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1 Introduction

The Volkswagen group is one of the world's leading automobile manufacturers and the largest carmaker in Europe. The group is made up of multiple brands (among others Volkswagen and Audi). The product range extends from low-consumption small cars to luxury class vehicles. The large number of different car models leads to a wide spectrum of infotainment systems that have to be addressed. They vary in functionality, in the number of available input/output devices as well as in the characteristics of those devices, such as size and display resolution. As an illustrative example for this heterogeneity Figure 1 and Figure 2 below show the car cockpits and the user input/output devices of two Volkswagen models.

The intent for integrating web technologies into a car may be for instance to display web content in the car HMI or for realizing the entire infotainment HMI. Especially in the second aspect internal car data has to be accessible by web technologies. Consequently, the integration of web technologies (e.g. HTML5) into cars leads to a number of car-specific requirements. In this position paper we define technical challenges that have to be addressed by a working group focusing on 'web applications in your car'.

Figure 1: Car cockpit of the Volkswagen CC

Figure 2: Car cockpit of the Volkswagen up!

2 Technical challenges for web technologies in cars

2.1 Data management and synchronization for multiple displays

Cars often contain more than one display. Typically this is a head unit display, which is the main infotainment display (e.g. for navigation or media control), and an electronic instrument cluster that includes the speedometer. There exist use cases for presenting the same content on both displays. Besides using different presentation styles in each display, there is also a need to synchronize them. This might be for instance synchronized access to content data.

2.2 Data management and synchronization of multiple audio sources

Audio content that is rendered in cars might be accessed/streamed from sources such as storage media, a car radio or internal storage (e.g. navigation advices or safety warnings). Technologies controlling these audio sources must allow management of each audio output and the mixing of all sources into one output channel.

2.3 Priority management for presenting safety-related information

Visual and audio information rendered in cars is not only for infotainment purposes. Car systems also display safety-related information (e.g. alerts) that has to be presented immediately while aborting other information presentations. Technologies used for presenting information to the driver (audio and/or graphics) must function with priority management (e.g. alerts on display, pop-ups, overlays, automatic muting of non-safety-related content).

2.4 Event management and information processing between web-technology-based applications (‘web-apps’)

In case more than one ’web-app‘ is employed in a car (e.g. one per display), it is necessary that events and information messages are exchanged between these ’web-apps‘. Such communication is essential when one app relies on user input that is registered by another application.

2.5 Management and synchronization of multimodal input (simultaneous input via different channels)

Interactions between the driver and vehicle systems might not be limited to touchscreen input as on many consumer electronics devices. In cars user input might be extended by using speech, hand writing on a touch-sensitive surface or various gestures. In order to allow a seamless interaction, the inclusion and combination of user input via different interaction channels must be addressed by information presentation technologies.

2.6 Management and synchronization of multimodal output (simultaneous output via different channels)

Interaction between drivers and vehicle systems might not be limited to a graphical output on displays. Output might be extended by auditory and haptic information. In order to allow a seamless interaction, the combination and synchronization of output via different interaction channels must be addressed by information presentation technologies.

2.7 Inclusion of internal and possibly security-relevant car data

In case web-based technologies are used within car infotainment systems, they need access to internal and possibly security-relevant car data such as driver assistance systems, current vehicle position or current speed. Hence there is a need for a common API in order to access this data. Moreover a security control has to be established, which will decide whether access to data should be granted or denied for a certain web-app (e.g. an OEM or third party app).

2.8 Inclusion of complex content

The car infotainment may provide very rich content to the user. Examples are complex graphics for navigation or the video from a rear view camera. Infotainment system technologies must support high performance presentation and at the same time cope with limited hardware resources.

2.9 Availability of appropriate UI frameworks

For web technologies like HTML5, different JavaScript-based UI frameworks may be used (e.g. jQuery). The use cases for the interaction of drivers with cars require specific UI frameworks that are applicable to the input and output devices in cars. Moreover, brand-specific UI design should be possible.

2.10 Availability of high-performance web browsers that run on performance-constrained hardware

Web technologies that address consumer devices like PCs and smartphones typically rely on high computation performance on the device. The computation performance may be even more constrained in cars as the development cycles are much longer. In order to provide a valuable user experience to the driver there is a need for high-performance web browsers that run on performance-constrained hardware.

3 Conclusion

Depending on the use cases for integration of web technologies in cars, there are still various technical challenges that need to be addressed by an appropriate working group. We see challenges in the field of multiple input/output devices, data synchronization, information processing, priority management, security, framework availability and performance. Finding solutions for these topics and standardization of the results may lead to seamless employment of web technologies in cars.