
An Introduction to Automotive User Interfaces

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Abstract

The objective of this course is to provide newcomers to Automotive User Interfaces with an introduction and overview of the field. The course will introduce the specifics and challenges of In-Vehicle User Interfaces that set this field apart from others. We will provide an overview of the specific requirements of AutomotiveUI, discuss the design of such interfaces, also with regard to standards and guidelines. We further outline how to evaluate interfaces in the car, discuss the challenges with upcoming automated driving and present trends and challenges in this domain.

Author Keywords

Automotive user interfaces; in-car user interfaces; car driving; manual and automated driving.

ACM Classification Keywords

H.5.2 [Information interfaces and presentation (e.g., HCI)]: User Interfaces

Introduction

Today, driving a car is more than the activity of maneuvering the vehicle from one location to the other. Besides the driving task, drivers also want to perform (non-driving-related) tasks [12] including the operation of safety and comfort functions or the infotainment system. Drivers want to be entertained (e.g., listen to music or radio stations) or com-

municate while on the go. Performing such activities can distract the drivers from their primary driving task, posing themselves and others at risk. Thus, the challenge for researchers and developers is to design feature-rich but easy-to-use interfaces for the car that allow for safe driving.

Benefits

The objective of this course is to provide newcomers to AutomotiveUI with an introduction and overview of the field and show how it is different from others. An intensive discussion of the requirements, trends, and challenges will help participants to get an overview and might be the basis for new research ideas. Especially with automated driving, we see the car as a platform that becomes more and more important for HCI. We want attendees to leave the course with a fresh perspective on the field and inspire them to build the next generation of in-vehicle interfaces or services.

Audience

This course is targeted at a broad audience including graduate students as well as industrial and academic researchers. We expect to present it to novices in the field of AutomotiveUI but assume that also researchers and practitioners with experiences in designing, developing, and evaluating AutomotiveUI are interested in joining and discussing.

Prerequisites

The expected audience should have a basic knowledge of HCI. This could be a previously attended course or a basic lecture at university or experiences from own projects in this domain. Since we provide an introduction for AutomotiveUI, there are no additional prerequisites.

Content & Practical Work

During the course we first provide an overall introduction to AutomotiveUI. This includes a discussion of important

terms, such as driving task, driver distraction, and vehicle systems. In this part, we also discuss the influence of in-vehicle activities on road accidents.

As a second part, we provide an overview on principles, guidelines, and standards that one should consider during the design of AutomotiveUI. We take this as a basis to also give deeper insights into the design of such interfaces, enriched with practical experiences from previous projects.

In the third part of the course, the participants learn how in-vehicle interfaces can be evaluated during the design. This includes the explanation of various measures with regard to evaluation, different testing procedures (e.g., Lane Change Task, Detection Response Task, and real road field trials). Furthermore, we plan to discuss study-related aspects by running a simulation experiment in the course.

For the fourth part, we elaborate the specific requirements and expected changes for future automated driving situations. Also based on the Dagstuhl Seminar #16262 on Automotive User Interfaces in the Age of Automation [14], this includes a discussion of the different driving modes from manual driving to fully automated driving, as well as the possibilities that arise when driving highly and fully automated. Also, the importance of take-over requests while highly automated driving will be explained.

As a concluding part, we outline remaining challenges and expected trends with regard to AutomotiveUI and more general human mobility.

Presentation Format

The course will be presented as an interactive lecture with slides, videos, and group discussions, and a live driving study. This format has been proven to be very suitable for this kind of introductory course. We previously held a sim-

ilar tutorial at CHI '16 [8] and at the premier German HCI conference and received very positive feedback.

Regarding the presentation format, we want to offer an interactive lecture where we include various interactive elements for the audience. By involving the audience, we strive to adapt the presentation to the specific (existing) knowledge and interests of the audience. We prefer to stretch the course over two sessions and assume that a typical audience size of 50 participants is acceptable.

Instructor Backgrounds

Bastian Pfleging is a senior researcher at the Human-Machine Interaction Group at the University of Munich (LMU), Germany. His research interests are automotive user interfaces, with a focus on multimodal interaction [10], workload [9], and the support of non-driving-related activities in the car [11], including communication [13]. Before joining LMU, he was a PhD student at the University of Stuttgart and a visiting researcher at the BMW Technology Office. In the HCI community, Bastian is involved in co-organizing different conferences like AutomotiveUI (Program Chair '17), MobileHCI, and Augmented Human, as well as various workshops (e.g., at CHI '16 [7], AutomotiveUI).

Nora Broy is a researcher at BMW Group in Munich, Germany. Her research interests lie on novel input and output modalities in the car and on the interaction with an automated vehicle [11]. She received her PhD at the Human-Computer Interaction Group of the Institute for Visualization and Interactive Systems (VIS) at the University of Stuttgart, Germany. Her thesis is about new display modalities in the car and particularly addresses the interaction with 3D displays [1, 2]. As part of her Master studies Nora was visiting the BMW Technology Office in Palo Alto. In the scientific

community, Nora served as poster chair at Pervasive Displays and was also reviewer for various conferences.

Andrew L. Kun is associate professor of Electrical and Computer Engineering at the University of New Hampshire, and Faculty Fellow at the Volpe Center. His research focus is human-computer interaction in vehicles [3, 6], primarily in speech interaction [5], as well as the use of visual behavior and pupil diameter measures [9] to assess and improve the design of user interfaces. He served as the General Chair of the 2012 AutomotiveUI conference [4].

Resources

Additional details about the course as well as accompanying material will be published on our course-related website. It provides information about the course and links to related material, so that participants can get familiar with the scope of the subject and the goals of the course.

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