Czech Technical University in Prague
Faculty of Electrical Engineering
Department of Computer Graphics and Interaction

User model for visually impaired older adults

Master thesis

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Master programme: Open Informatics
Branch of study: Human-Computer Interaction
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ZADÁNÍ DIPLOMOVÉ PRÁCE

ČVUT
ČESKÉ VYSOKÉ
UČENÍ TECHNICKÉ
V PRAZE

I. OSOBNÍ A STUDIJNÍ ÚDAJE

Příjmení: **Bílek**   Jméno: **Petr**   Osobní číslo: **407007**

Fakulta/ústav: **Fakulta elektrotechnická**

Zadávající katedra/ústav: **Katedra počítačové grafiky a interakce**

Studijní program: **Otevřená informatika**

Studijní obor: **Interakce člověka s počítačem**

II. ÚDAJE K DIPLOMOVÉ PRÁCI

Název diplomové práce:

Uživatelský model pro seniory se zrakovou vadou

Název diplomové práce anglicky:

User model for visually impaired older adults

Pokyny pro vypracování:

Senioři s vážnou zrakovou vadou často žijí v pobytových zařízeních, která jim poskytují specializovanou péči. Tato uživatelská skupina má specifické problémy a preference, zejména z hlediska orientace v prostoru a interakce s technologiemi. Časté jsou i problémy kognitivního charakteru (například Alzheimerova choroba). Pro tuto skupinu je často nutné přizpůsobit metody interakce s ICT na základě schopností a preferencí konkrétního uživatele. Podobně je vhodné podobným způsobem přizpůsobovat i formu poskytované péče. Toto přizpůsobení je možné na základě vhodného popisu vnějších faktorů relevantních pro interakci (model kontextu), zejména pak na základě popisu schopností, preferencí a potřeb konkrétní osoby (model uživatele).
Proveďte analýzu stávajících metod pro modelování kontextu se zřetelem na uživatelský model. Proveďte analýzu výsledků výzkumu zaměřeného na specifické schopnosti, preference a potřeby nevidomých osob vyššího věku. Analyzujte model péče podle prof. E. Böhma založený na psychobiografickém modelování osob [1,2].
Na základě provedené analýzy definujte funkční a nefunkční požadavky na model uživatele. Navrhněte model uživatele, který umožní modelování atributů významných při interakci s osobami s vážným zrakovým postižením se zřetelem na osoby vyššího věku. Struktura modelu umožní modelování atributů významných z hlediska psychobiografického modelování. Navrhněte scénáře adaptace vybraných aplikací na základě navrženého modelu. Dále navrhněte scénáře aplikace psychobiografického modelu péče s využitím navrženého uživatelského modelu. Navrhněte a realizujte prototyp uživatelského rozhraní pro pečovatele, které umožní správu uživatelského modelu jednotlivých klientů. Navržené řešení a realizovaný prototyp rozhraní vhodnou metodou otestujte s pracovníky pečujícími o osoby se zrakovou vadou.

Seznam doporučené literatury:

[1] E. Böhm, "Psychobiografický model péče podle Böhma", Mladá Fronta, 2015, ISBN 978-80-204-3197-4
[2] E. Procházková, "Práce s biografií a plány péče", Mladá Fronta, 2014, ISBN 978-80-204-3186-8

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III. PŘEVZETÍ ZADÁNÍ

Diplomant bere na vědomí, že je povinen vypracovat diplomovou práci samostatně, bez cizí pomoci, s výjimkou poskytnutých konzultací.
Seznam použité literatury, jiných pramenů a jmen konzultantů je třeba uvést v diplomové práci.

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| Datum převzetí zadání | Podpis studenta |

Declaration

I hereby declare I have written this master thesis independently and quoted all the sources of information used in accordance with methodological instructions on ethical principles for writing an academic thesis. Moreover, I state that this thesis has neither been submitted nor accepted for any other degree.

In Prague, May 2019

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Bc. Petr Bílek

Acknowledgements

Abstract

Senioři s vážnou zrakovou vadou často žijí v pobytových zařízeních, která jim poskytují specializovanou péči. Tato uživatelská skupina má specifické problémy a preference, zejména z hlediska orientace v prostoru a interakce s technologiemi. Časté jsou i problémy kognitivního charakteru (například Alzheimerova choroba). Pro tuto skupinu je často nutné přizpůsobit metody interakce s ICT na základě schopností a preferencí konkrétního uživatele. Podobně je vhodné podobným způsobem přizpůsobovat i formu poskytované péče. Toto přizpůsobení je možné na základě vhodného popisu vnějších faktorů relevantních pro interakci, zejména pak na základě popisu schopností, preferencí a potřeb konkrétní osoby.

Tato diplomová práce navrhuje řešení *Systému správy klientů* se zaměřením na uživatelský model a administrační uživatelské rozhraní. Navržený uživatelský model spojuje aspekty osobní psychobiografie, která je již úspěšně aplikována v gerontologické péči a aspekty, které jsou důležité pro interakci s technologiemi.

Klíčová slova: zrakové omezení, senioři, uživatelský model, uživatelské rozhraní, Ability-based design, User-Centered Design, uživatelský výzkum, testování použitelnosti

Older adults with severe vision impairment often live in residential care institutions that provide specialised care. This user group has specific needs, abilities, and preferences, primarily from the perspective of orientation in space and interaction with technologies. Frequently, they are challenged with cognitive issues (i.e., Alzheimer's disease). For this user group, it is often necessary to adapt the interaction methods with ICT accordingly to the abilities and preferences of a particular user. Similarly, it is convenient to adjust the form of provided care. This adaptation is enabled by an appropriate description of external factors relevant to the interaction, in particular by a proper description of abilities, preferences, and needs of a specific person.

This master thesis proposes the solution of the *Client management system* with the focus on the user model and the administration user interface. The designed user model connects aspects of personal psychobiography that is already successfully applied in the gerontological care and aspects that are important for interaction with technologies.

Keywords: visual impairment, older adults, user model, user interface, Ability-based design, User-Centered Design, user research, usability testing

Contents

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List of Acronyms

API Application Programming Interface. 41

CSO Czech Statistical Office. 1, 12

CTU FEE Czech Technical University in Prague, Faculty of Electrical Engineering. 1, 30

ETSI European Telecommunications Standards Institute. 7

FRUI User Interface Functional Requirements. 31

FRUM User Mode Functional Requirements. 31

GUMO General User Model Ontology. 8, 10

HTA Hierarchical Task Analysis. 50, 54

ICD International Statistical Classification of Diseases and Related Health Problems. 6, 48

ICF International Classification of Functioning, Disability and Health. 6, 10

NFRUI User Interface Non-functional Requirements. 34

NFRUM User Mode Non-functional Requirements. 34

OWL Web Ontology Language. 10

RDF Resource Description Framework. 8

SUI User Interface Scenario. 50, 54

SUM User Model Scenario. 43

UC Use case. 53, 54

UCD User-Centered Design. 1, 34, 37, 50, 61, 64, 65, 75, 77

UML Unified Modeling Language. 9

UserML User Model Markup Language. 8

VUMS Virtual User Modelling and Simulation Standardisation. 8, 9

WHO World Health Organization. 1, 5, 6, 10, 12, 48

Chapter 1

Introduction

This master thesis follows the research projects on the Czech Technical University in Prague, Faculty of Electrical Engineering (CTU FEE) – Department of Computer Graphics and Interaction that are focused on the group of visually impaired older adults.

The objective of the thesis is to design the user model and the user interface of the *Client management system*, which will serve workers of the residential care home and also indirectly the clients through various devices and provided care. The user model can represent individual aspects related to personal biography as well as aspects important for adaptation of user interfaces and interaction methods. This effort also aims to help the personnel of specialised care institution in providing personalised care and make the interaction with technologies accessible for the group of visually impaired older adults. In the design of the user model, the focus is placed on the ability-based design concept and the User-Centered Design (UCD) concept is followed in the process of the user interface design.

In this chapter, the motivation behind the idea of realisation of the whole solution is presented, as well, as the goals of the thesis.

1.1 Motivation

According to [1], the majority of visually impaired people, nearly 53 %, is older than 70 years. Also, data provided by the Czech Statistical Office (CSO) in [2] show, that the majority of people with visual impairment in the Czech Republic, nearly 67 %, is older than 60 years, which corresponds to global world data. Moreover, the proportion of older adults in the population is steadily rising and according to World Health Organization (WHO) this trend will continue, due to increasing life expectancy and decreasing birth rate [3].

During ageing, a large proportion of the population is acquiring some kind of health

impairment. Older adults with severe vision impairment often live in residential care institutions that provide specialised care based on personal psychobiographical modelling of individuals [4], [5]. This user group has specific needs, abilities, and preferences, primarily from the perspective of orientation in space and interaction with technologies. Frequently, they are challenged with cognitive issues (i.e., Alzheimer's disease). For this user group, it is often necessary to adapt the interaction methods with ICT accordingly to the abilities and preferences of a particular user. Similarly, it is convenient to adjust the form of provided care. This adaptation is enabled by an appropriate description of external factors relevant to the interaction (context model), in particular by a proper description of abilities, preferences, and needs of a specific person (user model).

1.2 Master thesis goals

This section summarises the general objectives of this master thesis. The primary aim is to design the user model for visually impaired older adults as well as the user interface for its maintenance. Individual goals that will lead to the accomplishment of the primary aim of this master thesis are listed below:

- **G1:** Analysis of current context modelling methods with a focus on user modelling.

    - *Discussed in Section 2.1*

- **G2:** Analysis of the outcomes of current research focused on specific abilities, preferences, and needs of visually impaired older adults.

    - *Discussed in Section 2.2*

- **G3:** Analysis of the care model according to E. Böhm [4], based on psychobiographical modelling of individuals.

    - *Discussed in Sections 2.3 and 2.4*

- **G4:** Definition of functional and non-functional requirements on the user model and user interface for caregivers.

    - *Discussed in Section 2.7*

- **G5:** Design of user model that will enable the modelling of attributes relevant to interaction with people with severe vision impairment with a focus on older adults. The structure of the model will also allow the modelling of important attributes from the psychobiographical modelling perspective.

    – *Discussed in Section 3.2*

- **G6:** Design of scenarios of adaptation of selected applications based on the designed user model.

    – *Discussed in Section 3.2.1*

- **G7:** Design of scenarios of adaptation of psychobiographical care model that will use the developed model.

    – *Discussed in Section 3.3.1*

- **G8:** Design and implementation of a prototype of a user interface for caregivers that will allow management of user models of individual clients.

    – *Discussed in Section 3.2.1 and Chapter 4*

- **G9:** Evaluation of the solution and developed user interface prototype with caregivers providing care to visually impaired older adults.

    – *Discussed in Chapter 5*

Chapter 2

Analysis

This chapter contains an analysis of current context modelling methods, with a focus on user modelling approaches. Further, the specific abilities, preferences and needs of the visually impaired older adults are described as well as the psychobiographic model of nursing care according to E. Böhm [4] and its application in practice. Furthermore, the user research summary, definition of the target group and summary of requirements for user model and user interface are also included in this chapter. Finally, there is described design methodology followed during the design process.

2.1 Context modelling

The context model is a crucial element in adaptation to the current condition of use regarding attributes of the interactive device, the user or the environment, where the interaction is performed. Context models of interactive systems typically consist of three parts: a user model, a target device model, and an environment model [6]. For the purposes of this work, the most important component of the context model is the user model, because the focus is placed on the information about users, especially on their psychobiography and their abilities following the ability-based design, see Section 2.8.1.

2.1.1 Summary of user modelling approaches

As mentioned above, the user model is the most important component of the context model for this work. This section contains a summary of user modelling approaches.

Definitions by the World Health Organization

The WHO comes up with models, which are based typically on medicine and also measurement and quantification of human performance, which is examined in rehabilitation

engineering. The WHO defined International Statistical Classification of Diseases and Related Health Problems (ICD) [7] and International Classification of Functioning, Disability and Health (ICF) [8]. These models are based on the user's disabilities rather than their abilities. For example of the ICD classification of *Vision impairment including blindness*, see [9].

vCard and xCard

The user model can be modelled using formats, which are desired for information exchange. An example of such a format is vCard (RFC6350 [10]). It is a standardised file format for electronic business cards. Properties of vCard standard provide some basic information about the user, such as name, gender, birth date, spoken language, address information, telephone numbers, e-mail addresses, URLs, logos, photographs, audio clips and more. The example of vCard can be seen below:

```
BEGIN:VCARD
VERSION:4.0
UID:urn:uuid:4fbe8971-0bc3-424c-9c26-36c3e1eff6b1
FN;PID=1.1:J. Doe
N:Doe;J.;;;
EMAIL;PID=1.1:jdoe@example.com
CLIENTPIDMAP:1;urn:uuid:53e374d9-337e-4727-8803-a1e9c14e0556
END:VCARD
```

Listing 2.1: Example of vCard, from [10].

There is also an XML representation of vCard, so-called xCard (RFC6351 [11]). The example of xCard can be seen below:

```
<?xml version="1.0" encoding="UTF-8"?>
<vcards xmlns="urn:ietf:params:xml:ns:vcard-4.0">
<vcard>
<fn>
<text>Simon Perreault</text>
</fn>
<n>
<surname>Perreault</surname>
<given>Simon</given>
<additional />
<prefix />
<suffix>ing. jr</suffix>
<suffix>M.Sc.</suffix>
</n>
...
```

Listing 2.2: Example of xCard, from [11].

ETSI ES 202 746 and ETSI ES 202 642

The European Telecommunications Standards Institute (ETSI) standards [12] and [13] specify information and preferences of users (*User profile*), that will result in driving the behaviour of the system and will apply independently of any particular product (scope, which represents the situation), for example, a user's preferred language or their need for enlarged text. The *User Profile Management system* model can be seen in Figure 2.1. The aim of this approach is that users should not be required to provide this information more times than it is necessary. Any information can be used by the service or device.
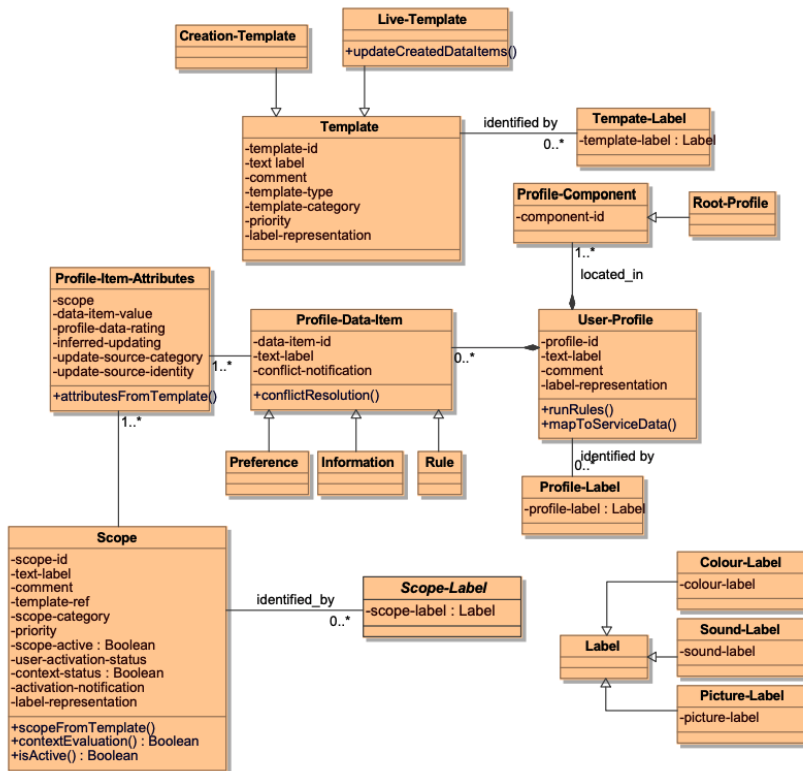
Figure 2.1: ETSI ES 202 746 – User Profile Management system model, from [12].

MyUI

Peißner et al. [14] come with the idea of individual patterns for accessible and adaptive user interfaces, which are built on information about the user, the context and the devices, which is gathered through system interaction and sensors. All information about the user is stored in the *User profile*, which variables include his abilities, disabilities, preferences and his current environment. All the values of the user profile are numeric between zero and four. The *User profile* is continuously updated by the context manager. In Table 2.1

there can be seen, that user profile mixes different variables and some of them are not so typical for user models (e.g.ambient light and ambient noise).

Name of variable	Description
Visual Acuity	Ability to perceive what is displayed on the screen
Field of Vision	Describes how limited the field of vision of the given user is.
Ambient Light	The amount of ambient light at the users place.
Ambient Noise	The amount of ambient noise at the users place.
Hearing	Describes how limited the user's ability to hear sounds is.
Language Reception	Ability to understand written or spoken language
Language Production	Ability to speak and write language
Understanding Abstract Signs	Ability to understand abstract signs and pictograms
Attention	Ability to handle multiple things at the same time, resp. focusing on something.
Processing Speed	Ability to process information fast.
Working Memory	Ability to remember an exact sequence of steps in a process and the ability to orientate in this process.
Long Term Memory	Ability to learn and remember information for a long time.
ICT Literacy	Ability to use modern information technology.
Hand-Eye Coordination	Ability to coordinate the movement of the hands with things seen.
Speech Articulation	Ability to speak
Finger Precision	Ability to move the fingers precisely.
Hand Precision	Ability to move the hand precisely.
Arm Precision	Ability to move the arms precisely.
Contact Grip	Ability to control things by touching them.
Pinch Grip	Ability to press single buttons.
Clench Grip	Ability to hold object.
First Name	The first name of the user.
Last Name	The last name of the user.
Email Address	The email address of the user.
Preferred Language	The language the user prefers to use.
Successful Interactions	The number of successful interactions with the system.
State transitions	The number of state transitions the user carried out.
MyUI Experience	The experience with the MyUI system.
PreferenceTonalOutput	Selects whether the user prefers output enhanced with sounds.
PreferenceSpeechOutput	Selects whether the user prefers speech-output in addition to text.

Table 2.1: MyUI – User profile variables, from [14].

GUMO and UserML

Heckmann et al. [15] introduce the General User Model Ontology (GUMO) for the uniform interpretation of distributed user models in intelligent semantic web enriched environments. GUMO uses User Model Markup Language (UserML) [16], which is a user model exchange language based on Resource Description Framework (RDF) [17].

Virtual User Modelling and Simulation Standardization (VUMS)

In [18], Kaklanis et al. proposed standardisation of user models for simulation and adaptation purposes. Their work presents the Virtual User Modelling and Simulation Standardisation (VUMS) which towards the development of an interoperable user model, which is able to describe both able-bodied people and people with various kinds of disabilities.

Their solution comes with defined taxonomy of variables, which divide user variables into categories, e.g. motor parameters, visual parameters (see Figure 2.2 for example of VUMS class diagram of visual variables in Unified Modeling Language (UML)) and more. Each variable also has descriptors, which helps to describe a virtual human in detail, for example name, description, unit, data type, values and more.
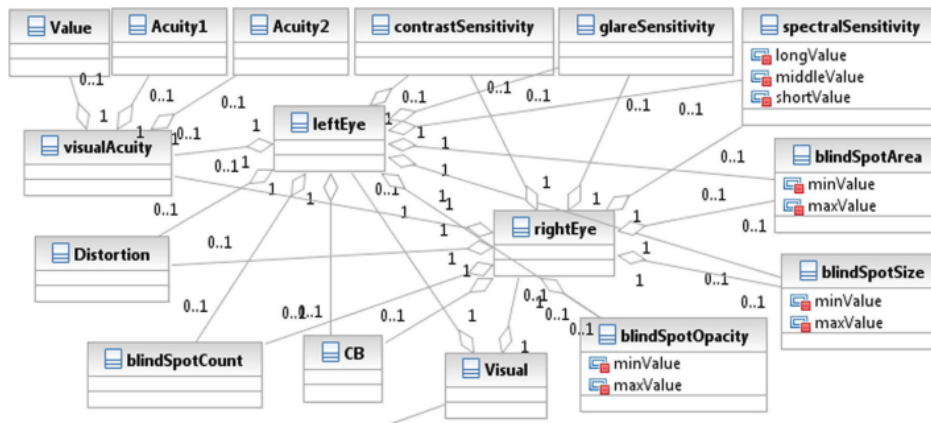
Figure 2.2: VUMS – Visual variables – UML class diagram, from [18].

Ontology-based modelling for knowledge management systems

Razmerita et al. [19] introduced ontology-based user modelling for knowledge management systems. As shown in Figure Figure 2.3, the architecture consists of three different ontologies: user ontology (characteristics of users and their relationships), domain ontology (domain and application-specific concepts and their relationships) and log ontology (semantics of the user interaction with the system). User model consists of two parts. The *explicit definition*, which is provided by the user himself, contains properties like identity, email, address, competencies, cognitive style, preferences and so-called behavioural profile. The *implicit definition*, which is maintained by intelligent services, is used to update and maintain user model based on usage data and to provide personalised services (based on the characteristics of the users).
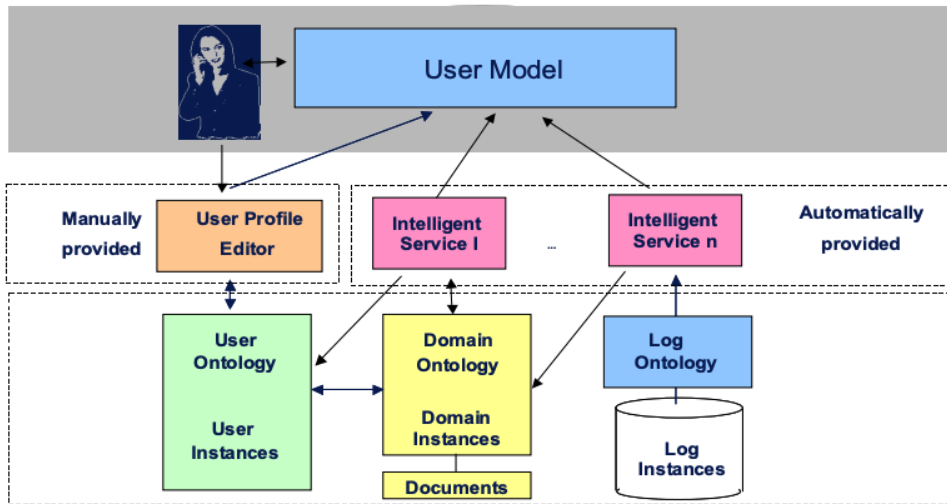
Figure 2.3: An ontology-based user modelling system introduced by Razmerita et al., from [19].

User Navigation Ontology – UNO

Kikiras et al. [20] present a user model for navigation systems, which is represented through a Semantic Web ontology. For that purpose, they use the Web Ontology Language (OWL) [21] for describing the user classes and their properties. During ontology development, they extend some of the concepts specified in the GUMO ontology [15]. They also adopted the ICF [8] of WHO for representing certain functioning and disability issues of an individual. Their model comes up with so-called *User profile*, which is depicted in Figure 2.4. The *User profile* captures user's demographics, mental-cognitive characteristics, sensory abilities, motor capabilities, navigational preferences and interface preferences.
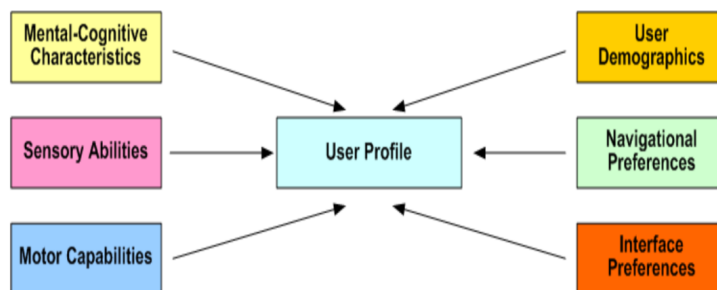
Figure 2.4: Kikiras et al. – Components of a navigation-oriented User Profile, from [20].

Conclusion

For purposes of this thesis, it is necessary to design a user model that can model specific abilities and limitations of the users and at the same time is easy to maintain. In this regard, the approach of Kikiras et al. [20] is inspiring, especially the concept of so-called *User profile*. Unfortunately, their approach brings complexity in the form of an ontological concept.

So the solution proposed in this thesis is inspired by the *User profile* concept presented by Kikiras et al. [20] but deals with the complexity of the ontological approach.

2.2 Specific abilities, preferences and needs of visually impaired older adults

The proportion of older adults in the population is steadily rising. In addition, according to World Health Organization (WHO), this trend will continue due to increasing life expectancy and decreasing birth rate [3], see WHO prediction in Figure 2.5.
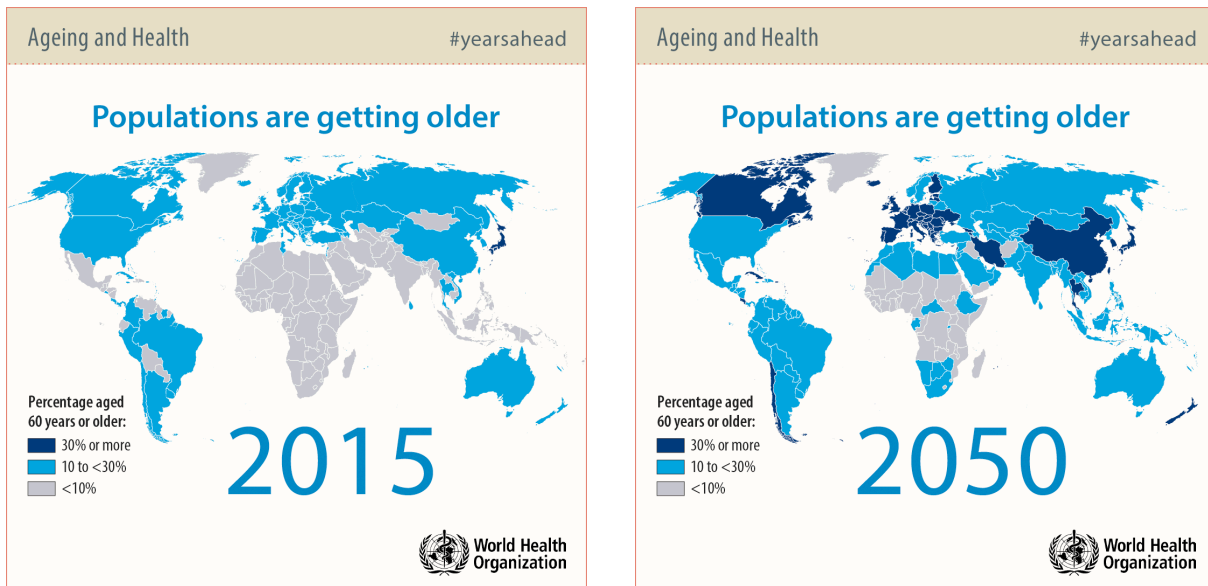
Figure 2.5: Predicted population ageing according to the World Health Organization (WHO), from [22].

During ageing, a large proportion of the population is acquiring some kind of health impairment. This fact can also be seen in data of the CSO (data were processed in 2013) [2]. In Table 2.2 there can be seen, that 18.6 % of people between the ages of 60 and 74 have some kind of disability. In category 75+ years old, the percentage of disabled people rapidly rises, it is around 42.1 %.

	Population (31.12.2012)	Disabled persons	in %
Men			
0–4	800 529	41 598	5.2 %
15–29	965 010	37 473	3.9 %
30–44	1 283 105	55 504	4.3 %
45–59	1 041 525	103 979	10.0 %
60–74	823 719	175 793	21.3 %
75+	250 461	98 414	39.3 %
Total	5 164 349	512 761	9.9 %
Women			
0–14	759 767	22 710	3.0 %
15–29	916 834	27 670	3.0 %
30–44	1 212 625	54 443	4.5 %
45–59	1 033 965	102 912	10.0 %
60–74	970 899	157 418	16.2 %
75+	457 686	199 760	43.6 %
Total	5 351 776	564 913	10.6 %
Total			
0–14	1 560 296	64 307	4.1 %
15–29	1 881 844	65 143	3.5 %
30–44	2 495 730	109 947	4.4 %
45–59	2 075 490	206 891	10.0 %
60–74	1 794 618	333 211	18.6 %
75+	708 147	298 174	42.1 %
Total	10 516 125	1 077 673	10.2 %

Table 2.2: Overview of disabled persons in the Czech Republic, from [2].

According to 2013 statistics, 102 195 people in the Czech Republic were visually impaired. Nearly 60 % of these people were women. This can be seen in Table 2.3. The majority (nearly 67 %) of people with visual impairment are in the 60+ age group. This corresponds to global world data, according to [1], 52 % of visually impaired people are older than 70 years.

Age	Type of disability								Total disabled persons	Average disability rate per person
	physical	visual	hearing	mental	psychical	internal *	other	**Total**		
Men										
0–14	13 143	4 472	2 943	10 830	8 798	20 842	2 596	**63 624**	41 598	1.5
15–29	17 481	2 270	1 458	11 006	7 747	16 106	364	**56 432**	37 473	1.5
30–44	19 198	3 799	2 347	13 400	11 144	24 368	1 069	**75 324**	55 504	1.4
45–59	46 284	8 856	4 160	8 069	14 213	63 941	5 310	**150 833**	103 979	1.5
60–74	78 142	9 364	10 467	6 610	14 777	134 608	6 154	**260 122**	175 793	1.5
75+	46 807	12 596	16 471	5 908	8 760	77 739	4 970	**173 251**	98 414	1.8
Total	**221 055**	**41 357**	**37 846**	**55 823**	**65 438**	**337 605**	**20 463**	**779 586**	**512 761**	**1.5**
Women										
0–14	6 934	2 242	868	4 853	1 740	10 923	1 705	**29 266**	22 710	1.3
15–29	12 018	2 231	1 079	8 388	4 844	12 415	675	**41 649**	27 670	1.5
30–44	19 246	4 094	3 335	8 816	10 098	25 917	975	**72 482**	54 443	1.3
45–59	43 231	5 995	3 926	7 591	16 305	63 025	6 278	**146 352**	102 912	1.4
60–74	79 481	10 432	6 747	7 308	16 820	113 509	7 929	**242 226**	157 418	1.5
75+	118 202	35 844	32 674	11 795	30 272	153 599	16 302	**398 688**	199 760	2
Total	**279 112**	**60 838**	**48 630**	**48 751**	**80 079**	**379 388**	**33 864**	**930 663**	**564 912**	**1.6**
Total										
0–14	20 077	6 715	3 811	15 683	10 538	31 764	4 302	**92 890**	64 307	1.4
15–29	29 499	4 501	2 537	19 394	12 590	28 521	1 039	**98 081**	65 143	1.5
30–44	38 444	7 892	5 682	22 216	21 242	50 285	2 044	**147 805**	109 947	1.3
45–59	89 516	14 851	8 086	15 660	30 518	126 966	11 588	**297 185**	206 891	1.4
60–74	157 622	19 796	17 215	13 919	31 596	248 118	14 082	**502 348**	333 211	1.5
75+	165 009	48 440	49 144	17 703	39 032	231 339	21 272	**571 940**	298 174	1.9
Total	**500 167**	**102 195**	**86 476**	**104 574**	**145 517**	**716 993**	**54 327**	**1 710 249**	**1 077 673**	**1.6**

Table 2.3: Type of disability by age and gender, from [2].
*only one per person counted

The statistics also show that nearly 17 % of people with visual impairment were born with this disability. The others were affected by impairment during life due to injury, diseases, polymorbidity or other reasons (see Table 2.4).

	Cause of disability							
	congenital	injury	disease	polymorbidity	other	unknown	unfilled	**Total**
Type of disability								
physical	54 831	72 842	301 102	45 623	8 804	9 829	7 136	**500 167**
visual	17 354	6 984	50 694	18 954	2 245	4 901	1 063	**102 195**
hearing	13 031	2 671	34 835	27 844	3 100	2 961	2 033	**86 476**
mental	59 210	5 082	26 043	6 486	1 017	3 906	2 830	**104 574**
psychical	15 174	4 631	86 756	15 871	10 049	10 921	2 116	**145 517**
internal *	36 712	24 475	844 285	67 537	26 492	46 660	84 890	**1 131 051**
other	2 633	1 208	30 191	8 140	2 574	3 319	6 263	**54 327**
Total	**198 945**	**117 894**	**1 373 905**	**190 455**	**54 280**	**82 497**	**106 330**	**2 124 306**

Table 2.4: Cause of disability by gender and type of disability. All disabilities identified by the respondents are included in the given table, from [2].
*including multiple internal disabilities

About 40 % of visually impaired people have a light degree of impairment and about 10 % of visually impaired people are affected by a very severe degree of impairment (see Table 2.5). Classification of disability level in case of visual impairment is in Table 2.6.

	Level of disability *						Average rate of disability **
	light	moderate	severe	very severe	unknown	**Total**	
Type of disability							
physical	107 691	217 480	133 955	35 078	5 963	**500 167**	2.2
visual	40 930	33 118	18 015	9 134	998	**102 195**	1.9
hearing	27 877	34 968	16 798	5 960	873	**86 476**	2
mental	22 421	35 449	29 824	14 801	2 079	**104 574**	2.3
psychical	40 575	62 305	31 998	8 491	2 147	**145 517**	2
internal ***	361 321	466 526	176 708	45 507	80 989	**1 131 051**	1.8
other	18 140	16 181	10 105	5 037	4 862	**54 327**	1.9
Total	**618 955**	**866 028**	**417 403**	**124 008**	**97 913**	**2 124 306**	**2**

Table 2.5: Level of disability by gender, age and type of disability, from [2].

* In the case of persons, the most severe disability is counted. In the case of type of disability, all disabilities are counted.

** light = 1, moderate = 2, severe = 3, very severe = 4

*** including multiple internal disabilities

Level	Disability
1 – light	Starbismus during childhood.
	Moderate purblindness (vizus with correction 6/18–6/60).
2 – moderate	Loss of one eye.
	Severe purblindness (vizus 6/60–3/60).
3 – severe	Purblindness during childhood and youth after completing compulsory school attendance (vizus 6/60–3/60).
	Very severe purblindness (vizus with correction 3/60–1/60).
4 – very severe	Complete or practical blindness of both eyes.

Table 2.6: Classification of disability level in case of visual impairment, from [2].

Table 2.7 shows that for those with only visual impairment, the greatest limitation is the limitation of orientation (almost 76 % of people). Over 45 % of visually impaired people (with only visual impairment) are also restricted in household management and over 35 % are also restricted in mobility, self-care and information reception.

	Limitation of										Total disabled persons	Average disability rate per person
	mobility	orientation	self-service	household constraints	reception of information	communication abilities	self-reliant eating	legal capacity	other	**Total**		
	Type of disability *											
physical	139 699	9 404	64 872	69 339	6 420	8 614	14 718	2 698	16 812	**332 576**	169 362	2
visual	5 931	12 031	6 600	7 398	6 344	3 911	803	511	3 183	**46 712**	15 867	2.9
hearing	1 467	5 475	770	1 431	9 025	10 278	51	402	1 483	**30 382**	13 937	2.2
mental	6 829	22 920	19 408	23 972	26 186	29 654	5 559	21 275	3 347	**159 151**	36 271	4.4
psychical	7 939	18 493	17 573	23 231	24 532	28 966	4 588	12 889	13 834	**152 045**	49 246	3.1
internal	74 145	6 636	33 150	49 370	6 427	7 752	40 125	2 098	73 175	**292 877**	209 865	1.4
other	4 193	499	3 173	2 418	169	265	1 123	169	5 453	**17 462**	9 369	1.9
Total	**240 202**	**75 457**	**145 546**	**177 159**	**79 104**	**89 441**	**66 967**	**40 042**	**117 288**	**1 031 206**	**503 917**	**2**

Table 2.7: Consequences of disabilities by gender, age and type of disability, from [2].
* only people with a single type of disability

For all of these reasons, in many cases, an independent life of elderly people is disrupted in some ways. For these cases, there are special institutions that can offer professional care. However, moving to a new environment is complicated, people can face orientation and navigation problems in a new environment, and their lifestyle, which they were accustomed to in their natural environment is also disrupted [23].

2.2.1   Summary of previous research

In the following subsections, there is a summary of previous research focused on the capabilities, preferences and needs of visually impaired older adults, especially with an emphasis on interaction with information technologies.

Sight

The deterioration of sight that occurs during ageing leads to limitations in the ability to perform activities of daily living. Although modern medicine can cure some age-related eye diseases, there are still diseases that can not be cured, the progression of the disease can only be slowed down [24].

Hearing

Hearing can greatly help in interacting with the user interface. Older adults expect the virtual keyboard on the device to be supplemented with sound feedback that will signal the keystroke. The ear of older adults has a limited spectrum of frequencies that it is able to perceive (very low and very high frequencies are cut). For some older adults, a sound of at least 90dB is required due to partial hearing loss. The sound level should be at least 10dB above the sound level of the environment. Sound notifications and reminders are easily passed over by older adults [23].

Cognition

Appropriate visual application design (high contrast, unambiguous icons, large buttons) is insufficient in avoiding problems with completing tasks for older adults. Information architecture and correct formulation are also important. If the interface displays information inappropriately, many people begin to blame themselves and not the application. Users can not predict what the application does (or what it could do), they also do not know how to navigate in the application and how to complete the task. As a result, the number of interaction errors increases. Based on the research of prof. Böhm, who claims that the knowledge of the patient's biography is a way to understand him/her, a model of psychobiographic nursing care has been drawn up [23]. More about Böhm's method in Section 2.3.

Motor capabilities

Based on observations, older adults needed 50–100 % more time to complete a task than a person under the age of 30. This increase is mostly the result of cognitive changes that lead to longer decision times. The time required for the movement itself is comparable to young people [23].

Orientation and navigation

Visually impaired people use different strategies to analyse space around them. Spatial information is not only perceived by sight but also by other senses such as hearing, touch, or movement. Processing space information by blind and visually impaired people is not less effective than by sighted people, but on the other hand, it is different. These people tend to code spatial relations by reference to their own body and/or the movement of their arms when exploring the space around them. This method appears to be the equivalent to the way sighted people use. On the other hand, this method appears to be less effective if tasks are complex. It has also been shown that people with congenital blindness tend to linearise curved paths on routes that they know better than on routes they are not so familiar with [23].

Assistive technologies and health monitoring

During the research of the adoption of clever household technology that monitors people, it has been found that older adults are willing to exchange part of their privacy at the cost of their independence. Even cameras are accepted if they allow a person to stay in their own house/flat. There is also described a solution of assisted living, consisting of a small cheap sensor, which is worn on the wrist. The results show the high precision of the proposed

method. There is also described a cloud framework offering services to older adults with cognitive disabilities, which provides the possibility of personalisation based on user needs and their preferences. A summary of researches suggests that a combination of healthcare constraints brings complications to both normal life and interaction with everyday needs and IT. There are several approaches to health monitoring and supporting the needs of people with different disabilities, including those who have come up with higher age. The question, however, is the borderline between people's security and the potential violation of their privacy [23].

2.3 Psychobiographic model of nursing care

The Böhm's model is an internationally recognised nursing model which is currently used at most in German-speaking countries in the field of geriatric and gerontopsychiatric care. The model is aimed to support the self-care of old and confused people and it is also focused on how to retain or restore the self-care ability for as long as possible by the principle of recovery of the older adult's interest by reviving his psyche [5], [25].

Böhm has always criticised classic ways of care (feed, keep clean, warm and comfortable and do the doctor's surgery). In the psychobiographic model, Böhm tries to broaden the viewpoint of the elderly, when care must become more tolerant and abandon the role of the overwhelming mother. Previous ways of care, where carers took over the whole self-care of a client, did not reflect the client's well-preserved skills and abilities. Care was focused mainly on saturation of client needs, which was the way, how to develop client's dependence on care. Böhm presents activating and reactivating care. His motto is to **first move soul, then body** [5], [25].

Professor Böhm has mapped the specifics of gerontopsychiatric long-term care in his research work. He also put the findings from basic psychological directions and theories into practice and precisely documented in individual case studies. The results of these researches are of great benefit to nursing care, but they are mainly of benefit to the client himself. In Böhm's model, the client is perceived primarily as a person with his biographical history, whether individual, regional or collective [5], [25].

2.3.1 Principles

The work of Professor Böhm is based on theories of S. Freud, C.G. Jung, A. Adler, A. Maslow, C. Rogers, E. Erikson and V.E. Frankl [5].

Erikson's theory

Erik Erikson divided human life into eight stages (see Figure 2.6), where each phase is associated with some vital life task, which carries a certain internal "conflict". If "conflict" is solved, it brings new strength for man's ego. If the "conflict" fails to resolve, then it leads to feelings of inferiority that the individual carries to the next stage.

Erikson described stages of human life in his book *Childhood and society*, in chapter *Eight Ages of Man* [26]. These stages are described in detail in the following subsections.

		1	2	3	4	5	6	7	8
VIII	MATURITY								EGO INTEGRITY VS. DESPAIR
VII	ADULTHOOD							GENERATIVITY VS. STAGNATION	
VI	YOUNG ADULTHOOD						INTIMACY VS. ISOLATION		
V	PUBERTY AND ADOLESCENCE					IDENTITY VS. ROLE CONFUSION			
IV	LATENCY				INDUSTRY VS. INFERIORITY				
III	LOCOMOTOR-GENITAL			INITIATIVE VS. GUILT					
II	MUSCULAR-ANAL		AUTONOMY VS. SHAME, DOUBT						
I	ORAL SENZORY	BASIC TRUST VS. MISTRUST							

Figure 2.6: Human life stages described by Erikson, from [26].

1. Basic trust vs. Basic mistrust

In the first stage, the task of the child is to gain basic trust in life and the world through the creation of a firm relationship with the mother or with the representative person. The stability and efficiency of the care that a child receives allow it to create a sense of hope that life is good.

2. Autonomy vs. Shame and doubt

In the second stage, the child's task is to gain self-confidence that it is able to make good decisions independently (development of will).

3. Initiative vs. Guilt

In the third stage, the child's task is to adopt a basic attitude of responsibility for their actions. It should perceive its initiative as good and should be supported by the environment.

4. Industry vs. Inferiority

In the fourth stage, the task of the child is to acquire the skills to purposefully and successfully treat the objects of the material world. In this period, his/her experience extends beyond family relationships and is subject of comparisons and evaluations in many school and out-of-school situations.

5. Identity vs. Role confusion

The crucial part of the development process is the formation of a personal identity that is closely related to the evolution of "ego". Before the mature "ego" appears, one has to gain an appropriate sense of identity. After the end of childhood development, during the biological and psychological adolescence, the young man's job is to establish a firm concept of self, its place and meaning in life.

6. Intimacy vs. Isolation

In the sixth stage, the young man's job is to achieve the ability to engage in a confidential emotional relationship with the other person with whom the person fully shares all the essential aspects of life.

7. Generativity vs. Stagnation

The task of adulthood is to contribute to others, especially by the care provided to their own children in their new family, as well as in the community in which one lives, by creating something useful. Man is productive, creates something, and is helpful to other people.

8. Ego integrity vs. Despair

In the last stage, the goal of personal development is to make certain the meaningfulness of how one lived and lives his life. This process can be called wisdom.

Böhm's method

The information obtained in this part of the analysis is based on the analysis of the following resources: [4], [5], [27]–[31].

Daily life and normality for patients is one of the core issues of Böhm's nursing model. The theory of Böhm is based on the understanding of patients, their biography and cop-

ing strategies. The biographic assessment and knowledge of coping strategies are crucial for the psychobiographic nursing concept. Patients should stay as long as possible independent and self-reliant and should keep their social competence. Böhm comes up with the theory that learning so-called *"copings"* takes place in the first 25 years of life, and in regression, one returns to their own lower copings. He described seven emotional accessibility levels or levels of interaction, which are in the opposite of the evolutionary stages described by Erikson. These seven phases are described in detail in the following subsections.

1. Socialization

The first phase is a phase of normal ageing. This phase corresponds to adulthood, the older adult has no communication problems and is able to adapt to social conventions. There is no problem with understanding both content and form of communication. The older adult is able to respond appropriately and also is also able to do what is requested. This is a stage of natural physiological ageing, and if we want to understand the patient at this stage, we need to know their regional history. If the older adult is unable to communicate at this level, it is necessary to change the communication technique and move to a lower level of interaction.

2. Wit

The second phase is a phase of wit, and this corresponds to the stage of youth (18–25 years). Performance of older adults gradually declines, so the interviews need to be adapted. However, the patient still understands the content of the communication, so an adequate form of care is activation. If the older adult person ceases at some point to understand the content of the information provided, the caregiver must move to the reactivation form of care.

3. Basic psychological and social needs

The third phase concerns basic emotional needs and corresponds to puberty (12–18 years). There are changes in behaviour and cognitive functions. Older adult at this stage ceases to understand the content of the communication. So it is necessary to use, for example, his dialect, to choose the words that are known to him. There is progressive neglect of basic self-care actions. It is important to know that if the basic needs of the older adult are not met, his/her health deteriorates. This may lead to acute confusion.

4. Imprints

The fourth phase concerns the period between the 6th and 12th year of life. The older adult applies learned rituals and patterns of behaviour that he/she gradually recalls from his childhood. The rituals and patterns are preserved in the subconscious and now come up in the form of so-called imprints. Older adult ceases to understand the information that is communicated to him/her by the caregiver. He/she does not understand both the content and the form of communication. This happens especially in situations where the patient is exposed to much information.

5. Drive

The fifth phase includes primarily instincts and concerns the period between the 3rd and 6th year of life. Older adult responds to stimuli from the environment in the same way, as he/she responded to them at this stage of life. Communication begins to be focused on the content of fairy tales, poems and songs and using of biographical sentences is significant.

6. Intuition

The sixth stage corresponds to the level of the toddler, so it is a period between the 1st and 3rd year of life. An older adult finds himself mentally at a time when he/she liked to play and he/she reacts emotionally to all stimuli. At this stage, religion or myths can be of great importance. Repetition of words and sounds is important for communication. Also, non-verbal communication based on touch, upon which the older adult is still consciously responding, is used.

7. Basic communication

The last phase refers to the age from birth to the 1st year of life. An older adult is now in the last stage when he/she is just in the foetal position and is not responding to his surroundings. Non-verbal communication based on the basal stimulation concept is required.

To determine the regression stage, the differential diagnostics system, developed by Böhm, is used. The system evaluates eight areas of older adult behaviour (psychomotor, orientation, emotions, memory, contact ability, formal thinking, will and content thinking) through a table scoring system with one numerical result [5]. Then, a form of care (see Figure 2.7) is based on regression degree. Forms of care are described in detail in the following subsections.

Activation (phase 1, 2 and partly 3)

This form of care is intended for those older adults who show only minimal changes in cognitive functions. They are able to actively cooperate with the staff and participate in their care. The aim of care is to support their self-sufficiency and to maintain their ability to self-determination and their own responsibility. An important role is played by staff who have previously taken over almost the whole self-care of the client.

Reactivation (phase 3, 4 and 5)

The goal of reactivation care is to improve the client's state by returning him/her at least one step higher in the regression phase scale.

This form of care is characterised by the use of impulses from patient biography to re-vitalise psyche and hence the self-care ability. Learned automatisms and rituals should be used to support the care. Memories revive positive emotions, which helps to activate emotional life.

Stimulation (phase 6 and 7)

This form of care is used for people with a severe form of psychological change. Basal stimulation provides older adults with clear, targeted and familiar information about themselves or their surroundings that was elemental to them. Most commonly used technique is smell stimulation, which uses smells important for the childhood of the patient. Also, music stimulation may be appropriate.
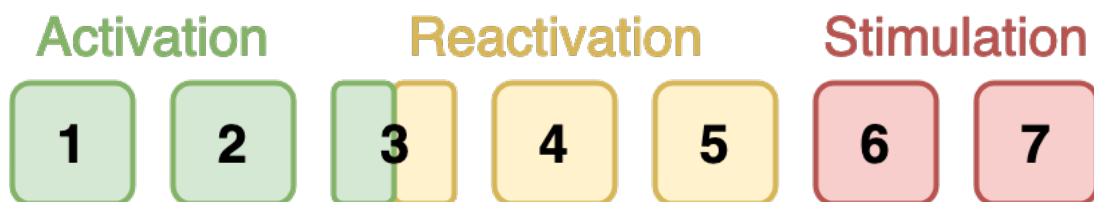
Figure 2.7: Form of care based on regression degree, from [5].

2.3.2 Biography of client

The information obtained in this part of the analysis is based on the analysis of the following resources: [4], [5], [30].

Client's biography is a crucial part of the psychobiographic nursing model. Biography of a client is a life story of an older adult enriched by an emotional subtext. In the biography, it is not only important to collect data about the client, but it also fundamentally changes the attitude of nursing staff towards the client. For the client, biography

can mean a way to overcome stressful situations and establish a good relationship with caregivers.

Biography is a comprehensive summary of the life of the older adult and his memories. Information derived from biographies helps to understand the behaviour of the older adult. Professor Böhm gives an example of an older adult who gets up every morning at exactly five o'clock, which can simply mean that he is preparing to go to work as he has been used to. Nursing staff may perceive this problem as a health problem (problem with sleeping), but he actually behaves only according to his stereotypes and habits. Based on the information that can be obtained from the biography, it is possible to fill the client's need to get up early in the morning.

Especially for clients who suffer from dementia, it is crucial to help them in keeping their orientation in place, time, and self. This is the main purpose of working with biography. If caretakers know exactly what client needs, it is not such a big problem to adjust daily regime. The structure of the day, which is determined only by carers, becomes another reason to reduce the client's orientation and makes it more difficult to adapt to the new environment. This increases the sense of hopelessness and helplessness, which are trigger factors of regression. Biography is a great way to understand the client as a complex personality.

If the client is new to the home for the elderly, his biography can serve as a communication bridge and accelerate his adaptation to a new environment. Biography is also often used to make it easier to establish new relationships and friendships within the home.

If an older adult suffers from dementia, it is very beneficial for him if his room is equipped with home accessories that are somehow related to his memories and therefore these play a very crucial role in maintaining his ability to navigate in a new environment.

Collecting information for biography is a long-term process. Older adult or his family may have concerns about providing all the necessary information, especially in the case of sensitive data. Clients are often willing to share information about themselves only after they have gained deeper trust with caretakers.

The client's biography will never be completely finished, it is an open book, which can be improved by new information and knowledge about the client.

2.4 User research

To learn more information about the application of Böhm's nursing care model in practice, the user research was conducted in the institution for visually impaired people – Home Palata (104 employees and 125 clients in 2019 [32]).

2.4.1 Participants

User research was conducted with three participants (P1–P3), all women, average age 44.33 ($SD = 15.95$, $MIN = 26$, $MAX = 55$). *P1* and *P2* work as activation service workers and *P3* works as a direct care worker (social worker). None of the participants worked in a similar type of facility before working in Palata. Mean duration of current job title was 7.83 years ($SD = 7.18$).

2.4.2 Procedure

The user research has the form of qualitative semi-structured interviews with employees of the institution for visually impaired people – Home Palata. The topics were focused on the activities of activation service workers and direct care workers, the usage of the Böhm's method in practice, and the usage of technologies in the institution (both by clients and workers). One interview lasted approximately 35 minutes (short briefing, 30 minutes interview and short debriefing).

2.4.3 Results

This section summarises the results of the user research, which are divided by the topics of the interviews.

Job description

The main task of the **activation service worker's** job is to give clients the opportunity of self-realisation even in older age. Activation service workers prepare for clients various types of activities, both individual and group. These include, for example, cooking, singing, memory training and many more. The activities are tailored to individual clients according to their preferences and habits from their previous life and are often related, for example, to the client's profession. All activities are voluntary and it is up to clients whether they want to do any of them. Activation service workers cooperate with health professionals and direct care workers and it is crucial to create one compact team of workers.

Direct care workers are responsible for the social aspects of care. They help clients with a wide range of activities, such as personal hygiene, dressing, moving and eating. An important part of their work is also communication with clients and supporting them in their favourite activities. Every direct care worker is in charge of three clients as a so-called *"key worker"*. He/she should know the most about these clients, map their needs and preferences and share this information with the entire team.

Daily programme

Palata's daily programme has three reference points – breakfast, lunch and dinner. Between breakfast and lunch, and then between lunch and dinner, there are group, as well as individual, activities that are provided by activation service workers and direct care workers. For clients, the program is voluntary and it depends only on them what activities they choose, each client has different interests and preferences. Within the individual activities, workers chat with clients, read, sing, go out and more.

There are plenty of group activities in Palata – rehabilitation exercises, workshops, singing, crosswords solving, memory training, art therapy, canistherapy, music therapy and more. Group activities take place regularly, usually once a week. Cultural events, such as concerts or theatre performances, are held twice a week at the Great Hall and these events are very popular. There are also held, approximately four to five times a year, excursions outside of Palata, for example, trips to castles and chateaus, trips to theatres and a trip by steamboat.

Technology use by clients

The use of computers and similar technologies is limited in Palata due to various limitations of clients. Most clients also have a barrier between them and modern technologies. *"People, clients, who come here can't work with modern technologies. Maybe they have never seen a computer during their lifetime."* (P2)

In Palata, there is a device called a reading magnifier, which is used by some clients. In some departments, gramophones are used to play old records and also to induce the atmosphere of the times when gramophones were commonly found in households. In addition, Palata uses voice-output clocks to inform clients of the current date, time, weather, and so on. Unfortunately, for most clients, these clocks are too complicated. *"The voice clocks we use here are too complicated. For most clients, clocks report too much information, which can lead to a big cognitive burden on clients."* (P3)

Biography and Böhm's psychobiographic method

In Palata, Böhm's psychobiographical model of care is applied, specifically its modification, which is adapted to work in Palata. *"We use the Böhms method adapted for our needs."* (P3) The client's biography is a key element of the psychobiographical model. *"Biography is such a client's book of life."* (P2)

The process of collecting information into biography and its processing begins in the period before the client comes to Palata. In this period, the client and his family may be asked to provide some information. *"Even before the client arrives, the client and his/her*

family are asked to think about providing information and photos of the client and to write a client's life story at their discretion." (P2) Unfortunately, cooperation with family and clients is sometimes difficult. "*Sometimes collaboration with client's family is complicated because they are reluctant to provide sensitive information about a close person.*" (P2) However, it is essential that neither the client nor his/her family is pushed into anything and that the provision of information must be based on a free decision.

After the client's entry to the facility, the *"key worker"* assigned to the client has to start the processing of biography. "*We then communicate with the client and processing the mapping, where we write down the information that client provides to us. Based on it, we create the client's life story, which is written into a biographical book with attached photographs.*" (P2) Workers must establish a relationship with the client to get as much information about the client as possible. "*The amount of information that clients are willing to convey is different, someone is willing to tell everything, someone almost nothing. It is up to us to establish a relationship with the client to tell us something, but at the same time, we must understand that client have told the information to us and may not want the information to appear somewhere. I had a client who directly wished for some information not to appear anywhere and did not even want to publish information under her name, so she invented a fictitious one.*" (P3)

Biography is in paper form. It has a fixed structure according to which workers must proceed during its creation process.

In the biography, there is a client's life story with photographic documentation. The life story contains information about the client's childhood, youth, adulthood, old age, and this information is then used to work with the client. There is a need to find out what the clients have gone through in their lives, about their families, their interests, their education, their occupations and then specific patterns of behaviour can be derived from this knowledge. "*Biography should tell us about client's behaviour patterns, in which environment he grew up, and we must realise that man in old age is hardly going to change his behaviour.*" (P3) It is also necessary to put the information about the client's life in the historical context. Many clients have experienced the First Czechoslovak Republic, the Nazi occupation, the putsch in 1948, the totalitarian regime, the Soviet invasion in 1968, and of course all these events influence man. "*We should have a basic, maybe even advanced, knowledge of history to know what it does to a man when he experiences during his active life such turbulence as in the 20th century in Europe, especially in Czechoslovakia.*" (P3) It is also necessary to learn negative information about the client to avoid possible misunderstandings and unpleasant situations. "*It is also good to know topics that client does not want to talk about. Some clients have experienced war or totalitarianism. Some of them don't mind talking about it, but some clients don't want to hear German or*

Russian. So it is necessary to know negative information, experiences and so on.“ (P2)

Also, the biography includes a client's tree of life (lineage), where information about his relatives, friends and so on can be found. *"In deeper dementia, clients become more likely to think that we, caregivers, are their friends when they were ten years old and they address us with the names of their friends. And when we know that he/she is addressing us on behalf of a friend, we know he/she has such a relationship with us.“ (P2)*

Furthermore, so-called *"activities of daily living"* are part of the biography. These are divided according to the tasks of the ordinary day (seventeen different tasks). They describe what is typical for the client, what he was used to and how to transfer this fact to Palata as faithfully as possible so that the client feels at home. The biography also affects activities such as client dressing up, which can be taken as an example of such a task of daily living. *"We had a client who belonged to the almost highest social class in the First Czechoslovak Republic. She was very fond of wearing luxury costumes with pearls. Thus, in dressing, it would be written in the activities of daily living, that she was used to the luxury, that she still keeps these habits and that even when she is infirm, we will not give her sweatpants even if it is easier for us to provide her with care.“ (P3)*

If a client with dementia enters the facility, it is necessary to collect the information as soon as possible. *"When a new client with dementia comes here, we need to find out as much information as soon as possible. There is a need for cooperation with the client's family. It may happen that the client enters Palata and in two months period, he will not be able to provide us with further information. Then, work based on the biography is complicated.“ (P2)*

Biography is constantly maintained and updated with new information. *"Biography is handled by everyone except medical staff. Maintenance of biography is the work of the whole team.“ (P2)* Access to biography, which is located in the nurses' room in locked safes, is available to all department workers and can be provided to the client or his/her family upon the client's request. *"Biography contains sensitive personal information, often even intimate, so trainees or anyone else who does not work in the department does not have access to it.“ (P2)* Employees have regular weekly meetings where they discuss individual clients. *"We always have a meeting on Wednesday, where clients are discussed according to Böhm's method. We all, including health professionals and a psychologist, discuss the client's score (differential diagnosis), the activities of daily living and so on. The key worker then selects all the relevant information he needs for further working with the client.“ (P2)*

The biography is fundamentally reflected in the work of caregivers. *"Activation and communication with the client are tailored to the biography."* (P2) *"For example, the client was a seamstress all her life, so she works with a fabric that reminds her of a long period of her life."* (P1)

Based on a biography, caregivers try to bring clients closer to the environment they have been familiar with during their active life. For example, listening to music and recordings from that period can help. *"The music of the 1950s is playing right next door – Chladil, Simonová and other singers. We play recordings from Semafor every day, so these days we get slowly to 1960s."* (P2) Then, for example, reading books about the time, when clients actively lived, about places, which clients could visit and about the activities they could perform can also help to induce well-being. *"We read autobiographies of actors, musicians, and writers. We also read about countries and places where clients often travelled in the 1970s – Hungary, Poland, East Germany, we read for example, about Rügen and Lake Balaton. We also read about camping or pig-slaughtering."* (P2) The aim is to retrospectively return clients to a time when they were actively living their lives. *"We are going back to the age when clients were about 25 years old."* (P2)

For less oriented clients, workers read fairy tales, various stories and poems. *"We read mainly the fairy tales of Božena Němcová, Karolína Světlá and other authors. We read especially the shorter ones, such as The Red Riding Hood. We also read some poems that are clients familiar to."* (P2)

The activities of clients and activities of workers with clients are recorded in the system. However, clients have the freedom of movement around Palata, and so, for example, a visit from a client's family is not recorded. *"Clients have freedom of movement, but most of them report such activities. If the client leaves Palata, we write down the fact that the client left and also the expected return."* (P2)

"The biography must be handled carefully, and workers must maintain a professional approach without an evaluation approach, even though some client's habits may, for example, seem weird to them." (P3) *"The problem is with the increasing difference between clients and workers. There are two completely different worlds, the world of young workers on one side and on the other side the world of clients who are still ageing. Therefore, the worker must understand the client, which is also very difficult and some misunderstandings may arise."* (P3)

Technology use by workers

A barcode readers system for recording client's activities, which is used in Palata, helps employees. Each activity is assigned a unique barcode that is scanned with the reader and all records are downloaded to the system at the end of every day.

All participants can imagine the electronic version of the biography, but the current form is more acceptable and enjoyable for most of them (*P2* and *P3*). *"It is nice to have it in the form of the book, it is more natural and easier to pass on to someone." (P2)*

2.5   Other research projects

On the CTU FEE – Department of Computer Graphics and Interaction, several research projects focused on the group of visually impaired older adults have taken place and are still underway. The research showed that technological products that are well-adapted to needs, preferences and abilities of users could help them with daily activities like orientation [33], [34] or leisure [35].

In the future, these projects could use the proposed user model as a central source of information about users. So these projects introduced some user model requirements that were reflected in Section 2.7.1.

2.6   User groups

Based on the conducted user research (see Section 2.4) and other research projects (see Section 2.5) there can be defined two user groups of our solution.

2.6.1   Primary user group

The representatives of this user group are employees (caregivers) of the specialised care institution. These workers will use the user interface to maintain the user model and to provide clients with appropriate care based on the information gained from the user model.

2.6.2   Secondary user group

The second group of users is represented by clients of the specialised care institution, who will benefit from the user model indirectly through various devices and provided care.

2.7 Requirements

This section specifies the functional and non-functional requirements for the user model and user interface for caregivers. The requirements are based on analysis, requirements of other projects, conducted user research and knowledge gained during iterative prototype evaluation.

2.7.1 Functional requirements

Functional requirements are defined separately for user model – User Mode Functional Requirements (FRUM) and user interface – User Interface Functional Requirements (FRUI).

User model

FRUM1: Basic information about the client
The user model will allow to model and maintain basic information about client including client's name, surname, birth date, birthplace, address, gender, education, department, room number, key worker, contact persons and photographs of the client.

FRUM2: Biography of the client
The user model will allow to model and maintain client's biography, divided into four categories – biographical sheet, activities of daily living, lineage and form of care (differential diagnostics sheet).

FRUM3: Activities of the client
The user model will allow to model and maintain records of client's activities.

FRUM4: Medical records of the client
The user model will allow to model and maintain medical records of the client, including the client's height and weight, diseases, injuries, allergies, diets and prescribed medication.

FRUM5: Abilities and disabilities of the client
The user model will allow to model and maintain the abilities and disabilities of the client, divided into three categories – sensory, motor and cognitive.

FRUM6: Interaction information and preferences of the client

The user model will allow to model and maintain information about interaction with client and preferences of the client, including the client's attended activities, hobbies, favourite places, interests in services and client's equipment.

FRUM7: History of the client's information changes

The user model will allow storing client's information changes history.

FRUM8: Relationship client-worker

The user model will allow to model and maintain the relationship between client and workers. The relationship will also capture the rights of workers (view/edit various information categories).

The user interface will allow the user to:

FRUI1: Log in to the application

The user will be able to log in to the application by username and password.

FRUI2: Log out of the application

The user will be able to log out of the application.

FRUI3: Browse and filter the client list

The user will be able to browse the list of clients. User will also be able to filter client list by client's name, surname, birth date, department, room and key worker.

FRUI4a: View basic information about the client

The user will be able to view basic information about the client (see *FRUM1*).

FRUI4b: View biography of the client

The user will be able to view the client's biography (see *FRUM2*).

FRUI4c: View activities of the client

The user will be able to view records of client's activities (see *FRUM3*).

FRUI4d: View medical records of the client

The user will be able to view the medical records of the client (see *FRUM4*).

FRUI4e: View abilities and disabilities of the client
The user will be able to view the abilities and disabilities of the client (see *FRUM5*).

FRUI4f: View interaction information and preferences of the client
The user will be able to view information about interaction with client and preferences of the client (see *FRUM6*).

FRUI4g: View history of the client's information changes
The user will be able to view the history of the client's information changes (see *FRUM7*).

FRUI5a: Edit basic information about the client
The user will be able to edit basic information about the client (see *FRUM1*).

FRUI5b: Edit biography of the client
The user will be able to edit the client's biography (see *FRUM2*).

FRUI5c: Edit medical records of the client
The user will be able to edit the medical records of the client (see *FRUM3*).

FRUI5d: Edit the abilities and disabilities of the client
The user will be able to edit the abilities and disabilities of the client (see *FRUM4*).

FRUI5e: Edit interaction information and preferences of the client
The user will be able to edit information about interaction with client and preferences of the client (see *FRUM5*).

FRUI6: Add a client
The user will be able to add a new client into the system.

FRUI7: Print client reports
The user will be able to print client reports.

The user interface itself:

FRUI8: Provide notifications about changes of client information
The system will provide notifications to relevant users about client's information changes (see FRUM8).

2.7.2 Non-functional requirements

Non-functional requirements are defined separately for user model – User Mode Non-functional Requirements (NFRUM) and user interface – User Interface Non-functional Requirements (NFRUI).

User model

NFRUM1: Extensibility and Modifiability
The solution will be as extensible and modifiable as possible for future modifications and extensions.

User interface

NFRUI1: Localisation
The user interface will be localised in Czech.

NFRUI2: Usability
The user interface design will follow standards for usability (see Section 2.8.3).

2.8 Design methodology and basic terms

In this section, two design approaches, ability-based design and UCD, are presented. The usability of the user interface is also described.

2.8.1 Ability-based design

Current tools use complex context models, especially for user description. Currently, most of the models describe user limitations and disabilities [36], [37]. Wobbrock et al. [36], [37] have come up with a concept of ability-based design based on user abilities instead of disabilities [6], [36].

According to [36], the ability-based design uses the so-called "positive affirmation of ability" approach, which states that all people have some abilities, whether of a different character or level. Ability-based design is therefore applicable to all people because everyone has some abilities.

Unlike the ability, which is about having the means or skill to do something, disability becomes something one experiences rather than something someone has. From this perspective, every person experiences some limitations in certain activities, at least in certain situations.

Examples of situations and factors that can limit physical and cognitive abilities, especially when interacting with technologies, are listed in Table 2.8.

Vibration	Cold temperatures
Divided attention	Impeding clothing (such as gloves)
Distraction	Encumbering baggage
Diverted gaze	Rainwater
Device out-of-view	Light levels (such as darkness and glare)
Intervening objects	Ambient noise
Bodily motion (such as walking)	Social behaviors (such as interruptions)
Vehicular motion	Multitasking
Uneven terrain	Stress
Physical obstacles	Fatigue
Awkward postures or grips	Haste
Occupied hands	Intoxication

Table 2.8: Factors that can limit physical and cognitive abilities, especially when interacting with technologies, from [36].

From the standpoint of compatibility between user abilities and system requirements with the user's abilities, there are three different situations (see Figure 2.8) [36], [37]:

(a) User abilities meet system requirements, so there is no problem with compatibility. User can interact with the system without limitations. The system is oblivious to the user's abilities and does not change from one user to another one.

(b) The user's abilities do not meet system requirements and the user is forced to use assistive technology. That is some "add-on", which is being inserted between the user and system and pretends change of system. Consequently, the burden of change is transferred to a user who must decide how to become amenable to the system. As in (a), the system does not care about the user's abilities and does not change depending on the specific user.

(c) In ability-based design, system changes according to the user's abilities, so no assistive technologies need to be used.
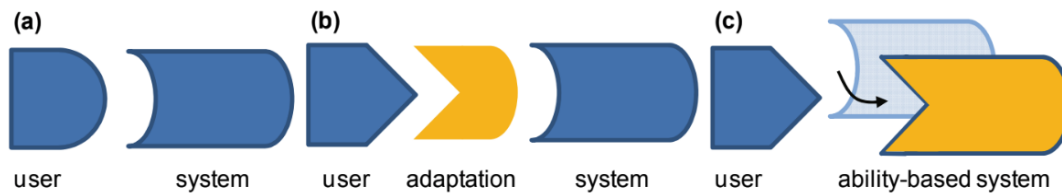
Figure 2.8: Compatibility between user abilities and system requirements on the user's ability, from [37].

Wobbrock et al. [36], [37] have also established principles for ability-based design:

1. **Ability**

   Designers focus on users' abilities, not disabilities. They try to utilise everything that users can do in certain situation, context, or environment.

2. **Accountability**

   Designers respond to poor usability by changing systems, not users. They are leaving users as they are.

3. **Availability**

   Designers use low-cost, inexpensive and available software, hardware, and other components.

4. **Adaptability**

   Interfaces might be self-adaptive or user-adaptable to provide the best possible match to users' abilities.

5. **Transparency**

   Interfaces may give users awareness of adaptive behaviours and the means to manipulate with those adaptations.

6. **Performance**

   Systems might sense, monitor, measure, model, display, predict, or otherwise utilise users' performance to provide the best possible match between systems and users' abilities.

7. **Context**

   Systems may pro-actively sense context and anticipate its effects on users' abilities.

The first three principles (1, 2 and 3) are required for the ability-based design. The next two principles (4 and 5) relate to the adaptivity and adaptability of the user interface. The last two principles (6 and 7) relate to user perception and context. The principles 4-7 are optional but recommended [36].

2.8.2 User-Centered Design

UCD [38], [39] refers to the description of design processes in which emphasis is placed on end-users of the product, especially on their needs, requirements and limitations. UCD is based on ISO 9241-210 international standard [40], which provides requirements and recommendations for such a design process. UCD is an iterative process, where individual phases are repeated until the product requirements are met.
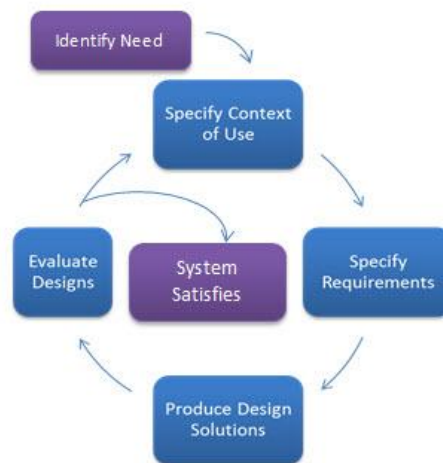
Figure 2.9: User-centered design (UCD) process, from [41].

In Figure 2.9, there can be seen individual steps of the UCD process. From these steps, three main phases can be derived.

Analysis
The analysis is the first step of the UCD and is crucial to understand, who will be the target audience (target group) of the product and understand the domain of end-users and their needs and requirements.

Design and implementation
The design phase is a phase, where ideas are being developed. The acquired knowledge and requirements from the analysis are transformed into the design. Then, the solution is implemented and the implementation takes several forms, from simpler to final product. The first one is the low-fidelity prototype, which is used mainly in initial cycles of the UCD process and it usually takes the form of sketches that represent the main functionality of the product. The second one is the high-fidelity prototype that is already trying to get closer to the final product with more features and details. And of course, the third one is the final product.

Evaluation

In the final phase, the product is evaluated. There are several methods, how this can be done, such as expert analysis (heuristic evaluation [42], cognitive walkthrough [43]) and usability studies with participants from the target group.

2.8.3   Usability

According to Jakob Nielsen [44], usability is a quality attribute that evaluates how difficult it is to use user interfaces. Nielsen comes up with five quality components:

Learnability

How easy is it for users to accomplish basic tasks the first time they encounter the design?

Efficiency

Once users have learned the design, how fast can they perform tasks?

Memorability

When users return to the design after a period of not using it, how easily can they reestablish proficiency?

Errors

How many errors do users make? How severe are these errors? How easily can users recover from the errors?

Satisfaction

How pleasant is it for the user to use the design?

2.9   Summary of the analysis

In this Chapter, the whole analysis is summarised. Firstly, the analysis of current context modelling methods, with a focus on user modelling approaches was performed. Then, the specific abilities, preferences and needs of the visually impaired older adults were described as well as the psychobiographic model of nursing care according to E. Böhm [4] and its application in practice. There was further conducted user research with employees of the residential care home. Based on these steps, target group and requirements for the user model and user interface were defined. Finally, the design methodology followed during the design process was described.

During the analysis phase, all the necessary information was obtained to continue working on the user model and user interface. Gained information will be used in the next stages of the process – design (Chapter 3), implementation (Chapter 4) and evaluation (Chapter 5).

Chapter 3

Design

In this Chapter, the design of the whole solution of the system is proposed. The design is based on the previous analysis phase (see Chapter 2) and also go hand in hand with the implementation (see Chapter 4) and evaluation (see Chapter 5). Note that in this thesis, the focus is placed on the user model and the user interface of the *Client management system*, which will be used by the workers of the residential care home and which was the subject of most considerable emphasis in this thesis.

3.1 Proposed solution

The whole solution consists of the user model, user interface for its maintenance, proxy, which will be used for logging of clients' activities to provide device adaptability and appropriate Application Programming Interface (API), which will provide all the relevant information from the user model to the user interface and client's devices. The solution also takes into account the connection to an existing system from which records of client activities could be obtained (see Section 2.4). The architectural overview is depicted in Figure 3.1. The user model and user interface, which are the subject of this theses, are described in detail in the following sections.
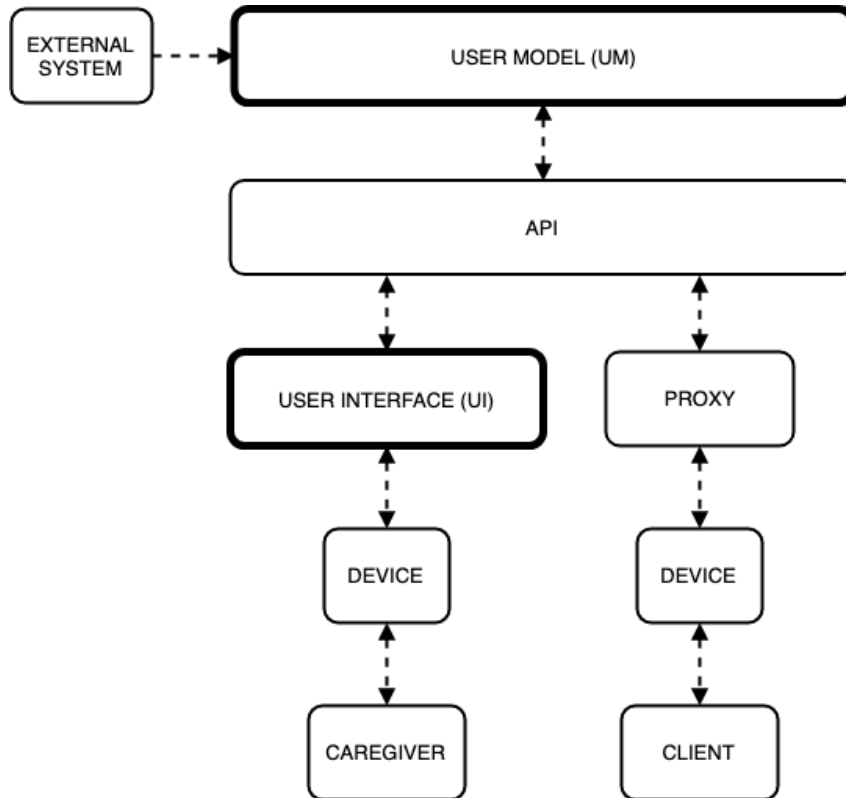
Figure 3.1: Proposed solution – High-level view.

As mentioned in the analysis (see Section 2.6), there are two groups of users, whom the solution will serve – primary group, represented by the workers (caregivers) of the residential care home and secondary group, represented by the clients, who will use the user model indirectly through their devices – technological applications will use the model for adaptation of user interfaces and interaction. It would be possible to adapt properties like information complexity, speech rate, or volume. Also, it will be possible to provide more personal communication by addressing the client by her or his name in an appropriate way. Also, technological applications like interactive indoor orientation system can provide personalised information like instructions on how to navigate to one's own room.

3.2   User model

In this Section, the design of the user model is proposed. Following the ability-based design concept (see Section 2.8.1), the design focuses on the clients' abilities and not their limitations, which, however, must also be captured to some extent. In the following sections, scenarios and storyboards[1] of adaptation and personalisation of various devices based on the user model are presented. Then, a user model design, which was gradually developed during the iterative process, is proposed. Note that only the final form of the user model is presented.

3.2.1   Scenarios of adaptation and personalisation

Adaptation and personalisation of various devices is a very important aspect of helping in the care of an older adult. It should reflect the client's abilities, preferences and needs as well as the surrounding environment. Based on the analysis of Böhm's method and its application in practice, there can be deduced some scenarios of adaptation and personalisation of various devices, that can be supported by the user model, which will be proposed below (User Model Scenario (SUM)). The scenarios are also depicted using storyboards.

Scenario SUM1: Client's biography

Adaptation and personalisation should be based on the client's biography, it should adapt to the client's memories, history and habits.

Mr Dvořák is used to getting up before 6 am and he is used to listening to the morning news. Mrs Nová is, unlike Mr Dvořák, used to getting up later, just before breakfast.

The corresponding storyboard can be found in Appendix A in Figure A.1.

Scenario SUM2: Client's activities

Adaptation and personalisation should reflect the client's activities. It should support activities, which the client likes.

Mr Dvořák likes to walk in the garden when the weather is nice. Mrs Nová, on the contrary, prefers to spend time inside the building, where she likes to attend various group activities such as memory training.

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[1]Storyboards made using an online tool *Pixton Comics* [45].

The corresponding storyboard can be seen in the following Figure 3.2.
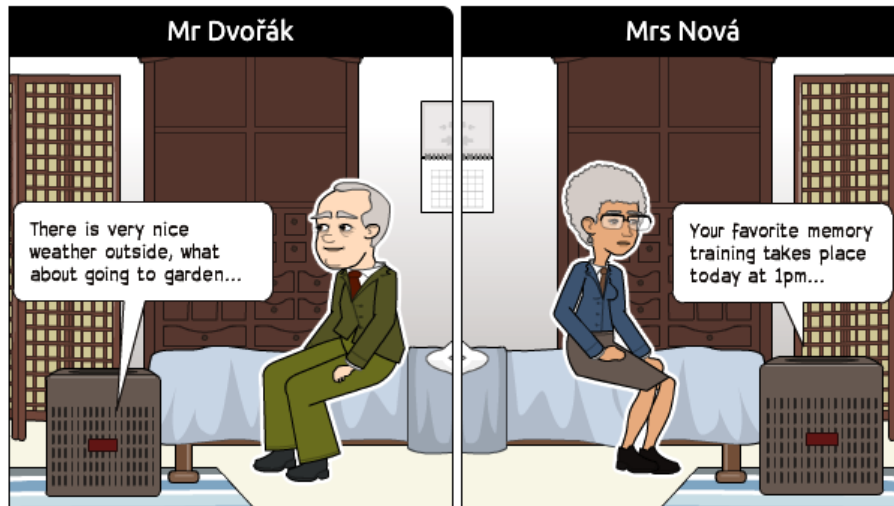
Figure 3.2: Storyboard SUM2.

Scenario SUM3: Medical records

Adaptation and personalisation should reflect the medical records of the client.

Mr Dvořák has a severe degree of diabetes, so it is important for him to know what food will be given throughout the day to plan insulin doses. Mrs Nová has a nut allergy and therefore she will appreciate the information whether or not nuts will be present in the next meal.

The corresponding storyboard can be found in Appendix A in Figure A.2.

Scenario SUM4: Client's preferences

Adaptation and personalisation should reflect the client's preferences. There should be some level of personalisation of the device.

Mr Dvořák wears a hearing aid on both ears, so his devices just need a slightly increased volume of 65dB. On the contrary, Mrs Nová does not wear any hearing aid because she feels better without it, but her devices need an increased volume of 80dB.

The corresponding storyboard can be found in Appendix A in Figure A.3.

3.2.2 User model design

Based on the requirements (see Section 2.7.1), there can be deduced some information categories – user model components. These categories of the user model are depicted in Figure 3.3.
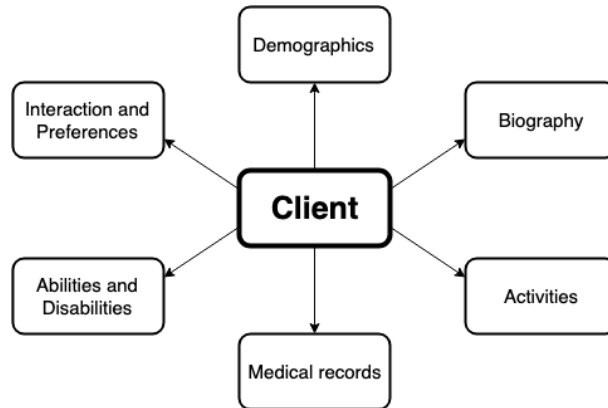
Figure 3.3: User model components.

Demographics

This category (see Figure 3.4) contains basic information about client including the client's name, surname, birth date, birthplace, address, gender, education, department, room number, key worker, contact persons and photographs of the client. The user model also allows to model and maintain the relationship between client and workers. The relationship also captures the rights of workers (view/edit various information categories).
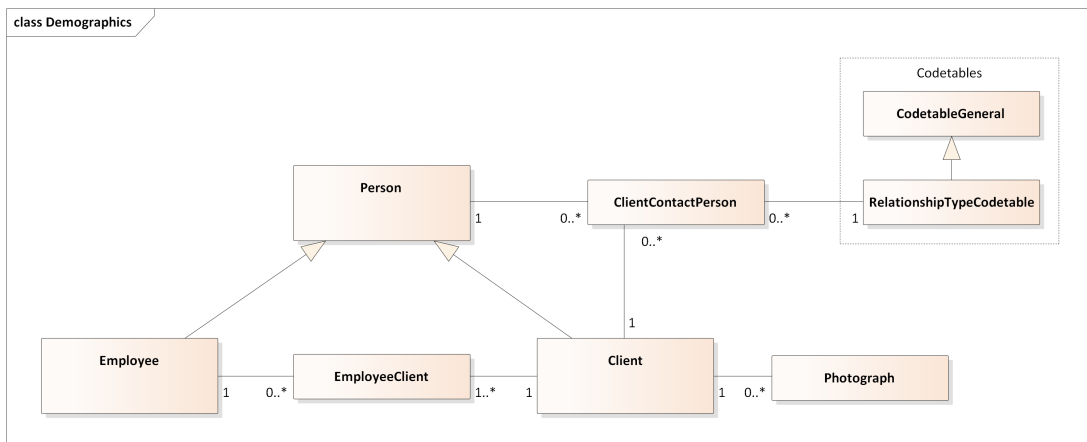
Figure 3.4: User model – Demographics.

The individual class attributes can be seen in Appendix B.1.

Biography

The client's biography is divided into four sub-categories (see Figure 3.5). The first one is the biographical sheet, which represents the life story of the client. Then, there are the activities of daily living, which are represented by seventeen different tasks of the ordinary day (see Section 2.4 and [5]). The next category is the lineage, which captures the family tree of the client. And finally the form of care, which is composed of three different types of care (activation, reactivation, stimulation) and the differential diagnostics score (eight areas of older adult behaviour, see Section 2.3 and reference [5]).
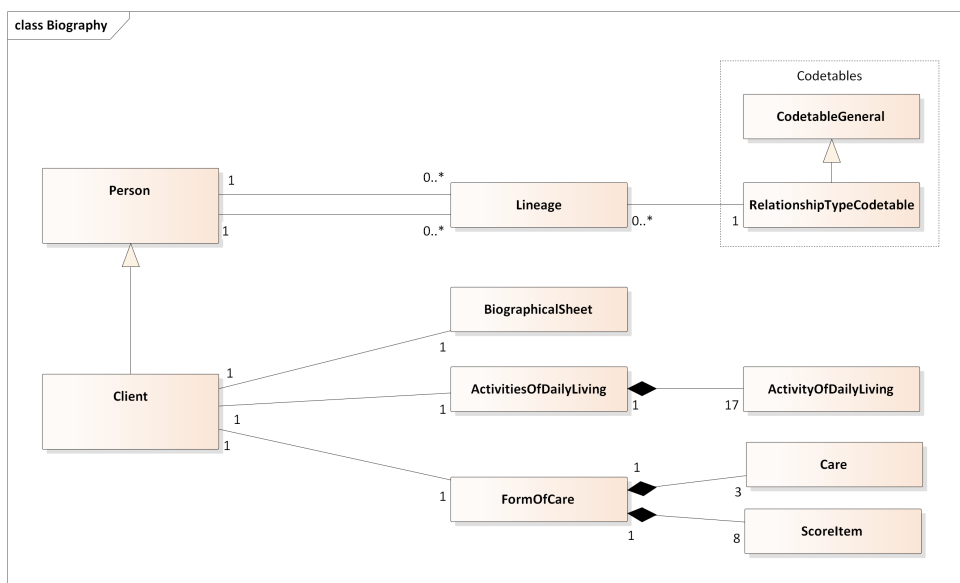
Figure 3.5: User model – Biography.

The individual class attributes can be seen in Appendix B.2.

Activities

This category contains records of the client's activities. According to the conducted user research (see Section 2.4), the employees use a barcode readers system for recording client's activities. Each activity is assigned a unique barcode that is scanned with the reader and all records are downloaded to the external system at the end of every day.
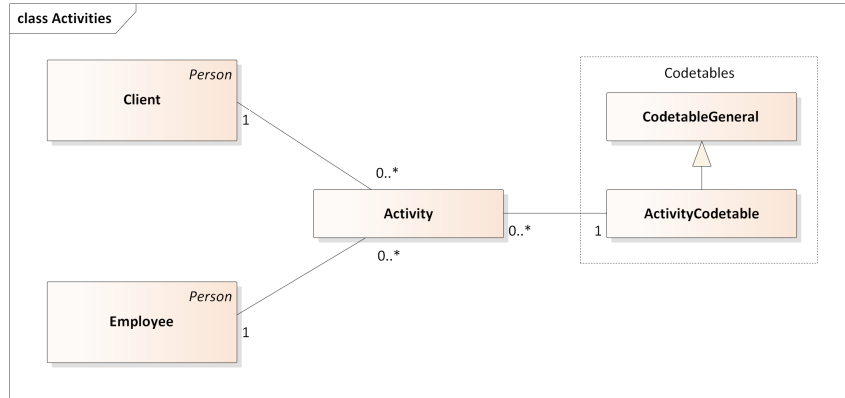
Figure 3.6: User model – Activities.

The individual class attributes can be seen in Appendix B.3.

Medical records

To this category (see Figure 3.7) belongs medical records of the client, including the client's height and weight, diseases, injuries, allergies, diets and prescribed medication.
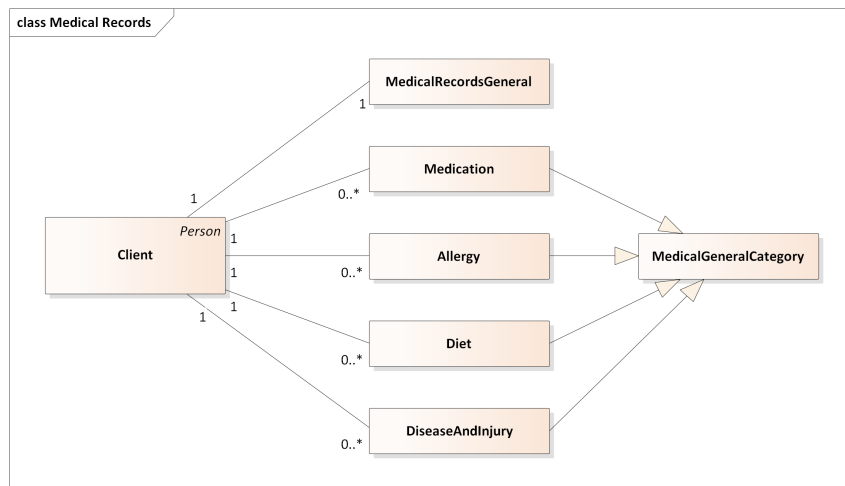
Figure 3.7: User model – Medical records.

The individual class attributes can be seen in Appendix B.4.

Abilities and Disabilities

The abilities and disabilities of the client are divided into three sub-categories – sensory, motor and cognitive (see Figure 3.8).

The *sensory* category contains information about sensory abilities and disabilities of the client. Information is divided into sight, hearing and touch, additionally for each eye, ear and hand separately.

The *motor* category captures mobility information, such as motor impairment but also, for example, the ability to stand alone or ability to move independently.

The *cognitive* category contains information about cognitive abilities and limitations of the client, for example, the client's knowledge of his room or level of independence.

Information about impairment captures the severity, origin, progression and other characteristics of the impairment. There are also captures the abilities of the client, for example, the ability to perceive object shapes or level of client's tactile abilities. If the attribute is expressed in scale, a range of 0 to 6 is used. For example, for the visual impairment, the ICD 9D90 classification [9] defined by the WHO is used.
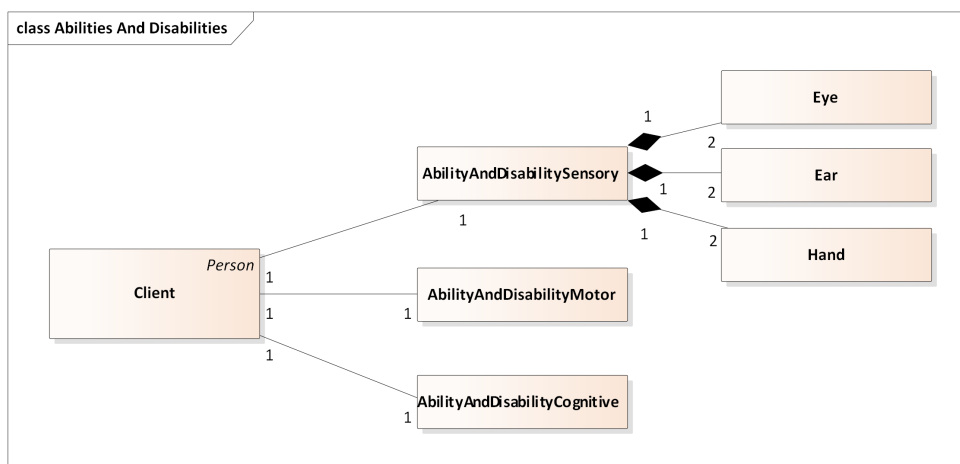
Figure 3.8: User model – Abilities and Disabilities.

The individual class attributes can be seen in Appendix B.5.

Interaction and Preferences

This category (see Figure 3.9) contains information about interaction with client and preferences of the client (for example client's dominant hand or dominant modality), including the client's attended activities, hobbies, favourite places, interests in services and client's equipment.
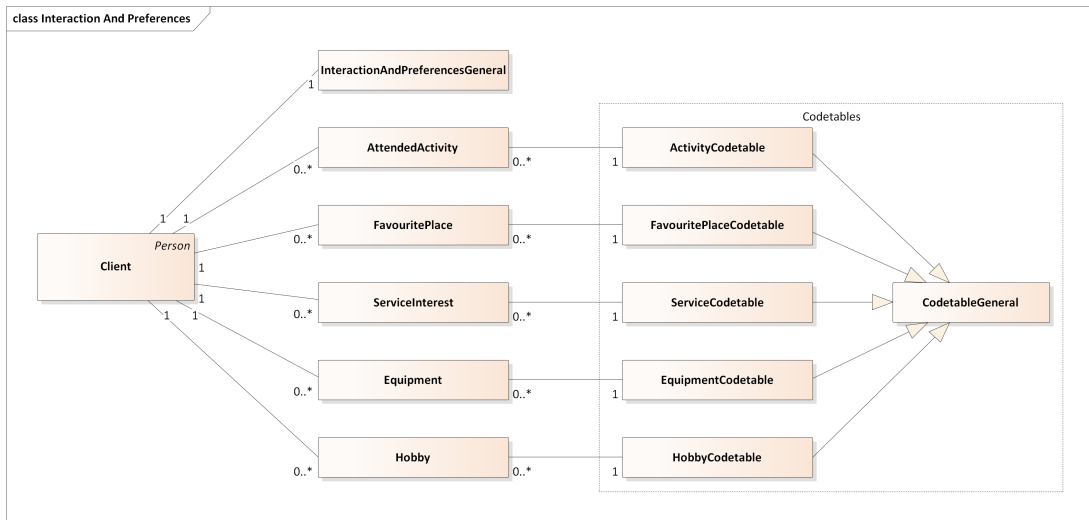
Figure 3.9: User model – Interaction and Preferences.

The individual class attributes can be seen in Appendix B.6.

History

This additional component (see Figure 3.10), which is not shown in the high-level view of components is used to store changes of client information.
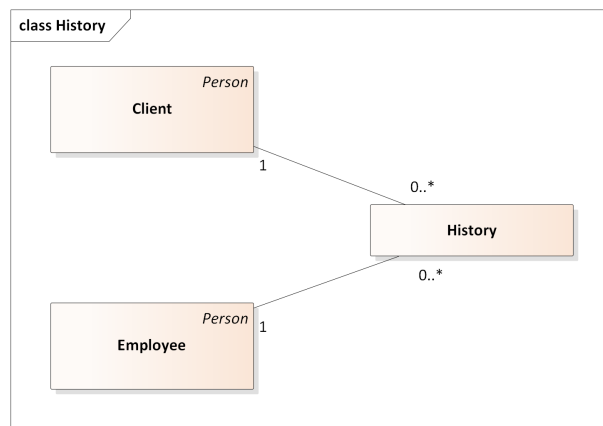
Figure 3.10: User model – History.

The individual class attributes can be seen in Appendix B.7.

3.3 User interface

This Section describes the design of the user interface of the *Client management system*, which will be used by the workers of the residential care home (primary user group, see Section 2.6).

The user interface design phase follows the UCD approach. In this chapter, the user interface design is formally described using use cases, scenarios and storyboards[1]. Then, a formal model of the user interface is described using the Hierarchical Task Analysis (HTA) and plans. Finally, the low-fidelity and the high-fidelity prototypes of the user interface are described, as well as its development process.

3.3.1 Formal description of user interface

This section describes the interaction between the user interface and its users. The needs and goals of the users are firstly showed on example scenarios and illustrated using storyboards and afterwards generalised into use cases.

Scenarios

Based on the analysis of Böhm's method and its application in practice, there can be deduced some scenarios that can be supported by the user interface (User Interface Scenario (SUI)). The scenarios are also depicted using storyboards.

Scenario SUI1

Mr Novák has been assigned as a key worker of Mr Dvořák, a new client, who will come to the residential care home for visually impaired people – Home Palata next week. He knows about Mr Dvořák enough basic information in advance and thus creates his record in the application. After the arrival of Mr Dvořák to the residential care home, Mr Novák meets him and during an interview, he finds out as much as possible important information, which will be crucial for client's biography creation. After the interview, Mr Novák puts new information about Mr Dvořák into the application, including the basic information, biographical story, information about relatives and information about interaction and preferences of the client.

The corresponding storyboard can be seen in the following Figure 3.11.

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[1]Storyboards made using an online tool *Pixton Comics* [45].

Figure 3.11: Storyboard SUI1.

Scenario SUI2

Within a few months, Mr Dvořák's vision impairment deteriorated and he started using a blind stick. Since coming to the residential care home for visually impaired people, Mr Dvořák has been very fond of staying in the garden and would like to visit the garden even though he will need assistance because of his visual impairment. His key worker, Mr Novák, put all this information into the application.

The corresponding storyboard can be found in Appendix C in Figure C.1.

Scenario SUI3

After logging into the application, Mr Novák is notified that a new client, Mr Mladý, had been added into the system and Mr Novák was assigned to him as a key worker. Mr Novák finds out that the client was assigned to him by Mrs Svobodová, his superior. Mr Novák then goes through basic information about the client, his health records, biography, information about abilities and disabilities as well as information about interaction with the client and his preferences, where he finds out that Mr Mladý would be interested in memory training group activity. During the next week, Mr Mladý takes part in memory training activity and Mr Novák records this fact using a system of QR readers, which is used nowadays in the residential care home – Home Palata. (see Section 2.4).

The corresponding storyboard can be found in Appendix C in Figure C.2.

Scenario SUI4

Mr Novák, Mr Dvořák's key worker, needs to find out in the application his client's activities. He is browsing and filtering list of clients, finds Mr Dvořák and goes through the list of his activities. He finds out that Mr Dvořák has not been involved in any group activity for a long time. So Mr Novák prints a list of Mr Dvořák's activities, so he can discuss this fact with his colleagues during a regular weekly meeting.

The corresponding storyboard can be found in Appendix C in Figure C.3.

Use cases

The use cases generalise scenarios which were stated in the previous section and define the interaction between users and the user interface. The Use case (UC) diagram can be seen in Figure 3.12.
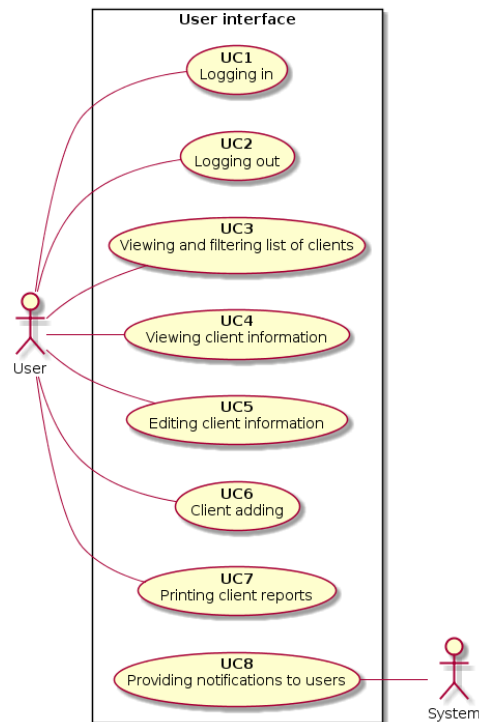
Figure 3.12: User interface: Use case (UC) diagram.

The specified use cases reflect the user interface functional requirements defined in Section 2.7.1:

- **UC1: Logging in**

- **UC3: Viewing and filtering list of clients**

- **UC4: Viewing client information**

- **UC5: Editing client information**

- **UC6: Client adding**

- **UC7: Printing client reports**

- **UC8: Providing notifications to users**

The following table (Table 3.1) shows the Use case corresponding User Interface Scenario:

Use case/Scenario	SUI1	SUI2	SUI3	SUI4
UC1	X	X	X	X
UC2	X	X	X	X
UC3				X
UC4			X	X
UC5	X	X		
UC6	X			
UC7				X
UC8			X	

Table 3.1: User interface: Use case (UC) corresponding User Interface scenarios (SUI).

3.3.2 Formal model of user interface

The formal model of the user interface can be described by Hierarchical Task Analysis (HTA) [46], which is a structured and objective approach to describing user performance of tasks. The HTA and plans for proposed user interface can be found in Appendix D.

3.3.3 Low-fidelity prototype

A very first prototype (low-fidelity prototype) of the user interface was created in the form of a paper prototype and was implemented using tool Balsamiq Mockups [47] (more about the implementation of the low-fidelity prototype in Section 4.1).

The structure of the proposed user interface reflects the user model structure (see Section 3.2.2) and user interface requirements (see Section 2.7.1), collected in time before the creation of the low-fidelity prototype. The goal was to create a prototype that is easy to maintain and minimalist, clean and intelligible.

This prototype was evaluated in the usability study with three representatives of the primary user group (see Section 5.1). The participants were from the Czech Republic, so the prototype has been created in Czech (non-functional requirement *NFRUI1*).

The user interface consists of five main screens, which further branches into sub-screens. The example of the low-fidelity prototype screen can be seen in Figure 3.13. The complete structure of screens and all screens can be seen in Appendix F. The complete structure of screens and all screens can be seen in Appendix E.
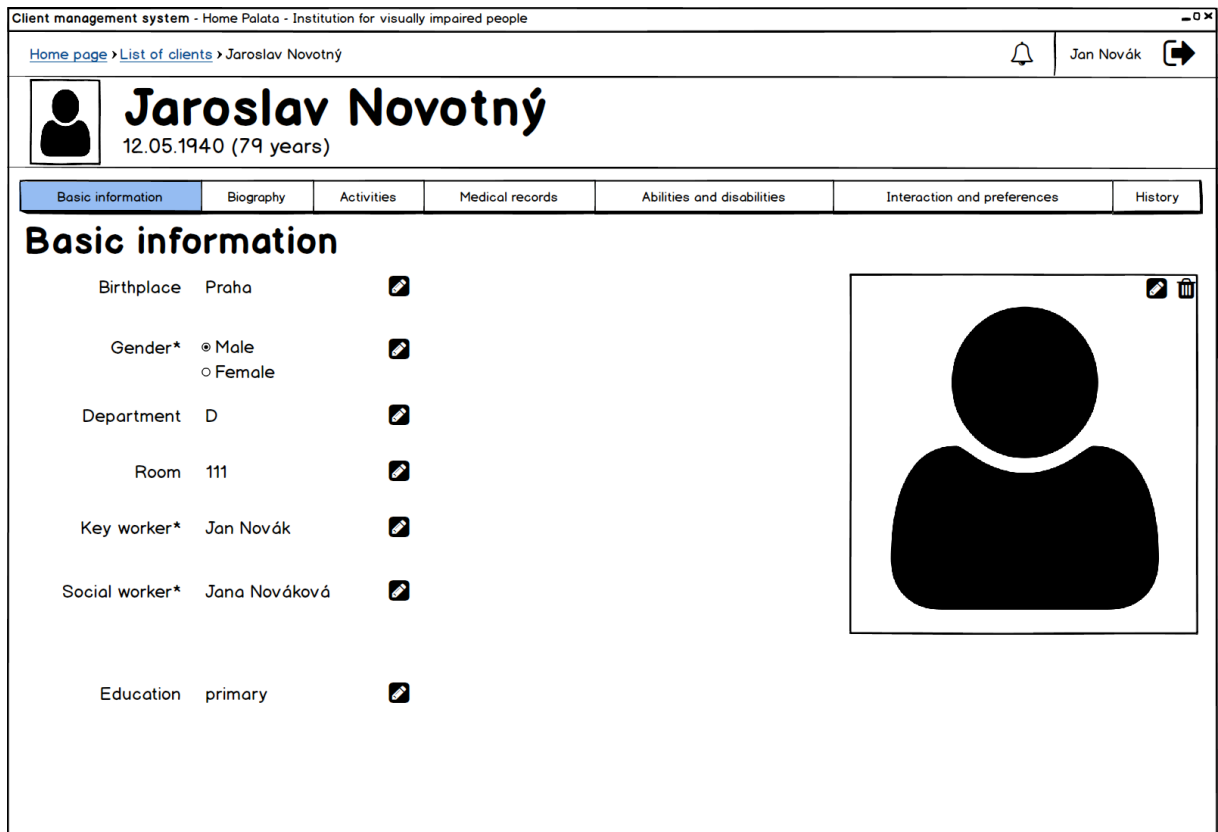
Figure 3.13: Lo-fi prototype SCR4a – Client detail – Basic information (translated into English).

Login page (*SCR1*)

The *Login page* (see Figure E.2) is the first screen the user encounters when interacting with the application. The screen allows the user to enter username and password to log into the system.

Home page (*SCR2*)

The *Home page* (see Figure E.3) acts as the main application signpost. It allows the user to go to the client search screen or to add a client screen. At the top of the screen, there is a panel that informs the user about the current location, allows the user to view notifications (see Figures E.21 and E.22), displays the user's name and surname, and allows the user to log out of the system. This panel then appears on all other screens.

List of clients page (*SCR3*)

The *List of clients page* (see Figure E.4) displays the list of clients and allows the user to apply filtration of records.

Client detail page (pages *SCR4x*)

The *Client detail page* consists of seven sub-pages:

- **Basic information (*SCR4a*)**
  The *Basic information* screen (see Figure E.5) displays basic information about the client. As an example of the low-fidelity prototype, the *Basic information* screen can be seen in Figure 3.13.

- **Biography**
  The *Biography* consists of four sub-pages:

  - **Biography – Biographical sheet (*SCR4b1*)**
    The *Biography – Biographical sheet* screen (see Figure E.6) displays biographical sheet text and attached photographs. The user is able to edit text and maintain attached photographs.

  - **Biography – Activities of daily living (*SCR4b2*)**
    The *Biography – Activities of daily living* screen (see Figure E.7) displays table with seventeen different activities of daily living (see Section 2.4). The user can edit each table row (activity) separately.

  - **Biography – Lineage (*SCR4b3*)**
    The *Biography – Lineage* screen (see Figure E.8) displays the family tree of

the client. The user can maintain the lineage (see Figure E.9 and relationship add dialogue in Figure E.10).

– **Biography – Differential diagnostics sheet (*SCR4b4*)**

The *Biography – Differential diagnostics sheet* screen (see Figure E.11) displays table with differential diagnostics score of the client and corresponding form of care.

- **Activities (*SCR4c*)**

The *Activities* screen (see Figure E.12) displays activities of the client. The screen is only used to show activities, the data is located in an external system (see Section 3.1). The user can filter activity records.

- **Medical records (*SCR4d*)**

The *Medical records* screen (see Figure E.13) shows health information. It shows the client's height and weight and further diseases, injuries, allergies, diets and prescribed medication. The user can maintain all this information.

- **Abilities and disabilities**

The *Abilities and disabilities* consist of three sub-pages:

– **Sensory (*SCR4e1*)**

The *Abilities and disabilities – Sensory* screen (see Figure E.14) shows information about the client's sensory abilities and disabilities, such as severity, origin, progression and other characteristics of visual, hearing and tactile impairment and also corresponding abilities of the client, for example, the ability to perceive object shapes.

– **Motor (*SCR4e2*)**

The *Abilities and disabilities – Motor* screen (see Figure E.15) shows information about the client's motor capabilities, such as severity, origin, progression and other characteristics of motor impairment and also corresponding abilities, for example, the ability to stand alone.

– **Cognitive (*SCR4e3*)**

The *Abilities and disabilities – Cognitive* screen (see Figure E.16) shows information about the client's cognitive capabilities, such as the ability to read Braille, knowledge of the room, knowledge of the residential care home – Home Palata and other abilities.

- **Interaction and preferences (*SCR4f*)**

The *Interaction and preferences* screen (see Figure E.17) displays information relevant to client interaction and client's preferences, such as dominant hand, primary

modality and more. On the screen, there are also tables for records of client's attended activities, hobbies, equipment which client use, favourite places and interests in services. The user can maintain all this information, including adding and removing records in tables.

- **History (*SCR4g*)**
  The *History* screen (see Figure E.19) displays a history of client information changes. The user can filter records of changes.

Add client page (*SCR5*)

The *Add client page* (see Figure E.20) allows the user to add a client into the system. Some fields are marked with an asterisk, indicating that they are mandatory. The user has the option to save the new record (and get on the *Client detail page* screen) or to cancel the process of the creation and return to *Home page*.

3.3.4 High-fidelity prototype

The concept of the user interface remains similar to the low-fidelity prototype. There are used screens specified in the low-fidelity prototype (see Section 3.3.3) but the visual appearance of the user interface is improved to get closer to the final product. The experience is also enhanced by the implementation of simple animations or effects, for example, animation of expanding notification detail (see Figure F.27) or buttons hover effect (see Figure F.24). There are also changes based on the requirements, comments and suggestions, gained during the low-fidelity prototype evaluation (see Section 5.1) as well as changes reflecting the findings of the evaluation of the low-fidelity prototype.

This prototype was evaluated in the usability study with six representatives of the primary user group (see Section 5.2). Similarly to the low-fidelity prototype, the prototype is in Czech (non-functional requirement *NFRUI1*).

The example of the high-fidelity prototype screen can be seen in Figure 3.14. The complete structure of screens and all screens can be seen in Appendix F.

Figure 3.14: Hi-fi prototype SCR4a – Client detail – Basic information (translated into English).

Improvements and adjustments

As described above, there are some changes based on the requirements, comments and suggestions, gained during the low-fidelity prototype evaluation and also changes reflecting findings of the evaluation of the low-fidelity prototype. All changes can be seen in Appendix F, where all the screens are shown. The main changes are emphasized below:

Naming of screen Differential diagnostics sheet (SCR4b4)

The naming of the screen *Differential diagnostics sheet (SCR4b4)* has been changed to *Form of care*, which should eliminate the problems that occurred during low-fidelity prototype evaluation (see Finding 1 in Section 5.1).

Highlight of notifications

The notification is highlighted by red colour, see Figure F.26. This change should fix the problem of feeble notification, that was faced by participants during low-fidelity prototype evaluation (see Finding 2 in Section 5.1).

Unsaved data alert

The notification about the unsaved data has been added to the prototype, see Figure F.29. This should eliminate the situation when users omitted the final confirmation of data change (see Finding 3 in Section 5.1).

Extended attribute values options

The text description is added for *"other"* attribute value option. Also, an undefined value of attributes, which values are selected through radio buttons is possible.

Client information print

There has been added a possibility to print out the information about the client, for example, see Figure 3.14, where the printing icon can be seen in the top right corner of client detail.

New attributes

Many new attributes have been added to the prototype, for example, contact persons, detailed information about form of care, textual notes to abilities and disabilities attributes and many more.

3.4 Summary of the design

In this Chapter, the whole solution of the system was proposed with a focus on the user model and user interface. The user model design and the evolution of the user interface of the system were described in detail.

The user model design is following the ability-based design concept (see Section 2.8.1), so the focus is placed on the clients' abilities rather than their limitations. Following the UCD approach, both prototypes of the user interface were evaluated with the target audience and the findings of the low-fidelity prototype evaluation influenced the high-fidelity prototype to meet the requirements of target users. Details about the implementation of the prototypes can be found in Chapter 4 and a description and results of the evaluation of the prototypes are summarised in Chapter 5.

Chapter 4

Implementation

In this Chapter, the implementation of the low-fidelity and high-fidelity prototype of the user interface is described. Note that only the implementation of the user interface prototypes is a goal of this thesis.

The implementation of prototypes went hand in hand with the design and evaluation, see Sections 3.3.3 and 3.3.4 for design and Sections 5.1 and 5.2 for evaluation. For the purpose of the creation of the user interface prototypes, two different development tools were used. Each prototype has been implemented to support the interaction needed to accomplish the tasks performed during the prototype evaluation. The implementation of the low-fidelity prototype is, as well as the implementation of the high-fidelity prototype, attached to this master thesis (see Appendix J).

4.1 Low-fidelity prototype of user interface

The low-fidelity prototype was implemented using Balsamiq Mockups [47] and all application screens and all necessary interaction elements were implemented. All screens are shown in Appendix E. The prototype was then evaluated in paper form (see Section 5.1).

4.2 High-fidelity prototype of user interface

After the low-fidelity prototype evaluation, the high-fidelity prototype was implemented. The tool Axure [48], which enables the creation of more advanced prototypes, was used for this purpose. The more advanced tool features such as global and local variables, functions, *OnPageLoad* actions (example can be seen in Figure 4.1), dynamic panels, and so on have been used during the prototype creation process.
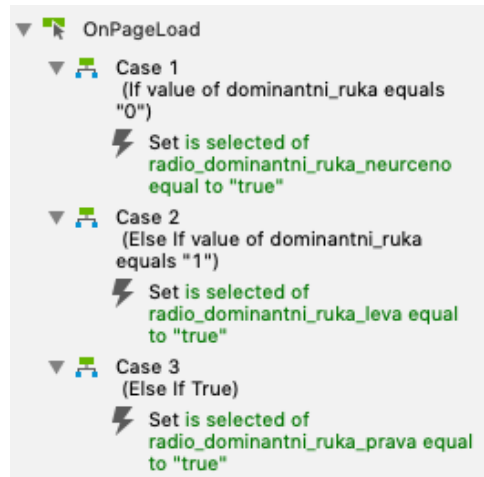
Figure 4.1: Hi-fi prototype implementation – Example of used *OnPageLoad* actions.

The prototype was then generated as HTML files and evaluated in the form of interactive computer application (see Section 5.2). All screens are shown in Appendix F.

4.3   Summary of the implementation

In this Chapter, the implementation of both generations of the user interface prototypes was described. Following the UCD, both prototypes (low-fidelity and high-fidelity) were evaluated and details about the evaluation can be seen in Chapter 5.

Chapter 5

Evaluation

Following the UCD approach, both prototypes of the user interface were evaluated using appropriate evaluation methods. This Chapter describes the procedure of the evaluation of both user interface prototypes and the corresponding results and conclusions.

5.1 Low-fidelity prototype of user interface

To obtain initial feedback from the users, the low-fidelity prototype described in Section 3.3.3 was evaluated in a usability study.

Participants

Low-fidelity prototype evaluation was conducted with three participants (P1–P3), all women, average age 33.33 ($SD = 11.09$, $MIN = 25$, $MAX = 49$). All participants work as activation service workers. One of the participants (P2) was previously interviewed in the user research. None of the participants has participated in a usability study before. Mean duration of current job title was 1.33 years ($SD = 0.47$).

Procedure

The usability study was conducted with employees of the institution for visually impaired people – Home Palata. The test session was under non-laboratory conditions, and it took a maximum of an hour. Paper low-fidelity prototype and The Wizard of Oz technique were used. The participants were recorded on a camera in order to log the testing session afterwards.

The course of testing session was based on a prepared session guide, see Appendix G.1. Firstly, the participants were informed about the process of the testing session. After the briefing, they filled in a pre-test questionnaire:

Pre-test questionnaire

Q1: Have you already participated in user testing in the past?

Q2: What is your job title in Palata?

Q3: How long have you been working in Palata?

Q4: How do you rate your computer skills?

Then, the system (application) was introduced to them briefly, and they were informed about the purpose of the system. Participants were encouraged to comment aloud their activities. After that, participants were asked to complete a list of three complex tasks (see Appendix H) focused on intended typical interaction with the user interface:

- logging in and out

- searching for a client

- viewing information

- editing information

- adding client

After completing all tasks, participants filled in the post-test questionnaire:

Post-test questionnaire

Q1: What did you like about the application?

Q2: What did you dislike about the application? What was incomprehensible to you?

Q3: Do you have any comments, suggestions, or requests regarding the application?

Q4: How do you rate the understandability of the test assignment? *(1=the best, 5=the worst)*

Q5: Did you feel uncomfortable being recorded? *(1=not at all, 5=definitely yes)*

Q6: How would you rate the testing process? *(1=the best, 5=the worst)*

Finally, participants were asked to share their opinion on the application and the testing session.

Results

Test results for individual participants can be found in Appendix H. A summary of the low-fidelity prototype evaluation results is presented in the following section *Conclusion of the low-fidelity prototype evaluation.*

Findings

In this section, all the findings of the low-fidelity prototype evaluation are described. Each finding has description, severity and proposed improvement. Definition of various severities of findings can be found in Table 5.1 and is based on the definition by Jakob Nielsen [49].

Severity	Definition
0	**No usability problem** at all.
1	**Cosmetic problem:** no need to be fixed unless extra time is available on project.
2	**Minor usability problem**: fixing this should be given low priority.
3	**Major usability problem**: important to fix, so should be given high priority.
4	**Usability catastrophe**: must be fixed before product can be released.

Table 5.1: Severities of findings [49].

Finding F1: Misleading and incomprehensible item name

Severity: 4

Participants: all

Description: All participants were not able to find the form of care, which is placed under *"Differential diagnostics sheet"*, even when passing through several screens (see Figure 5.1).

Figure 5.1: Lo-fi prototype evaluation – Finding F1 – Misleading and incomprehensible item name.

Proposed improvement: The item should be renamed to avoid confusion for users. Participants suggest changing the name to *"Form of care"*.

Finding F2: Feeble notification

Severity: 3

Participants: P1, P3

Description: Participants had a problem noticing the notification. In the low-fidelity prototype, notification was represented by a tiny black circle, see Figure 5.2.
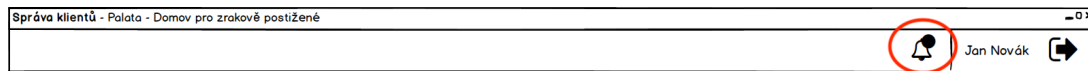
Figure 5.2: Lo-fi prototype evaluation – Finding F2 – Feeble notification.

Proposed improvement: Notification should be more visible. This can be enhanced by colour enhancement (probably red).

Finding F3: Omitted final confirmation of lineage editing

Severity: 3

Participants: P1, P2

Description: Participants omitted the final confirmation of lineage editing, see Figure 5.3. This situation could happen even when editing other information.
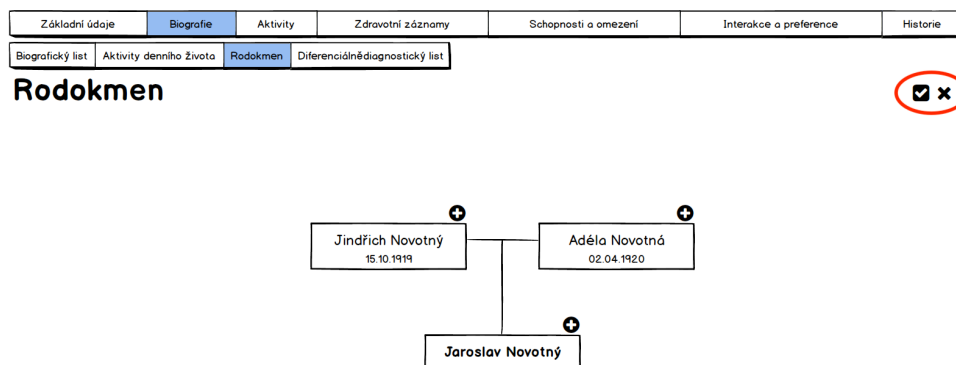
Figure 5.3: Lo-fi prototype evaluation – Finding F3 – Omitted final confirmation of lineage editing.

Proposed improvement: If the user does not confirm editing, he/she might be warned that there are some unsaved changes when switching to another screen. It is also worth considering the colour highlighting of the buttons.

Conclusion of the low-fidelity prototype evaluation

During the usability study of the low-fidelity prototype, the basic functionality of the user interface was verified.

The usability study also revealed three problems of the proposed design, which must be fixed in the next stages of the design process. The biggest problem faced by all participants was the incomprehensible and misleading term *"Differential diagnostics sheet"*, which was used based on literature analysis. It turned out that none of the participants could imagine anything under this term. This problem can be fixed by renaming the item to *"Form of care"*, which was also suggested by all the participants. Another, quite fundamental problem was feeble notification, which was represented by a tiny black circle. This problem was faced by two participants. The solution to this problem is to make notification more visible. This can be enhanced by colour enhancement (probably red). And the last problem, also faced by two participants, was the problem of leaving out the final confirmation of the information editing. The solution is to notify the user if he/she does not confirm editing and he/she intends to move to another screen. Highlighting the buttons could also help to improve interaction.

The usability study also provided valuable feedback from the participants (for details, see Appendix H), and the knowledge gained during testing and post-test interviews can be useful to improve the design of the user interface. Post-test interviews also brought a requirement for new functionality – printing of client information.

The positive information is that all the participants quickly became familiar with the application, even searching for information (attributes) has become easier after a while. All the participants also emphasise the clarity of the proposed design.

5.2 High-fidelity prototype of user interface

The high-fidelity prototype described in Section 3.3.4 was evaluated in a usability study, aiming to uncover errors in the pre-final design.

Participants

High-fidelity prototype evaluation was conducted with six participants (P1–P6), all women, average age 43.5 ($SD = 14$, $MIN = 26$, $MAX = 64$). Three participants work as activation service workers (*P1*, *P2*, *P3*), two participants as direct care workers (*P4*, *P6*) and one participant (P5) works as a speech and occupational therapists. Two of the participants (*P2*, *P3*) have participated in previous low-fidelity prototype evaluation. Mean duration of current job title was 6.87 years ($SD = 4.7$).

Procedure

As same as low-fidelity prototype evaluation, the usability study of the high-fidelity prototype was conducted with employees of the institution for visually impaired people – Home Palata. The test session was under non-laboratory conditions, and it took a maximum of 45 minutes. Participants were using a computer (MacBook Pro, screen size 13 inches, Google Chrome), and remote computer mouse. The screen of the computer was recorded with sound captured by the internal laptop microphone to log the testing session afterwards.

The course of testing session was based on a prepared session guide, see Appendix G.1. Firstly, the participants were informed about the process of the testing session and after the briefing, they filled in a pre-test questionnaire (the questionnaire contained the same questions as in the low-fidelity prototype evaluation):

Pre-test questionnaire
Q1: Have you already participated in user testing in the past?
Q2: What is your job title in Palata?
Q3: How long have you been working in Palata?
Q4: How do you rate your computer skills?

Then everything went on the same way as evaluation of the low-fidelity prototype, the system (application) was introduced to participants briefly, they were informed about the purpose of the system and they were encouraged to comment aloud their activities. After that, participants were asked to complete a list of three complex tasks (see Appendix I)

focused on intended typical interaction with the user interface. Most of the tasks were the same as when evaluating the low-fidelity prototype, but there was a slight variation due to a more significant focus on evaluating key functionalities. After completing all tasks, participants filled in the post-test questionnaire (the questionnaire contained the same questions as in the low-fidelity prototype evaluation):

Post-test questionnaire
Q1: What did you like about the application?
Q2: What did you dislike about the application? What was incomprehensible to you?
Q3: Do you have any comments, suggestions, or requests regarding the application?
Q4: How do you rate the understandability of the test assignment? *(1=the best, 5=the worst)*
Q5: Did you feel uncomfortable being recorded? *(1=not at all, 5=definitely yes)*
Q6: How would you rate the testing process? *(1=the best, 5=the worst)*

Finally, participants were asked to share their opinion on the application and the testing session.

Results

Test results for individual participants can be found in Appendix I. A summary of the high-fidelity prototype evaluation results is presented in the following section *Conclusion of the high-fidelity prototype evaluation*.

Findings

In this section, all the findings of the high-fidelity prototype evaluation are described. As well as low-fidelity prototype evaluation, each finding has description, severity and proposed improvement. Definition of various severities of findings is based on the definition by Jakob Nielsen [49] and can be found in Table 5.1.

Finding F1: Small and feeble radio buttons and checkboxes
Severity: 3
Participants: P1, P2, P5
Description: The participants complained about the size of the radio buttons and checkboxes, which were also very feeble in their point of view (see Figure 5.4).
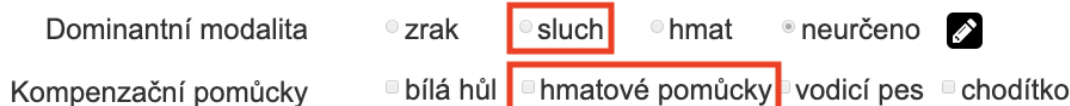
Figure 5.4: Hi-fi prototype evaluation – Finding F1 – Small and feeble radio buttons and checkboxes.

Proposed improvement: In the final product, it is necessary to increase the size of active elements of the interaction, such as radio buttons and checkboxes.

Finding F2: Difficult search for attributes

Severity: 3

Participants: all

Description: All the participants faced the problem of finding individual information (attributes). The problem is a large number of attributes and also the ambiguity of distribution into the categories.

Proposed improvement: The solution may be adding a search box, which will be searching for the individual attributes.

Finding F3: Unclear difference between screens

Severity: 3

Participants: P1, P2, P4, P5, P6

Description: The participants were confused by the *Activities (SCR4c)* and *Activities of daily living (SCR4b2)* screens. Screens naming may be confusing during the first walk-through through the application. In addition, *Activities of daily living (SCR4b2)* screen is hidden by default as a *Biography* sub-page, see Figure 5.3.

Figure 5.5: Hi-fi prototype evaluation – Finding F3 – Unclear difference between screens.

Proposed improvement: In the final product, the *Activities (SCR4c)* screen should be renamed to improve user orientation in the application. For example, the screen could be renamed to *"Activities of the client"*.

Conclusion of the high-fidelity prototype evaluation

During the usability study of the high-fidelity prototype, the more advanced functionality, compared to low-fidelity evaluation, of the user interface was verified.

The usability study revealed three problems of the proposed design, which may be fixed before the final product will be released. The biggest problem faced by all participants was a difficulty of searching for individual attributes. The problem is caused by a large number of attributes and also the ambiguity of distribution into the individual categories. The problem can be fixed by adding a search box, which can be used for the individual attributes search. Another problem is the unclear difference between screens *Activities (SCR4c)* and *Activities of daily living (SCR4b2)*. Five participants out of six have faced this problem. During the first walkthrough through the application, screens naming may be confusing and also, *Activities of daily living (SCR4b2)* screen is hidden by default as a *Biography* sub-page. The solution is to rename the screen *Activities (SCR4c)* to improve user orientation in the application, for example, the screen could be renamed to *"Activities of the client"*. And the last problem, which was faced by three participants, were small and feeble radio buttons and checkboxes. The participants complained about the size of the radio buttons and checkboxes and these interaction elements were also very feeble in their point of view. This problem can be fixed by increasing the size of the active elements of the interaction.

The knowledge gained during testing and post-test interviews can be very useful to improve the design before releasing the final product. Post-test interviews also brought a requirement for the new attribute – information when the client joined the residential care home for visually impaired people – Home Palata.

Despite all the problems faced by the participants during the application evaluation, very positive feedback on the application's clarity was obtained.

5.3 Summary of the evaluation

In this Chapter, the process of the evaluation of both prototypes (low-fidelity and high-fidelity) of the user interface, as well as the corresponding results, were described and summarized. The evaluation of both generations of the prototypes indicated that the user interface is generally clear for employees of the residential care home.

Chapter 6

Conclusion

The main goal of this thesis was to design the user model for visually impaired older adults and the user interface, which will serve workers of the residential care home to manage this model. The whole solution of the *Client management system* is proposed with the focus on the user model (following the ability-based design) and corresponding administration user interface (following the UCD).

The user model design connects aspects of personal psychobiography that is already successfully applied in the gerontological care and aspects that are important for interaction with technologies. Mutual connection of the personal psychobiography and user profile in one user model could bring various benefits. Knowing particular client abilities could improve interaction significantly. For interaction with technologies, it would be possible to adjust a user interface according to the needs and preferences of a specific client, properties like rate of speech, information complexity and volume could be automatically considered. Technological applications like interactive indoor orientation system could provide personalised information like instructions on how to navigate to one's room. Also, personal psychobiography could be used to make the interaction more natural and personal. Data in the user model could be used for client identification and upon this, it would be possible, for example, to address the client by her/his name in an appropriate form.

6.1   Goals fulfilment

The whole process consisted of several steps that correspond with the goals defined in Section 1.2. Goals of this thesis, together with the description of their realisation, are listed below.

G1: Analysis of current context modelling methods with a focus on user modelling.

The current context modelling methods were analysed with the focus on the user modelling and the summary can be seen in Section 2.1.

G2: Analysis of the outcomes of current research focused on specific abilities, preferences, and needs of visually impaired older adults.

The specific abilities, preferences and needs of the visually impaired older adults were described as well as the statistical overview of visual impaired older adults, see Section 2.2.

G3: Analysis of the care model according to E. Böhm [4], based on psychobiographical modelling of individuals.

The psychobiographic model of nursing care according to E. Böhm [4] were described, see Section 2.3. Further, the user research with the employees of the residential care home was conducted to obtain information about the application of the psychobiographical model in practice, see Section 2.4.

G4: Definition of functional and non-functional requirements on the user model and user interface for caregivers.

Based on the analysis, requirements of other projects, conducted user research and knowledge gained during iterative prototype evaluation the functional and non-functional requirements for the user model and user interface for caregivers were specified, see Section 2.7.

G5: Design of user model that will enable the modelling of attributes relevant to interaction with people with severe vision impairment with a focus on older adults. The structure of the model will also allow the modelling of important attributes from the psychobiographical modelling perspective.

The design of the user model was proposed. Following the ability-based design, the design focuses on the clients' abilities and not their limitations, which, however, must also be captured to some extent. The user model design connects aspects of personal psychobiography and aspects that are important for interaction with technologies. For details, see Section 3.2.

G6: Design of scenarios of adaptation of selected applications based on the designed user model.

Scenarios and storyboards of adaptation and personalisation of various devices based on the user model were presented, see Section 3.2.1.

G7: Design of scenarios of adaptation of psychobiographical care model that will use the developed model.

Scenarios and storyboards of adaptation of psychobiographical care model that will use the user model and user interface were presented, see Section 3.3.1.

G8: Design and implementation of a prototype of a user interface for caregivers that will allow management of user models of individual clients.

The user interface of the *Client management system* was designed following the UCD approach and there were implemented two generations of the prototypes. For the details about the design of the low-fidelity prototype, see Section 3.3.3 and for the implementation details, see Section 4.1. For the details about the design of the high-fidelity prototype, see Section 3.3.4 and for the implementation details, see Section 4.2.

G9: Evaluation of the solution and developed user interface prototype with caregivers providing care to visually impaired older adults.

Following the UCD approach, both prototypes of the user interface were evaluated using appropriate evaluation methods. For the details about the low-fidelity prototype evaluation, see Section 5.1 and for the details about the evaluation of the high-fidelity prototype, see Section 5.2.

6.2 Future work

Since only the user model and user interface have been designed and the prototypes of the user interfaces were evaluated, there is room for further work and improvements in the future when the entire proposed solution should be realised.

The user model has to be implemented and it is the subject of the future work to fill the user model with data of real clients of the residential care home. There is also necessary to implement the connection with the external system, which will provide the user model with the information about clients' activities (see Section 3.1) and to design and implement the proxy, which will log the client's activities during the interaction with devices. Then, the model should be evaluated for the purposes of providing personalised daily care. Then, technological applications will be able to use the model for adaptation

of user interfaces and interaction.

The user interface has to be implemented and must be connected to the user model. Also, the recommendations to the design summarised in Section 5.2 should be taken into account. Then, it will be possible to integrate the solution into the work of employees of the residential care home and also the evaluation of the final version of the system has to be performed.

The user interface can be expanded to include an administrative section, where the codetables (activities, services, favourite places and so on) will be maintained and also the daily programme of the clients will be managed, which will also bring the user model extension.

Appendix A

User model storyboards

Scenario SUM1: Client's biography
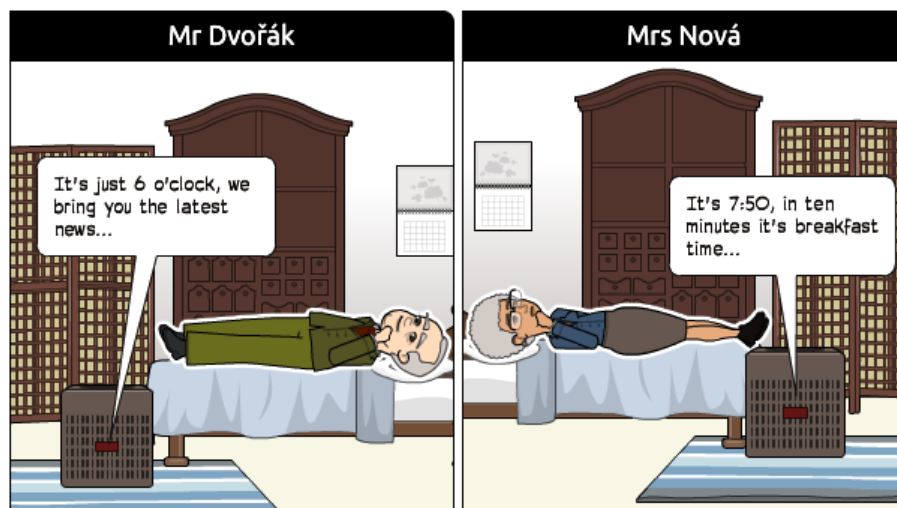
Figure A.1: Storyboard SUM1.

Scenario SUM2: Client's activities

The storyboard can be found in Section 3.2.1 in Figure 3.2.

Scenario SUM3: Medical records
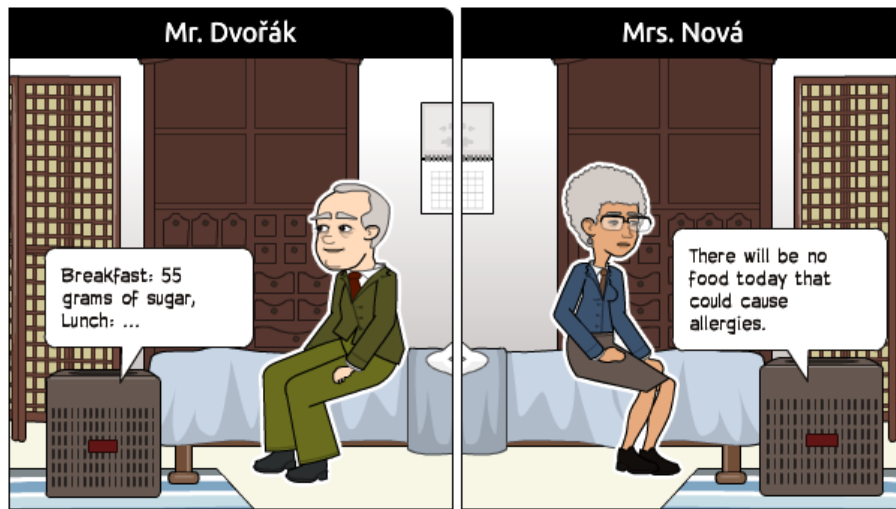
Figure A.2: Storyboard SUM3.

Scenario SUM4: Client's preferences
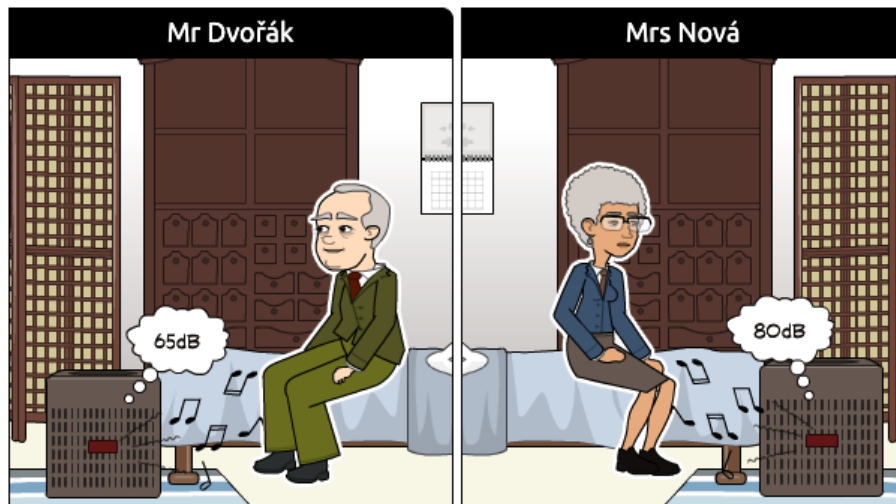
Figure A.3: Storyboard SUM4.

Appendix B

User model attributes

B.1 Demographics

Person

Attribute	Description
idPerson	Person unique identifier.
name	Name of the person.
surname	Surname of the person.
birthplace	Birthplace of the person.
birthdate	Birthdate of the person
permanentResidence	Place of the permanent residence of the person.
gender	Gender of the person.
phone	Phone number of the person.
email	Email of the person.

Table B.1: User model – Person class attributes.

Client

Attribute	Description
idClient	Client unique identifier.
department	Department of the client.
room	Room of the client.
education	Level of education of the client.
inCareHomeFromDate	Date from which the client is in the residential care home for visually impaired people.
+ inherited attributes from Person	

Table B.2: User model – Client class attributes.

Employee

Attribute	Description
idEmployee	Employee unique identifier.
jobTitle	Job title of the employee.
department	Department of the employee.
username	Username of the employee.
password	Password of the employee.
+ inherited attributes from Person	

Table B.3: User model – Employee class attributes.

Photograph

Attribute	Description
idPhoto	Photograph unique identifier.
idClient	Client unique identifier.
binary	Binary of the photograph.
profilePhoto	Status of the profile photograph (if the photograph is assigned as profile photograph).
note	Textual photograph note.

Table B.4: User model – Photograph class attributes.

EmployeeClient

Attribute	Description
idClient	Client unique identifier.
idEmployee	Employee unique identifier.
relationship	Textual description of the relationship between the client and the employee.
rightDemographics	Rights of the employee to view/edit *Demographics* information category.
rightBiography	Rights of the employee to view/edit *Biography* information category.
rightActivities	Rights of the employee to view/edit *Activities* information category.
rightMedicalRecords	Rights of the employee to view/edit *Medical records* information category.
rightAbilitiesAndDisabilities	Rights of the employee to view/edit *Abilities and Disabilities* information category.
rightInteractionAndPreferences	Rights of the employee to view/edit *Interaction and Preferences* information category.

Table B.5: User model – EmployeeClient class attributes.

ClientContactPerson

Attribute	Description
idClient	Client unique identifier.
idPerson	Person unique identifier.
idRelationshipTypeCodetable	Relationship type codetable item unique identifier.

Table B.6: User model – ClientContactPerson class attributes.

CodetableGeneral

see section B.8

RelationshipTypeCodetable

see section B.8

B.2   Biography

Person

see section B.1

Client

see section B.1

Lineage

Attribute	Description
idPersonParent	Person unique identifier (relational parent).
idPersonChild	Person unique identifier (relational child).
idRelationshipTypeCodetable	Relationship type codetable item unique identifier.

Table B.7: User model – Lineage class attributes.

BiographicalSheet

Attribute	Description
idBiographicalSheet	Biographical sheet unique identifier.
idClient	Client unique identifier.
text	Text of the biographical sheet

Table B.8: User model – BiographicalSheet class attributes.

ActivitiesOfDailyLiving

Attribute	Description
idClient	Client unique identifier.

Table B.9: User model – ActivitiesOfDailyLiving class attributes.

ActivityOfDailyLiving

Attribute	Description
description	Textual description of the activity of daily living.
positiveBiographyInformation	Positive – information from the biography.
positiveCurrentState	Positive – current state.
positiveWhatToDo	Positive – ”what to do”.
positiveNote	Positive – textual note.
negativeBiographyInformation	Negative – information from the biography.
negativeCurrentState	Negative – current state.
negativeWhatToDo	Negative – ”what to do”.
negativeNote	Negative – textual note.

Table B.10: User model – ActivityOfDailyLiving class attributes.

FormOfCare

Attribute	Description
idClient	Client unique identifier.

Table B.11: User model – FormOfCare class attributes.

Care

Attribute	Description
description	Textual description of care.
active	Status if the care is active.
note	Textual note to care.

Table B.12: User model – Care class attributes.

ScoreItem

Attribute	Description
description	Textual description of differential diagnostics score item.
score	Numeric value of differential diagnostics score item.

Table B.13: User model – ScoreItem class attributes.

CodetableGeneral

see section B.8

RelationshipTypeCodetable

see section B.8

B.3 Activities

Client

see section B.1

Employee

see section B.1

Activity

Attribute	Description
idClient	Client unique identifier.
idActivityCodetable	Activity codetable item unique identifier.
datetime	Date and time of the activity.
idEmployee	Employee unique identifier.

Table B.14: User model – Activity class attributes.

CodetableGeneral

see section B.8

ActivityCodetable

see section B.8

B.4   Medical records

Client

see section B.1

MedicalRecordsGeneral

Attribute	Description
idClient	Client unique identifier.
height	Height of the client.
weight	Weight of the client.

Table B.15: User model – MedicalRecordsGeneral class attributes.

MedicalGeneralCategory

Attribute	Description
idClient	Client unique identifier.
description	Textual description of the record.
note	Textual note to the record.
fromDate	Start date of the validity of the record.
toDate	End date of the validity of the record.

Table B.16: User model – MedicalGeneralCategory class attributes.

Medication

Attribute	Description
+ inherited attributes from MedicalGeneralCategory	

Table B.17: User model – Medication class attributes.

Allergy

Attribute	Description
+ inherited attributes from MedicalGeneralCategory	

Table B.18: User model – Allergy class attributes.

Diet

Attribute	Description
+ inherited attributes from MedicalGeneralCategory	

Table B.19: User model – Diet class attributes.

DiseaseAndInjury

Attribute	Description
+ inherited attributes from MedicalGeneralCategory	

Table B.20: User model – DiseaseAndInjury class attributes.

B.5 Abilities and Disabilities

Client

see section B.1

AbilityAndDisabilitySensory

Attribute	Description
idClient	Client unique identifier.

Table B.21: User model – AbilityAndDisabilitySensory class attributes.

Eye

Attribute	Description
side	Side of the eye – left/right.
impairmentSeverityLevel	Level of the visual impairment.
impairmentDescription	Textual description of the visual impairment.
impairmentOrigin	Origin of the visual impairment.
impairmentOriginOther	Textual note to the other type of the visual impairment origin.
impairmentFromAge	Age at which the visual impairment started.
impairmentProgression	Status of the progression of the visual impairment.
abilityToReadLevel	Level of the ability to read.
abilityToReadNote	Textual note to the ability to read.
abilityToPercieveColoursLevel	Level of the ability to perceive colours.
abilityToPercieveColoursNote	Textual note to the ability to perceive colours.
abilityToPercieveLightLevel	Level of the ability to perceive light.
abilityToPercieveLightNote	Textual note to the ability to perceive light.
abilityToPercieveObjectShapesLevel	Level of the ability to perceive object shapes.
abilityToPercieveObjectShapesNote	Textual note to the ability to perceive object shapes.

Table B.22: User model – Eye class attributes.

Ear

Attribute	Description
side	Side of the ear – left/right.
impairmentSeverityLevel	Level of the hearing impairment.
impairmentDescription	Textual description of the hearing impairment.
impairmentOrigin	Origin of the hearing impairment.
impairmentOriginOther	Textual note to the other type of the hearing impairment origin.
impairmentFromAge	Age at which the hearing impairment started.
impairmentProgression	Status of the progression of the hearing impairment.
hearingAidActive	Status of the hearing aid usage.
hearingAidActiveNote	Textual note to the used hearing aid.
minimumVolume	Minimum required volume in dB.

Table B.23: User model – Ear class attributes.

Hand

Attribute	Description
side	Side of the hand – left/right.
abilityTactileLevel	Level of the tactile ability.
abilityTactileNote	Textual note to the tactile ability.
absenceFingerThumb	Status of the thumb finger absence.
absenceFingerIndex	Status of the thumb index absence.
absenceFingerMiddle	Status of the thumb middle absence.
absenceFingerRing	Status of the thumb ring absence.
absenceFingerLittle	Status of the thumb little absence.

Table B.24: User model – Hand class attributes.

AbilityAndDisabilityMotor

Attribute	Description
idClient	Client unique identifier.
impairmentSeverityLevel	Level of the motor impairment.
impairmentDescription	Textual description of the motor impairment.
impairmentOrigin	Origin of the motor impairment.
impairmentOriginOther	Textual note to the other type of the motor impairment origin.
impairmentFromAge	Age at which the motor impairment started.
impairmentProgression	Status of the progression of the motor impairment.
abilityToStandAloneLevel	Level of the ability to stand alone.
abilityToStandAloneNote	Textual note to the ability to stand alone.
absenceOfLimbUpperLeft	Status of the upper left limb absence.
absenceOfLimbUpperRight	Status of the upper right limb absence.
absenceOfLimbLowerLeft	Status of the lower left limb absence.
absenceOfLimbLowerRight	Status of the lower right limb absence.
mobilityIndependently	Status of the ability to move independently.
mobilityIndependentlyNote	Textual note to the ability to move independently.
mobilityWithStick	Status of the ability to move with the stick.
mobilityWithStickNote	Textual note to the ability to move with the stick.
mobilityWithWalker	Status of the ability to move with the walker.
mobilityWithWalkerNote	Textual note to the ability to move with the walker.
mobilityWithWheelchair	Status of the ability to move with the wheelchair.
mobilityWithWheelchairNote	Textual note to the ability to move with the wheelchair.
mobilityBed	Status of the ability to move on the bed.
mobilityBedNote	Textual note to the ability to move on the bed.

Table B.25: User model – AbilityAndDisabilityMotor class attributes.

AbilityAndDisabilityCognitive

Attribute	Description
idClient	Client unique identifier.
abilityMentalLevel	Level of the mental (cognitive) ability.
abilityMentalLevelNote	Textual note to the mental (cognitive) ability.
abilityToReadBraille	Status of the ability to read Braille.
independenceRoomLevel	Level of the independence in the room.
independenceInsideBuildingLevel	Level of the independence inside the building of residential care home.
independenceSurroundingsLevel	Level of the independence in the surroundings.
independenceFamiliarPathsLevel	Level of the independence on the familiar paths.
independenceGardenLevel	Level of the independence in the garden.
independenceOutsidePalataLevel	Level of the independence outside the residential care home.
knowledgeRoomLevel	Level of the room knowledge.
knowledgeRoomNote	Textual note to the room knowledge.
knowledgePalataLevel	Level of the residential care home knowledge.
knowledgePalataNote	Textual note to the residential care home knowledge.
abilityToDescribeWhereIsWhatLevel	Level of the ability to describe where is what.
abilityToDescribeWhereIsWhatNote	Textual note to the ability to describe where is what.
abilityToDescribeHowToGetSomewhereLevel	Level of the ability to describe how to get somewhere.
abilityToDescribeHowToGetSomewhereNote	Textual note to the ability to describe how to get somewhere.
timidityLevel	Level of the timidity.
timidityNote	Textual note to the timidity.

Table B.26: User model – AbilityAndDisabilityCognitive class attributes.

B.6   Interaction and Preferences

Client

see section B.1

InteractionAndPreferencesGeneral

Attribute	Description
idClient	Client unique identifier.
dominantHand	Dominant hand.
dominantModality	Dominant modality (sight, hearing, touch).
compensationAidWhiteCane	Status of the usage of the white cane.
compensationAidTactile	Status of the usage of the tactile compensation aid.
compensationAidGuideDog	Status of the usage of the guide dog.
compensationAidWalker	Status of the usage of the walker.
compensationAidWheelchair	Status of the usage of the wheelchair.
compensationAidOther	Status of the other type of the compensation aid usage.
compensationAidOtherNote	Textual note to the other type of the compensation aid usage.
orientationSight	Status of the orientation using sight.
orientationRail	Status of the orientation using rail.
orientationOther	Status of the other type of the orientation usage.
orientationOtherNote	Textual note to the other type of the orientation usage.
eatingPreference	Eating preference (room/eatery/recreation room).
interestVisitingNewPlaces	Status of the interest in visiting new places.

Table B.27: User model – InteractionAndPreferencesGeneral class attributes.

AttendedActivity

Attribute	Description
idClient	Client unique identifier.
idActivityCodetable	Activity codetable item unique identifier.
frequency	Frequency of attendance.
note	Textual note.

Table B.28: User model – AttendedActivity class attributes.

FavouritePlace

Attribute	Description
idClient	Client unique identifier.
idFavouritePlaceCodetable	Favourite place codetable item unique identifier.
note	Textual note.

Table B.29: User model – FavouritePlace class attributes.

ServiceInterest

Attribute	Description
idClient	Client unique identifier.
idServiceCodetable	Service codetable item unique identifier.
note	Textual note.

Table B.30: User model – ServiceInterest class attributes.

Equipment

Attribute	Description
idClient	Client unique identifier.
idEquipmentCodetable	Equipment codetable item unique identifier.
note	Textual note.

Table B.31: User model – Equipment class attributes.

Hobby

Attribute	Description
idClient	Client unique identifier.
idHobbyCodetable	Hobby codetable item unique identifier.
note	Textual note.

Table B.32: User model – Hobby class attributes.

CodetableGeneral

see section B.8

ActivityCodetable

see section B.8

FavouritePlaceCodetable

see section B.8

ServiceCodetable

see section B.8

EquipmentCodetable

see section B.8

HobbyCodetable

see section B.8

B.7   History

Client

see section B.1

Employee

see section B.1

History

Attribute	Description
idClient	Client unique identifier.
idEmployee	Employee unique identifier.
datetime	Date and time of the change.
category	Category of the change.
item	Changed item (attribute).
oldValue	Old value of the attribute.
newValue	New value of the attribute.

Table B.33: User model – History class attributes.

B.8 Codetables

CodetableGeneral

Attribute	Description
id	Codetable item unique identifier.
description	Textual description of the codetable item.
note	Textual note to the codetable item.

Table B.34: User model – CodetableGeneral class attributes.

RelationshipTypeCodetable

Attribute	Description
+ inherited attributes from CodetableGeneral	

Table B.35: User model – RelationshipTypeCodetable class attributes.

ActivityCodetable

Attribute	Description
category	Category of the activity.
+ inherited attributes from CodetableGeneral	

Table B.36: User model – ActivityCodetable class attributes.

FavouritePlaceCodetable

Attribute	Description
+ inherited attributes from CodetableGeneral	

Table B.37: User model – FavouritePlaceCodetable class attributes.

ServiceCodetable

Attribute	Description
+ inherited attributes from CodetableGeneral	

Table B.38: User model – ServiceCodetable class attributes.

EquipmentCodetable

Attribute	Description
+ inherited attributes from CodetableGeneral	

Table B.39: User model – EquipmentCodetable class attributes.

HobbyCodetable

Attribute	Description
+ inherited attributes from CodetableGeneral	

Table B.40: User model – HobbyCodetable class attributes.

Appendix C

User interface storyboards

Storyboard SUI1

The storyboard can be found in Section 3.3.1 in Figure 3.11.

Storyboard SUI2

Figure C.1: Storyboard SUI2.

Storyboard SUI3

Figure C.2: Storyboard SUI3.

Storyboard SUI4

Figure C.3: Storyboard SUI4.

Appendix D

Hierarchical Task Analysis and Plans

Hierarchical Task Analysis
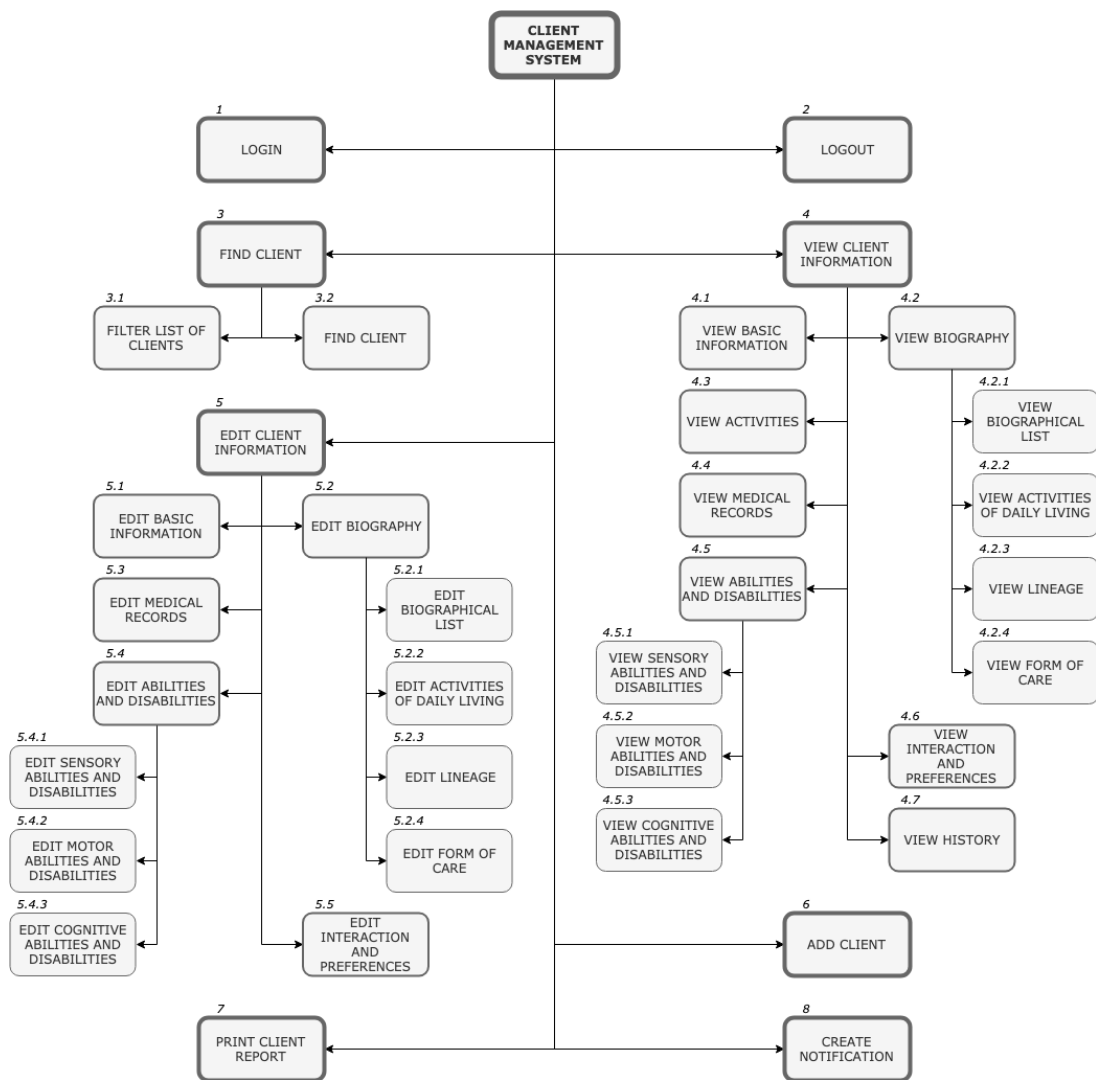
Figure D.1: Hierarchical Task Analysis of the proposed Client management system.

Plans

Every action is performed by User, if another actor is not mentioned explicitly.

Scenario *SUI1*: $1 - 6 - 5.1 - 5.2.1 - 5.2.3 - 5.5 - 2$
Scenario *SUI2*: $1 - 5.4.1 - 5.5 - 5.2.4 - 2$
Scenario *SUI3*: *(Another User)* $6 - 1 - $ *(System)* $8 - 4.1 - 4.7 - 4.2.1 - 4.2.2 - 4.2.3 - 4.2.4 - 4.5.1 - 4.5.2 - 4.5.3 - 4.6 - 2$
Scenario *SUI4*: $1 - 3.1 - 3.2 - 4.3 - 7 - 2$

Appendix E

Low-fidelity prototype: Screens

E.1   Overview
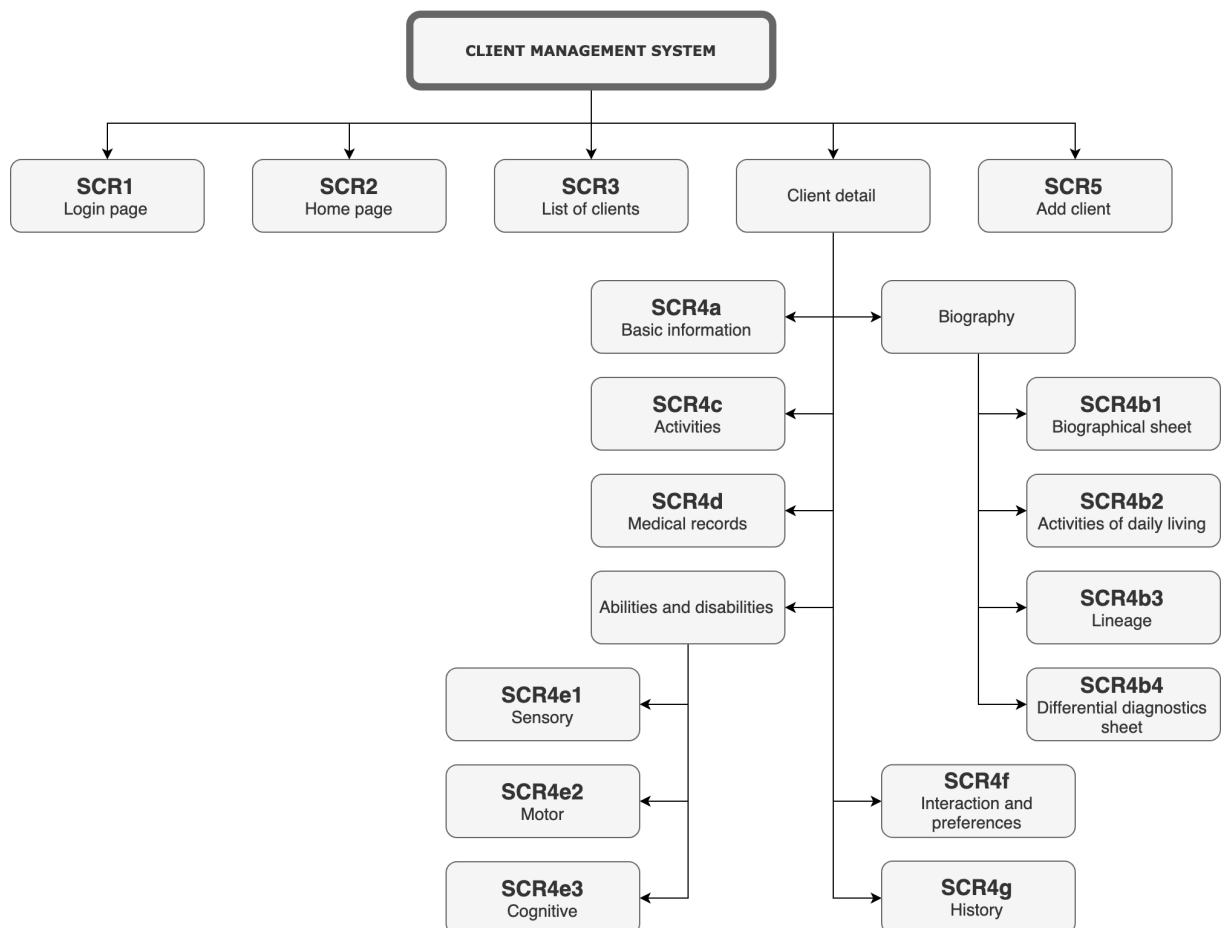
Figure E.1: Lo-fi prototype – overview.

E.2   Individual screens
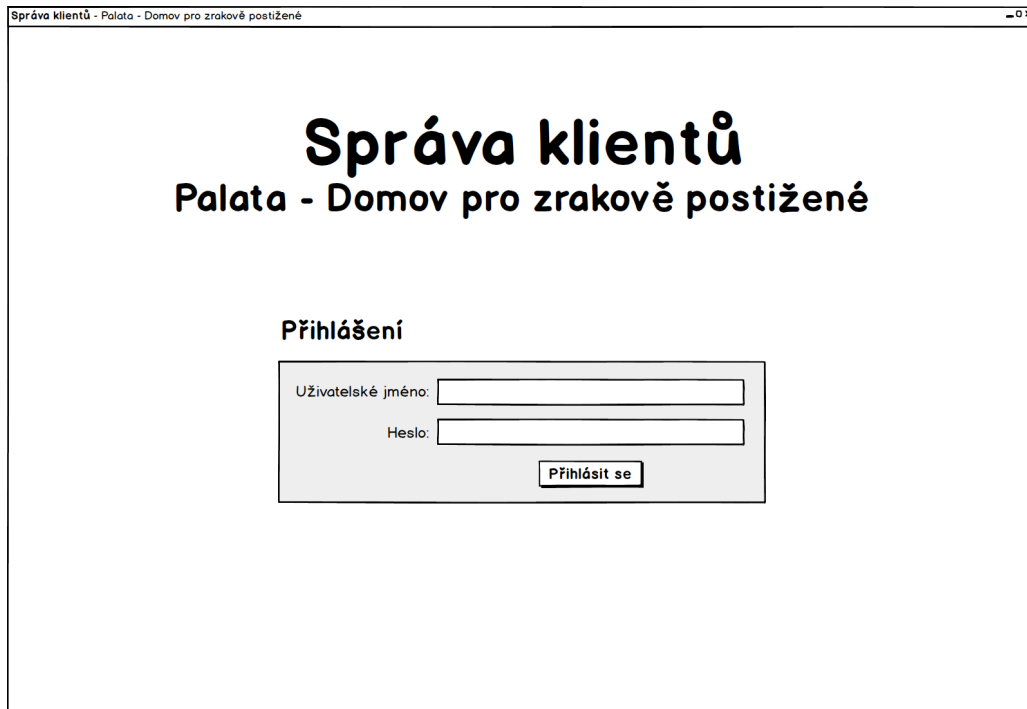
Figure E.2: Lo-fi prototype SCR1 – Login page.

Figure E.3: Lo-fi prototype SCR2 – Home page.
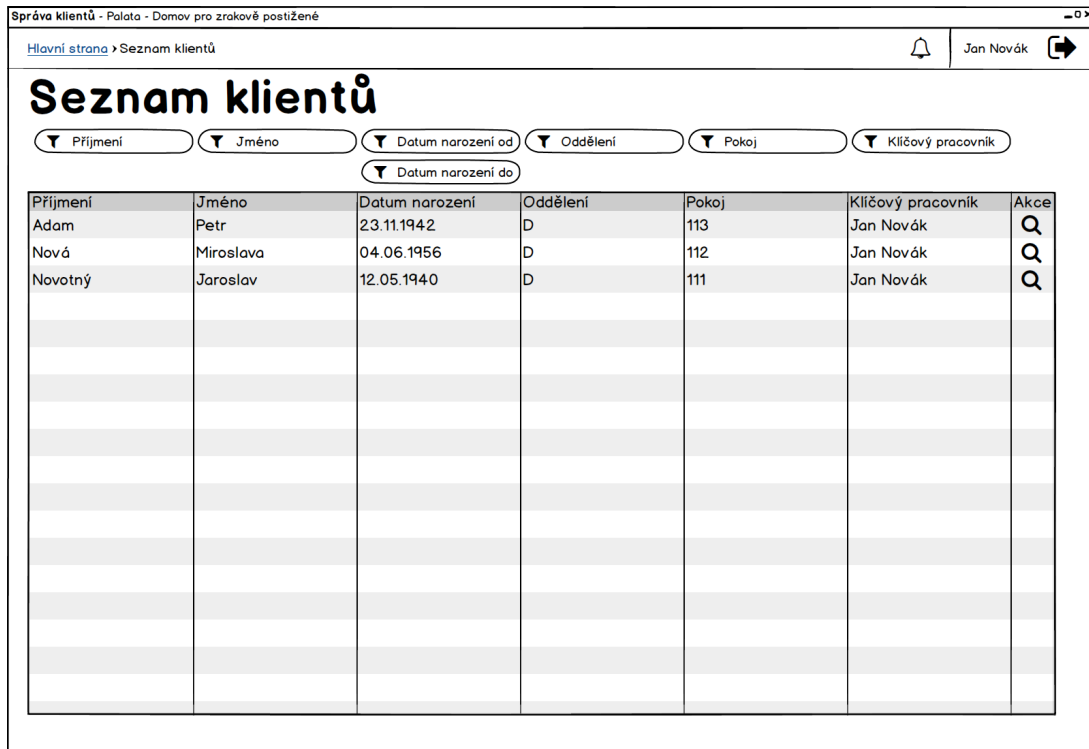
Figure E.4: Lo-fi prototype SCR3 – List of clients.
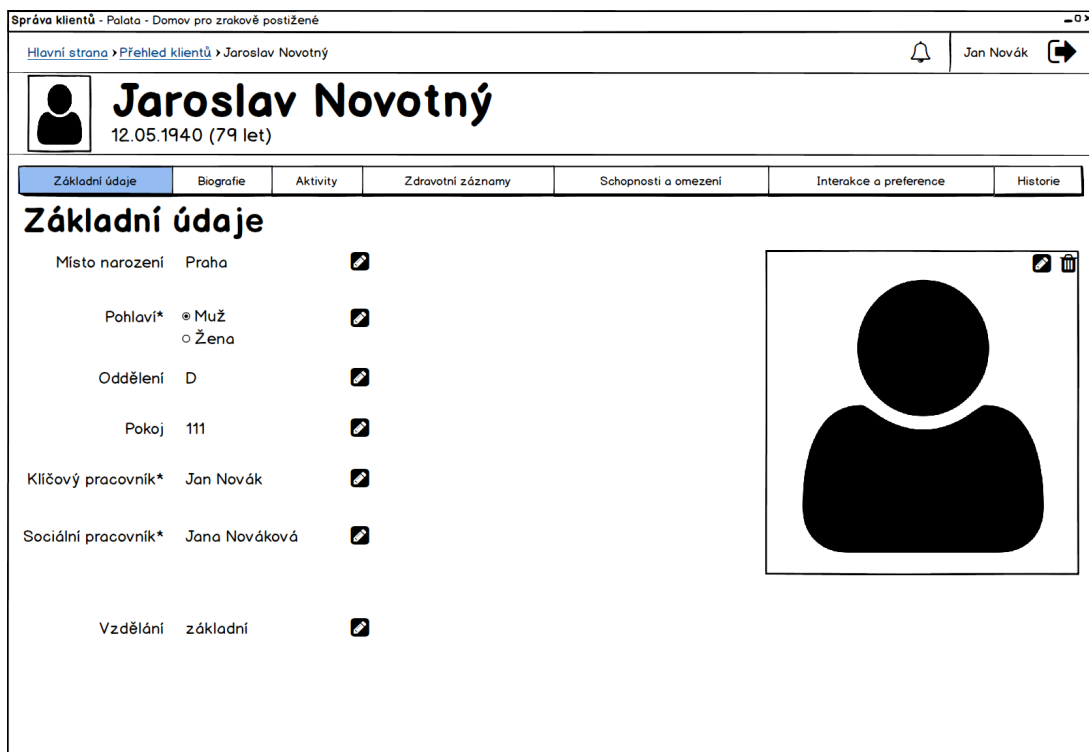
Figure E.5: Lo-fi prototype SCR4a – Client detail – Basic information.

Hlavní strana › Přehled klientů › Jaroslav Novotný   Jan Novák

Jaroslav Novotný
12.05.1940 (79 let)

| Základní údaje | Biografie | Aktivity | Zdravotní záznamy | Schopnosti a omezení | Interakce a preference | Historie |

Biografický list | Aktivity denního života | Rodokmen | Diferenciálnědiagnostický list

Biografický list

Fotografie

Figure E.6: Lo-fi prototype SCR4b1 – Client detail – Biography – Biographical sheet.

Hlavní strana › Přehled klientů › Jaroslav Novotný   Jan Novák

Jaroslav Novotný
12.05.1940 (79 let)

| Základní údaje | Biografie | Aktivity | Zdravotní záznamy | Schopnosti a omezení | Interakce a preference | Historie |

Biografický list | Aktivity denního života | Rodokmen | Diferenciálnědiagnostický list

Aktivity denního života

Aktivita	Informace z biografie pozitivní	Současný stav	Poznámka	Informace z biografie negativní	Současný stav	Poznámka	Akce
Komunikace							✎
Mobilita							✎
Podpora vitálních funkcí							✎
Sebepéče - hygiena							✎
Příjem potravy a tekutin							✎
Vylučování							✎
Sebepéče - oblékání							✎
Být mužem/ženou							✎
Zaměstnat se							✎
Klid a spánek							✎
Péče o bezpečné prostředí							✎
Zajistit sociální oblasti života - vztahy							✎
Zvládání zátěžových situací							✎
Orientace prostředím							✎
Orientace časem							✎
Orientace osobou							✎
Orientace situací							✎

Figure E.7: Lo-fi prototype SCR4b2 – Client detail – Biography – Activities of daily living.
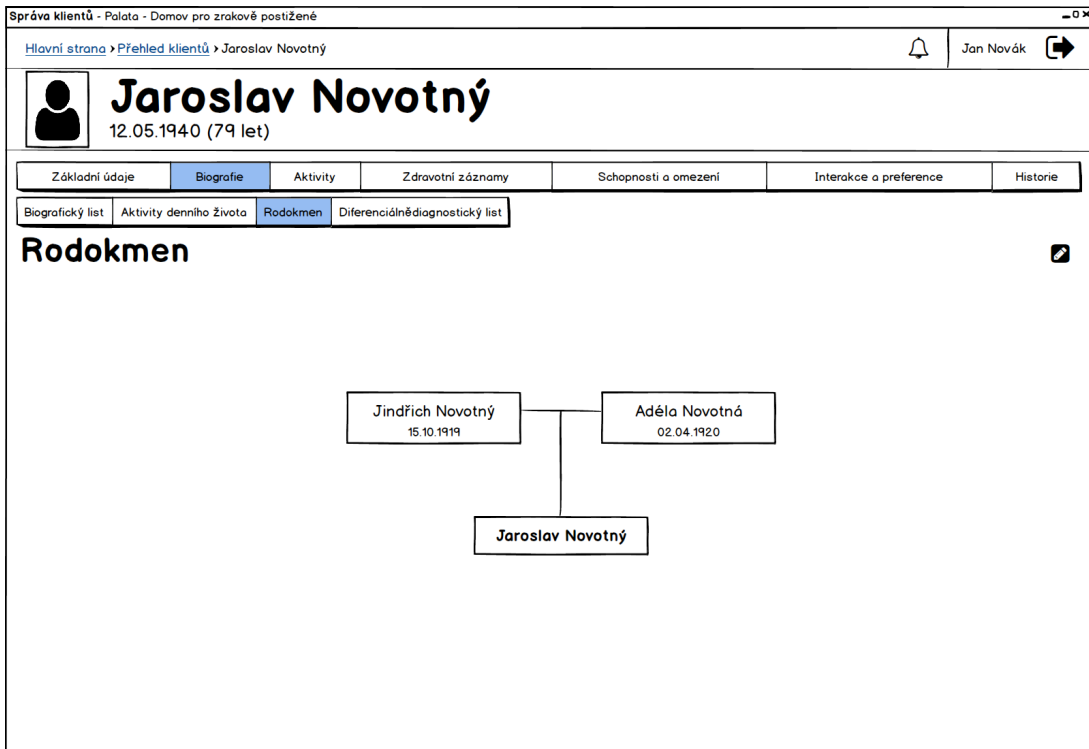
Figure E.8: Lo-fi prototype SCR4b3 – Client detail – Biography – Lineage.
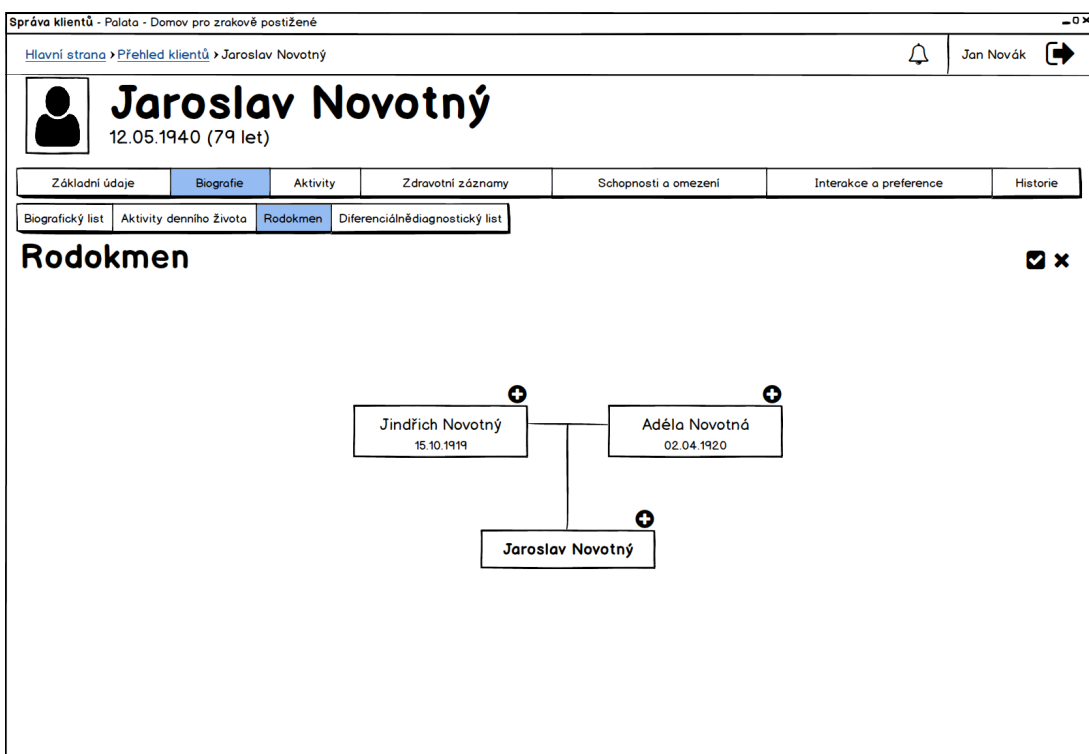
Figure E.9: Lo-fi prototype SCR4b3 – Client detail – Biography – Lineage update.

Figure E.10: Lo-fi prototype SCR4b3 – Client detail – Biography – Lineage: Relationship add dialogue.

Figure E.11: Lo-fi prototype SCR4b4 – Client detail – Biography – Differential diagnostics sheet.

Figure E.12: Lo-fi prototype SCR4c – Activities.

Figure E.13: Lo-fi prototype SCR4d – Medical records.

Správa klientů - Palata - Domov pro zrakově postižené

Hlavní strana › Přehled klientů › Jaroslav Novotný

Jaroslav Novotný
12.05.1940 (79 let)

| Základní údaje | Biografie | Aktivity | Zdravotní záznamy | Schopnosti a omezení | Interakce a preference | Historie |

| Senzorické | Motorické | Mentální |

Schopnosti a omezení - Senzorické

Vážnost zrakového postižení ○0 ○1 ○2 ○3 ◉4 ○5
Popis postižení   slabozrakost
Původ postižení □ vrozené □ úrazem □ nemocí □ polymorbidita □ jiné □ neznámé
Postižení od věku
Progrese ○ ano ○ ne
Schopnost číst ○0 ○1 ○2 ○3 ○4 ○5
Schopnost vidět barvy ○0 ○1 ○2 ○3 ○4 ○5
Schopnost vidět světlo ○0 ○1 ○2 ○3 ○4 ○5
Schopnost vnímat tvary ○0 ○1 ○2 ○3 ○4 ○5

Vážnost sluchového postižení ○0 ○1 ○2 ○3 ○4 ○5
Popis postižení
Původ postižení □ vrozené □ úrazem □ nemocí □ polymorbidita □ jiné □ neznámé
Postižení od věku
Progrese ○ ano ○ ne
Potřebná minimální hlasitost (dB)

Hmatové schopnosti ○0 ○1 ○2 ○3 ○4 ○5
Absence prstů ○ ano ○ ne

Figure E.14: Lo-fi prototype SCR4e1 – Abilities and disabilities – Sensory.

Správa klientů - Palata - Domov pro zrakově postižené

Hlavní strana › Přehled klientů › Jaroslav Novotný

Jaroslav Novotný
12.05.1940 (79 let)

| Základní údaje | Biografie | Aktivity | Zdravotní záznamy | Schopnosti a omezení | Interakce a preference | Historie |

| Senzorické | Motorické | Mentální |

Schopnosti a omezení - Motorické

Vážnost motorického postižení ○0 ○1 ○2 ○3 ○4 ○5
Popis postižení
Původ postižení □ vrozené □ úrazem □ nemocí □ polymorbidita □ jiné □ neznámé
Postižení od věku
Progrese ○ ano ○ ne

Primární ruka ○ pravá ○ levá ○ neurčeno
Vydrží samostatně stát ○ ano ○ ne
Pohyblivost □ samostatně □ s holí □ s chodítkem □ vozík □ lůžko

Figure E.15: Lo-fi prototype SCR4e2 – Abilities and disabilities – Motor.

Figure E.16: Lo-fi prototype SCR4e3 – Abilities and disabilities – Cognitive.

Figure E.17: Lo-fi prototype SCR4f – Interaction and preferences.

Figure E.18: Lo-fi prototype SCR4f – Interaction and preferences: Add/remove of favourite place dialogue.

Figure E.19: Lo-fi prototype SCR4g – History.

Figure E.20: Lo-fi prototype SCR5 – Add client.
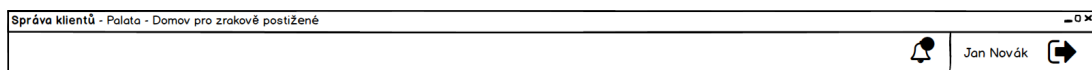
Figure E.21: Lo-fi prototype – Top panel with notification.

Figure E.22: Lo-fi prototype – Notification detail.

Appendix F

High-fidelity prototype: Screens

F.1 Overview
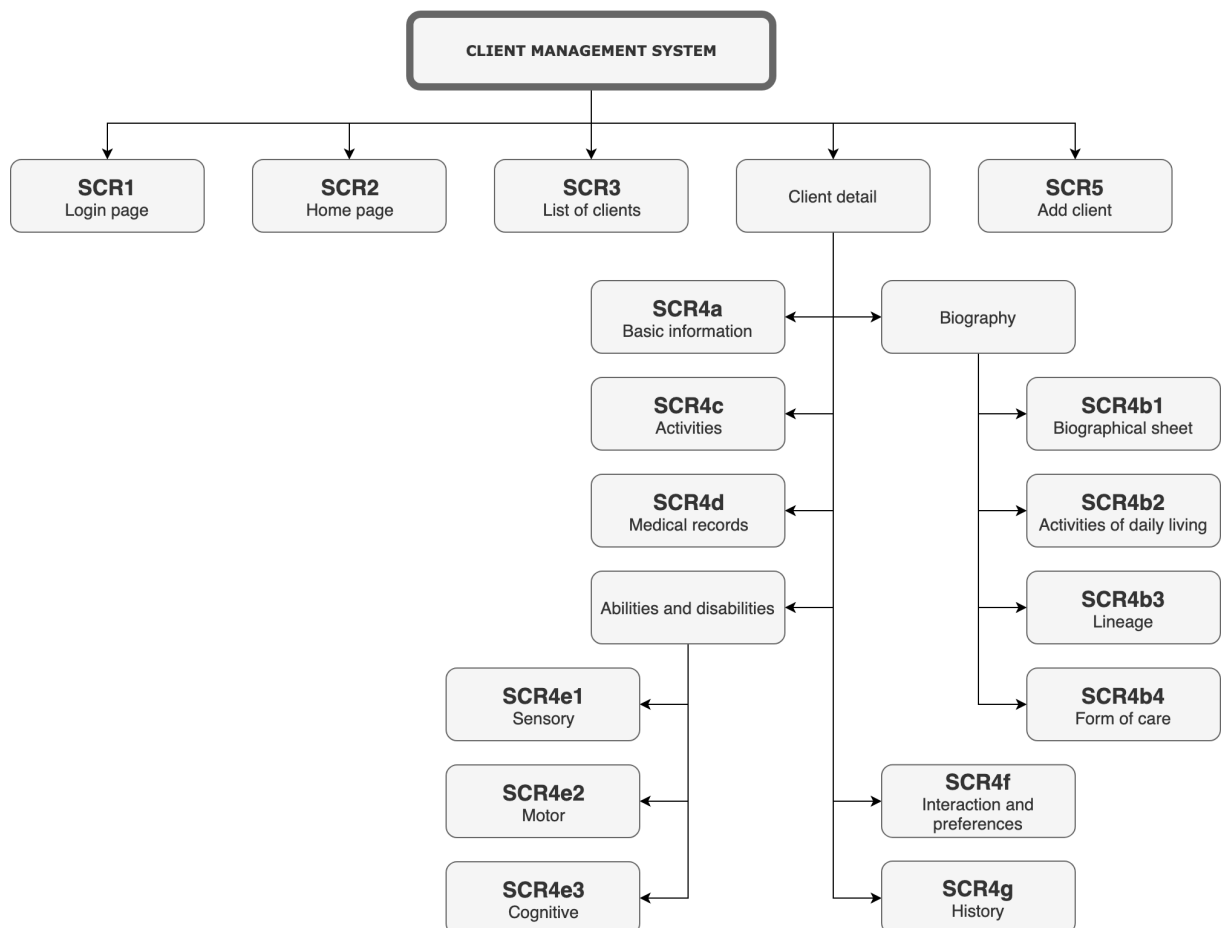
Figure F.1: Hi-fi prototype – overview.

F.2 Individual screens

Figure F.2: Hi-fi prototype SCR1 – Login page.

Figure F.3: Hi-fi prototype SCR2 – Home page.

Figure F.4: Hi-fi prototype SCR3 – List of clients.

Figure F.5: Hi-fi prototype SCR4a – Client detail – Basic information.

Figure F.6: Hi-fi prototype SCR4a – Client detail – Dropdown menu for Biography.

Figure F.7: Hi-fi prototype SCR4a – Client detail – Dropdown menu for Abilities and disabilities.

Figure F.8: Hi-fi prototype SCR4b1 – Client detail – Biography – Biographical sheet.

Figure F.9: Hi-fi prototype SCR4b1 – Client detail – Biography – Biographical sheet with photo detail.

Figure F.10: Hi-fi prototype SCR4b2 – Client detail – Biography – Activities of daily living collapsed.

Figure F.11: Hi-fi prototype SCR4b2 – Client detail – Biography – Activities of daily living expanded.

Figure F.12: Hi-fi prototype SCR4b3 – Client detail – Biography – Lineage.

Figure F.13: Hi-fi prototype SCR4b4 – Client detail – Biography – Form of care.

Figure F.14: Hi-fi prototype SCR4c – Activities.

Jaroslav Novotný　　　　12.05.1940 (79 let)

| Základní údaje | Biografie | Aktivity | Zdravotní záznamy | Schopnosti a omezení | Interakce a preference | Historie |

Zdravotní záznamy　　　　　　　　　　　　　　　　　🖨

| Výška (cm) | 175 | ✏ |　| Váha (kg) | 81 | ✏ |

Nemoci a úrazy ➕

Nemoc/úraz	Od	Do	Poznámka	Akce

Užívané léky ➕

Lék	Od	Do	Poznámka	Akce

Alergie ➕

Alergie	Od	Do	Poznámka	Akce
Lepek	01.01.1990	současnost		✏ 🗑

Diety ➕

Dieta	Od	Do	Poznámka	Akce

Figure F.15: Hi-fi prototype SCR4d – Medical records.

Hlavní strana > Seznam klientů > Jaroslav Novotný 　　　　　　　　　　　Jan Novák

Jaroslav Novotný　　　　　12.05.1940 (79 let)

| Základní údaje | Biografie | Aktivity | Zdravotní záznamy | Schopnosti a omezení | Interakce a preference | Historie |

Schopnosti a omezení – Senzorické

Levé oko

Vážnost zrakového omezení　　○0 ○1 ○2 *3 ○4 ○5 ○6 ○neurčeno

Popis omezení
slabozrakost

Původ omezení　　*vrozené ○úrazem ○nemocí ○polymorbidita ○jiné: ___ ○neurčeno
Omezení od věku
Progrese　　○ano ○ne *neurčeno
Schopnost číst　　○0 ○1 ○2 ○3 ○4 ○5 *neurčeno
Poznámka
Schopnost vidět barvy　　○0 ○1 ○2 ○3 ○4 ○5 *neurčeno
Poznámka
Schopnost vidět světlo　　○0 ○1 ○2 ○3 ○4 ○5 *neurčeno
Poznámka
Schopnost vnímat tvary　　○0 ○1 ○2 ○3 ○4 ○5 *neurčeno
Poznámka

Pravé oko

Vážnost zrakového omezení　　○0 ○1 ○2 *3 ○4 ○5 ○6 ○neurčeno

Popis omezení
slabozrakost

Původ omezení　　*vrozené ○úrazem ○nemocí ○polymorbidita ○jiné: ___ ○neurčeno
Omezení od věku
Progrese　　○ano ○ne *neurčeno
Schopnost číst　　○0 ○1 ○2 ○3 ○4 ○5 *neurčeno
Poznámka
Schopnost vidět barvy　　○0 ○1 ○2 ○3 ○4 ○5 *neurčeno
Poznámka
Schopnost vidět světlo　　○0 ○1 ○2 ○3 ○4 ○5 *neurčeno
Poznámka
Schopnost vnímat tvary　　○0 ○1 ○2 ○3 ○4 ○5 *neurčeno
Poznámka

Levé ucho

Vážnost sluchového omezení　　○0 ○1 ○2 ○3 ○4 ○5 *neurčeno

Popis omezení

Původ omezení　　○vrozené ○úrazem ○nemocí ○polymorbidita ○jiné: ___ *neurčeno
Omezení od věku
Progrese　　○ano ○ne *neurčeno
Potřebná minimální hlasitost (dB)
Naslouchadlo　　○ano: ___ *ne ○neurčeno

Pravé ucho

Vážnost sluchového omezení　　○0 ○1 ○2 ○3 ○4 ○5 *neurčeno

Popis omezení

Původ omezení　　○vrozené ○úrazem ○nemocí ○polymorbidita ○jiné: ___ *neurčeno
Omezení od věku
Progrese　　○ano ○ne *neurčeno
Potřebná minimální hlasitost (dB)
Naslouchadlo　　○ano: ___ *ne ○neurčeno

Levá ruka

Hmatové schopnosti　　○0 ○1 ○2 ○3 ○4 ○5 *neurčeno
Poznámka
Absence prstů　　○palec ○ukazovák ○prostředník ○prsteník ○malíček

Pravá ruka

Hmatové schopnosti　　○0 ○1 ○2 ○3 ○4 ○5 *neurčeno
Poznámka
Absence prstů　　○palec ○ukazovák ○prostředník ○prsteník ○malíček

Figure F.16: Hi-fi prototype SCR4e1 – Abilities and disabilities – Sensory.

Jaroslav Novotný   12.05.1940 (79 let)

| Základní údaje | Biografie | Aktivity | Zdravotní záznamy | Schopnosti a omezení | Interakce a preference | Historie |

Schopnosti a omezení – Motorické

Vážnost motorického omezení   0 1 2 3 4 5 *neurčeno

Popis omezení

Původ omezení   vrozené úrazem nemocí polymorbidita jiné: *neurčeno

Omezení od věku

Progrese   ano   ne   *neurčeno

Vydrží samostatně stát   ano   ne   *neurčeno

Poznámka

Absence končetin   pravá horní   pravá dolní   levá horní   levá dolní

Pohyblivost	Ano/Ne	Poznámka	Akce
samostatně	✓		
s holí			
s chodítkem			
vozík			
lůžko			

Figure F.17: Hi-fi prototype SCR4e2 – Abilities and disabilities – Motor.

Jaroslav Novotný   12.05.1940 (79 let)

| Základní údaje | Biografie | Aktivity | Zdravotní záznamy | Schopnosti a omezení | Interakce a preference | Historie |

Schopnosti a omezení – Kognitivní

Mentální zdatnost klienta   0 1 2 3 4 5 *neurčeno

Poznámka

Schopnost číst Braillovo písmo   ano   ne   *neurčeno

Samostatnost (maximální stupeň)

Místo	Sám	Doprovod	Vůbec	Neurčeno	Akce
pokoj				*	
uvnitř budovy				*	
blízké okolí				*	
známé cesty				*	
zahrada				*	
mimo Palatu				*	

Znalost pokoje   0 *1 2 3 4 5 neurčeno

Poznámka   klient je na Palatě již delší dobu, znalost pokoje je velmi dobrá

Znalost Palaty   0 1 2 3 4 5 *neurčeno

Poznámka

Schopnost popsat, kde co je   0 1 2 3 4 5 *neurčeno

Poznámka

Schopnost popsat, kudy se kam jde   0 1 2 3 4 5 *neurčeno

Poznámka

Bojácnost   0 1 2 3 4 5 *neurčeno

Poznámka

Figure F.18: Hi-fi prototype SCR4e3 – Abilities and disabilities – Cognitive.

Figure F.19: Hi-fi prototype SCR4f – Interaction and preferences.

Figure F.20: Hi-fi prototype SCR4f – Interaction and preferences: Favourite place add dialogue.

Figure F.21: Hi-fi prototype SCR4f – Interaction and preferences: Favourite place remove confirmation dialogue.

Figure F.22: Hi-fi prototype SCR4g – History.

Figure F.23: Hi-fi prototype SCR5 – Add client.

Figure F.24: Hi-fi prototype – Button hover effect.

Figure F.25: Hi-fi prototype – Top panel without notification.

Figure F.26: Hi-fi prototype – Top panel with notification.
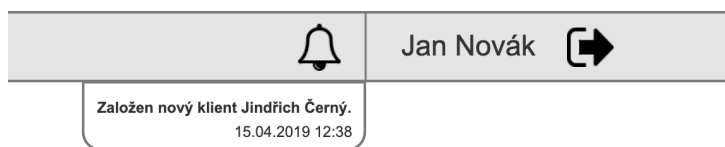
Figure F.27: Hi-fi prototype – Top panel with notification detail.

Figure F.28: Hi-fi prototype – Value editing.
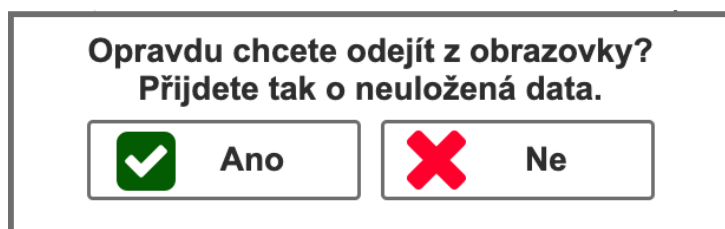
Figure F.29: Hi-fi prototype – Unsaved data notification dialogue.

Appendix G

Evaluation of prototypes

G.1 Session guide

Ice-breaking

At the very beginning of the testing session, the participant was welcomed and the evaluation process was introduced. The participants were informed of the basic instructions and the *Consent to use of personal data and records of user interface testing participant* (see Section G.2) was obtained.

Pre-test questionnaire

Before the start of testing, participants completed a pre-test questionnaire. The task of this questionnaire was to find out additional information about the test participants.

Tasks

The main activity of the participants was the fulfilment of the prepared task list. The participants were encouraged to comment aloud their activities. At the beginning of each task, the situation was introduced and the participant was subsequently given the task to complete.

Post-test questionnaire

After completing the tasks, the participants completed a post-test questionnaire. The purpose of this questionnaire was the final evaluation of the user interface of the application as well as feedback on the testing session itself.

Acknowledgement

In the end, all participants were thanked for participating in the testing process.

G.2 Consent to use of personal data and records of user interface testing participant (CZ)

Smlouva o použití osobních údajů a záznamů při participaci na testování uživatelského rozhraní

Smlouva se uzavírá mezi výzkumníkem a participantem, obě strany se zavazují bezvýhradně plnit níže uvedené přísliby a povinnosti.

Petr Bílek,
narozen **26. dubna 1993**
dále jen **"výzkumník"**

a

_____

narozen/a _____
dále jen **"participant"**

1. Úvodní ustanovení

Záznamy a osobní údaje byly pořízeny jako výzkumný materiál nezbytný k úspěšnému dokončení diplomové práce na téma „Uživatelský model pro seniory se zrakovou vadou" na Českém vysokém učení technickém v Praze, Katedře počítačové grafiky a interakce.

2. Práva a povinnosti participanta

Participant souhlasí s použitím všech audio a video záznamů pořízených v Praze dne _____ při participaci na testování uživatelského rozhraní a všech doplňkových informací a dat předaných participantem ústně nebo písemně. Participant neuděluje schválení k publikaci výsledků jakkoli spojených s identitou participanta. Jakékoli zveřejnění výsledků je třeba provést pouze po znemožnění identifikace participanta.

3. Práva a povinnosti výzkumníka

Výzkumník se zavazuje k úplnému smazání audio a video záznamů pořízených během výzkumu, vyjma materiálů použitých v závěrečné diplomové práci. Všechny takto použité záznamy a informace shromážděné v průběhu testu budou publikovány výhradně v pozměněné podobě zamezující jakoukoli identifikaci participanta. Pouze výzkumník bude mít po dobu výzkumu přístup k nepozměněné podobě audio a video záznamů pořízených v průběhu testu. Výzkumník zodpovídá za dodržení všech uvedených pravidel a podmínek.

4. Závěrečná ustanovení

Tato smlouva je vyhotovena právě ve dvou kopiích, přičemž každá ze stran obdrží právě po jedné z nich.

S výše uvedeným souhlasím a zavazuji se tuto smlouvu dodržet. Svůj souhlas stvrzuji podpisem uvedeným níže.

Výzkumník:

v _____ dne _____

podpis výzkumníka

_____

Participant:

v _____ dne _____

podpis participanta

_____

Appendix H

Evaluation of low-fidelity prototype

H.1   Test tasks for usability study

Task 1

1. Log in to the application as worker Jan Novák with following credentials:

   - **username**: novakjan
   - **password**: novak

2. Find client Jaroslav Novotný and find out the following information about him:

   (a) birthplace

   (b) education

   (c) height

   (d) allergies

   (e) his father's name, surname and date of birth

   (f) activities of the client on 01.03.2019

   (g) severity of visual impairment and its description

   (h) eating preferences (eatery/room)

   (i) form of care

3. Log out of the application.

Task 2

You are logged in the application as worker Jan Novák and you are on the Home page. A new client has been created and you have been assigned as his key worker.

1. Find out who the newly created client is.

2. Get to the detail of the client.

3. Determine when and by whom the client was added into the system.

4. Upload the client's profile photo, which is located on the desktop.

5. Edit the following information about the client:

   (a) Set the necessary minimal sound volume to 75dB.

   (b) Add garden as client's favourite place (leave the note blank).

   (c) Remove the garden from the list of favourite places.

6. Log out of the application.

Task 3

You are logged in the application as worker Jan Novák and you are on the Home page.

1. Add a new client with the following information:

   - Ivana Svobodová
   - born 19.06.1939 in Prague
   - department D
   - room not yet determined
   - key worker: Jan Novák
   - social worker: Jiřina Veselá

2. Edit the following information about client:

   (a) height: 155cm

   (b) biographical list (add any text)

   (c) add her father to lineage: Petr Svoboda (19.9.1918)

   (d) activities of daily life – fill in any line

3. Log out of the application.

H.2 Participant 1

Age: 49 years

Job title: activation service worker

Duration of current job title: 1 year

Pre-test questionnaire

The results of pre-test questionnaire of Participant 1 can be found in Table H.1.

Question	Answer
Q1	no
Q2	activation service worker
Q3	1 year
Q4	beginner user

Table H.1: Lo-fi prototype testing – Participant 1 pre-test questionnaire results.

Log

Task 1

- (2g) The participant cannot find the form of care even when passing through several screens.

Task 2

- (1) The participant has a problem noticing the notification. However, the notification is found after a while.

Task 3

- (2c) The participant omitted the final confirmation of lineage editing.

Post-test questionnaire

The results of post-test questionnaire of Participant 1 can be found in Table H.2.

Question	Answer
Q1	full-screen width tables, clarity (mostly)
Q2	*"I couldn't find the form of care. I would give the form of care as new menu item or as a replacement for the differential diagnostics sheet"*
Q3	**in the following section*
Q4	2
Q5	2
Q6	1

Table H.2: Lo-fi prototype testing – Participant 1 post-test questionnaire results.

Post-test questionnaire Q3 results

SCR3

- transition to screen *SCR4a – Client detail* on double click

SCR4 all

- new requirement: print of client information

SCR4a

- add birthdate as an item of basic information

- highlight birthdate in the top of the screen

- add contact persons (email, phone number, relationship to the client)

- add the client's place of permanent residence

- remove social worker

SCR4b2

- rework to the collapsible section for each activity of daily living

- positive and negative information in separate table rows (columns: biography information, current state, "what to do", note)

SCR4b3

- invert the arrangement of lineage (client at the top)

- add notification about unsaved changes

SCR4b4

- rename *"Differential diagnostics sheet"* to *"Form of care"*

SCR4e1

- split attributes for left and right eye

- split attributes for left and right ear

- add information about hearing aid use (each ear separately)

- add information about missing fingers (each hand separately)

SCR4e2

- add information about missing limb

- add a textual note to mobility

SCR4e3

- add a textual note to mental ability

SCR4e4

- use of better terminology: *"lunching"* ⇒ *"eating"*

SCR5

- remove social worker

H.3   Participant 2

Age: 26 years

Job title: activation service worker

Duration of current job title: 2 years

Pre-test questionnaire

The results of pre-test questionnaire of Participant 2 can be found in Table H.3.

Question	Answer
Q1	no
Q2	activation service worker
Q3	2 years
Q4	moderately experienced user

Table H.3: Lo-fi prototype testing – Participant 2 pre-test questionnaire results.

Log

Task 1

- (2g) The participant cannot find the form of care even when passing through several screens.

Task 2

- no problem

Task 3

- (2c) The participant omitted the final confirmation of lineage editing.

Post-test questionnaire

The results of post-test questionnaire of Participant 2 can be found in Table H.4.

Question	Answer
Q1	clarity of the application
Q2	-
Q3	**in the following section*
Q4	1
Q5	1
Q6	1

Table H.4: Lo-fi prototype testing – Participant 2 post-test questionnaire results.

Post-test questionnaire Q3 results

SCR4a

- add birthdate as an item of basic information

- highlight birthdate in the top of the screen

SCR4b3

- rename *"Differential diagnostics sheet"* to *"Form of care"*

H.4 Participant 3

Age: 25 years
Job title: activation service worker
Duration of current job title: 1 year

Pre-test questionnaire

The results of pre-test questionnaire of Participant 3 can be found in Table H.5.

Question	Answer
Q1	no
Q2	activation service worker
Q3	1 year
Q4	moderately experienced user

Table H.5: Lo-fi prototype testing – Participant 3 pre-test questionnaire results.

Log

Task 1

- (2a) The participant completely ignores the information on the SCR4a – "Basic Information" screen. The participant tries to find all information on the SCR4b1 – "Biographical sheet" screen. After a while, the participant became familiar with the application and continued to search for information in the right way.

- (2g) The participant cannot find the form of care even when passing through several screens.

- (2) The participant always returns to the SCR4a – "Basic Information" screen.

Task 2

- (1) The participant has a problem noticing the notification. However, the notification is found after a while.

Task 3

- no problem

Post-test questionnaire

The results of post-test questionnaire of Participant 3 can be found in Table H.6.

Question	Answer
Q1	clarity
Q2	-
Q3	*in the following section
Q4	1
Q5	1
Q6	1

Table H.6: Lo-fi prototype testing – Participant 3 post-test questionnaire results.

Post-test questionnaire Q3 results
SCR4b3

- rename *"Differential diagnostics sheet"* to *"Form of care"*

- add a table with possibility to choose each form of care and add a textual note

Appendix I

Evaluation of high-fidelity prototype

I.1 Test tasks for usability study

Task 1

1. Log in to the application as worker Jan Novák with following credentials:

   - **username**: novakjan
   - **password**: novak

2. Find client Jaroslav Novotný and find out the following information about him:

   (a) birthdate

   (b) birthplace

   (c) education

   (d) contact person

   (e) height

   (f) allergies

   (g) his father's name, surname and date of birth

   (h) activities of the client recorded by Ivana Bohatá

   (i) severity of visual impairment and its description and origin

   (j) eating preferences

   (k) activities of daily living – *"Mobility"*

   (l) form of care

   (m) Does the client use a hearing aid?

   (n) Is the client able to move independently?

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(o) What is the client's knowledge of his room?

3. Print client's activities of daily living.

4. Log out of the application.

Task 2

You are logged in the application as worker Jan Novák and you are on the Home page. A new client has been created and you have been assigned as his key worker.

1. Find out who the newly created client is.

2. Get to the detail of the client.

3. Determine when and by whom the client was added into the system.

4. Edit the following information about the client:

   (a) dominant hand - right

   (b) Set the necessary minimal sound volume required for the left ear to 85dB.

   (c) Add garden as client's favourite place (leave the note blank).

   (d) Remove the garden from the list of favourite places.

5. Log out of the application.

Task 3

You are logged in the application as worker Jan Novák and you are on the Home page.

1. Add a new client with the following information:

   - Ivana Svobodová
   - born 19.06.1939 in Prague
   - department D
   - room not yet determined
   - key worker: Jan Novák

2. Edit the following information about client:

   (a) Add information that the client is missing the little finger on his left hand.

   (b) Edit the text in the biographical sheet (add any text).

3. Log out of the application.

I.2 Participant 1

Age: 64 years

Job title: activation service worker

Duration of current job title: 10 years

Pre-test questionnaire

The results of pre-test questionnaire of Participant 1 can be found in Table I.1.

Question	Answer
Q1	no
Q2	activation service worker
Q3	10 years
Q4	beginner user

Table I.1: Hi-fi prototype testing – Participant 1 pre-test questionnaire results.

Log

Task 1 (time: 13:04)

- (2i) The participant searches for the severity of visual impairment on the *Medical records (SCR4d)* screen but then correctly finds the *Abilities and disabilities – Sensory (SCR4e1)* screen.

- (2k) The participant searches for the activities of daily living on the *Activities (SCR4c)* screen but then correctly finds the *Activities of daily living (SCR4b2)* screen.

- (2l) The participant searches for the form of care on the *Medical records (SCR4d)* screen, then on the *Basic information (SCR4a)* screen but then correctly finds the *Form of care (SCR4b4)* screen.

- (3) The participant searches for the activities of daily living on the *Activities (SCR4c)* screen again but then correctly finds the *Activities of daily living (SCR4b2)* screen.

Task 2 (time: 7:50)

- (4a) The participant searches for the dominant hand on the *Medical records (SCR4d)* and *Abilities and disabilities – Sensory (SCR4e1)* screens, where the participant wants to add a note to the right hand record. Finally, the participant correctly finds the *Interaction and preferences (SCR4f)* screen.

Task 3 (time: 3:52)

- no problem

Post-test questionnaire

The results of post-test questionnaire of Participant 1 can be found in Table I.2.

Question	Answer
Q1	detailed information about client; the application is well-arranged
Q2	small radio buttons and checkboxes
Q3	*see Q2 answer*
Q4	2
Q5	4
Q6	1

Table I.2: Hi-fi prototype testing – Participant 1 post-test questionnaire results.

I.3 Participant 2

Age: 49 years

Job title: activation service worker

Duration of current job title: 1.2 years

Pre-test questionnaire

The results of pre-test questionnaire of Participant 2 can be found in Table I.3.

Question	Answer
Q1	49 years
Q2	activation service worker
Q3	1.2 years
Q4	moderately experienced user

Table I.3: Hi-fi prototype testing – Participant 2 pre-test questionnaire results.

Log

Task 1 (time: 11:50)

- (2i) The participant searches for the severity of visual impairment on the *Medical records (SCR4d)* screen but then correctly finds the *Abilities and disabilities – Sensory (SCR4e1)* screen.

- (2k) The participant searches for the activities of daily living on the *Activities (SCR4c)* screen but then correctly finds the *Activities of daily living (SCR4b2)* screen.

Task 2 (time: 5:42)

- (4a) The participant searches for the dominant hand on the *Abilities and disabilities – Motor (SCR4e2)* and *Abilities and disabilities – Sensory (SCR4e1)* screens. Finally, the participant correctly finds the *Interaction and preferences (SCR4f)* screen.

Task 3 (time: 3:06)

- no problem

Post-test questionnaire

The results of post-test questionnaire of Participant 2 can be found in Table I.4.

Question	Answer
Q1	clean design
Q2	small radio buttons and checkboxes; location of information about dominant hand
Q3	*see Q2 answer*
Q4	2
Q5	2
Q6	1

Table I.4: Hi-fi prototype testing – Participant 2 post-test questionnaire results.

I.4 Participant 3

Age: 26 years

Job title: activation service worker

Duration of current job title: 3 years

Pre-test questionnaire

The results of pre-test questionnaire of Participant 3 can be found in Table I.5.

Question	Answer
Q1	26 years
Q2	activation service worker
Q3	3 years
Q4	moderately experienced user

Table I.5: Hi-fi prototype testing – Participant 3 pre-test questionnaire results.

Log

Task 1 (time: 8:42)

- (2i) The participant searches for the severity of visual impairment on the *Medical records (SCR4d)* screen but then correctly finds the *Abilities and disabilities – Sensory (SCR4e1)* screen.

Task 2 (time: 4:20)

- (4a) The participant searches for the dominant hand on the *Medical records (SCR4d)*, *Abilities and disabilities – Motor (SCR4e2)* and *Abilities and disabilities – Sensory (SCR4e1)* screens. Finally, the participant correctly finds the *Interaction and preferences (SCR4f)* screen.

Task 3 (time: 1:56)

- no problem

Post-test questionnaire

The results of post-test questionnaire of Participant 3 can be found in Table I.6.

Question	Answer
Q1	simplicity, easy information maintenance
Q2	items naming like *"motor"*, *"cognitive"*
Q3	-
Q4	1
Q5	2
Q6	1

Table I.6: Hi-fi prototype testing – Participant 3 post-test questionnaire results.

I.5 Participant 4

Age: 26 years

Job title: direct care worker

Duration of current job title: 3 years

Pre-test questionnaire

The results of pre-test questionnaire of Participant 4 can be found in Table I.7.

Question	Answer
Q1	26 years
Q2	direct care worker
Q3	3 years
Q4	moderately experienced user

Table I.7: Hi-fi prototype testing – Participant 4 pre-test questionnaire results.

Log

Task 1 (time: 8:39)

- (2k) The participant searches for the activities of daily living on the *Activities (SCR4c)* screen but then correctly finds the *Activities of daily living (SCR4b2)* screen.

- (3) The participant searches for the activities of daily living on the *Activities (SCR4c)* screen again but then correctly finds the *Activities of daily living (SCR4b2)* screen.

Task 2 (time: 6:48)

- (4a) The participant searches for the dominant hand on the *Abilities and disabilities – Motor (SCR4e2)* and *Abilities and disabilities – Sensory (SCR4e1)* screens, where the participant wants to add a note to the right hand record. Finally, the participant correctly finds the *Interaction and preferences (SCR4f)* screen.

Task 3 (time: 2:21)

- (2a) The participant searches for the absence of fingers on the *Abilities and disabilities – Motor (SCR4e2)* screen but then correctly finds the *Abilities and disabilities – Sensory (SCR4e1)* screen.

Post-test questionnaire

The results of post-test questionnaire of Participant 4 can be found in Table I.8.

Question	Answer
Q1	*"The application is clear and I quickly got familiar with it. I like medical records along with direct care and activities."*
Q2	-
Q3	-
Q4	1
Q5	1
Q6	1

Table I.8: Hi-fi prototype testing – Participant 4 post-test questionnaire results.

I.6 Participant 5

Age: 42 years

Job title: speech and occupational therapists

Duration of current job title: 14 years

Pre-test questionnaire

The results of pre-test questionnaire of Participant 5 can be found in Table I.9.

Question	Answer
Q1	42 years
Q2	speech and occupational therapists
Q3	14 years
Q4	moderately experienced user

Table I.9: Hi-fi prototype testing – Participant 5 pre-test questionnaire results.

Log

Task 1 (time: 9:43)

- (2i) The participant searches for the severity of visual impairment on the *Medical records (SCR4d)* screen but then correctly finds the *Abilities and disabilities – Sensory (SCR4e1)* screen.

- (2k) The participant searches for the activities of daily living on the *Activities (SCR4c)* screen but then correctly finds the *Activities of daily living (SCR4b2)* screen.

Task 2 (time: 3:54)

- (4a) The participant searches for the dominant hand on the *Abilities and disabilities – Motor (SCR4e2)* screen. Finally, the participant correctly finds the *Interaction and preferences (SCR4f)* screen.

Task 3 (time: 4:21)

- (2a) The participant searches for the absence of fingers on the *Abilities and disabilities – Motor (SCR4e2)* screen but then correctly finds the *Abilities and disabilities – Sensory (SCR4e1)* screen.

Post-test questionnaire

The results of post-test questionnaire of Participant 5 can be found in Table I.10.

Question	Answer
Q1	well orientation ⇒ easy access ⇒ clarity
Q2	small and feeble radio buttons and checkboxes; location of the information about the absence of fingers (*"It would fit rather into motor information."*)
Q3	*see Q2 answer*
Q4	1
Q5	1
Q6	1

Table I.10: Hi-fi prototype testing – Participant 5 post-test questionnaire results.

I.7 Participant 6

Age: 54 years

Job title: direct care worker

Duration of current job title: 10 years

Pre-test questionnaire

The results of pre-test questionnaire of Participant 6 can be found in Table I.11.

Question	Answer
Q1	54 years
Q2	direct care worker
Q3	10 years
Q4	moderately experienced user

Table I.11: Hi-fi prototype testing – Participant 6 pre-test questionnaire results.

Log

Task 1 (time: 15:28)

- (2i) The participant searches for the severity of visual impairment on the *Medical records (SCR4d)* screen but then correctly finds the *Abilities and disabilities – Sensory (SCR4e1)* screen.

- (2k) The participant searches for the activities of daily living on the *Activities (SCR4c)* screen but then correctly finds the *Activities of daily living (SCR4b2)* screen.

Task 2 (time: 7:18)

- (4a) The participant searches for the dominant hand on the *Abilities and disabilities – Motor (SCR4e2)* screen. Finally, the participant correctly finds the *Interaction and preferences (SCR4f)* screen.

Task 3 (time: 3:54)

- (2a) The participant searches for the absence of fingers on the *Abilities and disabilities – Motor (SCR4e2)* screen but then correctly finds the *Abilities and disabilities – Sensory (SCR4e1)* screen.

Post-test questionnaire

The results of post-test questionnaire of Participant 6 can be found in Table I.12.

Question	Answer
Q1	*"In my opinion, the application is well-arranged. If a staff member wants to learn something about the client, he can make a good picture of the client. Everything is understandable after a while."*
Q2	-
Q3	information when client joined Home Palata is missing
Q4	1
Q5	4
Q6	3

Table I.12: Hi-fi prototype testing – Participant 6 post-test questionnaire results.

Appendix J

List of master thesis attachments

hifi_prototype.zip
> package with Axure file containing the high-fidelity prototype implementation

imgs.zip
> images presenting achieved results

lofi_prototype.zip
> package with Balsamiq Mockups file containing the low-fidelity prototype implementation

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