PIONEER CORPORATION

The use of the embedded database Entier has improved development efficiency and made it possible to dynamically update points of interest (POIs).

Effective transmission of information with Entier enriches the automotive experience.

Pioneer Corporation has adopted the embedded database Entier, developed jointly by Hitachi, Ltd. and Hitachi Software Engineering Co., Ltd., for the latest high-end model of its CYBER NAVI car navigation system. Pioneer chose Entier because of its advanced search functionality, excellent reliability, such as protection against loss of power, and strong support. By using Entier, Pioneer is able to enrich the automotive experience through greater development efficiency, dynamic POI updating, and the effective transmission of information.

**Case study**

The use of a relational database (RDB) in the development of car navigation systems provides flexible search capabilities.

Pioneer, the leading manufacturer of car navigation systems, has its Carrozzeria series of products on the car navigation market. In May 2008, Pioneer released the latest model of CYBER NAVI, its high-end product in the Carrozzeria series.

"In 2006," says Mr. Yano, "we announced the Smart Loop plan, our vision for the next-generation automotive experience in which drivers can share a wide range of information transmitted by other drivers, including information about driving conditions and parking areas. Taking this concept one step further, we have implemented the seamless transfer of information between the car navigation system and the PC in our new product."

The CYBER NAVI series has extended the range of home applications. Examples include batch transfers of music data and the preparation of driving plans on a TV set, all made possible by the detachment of the "brain unit," which integrates a hard disk drive and a CPU. In the new model, connectivity with a PC has been enhanced to enable the transfer of music data and the execution of navigation operations over a USB connection.

The other new CYBER NAVI feature is multi-search functionality. Previous models provided separate search menus organized under such headings as category, name, address, and telephone number. As a result, the user needed to know some piece of information that would match some item in the menu system in order to get a result. With the new product, however, the user can enter any word or words as search criteria, just as if the user were doing a Web search. The product also has a new Japanese-language input system with an original dictionary. The new system automatically analyzes the character string entered to determine its type, and then selects the appropriate search mode. For example, if the user enters a place name, the address search mode is selected. Similarly, the entry of an ordinary noun activates the name search mode, and the entry of consecutive numbers activates the telephone number search mode.

The multi-search functionality and its convenience are due to Pioneer’s Japanese-language input system and Hitachi’s Entier, the first RDB Pioneer has used in developing a car navigation system.

**Appreciation for support and protection against loss of power**

Explains Mr. Tarui, "In the beginning, the song management functionality development team thought it could reduce its workload and maintain product quality by using an RDB."

Pioneer therefore developed song management functionality using only its own technology, but found that a lot of work was required to re-create the program every time a new product was developed. As a result," Mr. Tarui continued, "we had to defer song management to an RDB so that we could shift manpower to the development of new functions."

Next, the navigation functionality development team became interested in an RDB, using it to dynamically update frequently changing POIs.

"Previously," says Mr. Adachi, "we used a data format specialized for car navigation systems for POI management, but the format was not flexible. For example, when we needed to update data, we had to replace part of the data. The RDB, however, lets us replace data at the record level. With the RDB, we can apply updates dynamically."

Because a car navigation system handles tens of millions of facilities, it must have a high-performance RDB. Pioneer performed benchmark tests on several RDB products, and chose Hitachi’s embedded database Entier after a comprehensive evaluation of response, search functions, and support. Among the evaluation benchmarks, we emphasized the in-depth support.

In the words of Mr. Tarui, "Because we would be using an RDB for the first time, the reliability of the manufacturer was important to us. For the song management functionality, we received strong support and input from the Entier team during the initial design stage and, especially in the tuning stage, had much closer support and cooperation than we have previously experienced."

For its part, the navigation functionality development team appreciated that the many amendments it asked for were duly incorporated in the next revision.

Says Mr. Matsumoto, "Reliability was a must for us. It was essential that whenever the system is turned off during data
In addition to the leading-match search about the tenants in a facility was required system,” says Mr. Uchida, “information function can be used. “In the previous fast-food shop on a map, the spatial search the logo that is to be displayed for a locate a tenant in a large facility or to find For those cases when it is necessary to increases in data,” he notes with admiration. variability of search functions with minimum repetition columns are able to implement a amount of additional data, Entier’s fuzzy search functions require a large piece of partial information. Although such part of a facility name or only some other wanted the system to be able to search adds to the facility name. “In addition to the leading-match search function our system already had provided,” says Mr. Matsumoto, “we thought we also function our system already had provided,” says Mr. Uchida, “because a GUI for Entier is a natural component in efficiency and provide flexible search With the ability to improve development structure, it is easy to change classification recommendations Entier to them.”

When new employees join us, I have no trouble recommending Entier to them.” In Entier, simply by reorganizing the table structure, it is easy to change classification items or add new search functions. With the ability to improve development efficiency and provide flexible search functions, Entier is a natural component in Pioneer’s Smart Loop plan.

Greater power of representation enables the shape and weight of buildings to be reproduced with realistic 3D graphics. The latest CYBER NAVI model provides greater connectivity with a PC and more convenient functionality, including multi-search capabilities. 

The multi-search functionality, a major feature of the new product, is implemented with repetition columns that allow one column to hold multiple values. In each repetition columns, multiple partial strings included in a facility name are registered in addition to the facility name. “In addition to the leading-match search function our system already had provided,” says Mr. Matsumoto, “we thought we also wanted the system to be able to search even when the user knew only the middle part of a facility name or only some other piece of partial information. Although such fuzzy search functions require a large amount of additional data, Entier’s repetition columns are able to implement a variety of search functions with minimum increases in data,” he notes with admiration. For those cases when it is necessary to locate a tenant in a large facility or to find the logo that is to be displayed for a fast-food shop on a map, the spatial search function can be used. “In the previous system,” says Mr. Uchida, “information about the tenants in a facility was required separately from the POI, and the updating of this data required another step. With Entier, which centrally manages facilities and tenants, data can be updated faster. As a result, we were able to considerably reduce the number of development steps.” “Next,” says Mr. Adachi looking toward the future, “we want to implement a full-text search function and an incremental search function that narrows down the number of matches each time an additional character is entered as the search string.”

Flexible search functions make users’ lives easier.

Says Mr. Yano, “I think the biggest gain from adopting Entier is the new possibilities it opens up for development. I want to keep on enhancing both the song management functionality and navigation functionality.” With the benefits it has already gained from introducing Entier, Pioneer is planning to employ Entier for other product lines. “It took me very little time to be able to use Entier,” says Mr. Uchida, “because a GUI development environment was available and I could also enter commands directly. When new employees join us, I have no trouble recommending Entier to them.” In Entier, simply by reorganizing the table structure, it is easy to change classification items or add new search functions. With the ability to improve development efficiency and provide flexible search functions, Entier is a natural component in Pioneer’s Smart Loop plan.