Development of XML Technology-based Road Web Markup Language

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SUMMARY

The Hokkaido Development Bureau is currently promoting ITS technology R&D intended for Hokkaido's cold and snowy climates called "**ITS/Win Research Program**". In this program, we are developing Internet Technology-based Road Information Systems by public/private joint research projects based on open application. In this paper, we report the development of **XML Technology-based Road Web Markup Language (RWML)** and the field experiment of prototype **Drive Advice Server (DAS)** which uses RWML and can provide personalized information of road weather and surface condition, and also local event information at road stations on the route to destination based on the user's request via Internet.

INTRODUCTION

The US Department of Commerce issued a report in June 1999 that says between 1995 and 1998, IT-producers, while accounting for only about 8 percent of U.S. GDP, contributed on average 35 percent of the nation's real economic growth(1). The Japanese Ministry of Posts and Telecommunications reported the number of Internet users in Japan as 16.94 million people in 1998(2) and estimated this number would rise to 41.36 million people (41% of all households) in 2005(3). The key word of the new type of society in the Internet age is "Information sharing". Nowadays every one can access various information at fingertip. Society then focussed on the potential to share information via networks. The Intranet, which uses the Internet technology to share information within an institution, has rapidly spread among advanced businesses. In addition, the focus today is on introducing EC (electric commerce) and CALS (material purchase and bidding by on-line network) and the Extranet, in which an Intranet is constructed to share information among organizations and businesses with close mutual relations.

XML TECHNOLOGY-BASED ROAD WEB MARKUP LANGUAGE

The explosive popularization of the Internet has also given a great impact to ITS. Many advanced road authorities started provision of road information via Internet. Car-navigation systems with mobile communication function and In-car PC have appeared

on the market. In addition, various automobile and electric appliance manufacturers have launched information services using Internet technology for vehicles in Japan. To say that the era of the network-connected car is approaching is no exaggeration. When the era of such a network-connected car arrives, we can estimate that information provided for drivers will be higher value added: road information provided by regional road authority via Internet will be utilized combined with other information. The potential to develop a new industry will arise(4).

Internet homepages are written in Hyper Text Markup Language(HTML). HTML was made for describing format and layout of the contents such as text and images, and hyper links to jump to other pages and servers. HTML is easy-to-use plain text and using pairs of tag to describe these rules.

In contrast, XML(eXtensible Markup Language) extended the rules of HTML and defined the general method of extending to describe machine-readable structured data. XML uses pairs of special tag, and makes the data easily understandable to user side. The first recommendation of XML specification was published by W3C(World Wide Web Consortium) which promotes the standardization of Internet technology in February, 1998. XML technology has lately attracted considerable attention especially in EC(Electric Commerce) field. In this field, the information systems are required searching suitable shops and goods based on the customer's request.

The Civil Engineering Research Institute and Joint Research Group including Omron Corporation, Nagoya Electric Works Co., Ltd., Mitsubishi Electric Corporation, Japan Weather Association Hokkaido Head Office, Nippon Koei Co., Ltd. intended the use of XML technology in road information systems field and started the development of XML Technology-based Road Web Markup Language(RWML) and RWML-based Drive Advice Server(5).

RWML is a useful tool to disseminate road information via Internet for secondary use. RWML data will be so easy to collect and handle that it will be possible to build a new road information system which can deliver much more value-added information to users by combining road information with weather forecast and local event information. For that reason, RWML we developed include weather, disaster and regional information in addition to road information. Currently, the first draft of RWML(Ver.0.70) which includes data structures and definitions is available at the Civil Engineering Research Institute(CERI) website (http://www2.ceri.go.jp/eng/its-win/RWML.htm).

RWML consists of the following four parts,

1) Road Information; it describes information of road and traffic condition. Road weather data at roadside weather stations, road surface condition, monitoring camera images, traffic congestion and regulation, traffic volume and travel time, specific place information such as attention, view and feature are included.
2) Weather Information; it describes information from weather organizations. Now-casting and forecasting weather information are included. Warning information is

also included.

3) Disaster Information; it describes information of natural disasters which affects or will affects road and traffic condition. Information of earthquakes and tidal waves, disaster prevention-related organizations, evacuation routes and restoring activities are included.
4) Regional Information; it describes local event information at such as road stations and sightseeing spots information for tourist convenience. Event name, date and period, place, content and photo image are included.

RWML
|--road-info
| |--basic-info
| | |--place
| | |--update
| | |--authority
| | |--condition
| |--road-weather
| |--road-surface
| |--camera-image
| |--congestion
| |--regulation
| |--traffic-flow
| |--travel-time
| |--specific-place
|
|--weather-info
| |--basic-info
| |--actual
| |--forecast
| |--warnings
|
|--disaster-info
| |--earthquake
| | |--basic-info
| | |--
| |--volcano
| |--flood
|
|--regional-info
|--basic-info
|--name
|--schedule
|--outline
|--detail
|--image
|--website
|--keywords

Fig.1 Structure of RWML

```
<road-surface>
 <route>
  <route-name>National Highway Rt.230</route-name>
  <route-position>10.0KP/12.0KP</route-position>
 </route>
 <observe-time>1999-01-05T18:00+9.00</observe-time>
 <surface>Packed Snow</surface>
 <surface-temperature>-7.5</surface-temperature>
 <surface-salt>13.5</surface-salt>
<road-surface>
```

These descriptions mean,
at the time of 18:00 on Jan.5, 1999,
on the section of KP10-12 of National Highway Rt.230,
road surface is packed snow,
surface temperature is –7.5 degrees Celsius,
salt concentration is 13.5%.

Fig.2 Example of RWML

These data are maintained by different authorities that every data section must have basic information such as place, update, authority and providing condition. **Fig.1** shows basic structure of RWML, and **Fig.2** shows the example of road surface information described by RWML.

FIELD EXPERIMENT OF PROTOTYPE DRIVE ADVICE SERVER

The **Drive Advice Server (DAS)** is basically an on-demand server that can provide the most suitable (personalized) information for the driver, who requests the information, from a database whose data are collected from various information sources on the Internet. We assume the users of DAS will be the people just going for a drive, or while driving. For example, when the origin, destination and departure time are specified, road condition and local event information on the route, which have been searched from different data sources, are displayed. Currently we assume that DAS terminals can be PCs at home and office, kiosks at road stations, various in-car information devices. If it has Internet connecting function, it can be a DAS terminal.

As information sources, DAS uses internet documents which are opened to public. Most of these documents are plain text and images described by HTML. But it is very difficult to extract proper information from these document, and needs special program for each document. For that purpose, XML is very useful because it can handle data directly by using DTD(Document Type Definition). An application program such as DAS can easily get information from the internet.

In the winter of 1998/1999, we conducted the field experiment of prototype DAS. It equipped with a WWW server host program and a special program periodically

collecting information and building database, and a CGI program which selects and provides personalized information based on the user's request. This server was tested for the internet operation.

In this experiment, the following three servers were used as information sources.

Mountain passes information WWW server operated by Hokkaido Development Bureau

Contents: CCTV camera image, road information (weather, air temperature, wind speed, road surface, visibility, traffic regulation)
Form: HTML
Update: Every 30 minutes

Road stations' local event information server (form-page-based manual input)

Contents: Local event information (Event name, date and period, place, content and photo image, etc.)
Form: RWML (working draft version)
Update: Unscheduled (checking every 60 minutes)

Roadside web server installed at the Nakayama Pass (National Highway Rt.230)

Contents: CCTV camera image, road information (precipitation, visibility wind direction and speed, traffic volume)
Form: RWML (working draft version)
Update: Every 5 minutes

Fig.3 shows the system of XML technology-based Drive Advice Server. **Fig.4** shows the request and response images of the prototype system. Users can specify Origin and Destination from browser software, then can get road information and local event information at road stations' on the route.

In this experiment, 35 people tested this system via the Internet. Their answers are as follows.

- 86 % of respondents answered that display is easy to see.
- 91 % of respondents answered that display is easy to understand.
- 60 % of respondents answered that request results are mostly appropriate.
- 80 % of respondents answered that DAS is useful.

These answers shows that the system was accepted positively. But, some respondents pointed out that it should have more map-based graphical route guidance. Map-based graphical user interface is difficult for HTML that other application program such as JAVA applet should be developed.

Most of respondents pointed out that it must extend information source and service target area. On the whole, usefulness and expectation of the system were confirmed because there were so many constructive ideas presented by respondents.

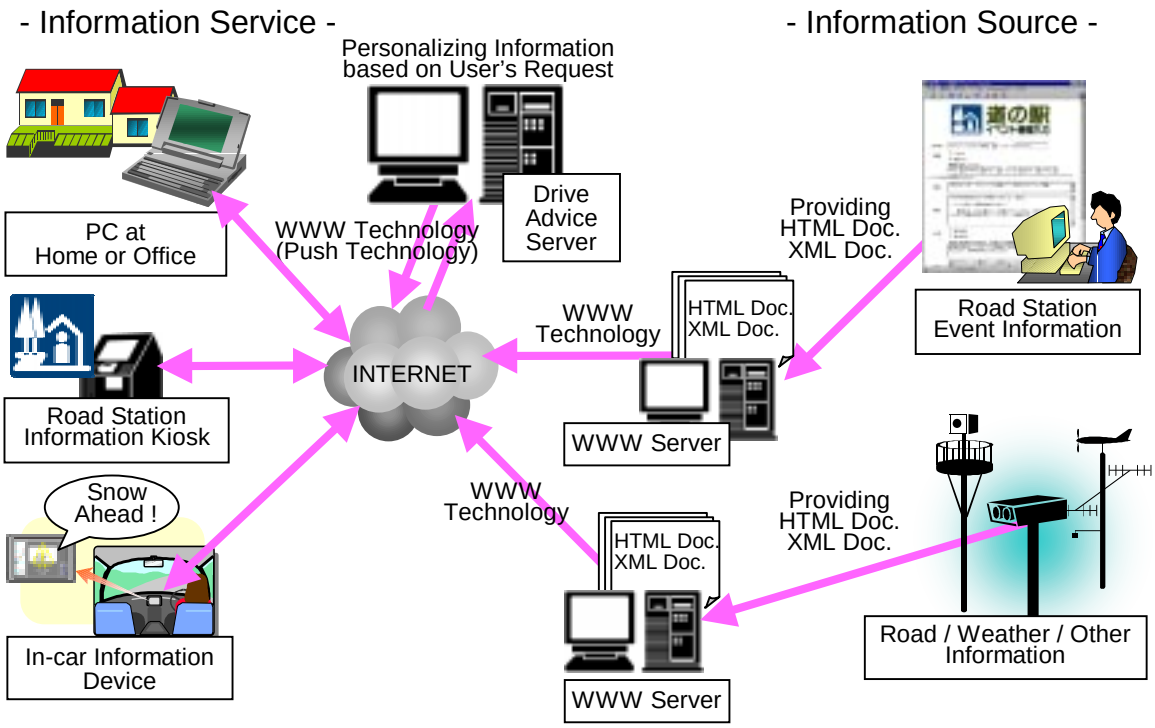

Fig. 3 XML Technology-based Drive Advice Server (DAS)

(Request and Response Images)

Fig. 4 Development of the Drive Advice Server Prototype

CONCLUSION AND FUTURE PROSPECTS

The Working Group have been making efforts of developing RWML since June, 1998. The first draft of RWML was opened to the public in July, 1999 as described above. We would like continue to make this efforts through application development such as DAS. In addition, standardization of tourist information is currently under discussion in the ISO committee. We would like to introduce some results of these activities.

Utilization of the Internet, whose popularization is explosive, will be a key also in the ITS field. Especially, XML technology will take one of the most important roles. For a region without a dedicated ITS infrastructure, Internet technology will provide a highly effective and realistic measure for building a regional ITS.

In 2002, the XIth PIARC International Winter Road Congress will be held in Sapporo. We plan to make the most advanced road information system using Internet technology toward the congress. We intend to more actively promote information exchange with all cold and snowy countries or areas in the world, such as North America, Northern Europe and Far Eastern Asia with whom we can share the issues of safety and efficiency of winter transport.

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