



Development of a non-invasive CAPacitive sensor oral MOUSE interface for the disabled elderly (CAPMOUSE)

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User requirement report D1.1

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Prepared by: Henrik Erb us





Contents

1.	The aim and scope of the user requirements	3
1.1.	Aim	3
1.2.	Scope	3
2.	Methodology	3
2.1.	Methods used to define user requirements.	3
2.2.	Quantitative user study	3
2.3.	Qualitative user study	4
2.4.	User study for elderly with high degree of disability	6
3.	User requirements.....	6
3.1.	Functionality	6
3.2.	User requirements of elderly with low degree of disability	7
3.3.	Requirements of elderly with high degree of handicap.	8
4.	Conclusions.....	8



1. The aim and scope of the user requirements

1.1. Aim

The aim of the user requirements is to study and define the development specifications within the consortium in order to deliver a concept that corresponds to the demands of prospective end users.

It is the consortium's intention to involve the end users in the project from the beginning and we want to look for the relevant requirements important for the development of a human interface for older people. We will analyze the end users daily needs of ambient assistance and how we can provide for the enhancement of their quality of life with a hands free oral interface.

To get a picture of the end user and his/her requirements we will invite PRO members with different degrees of experience of computers and electronic devices and with different degrees of disabilities and needs to a series of workshops. We will conduct tests and questionnaires that will result in different sets of requirements.

1.2. Scope

The of the project is to deliver a **CAPMOUSE prototype** integrated with the mobile device (Octopus) as an human interface, which is a hands free tongue controlled keyboard/mouse replacement via standard USB connection running on Windows OS applications and targeted to elderly with light disabilities and elderly with high spinal injuries, or progressive muscular decrease. The development will be based on the end user requirements report. The precondition is that the end user must have good tongue functionality, therefore persons with Cerebral Paresis and similar mostly are excluded.

2. Methodology

2.1. Methods used to define user requirements.

User studies are based upon the Design Process tools, such as user surveys, user interviews that form the fundament of the Function Analysis that specifies user requirements in detail.

2.2. Quantitative user study

LOTS and PRO: Defining specific user groups' need for technological innovation and expectations toward the usability of the end product.

Identification of users. We used PRO network and contacted PROsIT, the organization educating elderly in modern communication tools.

Survey among user groups, A survey was sent to the teachers at PROsIT asking them to identify the problems elderly had using primarily PC.



A quantitative user study has been performed in cooperation between PRO and LOTS during the winter 2010. PRO members that are teaching other elderly within the sub organisation PROsIT tried out early CapMouse prototypes to understand the concept and also respond to what they found were the major difficulties for elderly using computers in order to define suitable functionality areas to pursue.

In cooperation with PRO, a survey was sent to over 70 PRO members in Västra Götaland, who were asked to answer questions about issues concerning computer and mouse use. The survey showed that user groups had large problems with the handling of the mouse, especially double-click was considered to be a problem. Another survey was sent out to define a “typical user”. Based on the survey three personas were created: personality types, which represent the needs and problems of various user groups. In a further survey the test group did evaluate the personality descriptions, to reassure that our personas were adequately described and conjured with the experiences of the PROsIT leaders. .,

2.3. Qualitative user study

Qualitative user study was performed in April 2010 with in depth interviews of ten elderly. Some early design prototypes were tried out on them and user preferences concerning wearability and acceptance were addressed. The results of the study were used as input for the first concept development stages.

User interviews. Later we contacted 17 people who have expressed interest to participate in in-depth user study, and we organized two meetings.

The first one was held in Mariestad in January 2010 to talk about the project and answer questions and get general feedback on the technology, feasibility and also if they could identify the users that would be served by the CapMouse. Our ambition was also to get the PROsIT leaders engaged in the project for use as reference group in a later stage of the development. The feedback from the group was positive concerning the need for such a product and also responded that they would like to participate in the further development of the CapMouse.

The second round of user interviews was conducted in Gothenburg April 2010 as a part of a greater user workshop. The aim was to try to understand the needs of the user groups through interviews and by letting them try out early functional prototypes. The reference group was also photographed and their skull proportions were measured for the development of design and wearability concepts.

Persona plotting The Personas Image Boards were used in the interview to plot user preferences concerning the product identity. They were not only asked to plot their own preferences, but also the how they imagine the different personas would plot themselves in the matrix of preference. The persona image boards were also circulated among AAL partners.



Matrix of preferences.

These matrixes were developed to plot the user group preferences. They were not only asked to plot themselves but also the preferences of the personas. The first matrix was constructed with traditional-innovative on the x-axis and handicap product and lifestyle product on the y-axis. The result was that the general opinion was that they all, more or less preferred to see it as an innovative lifestyle product,

The second matrix also had traditional – innovative on the x-axis and high end – low end on the y axis. The result showed that the majority preferred a mid end solution.



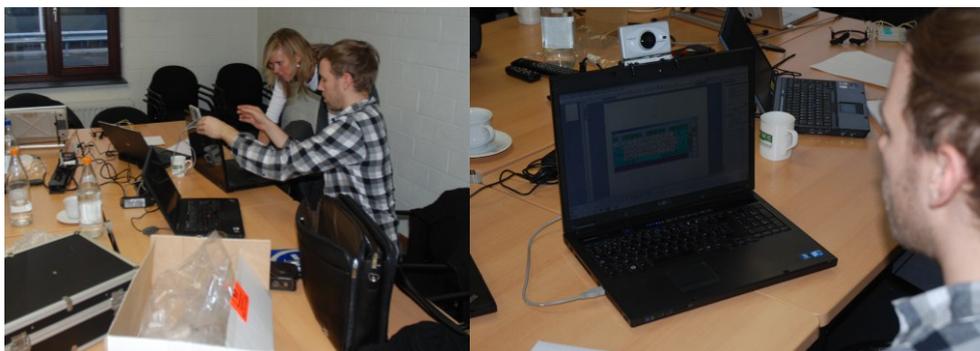


Images from user studies in Mariestad and Göteborg 2010

2.4. User study for elderly with high degree of disability

A user study was conducted in Gent, Belgium February 2011. We had two meetings with potential users and interviews with physio-therapists and speech therapists that guided us through the spectrum of products aimed at this particular user group.

A questionnaire was filled out to define what kind of disabilities could be served by CapMouse. The main focus was to define the types of disabilities and deceases that would be served by the CapMouse and in what way we could and should configure the CapMouse headset in terms of wearability and function.



Work shop with speech therapist and physiotherapist in Gent, February 2011

3. User requirements

3.1. Functionality

The result of the functionality analysis was that we will need different configurations to cover different disabilities. There will be significant difference in the use between people with light disabilities and those with severe disabilities.

Four different user groups were defined to be able to distinguish what functionality, wearability and configuration that would suit a specific user group need but also in what development stage functionality was to be developed. They were defined as follow:

- A. full movement of arms, hands and fingers
- B. full movement of arms, 50% reduction in hands and fingers
- C. 50% reduction in arms, hands, fingers
- D. 0% function in the arms, hands and fingers

Development Stage

- 1 User Studies
- 2 Refinement
- 3 Preproduction



By filtering the different requirements we had a good overview on what to develop two whom at what stage. This was communicated to the partners and decisions could be made.

Function Analysis. Cap Mouse									
User g	Function area	1	2	3	N/D/U	Weight	Comment	Koncept 1a	Kon
A,B,C,D	Main function	control	electric device	with tongue				Ja	
A,B	Vara	avtagbart					av användare med en hand	Nja	
C,D	Vara	avtagbart					av assistent	Ja	
A,B	Vara	påsättningsbart					av användare med en hand	Nja	
C,D	Vara	påsättningsbart					av assistent	Ja	
A,B,C,D	Inrymma	power source						Nej	
A,B,C,D	Inrymma	kommunikationsgränssnitt					med CPU	Ja	
A,B,C,D	Passa	användare					brevud mungipa på kindens utsida	Ja	
A,B,C,D	vara	anpassningsbar/ placerbar			N		mellan olika användare	Ja	
A,B,C,D	Inrymma	sensorer					passiv eller aktiv	Ja	
A,B,C,D	hålla	sensorer						Ja	
A,B,C,D	Medge	anläggning					mot mungipa	Ja	
A,B,C,D	förhindra	eftergift						Nja	
A,B,C,D	medge	konstant	anläggningstryck				Detta krav kan försvinna. Autokalibrad	Ja	
A,B,C,D	sättas	i standby					enkelt, fysiskt. Typ vid tandbort, äta osv. Få bort Cap mouse från mungipan	nej	
A,B,C,D	tåla	fukt					omkr IP 55	x	
A,B,C,D	tåla	temperatur					minus20 till plus 30 grader	x	
A,B,C,D	medge	rengöring							
A,B,C,D	upplevas	hygienisk							
A,B,C,D	skapa	distans	komprimerbar				mellan mungipa och mouse cap		
A,B,C,D	minimera	viktt							
A,B,C,D	erbjuda	fästyta					för för komprimerbar distans		
A,B,C,D	erbjuda	mothåll					mot kindutbuktning. Ej trycka på 3 sensorer samtidigt		
A,B,C,D	vara	laddbar	med batteri						
C,D	erbjuda	kraftbackup					alltid ha ström		
A,B,C,D	minimera	strömförbrukning					stanby, sändningstnby, auto wake up		

Function analysis was performed stating the functions of the product

3.2. User requirements of elderly with low degree of disability

Our user study showed that the main difficulty for elderly is cognitive. Understanding the rather advanced structure and interaction of an ordinary PC and fear of making mistakes was identified. That has, though, little to do with the functionality of the CapMouse. But the difficulties we identified were that many had problems with clicking the mouse, particularly to hold still between double click. Click and drag was also a difficulty that the elderly faced.

Putting on a headset and taking it off may be a problem the users will face. Especially when suffering from the consequences of a stroke. Elderly often suffer from muscle weakening, making it hard to lift their hands above their shoulders which will make it, in some cases, nearly impossible to put on an ordinary headset.

Almost all elderly interviewees preferred to feel the sensor head against their cheek in order to define its position.

They also preferred a cord rather than a wireless solution. The sense of reliability seemed important and with wireless solution can never offer the user that sense of reliability. Installing a wireless solution is also a hinder for the user.

The stigma of using the CapMouse is something that is difficult to ask about. When it comes to wearability concepts, the answers were as various as the number of participants. Our conclusion is that that the functionality delivered by CapMouse has to be comparable to the complexity of the mechanical wearability concept.



3.3. Requirements of elderly with high degree of handicap.

There are a lot of input devices on the market aimed at people with severe difficulties and disabilities. More or less all of them are highly customized to suit the specific needs of one particular individual. The CapMouse potential lies in being highly modularized in terms of hardware to meet the different requirements of the users. Some users will use the full intended functionality of the CapMouse, as some will use it in combination with other devices such as lip joystick and laser pointers.

The main user group that would potentially be served by a Cap mouse are primarily persons with High Spinal Injuries and people suffering from a progressive muscular disease. These users do have different demands on the CapMouse both in terms of sensor functionality and wearability compared to the ones mentioned above. The persons suffering from progressive muscular disease will probably be served the most by a CapMouse during the latest stage of their disease, making their benefit short due to short life expectancy.

These users cannot wear the CapMouse as the concepts were developed for the users with lower degree of disabilities. Mainly because they cannot support the weight of their own head and there for need a supportive headrest or even a head band.

These groups also need a higher degree of functionality that will be solved with adding more sensors. In addition they will use all day which adds higher ergonomic demands. In addition to that, customizing the product to certain individuals might be needed if modularization cannot solve it fully.

Stigma is naturally something that affects these users as the uses of more sensors add size to the most stigmatizing part of the product, the part close to the mouth.

4. Conclusions

We conclude that the requirements differ a lot between users with a low- and users with a high degree of disabilities. Developing one CapMouse headset aimed at serving the whole spectrum is possible if we focus on the users with the highest functionality demands and also on making it modularized, both in terms of mechanical design, functionality and electronics. This development is not feasible within the AAL-CapMouse project due to its high complexity and risk. The product need to be modular, adapting to different needs in terms of wearability, frequency of use, and for how long period at the time it is used. Basically all would be served by full mouse functionality, to be able to click, double click and right-click using the CapMouse.

Due to the fact that other input devices are faster the CapMouse might also replace the time based scanning function of other input devices, such as laser pointers and eye tracking reducing input time.