Special Article on Mobile Multimedia and ITS
Car Navigation Systems with i-mode Support

Car Navigation Systems with i-mode support ("i-mode equipped Car Navigation Systems") aim to quickly deploy and penetrate car-oriented multimedia services as part of the ITS business, by combining i-mode's strong business and technological features with Car Navigation Systems, which are undergoing dramatic change.

This article describes the development concept, an overview of the technology, and examples of applications.

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1. Introduction

i-mode equipped Car Navigation Systems aim to stimulate the sluggish market for car-oriented information services by expanding services that fully feature i-mode (mainly in terms of content and packet communications) and to cultivate the Intelligent Transportation Systems (ITS) market.

Car Navigation Systems are expected to become core equipment in handling information exchange for drivers and passengers. This perception led DoCoMo to develop and introduce information services for Car Navigation Systems, as one of its most important services in mobile multimedia. Subsequently, DoCoMo launched the service in March 2000.

2. i-mode Equipped Car Navigation Systems

2.1 Overview

Ever since i-mode's commercial release in February 1999, the Internet service for mobile phones has been rapidly gaining subscribers, owing to its convenience, rich content, reasonable rates and other popular features (There were approximately 9.5 million subscribers as of the end of July 2000.) [1].

Meanwhile, the market for Car Navigation Systems has also been brisk in Japan, where nearly 1.5 million units were shipped in 1999. The latest Car Navigation Systems are normally equipped with the following functions, and act as an information/communication gateway for drivers and passengers.

① A larger capacity and advanced functions, made possible by the adoption of DVD-ROMs and advanced high-performance Central Processing Units (CPUs).

② Functions to support the Vehicle Information and Communication System (VICS), Electronic Toll Collection (ETC) System and public mobile communications.

Based on those developments, i-mode equipped Car Navigation Systems are designed to utilize the larger screens of navigation systems by connecting them to i-mode handsets, which are normally used alone as mobile communications terminals, via a special adaptor in the car.

i-mode functions include voice communications, e-mail exchange and website access. Contents from DoCoMo's contracted providers can broadly be divided into four groups: transactions, lifestyle information, database, and entertainment. i-mode equipped Car Navigation Systems can not only display these types of information, but can also search for parking lots and restaurants, and recognize other car's locations via e-mail exchange, when combined with the system's own function to translate the car's location into data.

2.2 Services for i-mode Equipped Car Navigation Systems

In strict terms, the service targeted by i-mode equipped Car Navigation Systems is one of the i-mode functions, called "i-navi Link".

The main applications are:

① Display i-mode content on the system's screen (because it is easier to see on larger screen);

② Search for real-time information (e.g, traffic information, parking space information, event information) based on the system's location information and give route guidance based on obtained information; and

③ Identify other car's locations by exchanging e-mail with location information attached, arrange meetings via such e-mail exchange, and contribute to smoother more com-

fortable driving overall.

When an i-mode handset is connected to the system, the item "0. i-navi Link" item appears on the menu screen — this is not displayed on the normal i-mode screen — and allows the user to access content that carries location information. A sample screen is shown in Figure 1.

Prospective content location information, in addition to the normal i-mode content. For example, the content provider can offer information about the location of hotels, parking lots, skiing grounds, toilets, construction sites, cash dispensers and fast-food restaurants with drive-thru facilities, and even give real-time information in regard to their congestion status. There are more applications with just as much potential, such as content with event/sale information and other advertising information, "local" information provided to drivers who have an interest in it, and "target advertiing" .

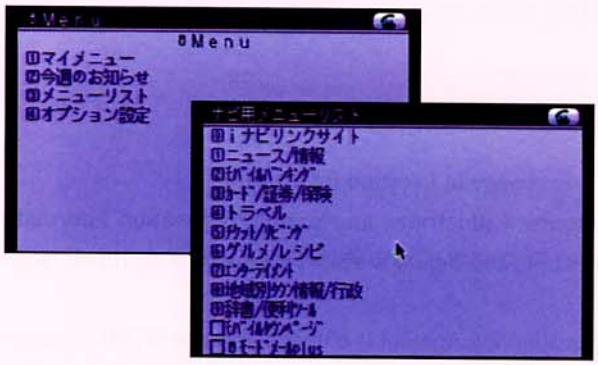

Figure 1 Menu Displayed on i-mode Equipped Car Navigation System's Screen

2.3 Configuration of the i-mode Equipped Car Navigation System

The system configuration is shown in Figure 2.

(1) i-mode Mobile Phones

Within the i-mode mobile phone line up [2], three models of the 502i series can be connected to i-mode equipped Car Navigation Systems.

(2) i-mode Equipped Car Navigation Systems

The latest Car Navigation Systems have a large capacity and advanced functions, as previously described. They are equipped with rich map information, have advanced locating functions and are capable of giving route guidance. i-mode equipped Car Navigation Systems offer new applications that combine the functions of i-mode and Car Navigation Systems, and provide access to services that are normally available to i-mode mobile phones, as illustrated below.

The basic functions are:

① Download, display and input of i-mode content;
② Normal e-mail exchange;
③ Voice communications including a combination of Phone-to★, hands-free, and other functions): and
④ Functions related to location information.

- Exchange of location information (e.g, current location, transit point, destination)
- Exchange of e-mail with location information attached (i.e, current location, transit point, destination)
- Display of target on the map screen (e.g, contents with location information attached)

★Phone-to function: The user can write phone numbers (Tel:) into an HTML file, then make a phone call by selecting a hyperlink on the screen.

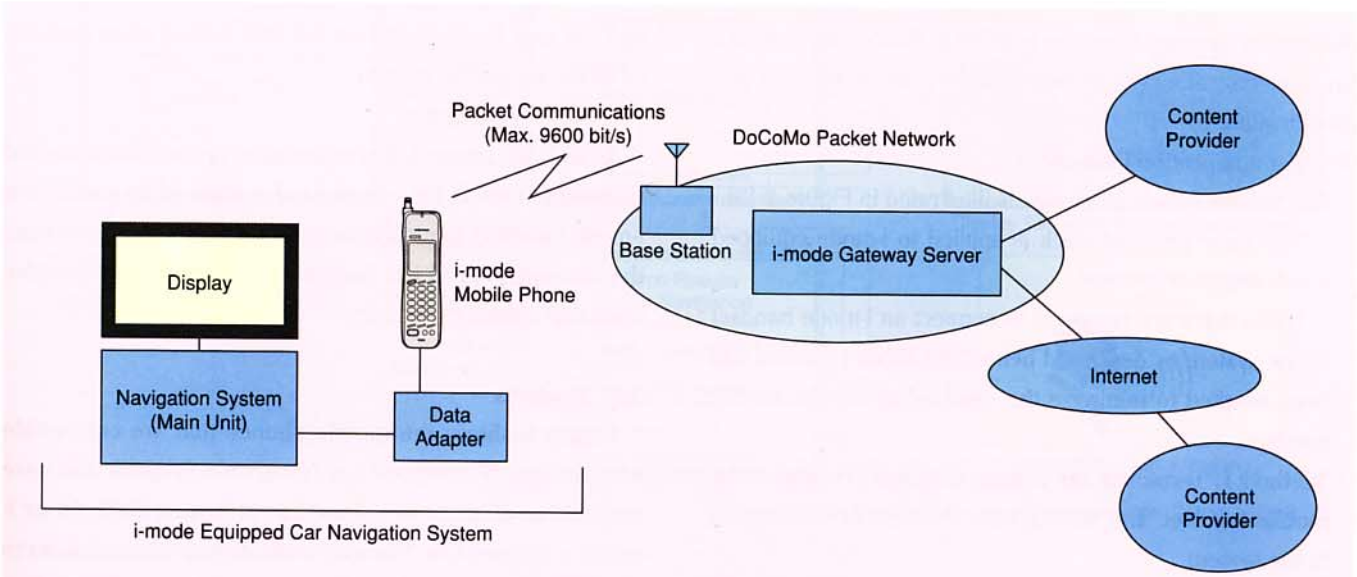

Figure 2 Configuration of the i-mode Equipped Car Navigation System

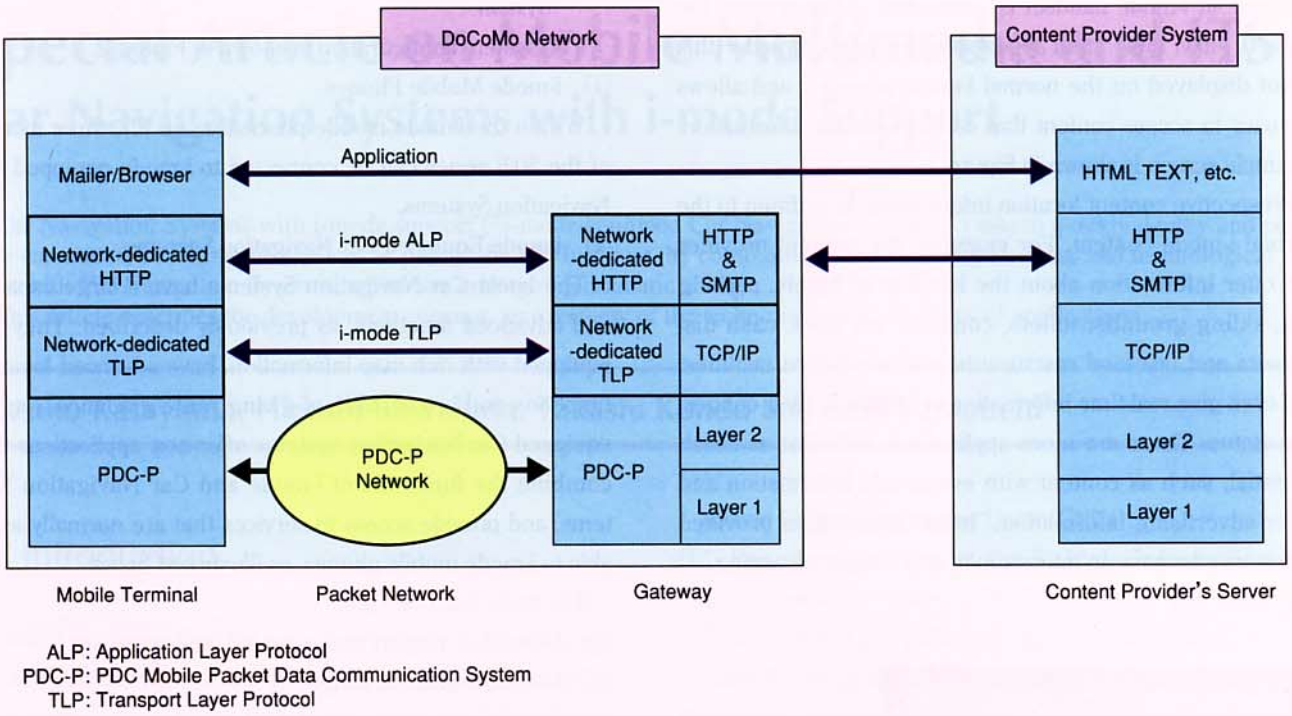

Figure 3 i-mode Protocol Stack

As depicted in Figure 2, the data adapter is sold separately at present because the market for Car Navigation Systems is still in its infancy. Car Navigation Systems with built-in adapters should appear as the penetration rate increases.

2.4 Key Information/Communication Technologies

(1) Content Description Language

As with i-mode, content for i-mode equipped Car Navigation Systems is written in HTML. Hence, the system's browser can display existing i-mode content without any modification.

(2) Communication Protocol

The protocol stack for i-mode is illustrated in Figure 3 [3].

The same protocol stack is applied to i-mode equipped Car Navigation Systems.

While there are two ways to connect an i-mode handset to the system as described below, the second method has been adapted to minimize the need to modify the mobile handset.

- Method 1: Terminate the communications protocol at the mobile handset, and deliver only the content information to the system.
- Method 2: Terminate the communications protocol at the system (including the adapter).

(3) Exchange of Location Information

Figure 4 illustrates an example of location information exchange, and Figure 5 shows a sample of an HTML source file.

Location information is embedded in the HTML content as a comment tag with reference to the locating system, latitude and longitude, and is exchanged between the content provider and the i-mode equipped Car Navigation System.

Comment tags are normally ignored by mobile handsets and can only be displayed on the map screen when connected to the navigation system.

(4) Security Measures

As with the Internet, it is essential to prevent unauthorized access and protect the copyright of content when connecting i-mode handsets to navigation systems. From this viewpoint, the i-mode equipped Car Navigation System adopts a mechanism that enhances security.

2.5 Products

Figure 6 shows the mobile phones that are compatible with the i-mode equipped Car Navigation Systems that were available or about to be released as of August 2000. As for i-mode equipped Car Navigation Systems, 22 models were available or about to be released as of August 2000. More models are expected to be released in the future.

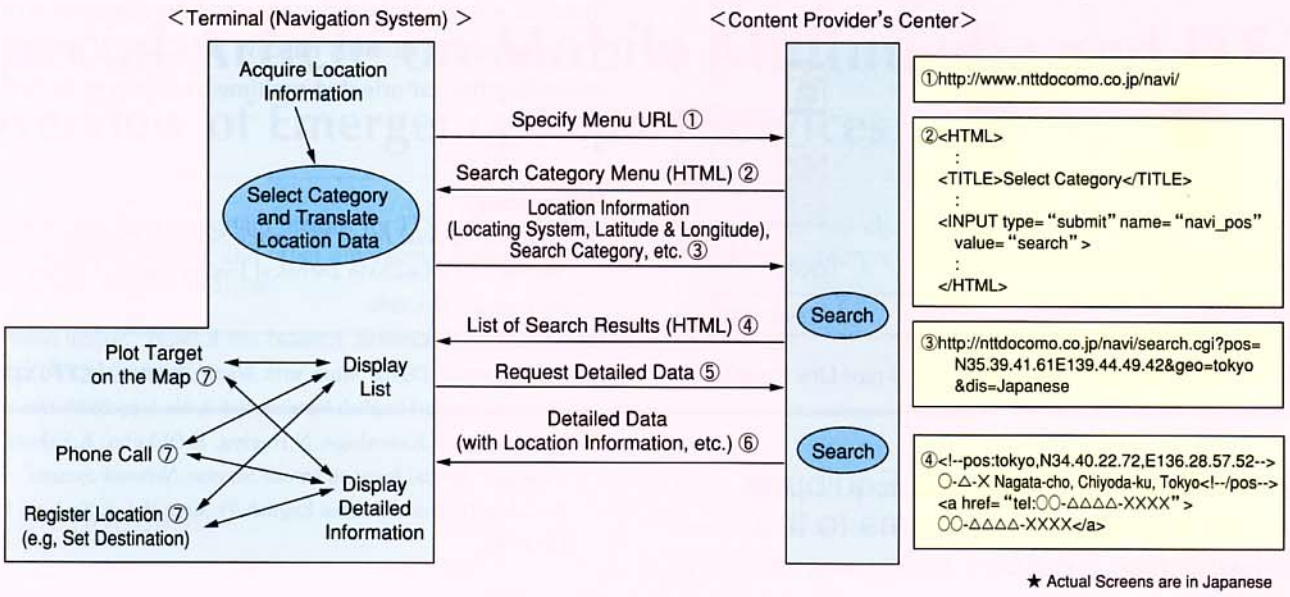

Figure 4 Exchange of Location Information

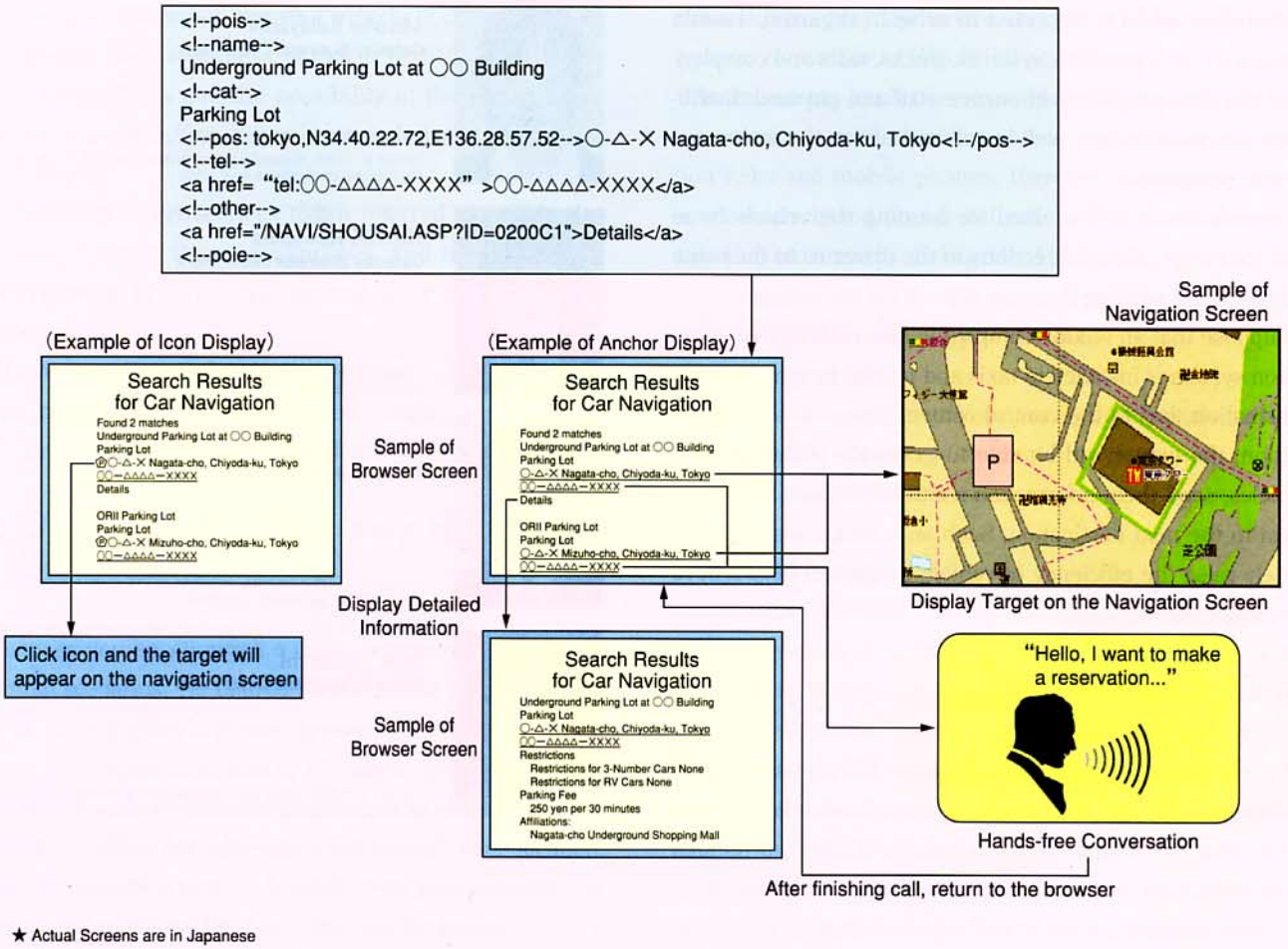

Figure 5 Sample of an HTML Source File

★ As of August 2000

Figure 6 i-mode Mobile Phones with i-navi Link Support

3. Application of i-mode Equipped Car Navigation Systems to the Business Sector

Although i-mode users are primarily ordinary consumers, the number of business users has been increasing lately. This is because i-mode handsets can access corporate Intranets, without the need for PCs or PDAs.

A similar trend is expected to arise in regard to i-mode equipped Car Navigation Systems: trucks, taxis and company cars (for salespeople, maintenance staff and physical distribution purposes) might well install and utilize the system or similar equipment.

Specifically, it will be used for locating the vehicle by e-mail exchange, giving directions to the driver as to the route to follow, and sending business reports via the Intranet.

Suppose that an i-mode compatible information/communication system is installed in taxis and trucks, to send location information, etc, to the control center. Based on such information, the center will be able to grasp the distribution of vehicles, send them information about traffic jams and guide them to the next destination. Such an arrangement will ultimately raise the efficiency of vehicle usage and help relieve the congestion of roads.

4. Conclusion

i-mode was originally designed as an Internet service for mobile phones. We believe that the application of its business concept and network technology to Car Navigation Systems, whose rate of penetration and development is rapidly increasing, is extremely effective in launching and quickly expanding the car-oriented multimedia business in the ITS sector.

References

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