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WHITE PAPER

Intelligent In-Vehicle Infotainment(IVI)

Introduction

Automotive infotainment is one of the fastest growing technologies in the industry – a growth trend expected to continue with the smart phones technology boom.

Consumers want PC-like responsiveness, human-machine interface and power from every device on the go. Meeting this growing demand for the best possible consumer experience, within time to market demands, is increasingly falling in the infotainment domain.

Infotainment units are hardware devices used in vehicles to provide navigation, connectivity and audio / visual entertainment. Most vehicles nowadays have infotainment for entertainment, connected with devices such as personal navigation systems and smart phones with a hands-free car kit. Smart phone connectivity bridges the product life cycle gap between car infotainment systems and smart phones. It utilizes the advances made in a rapidly expanding smart phone based infotainment system.

IVI features include, handset integration, head-up display, infotainment systems for driver assistance, interior personalization and Cloud based infotainment. The million dollar question is, can a smart phone replace all systems used in the car, from dashboards and navigation systems to car audios and telematics?

Integrating technology to support multiple features or systems is not a new idea. Indeed, many automotive component suppliers are involved in integrating the existing car navigation system with the car audio and the mobile phone, using a handsfree kit or Bluetooth.

Fresh thinking and focus is all that is required to bring about a change in the automotive infotainment domain. Including a cluster dashboard in the integrated solution with a smart phone could well be the future trend. The possibility of standardizations, with MirrorLink, which uses Virtual Network Computing (VNC), has added strength to handset integration.

Infotainment systems are not only used in entertainment, they are also used in road assistance for driver safety, with features such as video & data recording from rear view & night vision cameras and black box recording. Add an augmented reality head-up display and you not only have a driver that stays focused on the screen, but also one that assimilates more information on the move.

There is a huge and growing market opportunity for IVI systems that create a superior in-car user experience. The interlacing of the car's IVI system with the driver's mobile device and applications can help achieve that connected car experience. The main mobile applications used for music streaming include Spotify and iTunes, with each media player using different methods to get user experience data.

This convergence enables the creation of innovative applications which interact with the electronics control unit for remote monitoring and control in-car multimedia experiences, navigation and internet connectivity.

Intelligence in IVI can be used in various scenarios and with different implementation approaches:

Proposed approach

With rapid growth in smart phone and Cloud technologies, consumers are clamoring for live streaming of music, Internet radio and smart phones. Ideas for advanced infotainment features integrate both user behavior and the next level of data based infotainment systems. They can:

- Add power to IVI by manually personalizing the media source playlist or by automating the choice of entertainment based on user behavior data. User behavior data is derived by analytics inputs from interactive voice recognition, based on the mood of the vehicle owner.
- Enroll on demand entertainment from Cloud based sources to intelligent IVI instead of local media databases like DVD players or Bluetooth streaming audios.
- Share and store media files like photos, music and videos, which include, Cloud based media databases like Twonky, Plex and air video. This sharing of media files will lead to saving local space and having more media choices between groups.

Universal plug and play or digital living network alliance software helps people enjoy personal and online music, photos and videos. It is also used to share favorite media with PCs, TVs, stereos and other devices connected to your network.

Vehicle-to-vehicle communication can be used to transfer music by:

- Extending vehicle interior personalization like ambient & mood lighting and instrument cluster rearrangement to include user's choice of music. This opens up the

possibility of completely altering how the car's dashboard and other interior components look.

- Having integrated technology by extending the human-machine interface of smart phones with navigation units. It is done by using virtual network computing, hands-free or Bluetooth interfaces.

Registering vehicle health reports on an infotainment device would also be possible as an advanced feature. It is a feasible scenario as intelligent IVI acts like a standalone Electronics Control Unit (ECU) and could easily be interfaced by a gateway to talk to other ECU's. An application which is resident on the infotainment unit can typically utilize standard on board diagnostic tests to provide vital health information.

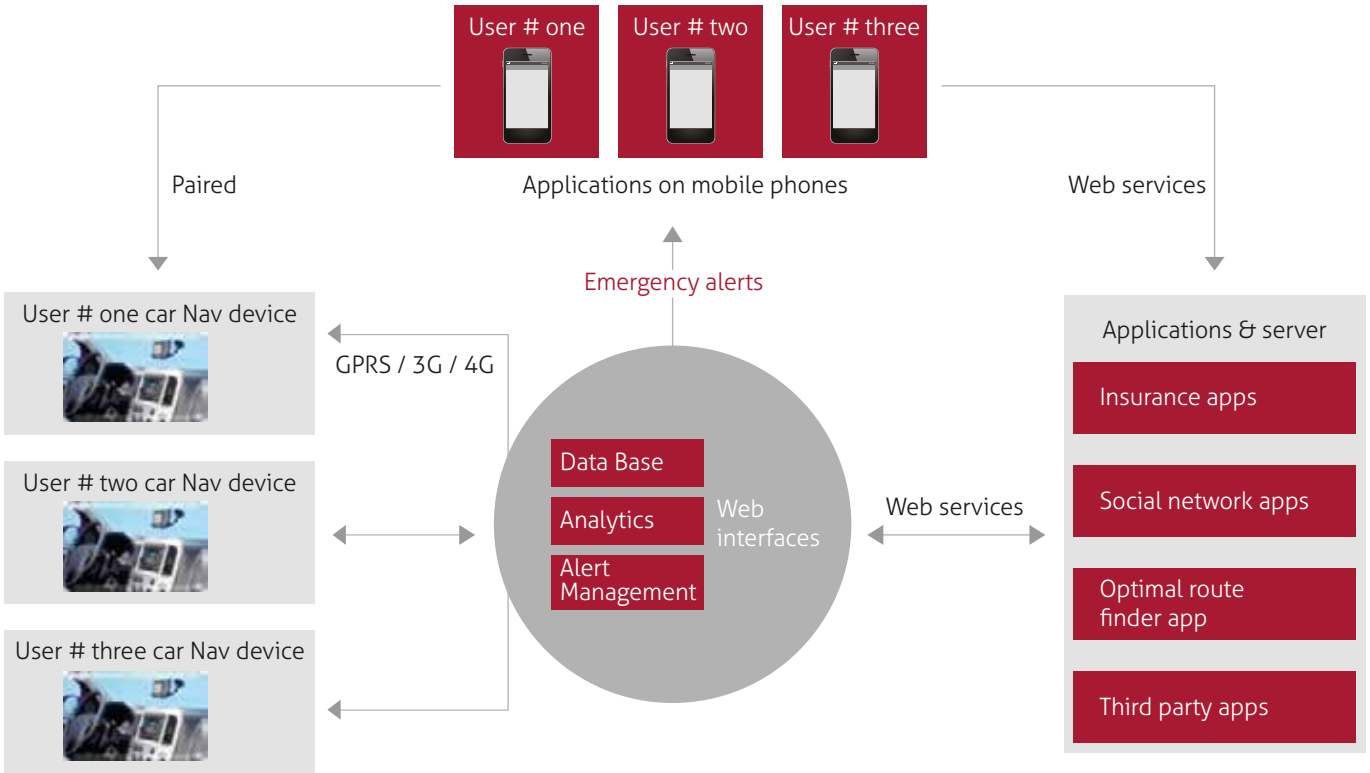
Typical use cases

This system architecture could, for example, be used for intelligent profiling. It could detect kids in a vehicle through an interactive voice recognition system or an image processing system, using the human detection algorithm.

Lone drivers identified by interactive voice recognition or image processing, could choose pre-set music or make a mood-based profile to help them relax.

Profiling can be achieved in two ways – manually or semi-automatically. Semi-automatic profiling takes various inputs such as voice recognition for identifying persons, a human detection algorithm to detect images of users in the cab or even noise level detection.

More intelligence can be added by getting Cloud based songs, depending on the user situation. Indeed, making an interactive radio by requesting for a song to be broadcast is one of the challenges which need support from Cloud or a frequency modulation radio service provider.



Existing devices with user behavior analytics

Some existing media players distinguish user behavior patterns in both thick and thin customers, where analytics is done on the device itself, as well as on the Cloud. Media players use their own technique or approach to analyze user behavior. The big disadvantage is that logging too much user behavior data makes the device performance low. A Cloud based system, which distinguishes user behavior patterns using analytics, is done online. Cloud based players perform better, as they put a lower burden on the central processing unit.

Examples, Genius Mixes in iTunes, the Last.fm feature in Spotify; the history based choice feature in Pandora and the history based channel selection satellite radio.

iTunes has a big music database with intelligence in PC application. It uses the Genius feature to create a playlist from the library, based on a single selected song played on the drive. Spotify, however, streams music online, has an on-demand option and is mostly free and Pandora chooses a song or artist based on history.

Conclusion

Allowing users to personalize their cars and infotainment systems with user experience data, music, apps, themes and colors of their choice can only enhance their driving experience. Integrating these features with customized human-machine interfaces to retain brand identity can be a key to success in an exponentially growing industry.

ABS	Antilock Braking System
BA	Brake Assist
CPU	Central Processing Unit
EBD	Electronic Brake force Distribution
ECU	Electronics Control Unit
HFCK	Hands Free Car Kit
HMI	Human Machine Interface
HUD	Heads-Up Display
IVI	In-Vehicle Infotainment
IVR	Interactive Voice Recognition
LED	Light Emitting Diode
OBD	On Board Diagnostics
OEM	Original Equipment Manufacturer
PC	Personal Computer
PND	Personal Navigation Device
uPNP/DLNA	Universal Plug and Play / Digital Living Network Alliance
VSC	Vehicle Stability Control

About the author

Vageesh Kumar:

Vageesh Kumar is an executive at Mindtree with over 13 years' experience. He specializes in the automotive domain and is involved in the testing of automotive and consumer electronics applications. Vageesh is a Bachelor of Engineering, in Electronics and Communications.