Interaction for people with special needs (Special Interfaces)

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***Abstract*— The paper presented is part of the IEEE Ro-Man conference CaMeLi workshop "Interactive Robots for aging and/ or impaired people" and describes how people with different types and degrees of disabilities operate mainstream or alternative user interfaces. The focus of the paper is to give an overview of how people with special requirements can use state of the art technology such as touch screens and which assistive technology is required. It will present solutions and examples and show what is possible and where are the limitations.**

I. INTRODUCTION

Disability is part of the human condition. Almost everyone will be temporarily or permanently impaired at some point in life, and those who survive to old age will experience increasing difficulties in functioning. [1] In the industrialized countries, people are getting older while at the same time fewer children are born. This demographic change is also known as "double aging effect". Since the loss of abilities is a well-known age related factor, more people in an aging society will be at risk of age related impairments. At the same time technology is becoming more and more complex which in turn leads to new and different ways of interaction e.g. touch and gestures. Mobile phones with standard keypads are becoming seldom, and have been replaced by touch based devices. Especially those who are blind or visually impaired are now left behind, as the tactile sense is not supported any longer, they are not able to feel the buttons anymore. Also those with reduced dexterity are facing new barriers, as they cannot separate the different buttons. In order to solve these issues new interaction concepts had to be developed to meet the needs of the different user groups and make the new devices accessible.

II. INTENDED USER GROUPS

ISO/IEC Guide 71:2001 [2] and ISO TR 22411:2008 [3] (both under revision) provide a detailed overview of the reduced abilities and characteristics of older persons and persons with disabilities as well as derived general accessibility requirements and applicable design methods. The presentation will provide an overview of the basic requirements and needs of people with sensory (blind, visually, hearing impaired etc.), motoric and cognitive limitations. A detailed overview on Background analysis of future interaction technologies and supporting information was developed by ETSI [2].

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III. ACCESSIBILITY OF GUI

While modern Graphical User Interfaces (GUI) compared with old command line interfaces such as UNIX console are more usable for most users, they are no progress for blind users in terms of accessibility. Since command line UIs are organized in an n # m matrix only containing ASCII characters, predominantly alphabetic characters, numbers and common punctuation signs, they only needed to be transferred to a connected refreshable braille display or Text To Speech engine. These refreshable braille displays also have some buttons in order to interact with the UI. When graphical UIs e.g. Unix GNOME, MS Windows, MacOS, etc., were introduced, assistive technology (AT) manufacturers faced several problems: - Extracting information (none-ASCII presentation of text) - Converting two dimensional presented information to one dimensional output device - prioritizing which information to present to the user at what point in time (multitasking) - identifying and translation information from icons and screen layout into text. - substitution of mouse usage In order to cope with these problems all so called screen readers [5] for GUI contain internally an off-screen-model in which the different components of the GUI are organized in a hierarchical manner, obtained by several different techniques e.g. keyboard and mouse hooks, accessibility api such as MSAA / UIA [6], etc. The difference between various screen readers for the same GUI are the prioritizing of information, interaction of the user with the GUI and adaptation of the screen reader to personal preferences or the application in use (scripting). The presentation will give an overview of the current available screen readers and screen magnifiers and will show the limitations of these solutions. Besides screen reader and assistive software, the presentation will also show different state of the art assistive devices intended for people with motoric impairments, including a special software which allows people like Stephan Hawkins to enter text by solely moving his eyes.

IV. (NATURAL) ASSISTIVE USER INTERFACES

Likewise the way from command line based operating systems to graphical based operating systems natural user

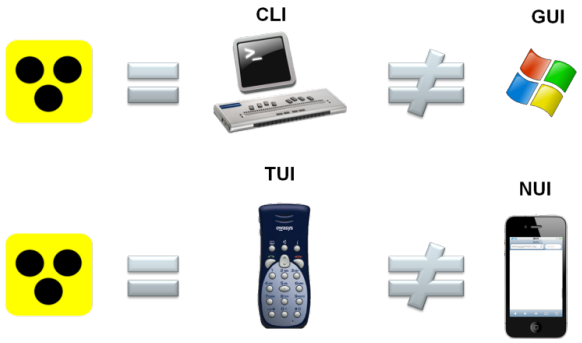

Fig. 1. UI Evolution

interfaces improved the usability but decreased the accessibility at least at the beginning. The usage of touch gestures is somehow natural and the basic gestures are clear for most people, however one has to be able to see the screen and a none-vision operable touch screen was not foreseen. With the introduction of the mobile screen reader Voice Over [7] and TalkBack [8] Apple and Google introduced new interaction concepts making touch screens accessible. The presentation will dwell on the accessibility of Android and iOS and present ways how to use state of the art smart phones and/or tablets with low or no vision. With the increased complexity Apple and Google also improved the voice interaction capabilities and therefore paved the road to natural voice interaction. The presentation will also show the possibilities to interact with state of the art devices by voice interaction.

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