On In-Car User Interfaces for Car-2-X Pull-Applications: Design Considerations for HMIs

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ABSTRACT

Recent development in Car-To-Car research has brought up different use cases mostly focussed on safety related applications. Human Machine Interfaces (HMIs) are crucial for bringing these information to the users' attention. Even more difficult is the HMI design when it comes to user-initiated queries on the basis of this technology. This paper discusses the key issues when designing HMIs for so called Car-To-Car Pull-Applications.

1. INTRODUCTION

Today's research in Vehicle-To-Vehicle Communication is mostly focussed on safety related applications. Therefore, the first decade of the 21st century comprises many research efforts in developing the underlying technology: Among other, goals were evaluating carefully selected use-cases in the safety domain, e.g., hazard detection and local danger warnings [2]. Recent research efforts just started to investigate applicable HMIs for these kind of use-cases [1].

While the benefit of above described applications is out of question the available technology can also be used to provide value added services based on information available somewhere in the network (The user could, for example, request the current length of a traffic jam). In contrast to the established applications in the safety domain (*C2X Push*), user initiated use-cases (*C2X Pull*), add a number of additional challenges when it comes to designing in-car user interfaces which we address in this paper.

2. DESIGN CONSIDERATIONS

Table 1 lists the key issues which have a direct impact on the design of Push and Pull applications.

The most significant difference is the need for input modalities: Here, Push applications have no requirements on the sending side while the Pull-Case can feature a wide range of input modalities. Designing in-car user interfaces always bring up the question of driver distraction. Due to the necessity of input modalities, the user interface has to be de-

	C2X-Push	C2X-Pull
Input Modalities	-	Speech, Gestures, Touch
Domain	Mostly Safety Related	Value Added Services
Initiator	System Initiated	User Initiated

Figure 1: Differences between Push and Pull applications which have a direct impact on designing HMIs for the respective application type

veloped even more carefully under this aspect.

Another important factor is the initiator: While in safety related applications a notification about an event is broadcasted over the ad-hoc network in the latter scenario an information request is started by the user. After a required information is found within the network it has to find its way back to the initiator. One challenge here is for example how the HMI should react on high latency times. Since the ad-hoc network is highly mobile, the required information might not even find its way back to the initiator in some cases and therefore the system will get no notice of a failure. Simple timeouts are frustrating from a user's perspective. One solution to get around this problem is to put the driver's focus back to the road while the system informs him to continuisly trying to find the requested information and notifiy him as it becomes available.

While the system searches, the user could issue a second request. Handling multiple requests of a user to different times and refering to one of them is also a major challenge when designing the HMI.

The highly *asynchronic* points in time of request and answer have also an impact on the presentation: Relevance filtering and evaluating the current traffic situation have to be done in order to not distract the driver from his primary task. Thus, the HMI requires access to knowledge sources holding these kind of information.

3. REFERENCES

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