



Nuance Voice Control for Automotive

Enabling a Single Consistent Voice User Interface to Connected Car Services

Lewis Mowatt, Nuance Communications, February 2009

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In today's fast-paced mobile society, people are spending more and more time in their cars. Longer commutes, jam-packed schedules and increasingly wired lifestyles have created strong demand for services that keep drivers connected on the go. Drivers have come to value the ability to control dialing, in-car entertainment and navigation systems using speech. Now drivers want on-demand access to real-time information and dynamic network services. They want to know which local fuel station has the best price on diesel. They want the latest weather conditions in their destination location. And they want up-to-date driving directions based on current maps. Month-old data and yesterday's news will simply no longer suffice.

Fortunately for drivers, connected services are no longer marketing vaporware. Device manufacturers and automakers alike are leveraging the latest technologies to meet growing demand for off-board services. For example:

- BMW ConnectedDrive offers car drivers a variety of information, communication and assistance services ranging from up-to-date traffic information, e-mailing to location based services and business finder.
- TomTom recently launched GO x40 LIVE, which provides real-time traffic information; TomTom's Fuel Price Service; Local POI Search powered by Google; weather updates; and TomTom Buddies for exchanging location information and text messages with friends.
- Announced at CES 2009, Ford's next-generation SYNC™ will not only lets drivers use voice commands to play music, make phone calls, monitor vehicle health and connect to 911, but will offer dynamic access to traffic reports, turn-by-turn directions, business searches, and the latest news, sports and weather.

NVC Auto offers a compelling value proposition for today's leading automakers:

- Enables innovative new services that differentiate your brand from the competition
- Delivers integrated access to on-board and off-board services for a consistent, safe and convenient user experience
- Meets the needs of global markets with support for 18 languages
- Supports customized task flows and branding for unique service offerings
- Provides the ability to add more services over time

The connected car has arrived and is here to stay. The question is how to make connected services safe and easy to use. The answer? Nuance Voice Control for Automotive (NVC Auto).

Safer, more convenient access to the connected car experience

Connectivity should not come at the expense of safety and convenience. That's why an easy-to-use driver interface that minimizes driver distraction is critical to the ongoing success of connected solutions. Speech interfaces went a long way toward addressing key safety concerns by enabling hands-free, eyes-free access to and control of in-vehicle systems network services. Until now, however, drivers

have not had a single, consistent interface for interacting with on-board and off-board functionality and services. Switching back and forth between interfaces—each with its own set of commands—can be a distraction in itself, hampering ease of use and putting driver safety at risk.

According to the **Automotive Voice UI Usability Study**¹ conducted by MAIX Market Research & Consulting in December 2008, the majority of car drivers who are used to controlling their in-car systems by voice consider speech access to connected services, such as up-to-date traffic and weather information, one of the most important feature improvements that automakers and device

manufacturers can offer. The study findings showed that respondents prioritized voice access to connected services as follows:

- Traffic information (42.7%)
- Weather information (39.7%)
- Finding a business (37.3%)
- Searching the web for generic information (33.7%)
- Searching the web for location based services (32.1%)

NVC Auto delivers a consistent user experience across on-board and off-board services. Here's how:

- A content-rich speech interface enables safe, convenient hands-free, eyes-free interaction
- Natural, conversational speech provides access to both static on-board information and services as well as dynamic, on-demand network services
- Powerful speech recognition technology and natural language understanding yield consistently accurate and intelligent results

NVC Auto is the industry's first solution to provide seamless access to all services —on-board and off-board — via a single, consistent voice user interface. It combines the best of Nuance's foundation technologies, embedded speech solutions, and mobile speech applications to give today's drivers safe, intuitive access to the complete "connected car" experience.

Extensive experience working with auto makers, mobile carriers, and device manufacturers makes Nuance uniquely qualified to provide unified speech access to connected car services. Nuance offers the most complete,

integrated suite of technologies and services to enable voice-activated dialing, voice destination entry for navigation systems, vehicle command and control, and in-vehicle entertainment systems. Our speech recognition and text-to-speech software delivers state-of-the-art performance and a rich set of features and tools tailored for the highly demanding automotive environment. In addition, Nuance's broad set of mobile speech solutions —from simple voice dialing to speech-based Web search — is enabling leading carrier partners to deliver intelligent access to mobile services and applications.

NVC Auto brings together Nuance's proven technologies and demonstrated expertise in delivering embedded and mobile speech solutions to give drivers safe, convenient access to on-device, in-vehicle, and connected services. The success of our automotive solutions speaks for itself:

- Nuance’s automotive speech solutions have been successfully implemented in around 10 million cars worldwide, representing more than 100 models from more than 25 automobile brands from all major car manufacturers, including Daimler, Fiat, Ford, Hyundai, Nissan, PSA, Renault, in all major PND brands incl. Garmin, Medion, Mio, Navigon and TomTom, as well as quality Tier 1 suppliers, such as Aisin AW, Alpine, Bosch Blaupunkt, Bury, Denso, Magneti Marelli and Microsoft.
- Nuance Voice Control, a comprehensive system that enables users to control mobile devices using easy-to-remember voice commands, has been deployed by major mobile carriers including Sprint in the United States, Rogers in Canada, and Palm, Inc.
- General Motors’ widely deployed OnStar system uses Nuance Voice Control’s core speech recognition engine for its off-board automotive services

What’s more, Nuance has the automotive world covered. NVC Auto is available in 25 languages to meet the needs of all major automobile markets across the globe.

A speech-driven hub for complete access, control and communications

NVC Auto consists of several key components that work together to deliver integrated access to on-board and off-board services through a single speech interface. The NVC Auto in-vehicle head unit serves as “mission control,” tying together all solution components to enable high-performance speech interaction with all services available in a connected car environment. The in-vehicle head unit leverages the Nuance VoCon® 3200 speech recognition engine and Nuance Vocalizer™ text-to-speech (TTS) solution to enable direct speech interaction with on-board applications. These proven solutions allow drivers to use speech for controlling in-vehicle systems — mobile phones, entertainment systems, navigation devices, and more.

NVC Auto includes a customizable set of gate commands that trigger access to Nuance’s remote speech applications — both standard and custom — to enable voice interaction with off-board services over a mobile network. These remote speech applications leverage Nuance Recognizer, a best-of-breed speech recognition solution for integrated voice response. The remote speech applications interact with multiple information services to gather the response to the user’s query and transmit the results back to the client on the in-vehicle head unit. Finally, the in-vehicle head unit displays or reads the results back to the user.

Figure 1

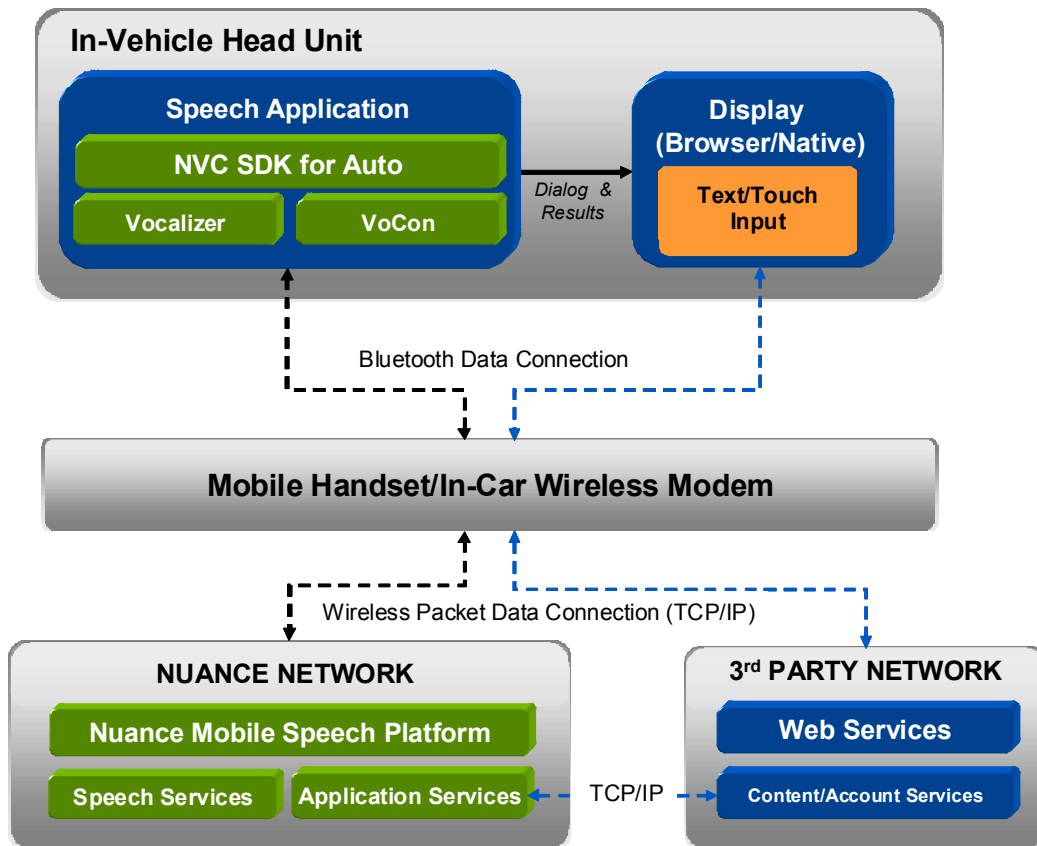


Figure 1 shows how all NVC Auto components work together to deliver integrated access to on-device, on-board, and off-board services through a single, consolidated speech interface.

One integrated speech interface to a broad spectrum of services

Nuance Voice Control Auto lets drivers use a single integrated speech interface to interact with a complete range of connected car features, functions and services. Nuance’s advanced Natural Language Understanding capabilities support exceptionally accurate recognition of natural, “out-of-grammar” utterances for more efficient interaction with connected car services. Natural language understanding is critical for handling the immense variability in spoken prompts or commands for information retrieval and service access. What does this mean for drivers? They can take full advantage of available features and services by using natural, conversational speech — without having to memorize a long list of commands.

Let’s explore the specific types of connected car services drivers can access using NVC Auto.

On-Board Services

NVC Auto provides enables speech-driven interaction with on-board functionality. The in-vehicle head unit incorporates proven solutions including Nuance’s VoCon 3200 speech recognition engine and Vocalizer for Automotive TTS technology (TTS) (see side bar for more information).

These solutions enable drivers to use speech to interact with in-vehicle features, devices and systems and to access on-board content, like music files or maps. With NVC Auto, drivers can use voice commands to control in-vehicle audio and climate; select music from extensive playlists on in-car entertainment systems (Ford SYNC® , for example, supports up to 15,000 tracks); and enter destination addresses into vehicle navigation systems.

NVC Auto includes proven solutions for enabling speech-driven interaction with **on-board services**:

VoCon 3200

A high-performance speech recognition engine tuned for the demanding automotive environment, VoCon 3200 delivers exceptional recognition accuracy. It offers:

- Large vocabulary support (up 300,000 item list of names, addresses, music titles, etc.
- Noise-robust front-end.
- Patented spelling module
- Low CPU requirements (ARM 9)
- One-shot destination entry
- Support for 27 different languages
- Optional speaker adaptation for addressing unique recognition challenges

VoCon 3200 comes with a development environment for prototyping and benchmarking; professional services including UI design implementing , tuning and consulting, and application modules for voice dialing, address entry and music selection.

Nuance Vocalizer for Automotive

A text-to-speech solution designed for navigation and automotive human-machine interface (HMI) applications, Vocalizer for Automotive scales to meet the requirements of standard personal navigation devices, baseline telematics platforms, and high-end in-car HMI systems.

Built around a single language-independent API and core engine, Vocalizer for Automotive supports fast prototyping, porting, and flexible addition of new languages and voices.

NVC Auto incorporates proven Nuance solutions for accessing **off-board services** using natural speech:

Nuance Voice Control (NVC) 2.0

An innovative suite of speech capabilities — built using a customizable, modular framework — that includes:

- Voice activated dialing
- Free-form Web search
- Text or email message addressing and dictation
- Music search
- Navigation
- And any other feature or service operators and OEMs want to voice enable.

Nuance Mobile Speech Platform (NMSP)

A groundbreaking architecture of tools and components, NMSP enables mobile application developers to enhance their offerings with a seamless speech experience. NMSP can be leveraged to enhance:

- mobile search
- mobile messaging
- mobile navigation services

Nuance Recognizer

Nuance Recognizer, a best-of-breed speech recognition solution for network based applications that promotes more natural interactions through features like:

- one-step correction
- implicit confirmations
- mixed initiative
- robust parsing
- selective barge-in
- information-based dialogs
- conversation management

Off-Board Services

NVC Auto also enables interaction with off-board services through remote speech applications based on the Nuance Mobile Speech Platform (NMSP). Communication between a remote application server and the NMSP client — which resides within the in-vehicle head unit — enables the driver to use the same speech interface to connect to a wireless network for accessing dynamic real-time information and services such as:

- News, weather and traffic updates
- Latest sports scores or stock prices
- Dining options in current area or point of destination
- Movie theatre locations, film listings and times
- Price comparisons for hotels, gasoline, etc.

How can the driver use the same voice interface to interact with on-board and off-board services? Gate commands—recognized by VoCon 3200 on the in-vehicle head unit—trigger access to remote services over a wireless network. Automakers can use the fixed commands that come standard with NVC Auto or they can modify the commands to be consistent with the vehicle's overall human-machine interface for a superior user experience. They can even use natural language gate commands which allow the driver to access network services using conversational speech for an exceptionally fluid user experience.

Figure 2

Category	Gate Command
Search & Content	Find Business
	Find Business
	Find Restaurant
	Find Movie
	Get Directions
	Get Weather
	Get Sports
	Get Stock Quote
	Get News
	Find Music
	Go To <<Custom Application>>
	Find <<Custom Command>>

Fig. 2 shows NVC Auto’s standard gate commands for triggering access to off-board information and services over a mobile network.

Once the gate command triggers access to the remote services, subsequent speech recognition occurs remotely — a transition that is completely transparent to the driver. Then the network-based components of NVC Auto prompt the driver for more information. For example, if the driver utters the standard gate command, “Get Weather,” NVC Auto’s remote speech applications prompt the driver for more detailed information. (i.e., “For what location?”). Upon recognizing the driver’s response, (i.e., “Boston, Massachusetts”) NVC Auto communicates with the remote data services to retrieve up-to-date information about current weather conditions in Boston and returns it to the client on the in-vehicle head unit for presentation to the driver.

NVC Auto’s remote speech applications take advantage of Nuance Recognizer, a best-of-breed solution for integrated voice response, to enable more efficient and natural interactions with remote data services — without compromising accuracy or reliability (see sidebar for more information).

Figure 3

Gate Command	Location	Result
“Get Weather”	“Boston, Massachusetts”	NVC Auto returns current information about weather in Boston — either actual data or web URL



Figure 3 shows which driver commands and utterances are recognized on the device and which are recognized on the network. Thanks to NVC Auto’s integrated speech interface, this distinction is completely transparent to the user.

Industry-Leading Language Support

NVC Auto offers the industry's broadest range of search and content language support to address the needs all major automobile markets in all regions of the world. Supported languages include:

Americas

- US English (ENU)
- US Spanish (SPM)
- Canadian French (FRC)
- Brazilian Portuguese (PTB)

Asia

- Australian English (ENA)
- Japanese (JPJ)
- Mandarin (MNC) 3
- Cantonese (CAH)
- Korean (KOK)

Europe (DEFIGS)

- Dutch (DUN)
- Flemish (DUB)
- UK English (ENG)
- European French (FRF)
- Italian (ITI)
- German (GED)
- Castilian Spanish (SPE)

Europe (Rest)

- Czech (CZC)
- Danish (DAD)
- Finnish (FIF)
- Greek (GRG)
- Polish (PLP)
- EU Portuguese (PTP)
- Russian (RUR)
- Swedish (SWS)
- Turkish (TRT)

Nuance Professional Services

In today's crowded automotive market, being first to market with innovative new features can be a huge competitive advantage. Nuance's Professional Services team can provide fully built and tested integrated speech interfaces on behalf of customers or we can supplement your in-house resources and expertise to accelerate the development process. Either way, Nuance's Professional Services team can draw on its extensive experience in application development and data collection to ensure a faster time to market. Depending on specific project needs, Nuance clients and partners can choose the appropriate level of support — ranging from consultative services to end-to-end implementations.

Our Professional Services organization spans the globe and can provide local support and services in many different regions. For each engagement, we can draw from more than 100 professionals in the United States, Canada, Belgium, Germany, France, Taiwan, Korea, Japan, Australia and the United Kingdom to assemble a team that includes just the right mix of resources, including:

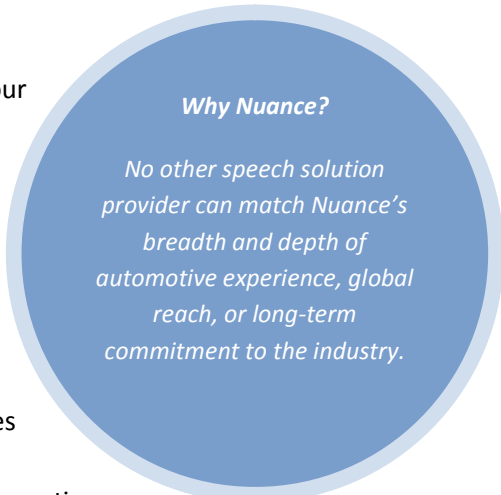
- Local and global project managers
- Hardware platform specialists
- Speech scientists
- Quality assurance engineers
- Speech user interface designers
- Voice application and grammar developers

Using Nuance’s proven project standards and global engagement methodology, our experienced professionals will work closely with your organization to create a high-quality NVC Auto solution that enables safe, convenient interaction with connected car services.

Hosting Services

The mobile components of the NVC Auto solution – including the remote speech application and transaction servers—are offered as hosted service. These components are maintained and operated by Nuance at one of our worldwide data centers. A hosted model ensures sufficient capability for NVC applications, transaction servers, and incoming data/phone lines — even as the number of users increases over time.

Hosting costs are determined by the number of active users, the number of transactions per user per month, and the service provision required for ensuring scalability to accommodate growing user activity.



Stay ahead of the curve with NVC Auto

In a recent article, *“In-Car Internet Is Here, and More Mobile Web Surfing Is Coming,”* Doug Newcomb, Senior Editor of Technology for Edmunds.com confirmed the advent of commercially viable connected car services²:

If you're an early adopter who wants to go online while on the road — beyond what's available on the small screen of a mobile phone — Web access in the car has arrived... Once technological and safety hurdles are overcome, being connected to the Web in our cars should become as common as listening to our iPods.

As the industry’s first single, integrated speech interface to both on-board *and* off-board services, NVC Auto addresses the technological and safety hurdles that — until now — have kept connected car services out of the mainstream. NVC Auto gives auto makers the opportunity to capture greater market share by attracting sophisticated auto buyers who seek to extend their wired lifestyle to their vehicles — without compromising safety or convenience.

To learn more about the NVC Auto solution, please contact Holger Scholl, Senior Sales Engineer, Nuance Communications, at holger.scholl@nuance.com.

References

¹*Automotive Voice UI Usability Study*, December 2008

- Conducted by MAIX Market Research & Consulting GmbH
- Commissioned by Nuance Communications
- Study participants included 473 owners of speech-enabled in-car navigation and infotainment solutions in US and UK

² *"In-Car Internet Is Here, and More Mobile Web Surfing Is Coming,"* Doug Newcomb, Senior Editor of Technology for Edmunds.com

About Nuance Communications, Inc.

Nuance is a leading provider of speech and imaging solutions for businesses and consumers around the world. Its technologies, applications and services make the user experience more compelling by transforming the way people interact with information and how they create, share and use documents. Every day, millions of users and thousands of businesses experience Nuance's proven applications and professional services. For more information, please visit: www.nuance.com.

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