

Building a smart mobility assistant in the inDAgo project

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Introduction

Today there is a strong desire to stay independent from help as long as possible. To people in the third age, everyday and leisure mobility is as important as autonomy in their homes because it ensures involvement in the community life. Mobility is essential to enable social contacts and an independent life.

When memory functions and physical conditions deteriorate with increasing age normal tasks like getting around in public spaces becomes more and more challenging. One difficulty in helping this group of users is that a lot of them do not admit to themselves that they are in need of help. This leads to the rejection of any kind of support. Furthermore, most members of today's generation of senior citizens have a refusing and antipathetic attitude towards modern technology. In the research project inDAgo¹ a system is created that supports elderlies to maintain mobility and thereby enables social integration. Studies are made during the whole development process to guarantee that the outcome assistant device is accepted and liked by the user group.

Approach

The project's outcome is a mobility assistant that leads the user to unknown places. The focus of the routing is the navigation of pedestrians in combination with live data of public transit time tables and with user's individual settings. So it can combine sections by feet with sections by public transport. Furthermore the system takes into account individual preferences and personal disabilities to plan the perfect route of every user. For example for a user who is in need of a walker-rollerator the system calculates more time and only leads him to barrier-free bus stops.

Today's most obvious solution for such a mobile assistant is the development of a smartphone app. Although it is certainly one of the cheapest and quickest ways, this approach was rejected in the research project inDAgo. In 4 focus groups [1] 28 senior citizens expressed their dislike for modern smartphones. They consider these devices complex since they offer so many functionalities. By other user groups this fact is seen as an advantage, but for this target group it makes smart devices overwhelming. In the third age, people are averse to changing their life-long habits. They want to use a camera for shooting photos, a paper calendar to plan their day and a mobility assistant device to get to unknown places. They prefer to use their telephone only for making calls, rather than having several functions integrated in it.

There is also another reason why smartphones are not the only and best solution: A lot of helpful and supportive digital information is collected by sensors or manually entered into databases. These information give a surplus of awareness regarding the world around us. They allow us to leave our normal perspective and to catch the bigger picture. For instance we do not only know that our bus is coming 15 minutes later but also that other bus lines will be delayed too due to a traffic jam, which means there might be a better travelling option to get home.

All this information is mainly displayed on tiny smartphone screens. The inDAgo users cannot (and will not) spend their time trying to decide while sliding and tapping what might be relevant for them. This is the point where innovation can be applied: Currently there is a gap between virtual information from the cloud and our natural physical world that we live in. How can users know what information is important in a specific moment? When is something important and how can an assistive interface catch the user's attention?

Of course both worlds do use their own metaphors for dealing with information: Our physical objects and object-related processes bring along semantic information about how to use them: a door latch implies that it can be pushed, the pages of a book imply that they can be flipped through.

The digital world instead has its own metaphors. It has buttons for virtual check-ins, scrollable content and inline notifications. The thing is: From the entire human history humans are shaped to make decisions upon the estimation of their senses. We do not only use our eyesight - we interact using all means of perception: we feel, see, hear...

¹ "Regionale Alltags- und Freizeitmobilität für Senioren am Beispiel der Stadt Darmstadt" (inDAgo) is supported by the German Federal Ministry of Education and Research (BMBF). – Further information is available at www.indago-projekt.de.

The inDAgo approach is to enrich real objects that accompany elderly people in their everyday life with digital information. These objects can interpret data (in relation to given user profiles) and can transform it into a tangible experience (in- and output). Connected in a digital network these objects are capable to determine their status and communicate with each other to adapt to our contextual needs. The characteristics and behavior of these objects could be used to create contextual affordance for specific information, when the user's attention is needed. This is especially important in changing or impeding surroundings with noise or darkness.

Results

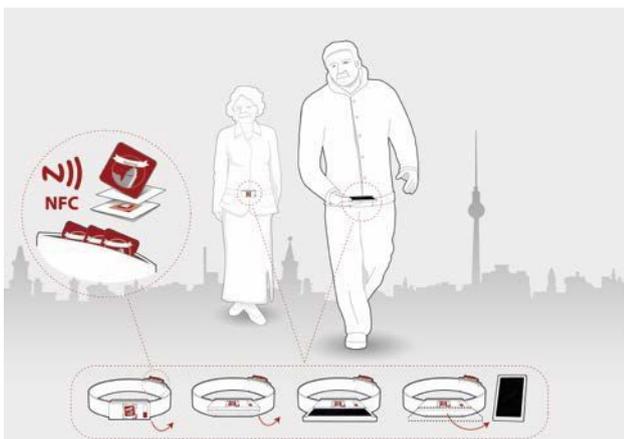
Since an early project stage all needed data resources, like pedestrian maps and the accessibility to the public transit system, were available to make the routing as exact as possible and convenient for every user. The challenging difficulty in the project was to integrate all this data in one physical device without making it too visible for the user. The device must fit the needs and environment of the users without appearing too technical or being too overwhelming.

There were elaborated ideas of wearables and everyday products with which the assistant can be combined. Following the user centered design process [2] some of these ideas were shown to 24 elderly people in group discussions to obtain the end users' feedback. The study showed that the acceptance of such a device is higher if the assistant is integrated in a discreet, everyday device that people know well and are already using today. The user group denies any product that might appear eye-catching or stigmatizing. Furthermore it was concluded that it is important that the device is directly attached to the body because elderly people always fear to lose things or to get robbed. To position the device on the wrist was seen as practical in terms of receiving information quickly and easily. Since this idea that was rated most positive the assistant was decided to be presented in the shape of a watch or a bracelet.

Although the users liked the idea of an unobtrusive watch assistant, the product developers supposed that showing the needed amount of functionalities on such a small screen is not possible, particularly since one third of the target group struggles with an impaired vision [3]. Therefore, it was decided to additionally offer the mobile assistant in more than one handheld design so that every user can choose the device that perfectly fits his or her needs and desires in the current situation. Several ideas of handheld devices were worked out and two of these were implemented within the project framework.

The first of these ideas that was proceeded was the concept of the assistant in form of a watch, because of its positive rating. An application was created and installed on an existing Smartwatch.

Beside the watch a little pouch was developed that contains a bigger screen and more interaction possibilities. This pouch can be attached to a personal everyday object, for example a belt, a bag or a walker-rollator.



Examples of use: Interplay of devices



To outsource some functionalities NFC tags were used, hidden in form of cotton badges. Thereby the user can interact with the assistant without clicking any button or tipping any screen; the user only has to attach the respective badge to its device to initiate a command. In this world of "Internet of Things" [4] functions are concrete and tangible. So a mental model of a function is adapted into the real world. The badges are planned to be used for example for the navigation destinations: They could show an icon of the destinations and communicate with the watch as well as the pouch. The user sees the destination on the badge and might even feel it; this offers better control in the interaction with the system and thereby encourages the user's actions. Because of their tangibility and physical appearance, badges even might enable a closer emotional relation. For example a badge that is linked with the information of the grandchild's address

could show on its front-side a photo of this grandchild. This makes the mental mapping easy and transmits the emotions to the family member with the technical badge. Furthermore this enhances the user experience.



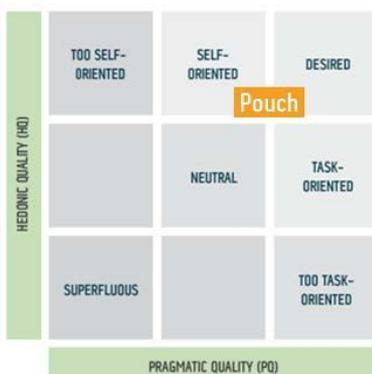
Prototypes of watch and pouch and badge that were tested in the usability evaluations

Both prototypes of watch and pouch were evaluated in separate usability studies. For studying the use of the watch a usability test [5] with 7 participants from the target group was conducted. The biggest usability problems were caused by the small size of the display and the navigation structure. The standardized questionnaire “AttrakDiff” [6] was used to measure the attractiveness of a product by evaluating the hedonic and pragmatic quality. The watch was accepted and seen as innovative, but not rated as an admired “must have” product because its lack of practicability.



AttrakDiff result of the inDAgo watch

The pouch was rated very positively in the usability test. 6 out of 8 participants had also taken part in the projects’ other user studies and surprisingly all preferred the pouch although before they always wanted the device as small and unobtrusively as possible. Reasons for this are the good readability and the variety of functionalities, both caused by the bigger display. This impression was also confirmed by the AttrakDiff, which classified the pouch as presentable and manageable.



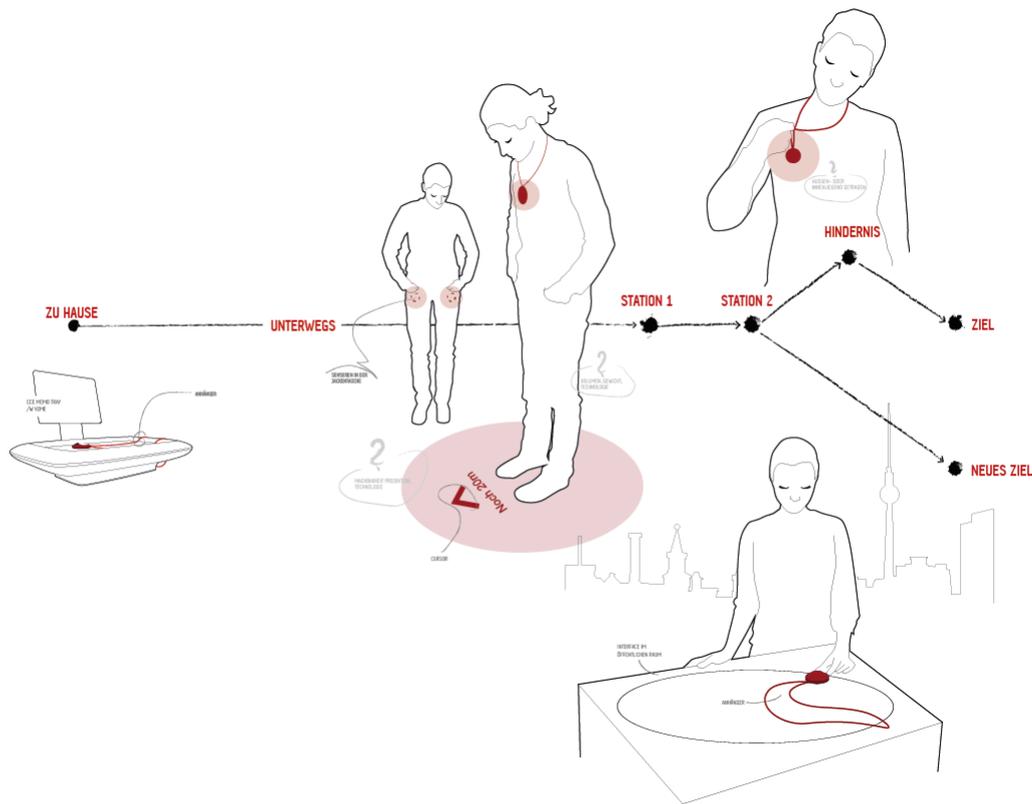
AttrakDiff result of the inDAgo pouch

Outlook

The project inDAgo is an example of how physical objects can be enhanced with contextual data to combine the digital with the real world. The shown use cases are examples, but many other forms of realization are imaginable as well.

While complex information might still need a graphical display for being visualized, a lot of smaller tasks with clearly defined in- and output can be transferred in tangible objects and installations in our surroundings. Introducing its Augmented Reality glasses for a wider spectrum of people, Google has recently shown plausible scenarios in what way wearables could develop.[7] In reference to the inDAgo context, other products could be smart bags reminding you to take all things with you for an upcoming appointment or smart walking shoes to intuitively find the right path.

The idea behind these objects is not to incapacitate the users but to use their existing skills and additionally provide them with trust in their actions by enhancing their senses. Consequently inDAgo is not about improving search but finding without obstacles.



Future scenario: A necklace might beam a tiny cursor on the ground to lead the user to the right direction.

The realization of some of these mentioned examples might not be technically possible yet, but certainly imaginable in the future. In the next few years, products developers will not just care about the pure usability of wearables, but will expand their view at larger scale on the overall behavior of connected objects.

The possibility to give physical objects a virtual representation lets product designers think in new ways to create innovative products. Especially for elderly people the Internet of Things, with clear references to tangible objects and physical actions, will bring back access to knowledge that is currently hidden in tons of virtual bits and data. Consequently the Internet of Things provides an opportunity to enhance the field of Ambient Assisted Living and should be progressed.

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