Multimodal Interfaces for Automotive Applications (MIAA)

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ABSTRACT
This paper summarizes the main objectives of the IUI workshop W2 on multimodal interfaces for automotive applications.

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General terms: Design, Reliability, Experimentation, Human Factors

Keywords: multimodal interfaces, human-machine-interaction, automotive applications

INTRODUCTION

Multimodal interaction constitutes a key technology for intelligent user interfaces (IUI). The possibility to control devices and applications in a natural way enables an easier access to complex functionality as well as infotainment contents. This kind of interaction is particularly suited for use in automotive scenarios where additional restrictions with respect to input and output modalities have to be taken into account.

In recent years, the complexity of on-board and accessory devices, infotainment services, and driver assistance systems in cars has experienced an enormous increase. This development emphasizes the need for new concepts for advanced human-machine interfaces that support the seamless, intuitive and efficient use of this large variety of devices and services.

A modern car already implements hundreds of functions that a user can interact with, in some cases deployed over almost a hundred embedded platforms. These numbers will even grow for the next generation of high-class vehicles. The growing number of electronic devices integrated into cars also affects the creation of the user interface. on data networks using CAN-bus and MOST for multimedia data.

The built-in electronic control units are able to provide valuable context information, which needs to be considered for an intelligent management of multimodal interaction inside the car. Sensor information like for example vehicle speed, location (using GPS plus gyroscope and accelerometer for greater reliability), outside temperature, etc., allows to draw conclusions about the current driving situation. Furthermore, dialog management needs to keep track of state changes of operating elements like control switches. Access to vehicle functions is also essential in order to initiate desired operations.

MAIN OBJECTIVES OF THE WORKSHOP

The goal of this workshop is to present, discuss, and jointly outline context-aware multimodal interfaces for car passengers that support the interaction of the passengers with the car and mobile Internet services, between the passengers inside the car, and between the passengers and the road environment.

Our notion of the dialog goes beyond the classical in-car command and control interface by enabling information seeking dialogs and by supporting the combination of speech and other modalities. Taking the external context into account (e.g. by supporting verbal references to landmarks visible in the surroundings of the car) will also be a focus topic.

A special interest will also lie on approaches that do not focus exclusively on the driver but target the co-driver and the backseat passengers as well. By doing so, these systems would extend the traditional dyadic dialog systems to multi-party systems that provide role-based access to available devices and services.

The ultimate goal of this workshop is to unify innovative aspects that aim towards a new dimension of ease of use. Interaction with technical devices in vehicles and the road environment is still very complex and complicated. Current

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in-car technologies like speech-directed device control and interfaces accessing media players should therefore be extended to multimodal interactive systems that address the needs of a wide variety of users. Innovative aspects could for example be user-group centered interfaces for drivers, co-drivers, and backseat passengers.

Another key objective will be the interaction and presentation management. Here, the focus will be on issues concerning multi-party interaction, multiple input and output devices (e.g., selection of a suitable output device, adaptation to contextual factors, intelligent routing/streaming of the data), context-based priority management (e.g., for local danger warnings) as well as personalized and role-based interaction management.

Furthermore, we will address the alignment of multimodal output presentation to additional passengers. To this end, appropriate contents need to be routed to output devices bound to specific seat areas but also adapted to the role of the speaker. Thus, it would make sense if a multimodal dialog platform supports role-specific access to the underlying services and appropriate configuration possibilities.

The naturalness and ergonomics of a multimodal interface does not only rely on its ability to recognize, analyze and fuse user input correctly but also on the quality of the information presented to the user.

Especially for the in-car context, it is crucial that we gain an understanding of how to provide the driver with information while minimizing the distraction from driving. Therefore, we will also discuss the development of a set of general interaction and presentation strategies, which can incorporate the situational context (e.g., driving speed, display size, learned user preferences) in order to derive interaction and presentation patterns for common in-car service and device interactions. Such services include browsing through potentially large data sets (e.g., media player, POI systems), system notifications (e.g., critical fuel level, speeding) and responses to state-changing requests on in-car devices (e.g., seat heating).

The key concept of in-car interfaces is to provide an integrated user interface for different applications, devices and services. Therefore, it is one main goal the MIAA workshop to foster the discussion of an integrated and extendable multimodal interface framework that is tailored to the special requirements for in-car scenarios. A central aspect here is information management, i.e., how, when and where to present information to the driver but also to the co-driver and the backseat passengers.

THE USER-CENTERED DESIGN PRINCIPLE

A connective aspect of the various contributions of this workshop will be user interface architectures along relevant user-centered design (UCD) dimensions. These dimensions will inter alia be effectiveness, efficiency, satisfaction and fun/pleasure.

In UCD, the needs of the target users form the guideline for the development of the technology. Special attention will be paid to task and context factors such as multi-tasking and the associated cognitive load for the driver and the social context of multi-party situations. In addition to providing information about the quality of the interfaces, the activities in Usability Engineering result in evaluation methodologies for intelligent multimodal systems in multi-party situations. Finally, these activities are meant to develop underlying theories about the interaction with intelligent multi-party systems in order to come up with models that can be used to generate design heuristics and guidelines for further developments.

REFERENCES

1. W. Wahlster, “Dialogue Systems Go Multimodal: The SmartKom Experience,” in SmartKom: Foundations of Multimodal Dialogue Systems, W. Wahlster, Ed., Cognitive Technologies Series, pp. 3–27. Springer, Heidelberg, Germany, 2006.

2. H. Bunt, “Dialogue Pragmatics and Context Specification,” in Abduction, Belief and Context in Dialogue, H. Bunt and W. Black, Eds., vol. 1, pp. pages 81–150. John Benjamins, Amsterdam, The Netherlands, 2000.

3. Andrew Sears and Julie A. Jacko, Eds., The Human Computer Interaction Handbook – Fundamentals, Evolving Technologies and Emerging Applications, Lawrence Erlbaum Associates, Mahwah, N.J., 2 edition, 2007.