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Sharing User and Context Models in Automotive HMI

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ABSTRACT

Person vehicles are increasingly equipped with functions and services that go beyond basic driving. While sensors of the vehicle collect much information about the environment, services today do not harness the full potential of this knowledge. To fill in the missing link, we propose a central knowledge component for user and context management, and illuminate some critical design issues.

1. INTRODUCTION

The Human-Machine Interface (HMI) in vehicles is currently undergoing an evolutionary change. While the focus is still on functions supporting the primary task, a new generation of more powerful interaction, service and entertainment concepts, which extend beyond driving and also involve non-driver passengers, is starting to surface. With these services that reach a greater degree of context-adaptivity and personalizability, a flexible, open new approach for maintaining and sharing user and context knowledge is needed: a knowledge base that brings together facts about passengers, vehicle and physical context.

What we propose herein is the use of a common ontology for automotive HMI systems, which entails several benefits: 1) Functions can easily be made context-adaptive, e.g. dependent on vehicle speed, traffic conditions or surroundings; 2) Applications can exchange knowledge and cooperate in new ways; 3) User models can be shared between vehicles (e.g. car and motorcycle); 4) Privacy features allow a fine-grained control over what is shared over a car-2-car channel.

2. ONTOLOGY DESIGN

Concepts. Fig. 1 outlines the major areas of the ontology we envision, including several sub-areas for each of them. The *user*-centric design paradigm is crucial to modern HMI development, hence this high-level concept plays a major role in our knowledge representation. Apart from generic user properties like demographics and characteristics, for which we suggest the GUMO [2] ontology, cognitive aspects should receive particular attention because of their impact on driver distraction. Further, interactions between user and vehicle and also between passengers are exposed. A rich *context* model allows vehicle controls, but also location and traffic events to influence the in-car information selection and presentation. Basing the model on existing standards such as [1] ensures high interoperability.

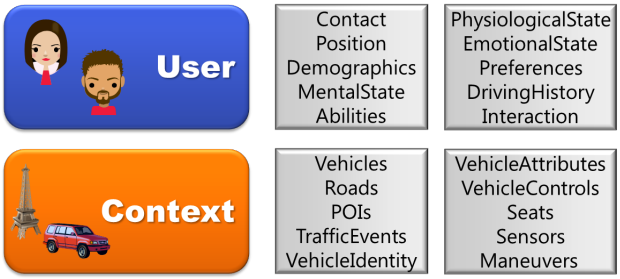

Figure 1: Top-level concepts for user and context.

Meta Knowledge. As a car is in motion most of the time, the context may change often and dramatically. Thus, the aspect of *time* plays a vital role for the design of an in-car knowledge management system. Essentially, we need to be able to associate a point in time or an interval with every piece of knowledge. Using a method like [3] enables time-based reasoning. In addition, we are dealing with a lot of uncertain information in the car, e.g. data based on sensors. Therefore, having a *confidence* associated with each fact can help applications assess the reliability of knowledge. Another recurring factor is the concept of geographic referencing, i.e. *location*. Most context information in fact applies only within certain geographical boundaries. Finally, to enable rich collaboration and road community scenarios, a setting that specifies the *privacy* level (e.g. vehicle, traffic ops and other road users) of a fact is needed.

In a follow-up study, we will examine both Driver Assistance Systems, as well as advanced in-development adaptive services, to define what could become a reference ontology for automotive HMI.

3. REFERENCES

[1] ISO/TS 24530-3:2006 Traffic and Travel Information (TTI) – TTI via Transport Protocol Experts Group (TPEG) Extensible Markup Language (XML) – Part 3: tpeg-rtmML.

[2] D. Heckmann, B. Brandherm, M. Schmitz, T. Schwartz, and B. M. von Wilamowitz-Moellendorf. GUMO - the general user model ontology. In *Proceedings of the 10th International Conference on User Modeling*, pages 428–432. Springer, 2005.

[3] H.-U. Krieger. A General Methodology for Equipping Ontologies With Time. In *7th International Conference on Language Resources and Evaluation*. ELRA, 2010. Oral presentation.