Technology Excellence Series

Automotive HMI Fit for 2020

Analysis of key trends affecting evolution of in-car user interfaces

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Executive Summary

The way drivers interact with their cars is evolving, driven by changes in a number of related domains – personal mobile devices, car technology, consumer electronics, demography, economics, etc. This white paper analyzes the impact of global trends in these areas on the evolution of the automotive HMI and shows that connected car, voice, motion, touch, biometrics and handwriting technologies form the backbone of a car HMI in 2020.

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Introduction

The way drivers interact with their cars is evolving, driven by changes in a number of related domains. This whitepaper outlines key trends affecting the development of automotive Human-Machine Interfaces (HMIs) in the coming 10 years and attempts to predict how a typical automotive HMI might look like in 2020.

Key Trends

Automotive HMIs are influenced by global trends in several key areas: personal mobile devices, consumer electronics, car technology, demography, economy and legislation.

Personal Mobile Devices

Introduction of Apple's iPhone back in 2008 gave the smartphone market a powerful boost. Since then, the growth rates have been nothing short of spectacular, with Gartner predicting that more than 1bn smartphones will be shipped in 2015 [Gartner], meaning that almost every driver will have one or more of these personal mobile devices. Every new generation of smartphones becomes more powerful, enabling users to perform increasingly more complex interactions in such areas as entertainment, shopping, social networking or gaming. Some key trends will shape the smartphone market between now and 2020. First, mobile devices are increasingly customized by 3rd party applications: IDC predicts that in 2015 more than 183bn applications will be downloaded [IDC], generating a revenue of $37bn [Canalys]. Second, mobile services will increasingly become cloud-based, making use of ever higher connection speeds and improving network coverage. Users now access the same set of data in the cloud from various devices they own, using the same, personalized UI. Third, user interfaces on smartphones are being defined by touch, voice and motion with users routinely using voice to complete various tasks. New services make use of user's "mobile context", which incorporates user's location and situation, personal preferences and attitude. Finally, smartphones continue to use a multitude of mobile operating systems, with no OS gaining dominant position.

Influence on Automotive HMI

Since drivers want to use their smartphones also while driving, automotive HMI has to allow seamless integration of various brought-in personal devices based on various software and hardware standards. It should enable safe completion of non-automotive tasks that users usually perform on their mobile devices, such as shopping, social networking or communication. In order to help users deal with an ever growing number of tasks of increasing complexity automotive UI has to be simple, intuitive and flexible. Another requirement is the ability to cope with downloadable apps in a safe way, because the same apps are used in the car and on the go

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using cloud-based profiles. Automotive HMI has to use concepts and technologies that users know from personal devices, where UI innovation happens at a faster pace: buttons and visual indicators are being replaced by motion recognition, touch, speech commands and alerts, voice biometrics and handwriting recognition. Driver‘s “mobile context“- location, preferences and emotions - has to be used to make the HMI more intuitive. Just like mobile devices, in-car HMI is connected to the internet all the time and is upgradeable over the air, but is also usable off-line.

Consumer Electronics

While the consumer electronics market does not witness the dramatic developments seen in the personal devices market, it continues to exert important influence on the automotive HMI evolution. The key trend in consumer electronics is that of the connected home. Various home appliances are now connected to the Internet and therefore can interact with other appliances or be controlled remotely. Consumer electronics OEMs increasingly introduce speech technology as a way of simplifying user interfaces on the devices which often have limited screen size or no screen at all.

Influence on Automotive HMI

As consumer electronics gets connected, consumers expect their cars to do the same. Therefore, most cars will be connected to the internet all the time and automotive HMI will be used to control and communicate with connected CE devices left at home.

Car Technology

The automotive industry is being shaped by four mega trends: emission reduction, safety, convenience and affordability [Roland Berger]. While there is no lack of innovation in the industry, longer product cycles mean that it takes longer for cutting edge innovations to reach the market. The number of models is on the increase - from 4400 in 2010 to 6000 in 2020 [ATKearney] - with new segments being defined yearly. Penetration of infotainment and telematics systems is also on the rise, with affordable solutions like Ford Sync and Fiat Blue&Me bringing them to the lower end segments of the market. Connected car is the most important trend in car telematics and infotainment, with 50m connected cars expected to be sold in 2015 [IMS]. Importantly, consumer research suggests that key in-car applications are mostly car- and travel-centric (real-time traffic and weather, off-board and on-board navigation, emergency calling, off-board vehicle information), i.e. different from those on personal mobile devices or PCs.

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Influence on Automotive HMI

Mega trends in the car industry have direct influence on the evolution of the automotive HMI. Proliferation of market segments brings demand for customizable solutions that can fit into numerous models rather than one or several. Connected car means that HMI has to be designed with connectivity in mind. And while safe completion of core automotive tasks stays in the focus, automotive HMI should also enable safe completion of non-automotive tasks that users usually perform on their mobile devices (shopping, social networking, entertainment). The growing importance of the Asian markets drives broader adoption of such UI concepts as handwriting recognition. Automotive HMI will increasingly make use of UI concepts and technologies that users are familiar with from CE, in a safe way.

Social and Demographic

There are important social and demographic trends that affect the way drivers perceive and use their cars. One social phenomenon, observed in developed, but also in developing markets is that a car starts to lose its position as a status symbol, and thus its utility aspect gets more attention. Another social trend that is directly influencing the automotive HMI is the universal desire of people to stay connected, wherever they are. Continued urbanization fuels demand for smaller, but “smarter” cars. A new category of drivers is emerging: non-buyers, with car sharing projected to grow at CARG of 30% until 2016 [Frost&Sullivan]. Analysis of the global demographic situation shows a diverging picture: while drivers get older in the developed countries, car buyers in new economies are younger and technology-savvy.

Influence on Automotive HMI

Aging of drivers in mature markets means that automotive HMI has to be built on simple and intuitive concepts, suitable for older drivers: speech commands and alerts, voice biometrics, gesture recognition. Also, demand for new types of related in-car services will grow: driver health monitoring concepts, emergency services, etc. Young drivers will embrace new HMI concepts as long as they are convenient and intuitive to use. The increased popularity of car sharing brings the need for personalization for many drivers in the same vehicle. Because customers want and expect connectivity in their cars, HMI should enable safe and convenient use of connected services and access to personal data stored in the cloud. In some segments innovative and cutting edge HMI concepts can become an important differentiator to counteract overall decline in the importance of the car brand.

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Economic Development

A key economic trend affecting the automotive industry is the shift of economic power to Asia. Indeed, it is predicted that in 2020 more cars will be sold in Asia than in North America and Western Europe combined [Economist]. This means that almost all growth in the car industry comes from the emerging markets, but cars sold there are cheaper cars with less sophisticated telematics and infotainment systems.

Influence on Automotive HMI

As more and more cars are sold in Asia, demand for low-cost infotainment and telematics solutions with possibly degraded quality or functionality increases. Many of the systems in these markets will replace the screen and most of the buttons by voice technology, eliminating the need for expensive hardware components. Support for local languages and dialects as well as handwriting recognition will be an important feature in these systems.

Legislation

There are constant efforts in all regions of the world to raise safety and environmental standards for personal transportation. These efforts often result in laws that prescribe certain always-on telematics services (e-Call, ERA-GLONASS) to be installed in all cars or make the use of hands free mandatory when making calls while driving. For example, in the US, talking on a hand-held phone while driving is banned in 10 states, while texting at the wheel is prohibited in 36 states.

Influence on Automotive HMI

Smaller and cheaper car resulting from the introduction of tighter environmental standards require lower-cost HMI solutions. At the same time, initiatives like eCall make the connected car a requirement and ensure broad adoption. Similarly, mandatory hands-free solutions result in a broader uptake of voice technologies.

Automotive HMI fit for 2020

All trends mentioned above have their influence on the evolution of automotive infotainment systems in general and their UI in particular. While predicting how a car HMI will look like in 2020 is no easy task, certain traits and features can be predicted with reasonable certainty.

The first key aspect that is already being widely adopted is connectivity. In a connected car, the user interface is designed with connectivity in mind, significantly enhancing the possibilities of such technologies as speech synthesis and especially speech recognition. However, when connectivity is not available, the UI stays functional by making use of the embedded technologies. Such a hybrid solution is powerful, flexible and robust.

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Voice, motion, touch, biometrics and handwriting technologies form the backbone of a car HMI in 2020. There are less buttons to press or knobs to rotate, making the UI not only more intuitive and suitable for more complex tasks, but also safer and easier to use for older people. The UI of new automotive services is built around the “mobile context” of the driver, i.e. the car takes into account driver’s location and driving situation as well as personal preferences and attitude. For example, for a careful driver in a difficult traffic situation the car will keep distractions to the minimum and only show the most urgent notifications.

Since many of the tasks drivers perform are travel-related, automotive HMI is specifically tailored for top performance in such areas as off-board and on-navigation, real-time traffic and weather information, vehicle diagnostics, messaging, etc.

At the same time, the proliferation of smartphones, music players and tablets means that another defining feature of the automotive HMI is seamless interoperability with brought-in mobile devices and consumer electronic devices at home. This interoperability goes beyond the simple ability to operate various devices in the car and means, for example, that the same UI profiles and data are shared across cars, mobile devices and consumer electronics. A driver uses the same, familiar UI across all his devices, instead of learning different UI concepts for each device. Another crucial feature is safe execution of downloadable applications in the car environment.

As cars are being shared by several (or even many) drivers, fast and reliable driver identification using voice biometrics becomes important. After the driver has been identified, the car HMI is personalized according to his or her preferences. However, it is not only a matter of convenience, but also a security feature, since cars store or provide access to more and more personal information.

Finally, unlike the current situation, where the car UI normally does not change after the car is manufactured, it will be possible to upgrade the UI over-the-air, adding newly released features or fixing problems. Drivers will additional UI features (like identification by voice) and get them activated without going to a service station. And as the number of car models increases, car manufacturers will seek to reuse the same HMI solutions across greater number of cars, meaning that these solutions have to be modular and easily customizable.

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About Nuance

As a leading supplier of speech components to automotive OEMs and vendors, Nuance Communications offers an integrated suite of technologies and services to enable voice-activated dialing, voice destination entry for navigation systems, vehicle command and control, in-vehicle entertainment systems and connected services. The company's speech recognition and text-to-speech software deliver state-of-the-art performance and a rich set of features and tools tailored for the highly demanding automotive environment. For more information, please visit:www.nuance.com/automotive

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