concerned workgroup as shown in Figure 4.13. Secondly, an editor would perform the assignment step on his own, which is shown by the solid line in the diagram in Figure. The dotted line describes the process by a request from an eCoach 4.13. When assigning interventions in studies, a copy is created in the background and thus also a separate configration. For example, an eCoach who also has an editor role may have just created a particular study and then create interventions for it himself and link them directly together. To illustrate a generalized case, in Figure 4.14 is a life cycle of an intervention from its conceptual inception, through the assignment to a study and the performance of a patient until the patient has completed the intervention. The end of an intervention has to be considered separately because a therapy does not simply stop when the intervention is over. The moment the eCoach assigns an intervention to the patient, an individual sequence of intervention lessons is put together for the patient, as each patient may need a different length of time for a task. Thus a guidance instance is created, which realizes the FAs from Section 3.1.4 *Therapy* and Section 3.1.3 *Interventions*. If the patient does the procedure unguided, then the feedback part is not performed.

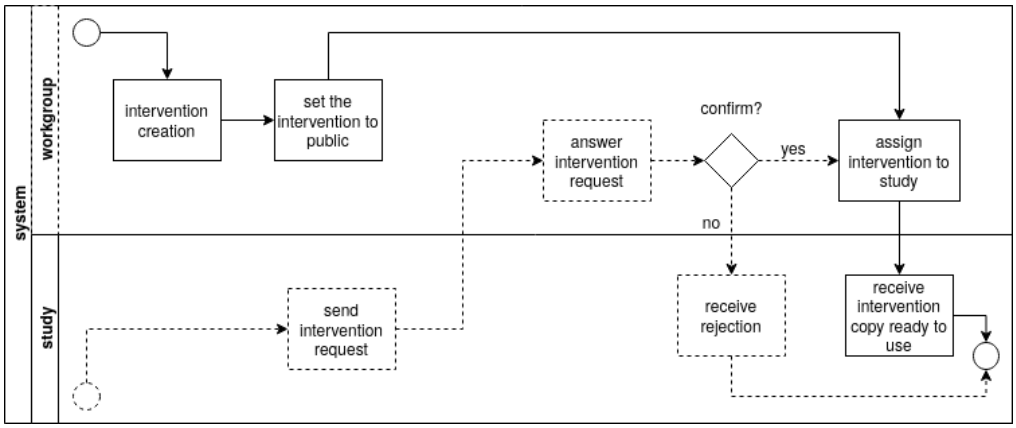

Figure 4.13: Assigning an intervention to a study.

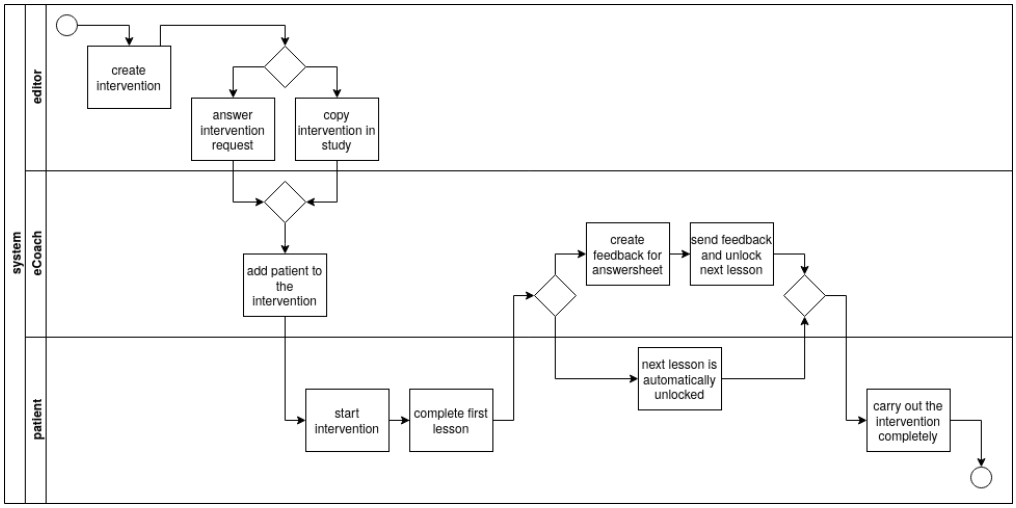

Figure 4.14: A simplified life circle of an intervention.

Between each guided module or lesson we see in Figure 4.14, you can see how a feedback allocation takes place. When the patient completes the lesson, the answersheet is sent to the supervising eCoach. The eCoach can control the therapy in any way he wants, for example by letting the patient repeat the lesson or enabling him to continue with the next one. The feedback can be in different forms, media or just text and it will be sent to the patient as soon as the eCoach wants it.

All diagrams are part of the online therapy process and have a different importance depending on the actor. Communication is probably the most important element. Who communicated with each other at what time was explained yet. How communication takes place will be referred to in the next section.

4.4 Communication channel

The start of the life cycle of a patient who registers up to the accompainment by an eCoach must of course start with a registration of the patient which cannot yet run over the backend. The initial connection between the two runs over a separate communication channel as shown in Figure 4.15.

The eCoach can send his invitation to a study in the beginning only via the email channel (e.g., Outlook), in which the patient gets a link to register. The system creates this link and saves it. For this reason this email must still be passed on to the API via the eCoach platform, because the invitation must be remembered by everyone and the validity must be defined. The authentication in general is always done via the backend. A second server to secure this data would be a consideration to avoid the transmission of passwords to third parties. Currently the data is stored encrypted on a server with all other files.

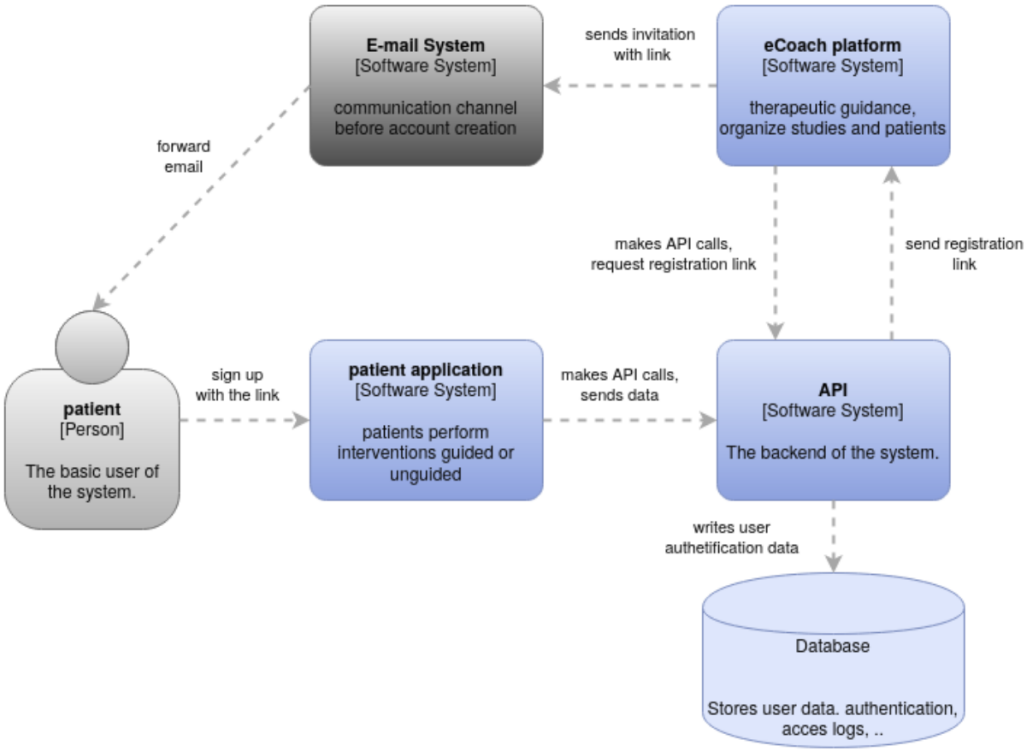

Figure 4.15: The communication channels during patient registration.

The later main communication channel will be the patients' answersheets and the therapists' feedback on the lessons worked on. This content exchange has its own

communication channel which is also handled via the API and runs between the patient application and the eCoach platform. Another way of communication between patient and therapist is a chat for the exchange of messages, which will be extended by video call and the attachment of media. This channel is represented by a separate thread. It is important that communication takes place via the backend and not directly between the platforms, since all interactions are played back here.

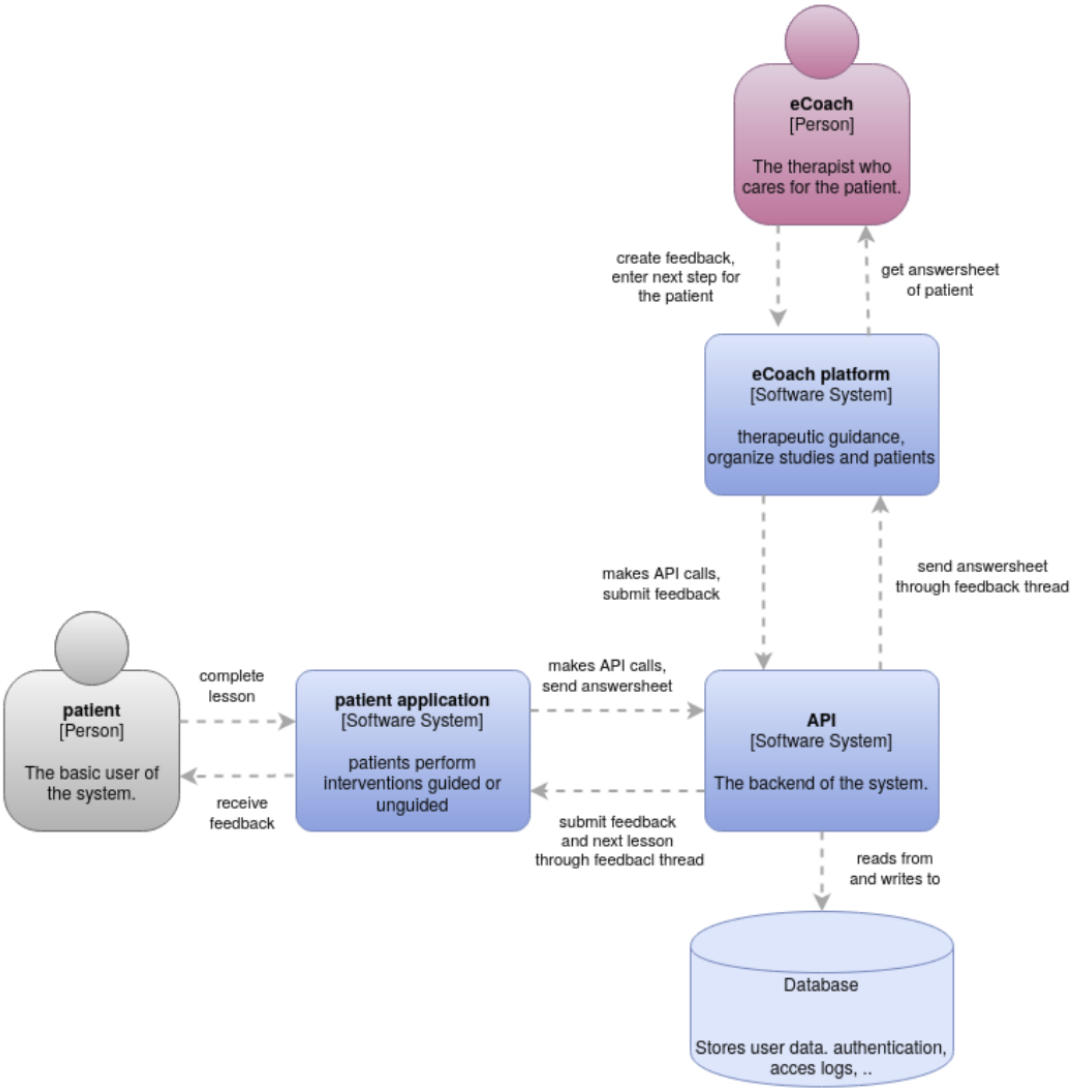

Figure 4.16: The seperate feedback thread for guided interventions.

The CMS communicates mainly with the backend and has less communication with the other two platforms. The provision of the interventions consists of the editors passing the created content to the database via the API. This is also where all retrieval takes place, both from the CMS when copying or assigning interventions to studies and from the patient app and eCoach platform when retrieving.

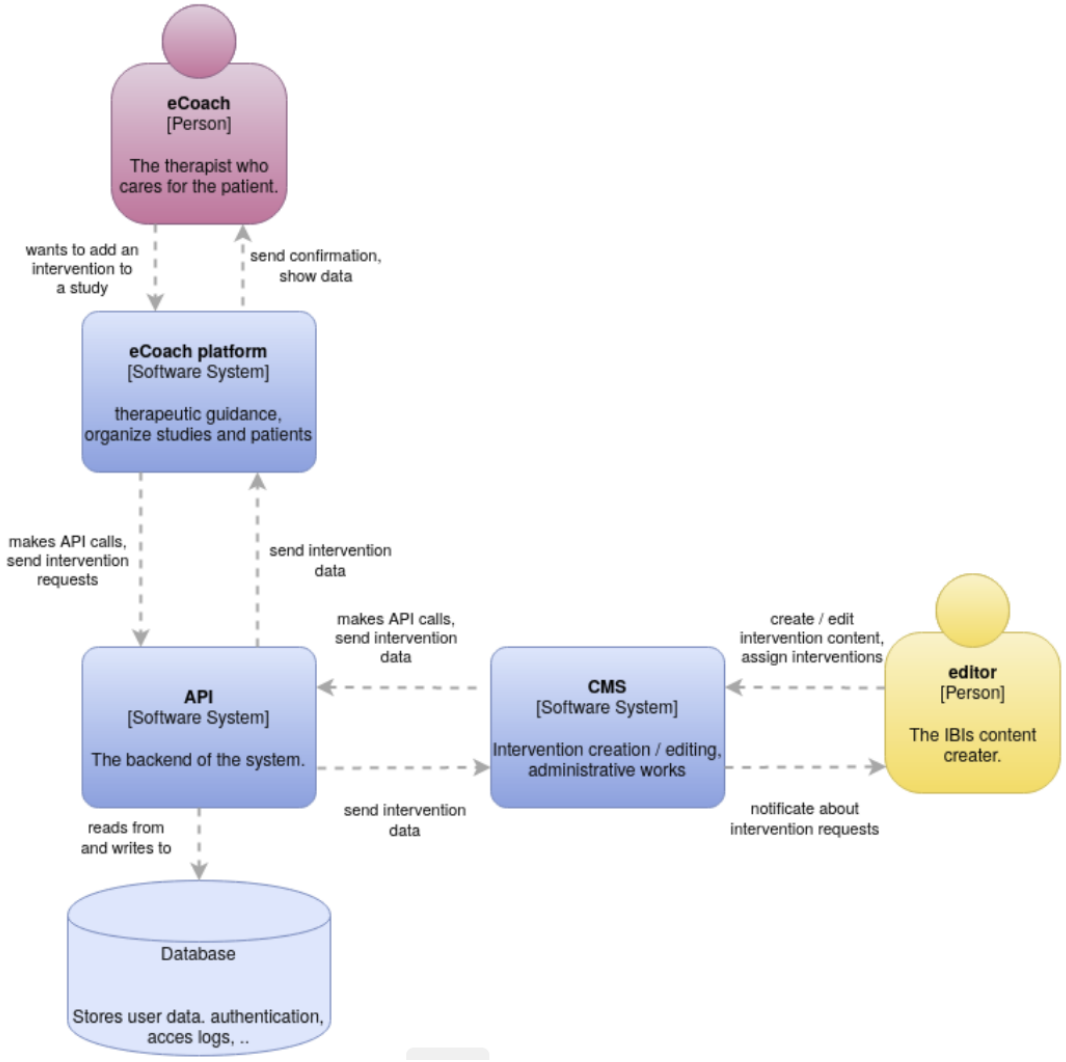

Figure 4.17: The communication between eCoach and editor.

In detail, all data sent and exchanged by the server is sent using the json format. All subsystems must take this into account. The server determines this and all subsystems must follow it to communicate. The storage of the data in the database via the API is

done using a mixture of NoSQL and SQL database systems. The relationships are in themselves based on a relational schema, but the individual elements of the tables are often json elements.

The data sent is user account data, groupings and affiliations of users through groups, interventions and their lessons, as well as the module answersheets filled out by patients and the therapists' feedback. Additionally, of course, group invitations, group requests, assignment of interventions, accompanying associations of patient and therapist and normal chat messages. The legally correct storage of data is discussed in the security section.

Another feature includes an emergency help button for the user when he is in an emergency situation and in the worst case has suicidal thoughts. This concept only makes sense if the help message is forwarded to a responsible person as soon as possible and does not arrive in the email inbox a few hours later. Here an extra email channel will be set up, which is under 24/7 supervision, as shown in Figure 4.18. Additionally, push notifications are sent through all channels to reach a responsible person as quickly as possible.

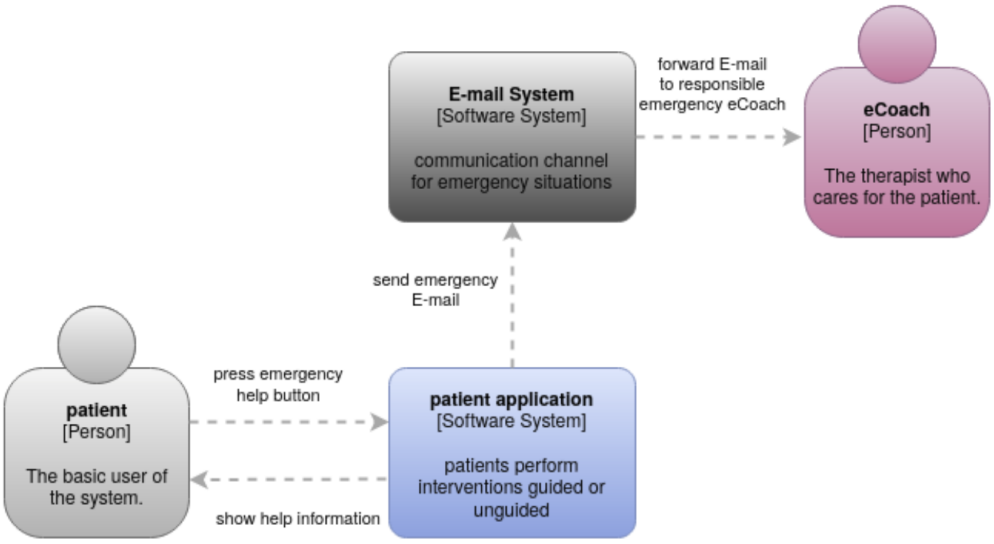

Figure 4.18: The extra channel for emergency situations.

The group notifications or system notifications as explained in chapter 4.4 have their own communication channel. These notifications are sent from the API.

Notifications

Another communication channel is the notifications that are sent from the backend to the subsystems and their users. It should be able to deliver all types of notifications (see *FA-F 17 Notifications*). Notifications are prioritized and can generally be divided for every user into the following four groups:

- Chat Message
- Group/Intervention
- Reminder
- System

There are slightly different notifications for the different platforms and roles, because an editor, for example, does not need the same notifications as a patient. Besides, there are undoubtedly notifications for admins that include IT support/help notifications and so on, but these are not listed here in detail. Furthermore, the frequency of reminder notifications can be changed or turned off in the settings, if desired. Priorities are assigned to notifications, because some notifications such as a patient sending emergency messages should have a higher priority than a normal chat message. Next, the differences in notifications between the roles are shown.

The patient

The app notifications for patients can be divided into six groups. The guidance group is new here, as this type of notification is only relevant between patient and eCoach. Reminder messages are displayed by pop up messages on the phone/desktop and also by email. For some studies the reminder notifications for patients cannot be turned off. This can be set by the responsible eCoach managers in the study settings.

1) Chat Message: This includes the normal message flow inside the patients message area from any other user or group (also missed video calls, transmitted media, etc.)
2) Study/Intervention: This includes study notifications of any kind and the interventions contained therein. (E.g., "You have been assigned to the study *xy*." or "New lesson available.")
3) Guidance: Everything that has to do with the support and feedback of the eCoach. (E.g., "You have received feedback for lesson *xy*." or "The eCoach *example* is your mentor for the study *xy*.")
4) Reminder: Notifications to remind of upcoming lessons or reminder of new chat messages.
5) System: Contains all system notifications such as updates.

The eCoach

Notifications are also available for eCoaches with or without manager status on their platform and slightly different from those for patients. The eCoaches can set which notifications they want to receive by email as reminder and how often they want to receive them. Moreover, they are able to send reminders to the patients manually.

1) Chat Message: This includes the normal message flow inside the eCoach message area from any other user or group (also missed video calls, transmitted media, etc.)
2) Group/Intervention: This includes organisationgroup and study notifications and also the interventions contained therein. (E.g., "The patient *example* would like to join your study *xy*." or "You have been assigned to the role eCoach manager in organisationgroup *xy*.")
3) Guidance: Everything that has to do with the support per se and also answersheets of the patients. (E.g., "The patient *example* has completed the lesson, your feedback is required." or "The Patient *example* was assigned to you.")
4) Reminder: Notifications to remind of required feedback, group requests or reminder of new chat messages. This also includes emergency notifications if a patient wrote an answer with critical words like death for example.
5) System: Contains all system notifications such as updates.

The editor

Notifications are also available for editors in the CMS. The editors can set how often they want to receive them as well. Clearly these notification groupings also apply to editors with manager status.

1) Chat Message: This includes the normal message flow inside the editor message area from any other user and group messages as well.
2) Workgroup/Intervention: This will include all notifications that occur in the workgroup and the interventions contained therein. (E.g., "The editor *example* would like to join your workgroup *xy*." or "The eCoach *example* would like to have the intervention *xy* in the study *xy*.")
3) Reminder: Notifications to remind of new chat messages or workgroup/intervention requests.
4) System: Contains all system notifications such as updates.

4.5 Privacy and Security

As mentioned before, it is very important to maintain the privacy and security policies. For this purpose, a list of regulations was also developed in this project to ensure data security. It must be ensured that the General Data Protection Regulation (GDPR) is observed, to achieve GDPR compliance [30]. The software company *Idera,Inc.*, which offers a system and application management software for Microsoft Windows and Linux servers, provides an overview on their website about what you should consider as a developer in the data protection context [18].

In order to consider a data protection and security concept, all security-critical interactions with the software were first collected. The NFA's from Chapter 3.2 were considered.

- Authentication: what should the password look like, how often should it be entered wrong, reset password
- Encrypted channels for communication (chats and messages, answersheets and feedback)
- Secure personal data, granular visibility of user data
- Storage of personal data
- Deletion of personal data
- Rights management of the roles involved
- Intercept from the API which role can login to which platform (e.g., patient cannot login to the CMS)
- Transfer of patients and their data, keyword: guidance (holiday replacement, sick leave, etc.)
- Visibility of profiles (which account can see which other accounts or which profile?)

For a security and privacy policy some considerations have been made, which sometimes concern the use of the system, especially user security, network security, organizational and administrative security are presented.

The network environment is secured by firewalls and the communication is end-to-end encrypted using TLS. Organizational security also includes the planning of training so that all system employees are sensitized to the handling of personal data. For their protection, this administrative information is subject to a two-factor authentication, where a proof of identification means using two different and independent components [27].

User security mainly covers the processing and storage of data. The intervention data is archived for the patient and the regarding mentor. In activity logs both can trace

and monitor the processes of the modules. The user accounts are pseudonymised and linked to the accruing data so that no conclusions can be drawn from individual data to persons. During registration, a basis for protected data is created by entering an email address and a password of sufficient complexity. To ensure privacy, all passwords are encrypted.

What the system knows about the user must not be passed on to unauthorized third parties and must be completely and timely deleted if the person concerned so wishes. Already during the creation of the interventions, certain fields can be marked as personal, which offers considerable advantages when deleting from the database. This saves anonymous data that cannot be traced back to the patient. This is a big advantage if you want to use the data for an evaluation. Moreover, every system user has the possibility to export his data. Mainly the functional requirements of Section 3.1.1 *Accounts* have been considered here. Furthermore, just like the requirement *reportings*, *confidentiality of patient information* and *exporting data* are considered here.

A data protection declaration precisely records all legal provisions. A declaration of consent informs patients about their rights and safety regulations when they start using the system. [25]

5 Conclusion

Finally, this section offers a summary as well as self-reflection on the process and execution of the task. Moreover, the thesis gives an outlook on the challenges the project will face and the topics that will be investigated in the future to improve the system

5.1 Summary

Carrying out a requirements analysis was essential in order to specify exact guidelines for the system, which can be followed when implementing the upcoming features. Based on the existing requirements, functional and non-functional requirements were distinguished, grouped and partly specified in detail. After that, mockups and interaction diagrams with the involved subplatforms were collected in order to rebuild the data model so that the patient app, the eCoach platform and the CMS could use a common new data model regarding the basic data structure. This included the new concept of groupings, the types of notifications that can occur per platform and user, as well as the procedure for assigning interventions to a group. In order to create a security concept the functional requirements and the created scenarios then were used and categorized. Thus the basis was laid to form the security-critical parts of the software into a data protection concept and a security declaration. As discussed in the Fundamentals, some features such as the future inclusion of family and friends and smart sensing features are essential to take online therapy to the next level. In addition to the requirements for the basic functionality of IMIs, some additional future features were defined and considered in the design concept to avoid later expensive and difficult adjustments to the system.

5.2 Discussion

Collecting and specifying the functional requirements proved to be extremely time-consuming due to their dynamics. It was also a challenge to include all parts of the system in all decisions, more precisely the team members working on them. In order to get detailed guidelines and requirements it was important that the sub-parts and

members of the psychology team agreed on them. With regard to reach the best possible agreement on drafts and requirements, many meetings and conversations were helpful and goal-oriented. As the system was built on the basis of a similar software project, difficulties were also apparent. The restructuring of the data model that was developed through this work was necessary and has now been fully adapted to the IMIs context. To specify the design concept, discussions were held with the therapeutic workers of the Institute of Psychology, who also gave feedback from their studies of test patients. Another advantage was the experience of the psychologists with the minddistrict system, because they were able to tell precisely about what they dislike about the system and what had to be retained in the new software system. The preliminary work that was already available in the project was definitely a help and gave a basis for requirements engineering. The task to keep the requirements always up to date and available for everyone was one of the most important work of the project. The biggest lessons learned are certainly the difficulty of the engineering process itself in such a large project involving several people.

5.3 Outlook

Considering the fact that the system is to be used by many patients and therapists as well as health insurance companies, there is a lot of visionary thinking. Before the system can be used for treatment, the implementation of extra features must first be moved back in the implementation order. If the basic functionalities all work smoothly, the future requirements will be implemented, which have also been recorded above in this work.

Some important further work will be the integration of the patients private environment, whereby the therapy can be integrated even further into everyday life. Through studies the software can be observed on test persons and possible errors can be corrected before operational use. The whole additional software development process should be supported by a usability engineer, who keeps the goal in mind and stays in contact with all project participants. If we take a look at the visionary requirements, we find that extensions of the chat module can be used for a video call, as already described in the functional requirements. The priority of such requirements was therefore deliberately set low. These requirements, which are taken into account in the specification, will be set up in later software versions. Another issue for future research to explore is multi-client capability, disjunct client-oriented data storage and its presentation and configuration. Moreover, smart sensing, artificial intelligence and detailed usability tests provide an interesting subject area for further research. Also, automated CI/CD pipelines will be used to monitor the application development. Before the platform can be used throughout Germany or even worldwide, some functions must be expanded.

Looking forward, the *eSano* software must comply with the requirements of the Medical Devices Act, as it uses a so-called healthcare app.

For all further work with the system, the collected data can be seen as a basic concept and can be used as orientation for following steps. The current state of the software maps all basic functionalities, which is why less prioritized requirements can be implemented as the next step. The visions of the project are clearly defined and point to a successful implementation of an online intervention platform. Looking to the future, it can be said that due to increasing digitalisation, the relationship between therapists and patients can be intensified through online care. In summary, such systems are more up-to-date than ever.

List of Figures

Bibliography

[1] C. Abras, D. Maloney-Krichmar, J. Preece *et al.*, "User-centered design," *Bainbridge, W. Encyclopedia of Human-Computer Interaction. Thousand Oaks: Sage Publications*, vol. 37, no. 4, pp. 445–456, 2004.

[2] Abteilung Klinische Psychologie und Psychotherapie Universität Ulm. (2020) eSano last accessed: 2020-05-24. [Online]. Available: https://esano.klips-ulm.de/de/

[3] G. Andersson and N. Titov, "Advantages and limitations of internet-based interventions for common mental disorders," *World Psychiatry*, vol. 13, no. 1, pp. 4–11, 2014. [Online]. Available: https://www.onlinelibrary.wiley.com/doi/abs/10.1002/wps.20083

[4] H. Balzert, *Lehrbuch der softwaretechnik: Basiskonzepte und requirements engineering*. Springer-Verlag, 2010.

[5] A. Barak, L. Hen, M. Boniel-Nissim, and N. Shapira, "A comprehensive review and a meta-analysis of the effectiveness of internet-based psychotherapeutic interventions," *Journal of Technology in Human Services*, vol. 26, no. 2-4, pp. 109–160, 2008. [Online]. Available: https://doi.org/10.1080/15228830802094429

[6] H. Baumeister, L. Reichler, M. Munzinger, and J. Lin, "The impact of guidance on internet-based mental health interventions — a systematic review," *Internet Interventions*, vol. 1, no. 4, pp. 205 – 215, 2014. [Online]. Available: http://www.sciencedirect.com/science/article/pii/S2214782914000244

[7] V. Bell, "Online information, extreme communities and internet therapy: Is the internet good for our mental health?" *Journal of Mental Health*, vol. 16, no. 4, pp. 445–457, 2007. [Online]. Available: https://doi.org/10.1080/09638230701482378

[8] M. Bilal, M. Waqar, and A. Javed, "An effective quality model for evaluating mobile websites," *University of Engineering and Technology Taxila. Technical Journal*, vol. 20, no. 3, p. 54, 2015.

[9] L. Chung, B. A. Nixon, E. Yu, and J. Mylopoulos, *Non-functional requirements in software engineering*. Springer Science & Business Media, 2012, vol. 5.

[10] M. R. Civanlar and B. G. Haskell, “Client-server architecture using internet and public switched networks,” Nov. 30 1999, uS Patent 5,995,606.

[11] B. F. Dear, J. B. Zou, S. Ali, C. N. Lorian, L. Johnston, M. D. Terides, L. G. Staples, M. Gandy, V. J. Fogliati, B. Klein, and N. Titov, “Examining self-guided internet-delivered cognitive behavior therapy for older adults with symptoms of anxiety and depression: Two feasibility open trials,” *Internet Interventions*, vol. 2, no. 1, pp. 17 – 23, 2015. [Online]. Available: http://www.sciencedirect.com/science/article/pii/S2214782914000323

[12] M. Domhardt, H. Geßlein, R. E. von Rezori, and H. Baumeister, “Internet-and mobile-based interventions for anxiety disorders: A meta-analytic review of intervention components,” *Depression and anxiety*, vol. 36, no. 3, pp. 213–224, 2019.

[13] C. Fankam, S. Jean, L. Bellatreche, and Y. Aït-Ameur, “Extending the ansi/sparc architecture database with explicit data semantics: An ontology-based approach,” in *European Conference on Software Architecture*. Springer, 2008, pp. 318–321.

[14] G. H. Galal and R. J. Paul, “A qualitative scenario approach to managing evolving requirements,” *Requirements Engineering*, vol. 4, no. 2, pp. 92–102, 1999.

[15] J. J. Garrett, *Elements of user experience, the: user-centered design for the web and beyond*. Pearson Education, 2010.

[16] M. Glinz, “On non-functional requirements,” in *15th IEEE International Requirements Engineering Conference (RE 2007)*. IEEE, 2007, pp. 21–26.

[17] H. Heitkötter, S. Hanschke, and T. A. Majchrzak, “Evaluating cross-platform development approaches for mobile applications,” in *International Conference on Web Information Systems and Technologies*. Springer, 2012, pp. 120–138.

[18] Idera,Inc. (2020) Idera,Inc. last accessed: 2020-05-24. [Online]. Available: https://www.ideracorp.com/Legal/PrivacyShield

[19] Kooperationsprojekt im Rahmen des Projekts "ICare - Integrating Technology into Mental Health Care Delivery in Europe". (2020) ICare Prevent last accessed: 2020-05-22. [Online]. Available: https://icareprevent.com/

[20] P. Loucopoulos and V. Karakostas, *System Requirements Engineering*. USA: McGraw-Hill, Inc., 1995.

[21] J. Ludewig and H. Lichter, *Software Engineering: Grundlagen, Menschen, Prozesse, Techniken*. dpunkt. verlag, 2013.

[22] J. L. Martin, B. J. Norris, E. Murphy, and J. A. Crowe, “Medical device development: The challenge for ergonomics,” *Applied ergonomics*, vol. 39, no. 3, pp. 271–283, 2008.

[23] Mental Health Intervention. (2020) Mental Health Intervention last accessed: 2020-05-22. [Online]. Available: https://mentalhealthintervention.org/

[24] minddistrict. (2020) minddistrict last accessed: 2020-05-22. [Online]. Available: https://www.minddistrict.com/

[25] M. Offergeld, “Vorlesung Usability Engineering - 06-UE-Integration-Entwicklungsorganisation-download-uni,” Wintersemester 2019/2020.

[26] R. Pichler, *Scrum: agiles Projektmanagement erfolgreich einsetzen*. dpunkt. verlag, 2013.

[27] M. Rouse. (2020) Zwei-Faktor-Authentifizierung last accessed: 2020-05-24. [Online]. Available: https://www.computerweekly.com/de/definition/Zwei-Faktor-Authentifizierung

[28] S. Saddichha, M. Al-Desouki, A. Lamia, I. A. Linden, and M. Krausz, “Online interventions for depression and anxiety–a systematic review,” *Health Psychology and Behavioral Medicine: an Open Access Journal*, vol. 2, no. 1, pp. 841–881, 2014.

[29] E. Scheuer, “Wie medical-decision-support-systeme die arzt-patient-beziehung verändern–digitalisierung von informationen führt zu einer erhöhten autonomie des patienten,” in *Digitale Transformation von Dienstleistungen im Gesundheitswesen I*. Springer, 2017, pp. 311–321.

[30] The General Data Protection Regulation. (2020) GDPR.EU last accessed: 2020-05-27. [Online]. Available: https://gdpr.eu/

[31] S. Thonse, N. Siddaramappa, R. Sindhgatta, P. Mahalingam, S. Dhulipala, and R. Subramanian, “Software system requirements specification framework and tool,” Aug. 3 2006, uS Patent App. 11/084,730.

[32] Youper. (2020) Youper - Emotional Health last accessed: 2020-05-22. [Online]. Available: https://www.youper.ai/

Declaration

I, Sabrina Böhm, matriculation number 868071, hereby declare that I created this work on my own. Except where referenced and credited to the original author, I have not used the material of others in my work.

Ulm, ...

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