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EB TechPaper *i*

How to communicate efficiently with cars

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There are several different technologies for vehicle operation, from buttons and touchscreens to control by gesture and voice commands, but which are best for the driver?

Despite all the headline news generated by the subject of autonomous driving and the many prototypes that have been developed, it will take some time until the end-result vehicles will be hitting our roads. At the same time, traffic congestion is increasing continuously and drivers want to be kept up to date and for people to be able to contact them at all times. That's why the number of technical features in cars is constantly increasing. To meet all these requirements we need intelligent interaction concepts that are easy to use and won't distract the driver. Yesterday's levers and switches have been replaced by a much more diverse range of vehicle operation options, from buttons and knobs, through conventional touchscreens that are operated with one or several fingers to interfaces that recognize gestures and systems that understand voice commands. Each of these systems has its specific strengths and weaknesses.

Operating concepts

The classic **on-off button** is probably the operating concept that is easiest to use and looks most like the operating systems of yesteryear. However, only limited input is possible with a button, moreover the number of buttons in the car must be manageable for the user. So many manufacturers switched over to multi-functional **push rotary button.** These could be additionally tipped and rotated, and newer models even have sensory surfaces so that the driver can enter input using a finger. The driver needs a little time to familiarize himself with all the functions and to be able to operate them without having to think about it. One advantage of these push rotary buttons is that, as soon as he is used to it, the driver can perform complex functions with one single operating element without looking on it.

However, many drivers who use smartphones and tablets on a daily basis think that the push rotary button is outdated. They prefer **touchscreens** and they are generally quite familiar with their use.

On the other end of the scale are older generations who prefer operating their computer and mobile phone with keys and buttons , and who aren't particularly adept with touchscreens. It also takes practice to use a touchscreen while you're driving because the vehicle's movement makes it difficult to enter input and necessitates permanent hand to eye coordination. Another consideration is that only touchscreens which are located on the center console and easy to reach offer the necessary convenience of operation, so instrument cluster and head-up displays are not operable with touchscreens.

Gesture control is a feature that augments the conventional touchscreens. It allows the driver to draw on the display with a finger and use intuitive abbreviations for frequently used functions (Fig. 1). So a simple roof symbol (^) can be drawn to navigate to the driver´s home instead of complicated entries. A proximity sensor that detects when the hand is approaching the screen, similar to the one that is currently installed in the Golf VII, can change the interface graphics to help the driver select the desired option. New sensors are also capable of detecting finger gestures in open space, right above the gear stick knob, for instance.

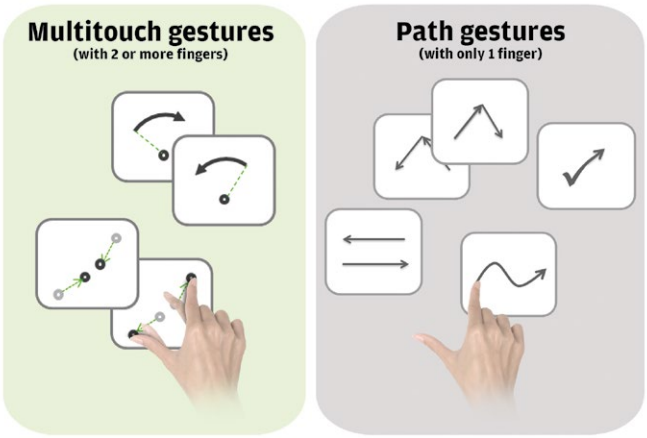


Fig. 1: Gestures
Gestures on a touchscreen can be performed with two or more fingers (multi-touch gestures) or just one finger (path gestures).

Being able to communicate with a car verbally as we do with other human beings is obviously an even easier concept. Modern interactive voice response (IVR) systems are fast approaching this ideal scenario. Natural Language Understanding (NLU) technology eliminates the need for the driver to learn specific commands, and he can choose his words more or less freely. For example, he could say, “Play me the current Top 20“, or “What’s the weather like at the destination?“ Several commands can also be given simultaneously. Configuration of the speech recognition system is, however, very complex, memory-intensive and time-consuming, and it is also necessary to compile new data for every additional language. This is the reason why many manufacturers are now moving their speech recognition software onto servers in the cloud (Fig. 2). This gives them more computing resources and each command that is entered can be used to expand the vocabulary base and continuously improve voice recognition. Despite all the progress in voice response technology over recent years, there is still a brief time delay between the command being given and its execution. Noise can also result in the command being misunderstood. And naturally yet there are not only state-of-the-art speech dialog systems in cars driving on the road, many people are driving cars which are some years old and have out-of-date and complicated-to-use speech technology inside.
These disadvantages have persuaded many drivers to prefer button technology until the IVR systems have been perfected.

Unfortunately, no single operating system is perfect for all applications and all users up to now. This means that drivers have to select the option most suited to the application, the situation and their personal preferences. And the vehicle manufacturers can only attempt to satisfy the broadest possible range of user needs, taking current technical trends into account, with the assistance of empirical data and usability studies. A carefully designed concept is necessary to ensure the consistent usability of all modalities so that drivers are not constantly challenged by the introduction of new operating options. Car manufacturers who have the courage to perfect two or three options, and eliminate all the other ones from their vehicles, would probably be much appreciated by drivers. In future, new legislation to prevent driver distraction and improve vehicle operation safety will probably also play an important role for user interaction concepts in vehicles and the drivers´ preferences and habits in terms of communicating with their cars.

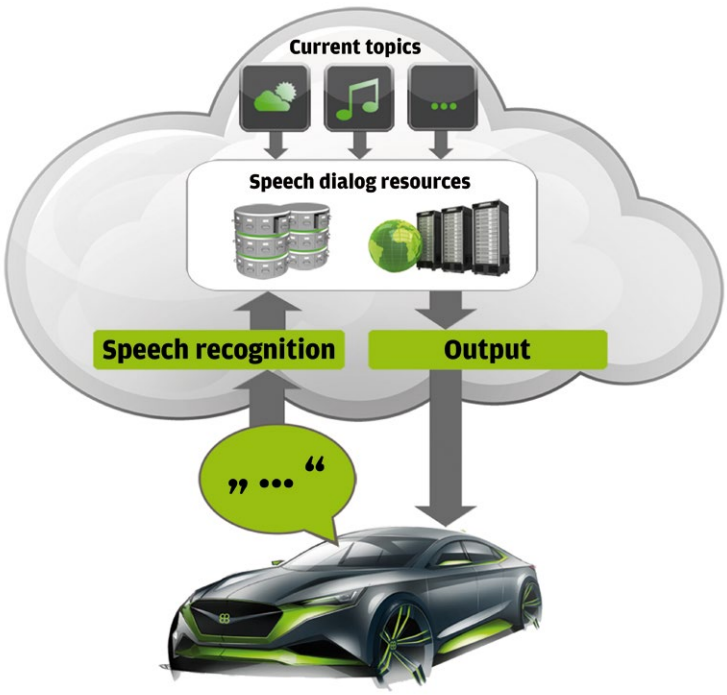
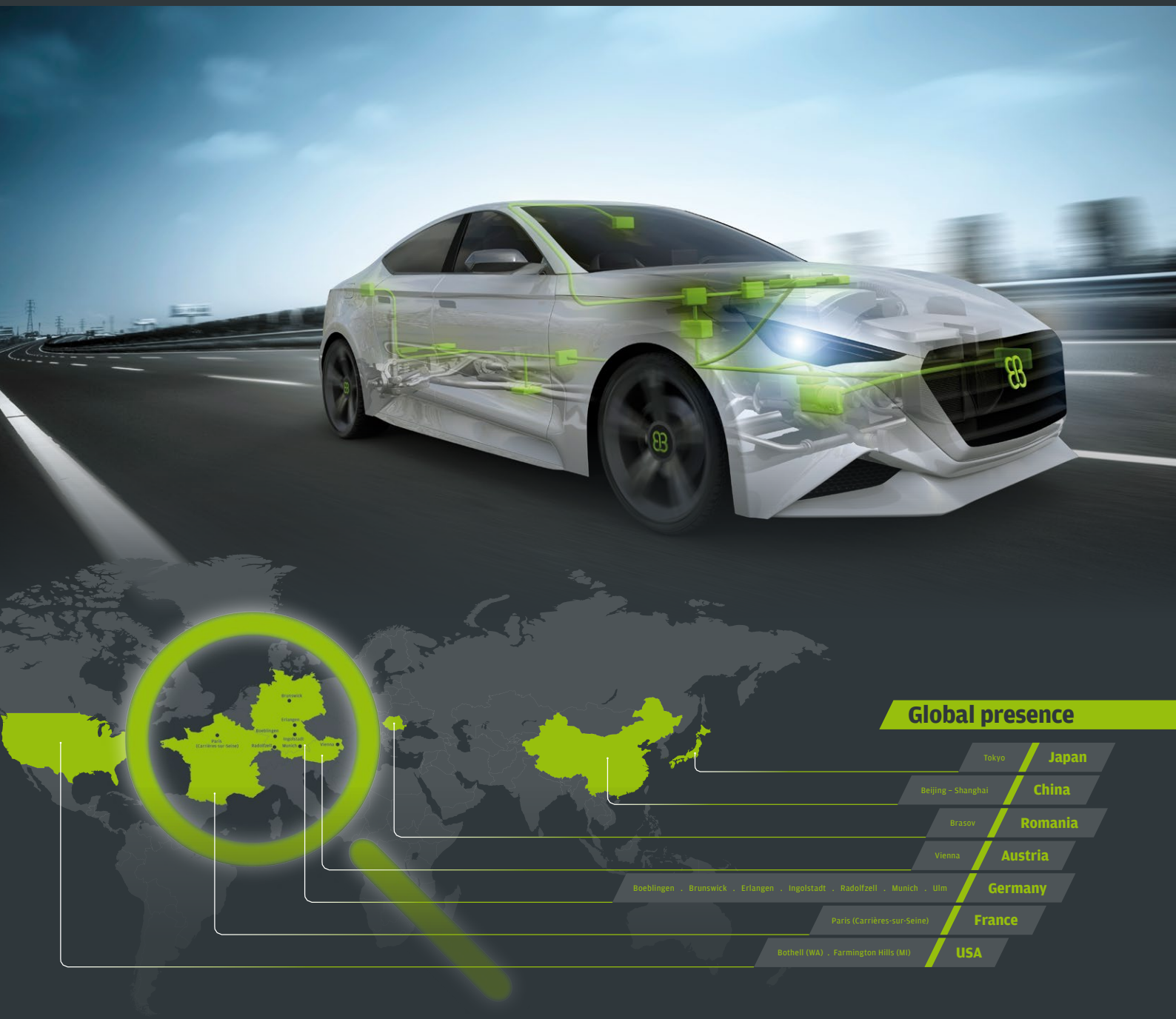


Fig. 2: Interactive Voice Response (IVR) in the cloud
Voice commands from the driver in the vehicle are transferred to the cloud for recognition and processing. The output is then transferred back to the vehicle, taking all current data and services into account.



About EB Automotive

EB Automotive is recognized internationally as one of the most important suppliers of embedded software solutions in the automotive industry. In addition to the development of products, EB Automotive also specializes in services and consulting for the automotive industry, supplying implementations of software solutions for a broad range of AUTOSAR ECUs, functional safety, infotainment, navigation, HMI and driver assistance systems. EB continues to invest in feature integration and development tools ensuring in-vehicle devices ship in volume earlier and arrive quickly to market.

Elektrobit Automotive GmbH
Am Wolfsmantel 46
91058 Erlangen, Germany
Phone: +49 9131 7701 0
Fax: +49 9131 7701 6333
sales.automotive@elektrobit.com
automotive.elektrobit.com