Car Information System for Added Value in Connected Cars

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OVERVIEW: Along with the interest in recent years in building a smart society in which people can live in harmony with the environment, easy-to-use driving support systems with benefits such as reducing congestion have been commercialized with the aim of providing safe, secure, and comfortable mobility. Amid these developments, and taking advantage of the spread of smartphones and advances in mobile communications, work on "connected cars" that connect vehicles to the Internet to create new value has gathered pace. Clarion Co., Ltd. supplies both telematics services and in-vehicle infotainment systems designed for these "connected cars." In developing new services that utilize car information from "connected cars," Hitachi is undertaking work that takes account of automotive security. In the future, Hitachi intends to utilize its know-how in fields such as in-vehicle infotainment systems and vehicle control technology to investigate services that create new value.

INTRODUCTION

ALONG with environmental changes such as global warming in recent years, growing interest in building a smart society in which people can live in harmony with the environment has led to measures being adopted in a variety of fields[1].

With the aims of providing safe, secure, and comfortable mobility, new services have been introduced in the automotive field that utilize intelligent transport systems (ITSs) to help alleviate traffic congestion and make driving more pleasant, for example by delivering information on congestion through vehicle information and communication systems (VICSs) and using it in car navigation (including taking account of congestion in route selection), and electronic toll collection (ETC) systems to provide quick passage through toll booths. Amid these developments, and taking advantage of the rapid spread of smartphones and advances in mobile communications, progress is being made in the provision of smart mobility that is safe, secure, comfortable, and ecological, with increasing work on "connected cars" that connect vehicles to the Internet to create new value[2].

In the area of in-vehicle infotainment systems, integration with smartphones is making it possible for the systems to do things such as interfacing with smartphone applications and accessing content from the Internet. Progress is also being made in the development of new services that utilize not only vehicle location but also other car information, including sensor information for supporting safe driving, car insurance, and remote on-board diagnostics (OBD).

This article describes the Clarion Telematics Service and its use of smartphones, and also use of car information and its application in automotive security.

CLARION TELEMATICS SERVICE

Clarion supplies telematics services that integrate smartphones with in-vehicle infotainment systems such as car navigation, displays, and audio equipment to make driving more pleasant by utilizing center services and content on the Internet.

Advances in Connected In-vehicle Infotainment Systems

(1) Linking in-vehicle infotainment systems to center systems

By using a network to link in-vehicle infotainment systems to a center system, some of the in-vehicle functions can be implemented instead on the center system (see Fig. 1).

Because it simplifies access to new information and the upgrading and adding of new functions to the in-vehicle infotainment system, users can be provided with new value.

(2) Use of cloud services

By combining large amounts of diverse cloud-based information, such as information that is held at the center, updated in real time, or obtained from sources such as social networking services (SNSs), it is possible to use the in-vehicle infotainment system

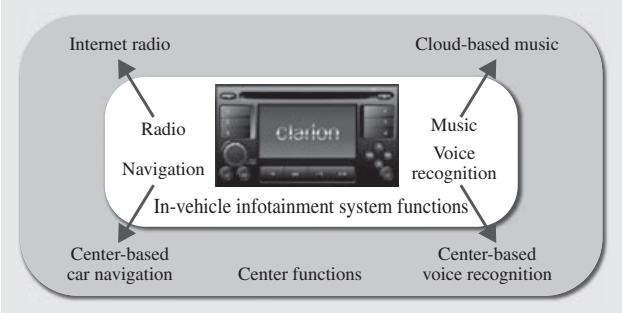

Fig. 1—In-vehicle Infotainment System Functions and Center Functions.
The functions provided by the in-vehicle infotainment system can be implemented at the center.

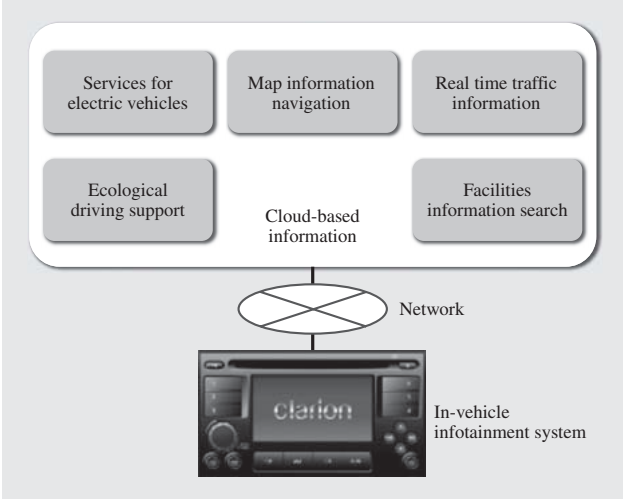

Fig. 2—Provision of Services that Use Cloud-based Information.
Comfort, security, and convenience can be achieved by providing drivers with cloud-based information.

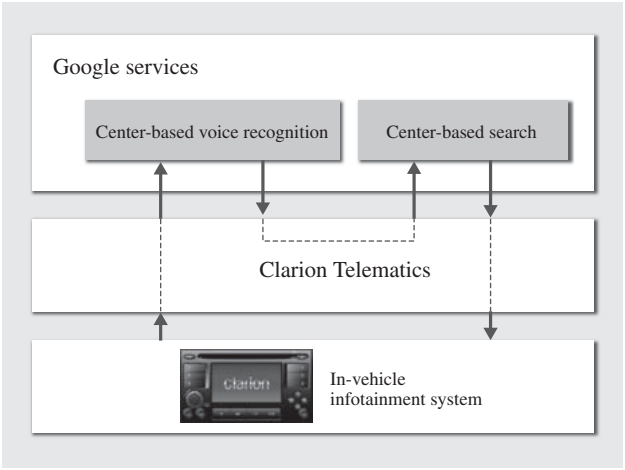

Fig. 3—Block Diagram of Center-based Voice Recognition.
Timely information can be delivered to drivers using center-based voice recognition and search functions.

as a conduit for providing the driver with services that are easy to use, safe, and convenient (see Fig. 2).

Taking advantage of this potential, Clarion has developed and launched cloud information network services for vehicles while also supplying the networked in-vehicle infotainment systems that can connect to these services.

Services Provided by Clarion Telematics

(1) System solution services

Clarion Telematics supplies system solution services that are specific to vehicles. These include infotainment services (such as news, weather, SNSs, and Internet radio), a map update service for car navigation systems, a software update service, a center-based voice recognition service, and a service for providing drivers with vehicle information and information from dealers[(3)].

(2) Center-based voice recognition service

This important service can provide an input mechanism suitable for use when driving. It uses Google[*1] technologies for center-based voice recognition and search in combination with Clarion's own center-based voice processing technology (see Fig. 3).

Center-based voice recognition is intended to improve recognition accuracy and make in-vehicle use of car navigation functions such as destination search easier. The search function can also use natural language voice recognition. For example, the user can say "I want to eat Italian" to search for Italian restaurants near their current location or destination.

(3) Safety considerations

Clarion has also utilized the know-how it acquired in the development of in-vehicle infotainment systems to provide safe services suitable for use from vehicles. The operation of the in-vehicle infotainment system is designed to be easy for the driver to use while in the vehicle, and Clarion Telematics also includes a function to enable or disable operation of the system while the vehicle is moving.

Structure of Clarion Telematics

(1) Overall structure of Clarion Telematics Service

The Clarion Telematics Service is a network service that supplies information to vehicles and includes the content management, security measures, and content required to deliver the service. To ensure flexibility and optimal delivery, the service operates

*1 Google is a registered trademark of Google Inc.

from Clarion's own center and draws on other cloud services as required.

(2) Connection between in-vehicle infotainment systems and smartphones

As smartphones are used to relay communications between the in-vehicle infotainment system and center, the choice of connection type is important.

Clarion Telematics supports both an "image transfer method" for transmitting smartphone image data to the in-vehicle infotainment system and a "content transfer method" for transfer of other data (see Table 1).

The "image transfer method" allows the driver to use the in-vehicle infotainment system screen to operate and view applications developed for the smartphone. The "content transfer method" is characterized by minimal dependence on the type of smartphone but requires data processing to be performed on the in-vehicle infotainment system.

Which of the two methods to use can be selected to suit the application or service concerned.

(3) Network connection procedure

The in-vehicle infotainment system can connect to the network via methods such as a telematics communication unit (TCU) or by Wireless Fidelity (Wi-Fi)*2.

(4) Hypertext markup language (HTML) support on in-vehicle infotainment systems

Services are implemented using HTML content to facilitate the standardization of service content, the addition of new functions, and maintenance, and to allow the rapid release of new services. Incorporating support for HTML into the in-vehicle infotainment system means that the center can send content to the in-vehicle infotainment system in HTML format (see Fig. 4).

Further Development of Clarion Telematics

Hitachi is working on expanding the range of services for the targeted delivery of information to drivers, including the provision of information intended to suit the needs of drivers. The center-based voice recognition service improves the interface with the driver by combining functions for the analysis and understanding of the speaker's intentions with the use of functions such as interactively narrowing down the intended meaning. By implementing these services and functions, Hitachi is providing drivers with comfort, security, and convenience.

*2 Wi-Fi is a registered trademark of the Wi-Fi Alliance.

Table 1. Smartphone Connection
The connection between an in-vehicle infotainment system and the center is split into separate "image transfer method" and "content transfer method" mechanisms.

Connection type	"Image transfer method"	"Content transfer method"
Summary	Transfers smartphone images to the in-vehicle infotainment system.	Transfers data from the smartphone to the in-vehicle infotainment system for processing.
Character-istics	• Provides access to a wide range of smartphone applications. • Provides access to the resources of the smartphone.	Minimal dependence on the model of smartphone.

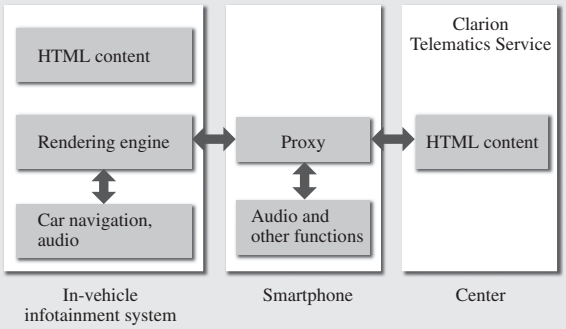

Fig. 4—Provision of Services Using HTML Content.
The provision of new services and the addition of new functions is facilitated by the use of HTML content to implement in-vehicle infotainment system functions.

In further developments, Hitachi will proceed with the use of mobility-related big data relating not only to vehicles but also to other sources such as people and public transportation agencies, and will adopt its global services to suit regional needs.

USE OF CAR INFORMATION AND AUTOMOTIVE SECURITY

Uses for car information that have been implemented to date include obtaining probe traffic information from vehicle location data and supporting safe driving based on parameters such as speed and acceleration collected from digital tachometers.

The emergence in recent years of "connected cars" has seen the launch of services that provide new value to drivers and other users through such things as smartphone applications that use car information or the use of car information by center systems (see Fig. 5).

The emergence of "connected cars" also means that, because vehicles are now connected to a network

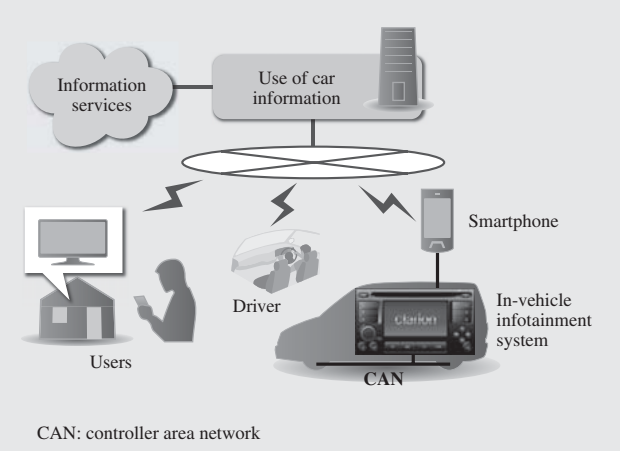

Fig. 5—Block Diagram of Service System Using Car Information.
Services that are safe, secure, comfortable, and ecological are provided to drivers and other users through the generation of knowledge from CAN and other car information at center systems.

rather than being the standalone systems they were in the past, it has become important for them to have the same sort of security measures as other digital devices.

Services that Use Car Information

(1) Insurance service

Insurers are beginning to offer options such as pay-as-you-drive (PAYD) insurance based on distance traveled and pay-how-you-drive (PHYD) insurance based on driving behavior. These services link insurance rates to risk assessments based on driving behavior, which consider factors such as distance traveled, speed, acceleration, and where and when the driving occurs.

(2) Remote OBD

Measures such as trials in the USA are in progress and aimed at providing a quicker way of identifying vehicles that are non-compliant with exhaust gas regulations through the periodic wireless collection of vehicle OBD information.

(3) Applications that use controller area network (CAN) data

Along with the spread of smartphones, service applications have appeared that utilize various CAN data by combining a smartphone with a CAN data collection unit.

These applications are in the form of systems that can use the smartphone to display information previously unavailable to the driver, including boost, fuel consumption, malfunction diagnosis information, and driving route logs.

Automotive Security

Projects in Japan, the USA, and Europe are studying the security risks associated with the use of CAN information, and also countermeasures[4), (5)].

Preventing threats such as unauthorized access, spoofing, abuse, or information leakage is important for "connected cars," and work is underway on countermeasures that use security techniques from other information systems such as corporate systems and digital home devices.

(1) Definition of security requirements

Security requirements are defined by clarifying the information assets that need to be protected and where the threats are targeted, and by conducting threat analyses and risk assessments that extend from the design of vehicle systems to their use and dismantlement phases.

(2) Selection of security measures

Based on the security requirements, countermeasures that utilize security techniques such as cryptography, authentication, access control, and tamper-proof technology are incorporated into the system design.

(3) Execution of security measures

The steps decided on in the security requirements are executed in response to vulnerabilities identified during operation. This includes measures such as incident management and security supervision in cooperation with an incident response team (IRT).

In these ways, the Clarion Telematics Service implements measures that use techniques such as authentication and data encryption for the in-vehicle infotainment system, smartphone, and center systems.

CONCLUSIONS

The emergence of the "connected car" has been accompanied by the launch of services that enable safe, secure, comfortable, and ecological driving.

In the future, Hitachi intends to help create a smart mobility society that takes account of people and the environment through systems and services that utilize more information on automotive and social infrastructure.

In doing so, there is a need to investigate in-vehicle infotainment systems that utilize CAN information and other car information and their security measures, and also to investigate services that create new value by using car navigation, audio, and vehicle control technologies that have been built up over time.

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