

Design and Development of a Web-based Service Platform for Assisting the Elderly in Reading Digital Documents and Records and Promoting Their Independence

Master Thesis

For attainment of the academic degree of
Master of Science in Engineering (MSc)

in the Master Programme Digital Healthcare
at St. Pölten University of Applied Sciences

by

Tijana Frank, MD

1610756808

First advisor: FH-Prof. Jakob Doppler MSc.

St. Pölten, 18.01.2019

Declaration

I declare that I have developed and written the enclosed Master Thesis completely by myself, and have not used sources or means without declaration in the text. Any thoughts from others or literal quotations are clearly marked. This work was not used in the same or in a similar version to achieve an academic grading or is being published elsewhere.

.....

Place, Date

.....

Signature

Preface

Thank you all who have supported me and have showed your understanding and love!

Tijana

Abstract

- Subject** The aim of this work was to develop and evaluate a prototype of a web-based application that includes functionality for real-time video connection, text-chat and screen-sharing with a draw-over function to serve as an online service platform for helping the elderly get assistance with reading digital documents and records necessary for conducting their Instrumental Activities of Daily Living (IADL).
- Objective** In the era in which the ability to use digital information and communication has become an imperative, older adults are forced to adapt to new technologies and trends. The new Information and Communication technologies enable us to look for information independently, but the access to digital information presume a computer literacy and keeping up to date with technology development. Old people, used to personal and direct communication, adapt to new technologies in average slowly and difficult in comparison with their younger contemporaries. Offering elders reliable and continuous personal support might be the key in helping them overcome these challenges and gain more skills which would help them get more independent. The help may be successfully provided over online applications and service platforms for helping them e.g. to manage their medication and healthcare records, to access online information, to manage their finances (e.g. online banking) or other online public and private services.
- Research Questions** **Q1:** Does a use of web-based service platform for Instrumental Activities of Daily Living (IADL) with functionality for real-time video connection, text-chat and screen-sharing with a draw-over function help older people to get assistance in reading digital documents and records? **Q2:** Does a web-based IADL Service Platform prototype (IADL-SP) prove to be useful in a limited usability evaluation that involves ten test participants in a closed test scenario about reading comprehension of digital documents and

records necessary for conducting their Instrumental Activities of Daily Living (IADL)?

Method	The thesis have used a mixed methods approach following a User-Centered Design process that includes: 1. Determining user needs from literature search; 2. Functional and technical specification based on personas and use cases; 3. Development of the IADL Service Platform; 4. User testing and evaluation of the main features of the IADL Service Platform with a small set of users, the test participants, who afterwards completed a usability questionnaire on Ease of Use, Ease of Learning, Usefulness and Satisfaction.
Results	Despite the fact that the IADL Service Platform is a prototype with a limited functionality that might have an impact on the results of assessment, it has been assessed with a very good average total grade 4,1 of maximum 5 on the Likert scale from 1 to 5. Furthermore, high grades given to the questions tailored to project the use of the IADL Service Platform in a real daily life scenario, have shown the overall satisfaction among majority of the elderly. The online video conversation proved to be especially important to understand the message and meaning of the shown documents leading to improvement of reading comprehension.
Conclusion	IADL Service Platform that combines both social inclusion and assistance that old people need, has a potential to become a platform tailored to meet wants and needs, the level of knowledge and skill of old people and to support them in coping with contemporary societal requirements and challenges.
Keywords	The elderly, Ageing, Instrumental Activities of Daily Living, Online Support, User-Centered Design, Information and Communication Technologies

Kurzfassung

- Zielsetzung** Ziel dieser Arbeit war die Entwicklung und Evaluierung eines Prototyps einer Web-basierten Applikation, die Echtzeit Video-Kommunikation, Text-Chat und Screen-Sharing mit einer Zeichenfunktion (Draw-Over) ermöglicht. Diese sollte als online Service-Plattform älteren Menschen helfen, Unterstützung beim Lesen digitaler Dokumente und Befunde, welche sie zur Umsetzung ihrer Instrumentalen Aktivitäten des Täglichen Lebens (IADL) benötigen, zu erhalten.
- Einleitung** In einer Ära, in der der selbstverständliche Umgang mit digitaler Information und Kommunikation unerlässlich ist, sind ältere Menschen gezwungen, sich mit neuen Technologien und Entwicklungen auseinanderzusetzen. Einerseits ermöglichen uns neue Informations- und Kommunikationstechnologien einen unabhängigen und jederzeit verfügbaren Zugang zu Informationen, andererseits erfordert ihre Nutzung Computerkenntnisse und sich immer auf dem neuesten Stand zu halten. Ältere Menschen, die direkte und persönliche Kommunikation gewöhnt sind, erlernen im Allgemeinen neue Technologien langsamer und schwieriger als jüngere. Das Angebot einer zuverlässigen und kontinuierlichen persönlichen Unterstützung könnte für sie eine essentielle Grundlage sein, um diese Herausforderungen zu meistern und zusätzliche Fähigkeiten zu erwerben, um unabhängiger agieren zu können. Die Hilfe könnte über Online-Applikationen und Service-Plattformen zur Verfügung gestellt werden, um ältere Menschen beispielsweise bei der Verwaltung ihrer Medikamente und medizinischen Befunde, beim Zugang zu online – Information, bei der Organisation ihrer Finanzen (z.B. online Banking) oder anderer öffentlicher und privater Online-Dienste zu unterstützen.
- Fragestellung** **Q1:** Bietet eine Web-basierte Applikation für Instrumentale Aktivitäten des Täglichen Lebens (IADL), die Echtzeit Video-Kommunikation, Text-Chat und Screen-Sharing mit einer

Zeichenfunktion (Draw-Over) ermöglicht, älteren Menschen Unterstützung beim Lesen digitaler Dokumente?

Q2: Erweist sich der Prototyp einer web-basierten IADL-SP in einer limitierten Usability-Bewertung zum Leseverständnis digitaler Dokumente, welche zur Durchführung ihrer IADL notwendig sind, mit zehn TeilnehmerInnen in einem geschlossenen Testszenario als nützlich.

- Methode** Die These verfolgt einen gemischten Methodenansatz nach einem User-Centered Design-Prozess, der unter anderem folgendes beinhaltet: 1. Ermittlung der Nutzerbedürfnisse aus der Literatursuche; 2. Funktionelle und technische Spezifikation auf der Grundlage von Personas und Anwendungsfällen; 3. Entwicklung der IADL Serviceplattform; 4. Anwendungsprüfung und Auswertung der Hauptmerkmale der IADL Serviceplattform anhand einer kleinen Auswahl von Nutzern mittels ausgefüllter Fragebögen über Bedienungsfreundlichkeit, Lern-, Nutzungs -und Benutzerfreundlichkeit.
- Ergebnisse** Obwohl von der limitierten Funktionalität des Prototyps der IADL-SP ein negativer Einfluss auf die Ergebnisse der Usability-Bewertung zu erwarten gewesen wäre, wurde die IADL-SP mit einer sehr guten durchschnittlichen Gesamtnote von 4,1 auf der Likert-Skala von 1 bis 5 bewertet. Darüber hinaus haben die hohen Bewertungen zu den Fragen, die auf die Nutzung der IADL-Serviceplattform in einem realen Alltagsszenario zugeschnitten sind, die Gesamtzufriedenheit bei der Mehrheit der älteren Menschen gezeigt. Das Online-Videogespräch erwies sich als besonders wichtig, um die Botschaft und die Bedeutung der gezeigten Dokumente zu verstehen und so das Leseverständnis zu verbessern.
- Conclusio** Die IADL-SP, die soziale Interaktion und Hilfestellung kombiniert anbietet, hat das Potential, eine Plattform zu werden, welche Wünschen und Bedürfnissen, dem Kenntnisstand und den Fähigkeiten älterer Menschen gerecht wird und sie dabei unterstützt, mit aktuellen sozialen Erfordernissen und Herausforderungen zurecht zu kommen.

Schlüssel- Ältere Menschen, Informations- und
wörter Kommunikationstechnik, Instrumentalaktivitäten des täglichen
Lebens, Online-Support, User-Centered Design.

Table of Content

Declaration	III
Preface	IV
Abstract	V
Kurzfassung	VII
Table of Content	X
1 Introduction	1
1.1 Challenge and Objectives	1
1.2 Pivotal Questions	3
1.3 Method and Structure of Work	3
2 Theoretical Background	5
2.1 Ageing and Changes in Physiological Functions	6
2.2 Instrumental Activities of Daily Living (IADL)	6
2.3 Information and Communication Technologies for IADL	9
2.3.1 Assistive Technologies in IADL	12
2.3.2 Communication Technology	13
2.3.3 Accessibility Apps	15
2.3.4 Smart and Assistive Living Environment	16
2.4 Key Challenges in Design of Online Services for the Elderly	17
3 User-Centered Design for Designing and Developing an IADL Service Platform	19
3.1 User-Centered Design – User Needs and Functional Requirements	19
3.2 User-Centered Design – Personas and Scenarios	19
3.3 IADL Service Platform – User Interface Design	23
3.4 IADL Service Platform – Hardware Setup	27
3.5 IADL Service Platform – Software Architecture	27
3.5.1 The Client-Side Component: iadl-master	28
3.5.2 The Server-Side Component: iadl-api-master	31
3.5.3 Third-Party Frameworks	32
3.6 IADL Service Platform – User Guide	33
4 Usability Evaluation – Test Design	39

4.1 Usability Evaluation Methods	39
4.2 Test Participants	42
4.3 Usability Evaluation Setup and Scenario	44
5 Usability Evaluation – Test Results and Analysis	48
5.1 Usability Testing and Evaluation protocol	48
5.2 Usability Questionnaire	52
6 Discussion and Conclusion	62
6.1 User Interface and Workflow	62
6.2 Usability Questionnaire and Research Questions	63
Literature	66
List of Figures	71
List of Tables	73
Listings	74
Pictures	75
Appendix	76
A. Consent to Participation	76
B. Evaluation Protocol	78
C. IADL-SP Usability Questionnaire (English)	80
D. IADL-SP Usability Questionnaire (German)	86
E. IADL-SP Usability Questionnaire (Bosnian-Croatian-Serbian)	92

1 Introduction

Due to increase of life expectancy and declining fertility rate, a median age in population is ascending, illustrating the ageing of global population [1]. WHO¹ expects that the number of people older than 65 will grow from 900 million in 2015 to 2 billion in 2050 [2]. Global migration, new trends in definition of family and partnerships, different interest among family members and decline of traditional family authority setup are only some of the reasons which leave a little space for old family members in contemporary households. Personal contacts are rare and often replaced with contacts over the telephone or messengers such as Viber and Skype also in those families living in the same city. In addition, fast development of technology is for old people difficult to keep up with [3], [4] and their adoption of new technologies is slower than in younger adults [5]. All these factors may influence the lives of old people and have direct or indirect impact on their health and overall well-being [1].

1.1 Challenge and Objectives

Ageing results in decrease of physical and mental capacity. Activities of Daily Living (ADL), representing the activities of basic physical self-care, originally defined and measured in the Index of independence scale by Katz in the 1950s [6] and further refined by researchers and clinicians as science has developed, decline in old age. Instrumental Activities of Daily Living (IADL), described by Lawton and Brody [7], include another range of more complex tasks, and require certain levels of both physical and mental ability important for everyday functional competence and independent living of old adults [6].

Unlike healthy and mobile elders, who can take care of themselves and run their households, those suffering from chronic diseases and disabilities may need support in both basic daily activities (e.g. dressing, grooming, bathing, eating, getting of the bed) and Instrumental Activities of Daily Living (e.g. shopping, handling finances, taking medication). Their own responsibility for managing

¹ World Health Organisation (WHO)

1 Introduction

financial and healthcare needs that was previously made by employers, might increase by retirement. The healthcare or life insurance, coverage of medicine prescriptions, choice of services, managing everyday finances, managing household, and finally, understanding information needed for informed decision, are for some old adults difficult to deal with [8]. Besides, they need social interactions, contacts with their family and emotional support for their physical and cognitive wellbeing [9]. Improved communication, recognition of their needs, and dedication are some of basic prerequisites for the efficient support.

In the world in which digital information and communication have become an imperative, older adults are forced to adapt to the latest technology trends and devices [10], which have been mostly designed by young engineers and for young people. The society should offer solutions and products, which will enhance the use of technology solutions among the old population and assist them in a management of their daily life. Programmes such as AAL Programme² that engages Information and Communication Technologies (ICT) in offering support to old people are getting popular in many countries, and the need of employing User-Centered Design approach (UCD) that involves older users in a design, creation and evaluation of products and services [11] is getting recognised. However, the use of Information and Communication Technologies is for some old adults, considering their learning speed, frailty and abilities affected by ageing, not an easy task. Information on the internet that is easily acquired by experienced users may be inaccessible to users without digital reading skills. A big amount of information and information sources, unverified quality of information, a number of images, advertisements, hypertexts and links, colourful layouts and complex user-interface elements, are only a few challenges that readers need to deal with [12].

Offering elders reliable and continuous personal support might be the key in helping them overcome these challenges and gain more skills which would help them get more independent. Personal assistance and support do not necessarily require physical presence and could be successfully provided over online applications and service platforms. Such platforms may facilitate ongoing assistance to elderly who live alone and reduce burden to their families. These might be services for helping them access online information, online public and private services such as online shopping or online banking, managing finances, using e-health platforms and/or any other assistance that supports them in their

² The Active and Assisted Living Programme is the European Programme addressing the needs of the ageing population by developing ICT based solutions to enhance the quality of life of older people. <https://www.aalforum.eu/about/the-aal-programme/>

1 Introduction

daily activities. Furthermore, solutions which combine social contacts and services in assisting the elderly in their daily activities may lead to successful and satisfying results for both support givers and recipients.

The aim of this work was to develop and evaluate a prototype of a web-based application that includes functionality for real-time video connection, text-chat and screen-sharing with a draw-over function, to serve as an online service platform for assisting elders in their Instrumental Activities of Daily Living. This Instrumental Daily Activities (IADL) Service Platform shall help old individuals to get a personal assistance with reading and understanding complex texts, terms and expressions in documents such as instructions of medication package leaflets, authorities' letters, writing and managing their costs and paying bills. To achieve this goal, the work on the Master thesis was performed in phases described in the section 1.3 of this chapter.

1.2 Pivotal Questions

Q1: Does a use of web-based service platform for Instrumental Activities of Daily Living with functionality for real-time video connection, text-chat and screen-sharing with a draw-over function help older people to get assistance in reading digital documents³ and records?

Q2: Does a web-based IADL Service Platform prototype prove to be useful in a limited usability evaluation that involves ten test participants in a closed test scenario about reading comprehension of digital documents and records necessary for conducting their Instrumental Activities of Daily Living (IADL)?

1.3 Method and Structure of Work

This thesis used a mixed methods approach following a User-Centered Design process and has included:

1. Determining user needs from literature search;
2. Functional and technical specification based on personas and use cases;

³ "An electronic data object that represents information originally written in a non-electronic, non-magnetic medium (usually ink on paper) or is an analogue of a document of that type." *Internet Security Glossary: RFC 2828* [web page]. Faqs.org, 2000. <http://www.faqs.org/rfcs/rfc2828.html>.

1 Introduction

3. Development of the IADL Service Platform;

4. User testing and evaluation of the main features of the IADL Service Platform with a small set of users.

In the first phase described in the chapter 2 (Theoretical background), an extensive literature search on functional changes in ageing and their implications on Instrumental Activities of Daily Living was performed. Social isolation was tackled in association with emotional support and well-being. Challenges which the elderly experience in communication have been discussed in regard to importance of integrating communication tools in a development of online services for supporting older adults in their daily activities. Data on Information and Communication Technologies and services available to older people to assist them in managing their Instrumental Activities of Daily Living were elaborated in the section 2.3 of the chapter 2. The literature search was finalised by gathering information on a perception of old people and factors influencing their acceptance of technology. That led to the next phase of the work, the functional and technical specification based on personas and use cases.

The next phase was a development of the IADL Service Platform performed in steps described in the chapter 3.

Finally, the IADL Service Platform was evaluated by ten (10) individuals (hereinafter referred to as participants) selected in a Facebook pool of friends and acquaintances based on inclusion criteria described in the section 4.2 of the chapter 4. After the usability test, the participants were led through the usability questionnaire based on the USE Questionnaire for Measuring Usability by Arnold Lund [13], that was modified and adapted to this work by courtesy of his author. The usability questionnaire is composed of twenty-eight questions divided into four groups, offering Likert-type scale answers from 1 to 5. The chapter 4 contains a description of the evaluation test and evaluation questionnaire in section 4.1, while the usability evaluation setup and scenario are described in the section 4.3.

The analyses and results of the evaluation test are presented in the chapter 5, leading to discussion and conclusion in the chapter 6.

2 Theoretical Background

The following chapter describes the fundamental findings of research leading to creation and development of the IADL Service Platform (hereinafter referred as to the IADL-SP), an online web-based platform for assisting the elderly in their Instrumental Activities of Daily Living.

A global demographic profile has changed over the last century and the world is experiencing a growth in the number of old people. Epidemiologic studies show the rapid increase in the number of old (aged 65 years and older) and very old persons (85 years and older) [14]. The share of population of 11% of the world's population over 60 years of age in 2015 is estimated to increase to 22% by 2050 [1]. In Europe, according to data from the Statistical office of the European Union (Eurostat) from 2016, the share of people aged 65 and above was 19,2 % (in Austria 18,5%) [14]. The median age of the EU population has increased from 29,4 in 1965 to 42,8 in 2018, as presented in Figure 1 [15].

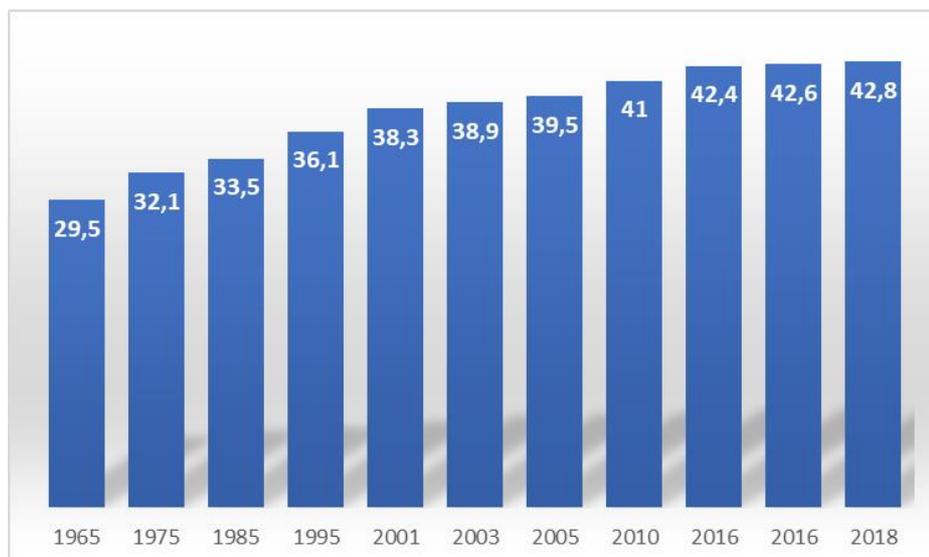


Figure 1. Median age of the EU population from 1965 to 2018 [15].

The shift in demography towards older ages brings also changes in lives of older people and their families, as well as the society. Population aging represents a demographic development that has a strong social and economic impact on

2 Theoretical Background

areas such social security and pension system, healthcare, labour market. As life expectancy grows, the motives and requirements of old people change [16]. Demographic changes also have a strong impact on nature of consumer market. Consuming power of older adults grows. According to results of market research by McKinsey Global Institute (MGI), the consumers, whose consuming power will shape the market in the next fifteen years in the United States, Western Europe, and Northeast Asia, are those of age 60 and over [17]. Industry and technology have been facing new challenges that the old population creates by demanding products which satisfy their abilities, wants and needs. To compete in the market, companies need to recognise the biggest consumers, to know their interests and motivation for spending [18].

2.1 Ageing and Changes in Physiological Functions

While some old people stay active and able to perform their activities independently, some may experience excessive limits in their physical abilities in using tools and technologies [19]. Problems in daily activities are in a close correlation with health problems. For example, frail older adults with chronic cardiovascular diseases may be physically weak to manage their household [20], degenerative changes in musculoskeletal system inhibit elderly patients' locomotion [21], people who suffer from arthritis may lack the ability to use telephone and other devices with small keys [20]. People ability to read and reading comprehension in general also declines with ageing [22]. Older adults may have problems to read and understand texts when written in a complex language or with a topography and layout so designed that a text is not legible for ageing eyes. Aging has an impact on cognitive abilities that also decline, leading to a decrease of learning speed, memory deterioration and limitations of executive functions [23]. Both functional and cognitive changes may lead to a reduction of ability to carry out activities of daily life.

2.2 Instrumental Activities of Daily Living (IADL)

Unlike the Activities of Daily Living (ADL)⁴, which include people's self-care activities such as personal hygiene, dressing, toileting, walking and eating, the

⁴ ADL (Activities of Daily Living) <https://www.britannica.com/topic/activities-of-daily-living>

2 Theoretical Background

Instrumental Activities of Daily Living (IADL) represent a set of complex activities necessary for everyday functional competence and functioning in a society as defined by Lawton and Brody [7]. The original scale for their assessment includes eight activities for women (use of telephone, shopping, preparing food, housekeeping, doing laundry, using transportation, taking medication, and handling finances), of which the following three, housekeeping, laundry and food preparation were excluded for men [6], [7]. The scale has been used and cited in scientific works and adopted in clinical practice as an instrument for assessment of independent living skills [24], but has not undergone the significant changes over the years. The list of Instrumental Activities of Daily Living can be found in literature both popular and scientific and although varies in terminology, the main content remains unchanged and includes the following activities:

- **Basic communication skills** including using a phone both regular and mobile, and email or the internet.
- **Transportation**, defined as the ability to drive or to use a public transport.
- Planning of meals, their preparation, cleaning up afterwards, and safe use of kitchen equipment belong to **Meal preparation** activities.
- Supplying and purchasing food, clothes and other supplies in appropriate manner are categorised under **Shopping**.
- **Housekeeping** that encompasses activities such as cleaning, making order, washing dishes and laundry.
- **Managing medication**, the ability to take prescribed and accurate doses of medicaments at the recommended time, and to avoid interactions with food and other medicaments.
- **Managing personal finances** that includes the independent operating within a budget, choosing a bank, paying bills and avoiding scams.

The work of this thesis focuses on those among them which include reading and require reading comprehension such as managing personal finances, managing medication, basic communication skills (e.g. writing emails), meal preparation (e.g. planning of meals, cooking recipes) and shopping.

In families in which older family members live in the same household with children, the care for older members is provided by partners and children or younger family members. According to EU statistics on income and living conditions [14], in 2015 more than 32% of the older people lived alone (35% in Austria). While some of them experience successful ageing defined by Rowe and Kahn through low morbidity, preserved cognitive and physical functions, and are staying active and up to date with new trends in society and technology [25], many older people are facing problems in adapting to reduction of their

2 Theoretical Background

functionality and living alone. Without any assistance, their everyday functional competence and Instrumental Activities of Daily Living are reduced, which may lead to reduction of their quality of life. Studies on independence in Instrumental Activities of Daily Living and their impact on morbidity and mortality are showing correlation between reduced independence and increased morbidity [26]. Getting ready for shopping, travelling to the nearest shop while having walking difficulties, reading labels on articles with a reduced eyesight, carrying groceries back home, unloading and unpacking, and finally preparing food, are the actions which are physically demanding and which the elderly may need assistance with. The results of analyses by Leskova on food shopping behaviour among seniors found that 22% of adults older than 60 had difficulties by shopping due to their limited mobility and problems with carrying their grocery back home. These limitations in physical activity also influenced their choice of store, making them decide to shop in the nearest stores [27].

Furthermore, elders are bigger drugs consumers of prescribed medication than younger adults due to medical problems characteristic for older age. The use of OTC⁵ medication in older adults' population is also increasing. According to information of American Pharmacists Association, 40% of all OTC products in United States is sold to older adults who make only 13% of American population [28]. Reasons for self-medication are various. A study on use of OTC drugs among senior citizens' population in India by Paul et al. shows that near 60% of elders buy OTC products due to distanced health system, 33% because of long waiting time in hospitals, while 4% believes that the OTC drugs offer better treatment. Regarding the source of information for use of OTC drugs, the same study has found that 55% of OTC consumers get the information from pharmacists and 41% use previous prescriptions [29]. Understanding and following directions for prescribed treatments and information on medicine package leaflets, clear and understandable contents as well as adequate readability level [30] prevents misunderstandings and medication error [31]. Lack of communication may cause misunderstandings of instructions on medicine prescriptions label that may lead to less effective treatment or serious health problems [31], [32]. People may not understand a doctor's letter and medicine prescription, but will not ask their physician for a detailed explanation either because of lack of time that general practitioner has for his patients or because patients are embarrassed to admit that they do not understand [32]. Some of the OTC drugs contain ingredients which may cause serious health problems to elders when combined with other medicaments, alcohol or high doses of caffeine

⁵ OTC (Over-the-Counter) drugs are medicaments which can be bought without prescription from a physician https://en.wikipedia.org/wiki/Over-the-counter_drug .

2 Theoretical Background

or their prescribed medicaments [29]. Use of medication in a way other than prescribed, taking higher dose, misunderstanding of instructions or prescriptions, forgetting to take medication on time and taking a double dose later, represent medication misuse that puts at risk especially old people due to changes in functions of organs, and hormonal status and metabolism, characteristic for an aging body. Some societies and institutions are proposing strategies for addressing this problem. Increasing support of family caregivers, providing information and education about medication management, are only some examples of initiatives for prevention of medication misuse in older population [33].

Management of household finances, paying bills and ability to keep records on expenditures and investments, play an important role in a maintaining the functional independence of seniors living alone. According to the results of study on behavioural changes in perceptions of trust by Caste et al., seniors seem to have more positive response to other people than younger adults due to age related changes in a neural activation, what makes them vulnerable to fraud [34]. Due to their lack of computer and internet skills, they are in a target of scammers, who use different methods to gain their trust. Information technology offers a plenty of opportunities to scammers to take advantage of elders' social isolation and trust. Hence, actions for assuring the security of their finances and the burden of a daily money management of old adults is becoming the subject of social services programmes in some countries [8].

Use and potential of Information Technology in offering solutions for supporting the elderly in their Instrumental Activities of Daily Life (IADL) is elaborated in next sections of this work.

2.3 Information and Communication Technologies for IADL

The use of computer and the internet has become an important segment of everyday life. The use of Information and Communication Technologies (ICT) may help to improve social contacts and cognitively stimulating activities such as reading, the access to health and other information and online services, thus contribute to prevention of cognitive decline in elderly and the overall quality of life in a senior population [35]. The new Information and Communication Technologies enable us to look for information independently, but the access to web-based applications for online health services, online banking and shopping presume a computer literacy and keeping up to date with technology

2 Theoretical Background

development. Old people, used to personal and direct communication, adapt to new technologies slowly and difficult in comparison with their younger contemporaries. As presented in Table 1, only 26% of the EU population of the age over 65 use internet banking, and a similar amount (27%) use online shopping. Slightly higher number of them (37%) read online newspapers and magazines, while only 16% participate in social networks [14], [16].

Table 1. Population in the EU 2016 using the internet, by age and type of use (% share) [14], [16].

	Internet use at least once a week (%)		Internet banking (%)		Online shopping in the previous 12 months (%)		Read newspapers and magazines online (%)		Participated in social networks (%)	
	Total population	65-74 years	Total population	65-74 years	Total population	65-74 years	Total population	65-74 years	Total population	65-74 years
EU*	79	45	49	26	55	27	58	31	52	16

* data of the EU 28 participating countries before Brexit.

The size of the elderly market is growing. The use of social media by Baby Boomers (those born between 1946 and 1964) increases and their growing investment in social and market trends makes them the key consumers of many brands [36]. Older adults want to maintain their independency after moving from their professional life into retirement. Besides the independency, they have more spare time that they want to fill with new activities. Though, the world market seems to be unprepared for aging consumers, showing a discrepancy between products and services offered to old consumers, and needs of older consumers [37]. To meet requirements of old consumers, producers must understand their philosophy of living, wishes and needs in detail and only then they may count with success in their business [37].

Studies on interactions and intersections between users and digital media have recognised a growth of consumer power and identified factors such as the infrastructure of the internet, which influence the consumer empowerment. These should be considered in a design of applications and services for seniors. Fast development of computer and internet applications and technologies is for older computer users with a basic or any knowledge difficult to keep up to date with. Although the use of computer and the internet among the elderly population has

2 Theoretical Background

increased over the last decade for five times (approximately 30%), the percentage of nonusers is still high (45% in EU and 48% in Austria) [14].

Communication changes, common among older people, cognitive loss in a speed and efficiency of information processing as well as a decrease of visual processing functions [38] are some of the reasons which may explain the low share of active new technologies users among the old population. Reduced learning speed, memory loss and problem solving, as well as a decrease in sensory keenness and motor skills which older computer users experience, lead to a lack of confidence and less computer use [3]. Computer literacy and skills needed for operation [39], readers general knowledge and education, memory limitations and vision impairment or higher level of multimorbidity [40] are some of factors which influence both written and verbal communication.

Study on behaviour of old people towards internet banking performed in the UK showed that the traditional banking with a face to face interaction is preferred over internet banking (IB) among older population [41]. Those older users, who get familiar with the internet banking, find this service very useful. Online banking may be complex even for a younger, unexperienced online banking user. Security measures like a confirmation of a security (TAC) number received on a mobile telephone that needs to be confirmed online within a couple of minutes or using a virtual keyboard for entering of login data, are only some of obstacles which elders may experience when using the online banking service. The poor computer knowledge combined with a lack of personal contacts with a bank personnel might be the main reason for reluctance to using online banking and the popularity of bill payments among older bank customers [42]. While online shopping websites seem simple to younger people, their modern and lavish interface may discourage an older user of further online shopping. In addition, those who use online banking applications, electronic medical records and cloud-based storage systems, may be victims of phishing. Study by Gavett et al. with a participation of 193 younger and older adults on phishing suspiciousness, showed that only 12 persons were not vulnerable to the experimental phishing attacks [43]. Educational initiatives such as online assistance may increase awareness of such websites and provide skills and experience to avoid being phished [43].

For older users, even the smallest computer problem e.g. text formatting, might be a problem that cannot be solved without assistance. While experienced computer users may find solutions for problems in different online forums, these are for users with a less technical experience, especially for older users, mostly of any help.

2 Theoretical Background

Some studies described a poor computer literacy as the most common reason for not using computer [39] among the older population. This may also lead to reduction of other physical and social activities [44]. Obstacles and limitations such as lack of knowledge and skills to operate equipment, problems with network or not understanding a programme, cannot be easily conquered without assistance of an experienced user, preferably a family member who is always favoured over entirely robotic assistance and care of machines.

Instead of being an obstacle, the technology should enhance the well-being of old people. This may be possible through support of family and society in helping the elderly with learning and adapting to new technologies or by using simple technology solutions, designed and developed for personalised and direct assistance. Promotional activities or computer courses for older users [45], and ad hoc online computer problem solving applications and services are only some of methods, which may be used in promoting new technologies to older adults.

However, Information Technology products for elders must be tailored to meet their needs, level of knowledge and skill, education, literacy, computer literacy and social engagement, physical and mental abilities, as well as their scepticism and difficulty in accepting new technologies [46], [47]. Technical and financial resources and the amount of time that a family can dedicate to assist an older family member also need to be considered in a development of such tools. The use of technology and digital media for communication, source of information and online services may lead to their independency in managing their everyday activities and healthier ageing.

An overview of the existing Information Technologies services and applications, which may be used for assisting the elderly in their daily life, is presented in the next section of this work.

2.3.1 Assistive Technologies in IADL

Research on day-to-day lives of old people, their habits and needs in managing their Instrumental Activities of Daily Living and resources which seniors use to make their life easier, is a challenge for both the society and industry. Smartphones and tablets designed for seniors allow them to use applications for playing games, maintaining their contacts, taking part in social activities, paying bills, listen to music, etc., but their use among senior population is still not widely accepted [14]. Besides, the access to information is more and more determined by the access to technology, that is not available to everyone, especially in developing countries [48].

2 Theoretical Background

Literature search for combinations of keywords and terms such as “Older adults information technology”, “App assisting the elderly”, “Smart homes acceptance among elderly” “Alders living alone”, “Applications for seniors”, “Instrumental Activities of Daily Living assistance” identified technology solutions for seniors’ leisure time, health apps, promotion of social activities, and monitoring in smart homes and Ambient Assisted Living programmes. None of which however have resulted in finding a technology solution enabling seniors get a personal, online support in their Instrumental Activities of Daily Living using a simple and user-friendly video-audio communication tool.

2.3.2 Communication Technology

Technologies have a potential to offer the elderly support in promoting their mental health through social contacts. Product for fostering social interaction among elders are in a focus of both industry, such as American product Stitch⁶, where people meet online, have discussions, play games, plans travels, etc. and science, e.g. BRELOMATE (Breaking Loneliness with Mobile Interaction and Communication Technology for Elderly), a research product of the University of Applied Sciences at FH St. Pölten in Austria [49].

According to Eurostat, the Statistical office of the European Union, only 25% of the EU internet users aged from 55 to 74 years participate in social networks, as presented in Figure 2, showing a significantly reduced usage in older population segments [14].

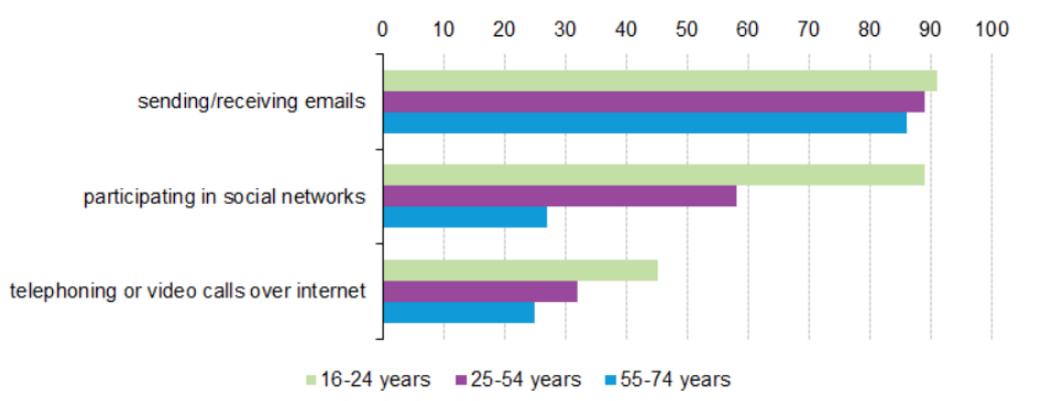


Figure 2. Use (%) of internet for communication, by age group among 28 EU country members in 2013 [14].

However, unlike younger people, the elderly seems not to greatly adopt social media applications. While more than 80% of this age group use emails as a

⁶ Stitch is an in the USA grounded online community <https://www.stitch.net/>

2 Theoretical Background

communication tool, less than 20% use the internet for telephoning or video calls, and only 6% use social media applications on a daily basis. Reasons why old people are reluctant to use such applications may be related to their age and health related issues [35], thus the understanding of these reasons may help create applications which would meet their needs more closely. Among the applications presented in the Table 2 which allow a video-communication with a family or friends, only Oscar Senior⁷ has been primarily designed for seniors for using video, chat and simplified Web-search functions, and is available in English, Dutch and Czech language. In a process of development of the IADL-SP prototype, participants without knowledge of English have pointed out difficulties they face when using an application with commands in English only. Functions and functionality of new mobile phones with a touch- screen may be too difficult, as well as the small screen and buttons of old types of mobile phones [50]. The self-assessment based research conducted among ten old volunteers by Teixeira et al. shows that the internet, mobile phone applications and SMS are still not vastly used for communication, mainly due to not understanding of services, their difficult and user-unfriendly interface, and a fear that mistakes may cause problems and embarrassing situations [51]. In a research that was conducted with the aim to provide a Mobile Instant Messaging product that fits the needs and abilities of old users, Kiat and Chen collected elders' opinions on the existing popular applications such as WhatsApp, Facebook Messenger and Viber [50], and analysed their requirements. The research resulted in creating a MIM prototype "Your IM" that was designed and developed for the elderly based on inputs of old test participants in each phase of development process, the approach that was found to be appropriate. When designed for elders in a way that provides a better interface and more functionality, e.g. bigger font, less complex and more intuitive command icons [51], social and service networks might get more on popularity among old users.

Table 2 presents the functions of the IADL-SP in comparison with other products present on the market. It is noticeable that the IADL-SP offers either same amount or more functions compared to the others, while only Skype offers the screen-sharing function that, since recently, cannot be used simultaneously with a video-connection. In addition, unlike for the other applications, the IADL-SP does not need to be downloaded and installed. Instead, a user gets it with a single click on a link to the ULR of the IADL Platform website that is sent to him.

Results of a study by Chopik, who examined the associations between technology use for social reasons and physical and psychological health among

⁷ <https://www.oscarsenior.com/>

2 Theoretical Background

older adults [52], showed the correlation between the greater technology use and better health, as well as the reduction of chronic illness.

Table 2. The comparison of functions of the IADL-SP with other products.

Product	Live video	Camera and photo sharing	Direct messaging	Screen sharing function	Draw-over function	App download over Google Play, App Store or Windows account
Skype	X	X	X	X		X
Viber	X	X	X		X	X
WhatsApp	X	X	X			X
FaceBook Messenger	X	X	X		X	X
Line	X	X	X			X
Google Hangouts	X	X	X			X
Oscar Senior	X	X	X			X
IADL Service Platform	X		X	X	X	

To promote the usage of online technology solutions, Boll and Brunne suggest that the society and online service network need to join their efforts in finding the best solution for old users. In a study on online support for the elderly, they have presented a new approach that integrates a social and online service networks in a platform with more functionalities, allowing old people to communicate, help each other and share common interests [53].

Solutions for supporting the elderlies have become a subject of several national and international programmes such as the cross-national “Active and Assistive Living” Programme of the EU [54] that encourages both the society and Information and Communication Technology (ICT) industry to develop products and services for helping old people break their social isolation and live better and healthier life.

2.3.3 Accessibility Apps

There is a variety of features integrated in operating systems of computers and mobile computing devices (e.g. Windows, Android, iOS, BlackBerry) which allow their users with or without disability to search the internet, write emails, play games and use social networks. Solutions such as text-to-speech and web-to-

2 Theoretical Background

speech processing tools [55], speech input software, text magnifier/zoom, dictation function, possibilities to change a text (e.g. font adjustment, space, colour, pictures, contrast) are either available in products and devices made solely for that purpose, or are integrated in applications, which can be downloaded, installed and used on computers and mobile devices. A certain amount of skill and experience is needed to download and install such applications, which may prove itself as a burden for the elderly. Applications which offer remote desktop access such as TeamViewer or Chrome Remote Desktop enabling assistance from afar are rather complex for elders without computer skills.

2.3.4 Smart and Assistive Living Environment

Ambient Assisted Living (AAL) is a general term for any technology solution that may help people function in their daily life independently and safe. Information and Communication Technology (ICT) offers a variety of products, which have found their use in the Ambient Assisted Living environment. Smart homes equipped with sensors, cameras, “smart” beds and other furniture, “smart” dishes and kitchen equipment, are only a few of the solutions available to the elderly and their care providers in the environment of Ambient Assistive Living (AAL), but they seem to tend to offer a pure robotic care. Products for enhanced communication, aids for Activities of Daily Living (ADL), writing/reading, recreation and leisure, should help old people gain their autonomy and better quality of life. The internet tends to develop into the Internet of Things (IoT) that will offer smart devices which will be able to locate, compute, sense or communicate with people or among themselves [56]. Old people living alone in smart homes may feel more comfortable than living in nursery homes. Technology and equipment enable their telemonitoring, supporting a family and care providers in managing their daily care for elders. User assessment of a smart home assistance in ADL and IADL in a study conducted by Ravishankar et al. [57] shows that the User-Centered Design that includes the user input throughout the design process and the emphasis on how people actually use technology, are the key factors for successful design of functional system [57]. Despite of progress made over the last years in technology, telemedicine and health care, Smart homes technologies still need more structured, interdisciplinary approach in reaching their objectives, and achieving an operational- and cost-effective result as well as the privacy protection and acceptance among their end users [58].

2.4 Key Challenges in Design of Online Services for the Elderly

WHO defines a Health as “the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health” [59].

With increase of life expectancy, the chance that several generations of a family are alive at the same time increases. Despite of the theoretical possibility that grandchildren, children, parents and grandparents live together, they are more likely to live separately. In many countries, even those with a traditional family setup in which old people live with their children, the number of old people living alone is rising, while support that they receive from families is declining [1]. Regular contacts with a family and friends play a very important role in life of the elderly who live alone. The link between loneliness and premature mortality is known [60], while support of family and friends and their assistance are associated with elders’ positive attitude towards life even when being confronted with serious problems and crises [9]. In a study that analysed the content of seniors’ online communities, Nimrod found that a possibility to have “online fun” when feeling sad or lonely was considered as the most popular reason for joining online communities [61]. Results of a study by Harley et al. who looked at the significance of online connections with a family and friends among old users in England, showed that the social network platforms were mostly used because they offered a face to face meeting with a geographically distanced but emotionally closed family members [62]. According to Boll and Brunne, the existing social networks and services are difficult for senior users because of their complex interface that is not designed for them. In their paper about the online support for elderly, they elaborated a concept of the integration of online services and social support for elderly in their daily life, and presented advantages of such a concept [53]. Hence, the backbone of the IADL Service platform is the effortless communication, enabled by simplicity and ease of its features and functions.

Difficulties, which old computer users experience in handling computer tasks, even with received instructions on components of program and user interface, are described in literature. Results of a systematic review of mixed studies on factors, which determine acceptance of electronic technologies models by old people, have shown that the perceived usefulness and perceived ease of use play important role among 40% of individuals [63]. Research conducted in a project UTOPIA (Usable Technology for Older People: Inclusive and Appropriate) raised the need of radical approach for designing interfaces suitable for old users

2 Theoretical Background

instead of introducing accessibility features in computers for general purpose [64]. The ease of use is the main attribute of the IADL-SP that should make old people decide to use it when encountering difficulties in their Instrumental Activities of Daily Living such as reading, managing medication, managing personal finances (e.g. online banking), shopping, participating in online social network, checking emails, editing texts in a word processor, etc. In regard to that, the key challenge in a design of the IADL-SP is the integration of the communication and ease of use in a solution that will be embraced by old persons.

3 User-Centered Design for Designing and Developing an IADL Service Platform

This chapter describes approaches and process in a development of the IADL-SP.

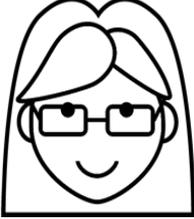
3.1 User-Centered Design – User Needs and Functional Requirements

The aim of the work was to create a prototype of a web-based IADL Service Platform (IADL-SP) that, due to its simplicity, enables old people who live alone to get a personal assistance in reading texts containing words and phrases which they do not understand. Its use should lead to successful management of their digital documents and records and foster their independency in their Instrumental Activities of Daily Living. The IADL-SP offers a real-time audio-video call that enables an old individual to get in a personal contact with a person who will assist him/her with reading. Besides the audio-video call, the IADL-SP has a text-messaging function that may be used for writing a rephrased text for easier explanation and understanding. Finally, its screen-sharing function complemented with the annotation (draw-over) function will serve for highlighting the parts of a document which need to be explained. The user interface shall be intuitive and user friendly, made to fit the cognitive and physical abilities of old users. The users shall use the IADL-SP without reading manuals, getting confused or asking for help.

3.2 User-Centered Design – Personas and Scenarios

The IADL-SP has been developed following the User-Centered Design approach framework in its four essential phases: research, development, prototyping and testing [65].

Table 3. Case 1: Personas, user stories and case scenarios.

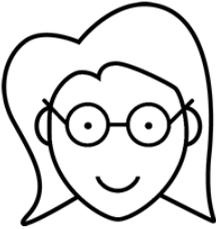
<p>Emma Hubert</p> 	<p>Facts & Demographic</p> <p>72 years old; Widow since last year, lives alone; Housewife; Lives in Austria, has never learned German well;</p>
<p>Behaviours and affinities</p> <p>Uses smartphone and tablet for Facebook, Viber and playing games; Uses computer for searching the internet but finds it difficult and complicated; Did not need to take care of finances when her husband was alive; Feels lost and incapable to manage her budget; Has one good friend who speaks German but lives on the other side of a city;</p>	
<p>Needs and goals</p> <p>Ad-hoc help with translation of letters and documents in German as she is aware that her German will never be as good as needed; Occasional help with household management and finances; Help to communicate with services she uses for running her household;</p>	
<p>User stories</p> <p><i>“Gas is switched off; it seems I did not pay a bill on time. What is written on the letter I’ve got? I need to solve it immediately, it’s cold. I need help, and my friend lives far away.”</i></p> <p><i>“I want my friend with me when I need her but feel bad to ask her to come over. If I could only read this letter with her and then ask her to write an email to my gas provider on my behalf.”</i></p> <p><i>“The IADL service platform offers exactly that what I need, an instant and smooth help from someone I know well and who can easily help me without asking too many questions. It is also good because I can stay home and do not need to invite someone to come over. “</i></p>	

In a process of software application development, it is important to gather as many as possible information about its end-users. Answering questions about their needs, goals, purpose they want to use it for, is a part of usability process that support designers in a development phase [66].

Table 4. Case 2: Personas, user stories and case scenarios.

<p>Max Novak</p> 	<p>Facts & Demographic</p> <p>81 years old; Widow, lives alone; Retired journalist; Has a daughter, MD, who lives abroad;</p>
<p>Behaviours and affinities</p> <p>Educated and literate, basic English proficiency; Writes books and articles for local newspapers; Uses smartphone for phoning and WhatsApp; Computer user with basic knowledge; uses it for typing his articles and books, for searching the internet, Facebook and emails. Often has problems with computer, and then he needs to call someone to help him; Has increased blood pressure and takes his medication regularly; Wears glasses, has cataract and has problems with reading small letters; Often buys OTC products, and although tries to read the instructions on information leaflet, has difficulties to understand them completely;</p>	
<p>Needs and goals</p> <p>Often urgently needs medical advice of his daughter; Wants to discuss with his daughter what medicament he takes, and everything in an easy and timely manner;</p>	
<p>User stories</p> <p><i>I want to buy an OTC product that reduces my blood pressure and need something for my circulation. Sometimes I feel dizzy and need some fast remedy. Who can advise me better than my daughter, but she is abroad?! I wish I could just see her and check with her what to take. You know, I also do not see well, and do not want to make mistake. I must be sure that I take it properly. In my age you never know.”</i></p> <p><i>“With the IADL Service Platform I could quickly and easily consult with my daughter. All other programs are so complicated; I always forget how to use them.”</i></p>	

Table 5. Case 3: Personas, user stories and case scenarios

<p>Julia Pepper</p> 	<p>Facts & Demographic</p> <p>65 years old; Divorced, lives alone; Two children, both living in another city; Retired teacher;</p>
<p>Behaviours and affinities</p> <p>Uses smartphone for phoning, Viber and Facebook, and laptop for emails and searching the internet;</p> <p>Computer user with basic knowledge; Mostly forgets how this works and need to check her notices/reminders;</p> <p>Likes shopping, sometimes sells some old stuff over the internet;</p> <p>Already experienced scam that has cost her a lot of nerves and some money.</p>	
<p>Needs and goals</p> <p>She needs someone to advise her when shopping and selling online to help her recognise fraud;</p>	
<p>User stories</p> <p><i>“I’ve announced in an internet platform that I am selling my coffee machine. Soon after I had got an offer from one old lady and after a few exchanged emails, I gave her my account number to transfer me 500 €. Two days later I am receiving an email from her in which she is informing me that she boked 500 € more which I should kindly transfer to the account of her son in Nigeria. Only then I realised that something was wrong. I called my bank and ask if money arrived. I was scared that I got into some mafia business. Fortunately, the money was not transferred yet, and the bank blocked my card on my request. I had to wait a couple of days to get a new card. But, how to shop and sell online? You never know if that is a fraud.”</i></p> <p><i>“If I just had someone to help me with these things. You know, this story with a coffee machine is not the only one I have experienced. All these emails look so real.”</i></p> <p><i>“The IADL Service Platform is ideal for me. I would just call my kids who would recognise scam in a second. Ugh, that would save me lots of nerves. Money too.”</i></p>	

The most typical users are represented through **personas**, the hypothetical archetypes, which represent real people in a process of design. The personas described in this work along with the **user stories** and **case scenarios**, are illustrated in the Table 3, Table 4 and Table 5 respectively.

Some personas are persons from the circle of family and friends, while others are taken from stories learned from acquaintances within the international community, both professional and private. Their attitudes, skills, needs, expectations and goals, as well as their environment and conditions under which they would be using the IADL Platform, are made based on real stories collected over the time of preparing material for this work.

Personas and users' stories led to the next step, the creation of the IADL-SP. The process of creation and development is described in the next section.

3.3 IADL Service Platform – User Interface Design

The main goal of creating the IADL-SP was to offer old users a simple and user-friendly application for getting online assistance when encountering problems with reading, i.e. understanding a written material. A person, who seeks help, needs to get into direct, personal contact with someone without much effort and without leaving a home or requesting someone to come for a visit. A web-based online tool that might satisfy these needs should fulfil certain requirements both functional and technical. It must be possible to use it without password that is easy to forget or lose if written somewhere; the contact must be established with a maximum of two to three clicks (opening browser and clicking on a saved link); it must be possible to reach more than one person or even include more persons in a single session; operations for using the IADL-SP must be easy and intuitive, otherwise the use might be contra-productive and frustrating; the screen must not be loaded with unnecessary contents that distracts or even hide the command buttons of the IADL-SP; the amount of command buttons must be reduced to the necessary minimum and buttons must not be hidden in features like a drop-down menu; the size of buttons must be adapted to an old eye and their labels intuitive and easy to describe in case that a user cannot find them; the colours must be mild and pleasant, with stronger contrast for better recognition; the size of video and screen-sharing containers must be adapted to allow effortless reading of a shared document.

Functional requirements such as the ease to start the programme, the amount and size of command buttons, and the simplicity of video and screen-sharing

3 User-Centered Design for Designing and Developing an IADL Service Platform

functions and size of their containers are reflected in the wireframes presented in the Figure 3 and Figure 4 respectively.

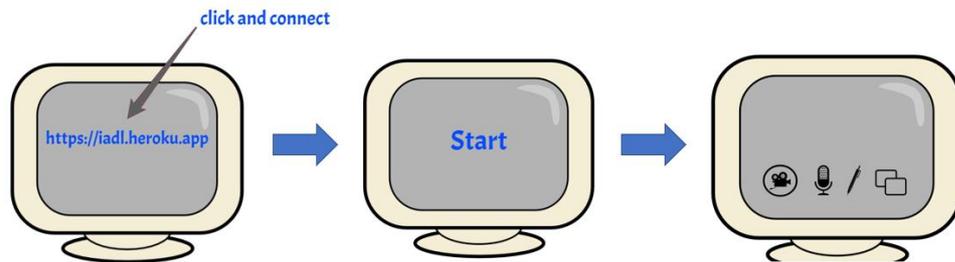


Figure 3. Mock-up: Connecting to the IADL Service Platform and starting screen.



Figure 4. Mock-up: Video, screen-sharing and annotation.

To create the IADL-SP that fulfils these functional requirements, the project has been created with a TokBox account that provides the access to infrastructure for building applications on OpenTok⁸ using WebRTC⁹ for audio-video communications and screen-sharing. Node.js and OpenTok React, the library used for building the application, are the core of the application. User's device, acting as a client, communicates with a server deployed on another third-party framework HEROKU¹⁰, container-based cloud Platform as a Service (PaaS). The next third-party framework used for building the IADL Platform is the GitHub¹¹, that is used for codes hosting, and finally a data base MongoDB¹² that uses

⁸ <https://tokbox.com/developer/>

⁹ WebRTC is a free, open project standard providing Real-Time Communications (RTC) capabilities via simple APIs <https://webrtc.org/>

¹⁰Heroku is a cloud platform supporting many programming languages <https://www.heroku.com/about>

¹¹ GitHub, a web-based hosting service <https://github.com/>

¹²MongoDB is a cross-platform document-oriented database program <https://www.mongodb.com/>

3 User-Centered Design for Designing and Developing an IADL Service Platform

JSON¹³ for encoding. The IADL-SP is made for a desktop operating system Windows but works also on Google's Android on mobile devices (mobile telephone and tablet) running on Android (minimum 4.4.3). In the development phase, Firefox is only browser that supports all the features of the IADL-SP. An overview of the functional and technical requirements is presented in the Table 6.

Table 6. Functional and technical requirements for development of the IADL Service Platform.

	
<ul style="list-style-type: none"> - personal help without leaving home or getting a visitor; - audio-video connection; - possibility to reach more than one person or include in a single session more than one person; - no download or installation; - no log-in and passwords; - start a program with a few clicks; - simple and minimalistic screen; - commands intuitive and easy to find; - buttons must not be hidden in a menu or drop-down list; - buttons must be big enough for old eyes; - screen must be big enough for reading small texts; - colours must be pleasant and contrast stronger. 	<ul style="list-style-type: none"> - application (client and server side); - OpenTok with WebRTC for audio-video communications; - Heroku, container-based cloud Platform as a Service (PaaS); - GitHub for codes hosting; - MongoDB; - Windows or Android operating system; - Firefox browser; - desktop computer or laptop; - Web-camera; - headset; - internet connection (W-LAN or cable).

¹³ JSON (JavaScript Object Notation) is a data-interchange format that is for humans easy to read and right <https://www.json.org/>

3 User-Centered Design for Designing and Developing an IADL Service Platform

The user interface elements used in the IADL-SP are listed in the Table 7. They were made to be unpretentious and as simple as possible for use by old participants. The amount of input controls user interface elements as well as navigational and information elements was reduced to minimum for better overview and navigation, helping participants to recognise the necessary action. Finally, the IADL-SP was made to be a single page website for easier use.

Development of the IADL-SP required very few additional investments. Laptop used for development is Asus R558U with Intel Core i7 processor and NVIDIA GeForce 940MX, with the integrated sound system. An account was necessary for using the third-party platforms (OpenTok, Heroku and GitHub). The rest of technical requirements is described in the IADL-SP Hardware Setup (3.4) below.

Table 7. User interface elements used in the IADL-SP.

UI-element	Description	Example
Dropdown list	Used for input control to allow participant to select one item at a time	Selection of a document to share
Buttons	To indicate an action that starts upon click	Command buttons for video-audio connection, screen-sharing, text-chat or draw-over
Radio buttons	To allow participant selection only one item at a time	Selecting colours of a pen to draw over
Slider	Navigational component	Scroll up and down to navigate to the text field and back
Text field	For entering text messages	Text-chat
Icons	Simple images to help intuitive navigation	Pictures on command buttons of microphone, camera, telephone, screen-sharing, etc.
Message box	Window with information requiring an action	Consent to participate, password request;
Notifications	To indicate an error	When a browser other than Firefox was used, a participant was notified to use another browser

3.4 IADL Service Platform – Hardware Setup

The IADL-SP hardware setup uses financially affordable and technically simple equipment, requiring the following four components:

1. Desktop computer or laptop (equipped with a charger, keyboard and mouse) with Windows operating system. Computer or laptop specification was not defined, meaning that any functioning computer/laptop might be used. A tablet might be used, but it was, due to small size of screen, not convenient for the testing purpose;
2. Web-camera, integrated in a laptop or a low-costs Plug & Play webcam for Windows (e.g. Logitech Webcam with USB 2.0);
3. Headset with microphone (USB) - stereo for desktop or laptop if already not integrated in;
4. Broadband-internet connection, stationary or mobile with a minimum 265 kB/s upload speed.

The quality of video connection and picture might be influenced by the internet speed and light in a room of participant, so the tone quality that might also depend of the quality of headset.

3.5 IADL Service Platform – Software Architecture

The IADL-SP application requires both the client and the server component. The **Client-side component** is responsible for connecting to the session, publishing streams (both audio and video), subscribing to sessions of other clients, and loading in a user browser. **Server-side component** is responsible for generating a session and token and sending a session ID and token to a client.

The library used for development of the IADL-SP is React¹⁴, a JavaScript library for building interactive user interfaces. For building the application, a hardcoded **OpenTok React** sample was used and broken down into two main components: OpenTok Client side (iavl-master) and OpenTok Server side (iavl-api-master).

¹⁴ React (alternatively called ReactJS) is a JavaScript library <https://reactjs.org/>

3 User-Centered Design for Designing and Developing an IADL Service Platform

Schematic illustration of the IADL-SP architecture is presented on the Figure 5.

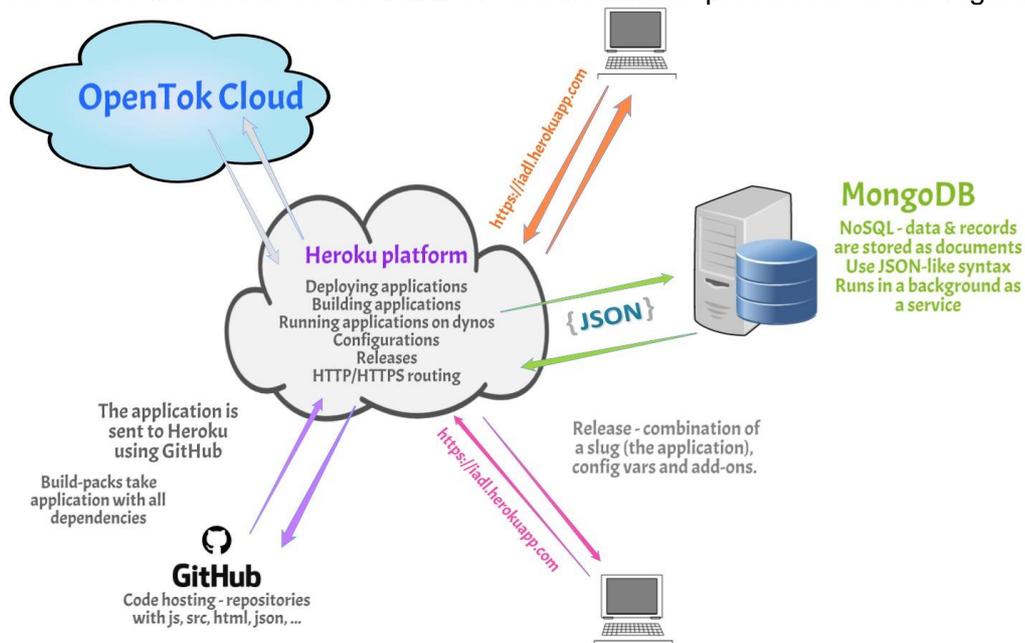


Figure 5. Schematic illustration of the IADL Service Platform architecture.

3.5.1 The Client-Side Component: iavl-master

The client-side (iavl-master) architecture is built of three main components: index.html, app.js and app.css.

Listing 1. Defining variables and binding functions.

```
// main class in React (creating variable)
class App extends Component {
  constructor(props) {
    super(props);
    this.state = {
      connected: false,
      active: false,
      publishers: null,
      subscribers: null,
      meta: null,
      localAudioEnabled: true,
      localVideoEnabled: true
    };
    this.startCall = this.startCall.bind(this); // connecting
    with functions whit THIS property
    this.endCall = this.endCall.bind(this);
    this.toggleLocalAudio = this.toggleLocalAudio.bind(this);
    this.toggleLocalVideo = this.toggleLocalVideo.bind(this);
  }
}
```

3 User-Centered Design for Designing and Developing an IADL Service Platform

The **index.html** page is a default page used for the initial commit that provides a basic structure of the site and includes the script attribute specifying the URL of OpenTok script. Although the scripts which load all the functions can be written in the index.html and executed automatically as the page loads, they are placed in a JavaScript file (app.js) of the Client-side component.

The **app.js** is responsible for controlling the behaviour of other elements of the application. It includes node libraries, a set of built-in modules which can be used without any further installation. Apart from codes for defining variables and binding functions presented on the Listing 1, the App.js contains, among other elements such as variables, strings, properties, methods, scripts and functions for:

- Importing Node libraries;
- Taking OpenTok credentials (apiKey, sessionId, token);
- Connecting to OpenTok to run events such as subscribe/unsubscribe to/from screen, subscribe/unsubscribe to/from camera, start/end screen-share. The protocol for communication with server is presented on the Figure 6.
- Defining the URL <https://iadl.herokuapp.com> that is sent to end-users;
- Loading in all the functions and processes as shown in Listing 2;

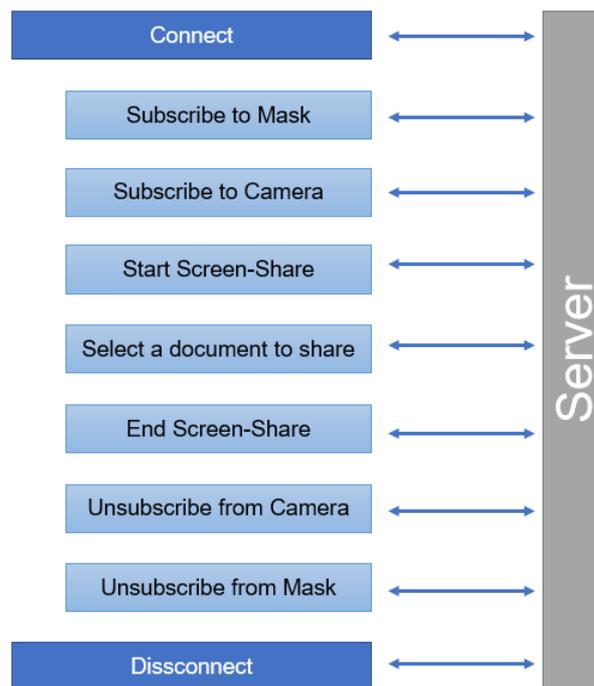


Figure 6. The protocol for communication between the Client-side and Server-side.

3 User-Centered Design for Designing and Developing an IADL Service Platform

- Making configuration for video and audio connection, screen-sharing, text- chat and annotation (draw-over);
- Building classes for container elements and adding them to index.html with a link to app.css file;
- Defining local functions for buttons (text-chat, camera, microphone, screen-sharing and annotation, i.e. draw-over);

Listing 2. Codes in app.js responsible for execution of functions and processes to html.

```
//returns all functions and processes from above to html- "visible part"
return (
  <div className="App">
    <div className="App-header">
      <img src={logo} className="App-logo" alt="logo" />
      <h1>IADL Service Platform</h1>
    </div>
    <div className="App-main">
      <div className="App-video-container">
        {!connected && connectingMask()}
        {connected && !active && startCallMask(this.startCall)}
        <div id="cameraPublisherContainer"
className={cameraPublisherClass} />
        <div id="screenPublisherContainer"
className={screenPublisherClass} />
        <div id="cameraSubscriberContainer"
className={cameraSubscriberClass} />
        <div id="screenSubscriberContainer"
className={screenSubscriberClass} />
        </div>
        <div id="controls" className={controlClass}>
          <div className={localAudioClass}
onClick={this.toggleLocalAudio} />
          <div className={localVideoClass}
onClick={this.toggleLocalVideo} />
          <div className={localCallClass} onClick={this.endCall} />
        </div>
        <div id="chat" className="App-chat-container" />
      </div>
    </div>
  </div>
);
export default App;
```

The App.css is used to control the presentation, formatting and layout.

3.5.2 The Server-Side Component: iadl-api-master

One of the main roles of the server-side component is to create sessions in the OpenTok cloud, generate tokens for clients, and send session IDs and tokens to clients. As well as the client-side component, the server-side repositories contain node libraries. In the first development phase, the node modules were installed locally. In the later phase when the application was deployed on a Heroku cloud platform, only a package.json file was push on the GitHub where all other repositories were stored. The essential part of the server application is placed in a JavaScript file server.js that is responsible for:

- Defining global variables and calling them from node modules;
- Initializing OpenTok, and requesting Api-Key and Api-Secret;
- Creating a session and storing it in the Express app;
- Connecting to the MongoDB and describing how the objects must be stored in.

Another important file of the Server-side component is the .env file used to safely store the OpenTok credentials (Api-Key, Api-Secret, Token and SessionID), which are then pulled by app.js (on the client-side component) as shown in Listing 3.

Listing 3. Code in app.js for taking OpenTok credentials from .env file.

```
// takes opentok credentials
let otCore;
const otCoreOptions = {
  credentials: {
    apiKey: '',
    sessionId: '',
    token: ''
  },
}
```

The Figure 7 shows the roles of client and server, and the flow within the OpenTok platform.

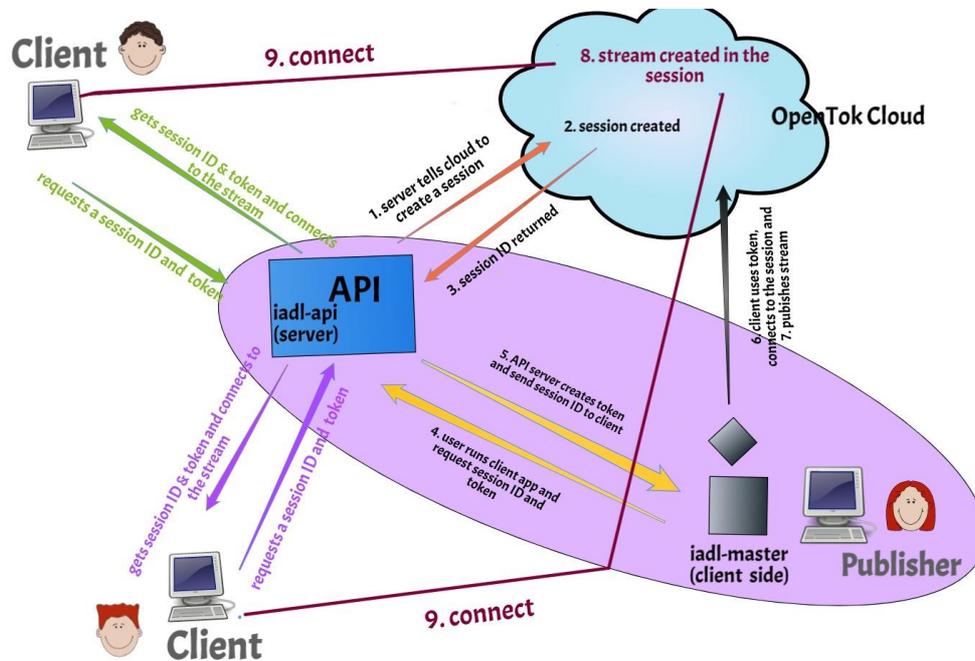


Figure 7. Workflow in an OpenTok session.

3.5.3 Third-Party Frameworks

The third-party frameworks engaged in the applications are OpenTok, GitHub, Heroku and MongoDB.

The video and audio real-time communication was enabled through Web Real-Time Communications (WebRTC) used in OpenTok through hosted infrastructure, Application Programming Interface (API) consisting of communication protocols, and other tools necessary for development of applications. The repositories were stored on GitHub, a free hosting service for source and revision control using a version control system Git. The codes, i.e. repositories were pushed to GitHub, and from there deployed to Heroku, a platform-based service, which infrastructure supported development, run and management of the IADL-SP application. In addition, Heroku released the “https routing” that was necessary for the functioning of screen-sharing. MongoDB was used for storing objects as documents using JSON-like syntax. The application components, both the client (iadl-master) and server (iadl-api-master) and their interaction with the third-party frameworks are presented on the Figure 8.

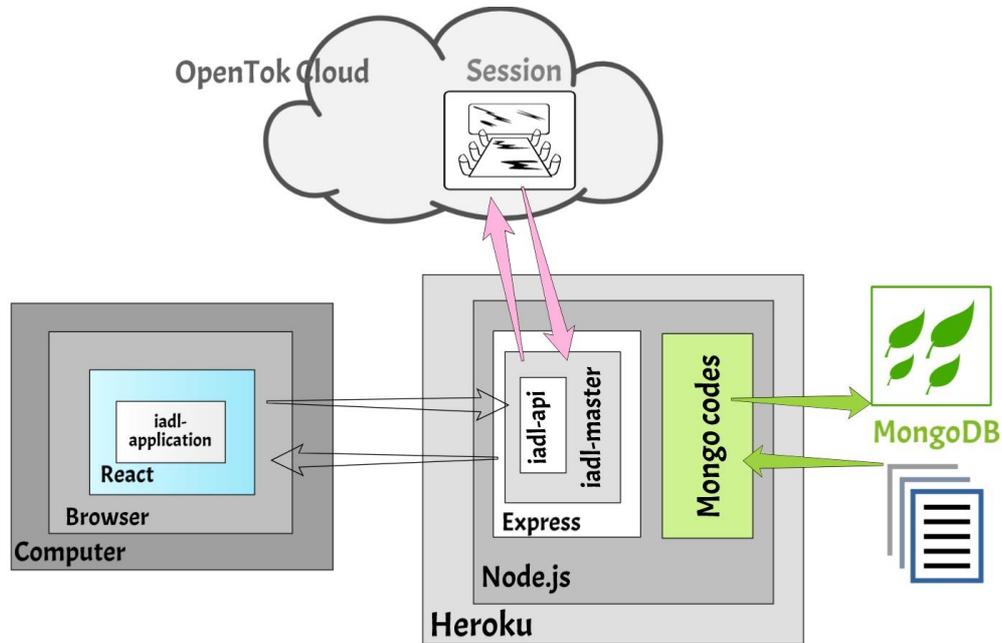


Figure 8. Application interaction with the third-party frameworks.

3.6 IADL Service Platform – User Guide

User interface in computer programmes is a part in which a user and machine interact. The user interface of the IADL-SP is designed to fit abilities and skills of old adult persons without or with limited computer skills. The amount of command buttons is therefore reduced to the necessary minimum for a better overview.

A user gets the access to the website of the IADL-SP with one click on a URL link provided over Viber, Facebook Messenger or other media. The procedures of download or installation which may require more skills are by this avoided and the start of using the IADL-SP simplified. Once the website is loaded, the IADL-SP is ready for use. The application may stay running as a desktop app, but at this stage of development this option is not considered due to costs of streaming over the TokBox account. The session can host up to five persons allowing a group online web-meeting. As the user interface needs to be designed based on understanding of users' needs and their cognitive processes rather than on aesthetic [65], design of the IADL-SP Platform is unpretentious. The design and a workflow are described and illustrated below in this section. After the click on the link <https://iadl.herokuapp.com> the users are connecting to the IADL-SP. The starting screen shows only one button with a "START" command, using the word common in all three languages used in the evaluation as shown on the Figure 9.

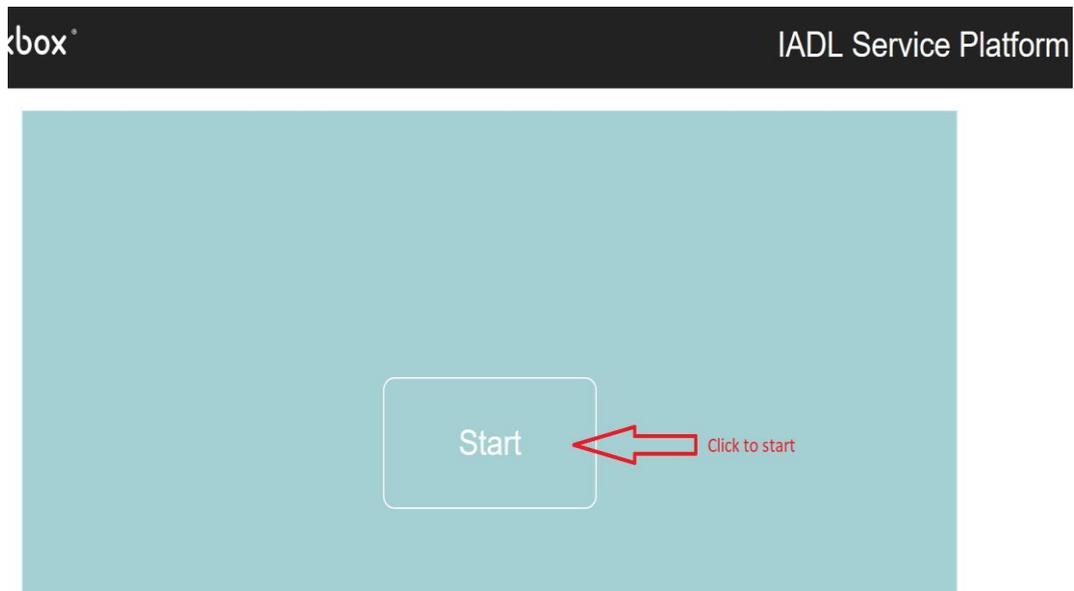


Figure 9. Start page of the IADL-SP.

With a click on the START button, the connection to session starts. A video-audio connection starts by selecting devices as illustrated on the Figure 10. Camera can be turned off/on without influencing the screen-sharing function. If both users allow the program to use the camera, they will both have two video-windows on their desktop.

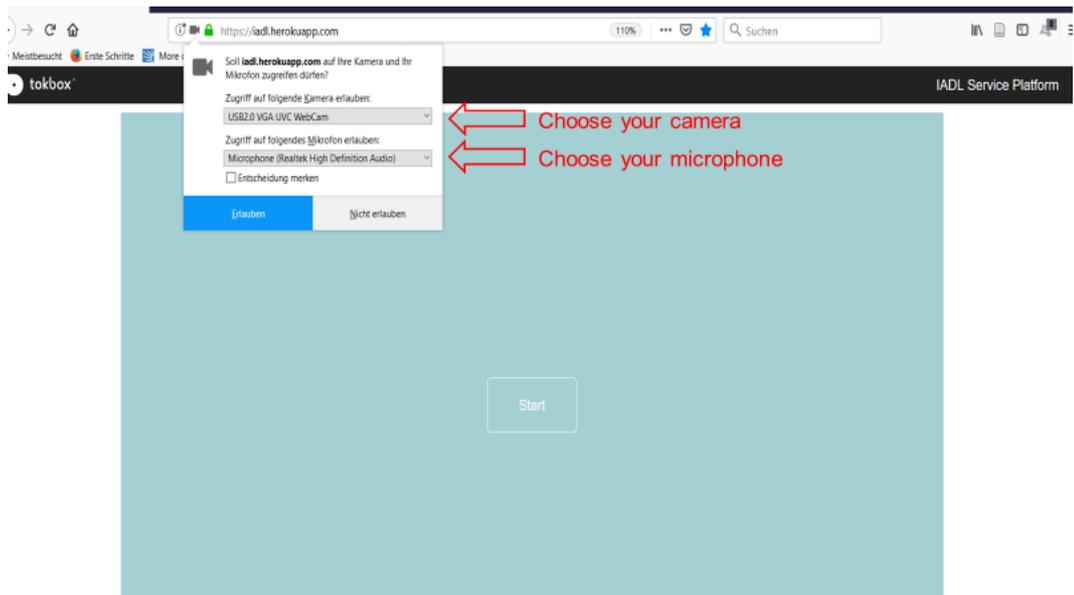


Figure 10. Choosing microphone and camera.

3 User-Centered Design for Designing and Developing an IADL Service Platform

Under the camera window there are five buttons for command functions, which are marked with icons/pictures and are supposed to be easily recognised as presented on the Figure 11. Each button has both on and off function.

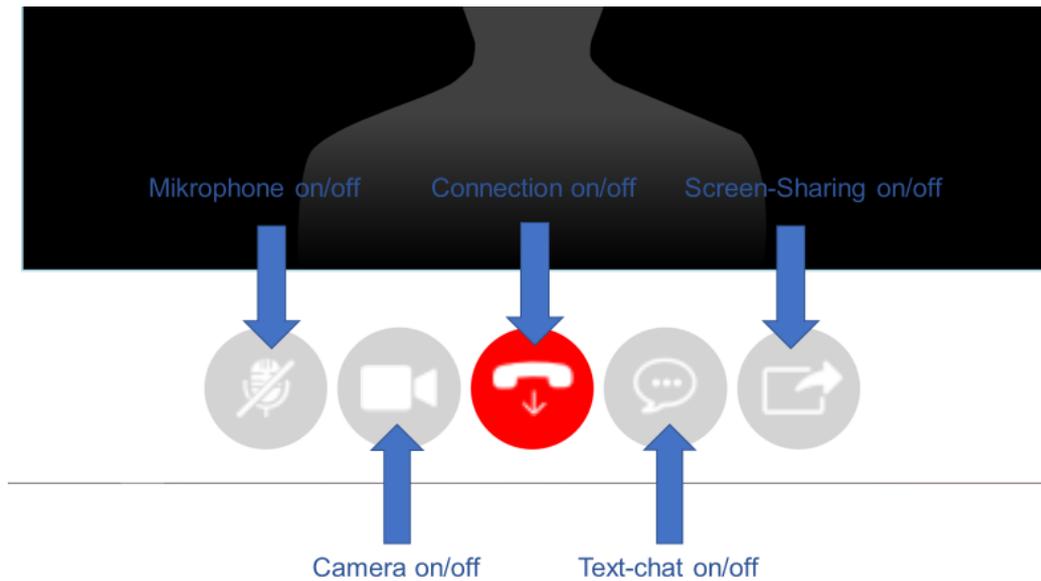


Figure 11. Functions - Command buttons.

All the functions can be turned on/off and used repeatedly without any order.

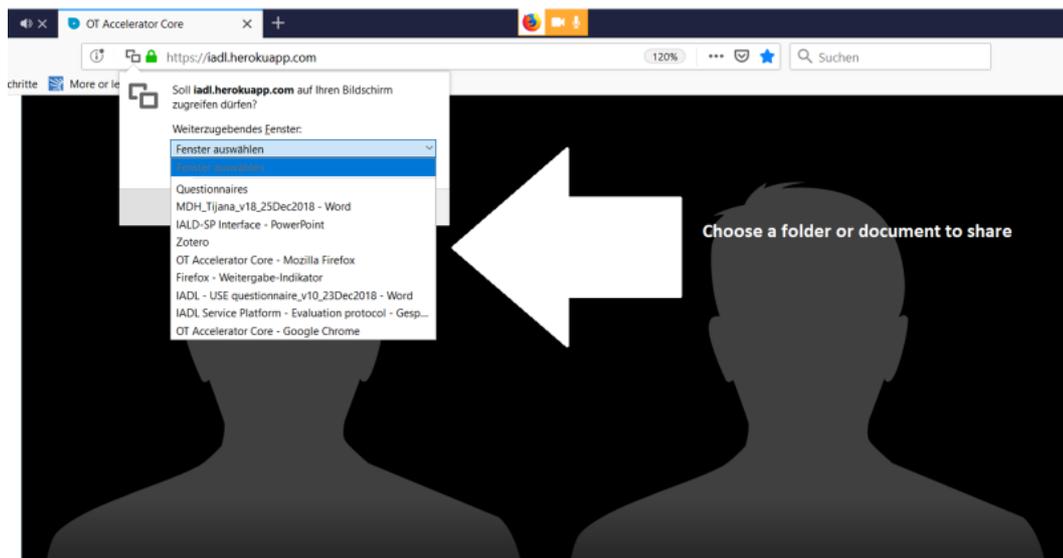


Figure 12. Selection of a folder or document to be shared.

The screen-sharing starts by selecting the screen-sharing button that activates a window offering to a participant the choice what to share, e.g. desktop, any word or pdf document or a webpage. They are shared by selecting any of them on a

3 User-Centered Design for Designing and Developing an IADL Service Platform

window that appears after clicking on the screen-sharing button. The Figure 12 shows how to share a screen. Each user may share the screen during the session, but only one at a time. Once the object for sharing is chosen, the access to it must be allowed as highlighted on the Figure 13.

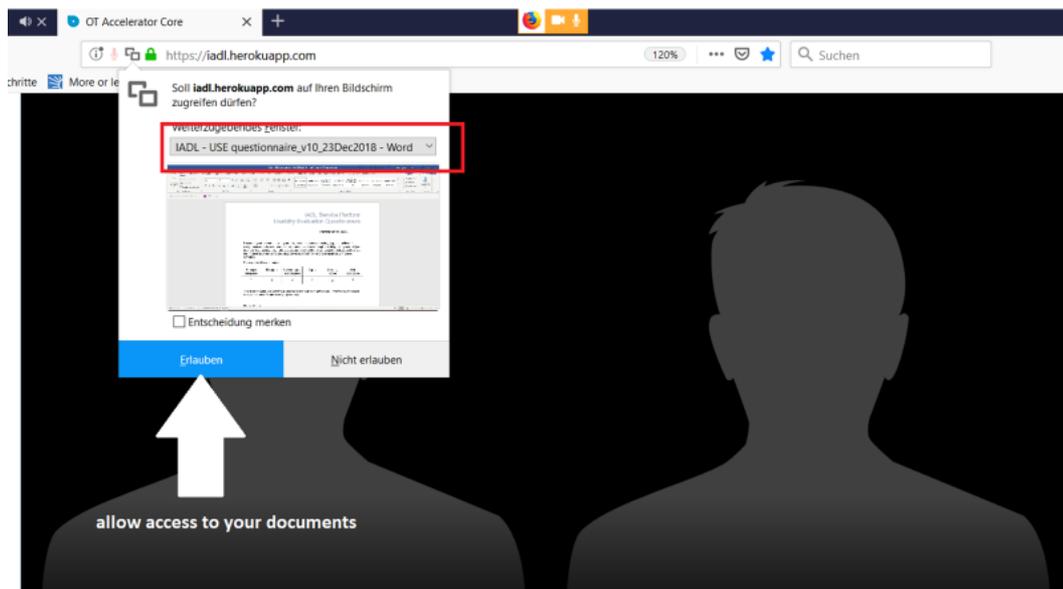


Figure 13. Allow the application to access the selected document.

After the access is accepted, the selected document will appear on the screen together with drawing tools as presented below on Figure 14. The screen-sharing is stopped by clicking on the same button that starts the screen-sharing.

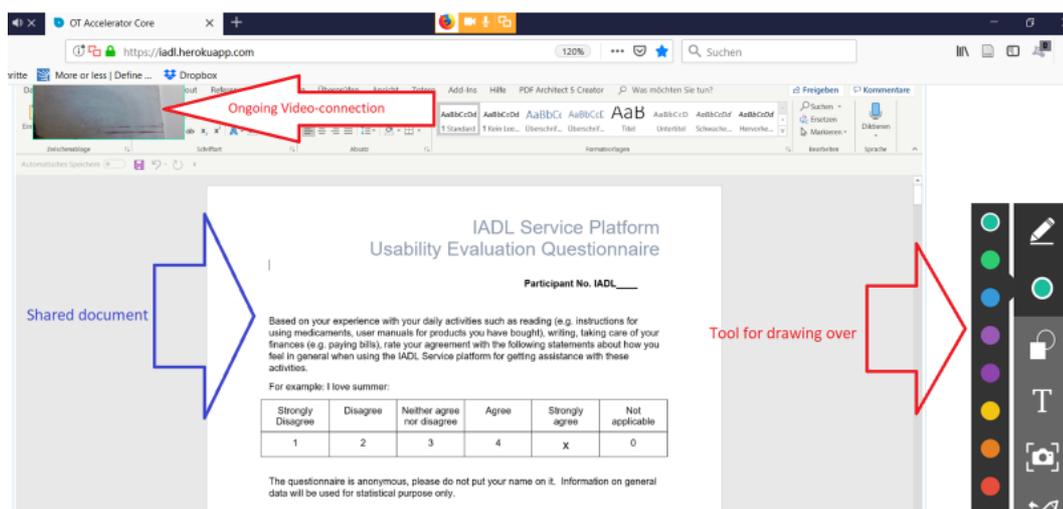


Figure 14. Shared screen and buttons, i.e. tools for drawing on a selected document.

3 User-Centered Design for Designing and Developing an IADL Service Platform

Allowing users to see the same document, the screen-sharing facilitates discussion and explanation of the document's content. When a screen is shared, the annotation (draw-over) function gets activated, offering the possibility to write and draw on a shared document, highlighting words and phrases which are the subject of a discussion as illustrated on the Figure 15.

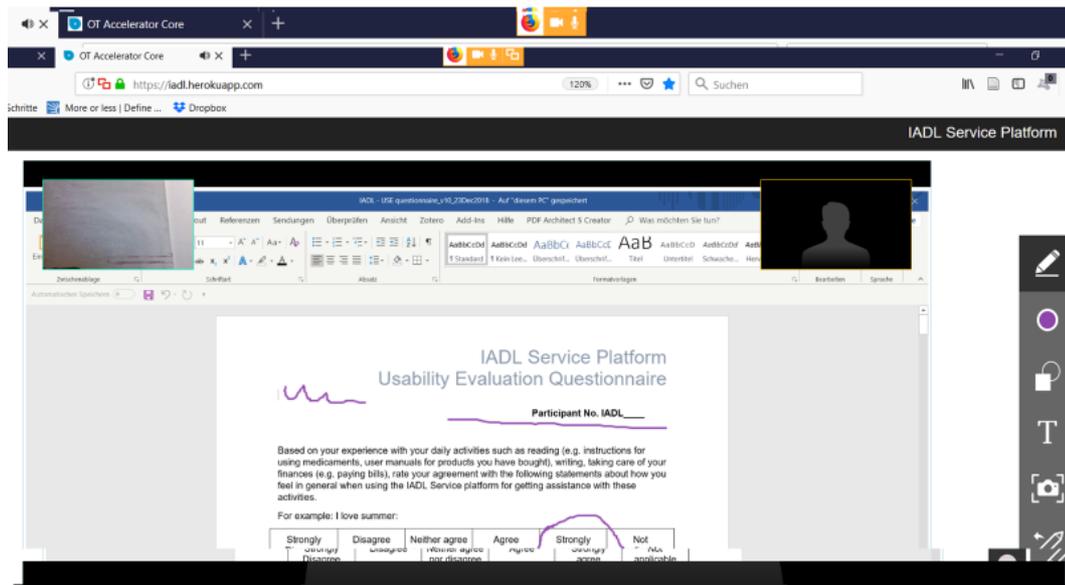


Figure 15. Shared document with drawings.

The video-connection stays active during the document-sharing, only the window-pane gets smaller.

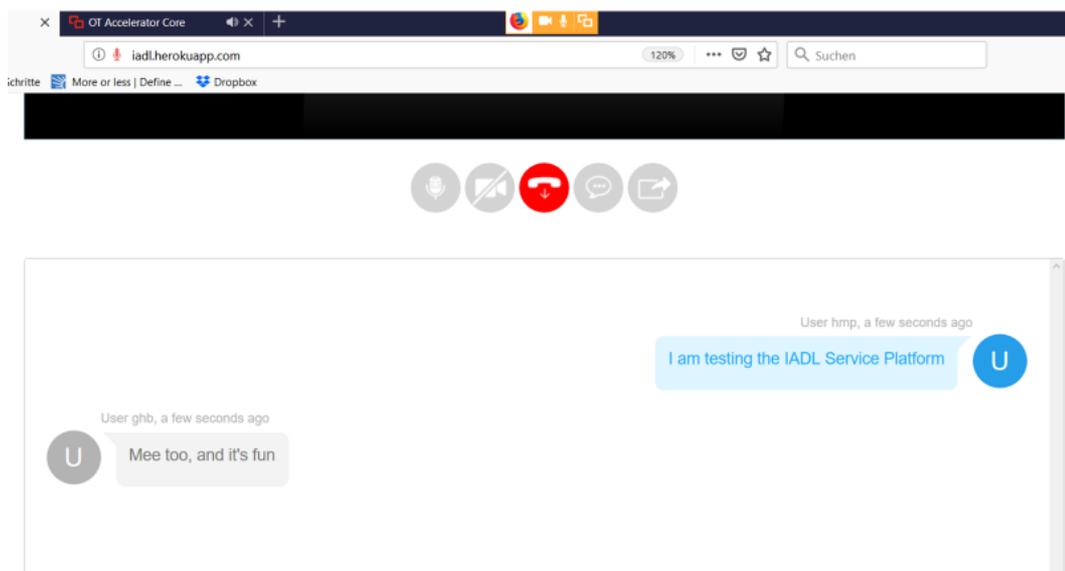


Figure 16. Window for text-chat.

3 User-Centered Design for Designing and Developing an IADL Service Platform

Finally, the IADL-SP offers the text-chat function. It gets activated by clicking on the text-chat button that activates a window placed at the bottom of a screen. The Figure 16 shows the text-chat window. The text-chat may be useful to users with hearing impairment or those who need assistance in writing.

4 Usability Evaluation – Test Design

“Usability: the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.” [67]

Usability may refer to the ease of use of many product and tools such as, for example, websites and software applications. As described by Ferre et al., the user interface (UI) is only one of segments of usability that is more complex and includes attributes such as: ease of using a system (Learnability), amount of tasks performed in a given time (Efficiency), user’s ability to remember how the system works after not using it for a while (User retention), number of mistakes made by the user (Error rate), and finally, the expression of user’s subjective impression (Satisfaction) [66].

The usability of the IADL-SP was tested by ten participants described below in the section 4.2 of this chapter, who have afterward provided their feedback through a custom-made usability questionnaire, also described in detail in the next section of this chapter.

4.1 Usability Evaluation Methods

In the field of usability evaluation, there is a variety of different examination methods that can be categorized according to various products and criteria. Evaluation methods used in a development process have a crucial role for production of a software that satisfies needs and requirements of its end users [68]. Methods which can be used for evaluation are, among others, usability tests and questionnaires. When real end users are used as test participants, the method is described as a user-based or empirical method. In a usability test, test participants are led to solve typical tasks with a test software and are monitored by experts. Questionnaires are another frequently used method in the evaluation of usability. They are relatively simple to manage, and offer standardised scoring and evaluation of subjective assessment of end users [68].

4 Usability Evaluation – Test Design

Table 8. The IADL Service Platform usability questionnaire.

EASE OF USE (9 questions)	EASE OF LEARNING (4 questions)
<ol style="list-style-type: none"> 1. It is simple to start the program. 2. Command buttons are easy to understand and find. 3. I can easily switch on/off functions or change from one to another one. 4. The size of shared screen is good; I can read a document without problem. 5. Colours and contrast of icons are appropriate. 6. If I make mistake and press a wrong button, I can recover back to the function I want quickly and easily. 7. I do not need to make notes and memos to remember how to use it. 8. It requires the fewest steps possible to help me accomplish what I want. 9. It is effortless to use it. 	<ol style="list-style-type: none"> 10. It is easy to understand how it works. 11. I learned to use it quickly. 12. It is intuitive. 13. It does not require advanced computer knowledge.
USEFULNESS (8 questions)	SATISFACTION (7 questions)
<ol style="list-style-type: none"> 14. It would help me get assistance that I need. 15. It would help me explain things that I need a help with easier. 16. It would help me understand and follow explanations easier. 17. Video connection is an important part of it. 18. Screen-sharing is useful for explaining or being explained. 19. Text-chat is useful complementary tool. 20. Drawing on a document is useful complementary tool. 21. I am satisfied that it has all functions together (video, chat and screen-sharing). 	<ol style="list-style-type: none"> 22. It would be fun to be helped on this way. 23. When I need assistance, I would use it rather than a telephone. 24. I like that it offers a face to face contact when helped. 25. I like to be helped by a real person and not by a machine. 26. I like that it offers possibility to have a group video-meeting. 27. It is a useful tool for face to face communication, not necessarily related to assistance. 28. Overall, I am satisfied with it.

4 Usability Evaluation – Test Design

In this work, both the usability test and questionnaire were used. In addition, the test participants were observed during the test and their “loud thinking” was documented in the evaluation protocol attached in the Appendix B.

Usability Test of IADL Service Platform

The participants performed a usability test comprising of eight tasks for evaluation of the main features of the IADL-SP: Connection to the session that includes Video and audio connection, screen-sharing, draw-over (annotation) and text-chat. The participants were asked to accomplish the tasks autonomously, and those who failed were assisted by the examiner. Results, reason for failure and participants’ comments were documented in the evaluation protocol. The testing tasks, scenario and evaluation protocol are described in detail in the section 4.3 of this chapter.

Usability Questionnaire

By courtesy of its author, Dr. Lund¹⁵, the USE Questionnaire for Measuring Usability [13] was modified and adapted to the purpose of this work and translated from English into German and Bosnian-Croatian-Serbian. The “USE” stands for Usefulness, Satisfaction, and Ease of Use. The IADL-SP usability questionnaire consists of twenty-eight questions grouped into four main groups: Ease of Use with nine questions, Ease of Learning with four questions, Usefulness with eight and Satisfaction with seven questions, as presented in the Table 8. The questionnaire offers five Likert-type scale answers in a range from 1 to 5, where 1 represents the lowest grade and 5 the highest grade, i.e. a range from “Strongly disagree” and “Disagree” over “Neither agree nor disagree”, to “Agree” and “Strongly agree”. The answer “not applicable” was also offered although not wished for. In addition, the participants were asked to answer the group of questions “General data” containing the questions about following information:

1. Demographic: age group (60-65, 66-70, 71-80, 81-85), gender and education background.
2. Use, frequency and purpose of using computer as well as the Internet offering the following answers: Playing games, Social media and messengers (e.g. Facebook or Viber, Skype), Online services such as online banking and online shopping, Office (Word, Power Point, Excel), Searching the internet (for various information and media).

¹⁵ Dr. Arnold Lund, PhD in Human Learning and Memory
<https://www.uwb.edu/css/faculty/bios/alund>

3. Experienced difficulties in any of Instrumental Activities of Daily Living with following answers: Never, Rarely, Sometimes, Often and Daily.

4.2 Test Participants

An important aspect of usability testing is getting feedback from a target group, i.e. end-users. For that reason, the selection of test participants is essential for the validity of testing. The primary end-users of the IADL-SP are the users looking for personal and ad hoc assistance when encountering difficulties in their activities related to communication, writing, reading, and managing their documents and records. Test participants for the evaluation of the IADL-SP were selected from a Facebook pool of friends and acquaintances. The invitation for participation was written on three languages, German, English and Bosnian-Croatian-Serbian to increase the number of eligible participants. The invitation included the information about the aim of development of the IADL-SP, its description, and the information on a stage of its development. The participants were informed about the criteria for participation in the evaluation, the time needed for testing and completion of questionnaire. Inclusion and exclusion criteria are listed below in the Table 9.

Table 9. Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
<ul style="list-style-type: none">+ Age \geq 60+ Living alone or with no one who might offer help with the IADL which are subject of this work+ Healthy (age norm)+ Experienced certain difficulties with reading and understanding written material+ Using computer and the Internet+ Participating voluntarily and autonomously	<ul style="list-style-type: none">– Advanced computer user

Participant's age was the first selection criteria. The participants had to be sixty years old or older (\geq 60). Besides, they had to live alone or with someone who could not offer them any assistance in their Instrumental Activities of Daily Living. Another important criterion was a level of computer knowledge. Only the

4 Usability Evaluation – Test Design

participants with a basic computer knowledge and skills in using the Internet were included in the evaluation. Unlike the basic users, the advanced computer users were not eligible for the participation. One of the inclusion criteria was the absence of any serious diseases that might influence their evaluation ability or compromise their physical and mental health. Participation in the evaluation was anonymous, meaning that personal data were replaced by a code (Participant IADL No.____) containing only "...information which does not relate to an identified or identifiable natural person or to personal data rendered anonymous in such a manner that the data subject is not or no longer identifiable..." according to Recital 26 of GDPR¹⁶. The consent to participation was given prior to evaluation as described in the section 4.3. Finally, the participants took part in the evaluation voluntarily and autonomously.

In the first selection phase, twenty-five older adults, who wished to participate in the evaluation, passed a telephone interview for detailed information, analyses of inclusion and exclusion criteria and the final selection. The answers on computer knowledge and using the internet posted in the General Data of the usability questionnaire were based on participants' self-assessment, so do their statement of experiencing certain difficulties in Instrumental Activities of Daily Living of any kind.

Actual Participants

Out of twenty-five applicants, fifteen fulfilled the inclusion criteria only partly.

Table 10. Actual participants in the evaluation.

Participant No. IADL:	Age group	Gender f/m	Education
1	66-70	f	Univ.
2	60-65	m	Univ.
3	81-85	m	Univ.
4	71-80	f	High.
5	71-80	m	High.
6	81-85	f	High.
7	60-65	f	Univ.
8	66-70	m	Univ.
9	71-80	f	High.
10	66-70	f	Univ.

¹⁶ The EU general data protection regulation 2016/679 (GDPR), Recital 26 <http://www.privacy-regulation.eu/en/recital-26-GDPR.htm>

4 Usability Evaluation – Test Design

One of them was excluded due to advanced computer skills, described as the exclusion criterion. Ten participants presented in the Table 10, who have fulfilled all the inclusion criteria, were selected for the participation and took part in the usability evaluation described in the section 4.3.

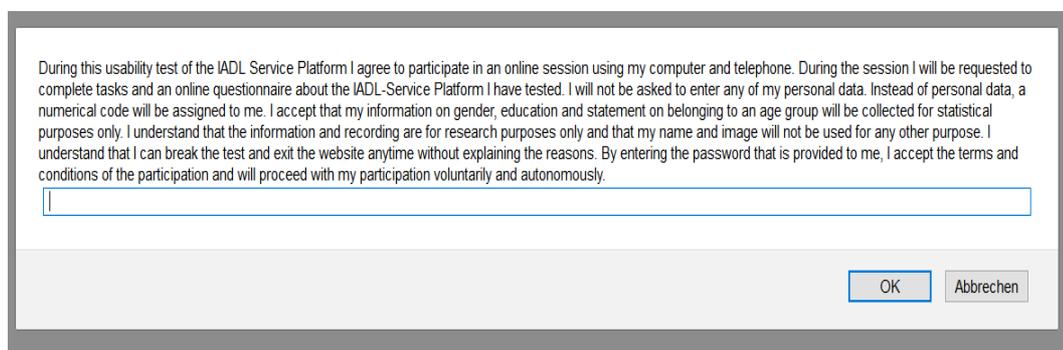
Six participants were female (f) and four were male (m). Two of them belonged to the age group 60-65, three of them to the group of 66-70 years old and 71-80 respectively, while two of them were in the group of 81-85 years old people.

Regarding the educational background, four participants finished a high school and six had a university degree.

4.3 Usability Evaluation Setup and Scenario

To facilitate a smooth evaluation process, the participants were asked to prepare their equipment (computer or laptop with charged battery, functioning internet connection and tested video and sound system, i.e. microphone and speakers or headset) before connecting to the session. Participants who did not have the Firefox were asked to download/install it, and those who needed assistance with the installation were assisted prior to the introduction phase described below.

The usability evaluation (UE) took place in the period from 10. to 29. December 2018. Date and time of the UE were agreed in advance with each participant. Time reserved for each UE was 45'-60' per participant. The UE was carried out online with participants from different geographical locations of the same time zone and in different languages, English, German and Bosnian-Croatian-Serbian. Only one test participant and examiner were present in each evaluation, i.e. testing session.



During this usability test of the IADL Service Platform I agree to participate in an online session using my computer and telephone. During the session I will be requested to complete tasks and an online questionnaire about the IADL-Service Platform I have tested. I will not be asked to enter any of my personal data. Instead of personal data, a numerical code will be assigned to me. I accept that my information on gender, education and statement on belonging to an age group will be collected for statistical purposes only. I understand that the information and recording are for research purposes only and that my name and image will not be used for any other purpose. I understand that I can break the test and exit the website anytime without explaining the reasons. By entering the password that is provided to me, I accept the terms and conditions of the participation and will proceed with my participation voluntarily and autonomously.

OK Abbrechen

Figure 17. Prompt message on consent to participation in the evaluation.

The usability evaluation started on agreed time when a participant joined the session using the link (<https://iadl.herokuapp.com>) sent via Facebook

4 Usability Evaluation – Test Design

messenger, Skype or Viber. Upon connecting to the ULR, a participant was prompted to read the informed consent (see Figure 17 and Appendix A). The terms and conditions of the participation were accepted by typing in a password provided at the end of the recruitment. After logging in, a participant joined the usability evaluation session by clicking on the START button intuitively after the page was loaded in a browser. The participants, who have not succeeded to start the program, were assisted using other communication tools (e.g. telephone, Skype).

The introduction of the IADL-SP and its usability evaluation were carried out in three consecutive online phases: 1. Introduction of the IADL-SP to the participants, 2. Usability testing and 3. Completion of the usability questionnaire.

1. Introduction phase (approximate duration 15’).

In the introduction phase and an interactive discussion, the participants were instructed on use of functions and commands of the IADL-SP. They were asked not to write memos during the introduction phase.

2. Usability testing phase (approximate duration 10’).

After the introduction phase, the participants tested the IADL-SP. The total time planned for testing was ten minutes. The time for accomplishment of tasks was set up based on the preliminary tests performed by volunteers in a development phase. The test was comprised of the following eight tasks:

Task 1. Turn a video and audio connection on!

Task 2. Share your screen!

Task 3. Find a word document of your choice, share your screen, and read and discuss the document!

Task 4. Choose a Website, share your screen, and read and discuss the content of the Website!

Task 5. Highlight a word on a shared document with a drawing tool (pen)!

Task 6. See the screen of the examiner and write on it using a drawing tool (pen)!

Task 7. Write/read a text message!

Task 8. Turn a video and audio off and on!

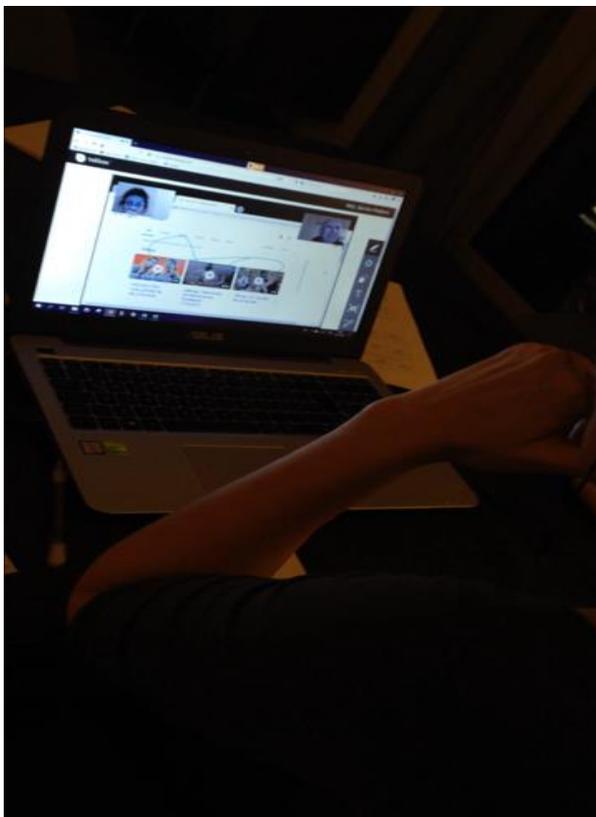
During the usability testing phase, the participants were asked to perform each task autonomously remembering instructions from the introduction phase. If they were not successful in absolving a task, they were assisted by the examiner. In

4 Usability Evaluation – Test Design

case of failure despite of assistance, they should have proceeded with the next task leaving the previous one unsolved. The participants were also asked to think loud during the test and to comment their actions. Picture 1 shows a sequence of video-connection during the evaluation by one of participants.

The steps, grades for accomplishment of the tasks and comments of the participants (loud thinking) were documented in the evaluation protocol attached in the Appendix B. Accomplishment of tasks was described with one of the three descriptive grades: Autonomous accomplishment, Accomplishment with assistance of examiner and Failure.

The information collected in the evaluation protocol was used for evaluation and discussion of possible future development of the IADL-SP. The main tool for the evaluation of the IADL-SP was the usability questionnaire, though.



Picture 1. Video-audio connection with a participant during the test phase.

3. Completion of the Usability Questionnaire

After the usability test, each participant stayed in the session to complete the usability questionnaire attached in the Appendices C, D and E. The time for completion of questionnaire did not exceed 20'. The questionnaire was shared on the screen of the examiner. The use of online questionnaire tools (such as

4 Usability Evaluation – Test Design

Google forms) was excluded due to complexity of use for older participants and anonymity guaranteed according to provisions of The General Data Protection Regulation (EU) 2016/679 ("GDPR")¹⁷.

The next chapter presents the analysis and results of the usability evaluation.

¹⁷ The General Data Protection Regulation (EU) 2016/679 ("GDPR")
https://ec.europa.eu/info/law/law-topic/data-protection/data-protection-eu_en

5 Usability Evaluation – Test Results and Analysis

Data analysis were made and presented using MS Excel (Microsoft Excel for Office 365 MSO). The results of tasks documented in the evaluation protocol were presented in charts. The mean (average) grades given to the statements on the questionnaire were calculated for each of twenty-eight questions and presented in charts. Besides, the mean grade of each group of questions was compared with one another as well as the range and standard deviation (SD) of grades within individual questions. The results of the usability questionnaire were also analysed for age groups, gender and education and their average grades were presented in charts.

Data from the evaluation protocol containing information on task accomplishment are presented below in the section 5.1, while the section 5.2 contains the results of usability questionnaire.

5.1 Usability Testing and Evaluation protocol

Figure 18 presents the percentage of autonomous and assisted connections to the usability evaluation sessions.

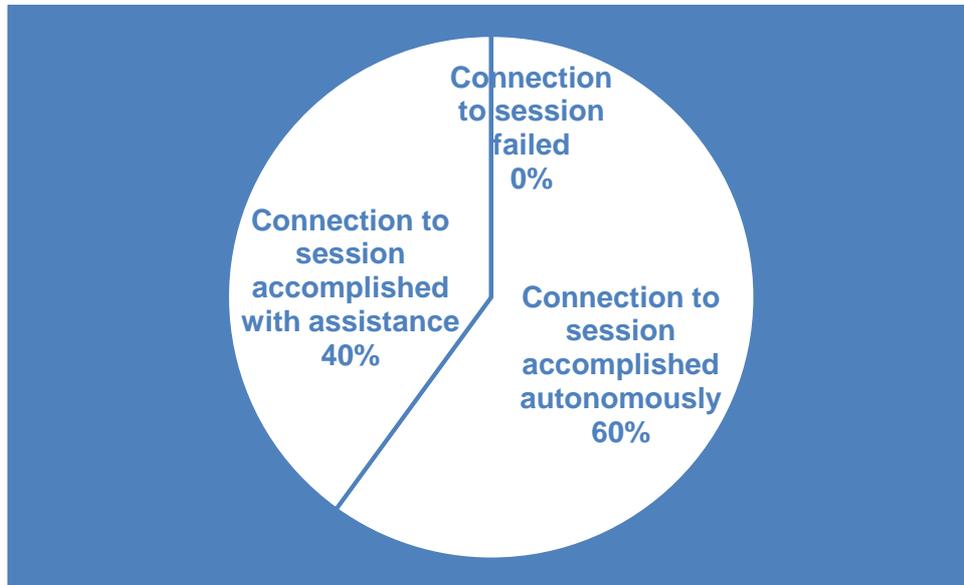


Figure 18. Percentage of autonomous/assisted connections to the usability evaluation sessions.

Out of ten participants, six have managed to connect to the usability evaluation session without any assistance. Other four participants needed assistance with Firefox prior to testing. Two of them did not have it installed and were assisted via Skype. Another two participants had Firefox installed but could not use the URL link because it was opened in a default browser other than Firefox. They were helped to copy/paste the URL into Firefox.

An overview on accomplishment of all eight testing tasks per participant is presented on the Figure 19.

Four participants accomplished autonomously all eight tasks. Three participants needed assistance with one task; one participant was assisted with two tasks and one with three, while one participant needed assistance with four tasks.

5 Usability Evaluation – Test Results and Analysis

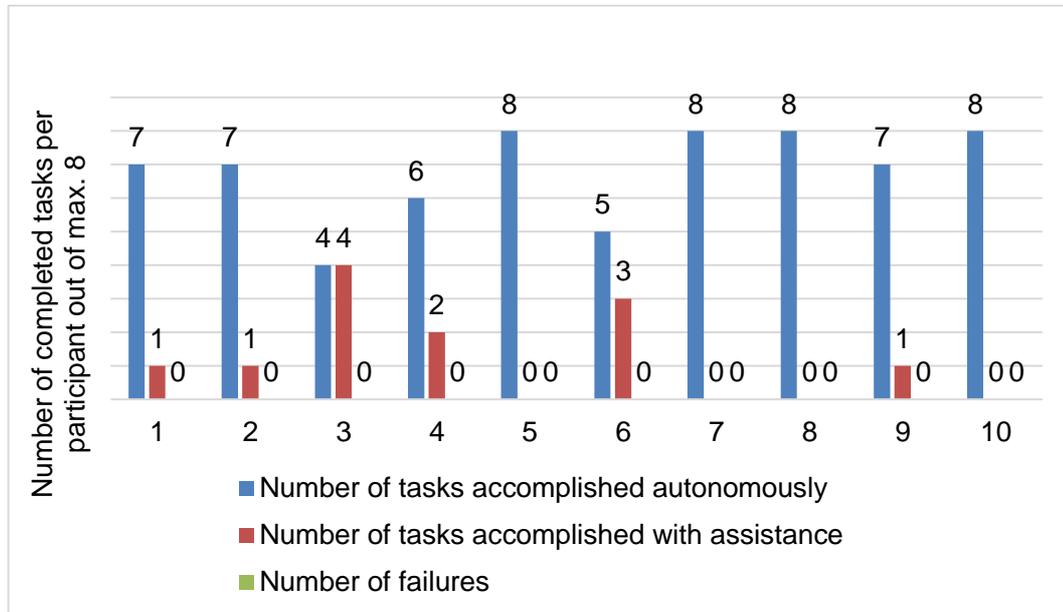


Figure 19. Overview on tasks accomplishment per participant.

Task 1. Turn a video and audio on! – The task was accomplished autonomously by all ten participants. One of participants asked if both the video and audio are activated with one command only.

Task 2. Share your screen! – Eight participants were able to share their screen (desktop) without any assistance, while two were assisted because they did not understand a language on a drop-down menu and needed translation.

Task 3. Find a word document of your choice, share your screen, and read and discuss the document! – Unlike seven participants who found a word document of their choice and shared it, three participants needed assistance. Two of them could not find a Windows Explorer while having the IADL-SP all over the screen. Another one pressed a wrong button not allowing the screen to be shared and had to repeat the command. None of them could scroll up and down a document. In that case the screen-sharing operated similarly to the screen capture rather than a real-time screen-sharing. This was manifested in the inability to share, i.e. to display other parts of a document without calling the screen-sharing function newly by turning the screen-sharing button off/on. The screen must have been shared newly when changing a document too. Furthermore, only a previously open, i.e. active document, could have been shared. The size of screen was satisfying as well as the size of a shared document. Regarding the reading of a displayed document, all the participants have easily indicated words or parts of a document and discuss them with the examiner.

5 Usability Evaluation – Test Results and Analysis

Task 4. Choose a website, share your screen, and read and discuss the content of the website! – This task was accomplished autonomously by six participants. Four of them needed assistance as no website was offered on their drop-down menu. This required steps such as turning the screen-sharing off, finding and opening a website in Firefox, turning the screen-sharing on, choosing the website and allowing the access. Scrolling up and down by sharing websites was functioning smoothly. Likewise sharing of the documents, all the participants found the discussion of the content of the shared website useful.

Task 5. Highlight a word on a shared document with a drawing tool (pen)! – The task was accomplished by all ten participants autonomously. Drawing on a shared word document was functioning well, while a drawing on a shared website was not visible until the website was closed, making all the drawings visible on a black screen that remained after closing the website. The draw-over tool was considered to be useful complementary tool for pointing out words and parts of documents to be discussed.

Task 6. See the screen of the examiner and write on it using a drawing tool (pen)! – Like the previous task, this task was absolved by all the participants without any assistance.

Task 7. Write/read a text message! – Eight participants could write and read the messages without assistance, while two of them did not find the scrollbar right at the beginning.

Task 8. Turn a video and audio connection off and on! – All ten participants were turning on/off video and audio without any assistance and found the possibility to switch them off during connection useful.

Major remarks regarding the user-interface and workflow (e.g. problems with screen-sharing) documented in the evaluation protocol during the testing and described above in the descriptions of tasks accomplishments, are listed in the Table 11.

Other participants' remarks collected during the usability testing were mostly regarding colours and contrasts. The colour of the starting screen was considered to be pleasant. Three participants suggested to have the word "Start" written with a colour stronger than white. Due to its bright colour, the scroll-bar was not recognised by two participants, who required assistance. In addition, the buttons seemed inactive to four participants for the same reason.

5 Usability Evaluation – Test Results and Analysis

Table 11. Participants' comments (loud thinking) during the evaluation test.

Subject	Description
Screen-sharing	Screen-sharing possible only when a document or website is active.
Screen-sharing	By changing a document to be shared, the screen-sharing button must be turned off/on.
Screen-sharing	Scrolling up/down of a document is not displayed, i.e. shared.
Drawing-over	Visible on a word or pdf document only.
Size of the shared screen	Satisfying.
Colours and contrasts	Too bright letters and discrete colours of buttons that make them look inactive.
User-Interface elements	Amount and size are satisfying; Icon for screen-sharing inappropriate; Scrollbar too discrete; To use pictures or other signifiers instead of a text in a dropdown list to make the understanding independent from a knowledge of any foreign language.

5.2 Usability Questionnaire

General Data

A part of usability questionnaire was reserved for answering questions on demographic and other general data. Apart from the information on age, gender and education that was presented in the section 4.2 (Test Participants), the participants provided some information on frequency and purpose of using computer. Out of ten participants, five participants use a computer daily, two participants use it sometimes and often respectively, and only one use it rarely. Frequency of use is presented on the Figure 20.

5 Usability Evaluation – Test Results and Analysis

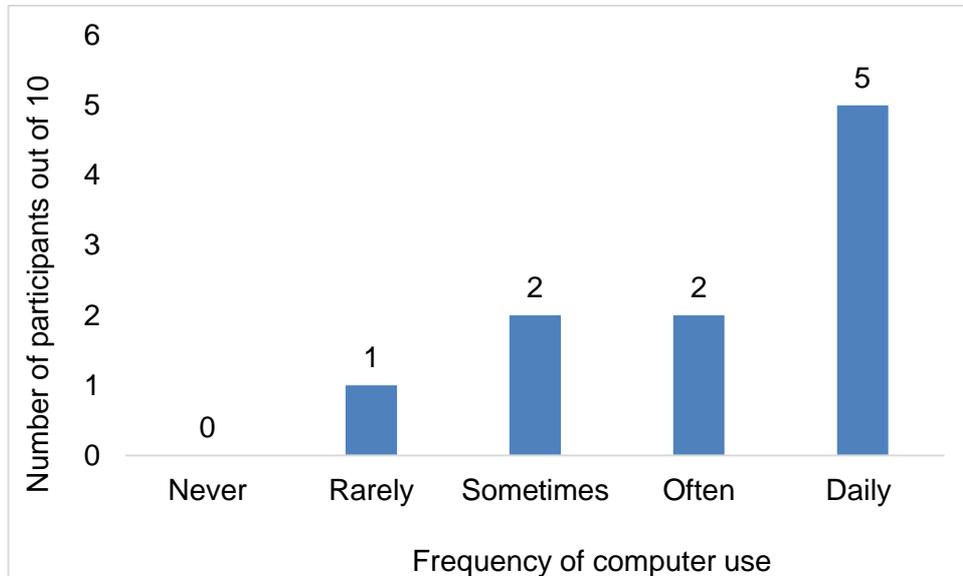


Figure 20. Frequency of computer use among 10 participants.

Regarding the purpose of computer use, social media and messengers are popular among the most of participants (nine), while the least used are online services and office package (four). These and information on use for other purpose such as email communication, online services (online shopping, online banking), playing games, and searching the internet are presented on Figure 21.

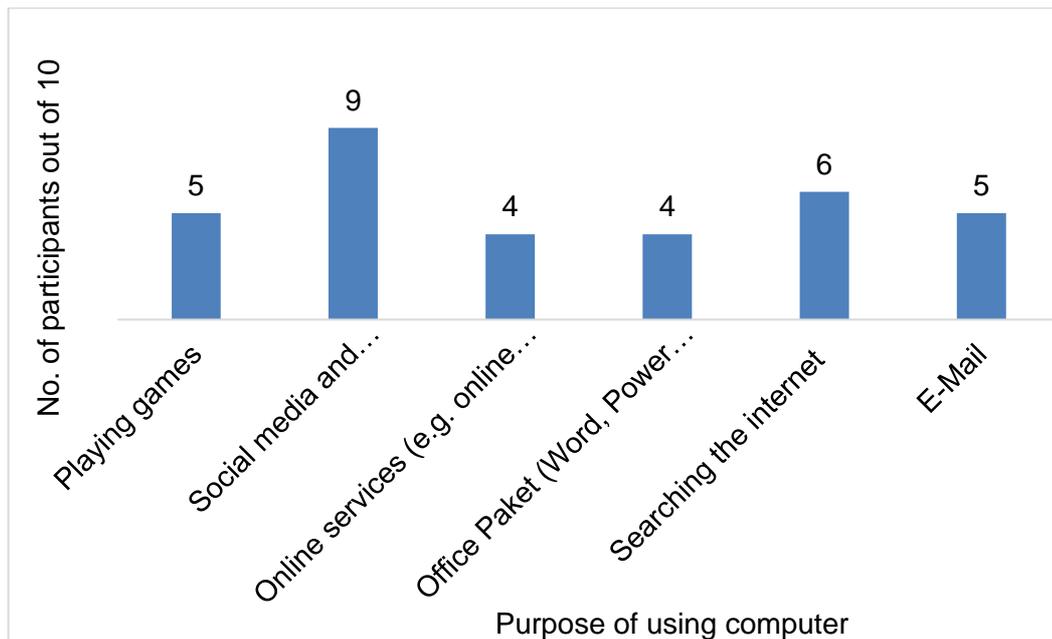


Figure 21. Purpose of using computer – total number of participants out of 10.

Furthermore, they have provided information on how often they experience problems with Instrumental Activities of Daily Living of any kind (see Figure 22).

5 Usability Evaluation – Test Results and Analysis

Problems occur rarely and often by two and three participants respectively, while five participants describe the frequency of problems occurrence as “sometimes”, but all admit that both the assessment and understanding of terms such as “rarely, sometimes, often” are subjective and unreliable.

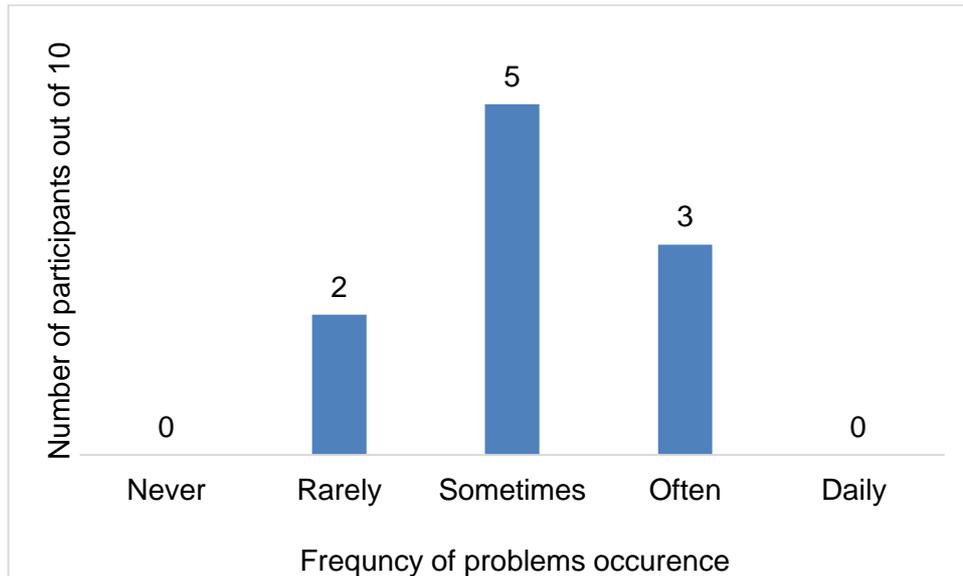


Figure 22. Frequency of occurrence of problems in IADL of any kind.

Results of the Usability Questionnaire

Each of twenty-eight questions offered the five Likert-like scale answers in a grade range from one to five (1-5). The Figure 23 presents the comparison of average grades of four groups of questions, Ease of Use, Ease of Learning, Usefulness and Satisfaction rated by all the participants.

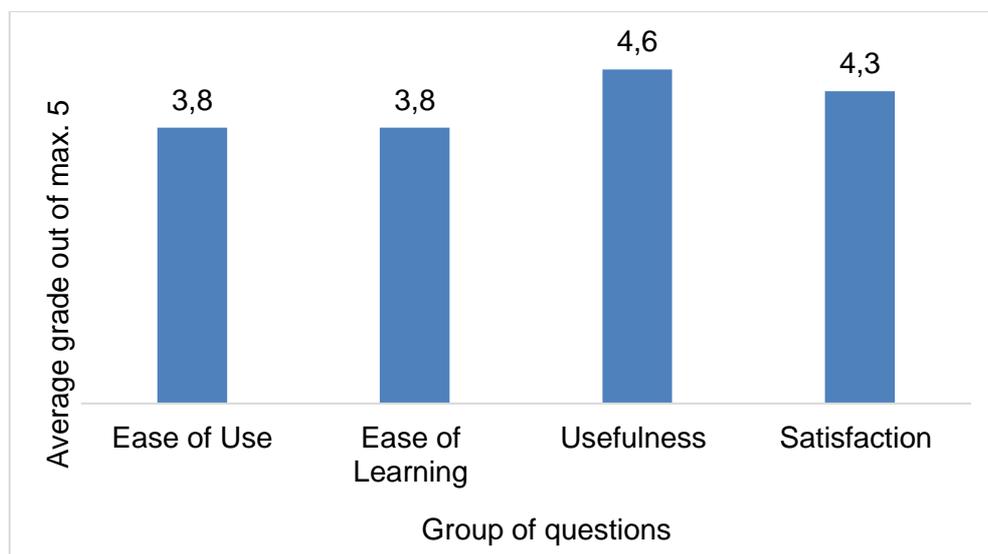


Figure 23. Comparison of average grades between four groups of questions.

5 Usability Evaluation – Test Results and Analysis

Both Ease of Use and Ease of Learning have the average grades 3,8 and are lower than average grades given to the groups of questions Usefulness and Satisfaction.

Comparison of grades given to the questions within the groups is described below.

The average, i.e. mean grades among the questions within the group Ease of Use vary between the grade 4,4 given to the question one (It is simple to start the program) and four (The size of screen is good, I can read a document without problem), the grade 3,1 to the question five (Colours and contrast of icons are appropriate) and grade 3 for the question seven (I do not need to make notes and memos to remember how to use it). In regard to grades within the individual questions, the lowest grade 4 and the highest 5 were given to the questions one and four, resulting in range of 1 and SD of $\sigma=0,46$. The range of the question five is 2 (with the highest grade 4 and the lowest 2), and standard deviation (SD) is $\sigma=0,54$. The range and standard deviation (SD) of the question seven are 3 and $\sigma=0,89$ respectively, where the lowest grade 2 has been given by three participants and highest grade 5 by one participant. The average grades of Ease of Use questions are presented on the Figure 24.

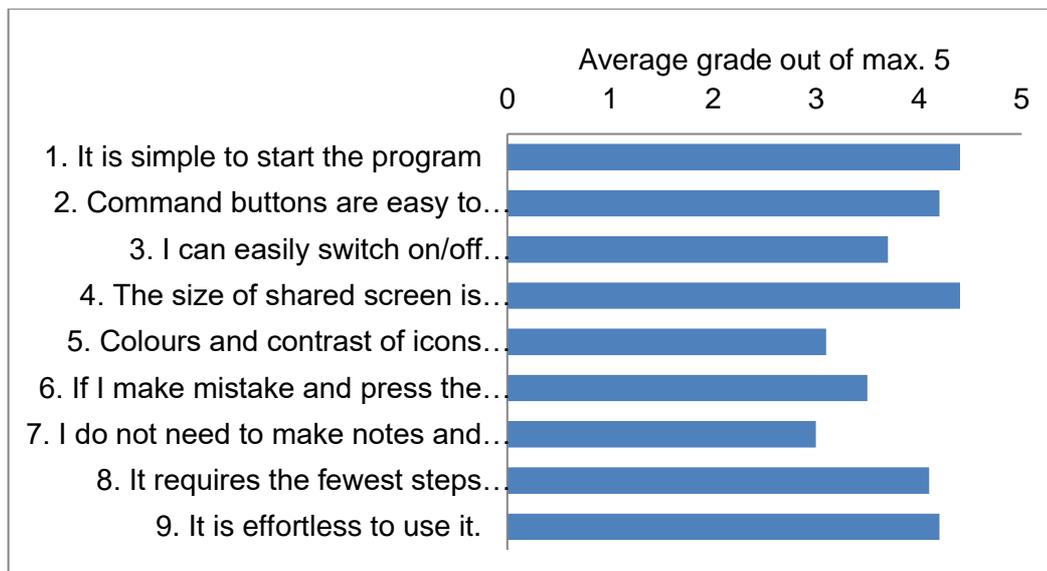


Figure 24. Average grades of questions on Ease of Use.

The average grade (mean) of the Ease of Use group of questions is compared between the age groups and shows a declining trend towards higher age groups as presented below with a line chart on the Figure 25.

5 Usability Evaluation – Test Results and Analysis

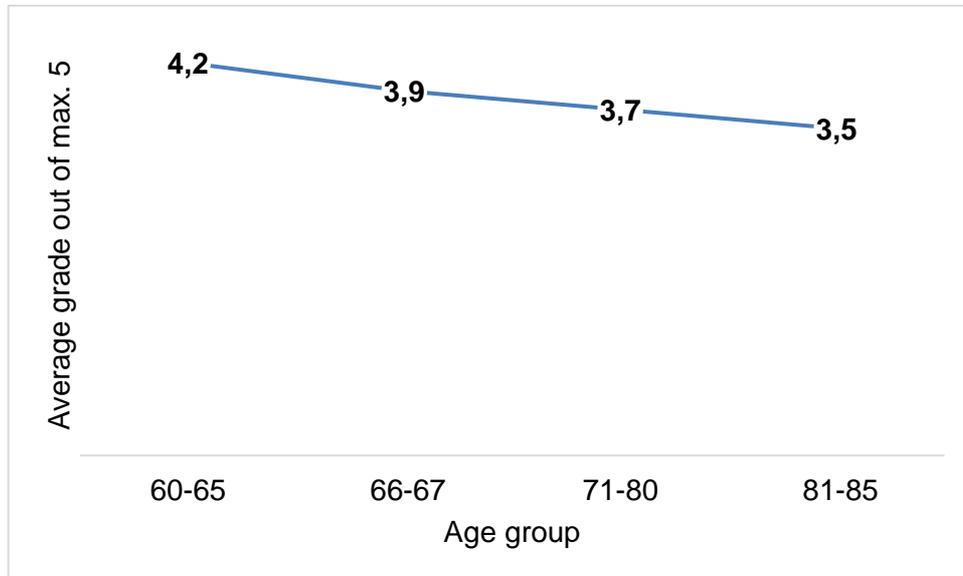


Figure 25. Average grade for Ease of Use questions per age group.

The mean grades of four questions of the group Ease of Learning are presented on the Figure 26. The question thirteen (It does not require advanced computer knowledge) was rated with the highest grades 4 by six participants and 5 by four participants, resulting in average grade 4,4 with a range of 1 and SD of $\sigma=0,48$.

The question ten (It is easy to understand how it works) follows with average grade 4,3, that has a range of 2 due to the highest grade 5 and the lowest 3. The SD is $\sigma=0,64$.

The questions eleven (I learned to use it quickly) and twelve (It is intuitive) were rated with a mean grade 3,2 and 3,4 respectively. The best grade 4 out of maximum 5 was given to the question eleven by four participants, and the lowest grade 2 by two participants, resulting in range of 2 and SD of $\sigma=0,75$.

The question twelve was rated with the highest grade 4 given by four participants, while six participants rated it with the grade 3. That resulted in a range of 1 and SD $\sigma=0,49$.

5 Usability Evaluation – Test Results and Analysis

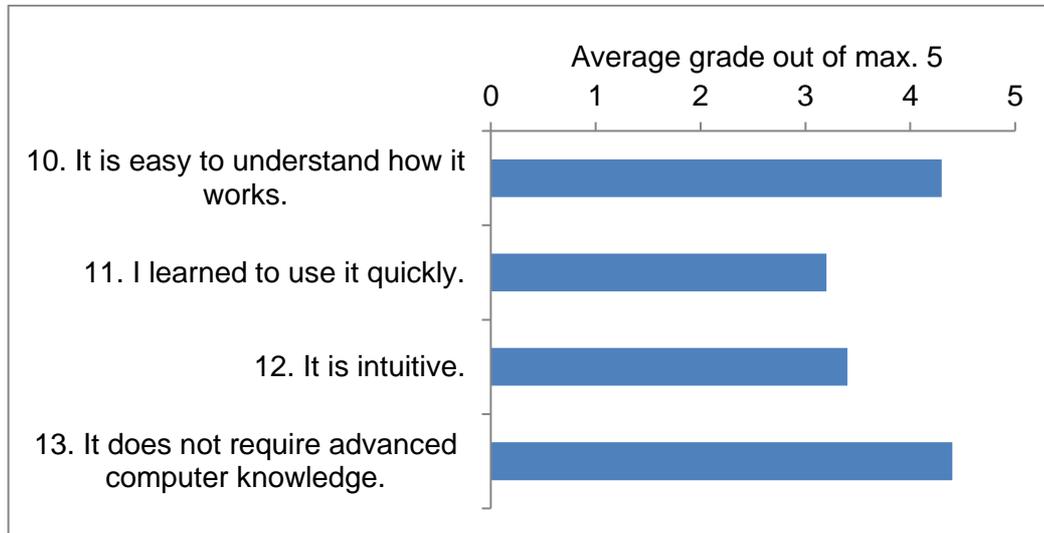


Figure 26. Average grades for questions on Ease of Learning.

As in the Ease of Use group, the average grade of the Ease of Learning group shows decline towards the older age (see Figure 27).

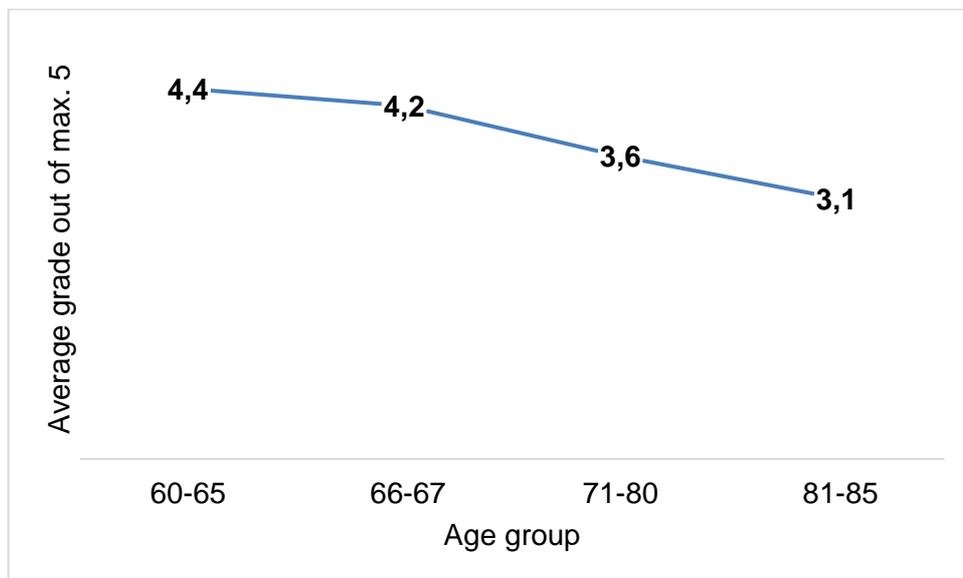


Figure 27. Average grade per age group for Ease of Learning questions.

The results of analysis of individual questions in the Usefulness group show higher average grades (see Figure 28). The questions seventeen (Video connection is an important part of it) and eighteen (screen-sharing is useful for explaining or being explained) were rated with the highest grades 5 by all ten participants.

5 Usability Evaluation – Test Results and Analysis

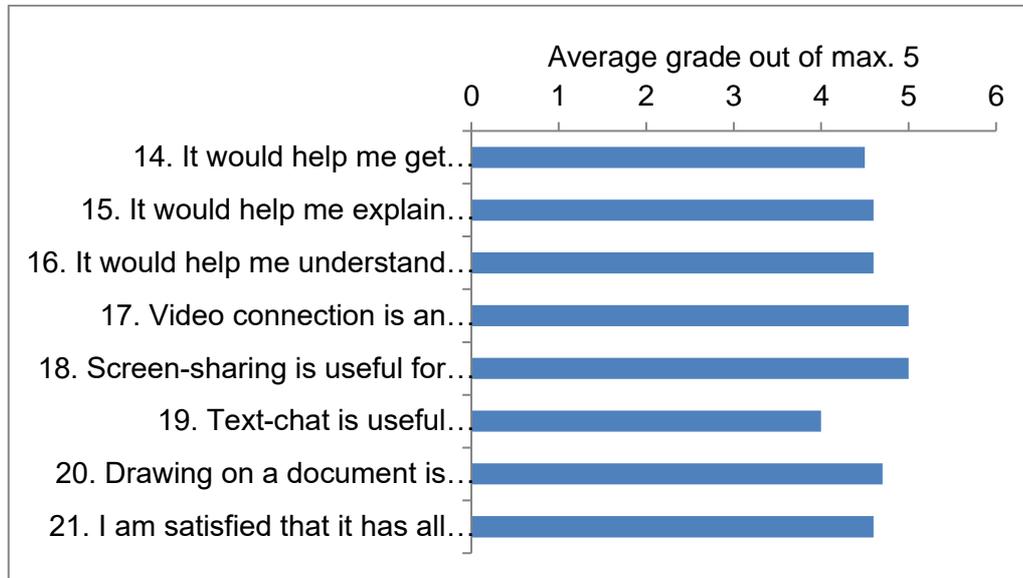


Figure 28. Average grades for questions on Usefulness.

The other questions in the group were also highly rated with the highest grade 5 and the lowest 4, resulting with the group average grade 4,6.

Unlike in Ease of Use and Ease of Learning, the average grade for the group Usefulness shows an increase towards the age group 71-80 and a slight decrease in the group of 81-85 year old people (see Figure 29).

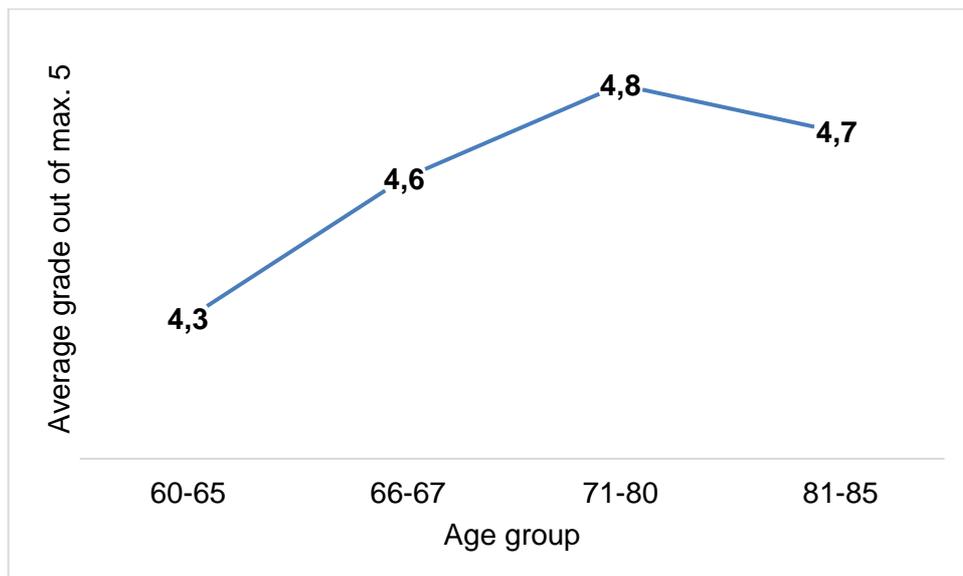


Figure 29. Average grade per age group for Usefulness.

Finally, the average grades given to the individual questions within the group Satisfaction are illustrated on the Figure 30. The highest possible grade 5 was

5 Usability Evaluation – Test Results and Analysis

given to the question twenty-five (I like to be helped by a real person and not by a machine) by all ten participants.

Possibility to have a face to face contact was rated with the average grade 4,8, where eight participants gave the grade 5 and four participants the grade 4. Similarly, the importance of a face to face communication in general assessed in the question twenty-seven was rated by all ten participants with either 5 or 4, resulting in the average of 4,5.

Overall satisfaction rated in the question twenty-eight was with the average grade 4,7 also high. Slightly lower average grade 4,3 was given to the question twenty-three (When I need assistance, I would use it rather than a telephone).

The question 22 (It is fun to be helped on this way) was rated with lower grades (minimum grade was 3 and maximum 4), resulting in the average 3,8 and range 2, and the SD of $\sigma=0,60$.

The lowest rated question was twenty-six (I like that it offers possibility to have a group video-meeting) to which one participant gave the grade 2, seven participants grade 3, and two participants grade 4, that resulted in the average grade 3,1, the range of 2 and the SD of $\sigma=0,54$.

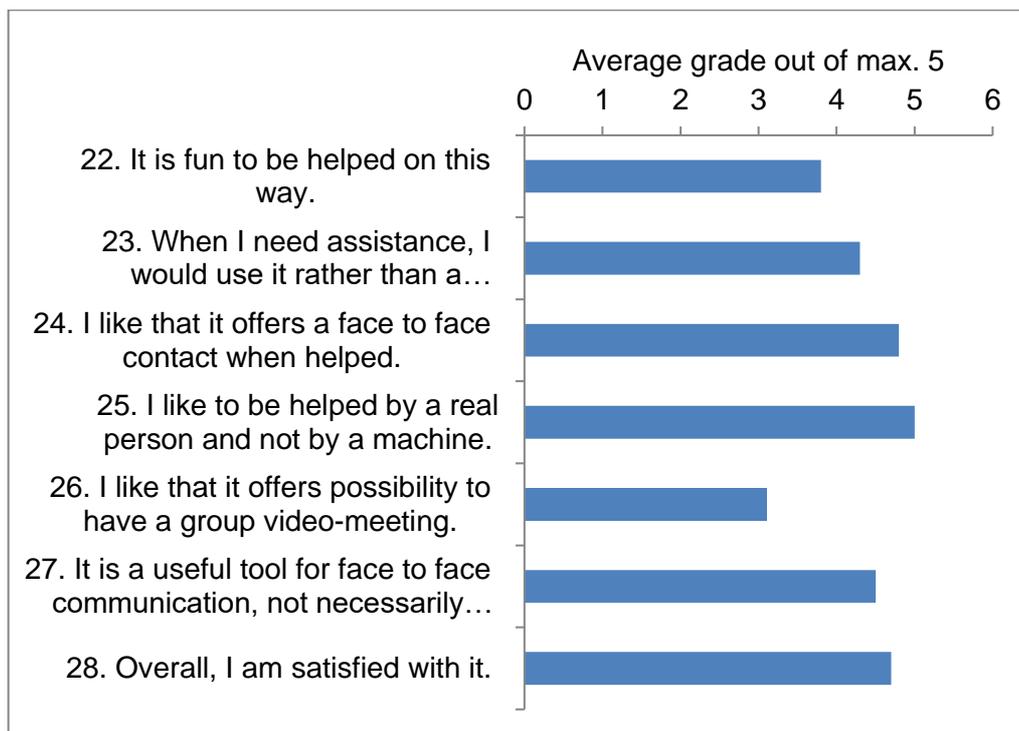


Figure 30. Average grades for questions on Satisfaction.

5 Usability Evaluation – Test Results and Analysis

Like for the Usefulness, the average grade for Satisfaction was increasing in the older age, reaching the maximum average of 4,4 in the age groups of 71-80 and 81-85 year old participants (see Figure 31).

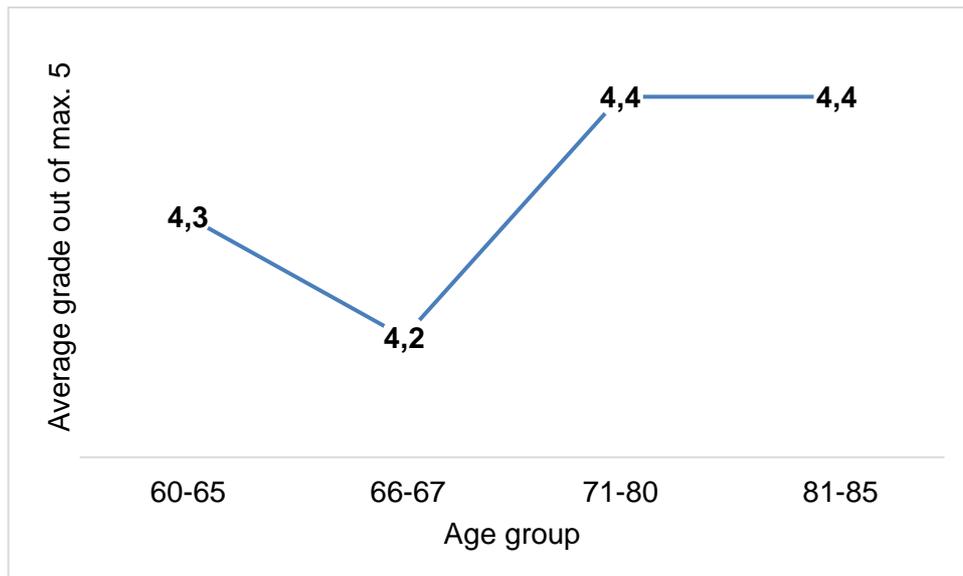


Figure 31. Average grade per age group for questions on Satisfaction.

Finally, the average grades of four groups were compared in regard to gender and educational background. Figure 32 shows a slight difference between the average grades given by females and males for the groups Ease of Learning and Ease of Use, while the groups Usefulness and Satisfaction were graded equally by both groups.

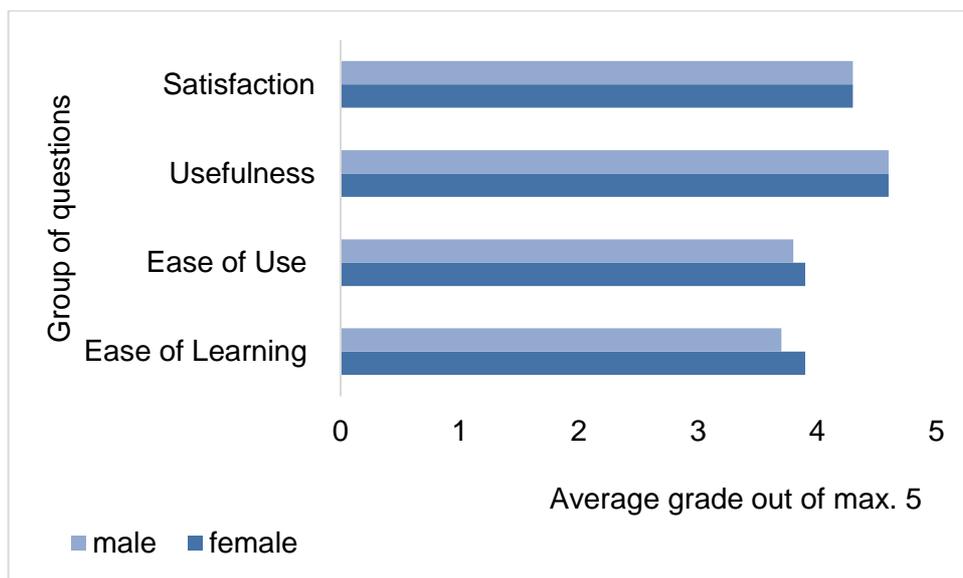


Figure 32. Comparison of average grades/group of questions per gender.

5 Usability Evaluation – Test Results and Analysis

When compared in regard to educational background, the Ease of Use and Ease of Learning were rated with slightly lower grades by the participants with a high school (3,7 and 3,5), who gave higher grades in average to the groups Usefulness (4,8) and Satisfaction (4,4) as presented on the Figure 33.

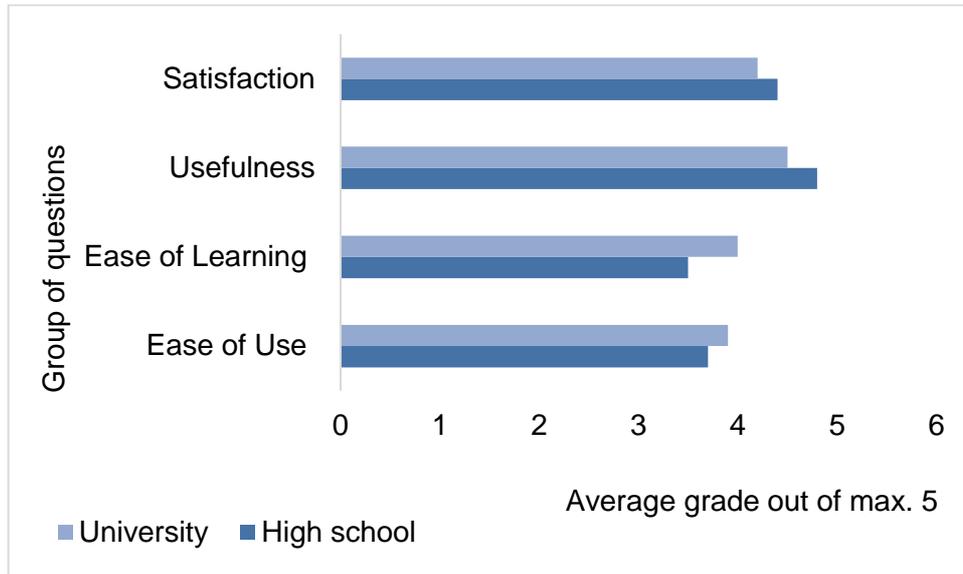


Figure 33. Comparison of groups' average grades per educational background.

6 Discussion and Conclusion

The aim of this work was to develop and evaluate a simple and user-friendly online platform for older people that would help them get assistance with reading digital documents and records they need for carrying out Instrumental Activities of Daily Living. This chapter contains a discussion about the main findings reflected on the user interface and workflow, and the interpretation of the usability questionnaire results in the context of research questions.

6.1 User Interface and Workflow

The IADL-SP has been created combining services and infrastructure of four third-parties (OpenTok, GitHub, Heroku and MongoDB) and was based on a React sample app that integrated some predefined OpenTok libraries and hardcodes, which could not be changed and/or fully adapted to the aim of the development of the IADL-SP. That resulted in limitations of some functions influencing the smooth workflow such as the inline installation of the Chrome screen-sharing extension that was, due to security reasons, disabled¹⁸ and needed to be installed directly from the Chrome Web Store. However, this might have been the reason for the incompatibility of the Chrome screen-sharing extension with the IADL-SP codes that was reporting an error i.e. inability to share a screen in Chrome. Microsoft Edge has not been used because it does not support a publishing of screen-sharing streams¹⁹. Unlike Microsoft Edge, Internet Explorer has had a screen-sharing support built-in²⁰, however it also did not work properly for the IADL-SP. For these reasons, the IADL-SP was developed for use in Firefox only. Furthermore, initial connections to the servers were resulting in repeated failed connection attempts. They have been most probably caused by delayed start-up from a sleep mode into which Heroku goes after prolonged inactivity. In the gap between the sleep mode and start, the

¹⁸ <https://blog.chromium.org/2018/06/improving-extension-transparency-for.html>

¹⁹ "Edge Browser Support (beta)." [Online]. Available: <https://tokbox.com/developer/beta/edge/>

²⁰ "Screen sharing - OpenTok docs." [Online]. Available: <https://tokbox.com/developer/guides/screen-sharing/js/>

6 Discussion and Conclusion

server on Heroku is shortly unavailable. By using professional Heroku account that is more stable instead of the free version used for this work, this would most likely not happen.

These and all other findings and suggestions for improvement of the user interface and workflow, which were collected during the development and evaluation and presented in the results (section 5.1), would be fixed and implemented in the course of eventual future development of the IADL-SP.

Some additional features and solutions may be explored and added, e.g.:

- Magnifier or a zoom-in function that was partially functioning in this version of the application. Zooming-in was changing only the size of video-window (container) leaving the size of a shared document unchanged.
- Documents transfer that would require the integration of other features e.g. camera/scanner.
- Displaying documents using a video-camera. IADL-SP showed a mirror writing - like effect that did not allow reading.
- Document reader to be used by people with visual impairment.
- Using the IADL-SP as a desktop app.

6.2 Usability Questionnaire and Research Questions

The issues regarding the user-interface of the IADL-SP, recognised during the development and evaluation phase, had an influence on participants' performance during the usability test with consequent lower grades of Ease of Use and Ease of Learning in comparison with the grades of Usefulness and Satisfaction. The reason for that might be that both groups of questions, Ease of Use and Ease of Learning were requiring participants' technical performance, while their answers on questions regarding Usefulness and Satisfaction were based on their subjective assessment of the IADL-SP projected in their real daily life scenario. The latter were also partly tailored to assess the importance of personal and personalised help in comparison with the pure robotic one, as well as the need for face to face contact.

Participants' "loud thinking" such as "With a bit more time for exercising I would do it better.", "I wish the computer could talk and tell me what to do.", "Will the connection be lost when I look for a document to share?", "Why the buttons look like shadows? Are they active?", "Do I start both the video and audio with one

6 Discussion and Conclusion

click?” have proved that the reduction of functions and commands of an application does not necessarily make it easily understandable for an old person without computer knowledge. Decline of the average grades for the groups of questions on Ease of Use and Ease of Learning, in which the grades for some individual attributes such as the ability of using the IADL-SP without reminders declined to 2,7 in the older age groups (for 71-80 year old) and to very low 2 (disagree) (81-85 year old), has justified the need for further improvement that would make the IADL-SP more intuitive, learnable and easier for use. It is worth mentioning that the longer and more detailed instructions could improve Ease of Learning and most probably Ease of Use, as these two attributes seem to be in correlation according to Lund [13]. Correlation would not be significant due to very small sample size and was therefore not calculated.

To answer the initial question (**Q1**) if a web-based IADL-SP for Instrumental Activities of Daily Living with functionality for real-time video connection, text-chat and screen-sharing with a draw-over function helps older people get assistance in reading of digital documents and records, the results of the questionnaire give the following answer – Very good average total grade 4,1 of maximum 5 on the Likert scale from 1 to 5, with 84,3% of grades 4 (agree) and 5 (fully agree), only 14,3% of grade 3 (neither agree nor disagree), and 1,4% of grade 2 (disagree) among 70 answers on Satisfaction, show that the majority of participants are overall satisfied with the prototype. The online video conversation proved to be especially important to understand the message and meaning of the shown documents leading to improvement of reading comprehension.

The second question (**Q2**) asks if a web-based IADL Service Platform prototype prove to be useful in a limited usability evaluation that involves ten test participants in a closed test scenario about reading comprehension of digital documents and records necessary for conducting their Instrumental Activities of Daily Living. The average grade 3,8 for both Ease of Use and Ease of Learning, as well as high average grades for individual questions such as simplicity of starting the program (4,4) and the simplicity of use (4,2), the ease of understanding (4,3), and the ability to use it without advanced computer knowledge (4,4), complemented with a high satisfaction with particular functions such as screen-sharing (5) and draw-over (4,7), have proved that the participants consider the IADL-SP to be useful despite of its limited functionality at this development stage.

Questions on gender and educational background were collected and presented for experiment only without research on this topic that should have preceded the evaluation, and any conclusion based on them would be speculative. However,

6 Discussion and Conclusion

the potential initiative for further development would require much bigger sample size and stronger involvement of end users in all phases of development.

There is a growing need for solutions which assist the elderly in management of their activities such as management of personal finances, personal healthcare and household management, whereas the number of solutions which offer help is still limited [8], [54]. On the other side, there are projects which solely focus on social inclusion of elders supported by online social networks and platforms. The IADL-SP combines both social inclusion and assistance that old people need, thus has a potential to become a platform tailored to meet their habits, wants and needs, the level of knowledge and skill, and to support them in coping with contemporary societal requirements and challenges.

Literature

- [1] WHO, National Institute on Aging, National Institutes of Health, "Global Health and Aging," 1 1-7737, 2011.
- [2] WHO, "Ageing and health," 2018. [Online]. Available: <http://www.who.int/news-room/fact-sheets/detail/ageing-and-health>. [Accessed: 21-Jul-2018].
- [3] E. Vaportzis, M. Giatsi Clausen, and A. J. Gow, "Older Adults Perceptions of Technology and Barriers to Interacting with Tablet Computers: A Focus Group Study," *Front Psychol*, vol. 8, Oct. 2017.
- [4] S. J. Czaja *et al.*, "Factors Predicting the Use of Technology: Findings From the Center for Research and Education on Aging and Technology Enhancement (CREATE)," *Psychol Aging*, vol. 21, no. 2, pp. 333–352, Jun. 2006.
- [5] S. J. Czaja, C. C. Lee, J. Branham, and P. Remis, "OASIS Connections: Results From an Evaluation Study," *Gerontologist*, vol. 52, no. 5, pp. 712–721, Oct. 2012.
- [6] L. S. Noelker and R. Browdie, "Sidney Katz, MD: A New Paradigm for Chronic Illness and Long-Term Care," *Gerontologist*, vol. 54, no. 1, pp. 13–20, Feb. 2014.
- [7] M. P. Lawton and E. M. Brody, "Assessment of older people: self-maintaining and instrumental activities of daily living.," *Gerontologist*, vol. 9, no. 3, pp. 179–186, Autumn 1969.
- [8] S. MacLeod, S. Musich, K. Hawkins, and D. G. Armstrong, "The growing need for resources to help older adults manage their financial and healthcare choices," *BMC Geriatr*, vol. 17, Apr. 2017.
- [9] S. Charles and L. L. Carstensen, "Social and Emotional Aging," *Annu Rev Psychol*, vol. 61, pp. 383–409, 2010.
- [10] S. Kemper and J. C. Lacaal, *Addressing the Communication Needs of an Aging Society*, vol. Technology for Adaptive Aging. National Academies Press (US), 2004.
- [11] J. Doppler, C. Gradl, S. Sommer, and G. Rottermann, "Improving User Engagement and Social Participation of Elderly People Through a TV and Tablet-Based Communication and Entertainment Platform," in *Computers Helping People with Special Needs*, 2018, pp. 365–373.
- [12] L. Salmeron, H. Strømsø, Y. Kammerer, M. Stadtler, and P. van den Broek, "Comprehension processes in digital reading," in *Learning to read in a digital world*, John Benjamins, 2017.
- [13] Lund, A., "(PDF) Measuring Usability with the USE Questionnaire," *ResearchGate*, 2001. [Online]. Available: https://www.researchgate.net/publication/230786746_Measuring_Usability_with_the_USE_Questionnaire. [Accessed: 25-Nov-2018].
- [14] Eurostat, "People in the EU: who are we and how do we live?," 2015, Nov. 2015.

- [15] "Population of Europe (2018) - Worldometers." [Online]. Available: <http://www.worldometers.info/world-population/europe-population/>. [Accessed: 19-Dec-2018].
- [16] "People in the EU - statistics on an ageing society - Statistics Explained." [Online]. Available: https://ec.europa.eu/eurostat/statistics-explained/index.php/People_in_the_EU_-_statistics_on_an_ageing_society. [Accessed: 19-Dec-2018].
- [17] R. Dobbs *et al.*, "Urban world: The global consumers to watch | McKinsey." [Online]. Available: <https://www.mckinsey.com/featured-insights/urbanization/urban-world-the-global-consumers-to-watch>. [Accessed: 19-Dec-2018].
- [18] R. Dobbs, J. Remes, and J. Woetzel, "Emerging Demographics Are the New Emerging Markets," *Harvard Business Review*, 13-Jul-2016.
- [19] A. Young, "Ageing and physiological functions.," *Philos Trans R Soc Lond B Biol Sci*, vol. 352, no. 1363, pp. 1837–1843, Dec. 1997.
- [20] The American Geriatrics Society's Health in Aging Foundation, "Eldercare At Home: Problems Of Daily Living. Resources. Health in Aging," 2018. [Online]. Available: <http://www.healthinaging.org/resources/resource:eldercare-at-home-problems-of-daily-living/>. [Accessed: 22-Jul-2018].
- [21] G. R. Boss and J. E. Seegmiller, "Age-Related Physiological Changes and Their Clinical Significance," *West J Med*, vol. 135, no. 6, pp. 434–440, Dec. 1981.
- [22] D. B. Elliott, M. Trukolo-Ilic, J. G. Strong, R. Pace, A. Plotkin, and P. Bevers, "Demographic characteristics of the vision-disabled elderly.," *Invest. Ophthalmol. Vis. Sci.*, vol. 38, no. 12, pp. 2566–2575, Nov. 1997.
- [23] D. L. Murman, "The Impact of Age on Cognition," *Semin Hear*, vol. 36, no. 3, pp. 111–121, Aug. 2015.
- [24] C. Graf, "The Lawton Instrumental Activities of Daily Living Scale.," *AJN, American Journal of Nursing*, vol. 108, no. 4, pp. 52–62, Apr. 2008.
- [25] J. W. Rowe and R. L. Kahn, "Human aging: usual and successful," *Science*, vol. 237, no. 4811, pp. 143–149, Jul. 1987.
- [26] J. C. Millán-Calenti *et al.*, "Prevalence of functional disability in activities of daily living (ADL), instrumental activities of daily living (IADL) and associated factors, as predictors of morbidity and mortality," *Archives of Gerontology and Geriatrics*, vol. 50, no. 3, pp. 306–310, May 2010.
- [27] D. Lesakova, "Seniors and Their Food Shopping Behavior: An Empirical Analysis," *Procedia - Social and Behavioral Sciences*, vol. 220, pp. 243–250, May 2016.
- [28] M. Wilhelm and J. M. Ruscin, "The Use of OTC Medications in Older Adults," *US Pharm.*, vol. 34, no. 6, pp. 44–47, 2009.
- [29] S. Paul, S. Marconi, M. Gohain, and A. Bhatt, "Senior citizens and over the counter drugs: challenges in rural India," *International Journal of Research in Medical Sciences*, pp. 1446–1449, 2016.
- [30] M. Á. Piñero-López, P. Modamio, C. F. Lastra, and E. L. Mariño, "Readability Analysis of the Package Leaflets for Biological Medicines Available on the Internet Between 2007 and 2013: An Analytical Longitudinal Study," *J Med Internet Res*, vol. 18, no. 5, May 2016.
- [31] T. C. Davis *et al.*, "Improving Patient Understanding of Prescription Drug Label Instructions," *J Gen Intern Med*, vol. 24, no. 1, pp. 57–62, Jan. 2009.

- [32] S. Graham and J. Brookey, "Do Patients Understand?," *Perm J*, vol. 12, no. 3, pp. 67–69, 2008.
- [33] "Substance Abuse and Misuse in Older Adults." [Online]. Available: <http://www.todaysgeriatricmedicine.com/archive/071708p20.shtml>. [Accessed: 24-Dec-2018].
- [34] E. Castle *et al.*, "Neural and behavioral bases of age differences in perceptions of trust," *Proc Natl Acad Sci U S A*, vol. 109, no. 51, pp. 20848–20852, Dec. 2012.
- [35] B. Niehaves and R. Plattfaut, "Internet adoption by the elderly: employing IS technology acceptance theories for understanding the age-related digital divide," *European Journal of Information Systems*, vol. 23, no. 6, pp. 708–726, Nov. 2014.
- [36] "4 Tips for Marketing to Baby Boomers in the Digital Age," *Contently*, 16-Jul-2014. [Online]. Available: <https://contently.com/2014/07/16/4-tips-for-marketing-to-baby-boomers-in-the-digital-age/>. [Accessed: 19-Dec-2018].
- [37] M. B. Arensberg, "Population aging: opportunity for business expansion, an invitational paper presented at the Asia-Pacific Economic Cooperation (APEC) International Workshop on Adaptation to Population Aging Issues, July 17, 2017, Ha Noi, Viet Nam," *J Health Popul Nutr*, vol. 37, Apr. 2018.
- [38] R. K. Kalapatapu and M. A. Sullivan, "Prescription Use Disorders in Older Adults," *Am J Addict*, vol. 19, no. 6, pp. 515–522, Dec. 2010.
- [39] S. Loipha, "Thai Elderly Behavior of Internet Use," *Procedia - Social and Behavioral Sciences*, vol. 147, no. Supplement C, pp. 104–110, 2014.
- [40] N. M. Gell, D. E. Rosenberg, G. Demiris, A. Z. LaCroix, and K. V. Patel, "Patterns of Technology Use Among Older Adults With and Without Disabilities," *The Gerontologist*, vol. 55, no. 3, pp. 412–421, Jun. 2015.
- [41] F. Asmi and T. Ishaya, "Understanding the Behavior of the Elderly towards Internet Banking in the UK," 2012.
- [42] Mattila Minna, Heikki Karjaluoto, and Tapio Pentto, "Internet banking adoption among mature customers: early majority or laggards?," *Journal of Services Marketing*, vol. 17, no. 5, pp. 514–528, Sep. 2003.
- [43] B. E. Gavett, R. Zhao, S. E. John, C. A. Bussell, J. R. Roberts, and C. Yue, "Phishing suspiciousness in older and younger adults: The role of executive functioning," *PLoS One*, vol. 12, no. 2, Feb. 2017.
- [44] G. I. J. M. Kempen, J. Ballemans, A. V. Ranchor, G. H. M. B. van Rens, and G. A. R. Zijlstra, "The impact of low vision on activities of daily living, symptoms of depression, feelings of anxiety and social support in community-living older adults seeking vision rehabilitation services," *Qual Life Res*, vol. 21, no. 8, pp. 1405–1411, Oct. 2012.
- [45] H. Blazun, J. Vosner, P. Kokol, K. Saranto, and S. Rissanen, "Elderly people's interaction with advanced technology.," *Stud Health Technol Inform*, vol. 201, pp. 1–10, 2014.
- [46] B. I. Fox and B. G. Felkey, "Identifying and Addressing Technology Challenges Among Older Adults," *Hosp Pharm*, vol. 49, no. 8, pp. 780–781, Sep. 2014.
- [47] R. Schulz, H.-W. Wahl, J. T. Matthews, A. De Vito Dabbs, S. R. Beach, and S. J. Czaja, "Advancing the Aging and Technology Agenda in Gerontology," *Gerontologist*, vol. 55, no. 5, pp. 724–734, Oct. 2015.
- [48] R. Mansell, "Global access to information & communication technologies (GAI): priorities for action," p. 37.
- [49] "BRELOMATE 2. CDHI - Center for Digital Health Innovation | News." .

- [50] B. W. Kiat and W. Chen, "Mobile Instant Messaging for the Elderly," *Procedia Computer Science*, vol. 67, pp. 28–37, Jan. 2015.
- [51] V. Duarte Teixeira, C. Galinho Pires, F. Pinto, J. Freitas, M. Dias, and E. Mendes Rodrigues, "Towards elderly social integration using a multimodal human-computer interface," 2012.
- [52] W. J. Chopik, "The Benefits of Social Technology Use Among Older Adults Are Mediated by Reduced Loneliness," *Cyberpsychol Behav Soc Netw*, vol. 19, no. 9, pp. 551–556, Sep. 2016.
- [53] F. Boll and P. Brune, "Online Support for the Elderly – Why Service and Social Network Platforms should be Integrated," *Procedia Computer Science*, vol. 98, pp. 395–400, Jan. 2016.
- [54] "AAL programme: Funding for Active and Assisted Living," *Digital Single Market*. [Online]. Available: <https://ec.europa.eu/digital-single-market/en/active-and-assisted-living-joint-programme-aal-jp>. [Accessed: 24-Dec-2018].
- [55] P. Kitzing, A. Maier, and V. L. Ahlander, "Automatic speech recognition (ASR) and its use as a tool for assessment or therapy of voice, speech, and language disorders.," *Logoped Phoniatr Vocol*, vol. 34, no. 2, pp. 91–96, 2009.
- [56] A. Dohr, R. Modre-Opsrian, M. Drobics, D. Hayn, and G. Schreier, "The Internet of Things for Ambient Assisted Living," in *2010 Seventh International Conference on Information Technology: New Generations*, 2010, pp. 804–809.
- [57] V. K. Ravishankar, W. Burleson, and D. Mahoney, "Smart Home Strategies for User-Centered Functional Assessment of Older Adults," *AUSMT*, vol. 5, no. 4, pp. 233–242, Dec. 2015.
- [58] S. Majumder *et al.*, "Smart Homes for Elderly Healthcare—Recent Advances and Research Challenges," *Sensors (Basel)*, vol. 17, no. 11, Oct. 2017.
- [59] "WHO | Track 2: Health literacy and health behaviour," *WHO*. [Online]. Available: <https://www.who.int/healthpromotion/conferences/7gchp/track2/en/>. [Accessed: 19-Dec-2018].
- [60] N. Valtorta and B. Hanratty, "Loneliness, isolation and the health of older adults: do we need a new research agenda?," *J R Soc Med*, vol. 105, no. 12, pp. 518–522, Dec. 2012.
- [61] G. Nimrod, "Probing the Audience of Seniors' Online Communities," *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, vol. 68, no. 5, pp. 773–782, Sep. 2013.
- [62] D. Harley, K. Howland, E. Harris, and C. Redlich, "Online communities for older users: what can we learn from local community interactions to create social sites that work for older people," presented at the HCI 2014 - Sand, Sea and Sky - Holiday HCI, 2014, pp. 42–51.
- [63] S. T. M. Peek, E. J. M. Wouters, J. van Hoof, K. G. Luijkx, H. R. Boeije, and H. J. M. Vrijhoef, "Factors influencing acceptance of technology for aging in place: A systematic review," *International Journal of Medical Informatics*, vol. 83, no. 4, pp. 235–248, Apr. 2014.
- [64] S. Milne, "Taking back the interface for older people," *ACM SIGCAPH Computers and the Physically Handicapped*, no. 75, pp. 15–16, Jan. 2003.

- [65] A. Cooper, R. Reimann, D. Cronin, and A. Cooper, *About face 3: the essentials of interaction design*, [3rd ed.], Completely rev. & Updated. Indianapolis, IN: Wiley Pub, 2007.
- [66] Ferre et al, "Usability basics for software developers," *IEEE Software*, vol. 18, no. 1, pp. 22–29, Jan. 2001.
- [67] ISO 9241-11, "ISO 9241-11: Ergonomic requirements for office work with visual display terminals (VDTs) - Part 11: Guidance on usability." 1998.
- [68] K. Figl, "Deutschsprachige Fragebögen zur Usability-Evaluation im Vergleich.," *Zeitschrift für Arbeitswissenschaft*, pp. 4. pp. 321-337, 2010.

List of Figures

Figure 1. Median age of the EU population from 1965 to 2018 [15].	5
Figure 2. Use (%) of internet for communication, by age group among 28 EU country members in 2013 [14].....	13
Figure 3. Mock-up: Connecting to the IADL Service Platform and starting screen.	24
Figure 4. Mock-up: Video, screen-sharing and annotation.	24
Figure 5. Schematic illustration of the IADL Service Platform architecture.	28
Figure 6. The protocol for communication between the Client-side and Server-side.....	29
Figure 7. Workflow in an OpenTok session.....	32
Figure 8. Application interaction with the third-party frameworks.....	33
Figure 9. Start page of the IADL-SP.....	34
Figure 10. Choosing microphone and camera.	34
Figure 11. Functions - Command buttons.	35
Figure 12. Selection of a folder or document to be shared.	35
Figure 13. Allow the application to access the selected document.	36
Figure 14. Shared screen and buttons, i.e. tools for drawing on a selected document.....	36
Figure 15. Shared document with drawings.	37
Figure 16. Window for text-chat.	37
Figure 17. Prompt message on consent to participation in the evaluation.	44
Figure 18. Percentage of autonomous/assisted connections to the usability evaluation sessions.	49

Figure 19. Overview on tasks accomplishment per participant.....	50
Figure 20. Frequency of computer use among 10 participants.....	53
Figure 21. Purpose of using computer – total number of participants out of 10. .	53
Figure 22. Frequency of occurrence of problems in IADL of any kind.	54
Figure 23. Comparison of average grades between four groups of questions....	54
Figure 24. Average grades of questions on Ease of Use.	55
Figure 25. Average grade for Ease of Use questions per age group.....	56
Figure 26. Average grades for questions on Ease of Learning.....	57
Figure 27. Average grade per age group for Ease of Learning questions.	57
Figure 28. Average grades for questions on Usefulness.....	58
Figure 29. Average grade per age group for Usefulness.....	58
Figure 30. Average grades for questions on Satisfaction.	59
Figure 31. Average grade per age group for questions on Satisfaction.....	60
Figure 32. Comparison of average grades/group of questions per gender.....	60
Figure 33. Comparison of groups' average grades per educational background.	61

List of Tables

Table 1. Population in the EU 2016 using the internet, by age and type of use (% share) [14], [16].	10
Table 2. The comparison of functions of the IADL-SP with other products.	15
Table 3. Case 1: Personas, user stories and case scenarios.	20
Table 4. Case 2: Personas, user stories and case scenarios.	21
Table 5. Case 3: Personas, user stories and case scenarios.	22
Table 6. Functional and technical requirements for development of the IADL Service Platform.	25
Table 7. User interface elements used in the IADL-SP.	26
Table 8. The IADL Service Platform usability questionnaire.	40
Table 9. Inclusion and exclusion criteria.	42
Table 10. Actual participants in the evaluation.	43
Table 11. Participants' comments (loud thinking) during the evaluation test.	52

Listings

Listing 1. Defining variables and binding functions.....	28
Listing 2. Codes in app.js responsible for execution of functions and processes to html.	30
Listing 3. Code in app.js for taking OpenTok credentials from .env file.	31

Pictures

Picture 1. Video-audio connection with a participant during the test phase. 46

Appendix

A. Consent to Participation

English

During this usability test of the IADL Service Platform I agree to participate in an online session using my computer and telephone. During the session I will be requested to complete tasks and an online questionnaire about the IADL Service Platform I have tested. I will not be asked to enter any of my personal data. Instead of personal data, a numerical code will be assigned to me. I accept that my information on gender, education and statement on belonging to an age group will be collected for statistical purposes only. I understand that the information and recording are for research purposes only and that my name and image will not be used for any other purpose. I understand that I can break the test and exit the website anytime without explaining the reasons.

By entering the password that is provided to me, I accept the terms and conditions of the participation and will proceed with my participation voluntarily and autonomously.

German/Deutsch

Während dieses Benutzerfreundlichkeits-Tests der IADL Service Plattform erkläre ich mich einverstanden, an einer Online-Sitzung mit meinem Computer und Telefon teilzunehmen. Während der Sitzung werde ich aufgefordert Aufgaben durchzuführen und einen Online-Fragebogen über die IADL Service Plattform auszufüllen.

Ich werde nicht aufgefordert, meine persönlichen Daten einzugeben. Anstelle persönlicher Daten wird mir ein Zahlencode zugewiesen. Ich billige, dass Informationen zum Geschlecht, zur Bildung und zu einer Altersgruppenzugehörigkeit nur zu statistischen Zwecken erhoben werden. Ich stimme ausschließlich zu, dass meine Informationen und Aufzeichnungen nur für Forschungszwecke verwendet und mein Name und mein Foto nicht für andere

Zwecke verwendet werden. Ich kann den Test jederzeit abbrechen und die Website verlassen, ohne Gründe dafür zu nennen.

Durch Eingabe des mir zur Verfügung gestellten Passworts akzeptiere ich die Teilnahmebedingungen und werde mit meiner Teilnahme freiwillig und autonom fortfahren.

Bosnian-Croatian-Serbian/bosanski-hrvatski-srpski

Za vrijeme testiranja IADL Servis Platforme, slažem se da učestvujem u online sesiji koristeći moj telefon i kompjuter. Za to vrijeme će od mene biti zahtijevano da izvršim određene zadatke i ispunim online upitnik o IADL Servis platformi, koju sam koristio/la. Od mene se neće zahtijevati da unesem svoje lične podatke. Umjesto ličnih podataka, biće mi dodijeljen numerički kod. Prihvatam da dam informacije o polu, obrazovanju i pripadnosti dobnoj skupini, koji će biti prikupljene isključivo u svrhu istraživanja. Razumijem i prihvatam da će prikupljenje informacije i snimci biti korišteni isključivo u istraživačke svrhe. Jasno mi je da mogu napustiti web-stranicu u bilo kom trenutku i bez objasnjenja.

Unoseći lozinku koja mi je data, prihvatam uslove učešća i pristupam učešću dobrovoljno i autonomno.

B. Evaluation Protocol

10	9	8	7	6	5	4	3	2	1	Participant No. IADL_	
										Age group	
										Gender (f/m)	
										Education (h/u)	
										accomplished autonomously	Connection to the session
										accomplished with assistance	
										failed	
										reason for assistance or failure	
										loud thinking	
										accomplished autonomously	Task 1. Turn a video and audio on!
										accomplished with assistance	
										failed	
										reason for assistance or failure	
										loud thinking	
										accomplished autonomously	Task 2. Share your screen!
										accomplished with assistance	
										failed	
										reason for assistance or failure	
										loud thinking	
										accomplished autonomously	Task 3. Find a word document of your choice, share your screen, and read and discuss the document!
										accomplished with assistance	
										failed	
										reason for assistance or failure	
										loud thinking	

C. IADL-SP Usability Questionnaire (English)

Participant No. IADL_____

Scale grades:

1 – strongly disagree, 2 – disagree, 3 – neither agree nor disagree, 4 – agree,
5 – strongly agree, n.a. – not applicable

Ease of Use

1. It is simple to start the program

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

2. Command buttons are easy to understand and find.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

3. I can easily switch on/off functions or change from one to another one.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

4. The size of shared screen is good, I can read a document without problem.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

5. Colours and contrast of icons are appropriate.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

6. If I make mistake and press a wrong button, I can recover back to the function I want quickly and easily

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

7. I do not need to make notes and memos to remember how to use it.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

8. It requires the fewest steps possible to help me accomplish what I want.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

9. It is effortless to use it.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

Ease of Learning

10. It is easy to understand how it works.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

11. I learned to use it quickly.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

12. It is intuitive.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

13. It does not require advanced computer knowledge.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

Usefulness

14. It would help me get assistance that I need.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

15. It would help me explain things that I need a help with easier.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

16. It would help me understand and follow explanations easier.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

17. Video connection is an important part of it.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

18. Screen-Sharing is useful for explaining or being explained.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

19. Text-chat is useful complementary tool.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

20. Drawing on a document is useful complementary tool.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

21. I am satisfied that it has all functions together (Video, Text-chat and Screen-Sharing).

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

Satisfaction

22. It would be fun to be helped on this way.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

23. When I need assistance, I would use it rather than a telephone.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

24. I like that it offers a face to face contact when helped.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

25. I like to be helped by a real person and not by a machine.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

26. I like that it offers possibility to have a group video-meeting.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

27. It is a useful tool for face to face communication, not necessarily related to assistance.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

28. Overall, I am satisfied with it.

Strongly disagree 1 2 3 4 5 Strongly agree n.a.

General Data:

1. Age

- 60-65
- 66-70
- 71-80
- 81-85

2. Gender

- Female
- Male

3. Education

- Primary school
- Gymnasium/high school
- University

4. How often do you use computer?

- Never
- Rarely
- Sometimes
- Often
- Daily

5. For what purpose do you use computer? – multiple answers are possible

- Playing games
- Social media and messengers (e.g. Facebook or Viber, Skype)
- Online services such as online banking and online shopping
- Office Package (Word, Power Point, Excel)
- Searching the internet (for various information and media)
- E-mail

6. Have you ever experienced any difficulties in Instrumental Activities of Daily Living?

- Never
- Rarely
- Sometimes
- Often
- Daily

7. Comments and suggestions for improvement:

D. IADL-SP Usability Questionnaire (German)

Teilnehmer No. IADL_____

Bewertungsskala:

1 – Lehne stark ab, 2 – Lehne ab, 3 – Weder noch, 4 – Stimme zu, 5 – Stimme stark zu, n.z. – nicht zutreffend

Bedienungsfreundlichkeit

1. Es ist einfach, das Programm zu starten.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

2. Befehle sind leicht zu verstehen und zu finden.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

3. Es ist einfach die Funktionen ein und auszuschalten oder von einem zum anderen zu wechseln.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

4. Die Größe des geteilten Bildschirms ist gut, ich kann ein Dokument ohne Probleme lesen.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

5. Farben und Kontrast der Icon - Symbole sind gut geeignet.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

6. Wenn man Fehler macht und den falschen Knopf drückt, kann man schnell und einfach wieder zu der gewünschten Funktion zurückkehren.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

7. Man braucht keine Notizen und Memos, um sich an den Benutzungsmodus zu erinnern.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

8. Es erfordert wenige Schritte, um zu erreichen was man will.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

9. Die Verwendung ist mühelos.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

Leichtigkeit des Lernens

10. Es ist leicht zu verstehen, wie es funktioniert.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

11. Ich habe die Benutzung schnell gelernt.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

12. Es ist intuitiv.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

13. Es erfordert kein fortgeschrittenes Computerwissen.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

Nutzen

14. Es würde mir helfen, die benötigte Hilfe zu bekommen.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

15. Es würde mir helfen Dinge zu leichter zu erklären.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

16. Es würde mir helfen, Erklärungen besser zu verstehen und Anweisungen besser zu folgen.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

17. Die Videofunktion ist ein wichtiger Teil.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

18. Die Bildschirmfreigabe ist nützlich, um Dinge zu erklären oder erklärt zu bekommen.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

19. Der Text-Chat ist ein nützliches Ergänzungswerkzeug.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

20. Das Markieren und Kommentieren eines Dokuments ist ein nützliches ergänzendes Werkzeug.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

21. Ich bin zufrieden, dass alle Funktionen (Video, Chat und Screen-Sharing) integriert sind.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

Zufriedenheit

22. Es macht Spaß, auf diesem Weg geholfen zu werden.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

23. Wenn ich Hilfe brauche, würde ich IADL-SP eher benutzen als ein Telefon.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

24. Mir gefällt der Vieraugenkontakt während man geholfen wird.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

25. Ich mag es, von einer echten Person und nicht von einer Maschine unterstützt zu werden.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

26. Mir gefällt, dass es die Gruppenvideomöglichkeit bietet.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

27. Es ist ein nützliches Werkzeug für die persönliche Kommunikation, unabhängig von der benötigten Hilfe.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

28. Insgesamt bin ich zufrieden.

Lehne stark ab 1 2 3 4 5 Stimme stark zu n.z.

Allgemeine Daten:

1. Alter

- 60-65
- 66-70
- 71-80
- 81-85

2. Geschlecht

- Weiblich
- Männlich

3. Ausbildung

- Volksschule
- Gymnasium
- Universität

4. Wie oft benutzen Sie Computer?

- Nie
- Selten
- Manchmal
- Oft
- Täglich

5. Wofür nutzen Sie Computer? – Mehrere Antworten möglich

- Spiele
- Social media und messengers (z.B. Facebook or Viber, Skype)
- Online-Dienste wie Online-Banking und Online-Shopping
- Office Paket (Word, Power Point, Excel)
- Internet Suche (für verschiedene Informationen und Medien)
- E-mail

6. Haben Sie schon einmal Schwierigkeiten in instrumentalen Aktivitäten des täglichen Lebens?

- Nie
- Selten
- Manchmal
- Oft
- Täglich

7. Kommentare und Verbesserungsvorschläge:

E. IADL-SP Usability Questionnaire (Bosnian-Croatian-Serbian)

Učesnik Br. IADL_____

Skala ocjena:

1 – Uopšte se ne slažem, 2 – Ne slažem se, 3 – Niti se slažem niti se ne slažem,
4 – Slažem se, 5 –Potpuno se slažem, b.o. – bez odgovora

Jednostavnost korištenja

1. Jednostavno je pokrenuti program.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

2. Komandna dugmad su jednostavna za razumjeti i pronaći.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

3. Mogu jednostavno uključiti/isključiti pojedine funkcije ili preći sa jedne na drugu.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

4. Veličina ekrana je odgovarajuća i mogu da čitam dokument bez poteškoća.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

5. Boje i kontrasti ikona su odgovarajući.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

6. Ako pogriješim ili pritisnem pogrešno dugme, vrlo lako mogu ispraviti grešku i vratiti se na željenu funkciju.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

7. Ne treba da pravim bilješke da bih se podsjetio/la kako se koristi.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

8. Potrebno je vrlo malo koraka do željenog cilja.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

9. Jednostavno je za koristiti.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

Lakoća učenja

10. Jednostavno je shvatiti kako radi.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

11. Naučio/la sam brzo kako se koristi.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

12. Koristi se intuitivno.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

13. Ne zahtijeva napredno poznavanje rada na računaru.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

Korisnost

14. Pomoglo bi mi da dobijem potrebnu pomoć.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

15. Bilo bi mi lakše objasniti sta želim.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

16. Bilo bi mi lakše razumjeti kad mi se objašnjava.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

17. Video veza je vazan dio Platforme.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

18. Dijeljenje ekrana je korisno kad se objašnjava ono što je nejasno.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

19. Tekstualne poruke su korisna pomoćna alatka.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

20. Pisanje i crtanje po dokumentu je korisna pomoćna alatka.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

21. Dopada mi se da su sve funkcije integrisane (video, tekstualne poruke, podjela ekrana).

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

Zadovoljstvo

22. Zabavno je dobiti pomoć na ovaj način.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

23. Kad mi treba podrška, koristio/la bih Platformu radije nego telefon.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

24. Dopada mi se da pruža mogućnost kontakta licem u lice kad mi treba pomoć.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

25. Dopada mi se da mi pomaže čovjek, a ne mašina.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

26. Dopada mi se mogućnost grupnog video-sastanka.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

27. Korisna je alatka za direktni kontakt licem u lice neovisno o asistenciji.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

28. Sve u svemu, dopada mi se.

Uopšte se ne slažem 1 2 3 4 5 Potpuno se slažem b.o.

Opšti podaci:

1. Dob

- 60-65
- 66-70
- 71-80
- 81-85

2. Pol

- Ženski
- Muški

3. Obrazovanje

- Osnovna škola
- Gimnazija/Viša škola
- Univerzitet

4. Koliko često koristite kompjuter?

- Nikad
- Rijetko
- Ponekad
- Često
- Svaki dan

5. U koju svrhu koristite kompjuter? – upišite sve moguće odgovore!

- Igrice
- Društvene mreže i servisi (npr. Facebook, Viber, Skype)
- Online servisi za npr. online bankarstvo ili kupovina
- Office paket (Word, Power Point, Excel)
- Pretraživanje interneta (razni mediji i informacije)
- E-mail

6. Da li ste ikada iskusili probleme u Instrumentalnim Aktivnostima Dnevnog Života?

- Nikad
- Rijetko
- Ponekad
- Često
- Svaki dan

7. Dodatni komentari i sugestije: