Telematics Information Service for Commercial Vehicles (B2B)

— Hitachi's ASP Service for Truck Fleet Management —

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OVERVIEW: In Japan, telematics information systems for commercial vehicles have yet to be introduced on a large scale due to the high costs associated with mobile communications and the installation of telematics equipment. As a result, little progress has been made beyond the stage of navigation systems that drivers are already familiar with. However, the recent explosive growth of the Internet and cell phone networks has led to a reduction in the cost of mobile terminals and telecommunication charges. It is therefore expected that there will soon be a rapid growth in telematics information services adapted to commercial vehicles (B2B: business to business) using inexpensive high-quality communication technology. Meanwhile, in geographically extensive countries such as the United States, it is harder to reduce the telecommunication costs because some regions are only accessible by satellite communication. As a result, the telematics information systems that have been set up so far have only been able to offer partial services, such as managing the movements of truck fleets. At Hitachi, we have focused our attention on Japan's domestic transportation vehicles, of which there are over 1 million. In April 2001 we inaugurated a truck fleet management ASP (application service provider) service, which includes functions that help transportation companies. A characteristic of this system is that the initial investment needed to set it up is reduced by sharing resources such as servers, networks and software.

INTRODUCTION

THE overwhelming majority of the road vehicles in Japan are used privately, and mostly at weekends. On the other hand, commercial vehicles such as trucks and taxis are generally operated on a full-time basis during the week. Since the drivers of these commercial

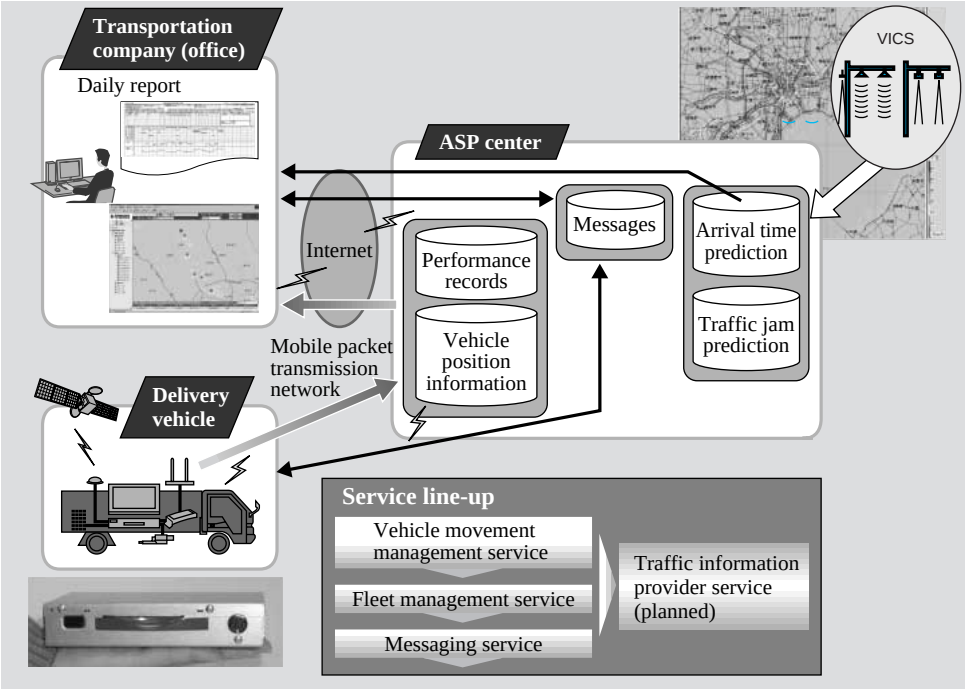


Fig. 1—Overview of Hitachi's Truck Fleet Management ASP Service.
Hitachi inaugurated a truck fleet management service in April 2001 as an ASP. It comprises three types of service, which customers can choose according to their individual requirements. In the future we will augment the current service by providing traffic information services based on VICS (vehicle information and communication systems) information.

Object of transport		Freight	People	
Vehicles		Trucks (transportation companies)	Buses	Taxis
Information provided	Vehicle position	(Fleet managers) ◎ (Consignors and recipients)	◎ (Fleet managers) (Users)	◎ (Fleet managers)
	Performance records (pick-ups, drop-offs)	◎ (Fleet managers)	–	–
	Urgent instructions	◯ (Drivers)	–	◯ (Drivers)
	Destination and route	◯ (Drivers)	–	◎ (Drivers)
	Urgent reports	(Fleet managers) ◯ (Consignors and recipients)	◯ (Fleet managers)	◯ (Fleet managers)
	Traffic information	◎ (Drivers) (Fleet managers)	△ (Fleet managers)	◎ (Drivers) (Fleet managers)
	Arrival time prediction	(Fleet managers) ◎ (Consignors and recipients)	◎ (Fleet managers) (Users)	(Drivers) ◎ (Users) (Fleet managers)

◎ : strong need ◯ : moderate need △ : small need – : no need
The beneficiaries of each type of information are shown in brackets.

TABLE 1. The Needs of Information Provision in Commercial Vehicles.
B2B telematics information services will develop rapidly as a means of providing fleet managers and vehicle users with valuable information such as the vehicle status and traffic conditions.

vehicles make their livings from driving, it is important for them to improve their work efficiency.

By focusing on commercial vehicles—especially transportation vehicles, of which Japan has over a million—Hitachi has developed a truck fleet management ASP (application service provider) service (see Fig. 1). We achieved this by drawing on our experience in the fields of infrastructure technology, information control technology and network/communications technology to produce a small-size telematics terminal.

In this paper, we summarize the trends of telematics information services aimed at commercial vehicles, and describe the ASP service for truck fleet management. We also discuss the plans for a driver support service and traffic information provider service that Hitachi is planning to expand from the B2B (business to business) field to B2C (business to consumer) field.

MARKET OF TELEMATICS INFORMATION SERVICES FOR COMMERCIAL VEHICLE

In Japan's freight transportation networks, such as parcel delivery services, a recent trend has been toward the use of smaller trucks, and the number of such vehicles has grown in excess of 1 million. This is much greater than the number of passenger-carrying road vehicles such as buses and taxis, of which there are only about 250 thousand.

Commercial vehicles have hitherto relied on wireless communication systems to keep drivers in touch with the fleet managers back at the office. These wireless systems provide a reasonably priced means of carrying out two-way spoken communication, but are limited in that the amount of information, and in that once a conversation has ended, there is no way of storing the information conveyed other than jotting down memos.

Meanwhile, in the field of logistics, the requirements of consignors are becoming increasingly diversified. For example, they may need delivery strictly on time, and the goods they are sending may be subject to strict quality control standards. This has generated a need for a greater degree of management over the delivery process. Passenger vehicles such as buses and taxis also need to find ways of improving their customer service and assuring the safety of passengers in order to gain a competitive edge.

To address the requirements of commercial vehicle operators, there is a growing need for the application of IT in telematics information systems or mobile transmission network technology.

The needs of information provider services in commercial vehicles are shown in Table 1.

Commercial vehicles can be broadly divided into those used for transporting goods, such as trucks and vans, and those used for transporting people, such as buses and taxis. Also, the beneficiaries of these information services can be classified into drivers, office-based fleet managers, and the users of vehicles, such as passengers, consignors and consignees. The types of information provided include not only information on the positions of vehicles, but also information provided to fleet managers and users such as the operating history collected from the vehicle,

and information provided to the driver in order to help him or her work efficiently.

TRENDS IN THE TRANSPORTATION INDUSTRY

From 1990 to 1998, there was a sharp rise in the number of companies entering the transportation field for the first time, and there are now more than 50 thousand companies operating in this area[1)]. However, since the collapse of Japan's bubble economy, the volume of goods transported has declined and consignors are demanding lower transportation costs. Other problems include the fact that consignors are making increasingly varied demands, such as for specified delivery times and temperature controlled wagons, and the fact that there is an increasing demand for delivery in small batches due to the adoption of SCM (supply chain management) and EC (electronic commerce), resulting in lower efficiency. Meanwhile, the Ministry of Land, Infrastructure and Transport Government of Japan and local authorities are pressing for stricter environmental controls such as exhaust gas restrictions.

On top of these problems, transportation companies must also strive to keep their costs to a minimum by saving energy and labor through the introduction of new systems, and by enhancing the management of drivers and vehicles.

Japan's transportation industry has a pyramidal structure, of which 99% of truck delivery companies are medium- and small-sized businesses. The introduction of a new system thus presents most delivery companies with a severe financial hurdle, and as a result the introduction of new systems is currently not making rapid progress.

SUMMARY OF HITACHI'S ASP SERVICE FOR TRUCK FLEET MANAGEMENT

Concept

To address the needs of the transportation industry, Hitachi set to work on the ASP service for truck fleet management with the aim of developing a service that can be introduced with minimal expense and effort. Since April 2001 we have been providing a broad line-up of solutions relating to the operation of trucks. Of the main concepts involved in the development of the truck fleet management ASP service is to improve the quality of transportation through the use of IT facilities. By gathering and providing information relating to transportation quality, such as the driving time, the vehicle speed and position, and the cargo temperature, the truck fleet management ASP service helps drivers and transportation companies to present a truly professional image to consignors and consumers alike.

Functions

Movement management functions

Each vehicle is provided with a telematics terminal, which uses GPS to measure its current position and reports it to an ASP center at regular intervals (usually every 15 minutes) via a mobile packet transmission network.

A PC (personal computer) at the transportation company's office can be connected to the ASP center via the Internet, and can be used to display the current position and route of each vehicle superimposed on a map of Japan.

Hitachi's ASP service can be linked to a freight tracking system, allowing the fleet managers to respond precisely to enquiries from consignors about their deliveries. As a result, the company can significantly improve its CS (customer satisfaction).

Fleet management functions

In Hitachi's truck fleet management service system, the telematics terminals collect three types of data (speed, time, and distance), and transmit it to Hitachi's ASP center via a mobile packet transmission network. The driving data collected in this way can be freely inspected and amended via the Internet, and can be used to print out documents such as daily driving reports and monthly statistical reports (see Fig. 2), or downloaded into accounting/payroll systems. It is also possible to identify bad driving habits such excessive acceleration or braking, speeding or prolonged idling,

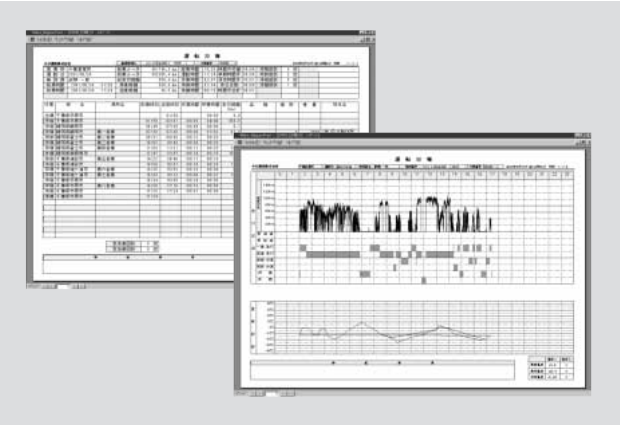


Fig. 2—Examples of Daily Driving Reports.
The system can output daily driving reports in the form of a performance record charts (top) and graphical driving records (bottom).

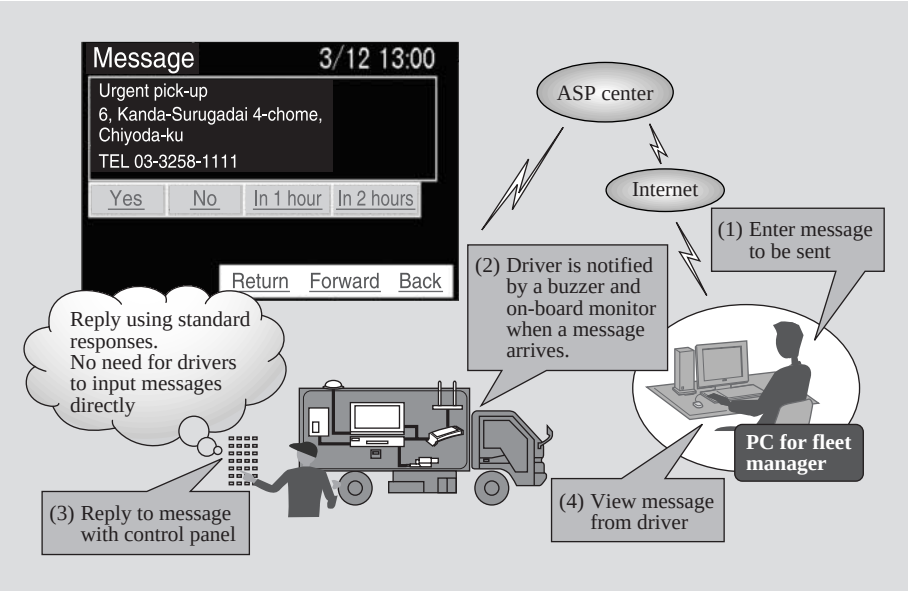


Fig. 3—Overview of the Messaging Service.
In addition to displaying information such as urgent pick-up orders on the on-board monitor, the service can transmit information such as accident warnings and weather conditions to all the other vehicles at once.

and this information can be used to make the drivers safer and more fuel-efficient by providing them with suitable feedback.

Messaging functions

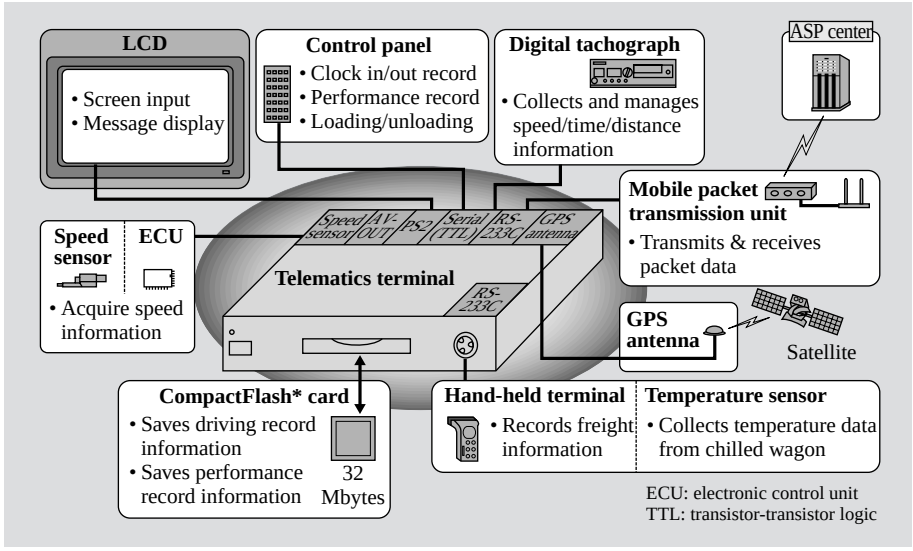
In Hitachi's ASP service, an LCD (liquid crystal display) is used to provide messaging functions. To contact one or more drivers, the fleet manager produces messages addressed to specific vehicles or to all the vehicles with a list of possible responses in the form of a set of selectable options. This allows the drivers to respond simply by selecting possible options (see Fig. 3), which is safer than would be the case if they had to respond to calls on a cell phone while driving. Also, since the text remains on the screen, there is no need to write memos. This approach not only allows people to work more effectively, but can also reduce the communication costs associated with the use of mobile networks.

Expandability of Hitachi's ASP Service Telematics Terminals

Fig. 4 shows how Hitachi's ASP service terminals can be expanded. The main constituent elements include:

(1) an LCD for displaying web pages,
(2) a control panel for inputting work/running-status data,
(3) a handheld terminal for freight tracking, and
(4) sensors (speed, temperature, etc.).

These components can be added in an incremental manner as the transportation business expands, thereby



*CompactFlash is a registered trademark of SanDisk Corporation and licensed by CFA (CompactFlash Association).

Fig. 4—Telematics Terminal Expansion Interface.
The telematics terminal can be connected to various types of equipment for different applications.

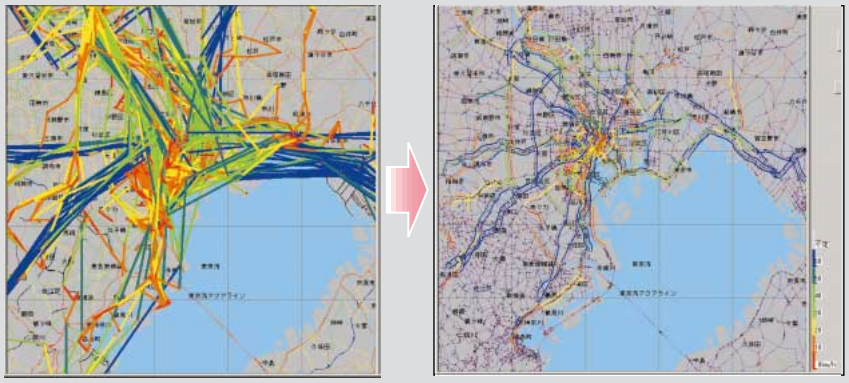


Fig. 5—Results of Map Matching and Route Estimation.
In this example, the actual data obtained from moving trucks (a) is converted into speed data for each road (b). (a) The truck position data is plotted on a map, colored according to the truck speeds, and connected by straight lines. (b) Characteristics such as the distances traveled and the routes taken by the trucks are used as evaluation functions to infer the routes taken and thereby convert the results into speed data for each route. The routes are colored according to speed in the actual screen display.

minimizing the initial outlay required for this system.

Advantages of Introducing Hitachi's Truck Fleet Management ASP Service

Users who have introduced Hitachi's ASP service have reported the following benefits:
(1) Vehicle movement management: Vehicles can be dispatched more efficiently due to the ability to respond more quickly to urgent orders from consignors.
(2) Automatic output of daily reports: Drivers can produce their daily reports in half the time it used to take.
(3) Improved mileage: Bad driving habits can be corrected based on feedback from the daily reports, resulting in better road safety and improved mileage.
(4) Messaging service: The cost of communications between the office and drivers can be reduced by using the messaging service.

Furthermore, introducing Hitachi's ASP service results in a better company image and is a strong selling point for consignors who are looking for improved transportation quality. As a result, it can help to broaden the transportation company's client base.

ENHANCED INFORMATION PROVIDER SERVICES

B2B Traffic Information Provider Services

Fusion of VICS information and floating cars

As ITS (intelligent transport systems) media becomes more varied and is applied over a wider range of regions, the functions that need to be offered by traffic information provider systems also become more diverse. In line with the June 2002 amendment to the Road Traffic Law Enforcement Regulations, VICS information — which was hitherto provided to car navigation systems by infrared beacons, radio-wave beacons, FM multiplex broadcasts and the like — can now also be used by private companies for business purposes. It is therefore expected that there will be a rapid development of information provider businesses offering enhanced VICS information with added value for commercial or consumer use.

Meanwhile, efforts are being made to research and develop so-called "floating cars," which are able to utilize information (e.g. speed and position) obtained from commercial vehicles such as trucks. Commercial applications for this technology are also being studied at an accelerating rate[2)]. By supplementing VICS information with information gathered by probe cars, it is possible to obtain traffic information that is much more detailed. Hitachi is investigating new traffic information services that exploit this information.

One example of floating car technology is a system that uses the positional information of trucks. In this system, the truck positional data that is obtained by GPS or similar means and collected by the fleet management system can still be used for fleet management of the commercial vehicles. However, the trucks can also be used as floating cars to provide highly useful data for evaluating the traffic conditions (see Fig. 5). We are investigating the possibility of using this sort of information obtained from real data to construct traffic information systems (in particular, systems that can be used to predict arrival times based on positional data obtained from other trucks).

Evaluation of trucks as floating cars

In the Hitachi's ASP service system described in previous chapter, the trucks are fitted with telematics

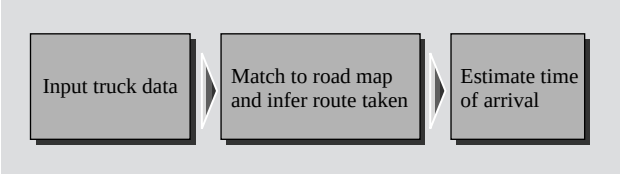


Fig. 6—Processing Flow of Truck Position Data.
The truck position data is processed to obtain traffic information.

equipment, GPS systems, packet cell phone terminals, etc., and thus have the potential to be used as floating cars. However, before the truck positional data can be used to produce traffic information, it needs to be converted to speed data on particular road section.

A method for using the positional data of trucks as traffic information is shown in Fig. 6. First, the truck positional data is superimposed on a map to infer the route on which the truck is traveling, and then the speed of the truck along this route is calculated. Next, this data is statistically processed to calculate the estimated arrival time.

To avoid excessive communication costs, the time intervals at which this positional information is uploaded should be made as long as possible. However, this makes it harder to track the routes traveled by the trucks.

To address this problem, Hitachi has developed techniques for inferring the routes traveled and for matching the results to road maps, allowing highly precise traffic information to be generated under conditions where there is a large time interval between the acquisition of positional data.

Fig. 5 (a) shows the results of plotting the raw truck positional data uploaded to the ASP center, where the straight lines indicate the speed of each truck. In this form it is difficult to comprehend the congestion state of individual roads. However, by using characteristics such as the distances and routes traveled by the trucks as evaluation functions to infer the route traveled by each truck, it is possible to convert the truck positional data into data expressing the speed of traffic along these routes [see Fig. 5(b)]. In trials conducted with actual data, we were able to utilize 86% of all the positional data in the generation of traffic information.

Estimating arrival times

This information on the speed of traffic along each route can be analyzed across a range of time bands to produce statistical data expressing the variation of traffic speeds along each road at different times of the day. The time needed to travel between any two points can then be estimated by adding up the time taken to travel each section of the route between them based on this statistical speed data (see Fig. 7).

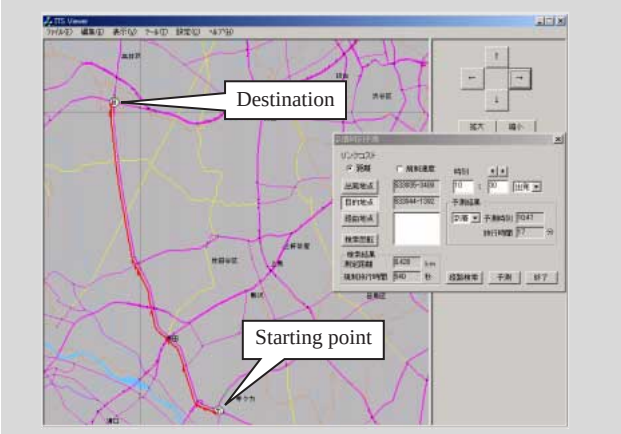


Fig. 7—Arrival Time Estimation.
By combining the VICS information with the information from floating cars, it is possible to estimate the time of arrival at any destination.

In our latest study, we examined a system that estimates arrival times based on positional information gathered from trucks in this way. In the future we plan to incorporate VICS information into the estimation process so as to arrive at a more practical implementation.

Driver Support Services

From providing information to providing services

Since 1997, various car manufacturers have been offering commercial services for providing information via cell phones that are compatible with the car navigation systems built into their own brand of car-examples including MONET (Toyota Motor Corporation) and COMPASSLINK (Nissan Motor Co., Ltd.). At present, these systems generally provide information obtained from outside the car to a navigation system with limited capabilities. However, as radio communication technology progresses and in-vehicle networks become more commonplace, it is thought that they will be provided with the capability of circulating information on the vehicle status (e.g. speed and position) across radio links.

Hitachi's ASP service system provides fleet managers with "vehicle operation/behavior management" functions via network. Hitachi is investigating a "driver support service" that resolves various requirements

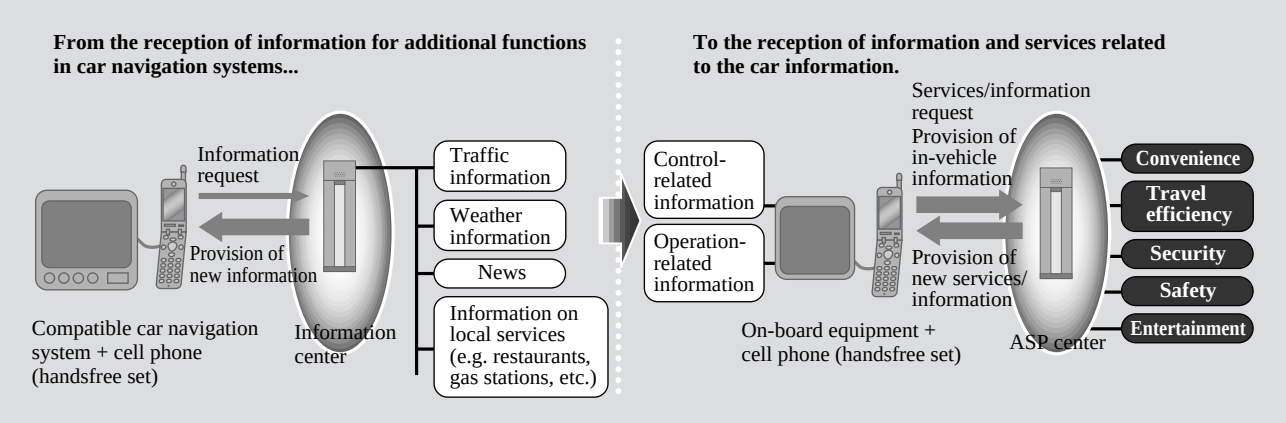


Fig. 8—Adapting the Service for Use in Cars.
It is expected that the service will evolve from a means of providing in-vehicle information into a means of providing new functions and services.

relating to drivers by circulating vehicle information outside the vehicle as in this ASP service platform to provide functions and services (see Fig. 8). As an example, a "safe driving diagnosis service" is described below.

Safe driving diagnosis service

In July 1998, a new law concerning non-life insurance rating organizations came into effect which released insurers from the obligation to use premium rates calculated by the rating organizations, allowing them to set their own automobile insurance rates. The resulting diversification of customer needs and price reductions have led to an era of unprecedented competition in the insurance market. Insurance companies have already made efforts to increase their competitiveness by adding new forms of indemnity and introducing discounts centered around comprehensive insurance for private vehicles (SAP: special automobile policy) and comprehensive insurance (PAP: package automobile policy). They have also begun to provide associated services in the event of a traffic accident or an emergency. Safe driving diagnosis is another type of service that has been offered to insurance holders in this respect.

In a conventional safe driving diagnosis (for commercial users), the vehicle's tachograph disc or the data card is recovered after a journey has been completed, and is subsequently analyzed by a specialist. But in the new service, the necessary vehicle information is collected and administered by a center, so the end user can ask a specialist to perform the safe driving analysis and obtain the results via the network whenever necessary (even when the driver is still driving) (see Fig. 9). It is also possible to implement new techniques such as allowing administrators to confirm the safe driving of a specific vehicle at any time.

Furthermore, the insurance companies can analyze information collected from vehicles for developing

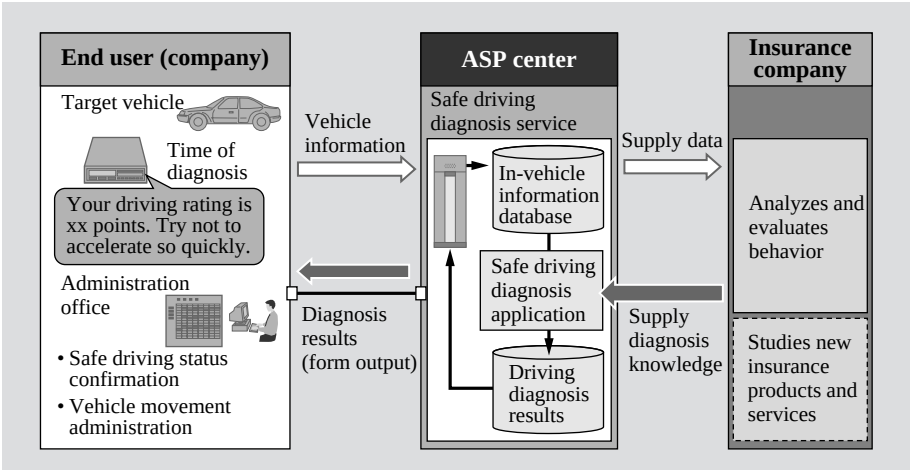


Fig. 9—Concept of a Safe Driving Diagnosis Service.
Information recovered by an ASP center is provided to a company with specialist knowledge in the diagnosis of safe driving (eg, an insurance company). The diagnosis results are delivered to the end user from ASP center.

detailed new insurance products, market research, etc.

Hitachi plans to verify the feasibility of these services by using its ASP service platform.

CONCLUSIONS

In this paper we have described the market trends associated with telematics information systems implementing B2B-oriented distribution ASP services. We have also described the ASP services currently provided by Hitachi, and have discussed the services being studied for provision in the future.

Hitachi plans to continue building up its repertoire of ASP services to meet the needs of customers, and will implement trials to verify the benefits experienced by customers using ASP services, thereby supporting the introduction of IT into the distribution business.

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