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# ITS for Rent

**Kayoko Hara, Nissan Motor Company**

The past decades have seen a lot of research on electric vehicles (EVs), because this kind of propulsion has a lower environmental impact than do traditional gasoline-based engines. Energy generated by large, highly efficient power plants is less expensive and less polluting than that generated by many small, inefficient engines.

Moreover, the advantages of small vehicles for urban driving, the typically short distances driven by business vehicles in the urban environment, and—of course—the zero-emission feature, has increased interest in EV car-rental services for short, in-town business trips.

However, although EVs use high-performance batteries, they still require a widespread network of charging stations. But when their range of movement is limited to a specific area (as is usually the case for business trips), they become an interesting alternative to private or public transportation.

In this installment of Intelligent Transportation Systems, Nissan's Kayoko Hara presents an EV rental project undergoing testing and demonstration in Yokohama, Japan.

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—Alberto Broggi

The concept of sharing electric vehicles (renting them for one or several hours or a fraction of an hour) has been around for a while. Examples of previous EV trials include the Praxitele in France, City Car in Matini, Switzerland, and various station car projects in the US. (Station cars are EVs that mass-transit riders drive to and from transit stations.) The

Daihatsu Motor Company, in conjunction with the Japan Electric Vehicle Association, also carried out a small-scale EV demonstration in Japan some 20 years ago.

In recent years, Japanese corporations and researchers have conducted a succession of demonstrations of shared small EVs. Leading the way was Honda's field trial of its Intelligent Community Vehicle System in 1998 at its Motegi recreational complex, which features a couple of racing circuits. Demonstrations in 1999 included

- trial operation of the Toyota Crayon system of compact electric commuter cars,
- an ITS/EV project that a group affiliated with the Ministry of International Trade and Industry (MITI) organized at Yokohama and Inagi, a Tokyo suburb,
- a commercial EV demonstration in Osaka, and
- a trial of the Nissan Hypermini EV in Ebina, near Tokyo.

More demonstrations are planned for Kyoto and other cities.

This recent spate of Japanese EV proj-



Figure 1. The ITS/EV Yokohama project uses a fleet of Nissan Hypermini electric vehicles.

ects has two major causes. One is the development of compact, next-generation EVs for in-town use powered by high-performance batteries; the other is that several Japanese automakers have announced various systems for sharing these new EVs.

In this installment of Intelligent Transportation Systems, I describe the ongoing ITS/EV Yokohama project, which is demonstrating an EV sharing system for business use. The project's goal is to find real customers at the demonstration site and to develop ways to minimize operating costs.

### The sharing system

The Yokohama project started in October 1999 with 30 EVs; it added 20 Nissan Hyperminis in January 2000. The Hypermini is a two-seat, 2.6-meter-long, lithium-ion-battery-powered EV recently developed and marketed for inner-city use and sold to the general public (see Figure 1). The Association of Electronic Technology for Automobile Traffic and Driving (JSK) is organizing the overall ITS/EV project, which groups of participating companies are implementing. Concurrent with the Yokohama project, JSK organized another EV-sharing event, demonstrating the use of EVs as a second car in a residential area of Inagi.

The project's EV sharing system has been developed largely by the Nissan Motor Company and NEC. A mobile-communications network links the communications equipment in each EV to the host computer at the operations center (see Figure 2). Users must register in advance to use the system. Each user receives a modified keyless entry fob that stores his or her identification information, which it can transmit to an EV.

Users can reserve an EV by telephone or at a Web site. At the reserved time, the user goes to the EV sharing station and presses a button on the fob while standing in front of an EV. The onboard communications system receives a signal carrying the person's ID and relays it to the operations center. The center compares it with the reservation information and transmits sharing permission to the vehicle. The vehicle then flashes its hazard warning lights and unlocks its doors. The user enters the vehicle and starts it with the ignition key, stored in a holder in the glove compartment. Upon returning the vehicle to the sharing station, the user puts the ignition key back in the holder. At that moment, the onboard communications sys-

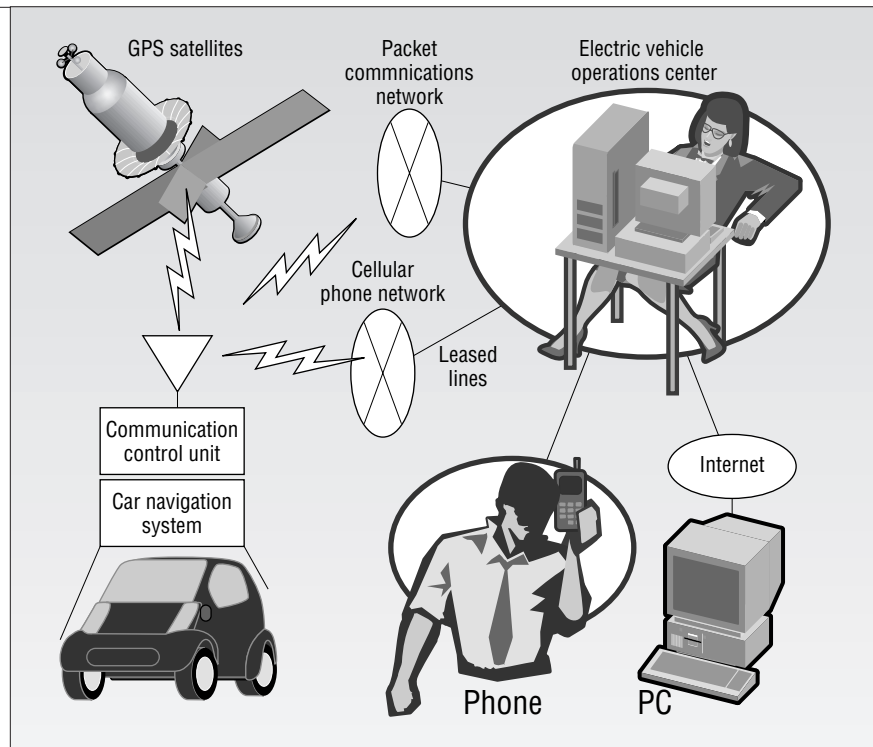


Figure 2. The electric vehicle sharing system being developed by the ITS/EV Yokohama project.

tem judges that the vehicle's use is completed and transmits the vehicle's position and other information to the operations center. The center calculates the sharing fee on the basis of the length of use and mileage and sends that information for display on the in-vehicle monitor. (Because no sharing fee is being charged during the demonstration, billing information is not displayed.) After exiting the EV, the user locks the doors with the fob.

### It pays to communicate

During EV operation, the onboard navigation system sends longitudinal and latitudinal information obtained from GPS satellites and information on the remaining battery charge to the operations center at set intervals. Because EVs still have a short driving range and virtually no charging ports are in place at present, people worry about running out of battery power en route. So, the EVs in this demonstration have a *return advisory function*. This feature constantly monitors the remaining battery charge and the distance from the present location to the vehicle return station, and warns drivers before they exceed the returnable range.

The EVs also have a call button that lets users make a voice call to an operator at the operations center. Users can easily obtain operator support in a variety of situations, such as if they do not know how to operate something, the vehicle suffers some trouble,

or they are likely to return the vehicle late.

In urban areas, securing sufficient space for EV stations can be especially difficult. Requiring large auxiliary facilities can pose an obstacle to obtaining station sites. However, because these EVs have communications capabilities, no special facilities are required for vehicle rental or return, except for the battery-charging equipment at EV stations.

The system uses a data communications network intended for ordinary cellular phones. Anywhere data communications service is available, one operations center can provide centralized management of the EV sharing system, even in remote regions.

### Taking it to the streets (and parking lots)

Yokohama's Minato Mirai 21 area—the demonstration's location—is a former shipyard that is being redeveloped into a commercial center with rows of high-rise buildings. Covering an area of approximately 10,000 square kilometers, MM21 is home to the offices and stores of 800 companies, having a combined workforce of approximately 50,000 people. On weekends and holidays, sightseers throng the area. The cost of owning a vehicle in MM21 is extremely high, with parking places renting for more than \$500 a month. Moreover, to ensure ample visitor parking, building managers have

Continued inside back cover

## ITS, continued from p. 85

restricted the long-term rental of parking places. This has caused insufficient parking for business-use vehicles. Yet 3,000 company cars still operate in this area.

In urban areas such as this, replacing the numerous business vehicles with public transportation is often impractical. Using clean, emission-free EVs that take up less space than conventional vehicles could greatly improve the urban environment. Business vehicles are generally driven relatively short distances within the city, so EVs, even with their limited driving range, could replace conventional cars for many trips.

For participants, the Yokohama project recruited employees working in MM21 who normally use company cars in their work. They drive the EVs while carrying out their duties. A questionnaire survey was conducted among the participants in February and March. The respondents evaluated the overall system favorably, including its concept, convenience, ease of vehicle and equipment operation, and additional functions such as the return advisory. The results also indicated that the need exists for such a system, if the rental fee is lower than the fee for an ordinary rental car or leased vehicle.

**A**fter being temporarily suspended at the end of March, the demonstration resumed in late May and is scheduled to run through September. During this period, the project will implement measures to reduce operating costs, such as unmanned operation of the operations center at certain business hours.

JSK intends to continue the demonstration with the goal of improving the system to a commercially feasible level by 2002. Among other improvements, the project aims to enhance the in-vehicle equipment's reliability, reduce costs, and develop a billing function. ■

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