NISEKO-YOTEI-TOYA E-ROUTE EXPERIMENT
- Regional ITS Experiment to Promote Auto Tourism in Hokkaido -

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SUMMARY

In summer 2002, we conducted an experiment on a regional ITS in the Niseko, Yotei and Toya areas of Hokkaido. During this experiment, called the Niseko-Yotei-Toya e-Route Experiment, information on roads, weather, and tourism was transmitted to cellular phones of driving tourists.   The information also was provided via web page and e-mail.   The results show that a system of information collection, compilation, and provision that implements XML-based Road Web Markup Language (RWML) can operate efficiently and foster auto tourism.

INTRODUCTION

The Civil Engineering Research Institute of Hokkaido (CERI), as part of a joint research group, has been developing Road Web Markup Language (RWML), which is based on Extensible Markup Language, or XML.   Also, we have been conducting field experiments in suburbs during summer and cities during winter toward proposing new applications of road, weather, and tourist information[1].   Enlisting the cooperation of administrative organs and private enterprises, these experiments were conducted as part of the Research on Application of Advanced Information/Communication Technologies for Mobile Terminal Devices.

This paper presents the results of the summer suburban experiments.   It also reports on construction of the RWML-based system of information collection, compilation, and provision and the benefits of tourist information provision for "circular tourism" promotion and regional revitalization.   In addition, we analyze future directions of RWML and ways of supporting auto tourism by information provision.

DEVELOPMENT AND IMPROVEMENT OF RWML AND FIELD EXPERIMENTS ON INFORMATION PROVISION TO TRAVELING VEHICLES

CERI has anticipated integration between Internet-compatible mobile terminal devices (e.g.,

cellular phones) and vehicle onboard devices (e.g., car navigation systems), as well as constant Internet connection by vehicles. We have been addressing the need to develop a technology that allows drivers to selectively acquire information depending on their tastes and on the current vehicle location from information sources distributed across the Internet. As a first step toward the development of such technology, CERI has been developing and improving Road Web Markup Language (RWML), a language that permits description of road information by XML, a next-generation Internet markup language.

RWML enables road-related information to be XML-compatible, distributed across the Internet, and provided to users of the RWML-implemented system. The application users can select and compile such information using RWML applications. These capabilities of RWML can lead to the development of a system that assists road users in making travel plans and driving comfortably according to their current locations, information needs, and tastes (Figure 1).
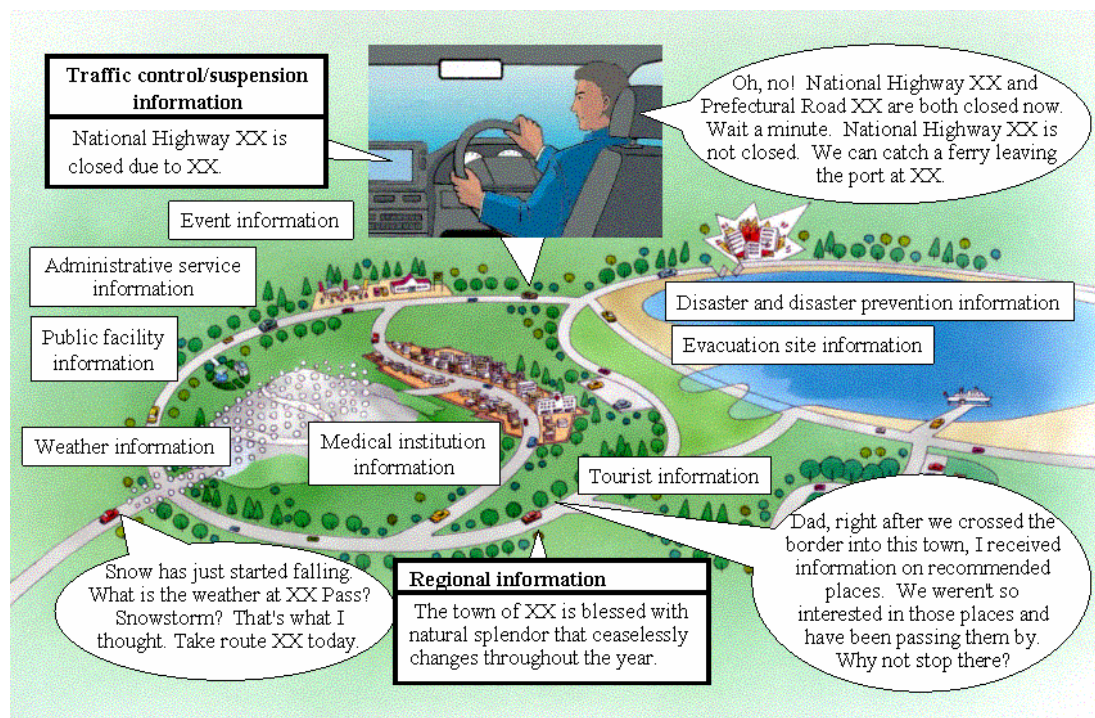

Figure 1   Use of information during travel

Since version 0.71 was released as open-source software (the specification can be seen at http://rwml.its-win.gr.jp) in October 1999, a joint research group led by CERI has been striving for further development of RWML.

Field information provision experiments to support auto tourism using RWML have been conducted in the past.   In the summer of 2001, the Niseko-Yotei-e-Route Experiment was conducted as a preliminary summer suburban experiment.   In 2002, a full-scale Niseko-Yotei-Toya e-Route Experiment was conducted.

The applications developed for these experiments employed RWML Versions 0.80, 0.81 and 0.82 for enhanced system implementability.   The employment of XML-based RWML as a data format has led to efficient construction of a system that collects data distributed across the Net and customizes them according to user needs.   Also, we confirmed that the specification of RWML can be upgraded flexibly.

NISEKO-YOTEI-TOYA E-ROUTE EXPERIMENT

(1) Objectives

One objective of the experiment is to increase the safety and convenience of roads through transmission of road, weather, and other information to cellular phones via the Internet. Another is to revitalize the region through the provision of tourist and other information.

(2) Organizations involved

The experiment was conducted from June through November 2002. The organization in charge was the Niseko-Yotei-Toya e-Route Experiment Committee, whose principal member is CERI. The committee consists of a Regional Section and a Research Section. The Regional Section was tasked with data and information provision and management, as well as publicity. The Research Section was charged with improvement of RWML and construction of an experimental system. The Regional Section was made up of local offices of the Hokkaido Development Bureau and the Hokkaido Government and 15 municipalities in the region. The Research Section was made up of 11 joint research partners of CERI. Public advertisement was made to solicit partners for this joint research. In addition, many other organizations in the Niseko-Toya-Yotei region, including the Michi-no-eki Committee of Hokkaido, were involved. The experiment was advertised on posters, flyers, in tourist magazines, on the official website of the experiment, and on official websites of cellular phone companies. Tourists visiting the region participated as experimental monitors. They visited the My e-Route page on the experiment website to register as monitors and completed the setup procedures required for e-mail transmission.

(3) Content provided

The types of information provided include information on roads and weather, as well as regional and tourist information. Information was provided to cellular phones and personal computers by e-mail and via the web page (Figure 2).

Road information was provided on the web. For road information on the Niseko and Yotei areas, the experimental website was linked to that of the Hokkaido Development Bureau. That website provides information on national highways in the Shiribeshi subprefecture of Hokkaido as a road user service for cellular phones. Specifically, the web page provides information on emergency traffic control/suspension, road traffic during adverse weather (control/suspension and rainfall), and weather observation data. For the Toya area, information was offered on construction-associated traffic regulations/closures on national highways. Also, we built a system to publish road administrators' messages on the web and a system that can broadcast e-mails containing emergency disaster information. On July 10, 2002, when a typhoon was expected to strike the region, emergency weather information was broadcast to tourists for warning.

Weather information was afforded by e-mail and via the web. The information sent by e-mail was weather forecast for the Niseko, Yotei, and Toya areas, including the daily high and low temperature. That made available on the web was weather forecast for municipalities in the region, including the daily high and low temperature.
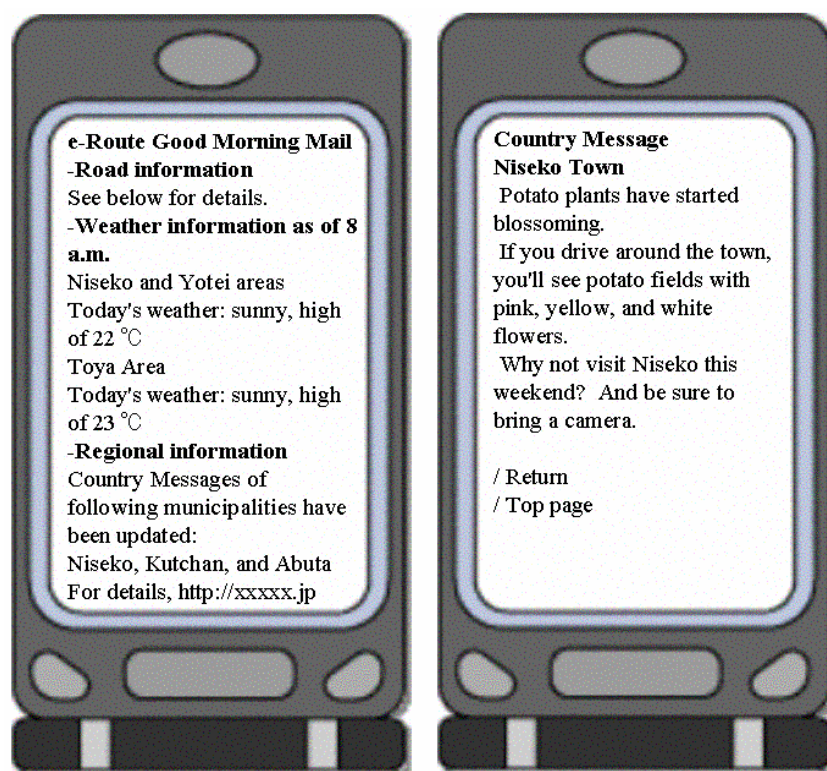
Figure 2　Example of an e-mail and posted on the web (Country Message)

Regional, tourist, and event information was offered on the Country Message page, the Tourist Information page, and the Event Information page. The Country Message page is where municipalities in the region can provide information to tourists. They supply timely information that is collected by staff of the tourist section and is not available in tourist magazines, e.g. the latest information on blossoming flowers and seasonal delicacies. The Tourist Information page offered 1,082 items of information on nature/scenic sites, hot springs, culture, participatory programs, dining, and lodging categories in existing tourist databases. The Event Information page listed 62 items on country fairs, concerts, events at Michi-no-ekis (road stations), and other items.

Private businesses offered 82 items on dining, lodging, and shopping in the Great Deal Information page. For example, information on local businesses (restaurants, lodges, etc.) and discounts was provided.

In addition, a website called My Recommendations was constructed. Monitors were able to post interesting experiences they had during their trip on this web page, which is accessible by cellular phone. This web page was created to allow monitors to transmit information to others and to exchange information with each other.

(4) Methods of information collection and provision

For provision and collection of information, RWML was employed to make all information on roads, weather, and the region and tourism compatible with XML. The road, weather, and regional and tourist information was supplied by the Road Information Center of the Hokkaido Development Bureau, the Hokkaido Branch of Japan Weather Association, and 15 municipalities in the region, respectively. Each of these organizations constructed its own

data server, which was made accessible on the web (Figure 3). The dedicated servers for mobile devices collect information from the data servers. In turn, they optimized the collected information according to time of day and user locations and needs before it was transmitted to personal computers and cellular phones of users.
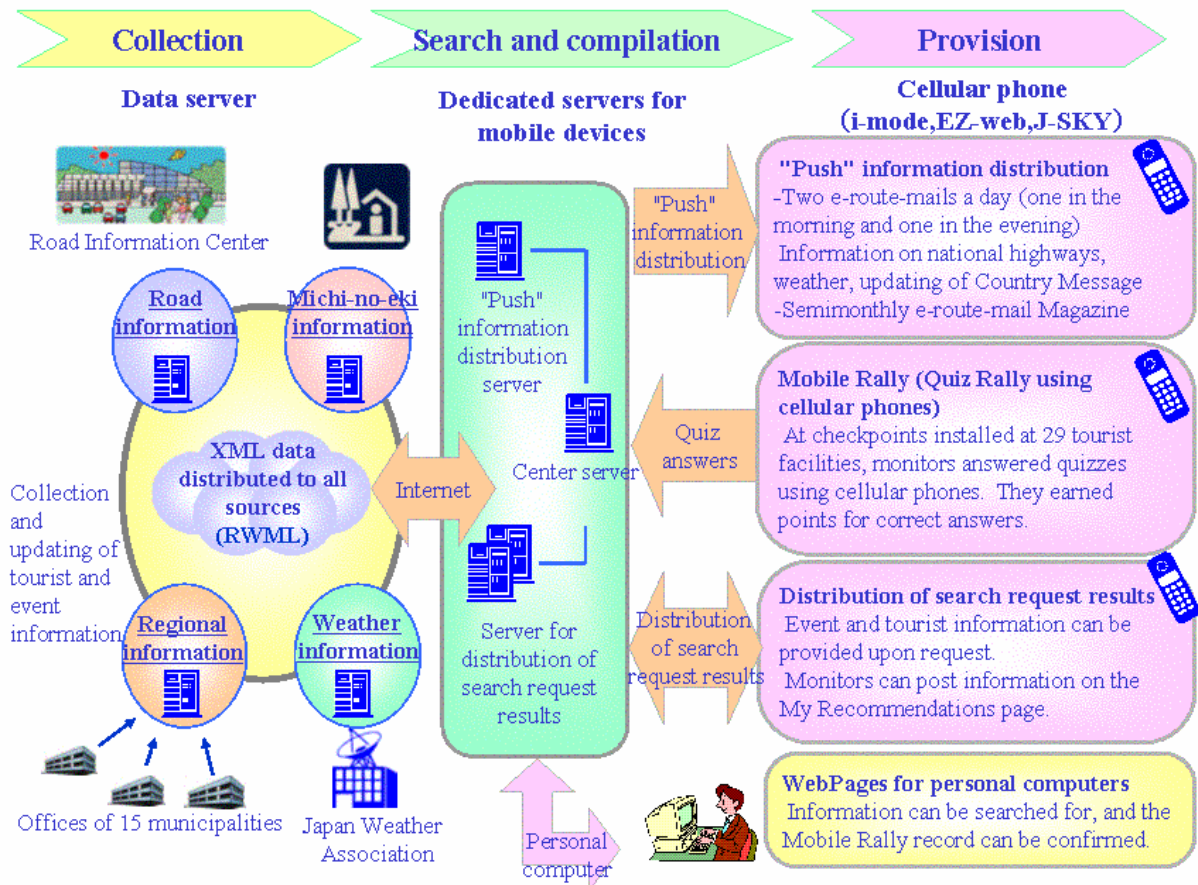

Figure 3   From information collection to provision

Regional and tourist information was entered on the data entry form on the web browser by personnel of each municipality. The data were automatically converted to XML format for entry in the system. The users were able to specify the time and date at which their real-time information, such as Country Message information, would be posted. Therefore, it was possible to provide detailed information in a timely manner.

There were two ways of providing information: "push" distribution, and distribution according to search request. By push distribution, e-mails were broadcast to monitors touring the region at 8:00 and 18:00. The e-mails contained links to web pages providing information on traffic regulation/closure on national highways, weather forecast information for the region, and information on updating of Country Message. Whether a monitor is traveling or not was determined based on whether the monitor was participating in the Mobile Rally discussed in the next section. Also, twice a month, e-Route-mail Magazine was e-mailed to monitors. This magazine offered information on upcoming events and seasonal information in order to attract tourists to the region.

By distribution according to search request, monitors were allowed to search, post, and browse information on the dedicated website. The Great Deal Information and Country

Message pages, as well as road, weather, tourist, and event information, could be searched for according to each municipality.   Also, posting on and browsing of the My Recommendations page was permitted.

(5) Mobile Rally

This experiment incorporated games to encourage participation by monitors and active touring of the region.   This concept comes from the Michi-no-eki Stamp Rally, which is a very popular recreation in Hokkaido now.   The rally was tailored to mobile communication devices for incorporation into this experiment.

At 29 tourist locations in the experimental area, a quiz was posted.   The quiz contained questions about the region.   Monitors entered answers to questions using their cellular phones.   They were given points for right answers, and the points were automatically recorded on their rally records.   After the experiment, they were automatically entered into drawings for prizes depending on the points they earned.   Whoever entered the right answer to the quiz question given at the "basic checkpoint" (a free tourist facility) was given a discount admission to a "special checkpoint" (a pay tourist facility) in the same village, town, or city.   The aim was to attract tourists to tourist facilities.   By monitoring whether a monitor was answering questions of the quiz, the experimental system judged whether the monitor was traveling.   Based on this judgment, "push" information was distributed.

CONSTRUCTION OF AN RWML-IMPLEMENTED INFORMATION PROVISION SYSTEM

(1) System configuration

The information provision system comprises data servers and dedicated servers for mobile devices.   The data servers store data made compatible with XML by RWML.   The dedicated servers for mobile devices collect, search for, compile, and provide information.

The components of the dedicated servers for mobile devices are the center server, the push server, and the request server.   The center server performs registration and management of monitors, launches the push e-mail function, and distributes push e-mails.   The push server compiles road, weather and regional information in the-mail according to location and tastes of monitors.   The request server searches the web for requested information.

We conducted this field experiment using the information provision system whose main component is the center server.   It was confirmed that the system can provide necessary information to personal computers and cellular phones of users by e-mail and via the web.

(2) Information exchange between data servers

In the experimental information provision system, servers exchanged XML data, which was converted by RWML, for all processes from data collection to provision.   However, the XML data did not include regional information offered by private organizations.   To exchange information posted all across the web, the data servers used the http protocol to communicate with each other over the Internet.

EXPERIMENTAL RESULTS

(1) Records in the dedicated servers for mobile devices

In the four-and-half-month-experiment, 2,000 monitors participated. E-mails transmitted to the participants during their travels numbered 8,287. The daily average number of e-mails transmitted was approximately 60.

Visits to the experimental website by cellular phone and personal computer users numbered 17,404 and 19,795, respectively. The daily averages were 127 from cellular phone and 144 from personal computer. Visitors to experimental web pages totaled 157,244 (1,148 per day): 98,826 were from cellular phone, and 58,418 from personal computer.

Monitors who visited all 29 checkpoints of the Mobile Rally numbered 4,080 (Figure 4). The number of participants who visited all six of the Michi-no-ekis was large. This suggests that Michi-no-ekis are tourist gateways to the region.
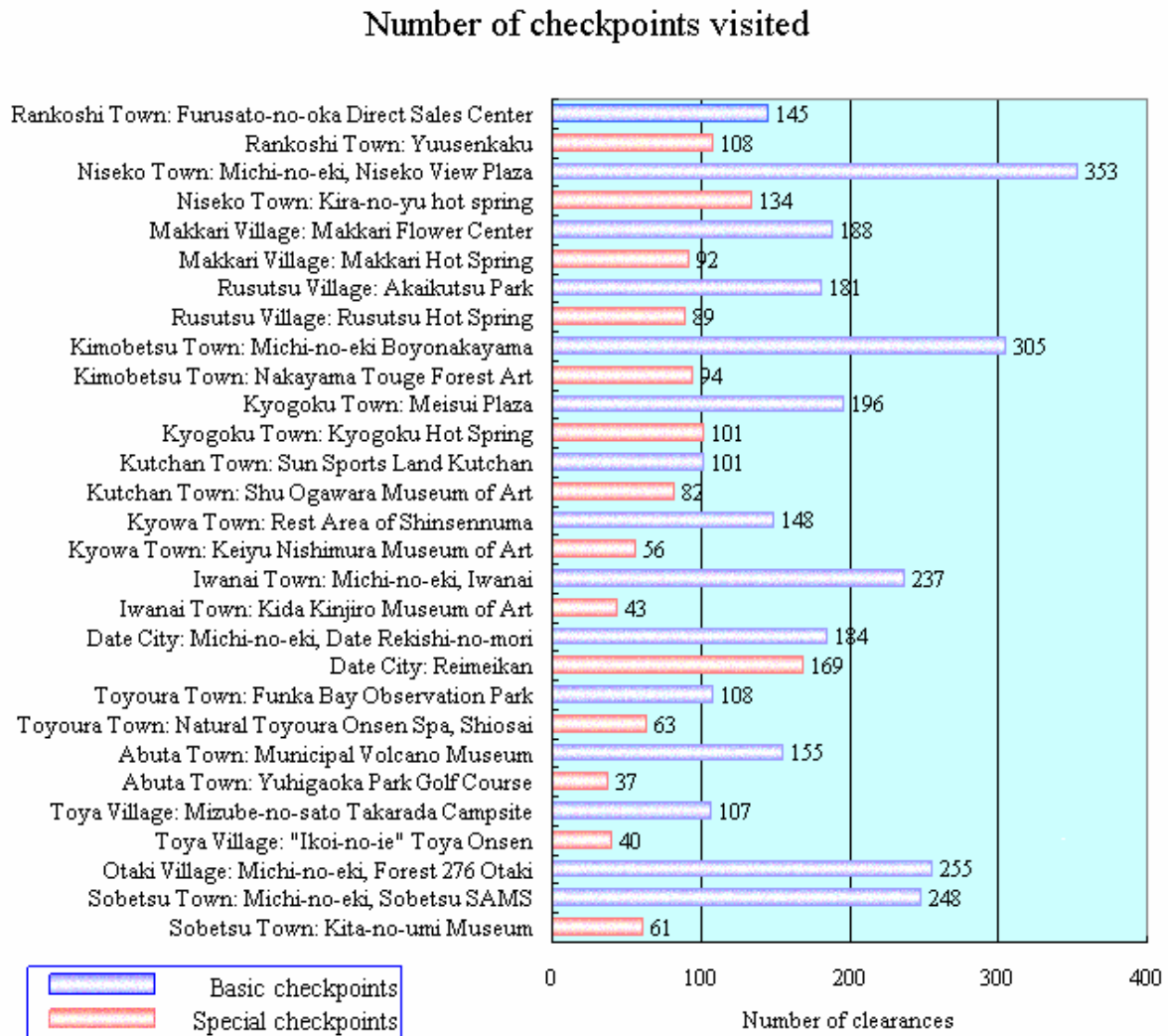
Number of checkpoints visited

Checkpoint	Number of clearances
Rankoshi Town: Furusato-no-oka Direct Sales Center	145
Rankoshi Town: Yuusenkaku	108
Niseko Town: Michi-no-eki, Niseko View Plaza	353
Niseko Town: Kira-no-yu hot spring	134
Makkari Village: Makkari Flower Center	188
Makkari Village: Makkari Hot Spring	92
Rusutsu Village: Akaikutsu Park	181
Rusutsu Village: Rusutsu Hot Spring	89
Kimobetsu Town: Michi-no-eki Boyonakayama	305
Kimobetsu Town: Nakayama Touge Forest Art	94
Kyogoku Town: Meisui Plaza	196
Kyogoku Town: Kyogoku Hot Spring	101
Kutchan Town: Sun Sports Land Kutchan	101
Kutchan Town: Shu Ogawara Museum of Art	82
Kyowa Town: Rest Area of Shinsennuma	148
Kyowa Town: Keiyu Nishimura Museum of Art	56
Iwanai Town: Michi-no-eki, Iwanai	237
Iwanai Town: Kida Kinjiro Museum of Art	43
Date City: Michi-no-eki, Date Rekishi-no-mori	184
Date City: Reimeikan	169
Toyoura Town: Funka Bay Observation Park	108
Toyoura Town: Natural Toyoura Onsen Spa, Shiosai	63
Abuta Town: Municipal Volcano Museum	155
Abuta Town: Yuhigaoka Park Golf Course	37
Toya Village: Mizube-no-sato Takarada Campsite	107
Toya Village: "Ikoi-no-ie" Toya Onsen	40
Otaki Village: Michi-no-eki, Forest 276 Otaki	255
Sobetsu Town: Michi-no-eki, Sobetsu SAMS	248
Sobetsu Town: Kita-no-umi Museum	61

Basic checkpoints
Special checkpoints

Figure 4   Number of checkpoints visited

Table 1 shows the eight special checkpoints where information on discounts was provided during the Mobile Rally. According to the table, approximately 49% of the monitors who visited took advantage of the discount information. Nakayama Touge Forest Art Museum and Kida Kinjiro Museum of Art achieved especially high rates of discount use. They attracted visitors who visited the basic checkpoints (Michi-no-eki) that are frequented by many visitors.

The My Recommendations page, in which experimental monitors were allowed to write about their interesting experiences, received 358 postings (Figure 5). The greatest number of postings was on dining (156 postings, 44%), followed by hot springs (58 postings, 16%) and nature & sightseeing (53 postings, 15%).

The total postings of each municipality by category show that most municipalities received postings related to dining. There were many postings about Niseko View Plaza and Forest 276 Otaki, two Michi-no-ekis retailing local delicacies. This suggests that it would be effective for local areas to dispatch information on their own delicacies, which could be referred to as Delicacy Information.

Table 1   Use of discounts at checkpoints

| Special checkpoint (* indicates Michi-no-eki is its basic checkpoint)	Municipality	Monitors visited	Monitors who used discount	Rate of discount usage
Kira-no-yu*	Niseko Town	134	59	44.0%
Nakayama Touge Forest Art Museum*	Kimobetsu Town	94	61	64.9%
Kyogoku Hot Spring	Kyogoku Town	101	55	54.5%
Shu Ogawara Museum of Art	Kutchan Town	82	31	37.8%
Keiyu Nishimura Museum of Art	Kyowa Town	56	20	35.7%
Kida Kinjiro Museum of Art*	Iwanai Town	43	32	74.4%
Reimeikan*	Date City	169	75	44.4%
Yuhigaoka Park Golf Course	Abuta Town	37	20	54.1%
Total		716	353	49.3%
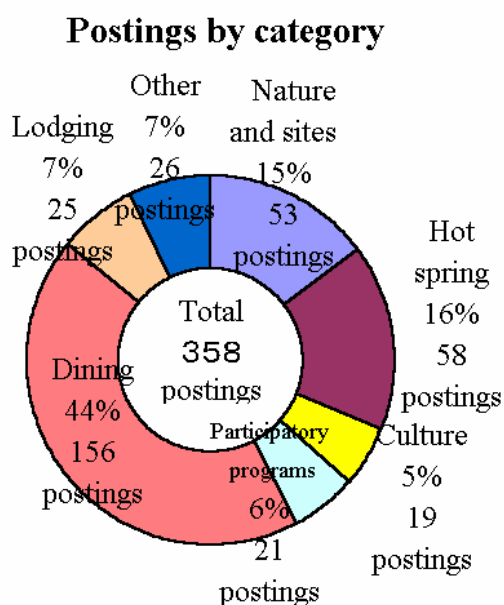
Figure 5   Postings by category

(2) Questionnaire results

After the experiment, questionnaires were conducted on the web and by post. The one on the web was for the experimental monitors; the one by postal was for winners of the Mobile Rally. Experimental monitors who filled out the questionnaire numbered 59; Mobile Rally winners numbered 108. The experimental monitors who filled out the questionnaire can be regarded as "sample" experimental monitors because their answers were randomly sampled. The Mobile Rally winners tended to be those who visited many checkpoints and received many "push" e-mails. The primary trends of these two questionnaires are as follows:

- Figure 6 shows the relative frequency of use for each item on the list of user choices. The information search menu was used by over 70% of the experimental monitors and the Mobile Rally winners. Regardless of participation or success in the Mobile Rally, many experimental monitors used the information provided.

- Figure 7 shows percentages of people who reported changing their travel plans as a result of the provided information: 34% for experimental monitors and 51% for Mobile Rally winners. The provided information gave them the opportunity to change their plans.

- Approximately 80% of experimental monitors and 80% of Mobile Rally winners who responded answered that they "spent money on unplanned shopping and dining (Figure 8)." The information provision has the potential for positive economic effects on the region.

- Figure 9 shows changes in travel plans. Many respondents answered "visited a place that had not been planned (e.g., a checkpoint of the Mobile Rally)." The respective percentages for experimental monitors and Mobile Rally winners who responded are 50 - 60% and 60 - 70%. The percentages of "changed the travel route" are also high (experimental monitors: 30%; Mobile Rally winners: 40%). The effects of the Mobile Rally, a participation-oriented event, can be seen in travel plan changes.
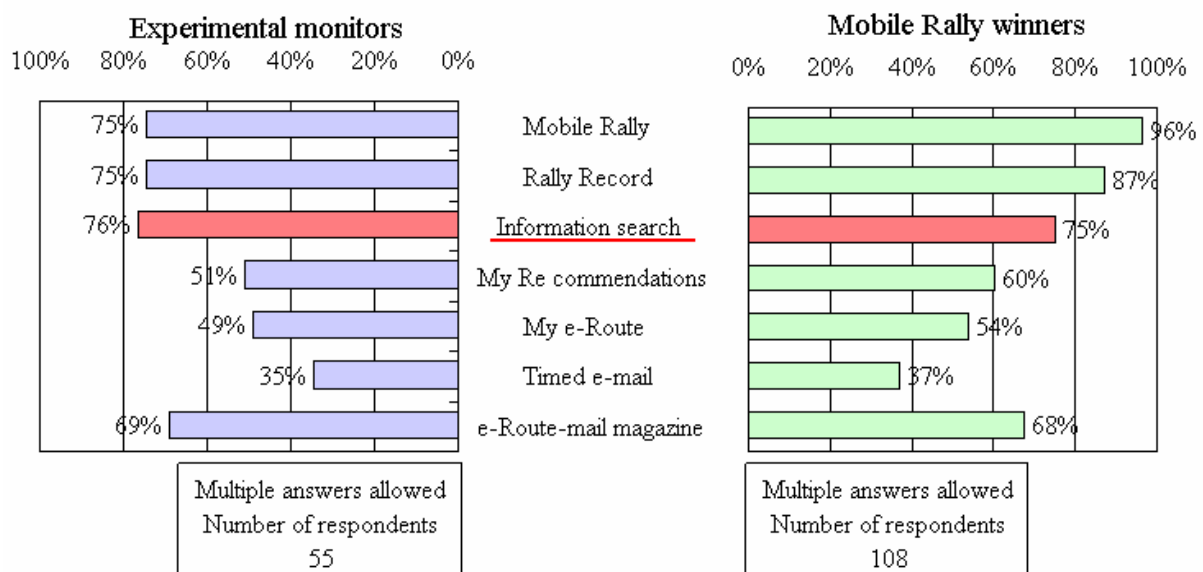
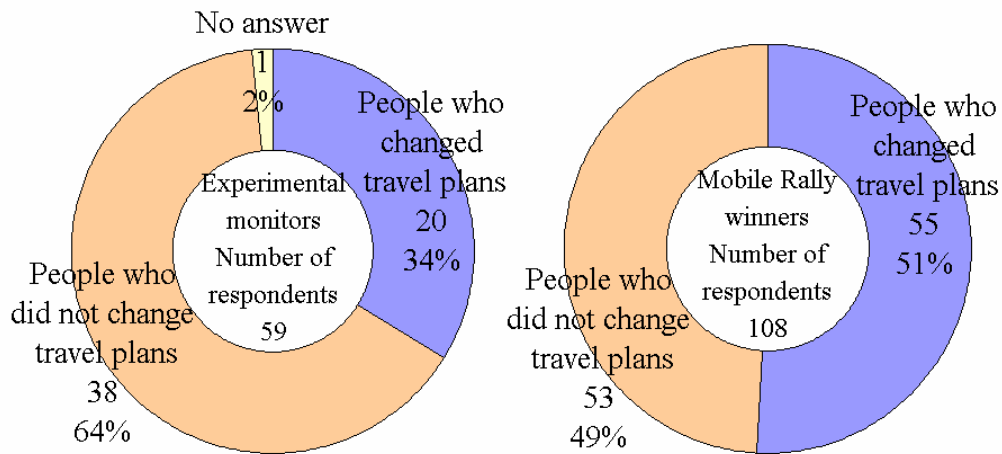

Figure 6   Relative use frequency of menu choices

No answer
1
2%

Experimental monitors
Number of respondents
59

People who changed travel plans
20
34%

People who did not change travel plans
38
64%

Mobile Rally winners
Number of respondents
108

People who changed travel plans
55
51%

People who did not change travel plans
53
49%

Figure 7   Changes to travel plans as a result of information provided

No changes to spending plan
4
20%

Experimental monitors
Number of respondents
59

Made unplanned expenditure
16
80%

No changes to spending plan
9
16%

No answer
1
2%

Mobile Rally winners
Number of respondents
108

Made unplanned expenditure
45
82%
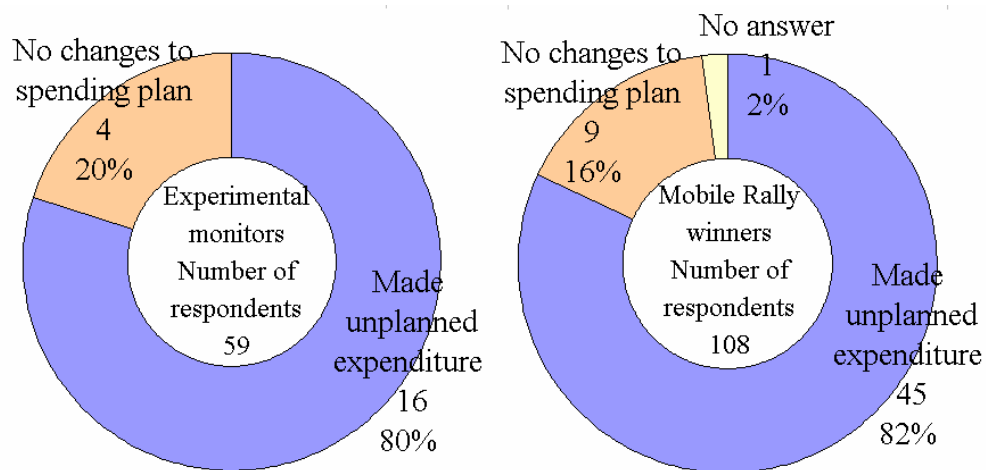
Figure 8   Expenses incurred by plan change

Experimental monitors

30%	Changed the destination
65%	Made an unplanned visit (basic checkpoint of Mobile Rally)
50%	Made an unplanned visit (special checkpoint of Mobile Rally)
20%	Made an unplanned visit (elsewhere)
25%	Took part in an unplanned event
10%	Changed the duration of travel
30%	Changed the travel route

100% 80% 60% 40% 20% 0%

Multiple answers allowed
Number of respondents
20

Mobile Rally winners

24%	
71%	
64%	
35%	
20%	
11%	
44%	

0% 20% 40% 60% 80% 100%

Multiple answers allowed
Number of respondents
55

Figure 9   Changes to travel plans

10

These results tell us that the proper provision of real-time road, weather, regional, and tourist information to auto tourists and effective planning to attract visitors to tourist sites can provide opportunities for change in travel plans.   Information provision, depending on how it is done, can contribute immensely not only to increasing tourists to the region, but also to development of an attractive region.

FUTURE DIRECTIONS OF RWML AND PROMOTING AUTO TOURISM BY INFORMATION PROVISION

The experiment confirmed that the RWML-implemented information provision system operates properly and effectively.   At present, new specifications of XML are being developed, and implementation of XML is increasing.   The environment for the development and use of XML is improving day by day.

Thus far, the specification and Document Type Definition (DTD) of RWML, as well as its data format, have been released as open-source software.   RWML has been repeatedly improved and modified, and necessary information items have been largely identified.   However, during the process of the experimental system construction, difficulties involved in development of RWML applications have been identified.   This could pose a problem for future dissemination.   Therefore, we have decided to significantly modify the structure of RWML.   We are currently formulating the specification of RWML Ver. 1.0, which is an upgrade of RWML Ver. 0.82.

From now, we will conduct research on upgrading of RWML along with its new development and use environments and on improving its applications and data, with the recognition that RWML is ready to enter practical use and dissemination.

In this summer suburban experiment, the provision of information on specific routes and locations was found to be effective in inducing users to engage in "circular touring."   The experimental results have also revealed that users tend to like region-specific information and participation-oriented programs.

The information and services provided in this experiment are considered to be of tremendous potential in the development of an information provision system to support auto tourism.   For example, they could be incorporated into regional ITS.   In future, the use and integration of roadside information should be realized, and a central computer should be constructed for the transmission of unique, detailed information.   We will study these possibilities and create a framework to achieve them.

CONCLUSIONS

In the summers of 2001 and 2002, we conducted a suburban field experiment.   The experimental results have proven that the RWML-implemented system operates well and is effective.   Also, it has been found that information provision aimed at promoting auto tourism is beneficial for tourism in the region to some extent.   In view of the results, we will work toward the provision of better information and toward increasing the opportunities for local regions to provide information.

In closing, we would like to express our appreciation to the member organizations and supporting organizations of the Niseko-Yotei-Toya e-Route Experiment Committee for their assistance.

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