LATEST TRENDS IN CAR NAVIGATION AND TELEMATICS SERVICES IN JAPAN

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ABSTRACT

Car navigation systems, which were first released in Japan in 1981, have now entered a phase of full-scale diffusion, owing to rapid advances in information technology, improvement of performance and reduction of equipment prices. Telematics services have also overcome various issues since they were first launched and, like car navigation services, they are now taking root as indispensable aids to drivers. Through the addition of communications functionality to car navigation units, telematics services facilitate exchanges of information with the outside world. In the coming years, it is expected that the functionality of car navigation systems will be used to transmit to drivers information obtained by vehicle-mounted sensors concerning the circumstances around vehicles. That capability will go beyond a simple communications function to contribute substantially to safety, peace of mind and support for eco-driving, among other improvements. This paper describes the latest trends in driver information services in Japan, the directions envisioned for these services in the future, and issues that will need to be addressed to facilitate further development.

1. INTRODUCTION

Advances continue to be made in car navigation systems, representing a typical platform for providing information to drivers as a means of improving the driving environment. In addition, telematics services that are accessed from the vehicle interior via a communications link to the

outside world are also progressing smoothly and are beginning to catch on among the driving population.

Against this backdrop, one of the key objectives of the New IT Reform Strategy adopted in Japan last year is to build the world's safest road traffic environment. This initiative envisions the use of communications links to obtain information from roadside devices for enhancing the safe operation of motor vehicles. Car navigation systems that have so far contributed to more comfortable driving through the provision of information to drivers thus appear to have entered the next stage of development. This new stage is aimed at securing the safety and peace of mind of driving through exchanges of information with the outside world and also at making vehicles more eco-friendly.

At the ITS Center of the Japan Automobile Research Institute (JARI), we have been conducting studies and surveys since fiscal 1998 to monitor the evolving state of the ITS industry in Japan with the aim of contributing to the industry's further growth and development. Based on our recent findings, this paper describes the latest trends in driver information services in Japan, as typified by car navigation and telematics offerings, and discusses issues that should be addressed to promote their further development.

2. CAR NAVIGATION TRENDS

2.1 Latest technological trends

The basic function of a car navigation system is to provide accurate traffic information. To accomplish that, the manufacturers of car navigation products are incorporating a dynamic route guidance system (DRGS) capability into their in-vehicle units in Japan, in addition to the use of Vehicle Information and Communication System (VICS) information for determining a suggested route. DRGS functions to re-calculate the route whenever real-time information about traffic congestion or restrictions is received from a network of roadside beacons or some other transmission facility. Another measure being taken is to store in the car navigation unit historical VICS traffic data, statistically processed according to the day of the week and the time of day. That database is used in addition to real-time VICS information to provide optimal route guidance and arrival time estimations with a higher degree of accuracy.

These more ingenious services being offered by car navigation companies are driving a trend toward greater capacity in car navigation storage media that is promoting a switch from

DVD-to HDD-based systems. Upper-end car navigation systems are now beginning to incorporate a 40-GB hard disk drive. The greater storage capacity allows music, still pictures and other data to be stored in the onboard unit. This fusion of car navigation and audio-visual (AV) functionality is proceeding at a rapid pace, as typified by last year's launch of "one-segment" digital terrestrial broadcasting targeted at portable devices. The field of digital broadcasting in Japan has already seen the diffusion of large-screen plasma and liquid crystal display television sets for home use. The know-how gained through those consumer electronics products is now also being utilized in car navigation systems for better image quality and acoustic effects, as well as for touch-panel operation screens.

Many car navigation units are also beginning to appear that are compatible with a memory card or are Bluetooth-enabled. This nondirectional, short-range wireless communications technology enables users to bring mobile phones, portable music players and other external devices into their vehicles for easy connection to the car navigation system.

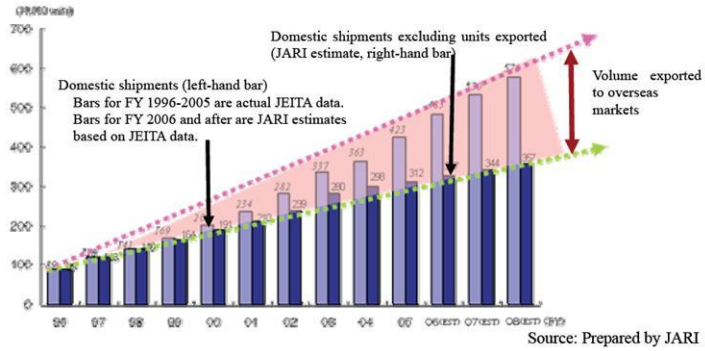
2.2 Market trends

2.2.1 Market trends in Japan

In our market research until fiscal 2005, data released by the Japan Electronics and Information Technology Industries Association (JEITA) on domestic shipments of car navigation systems were used in making future market forecasts of these products. However,JEITA's domestic shipment data also include a considerable volume of car navigation units that are installed on vehicles exported overseas. It was decided that the exported units should be excluded from the total in order to estimate the purely domestic demand for car navigation systems and gain a more accurate picture of the market in Japan. In our study for fiscal 2006,we re-estimated the shipments for several previous years by excluding the exported units in order to find the volume of purely domestic shipments and used the resulting data as the basis for making a market forecast. The results suggest that the Japanese market is nearly mature and that the aggregate value of car navigation system shipments will likely show only single-digit growth in the coming years.

The results of questionnaires and interviews revealed that over half of the equipment manufacturers still estimate future market growth at levels equal to or greater than our previous predictions. Looking at the market situation in Japan alone, this finding suggests that

manufacturers are not very conscious of the domestic market already being saturated. Almost all of the manufacturers were unanimous in the view that car navigation system prices have polarized between expensive, high-functionality units and inexpensive units. In spite of that, nearly all of the manufacturers are aiming to roll out high-functionality versions. This indicates that the question of how to absorb the burden of rising equipment costs is becoming a more serous issue than before.

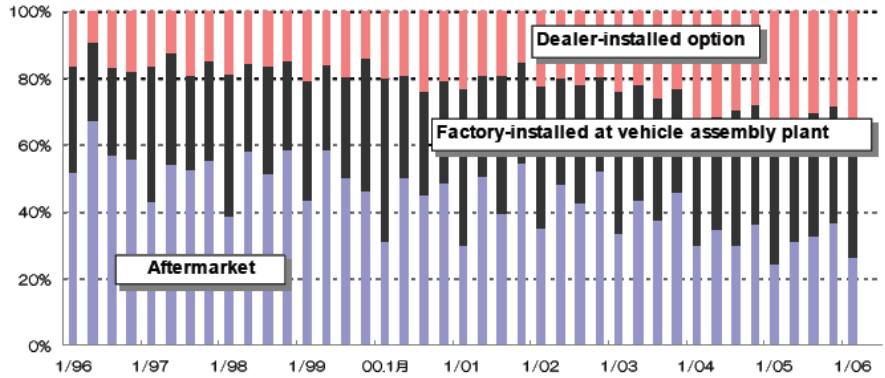


Source: Prepared by JARI

Figure 1. Domestic shipments of car navigation systems in Japan

2.2.2 Sales breakdown by sales channel

A breakdown of unit sales by sales channel (aftermarket vs. original equipment) shows that sales of aftermarket products have continued to decline in recent years. The sales results for 2006, however, indicate that this downward trend may have abated somewhat. One reason for that may be the response by car dealers to buyers' desire to have a certain aftermarket product installed at the time a new car is purchased. Aftermarket products are often among the first to incorporate new cutting-edge functions and are widely recognized by the buying public. Car dealers are providing such products as dealer-installed options.



Source: Prepared by JARI

Figure 2. Breakdown of car navigation system sales by sales channel

3. TELEMATICS TRENDS

The word telematics was coined by combining telecommunications with informatics. Car navigation systems serve as the basic platform for accessing telematics services, which provide dynamic traffic information from external sources in response to drivers' requests, thereby creating an environment for more comfortable driving.

Telematics services were launched in Japan in 1998 as information services that were primarily offered by vehicle manufacturers. However, the first-generation services did not reach the level of popular diffusion. Subsequently, new information services targeted at car navigation systems were launched in March 2002 to usher in the second generation of telematics designed to overcome the shortcomings of the first-generation offerings. Those services were CARWINGS offered by Nissan Motor Co., G-BOOK offered by Toyota Motor Corp., and Internavi Premium Club offered by Honda Motor Co. and featuring enhanced traffic information service.

One significant difference between the first and second generations is that revision of the Road Traffic Law in 2001 allowed private-sector providers to use VICS traffic information. Another major difference is that the rapid progress of information and communications technologies has led to substantially lower communications costs, making it much easier for drivers to access and obtain dynamic traffic information from external sources. The principal functions of telematics services can be broadly classified as the gathering and provision of accurate traffic information, the provision of amenities information, including parking and restaurant information, and security functionality such as emergency reporting. Typical examples

of telematics functions are explained below.

3.1 Gathering and provision of more accurate traffic information

VICS traffic information is provided in a timely manner via FM multiplex broadcasts and a network of roadside beacons within a certain area close to one's vehicle. However, if a driver's destination is in another city or prefecture, the arrival time estimated by the navigation system may differ substantially from the actual time, owing to the fact that VICS information about traffic conditions en-route or in the vicinity of the destination cannot be obtained in advance.To overcome that problem, telematics service providers have started offering "on-demand VICS" information service that facilitates route guidance which takes into account information on traffic congestion along the route to a driver's destination. A provider does this by downloading nationwide VICS traffic information to its own server so that information on traffic conditions at various points and along the route can be provided to drivers in a timely manner before their departure.

While VICS traffic information is available nationwide, as of September 2005 it was being provided only for only approximately 80,000 links of the some 260,000 links designated as target roads for VICS coverage. (Links refer to road segments running in all directions from one intersection to another intersection.) Information was still not being provided for the approximately 180,000 remaining links. Efforts are moving ahead to deploy probe-vehicle information services that would provide more accurate traffic information and complement the lack of VICS traffic information on those links. Moves are also under way to expand the gathering and provision of probe-vehicle information even to the links for which VICS travel times are already available. The aim is to offer more enhanced service by not limiting probe-vehicle information just to the links where VICS travel times are not yet provided.

3.2 Improvement of convenience

There are services that transmit the latest map information to drivers by taking advantage of

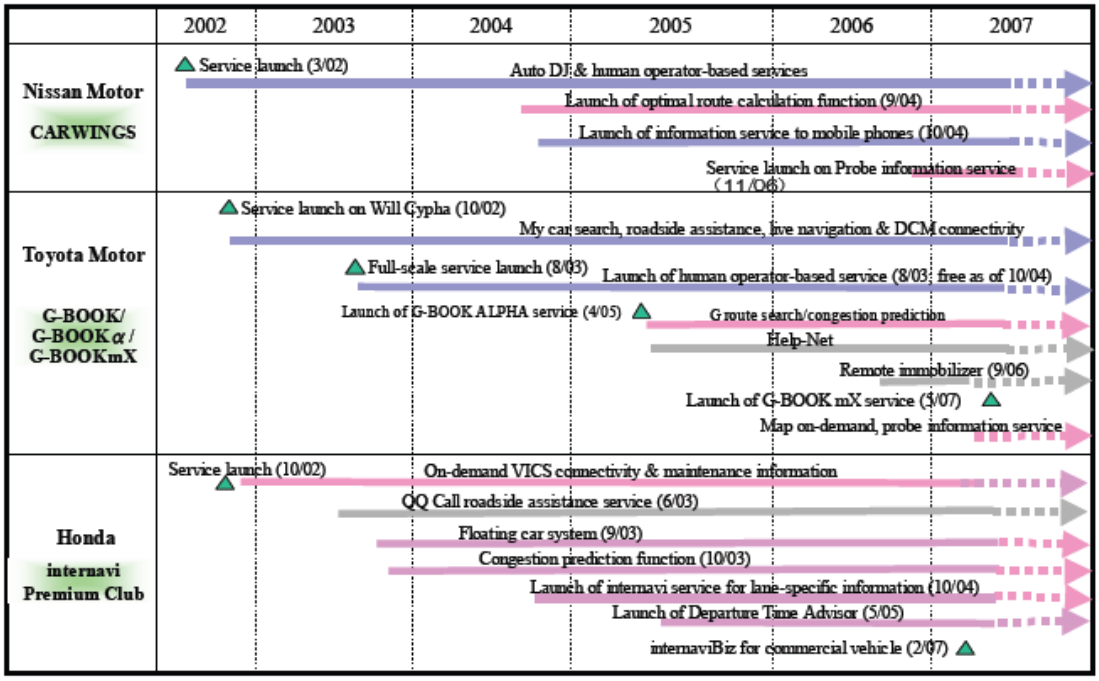
the telematics capability for two-way communications between an information center and vehicles. Other services offer the convenience of a human operator who searches for information on the destination or amenity facilities in place of the driver and transmits that information to the vehicle. In-vehicle systems are also beginning to incorporate agent functionality, whereby information about nearby facilities or points of interest in a town is automatically provided to the

driver during a trip and matches the time, place and occasion. News updates and other information can also be provided automatically.

3.3 Emergency reporting and other security functionality

Another distinct feature of second-generation telematics services is the enhancement of security functionality by linking a vehicle to a service center by means of a communications module (i.e., a mobile phone provided in the vehicle interior). If the engine is started or something unusual occurs while the driver is away from the car, the driver is automatically alerted by an e-mail message. In the event the car is stolen, it is automatically tracked. Immobilizers(防盗制动系统) are also beginning to be installed on luxury cars that enable a service center to disable the engine remotely so that it cannot be started.

Figure 3 outlines the service trends among Japan's three largest vehicle manufacturers. Since the start of telematics services, each company has continued to search for a killer application. A major trend seen in the table is a shift in emphasis toward the provision of more accurate traffic information.



Source: Compiled by JARI (Fiscal 2006 updated version)

Figure 3. Development of telematics services by three Japanese vehicle manufacturers

4. DEVELOPMENT OF DRIVER INFORMATION SERVICES

The principal aim of telematics services at present is to facilitate comfortable driving, such

as by providing accurate traffic information or information about amenity facilities, as mentioned above. However, efforts are also under way in various quarters to utilize the distinct feature of telematics for facilitating information exchanges with the outside world as a tool for addressing certain issues involved in vehicle use, including improvement of safety and environmental friendliness.

4.1 Efforts to improve safety and peace of mind of driving

The Advanced Safety Vehicle (ASV) initiative of the Ministry of Land, Infrastructure and Transport is one project promoting the development of vehicle safety systems. Some systems have already been commercialized, including ones designed to support drivers' operation of their vehicles through interaction between navigation system map information and vehicle control systems. One such example is a navigation-coordinated shift control system that obtains map information from the navigation unit before a vehicle enters a curve and automatically downshifts the automatic transmission. Another example is a curve entry speed support system that judges a suitable speed for entering a curve and automatically applies the brakes to reduce the driving speed to that level if the vehicle is exceeding it. The number of vehicles equipped with such systems currently accounts for only several percent of the total vehicle production volume. However, the installation rate may rise in the coming years as the percentage of vehicles equipped with factory-installed navigation systems increases, thus expanding the potential for interactive coordination with vehicle control systems.

In Tokyo, Metropolitan Expressway Co., Ltd. has been conducting a field operation trial of a safe driving support service on the inbound lanes of Metropolitan Expressway No. 4 near the Sangubashi curve since March 2005. The aim of this trial is to enhance safety at locations where traffic accidents occur frequently. Roadside sensors are used to detect the presence of a stopped vehicle or a traffic queue just beyond the curve and that information is provided to vehicles entering the curve (accessible by vehicles fitted with a 3-media VICS-enabled car navigation system). It has been reported that the provision of such information in this trial has substantially reduced the number of rear-end collisions and crashes into the expressway's side wall, caused by the unexpected presence of forward obstacles such as a disabled vehicle or a traffic queue.

Other new initiatives are also being carried out that involve the use of roadside devices to transmit still images and voice messages to drivers. One such example is the SMARTWAY

DEMO 2006 that was conducted by the Ministry of Land, Infrastructure and Transport in February 2006. Image information concerning traffic and lane restrictions due to road work near tunnel exits and the locations where such information was available were transmitted to and stored in car navigation units in advance. The stored image information was displayed on the navigation screen at a suitable time before a vehicle entered a tunnel so as to encourage the driver to be careful. In addition, roadside antennas were used to detect the presence of a vehicle in the through-traffic lane and that information was sent to the navigation system of a car traveling in the merging traffic lane to encourage the driver to merge carefully.

4.2 Environmental contributions

A revised Energy Conservation Law was enforced in Japan on April 1, 2006 that extends the scope of regulatory measures for reducing greenhouse gases, including carbon dioxide (CO2) emissions, to the physical distribution sector as well. This is aimed at achieving Japan's reduction goals pledged under the 1997 Kyoto Protocol. In view of this development, the use of ITS technologies in the trucking industry is expected to achieve energy savings, in addition to promoting safety. For instance, the use of digital tachographs and other vehicle-installed devices can improve efficiency that translates into a reduction of fuel consumption.

The Saitama Trucking Association has reported that the installation of drive recorders for the primary purpose of improving safety has also proved effective in cutting fuel consumption because of improved driving habits. The contribution to enhancing fuel economy is outlined in Figure 5. The results show that the devices improved truck fuel economy by approximately 41%. Assuming that a truck is driven one million kilometers in its lifetime, it translates into an estimated fuel cost saving of approximately 9.65 million yen. That figure is equivalent to the price of one truck.

Figure 4. Contribution to fuel economy improvement

Contribution to fuel economy improvement				
	Fuel economy	Lifetime mileage	Fuel consumed	Difference
Before installation	2.7 km/L	1 mil. km	370,370 L	
After installation	3.8 km/L	1 mil. km	263,158 L	107,212 L
Fuel cost saving: 107,212 L x 90 yen/L = 9,649,080 yen				

Source: Excerpt from a test report prepared by the Saitama Trucking Association

5. ISSUES INVOLVED IN FUTURE DEVELOPMENT

At the Japan Automobile Research Institute (JARI), we estimated that the combined number of users of the telematics services offered by the three vehicle manufacturers totaled more than 900,000 as of August 2006. The following points, including improvement of the content desired by users and enhancement of accuracy, can be cited as issues that need to be addressed in promoting the future diffusion of telematics services.

(1) Improvement of the functionality and accuracy of traffic information and route guidance

(2) Provision of real-time information on parking and other facilities

(3) Provision of real-time public transit information

(4) Updating of map data

(5) Provision of real-time point-of-interest (POI) information

(6) Enhancement of services through increased openness

The measures taken by companies to improve the accuracy of their traffic information and route guidance have produced a certain level of satisfactory results. Companies are now providing traffic congestion and travel time estimates that take into account historical traffic data, which each company processes using its own innovative techniques. Efforts to provide probe-vehicle information services have also contributed to this improvement. The required infrastructure is also steadily being put in place, including that for dedicated short range communications (DSRC). If connections can easily be made to an external network, it will not

be difficult to obtain real-time traffic information. However, the discrepancy between the rapidity of IT progress and the service life of vehicles poses a problem. The cutting-edge devices that are installed in new vehicles become old-fashioned and incapable of receiving the latest services by the time vehicles reach the end of their useful lives. This situation may become a more serious issue in the years ahead, especially with regard to the growing momentum toward using communications links for interactive coordination between the navigation system and vehicle control systems. This is expected to increasingly strengthen the trend to install original navigation equipment in new vehicles. Accordingly, it will be necessary for manufacturers to design and engineer their navigation systems with forward compatibility with new services that users will want later.

6. CONCLUSION

In the coming years, car navigation and telematics systems are expected to

contributesubstantially to safety, peace of mind and environmental friendliness, including support for eco-driving. These contributions will be in addition to further improvements in the areas of optimal route guidance, entertainment and security services. Furthermore, it is envisioned that vehicles will have enhanced communications functionality and be equipped with cameras and sensors. An in-vehicle communications terminal for connecting the vehicle to the outside world will serve as a portal and be transformed into a human-machine interface (HMI) that provides an indispensable link between the vehicle and the driver. In order to respond to these expectations and provide the services desired by drivers and society, it will be essential to heighten the public's awareness of available services, incorporate user opinions in the offerings, and design systems that will also be easy for older drivers to use.

References

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