

User Centered Inclusive Design Process: A 'Situationally-Induced Impairments and Disabilities' Perspective

Hyung Jun Oh, Hyo Chang Kim, Hwan Hwangbo, and Yong Gu Ji

Department of Information and Industrial Engineering, Yonsei University, Seoul, South Korea
hjuni1109@yonsei.ac.kr

Abstract. Mobile phones provide many functions to improve people's daily lives. However, there are some difficulties to apply the specialty of the mobile device on existing simple schematics of drawings and the approaches. Moreover, regarding handicapped people as special users is causing the stigma effect. Therefore, this research suggests an inclusive design process that by considering the idea of situationally-induced impairments and disabilities (SIID) for developing the product, its design is not only considered for the handicapped people, but also normal people can experience the handicapped situations.

Keywords: Inclusive Design, Accessibility, Smart Device, Mobile Application.

1 Introduction

Mobile phones provide many functions to improve people's daily lives, including call, video call, e-mail and Instant Message (IM), global positioning system (GPS) route displays, and multimedia messaging services (MMS). These functions enable communication, announcements, entertainment, or even mobile-electronic commerce (m-commerce). The portability of mobile phones enables these functions to be employed conveniently. Hence, mobile phones have become an integral part of people's daily lives [1]. However, disabilities experience difficulties using existing functions on mobile devices.

In 1990's, each government, civilian, academia, and industrial circle tries to reduce the level of information gap by increasing web accessibility through many kinds of devices. Actually, because of this effort, the reinforcement of equipment and information education was successfully happened [2]. However, today's incredibility of development of smart devices and Web 2.0 paradigm for mobile computing causes another increase of the information gap and the existing accessibility policy could not be supplemented properly [3].

Moreover, the common drawing and accessibility for handicapped people is existed, but since they decided handicapped people as static beings, the idea of SIID is not included.

Therefore, this research practically uses the idea of SIID to experience not only disabled user see as their problem, but also normal people can experience as the extensity of the handicapped situation to try to solve the problems together as the final goal.

2 Related Work

The discussion for the disable people is still on-going process and many different kinds of approaches are existed. In 2000, the unification of the approaches is accomplished and summary is shown in Table 1. For the distribution of the models, the point of disability's view is overly exaggerated, but effectively described about many different kinds of handicapped situations and people's differentiable reactions [4]. In the last social model, it describes the disability is not the defection of the body but look as the part of the society and gives the "Activity" and "Participation" as important parts that mobile device's flexibility of usage environment is going to be increasing case by case.

Table 1. Characteristics of disability model

Model	Perspective on Disabilities	Needs	Domain
Medical	Patients	Treatment, Cure	Medical
Rehabilitation	Clients	Assistance, AT	Engineering
Special Education	Children with disabilities	Education	Education
Legal	Citizens	Act, Laws	Politic
Social	Part of the Diversity of Life	Activity, Participation	Sociology

The concept of Situationally-induced impairment and disabilities (SIID) is introduced in the research from Sears [5]. In SIID, the idea of disability does not limit in bodily or mentally handicapped people, but also normal people also could experience the disability by external situation and environment. For example, in the shaking bus, we try to hold on the strap to stay in balance our body. In this case, a hand is used for balance the body that cannot execute the other task, and it is also applied for the normal people when they try to execute the task in the same disabled situation. In this disabled situation, it is called situationally-induced impairments and disabilities (SIID) and it extends the meaning of the disability that not only handicapped people's meaning, but also the normal people are applied in the meaning.

Through the idea of SIID, the application of SIID forms the many different kinds of images that are used in variety of researches especially to provide on countless mobile device research. Since the existent evaluation does not consider the side effect that are caused by various changes of situations, the device that provides the configuration does not match to the real environment's usability [11]. Moreover, the

difficulty on performance side is occurred especially “when a person is moving” because of decreasing of motor ability that is on the configuration which mobile device provides [12]. The development of mobile device is increasing for its portability that it is getting smaller, and putting many different kinds of functions and utilities providing for users. Increasing portability naturally guides users into variable usage configurations that users are using mobile devices in many different situations of environments. However, various functionality and miniaturization technologies provided by mobile devices require more cognitive load, therefore non-disabled experience difficulties of using. Whether the user has disability or not under the limited circumstances of cognitive ability that one user can be seen as disabled. It is very important to ensure that this situational disability to be solved for user safety and securing the convenience.

Users with disabilities, using Assistive Technology to assist their disability feel that social ‘stigma’ is stamped to their disability. Because of this, they have negative attitude towards appropriate assistive technology as well as fears about soft look or the disabled [7]. Similarly, in the study of Hemmingsson [8], he finds that students are reluctant to use technologies making them look as ‘deviants’. Through these reasons, the handicapped users want to cover or to be replaced something else “Assistive Technology” for not to be found [6], [9], [10]. The previous studies mention that people with disabilities might have their sense of alienation or social separation when we access disabled people as special users who require extra technologies. Through studies done in the past, designs concerning every disability circumstances are required in the product design rather than considering people with disabilities as special users who needs additional technologies.

Therefore this study suggests that concept of SIID should be considered in the product development process so that inclusive design process including the failure condition by considering existing design for people with disabilities as well as the general user experience.

3 Methods

This research is flowing In-depth Interview & Requirement analysis, Ideation & Concept generation, low-fidelity prototyping & Evaluation and Hi-fidelity prototyping & Evaluation. For satisfying the handicapped users’ special needs, we derived paradigm of participatory design that at least two more handicapped users were included.

3.1 In-depth Interview and Requirement Analysis

In the requirement analysis phase, we recruited people with disabilities and conducted in-depth interview. We could contact and recruited 8 people thanks to the researchers in Pennsylvania State University. Specifically, we were interested in people who had problems in use of mobile devices. Participants had a various type of disabilities and wide variety of backgrounds and occupations. There ages were 20 to 70. Three participants identified as female, five identified as male. The participants used a wide range

of accessibility features, including assistive technology and accessibility related applications in mobile phone.

We met with each participant for a single 2 hour semi-structured interview focused on exploring their experiences with daily activity, mobile devices usage, and feelings about accessibility problems. During the interview, the participant and the interviewer talk about assistive devices that are used by each participant. Adding to that, each interview includes 10-minute idea creation session (Assume a phone with needed functions and advertise it to hypothetical customers) to explore the actual needs of people with disabilities.

Issues that arise in using mobile devices to people with disabilities that are discovered through the course of interview are re-interpretated as situationally-induced impairments and disabilities (SIID) which can happen to non-disabled in the circumstances of regular use.

For reinterpretation, each problem found through impaired users were classified to environmental ‘context’ causing SIID and ‘activity’ required by the user.

Concept of context means surrounding environment, user behavior, and device context which can cause SIID through the user’s state in addition to the physical disability. Concept of activity refer to proactive behavior of the user through user call, text input, pointing behavior using smart devices on which you want to perform.

Through this process, as well as the requirements of users with disabilities and general user experience in the use of the device in the failure situations that require users to behave accordingly are analyzed.

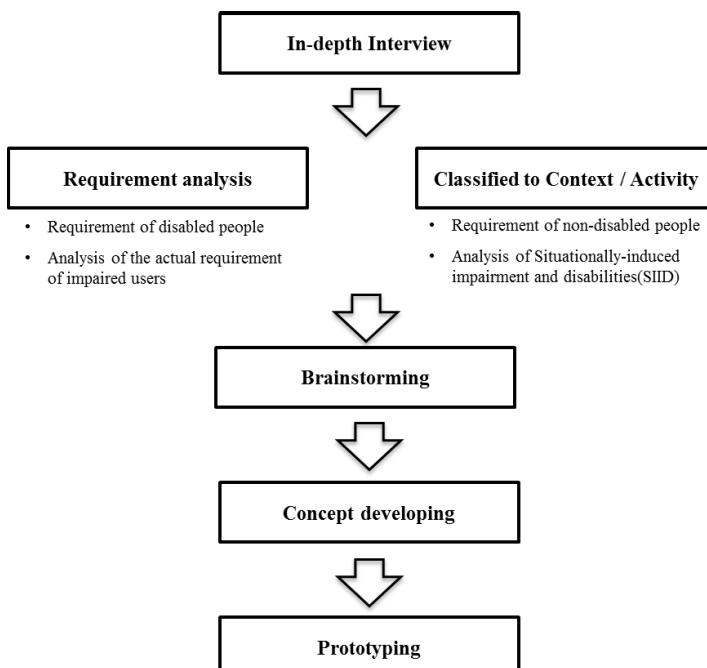


Fig. 1. Design process by considering for situational disabilities

4 Concept Development

In the stages of concept development include ideation phase and conceptualization phase. In the ideation stage, we used brainstorming and bodystorming as ideation methods. Through the conceptualization stages, we finished applying and organizing all the ideas of handicapped people's opinions and executed filtering to eliminate the useless ideas. Secondly, remaining ideas are classified within types and characters of handicapped people. Each group has certain criteria that are formed as unification, expansion, and abstraction. These three criteria are named within our segment. Finally, we designed UI flow and scenario for each conception.

4.1 Prototyping and Evaluation

In these conceptions, we selected one possible conception and concrete target user to build the paper prototype of the conception of UI. Paper prototype is proceeded to carry out the usable task and interview the handicapped people who use the smart devices. After the interview, there are several problems of paper prototype to compensate and we materialize completed UI. Through the previous interviews, we made experimental task. The task is used in comparative usability evaluations in between existing system and the completed UI that we materialized.

4.2 Results

Through the In-depth interview and Contextual mining, we can find out handicapped users' characteristics of using smart device. In the stage of Ideation, we can draw total numbers of 132 ideas, and in the stage of Conceptualization, we filtered out to useful 20 concepts.

In these 20 concepts, 5 concepts are proceeded with prototyping and evaluation that we confirmed the usage of our research's design process of effectiveness.

5 Discussion and Conclusion

Tools used by human can be divided into 'ready-to-hand' and 'present-at-hand'. 'Ready-to-hand' tools are the ones we use not consciously recognizing their operations, and 'present-at-hand' need our conscious efforts to operate [13]. To make technology more familiar to humans, the 'present-at-hand' should be transferred into 'ready-to-hand' by designs that suits human mental models. Design and outcomes that do not consider the cognitive limitations of users will not be actively utilized in various use contexts. To people with disabilities, these limitations are perceived more seriously. In our study, we do not distinguish between people with disabilities and people who are not, but only focus on the universal cognitive limitations that they both have. By doing so, we can suggest that various context that can cause cognitive limitations are integrated in designing digital devices. Moreover, we emphasize the methodological side of systems to integrate both supportive technologies and everyday technology to create more universal and applicable design solutions.

In this research, we make all types of handicapped people participated from the beginning of collecting of user requirement to evaluation of Ideation, Concept Development, and Prototyping. In the presently existent participatory design approach process, the handicapped users are special class to participate. Since the handicapped users are involved, the results that were produced can be possibly happened ‘the rejection of acceptance’ syndrome by handicapped people. Therefore, this research contains the steps of requirement analysis that not only the actual handicapped people involve, but also normal people’s usage of the devices is considered that any kind of accidental happening is considered and prevented. Moreover, not only the approach for the handicapped people is improved, but also normal users’ experiences of situational disabilities are prevented. By using the device, certain things such as deviant, stigma are also resolved. In this approach, the focus is not only for the handicapped people who need to have special needs but more likely to be pioneers to find out the new approaches of the usage of the devices and will provide designers new insights.

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