Designing a Mobile Application for Older Adults: A Case Study to improve Safe Driving

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Abstract
Aging is a growing phenomenon in almost all countries of the world. Mobility is fundamental for older adults because it allows them to maintain an active lifestyle. Technologies have been developed to contribute to safety driving, but most of them do not take age declines into account. Aiming to contribute to this field, we focused on the interface design and the content of a mobile application to help older adults to drive safely. We conducted road experimentations and interview to identify what are the older adult needs. We proposed valuable recommendations to the design of a mobile application to support older adults safe driving. Furthermore, we implemented a mobile application which includes two main features: a real time driving alert and a driving report.

Author Keywords
Older adults; Mobile Application; User Experience; Human Computer Interaction; Road Safety.

ACM Classification Keywords
H.5.2. Information interfaces and presentation (e.g., HCI): User Interface – Prototyping - Screen design (e.g., text, graphics, color)

Introduction

According to United Nations, the older people population will double from now to 2050 [1]. Many researchers called attention to the importance of conducting research to improve older drivers' safety. Older adults have a preference for motor vehicles because it is a synonym of independence and self-confidence [2]. Thus, it is in the best interest of society to allow them to drive as long as possible in a safe manner.

From our previous research with older adults, we noticed that older people are increasingly using technologies and mobile applications (app.) for their daily life activities (e.g.[3]). In road safety, we conducted user's studies with older drivers and designed feedback interactions especially for fatigue, based on persuasion and ergonomics criteria [4]. From these previous results, we foresaw the possibility of applying mobile technologies to contribute for older adults driving safety.

Our goal is to find out the manner to design an interface to simplify interactions between the older driver and the system. Our contribution is to design mobile interactions for older drivers. To do so, we developed a questionnaire to identify recommendations for a mobile app. for older drivers. The results were used as input to design a mobile app. for helping older people to drive safely.

Related work

Previous research has focused on age-related decline which may affect older adult interaction with technology [5]. However, most interfaces did not consider both abilities and impairments of older adults [6]. This age-related decline also impact on the driving, since older adults suffer from physical, cognitive and sensorial declines. For instance, physical abilities are worsening with the deterioration of psycho-motor skills, development of arthritis, which causes neck problems. The cognitive skills are affected and lead to a longer reaction time and a shorter memory. Sensory functions decline at the perceptual, visual and hearing levels [2]. When driving, people have to respond rapidly to risks with good abilities, and these impairments may have an impact on driving.

The importance of interactions between drivers and cars has been recognized in the Human-Computer Interaction community [7]. In the same line, much attention has been given to technologies focusing on older drivers' mobility [8]. It is necessary to develop a technology efficient to consider age-related decline. And to consider older adult's mobility needs by allowing them to use their personal car safely.

Methodology

This research project took place in a broader context to assess Intelligent Transportation Systems (ITS) with older adults. It was divided in two steps. The first step was to analyze the driving of older adults. We conducted experimentations with 65 older adults (mean age: 63.3; SD: 6.2) between 55 years-old to 84 years-old; 30 men and 35 women. Participants lived in the Montréal area (Québec, Canada), they actively drive and they affirmed having their driving license at least 20 years.

Participants drove in an instrumented vehicle and in a simulator. We collected and analyzed driving data (e.g.: speed, braking, localization). The results of this first step were used as input to the second part of the study.

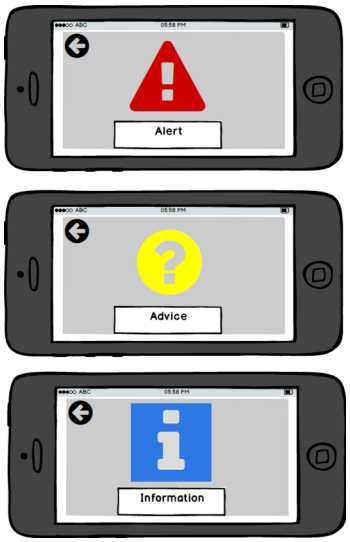

Figure 1: Recommendations proposed by older respondents for their driving mobile app.

Figure 2: Hudway glass

In the second step, we firstly conducted an interview with the older drivers, focusing on their needs and preferences, before developing a driving support mobile app. We designed the interview, based on scientific literature and guidelines [9, 10], which was divided in three sections. The first section we asked five questions about their driving activity in general: the first discomfort after starting driving; the scare when driving, problems which worry them; the type of road accident they are afraid and the riskiest situation. The second section included six questions about the HCI personalization and the desired content in the mobile app. We asked which both color and pictograms they prefer for an alert, advice (speed limit, etc.) and information (traffic, weather conditions, etc.). Finally, in the third section, we asked four questions related to benefits, confidence and privacy of the app.

Results

Interview about the older driver interface

Participants affirmed to be affected by tired eyes (23%) when they drive. Their main nervousness during driving was the low visual acuity (68%). The main activity which they are afraid is changing lanes on highways (42%) and they consider risky to driver under night condition (54%). We presume a link exists between low visual acuity and night condition. Regarding the mobile interface, an exclamation point in a triangle (47%) in red (86%) determine an alert. An advice is yellow (37%) with a question mark in a circle (25%). To receive drive information, participants wanted again the letter I in a square (47%) with the blue color (31%) (Figure 1). The majority of respondents wanted training with a real person to learn the app's features (85%). The participants said they would trust the information gathered by a mobile app. (86%) and did not consider that the system infringes their privacy (71%). If they had the opportunity to use a driver assistance system, they wanted the system to detect vulnerable users (cyclist or pedestrian) (60%). Furthermore, they wanted help for the speed control (14%), to park the car (14%), before left or right turns and help for blind spots or localization (<5%).

Concept of mobile application for the older drivers

The results of the research were applied to develop a first version of our driving app. This tool provides support for older drivers and consists of two app. meant to be working in tandem. The first app. is used to display driving information in real time. It is built using Unity and is configured to work with an Android phone, connected with a Hudway glass. Which is a car accessory turning smartphone into a professional Head-Up Display[1] in any car (Figure 2). Any drivers can buy it on the internet. The user interaction is a key factor to be taken into account, since the information must be shown without being distracting or disturbing the driver. The current version of the app. provides driving alerts, advice and traffic information through visual and audio notifications to give support for the drivers. The system provides notifications when the driver is above the speed limit, if the driver has to be careful about the traffic or if a point of interest is close to the driver (e.g., a gas station) (Figure 1). For the audio, a tone reinforces the notification.

The second app. is also an Android app. used to collect data during driving, analyze it and provide a driving report to the users. For this first version of the

[1] "Any transparent display that presents data without requiring users to look away from their usual viewpoints" (Definition from Hudwayglass website (https://hudwayglass.com/))

assistant, four types of data were collected: linear acceleration, speed (in kilometers per hour), location and rotation (azimuth). We are currently working in the design of the driving report and recommendation features. For the first prototype, we plan to provide driving reports showing information such as speed, routes and alert history and advice provided during the driving. The second feature of the app. is to provide a road safety recommendation system which would take as input the data collected and suggest driving recommendations, such as best driving hours or roads.

Conclusions and future work

In this research, we worked towards the design of a mobile app. to contribute to older adult safety driving. We identified key aspects of the interaction design and the content for a driving mobile app. We focused on interaction with the behaviour of the driver and the associated risks. Our results showed the needs and challenges encountered to develop the best mobile interaction for older adults which can be applied to further research in the field. We expect that our mobile app. could contribute to safety driving not only for older adults, but for everyone. As current and future work we will evaluate the mobile app. in real conditions with older drivers. We want to extend interactions related to projected information with the contextual activity (e.g.: road quality, vulnerable users) to improve the reports and recommendations. The results should be applied to improve the user's interaction with the app.

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