Regional Information Platform and Information Distribution System in Telecommunication and Broadcasting Convergence

~For Tourism Promotion and Disaster Prevention~

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***Abstract*—As the main focus of this research, we constructed an experimental website for the communication broadcasting cooperative transmission system and developed a regional information platform. In addition, we carried out a small-scale demonstration experiment at the Chino station. The results of the questionnaire show that there is high demand for the provision of regional information, as was initially expected. However, the level of satisfaction regarding the kind of information people wanted was higher with one-segment (1Seg) transmission. It appears that 1Seg is better at sorting and presenting information believed to be necessary, and that there are comparatively few people who want in-depth information unique to particular regions such as that provided by social network services. This means that the system should dynamically change the ratio of general and in-depth information based on the time, location, and user profile.**

Keywords-regional information; disaster prevention; tourism promotion; crawling; 1Seg

I. INTRODUCTION

In March 2012, the Japanese Tourism Agency adopted the new "Tourism Destination Promotion General Plan" as a basic plan to transform Japan into a tourism-oriented country. The authorities considered expanding tourist locations and improving the quality of tourism as the main directions for the plan. Specific goals were set, with the aim of increasing domestic travel spending to 30 trillion yen by 2016 and the number of foreign travelers to 18,000,000, while also improving traveler satisfaction. Tourism is one pillar of the growth strategy for Japan, and is also contributing to the recovery effort relating to the Great East Japan Earthquake [1].

Furthermore, the Japanese Tourism Agency is evaluating the need for a "Tourism Regional Development Platform" and has made these documents publicly available [2]. Regional tourism development is shifting from an organized group travel model to an individual or small group model, while participatory experience-type travel needs are growing, and travelers' needs are diversifying. To address these changes in travel needs and to establish networking projects to attract visitors, various concerned parties at the destinations need to meet and cooperate in a cross-sectional and substantive manner that will develop local tourism, by utilizing resources and offering products and services (optional tourism type products) unique to each region. Simply having concerned parties provide local travel products in their respective specialty fields, however, is not enough to carry out marketing that will determine what products are in demand, and tends to be insufficient as a system for dealing with complaints. Thus, in order to not only utilize local resources and sell local travel products, but also promote regional economic development that can sell these products and services, a regional tourism development platform providing a one-stop information center for selling local travel products across the sectors is a necessity.

The area around Chino is blessed with a rich variety of natural tourism resources such as Tateshina Plateau and the Yatsugatake Mountains, and is host to many tourists. Recently, however, a decline in travelers has led to a decline in spending, creating a serious problem. The lack of coordination between tourism operators has been raised as an issue in tourism recovery. Since Chino is a popular location for tourism, many tourism companies operate there; however, because most of these operators promote their activities

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individually, the effect is not a consolidated one. This is why there is a demand for a centralized "receptacle" organization to be established, which could manage operations and advertising for all customers under a united banner [3]. Thus, the "Tourism Regional Development Platform" is indeed a necessity.

Considering disaster prevention information, a wide range of information needs to be covered, including weather and river information, which is transmitted by each region, as well as earthquake information. As each type of information is transmitted through different media and in different formats, it is not possible to consolidate everything. In addition, manually converting media and formats means that information cannot be transmitted in real-time, and thus a system structure capable of immediate transmission is needed.

It is also apparent from experiences with the Great East Japan Earthquake that society depends on mobile phone networks, the Internet, and other digital information transmission infrastructure. Besides the use of social media and e-mail in times of emergency to confirm a person's safety, frequent access to websites via mobile phones and 1Seg public information broadcasts were also recorded.

In other words, the Great East Japan Earthquake proved that the various means of broadcasting and Internet communication complimented each other, and in so doing, confirmed the need to secure an information transmission system that can distribute information in a variety of formats.

One channel in Japan's terrestrial digital broadcasting format (ISDB-T) is split into thirteen sections, called "segments." A few of these segments are bundled together to send video, data, and audio. One of these segments, called one-segment (1Seg), is used exclusively for broadcasting to mobile devices. 1Seg local services in Japan are broadcasts aimed at mobile devices, although the service is limited to a few small regions.

Until now, the 1Seg local service broadcast was an experimental service, utilizing unused bands of the television broadcasting spectrum (white space). Various experiments were carried out in each community and service as a place ("special white space zone") to conduct research and development in addition to verification tests for the institutionalization of new services and systems as well as for business development and promotion. Expectations are high for the application thereof, especially in the fields of regional tourism recovery and disaster prevention.

This paper consists of an introduction in Section 1, and a discussion of past research in Section 2. Section 3 explains the aims of this research at a conceptual level. Section 4 discusses the implementation of the research and experiments, while Section 5 gives the details and results of the experiments. Finally, Section 6 presents a summary and discusses options for future research.

II. PAST RESEARCH

To the best of our knowledge, there are no examples of previous hands-on studies that have comprehensively addressed local area information systems and information transmission systems, as this research aims to do. The following examples are provided as related research.

There have been several reports on 1Seg local service experiments including those by Saito et al. [5] on tests conducted at the Sapporo Snow Festival, and Nishikawa [6]. In addition, numerous reports exist on experiments carried out on the transmission of information using 1Seg local services. There are also examples in which 1Seg has been used to tackle actual tasks in local areas.

Research on basic technology for data mining has resulted in advancements, and the effectiveness thereof is expected to improve. Deguchi [7] suggested the possibility of content navigation through recommendation and data mining. Additionally, Haseyama and Hisamitsu [8] investigated the use of video searching technology to allow users to access a particular video from among a great number of videos.

Prompted by the Association for the Promotion of Public Local Information and Communication, the work in [9] attempted to further standardize area information platforms from the viewpoint of municipalities.

In 2008, the Ministry of Internal Affairs and Communications established the Research Society for Regional Safety and Security Information Foundations, and proposed the construction of "safety and security public commons" [10], a mechanism to provide the foundation for sharing disaster information. From this, the "commons format XML" was established as a format for sharing information, which led to the creation of the "public information commons". Since June 2011, this service has been operating as an entity managed by the Foundation for MultiMedia Communications (FMMC). This paper uses the public information commons, and proposes a disaster prevention information transmission system.

In 2012, research was carried out on a regional information platform and 1Seg local broadcast service for tourism promotion and disaster prevention [11]. During the research, which contributed to the design of the fundamental concepts of the current research project, a 1Seg local service broadcasting experiment for a large-scale event (the Lake Suwa fireworks display) was carried out. And in the past research showed that through optimal use of communication and broadcasting, user's benefit was maximized [12].

III. AREA INFORMATION PLATFORM AND INFORMATION TRANSMISSION SYSTEM

This research is based on the conceptual design of one of the results from last year's research on the area information platform and information transmission system, and presents results based on tangible development and experimentation. In Section 3, the basic conceptual design is explained.

To transmit tourist and disaster prevention information in a timely fashion to those needing it, a regional information platform has been constructed. Development for data mining, content comprehension technology, and sampling technology amongst others, has also been carried out to gather and analyze the information, and then automatically generate and organize the information desired by the user. Transmission

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experiments were conducted to confirm the platform's effectiveness.

The current state is that tourism information for large areas is scattered, so the desired information cannot be obtained instantly. In addition, accessing individual or deep, hidden information is challenging. For these reasons, the regional information platform is designed to be included social media as illustrated in the lower portion of Fig. 1, and information on narrow region will be sourced through data mining. In addition, conceptually, as shown in the upper portion of the Fig. 1, a tourism and disaster prevention information transmission system that can link up with media from broadcasts or transmissions will be built. In terms of the transmitted content, the platform can connect with broadcasts and transmissions in a coordinated fashion, and can be optimized to organize programs according to the analysis of user data. An autonomous disaster prevention information system will also be created, to consider the possible use of broadcasts and transmissions in the event of a disaster.

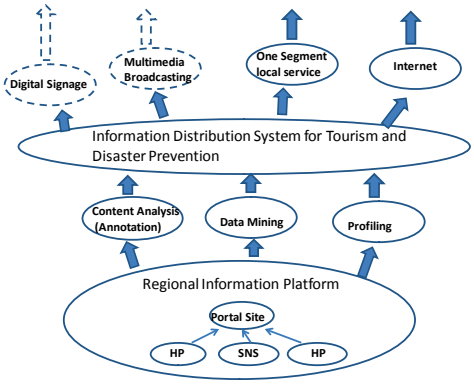

Figure 1. Regional information and distribution system

Whereas our previous research focused on a 1Seg local service broadcast transmission experiment at a large-scale event (the fireworks show), the transmission experiment in this research sets out to investigate an area information platform system and transmission system with the ability to link with broadcasts and transmissions.

IV. SYSTEM IMPLEMENTATION

A. Overall Construction

Fig. 2 shows the overall system configuration. The upper part of Fig. 2 corresponds to the area information platform shown in Fig. 1, while the lower part corresponds to the information transmission system.

The Regional Tourism Information Database crawls web sites, blogs, and other online resources of local individuals transmitting information, allocates weights to the detected keywords according to frequency, and stores them in a database. In addition, the Area Disaster Prevention Information Database regularly polls public information commons [10], not only gathering the latest information from the commons, but also detecting other information, such as the region's torrential rain information.

To report disaster prevention information in a timely manner on a tourism and disaster prevention portal site, work is underway to transfer such information from the Disaster Prevention Information Database to the Tourism Information Database, thereby allowing disaster prevention warning information to be presented without delay on the portal site.

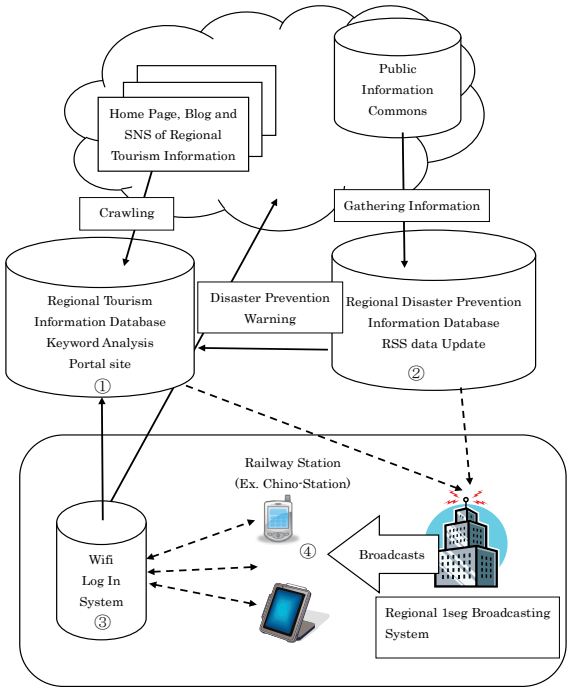

Figure 2. System configuration

B. Area Information Platform and Portal Site Construction

This corresponds to the part of Fig. 2 demarcated as ①. A platform has been created that can centrally manage not only official local area websites, but also personal sites, blogs, and social networking services (SNS), amongst others. By creating a one-stop portal site such as this, users (tourists) will be able to find the information they seek without having to search several sites. Additionally, local knowledge of the region can be extracted by crawling regional information, which is then analyzed according to what users want, and is uploaded to the portal site illustrated in Fig. 3. Moreover, we believe that this can be reflected in 1Seg broadcast programs.

Several of the existing tourist websites, such as those for the various tourist associations, hot springs associations, tourist operators, and special event committees were analyzed by the web crawler system which is installed in Tokyo University of Science, Suwa. A crawler program is used to search for keywords related to the Suwa region; the resulting website data is imported and analyzed with the results shown in Fig. 3. This effectively creates the one-stop portal for regional information. Dealing with information that is transmitted only by SNS, for example, information on the local Tateshina Plateau vegetable market, which was scheduled to be held every Sunday, but was suspended once owing to a typhoon, is not that simple; if you do not know the SNS address, you cannot view the information. However,

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if “Tateshina” is picked up as a keyword, a relationship is created from this keyword and it is possible to see the information.

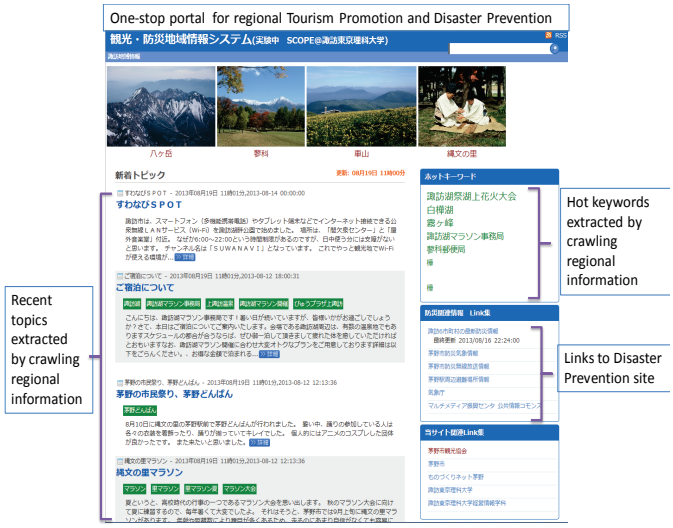

Figure 3. One-stop regional portal site

C. *Development of an Autonomous Disaster Prevention Information System*

This section relates to the part of Fig. 2 demarcated by ②. When developing the autonomous disaster prevention information system, it was decided that the public information commons [10] would be used. The goals of this public information commons are: (1) to send quickly and accurately safety and security information that was transmitted to residents in regions with public institutions, such as local public bodies, to all residents using various types of media, (2) to transmit various media to residents by sending information only once to the commons, (3) to use a data format that has been standardized and unified, and (4) to provide the foundation for the distribution of shared information.

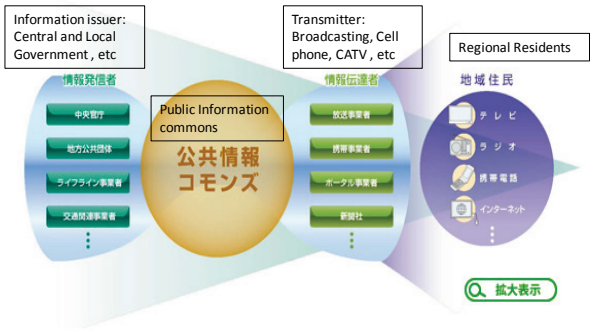

Figure 4. Public information commons conceptual design

Information originators positioned on the left of Fig. 4 are assumed to be central government agencies, local government, lifeline operators, and transportation related operators, for example. However, currently, almost all members are prefectural or municipal local governments. The majority of members that are information communicators, positioned on the right of Fig. 4, are local broadcasting offices, Cable television (CATV), Amplitude modulation (AM) / Frequency modulation (FM) radio, and community FM.

Extensible Markup Language (XML) format, which is used as a standardized data format, is versatile enough to express diverse and varied information under various conditions, from warnings and disaster information to peacetime activities. The public information commons is already being used to distribute evacuation advice/instructions, evacuation point information, emergency operation center establishment points, disaster information, events, notices, river water levels, rainfall information, early warning mail, weather and storm warnings, designated river water flood forecasts, and landslide alerts as actual information individually to several prefectures and cities.

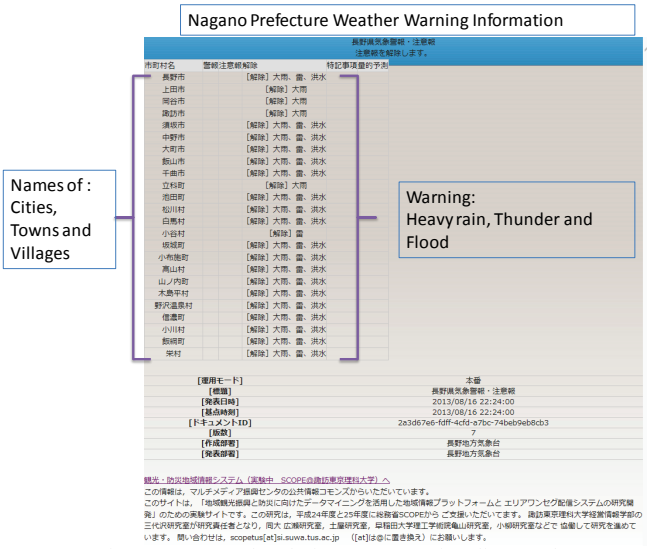

Figure 5. Screenshot during a Suwa region disaster alert

Fig. 5 shows an example of an actual heavy rainfall and flood warning released for the Suwa region. This type of warning is transmitted to the public information commons by the Nagano local meteorological observatory. The figure shows how it is presented on this regional information platform. Furthermore, from autumn 2013, Civil protection warning system in Japan (J-ALERT) is scheduled to be transmitted via the public information commons, and it is expected that almost all the safety and security information will be collated in the public information commons.

D. *Login System*

The Wireless Fidelity (WiFi) login system, which does not require prior registration, is illustrated in part ③ of Fig. 2. Tourism and disaster information is transmitted from this network interface. After logging in, the user enters the portal

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site as shown in Fig. 2, with disaster information also presented on this page. The login system consists of a WiFi transmission router and homepage, and a server for Dynamic Host Configuration Protocol (DHCP) control.

E. *Construction of a Communication Broadcasting Cooperative Transmission System*

This corresponds to the part demarcated as ④ in Fig. 2. By extracting data characteristics (mining), aspects such as the attention level and topics for a certain point in time and a certain location can be obtained, and dynamically formatted as a webpage matching the interests of the user. For broadcasting content, since program content is not directly and dynamically converted, it is possible to switch the display order for recommended locations based on the level of importance of the keyword about once a day. In the future, we intend accessing the Suwa tourism information database and converting the displayed content dynamically.

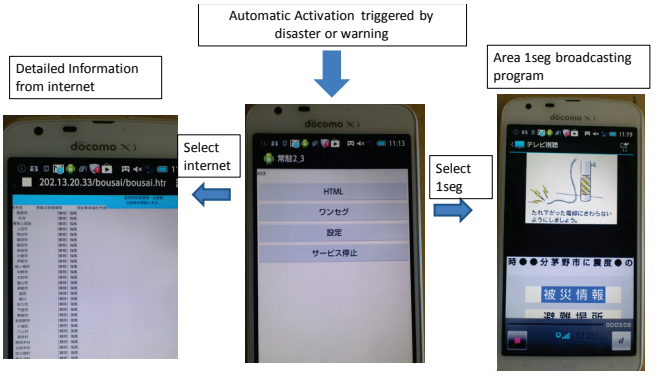

Figure 6. Communication broadcasting cooperative disaster prevention operational screenshot

Furthermore, as shown in Fig. 6, when a disaster or a warning occurs, a permanently installed smartphone application detects events that occur thanks to the updates to the Disaster Prevention Information Database, which launches the disaster prevention application. When a disaster occurs, because the Internet and radio waves may not necessarily be available, it is possible to select whether to collect information from the Internet or 1Seg broadcast for the disaster prevention application. If the 1Seg broadcast is selected, the 1Seg function automatically starts, selects a disaster prevention broadcasting channel, and enables the user to watch certain programs such as immediate disaster prevention broadcasts, This function has been successfully implemented.

It is assumed that tourist programs will be shown by default, but that the system will switch to disaster prevention broadcasts if a disaster occurs.

V. TRANSMISSION AND BROADCAST-BASED EXPERIMENT AT CHINO STATION

Using the regional information platform that was developed, a communication broadcasting cooperative type transmission experiment was performed on August 21, 2013 at Chino station, as shown in Fig. 7.

During the experiment, information was transmitted to travelers who were waiting for trains to return home after visiting Chino for the summer vacation via 1Seg broadcasts using the Internet and weak radio waves. Every year at this time, 100 to 200 people are typically waiting for the limited number of express trains in the direction of Tokyo in waiting areas inside the station. We distributed a questionnaire to these people at 1 pm, just before the fireworks display was about to start, and collected their replies before 5 pm.

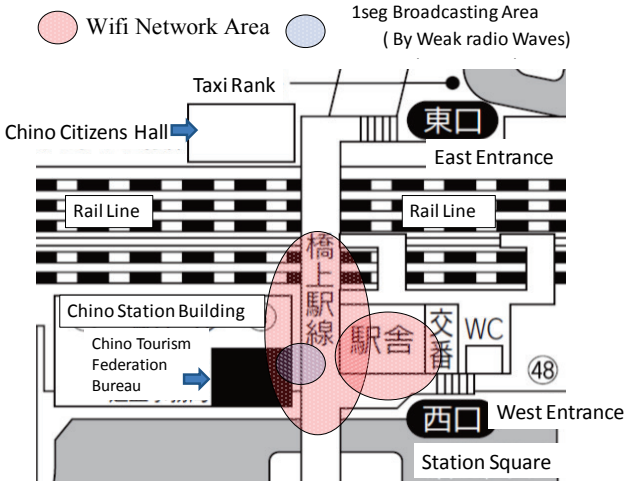

Figure 7. Experiment location: map of Chino station

A. *Information Transmission System and Data Transmission using WiFi*

For transmission using the Internet, a DHCP server and WiFi router were set up on the ceiling of a corridor on the second floor of the station. The tourism information database and disaster prevention information database servers were set up at the university. A public network connected these servers with the Chino station. Although several WiFi hotspots were already in operation within the station, the experiment required that the WiFi service be used without any prior registration, which meant that it should be possible to connect using only the Service Set Identifier (SSID) input. After connecting, as shown in Fig. 8, an image introducing tourism in Chino was displayed, which when clicked, was designed to connect directly to the tourist portal because the main goal of the WiFi service was for people to use the tourist portal and owing to the realization that a push type service was necessary.

Figure 8. Login screen and portal screen transition

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B. Broadcast System using Weak Radio Waves

During the experiment content was transmitted using weak radio waves. A transmitting device for the experiment was placed around the tourist information area inside the station, and the experiment was performed within a range of several meters in which the transmissions could be received. The video content, which was pre-prepared Chino tourist and disaster prevention videos, was encoded by H.264, a video codec for 1Seg, saved on the device's hard disk drive, and repeatedly transmitted. In addition, a compilation of Broadcast Markup Language (BML) for the data broadcast section was created beforehand using authoring tools on a separate computer, stored on the device's hard disk drive, and repeatedly sent using a carousel method.

C. Broadcast Programs

The content for 1Seg was divided and displayed as videos at the top of the screen with the data broadcasting section at the bottom of the screen. The video section showed Chino tourist videos for standard tourism, and it was assumed that this would switch to disaster prevention videos during emergencies. During the experiment, to ensure the questionnaire was easy to complete, a tourist video was shown for approximately 3 min, while a disaster prevention video was shown for approximately 2 min. Both videos were shown repeatedly.

Figure 9. Screenshot of 1Seg program on smartphone

Fig. 9 shows the smartphone program in use during the actual experiment. The top of the screen in this example displays a video introducing tourism in the Chino region, while the bottom of the screen displays text in the form of BML for tourists.

As shown in Fig. 10, information on a disaster and the prevention thereof can be acquired from the appropriate section on the display when a disaster occurs.

The regional information platform was accessed the day before the experiment to acquire tourist information. Keyword content relating the 1st to 4th ranking keywords is displayed in order with photos attached, while information relating to the 5th to 8th ranking keywords is displayed as large text entries. Additional items are displayed below this on the screen.

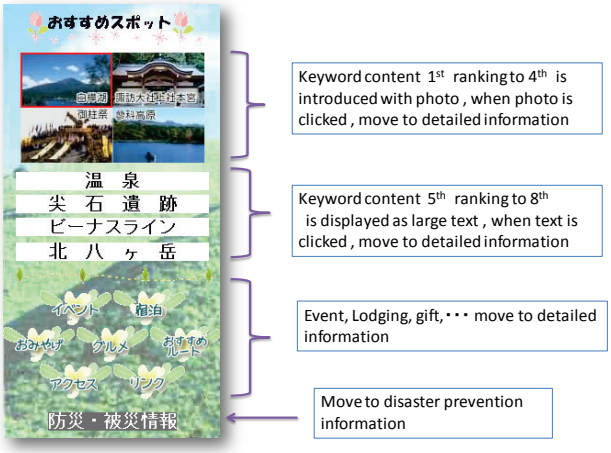

Figure 10. Layout of smartphone screen

When selecting information on a disaster and the prevention thereof as shown in Fig. 11, the system is designed to confirm aspects like the state of the disaster, evacuation points, aftershock information, safety information, and the state of recovery.

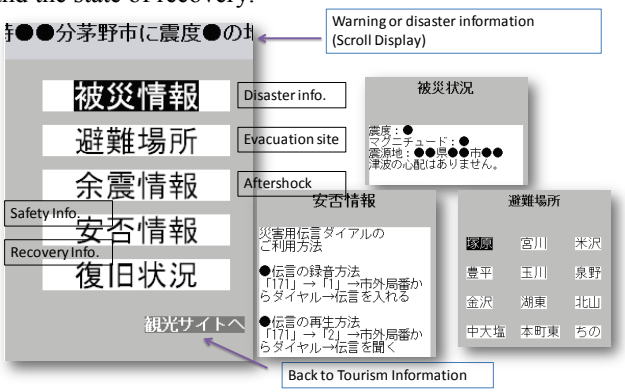

Figure 11. Disaster prevention BML screen

D. Results and Considerations of the Questionnaire

Students from Tokyo University of Science, Suwa interviewed people in the vicinity of the tourist information kiosk in the Chino station as part of administering the questionnaire.

Information collected via the questionnaire includes:

- The kind of information users require
- Usefulness and evaluation of information obtained via the Internet
- Usefulness and evaluation of information obtained via 1Seg
- Comprehensive evaluation of information transmitted during the experiment
- Profile of the questionnaire respondents

While handing out the questionnaires, the students also explained the tourist portal and broadcast system in detail. As this took a great deal of time, about 40 min per

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respondent, questionnaires were only completed by 30 people, which was fewer than expected.

We used an evaluation scale from 0 to 4, with 4 being the best. Below we discuss the obtained results, where each figure is given as the average of the marks for all test subjects.

1) Questions about information required by users

The demand for information on tourist spots (3.60), access to transportation (3.57), weather forecasts (3.53), drinking and eating (3.47), accommodation (3.34), and recommended tourist routes (3.28) was high. In terms of disaster prevention information, there was high demand for information on the disaster itself (3.73) and evacuation points (3.60).

2) Usefulness and evaluation of information obtained via the Internet

Results of the questions evaluating information obtained via the Internet are shown in Fig. 12 and summarized below: usefulness (3.25), whether the correct information was found (2.89), whether the latest information was available (3.57), and whether the regional information was useful (3.57). It appears that information focusing on the region in particular was highly desirable.

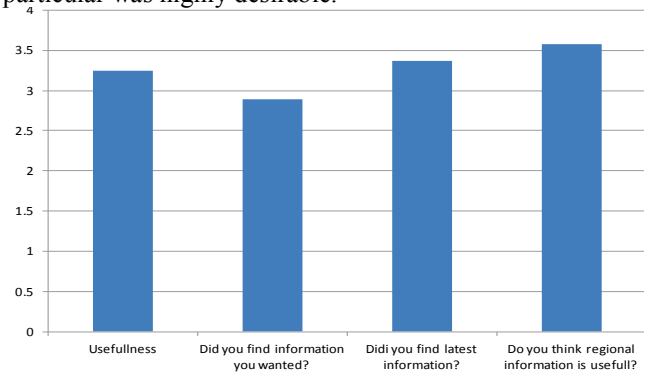

Figure 12. Usefulness and evaluation of information obtained via the Internet

Furthermore, when asking people to view and evaluate whether the content related to the top four keywords of the tourist portal via the Internet was useful, all items received an evaluation of 3 or above. This means that most of the test subjects agreed on the level of importance for the top keywords extracted by the system. Lake Suwa was ranked first, but we believe this is due to the many SNS articles about Lake Suwa, and the fact that during this time, many advertised events were due to take place at Lake Suwa.

In addition, for disaster prevention information, an average evaluation of 3.69 for the usefulness thereof was obtained, while the ability to view tourist and disaster prevention information on the same page received a high score of 3.72 on average.

3) Usefulness and evaluation of information obtained via 1Seg

Results of the usefulness of transmissions by 1Seg are shown in Fig. 13. High scores were received for access information (3.56), recommended routes (3.53), gourmet information (3.50), and hot springs guidance (3.47). Since test subjects were already at the Chino station, it appears that they were interested in return train access information and recommended routes for their next visit based on the individual tourist site information. The Togariishi archeological site (3.28) and tourist videos (3.21) were given low scores.

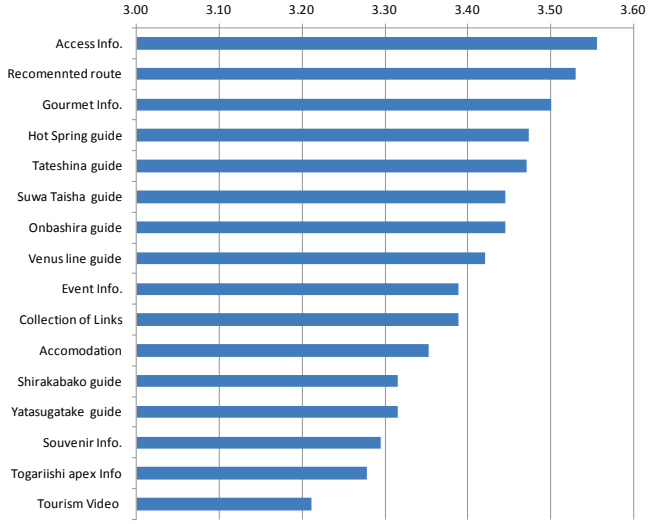

Figure 13. Usefulness of tourist information obtained via 1Seg

As shown in Fig. 14, regarding disaster prevention information, information allowing the user to decide what action to take following a direct disaster such as recovery information (3.72) and evacuation point information (3.63) was regarded highly. However, the reason that video footage for both tourism and disaster prevention received relatively low scores could be related to the fact that the users did not have enough time to watch the videos thoroughly.

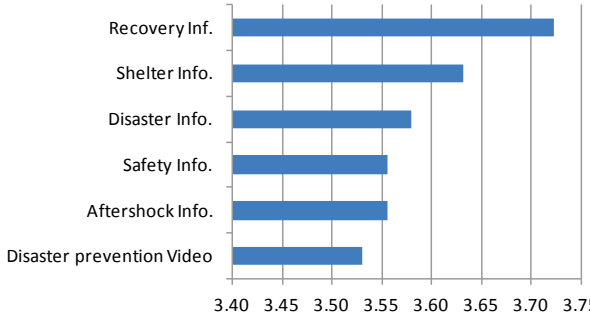

Figure 14. Usefulness of disaster prevention information obtained via 1Seg

4) Comprehensive evaluation of information transmitted

As shown in Fig. 15, on the whole, transmission via 1Seg received a higher evaluation than that via the Internet. In particular, for the question "Did you find the information you wanted?" the level of satisfaction was higher for

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information obtained via 1Seg. It appears that 1Seg is better at sorting and presenting information considered to be important, and that there are comparatively few people who want in-depth information unique to certain regions such as that provided by SNSs.

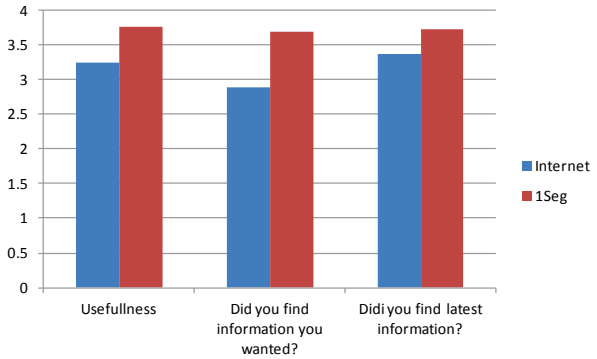

Figure 15. Comprehensive evaluation of information transmissions

5) Profile of subjects

Profiles of the participants showed a ratio of around 60% men and 40% women, of which almost half were in the age group 60 to 70 years old. Moreover, visitors from Nagano prefecture comprised 30% of the participants, those from Tokyo 23%, and those from Aichi prefecture 17%, with the remainder from other regions. The percentage of first time visitors was 23%, with the rest having visited the area two or more times.

Listed below are comments by the test subjects entered in the open section of the questionnaire.

- I see that this type of service is available, but if you made it so that advertisements, announcements and general information could be quickly understood by visitors, the service would be better. (male, 40 years old)
- I think it is a big help that climbers and such can view weather information in real time. (female, 20 years old)
- When viewing on a smartphone and such with a small screen, if there is a lot of information, isn't it difficult to read? (male, 40 years old)
- The elderly find it difficult to operate devices, and even though such new information is available, it's often the case we cannot obtain it easily. (female, 60 years old)
- I am very interested in this. I think it's great. (male, 20 years old and male, 40 years old)
- The 1Seg content is much easier to understand and I think it's good. (female, 30 years old)

VI. SUMMARY AND WHAT LIES AHEAD

The Japanese Tourism Agency is promoting the Regional Tourism Development Platform for tourism, while the Ministry of Internal Affairs and Communications is improving awareness of the necessity for a regional information platform by promoting the public information commons for disaster prevention.

As the main objective of this research, we constructed an experimental website for a communication broadcasting cooperative transmission system and developed a regional information platform. We also performed a small-scale demonstration experiment at Chino station.

Results of the questionnaire show that there was high demand for information focusing on the region, as was initially expected. Also, for questions on whether information was available that users wanted, the level of satisfaction was higher for information obtained via 1Seg. This implies that 1Seg is better at sorting and presenting information believed to be necessary, and that there are comparatively few people who want in-depth information unique to certain regions such as that presented by SNSs.

Furthermore, there was a high demand for disaster and crime prevention information, and users did not find it unusual that disaster prevention information was provided on the tourist portal.

What can be concluded at this point is that a tourist portal website that uses the regional information platform is useful for users who want to obtain in-depth information unique to a particular region (such as that available on SNSs). However, for users who want to view general information, it appears that 1Seg (data broadcasting) and similar methods, which are able to sort and present information in a format that is easy to find, are better. This raises the question of what ratio of sorted general information to regional in-depth information should be presented on the tourist portal. For example, it seems that the system should dynamically change the ratio of general and in-depth information based on the time, location, and user profile.

Furthermore, we were surprised by the fact that the usefulness of the video information did not score highly. It appears that participants did not want to take the time to watch the video since they were busy and had little time to spare.

For 1Seg, BML data were dynamically changed based on the frequency of the keywords in the regional information database, and a simulation experiment was performed that changed the data broadcast screen. The future plan is to include this type of mechanism into the system, and perform additional experiments using it.

In addition, because the local area government showed interest in the experiment performed during this study, we intend to construct a system with the cooperation of the local government and putting it to practical use.

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