Design and Evaluation of "Social Networking Radio" To Provide Voice and Sound of the Location Based Information

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***Abstract*—People in a city are usually seen spending a lot of time on their smartphones. By developing information technologies, we have become able to access information on the Internet and get in touch with friends anytime and anywhere. However, there is also the possibility that such behaviors make people a "cocoon" in social spaces. Therefore, we propose a new service called -social networking radio (SNR), which provides voice and sound of location-based information. By setting the voices in the city and listening while walking, we expect to encourage a user's interest around the town. This paper describes the concept of SNR, the system design, and from the experimental results, considers the playing method and contents of comments.**

Keywords-Radio; Navigation; Speech synthesis; Smartphone.

I. INTRODUCTION

Owing to the development of information technology, city walking and driving habits have changed. Before the inception of the smartphone and car navigation systems, we relied on a paper map and enquiries for navigation. Strolling the streets while studying maps and meeting people on routes, we were able to discover the attractiveness of the towns and experience the atmosphere of the town.

Today, by the evolving location service, it has become possible to reach specific destinations quickly and easily. However, it inhibits the chance to encounter the city and people. Furthermore, when we use the location information application of smartphones, we concentrate fully on the smartphone screen by looking downward, which isolates one. It is, therefore, necessary to research on city walking with interesting media that are different from existing navigation systems. There exists previous research that is related to interesting city walk; here, we introduce some of this research.

Kori developed a blog car radio system that presents blog entries in auditory style using speech synthesis [1]. He discussed a method of extracting text contents that is suitable for speech synthesis; he also verified the effectiveness of the method. This system collects information from a local blog, and summarizes the information to some "entry," which gives it the ranking for users. This ranking method helps to screen the content that is associated with the users' location. However, blog contents used in this system are not suitable for sightseeing, and its use for sightseeing based on location is not mentioned.

Nakatani proposed a new tourist navigation system that does not provide detailed route information [2]. By not presenting a specific route, attempts to induce a chance encounter and detour of the city were made. A navigation system that only provided a path and landmark was developed and experiments were conducted by actually walking around with this navigation system. By using this, subjects had a detour in the city. In his research, he discussed the route and time subjects walked around; however, there was no mention of how subjects changed their cognition of the town.

Suda proposed the system "GBvoice" to take advantage of leaving a characteristic old locality [3]. GBvoice recorded the voice of town dwellers who were interviewed and provided this to walking users. In this research, it was found that local contents led to user's motivation to discover new things about contents. However, this was not related to the location of users. It was also not possible to provide a voice that corresponded to the user's location.

We intend to develop a new navigation system that provides interesting comments that only locals know and provides it to the user depending on their location. We created this system to discuss how a change in user's route would change a cognitive map.

Therefore, we propose a news service—social networking radio (SNR), which provides information based on the route of walking. SNR provides interesting location-based information. By listening to information that only locals know, we are able to make users walk around normally.

This paper describes the concept of SNR, the system constitution, and by the experimental results, considers a playing method and comments. In addition, we discussed the changing of a subject's perspectives in the town by a cognitive map written by subjects.

II. CONCEPT

Collecting and vocalizing local information of the city, and playing it automatically corresponding to a user's location would enable users to walk around with ease. This is the fundamental concept of SNR, which is shown in Fig. 1. To achieve this, we propose two elements.

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The first element is to provide local information that only locals know. By providing local information rather than the information that is listed on the Internet, SNR promotes user interest in the city. If users listen to this information, they look around and try to find the location indicated by the information. It promotes a detour, thereby, making walking around fun.

The second element is to set the sound in the city and images of the city given to users, which also change. When we try to search location information and route in an existing web map, it is displayed in a text. Consequently, the user's point of view is downward unlike SNR, which provides users with local information by speech, thereby, allowing users to face upward. For example, when we hear the voice of a male while walking, we look up and see around to search his voice. This is unlike an image from the usual path. Forming a different image from the usual path could promote fun in city walking.

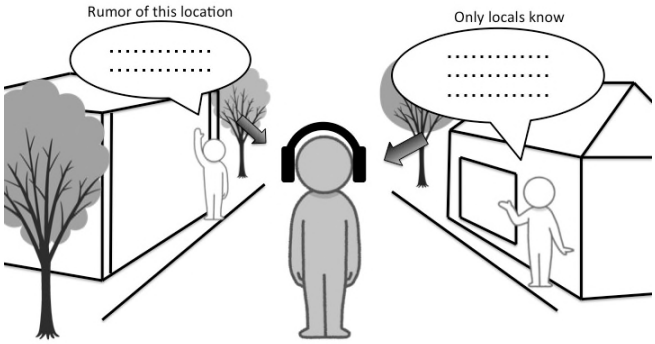

Figure 1. Concept of SNR.

III. SYSTEM DESIGN

The system design of SNR is configured in three sides (input side, output side, and vocalizing and processing side). In Figs. 2 and 3, the image of the system design and flowchart are shown .

A. Input Side

The informant enters the text in the text box, and the input system stores it in the input database. The comments of input are id, Name, and Text. These are stored in the MySQL database. Anyone can enter comments to this system because it is online (consists of Javascript and PHP).

B. Vocalizing and Processing Side

The vocalizing and processing side load text from the database, and converts the text to sound data with the speech synthesis system. This converts sound files that are stored in a local folder. This local folder associates local latitudes that are predetermined to play the sound file. If the text in database id is updated, this side loads the latest text automatically, and generates a new sound file.

C. Output side

The output side extracts the location of the user's information and measures the distance of this position together with the local latitude where the audio file is placed. When approaching a certain location, audio files placed in this position are automatically played. Here, we define "Rad" as a certain distance, which is the radius of the circle to be displayed on the map. In other words, if the marker indicating the current location is entered in a circle on the map, a sound file that is placed in its position is automatically played.

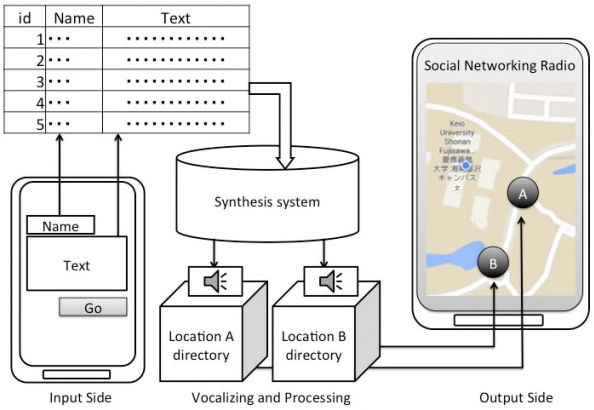

Figure 2. System design.

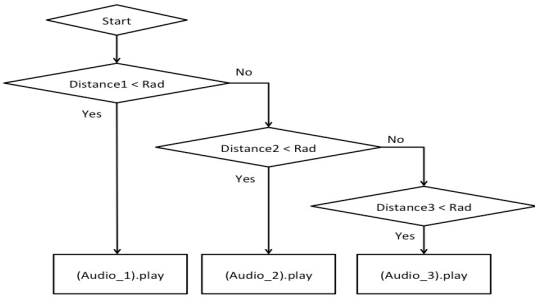

Figure 3. Flowchart.

To play an audio file automatically, an automatic playing permission button in SNR was installed. When users start the SNR and press this button, SNR will load the audio file on the server, which will be played automatically and corresponds to the location of the user.

Based on this system design, a prototype was implemented. In Figure 4, two prototypes are shown. The prototype on the right is the new version that has the automatic playing permission button installed.

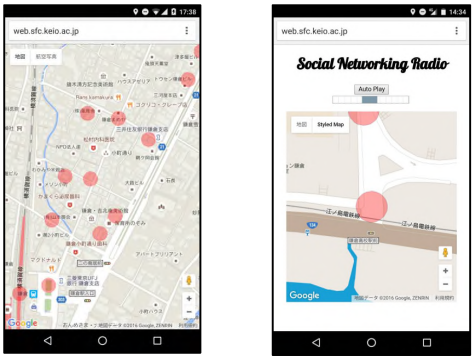

Figure 4. Prototype (right is the new version).

After the prototype implementation, the arrangement intervals of the comments were examined owing to simultaneous activation of the first and second audio in some cases. The average walking speed of people is said to be 1.5 m/s. If the length of one of the audio file used in the SNR is 10 to 25 s, the distance between the comments must be at least 37.5 m. Therefore, when the comments on the SNR are arranged, it is necessary to consider the distance. In Figure 5, the sample interval between the first comments and next comments is 25 seconds, and the speed of walking is 1.5m/s is shown.

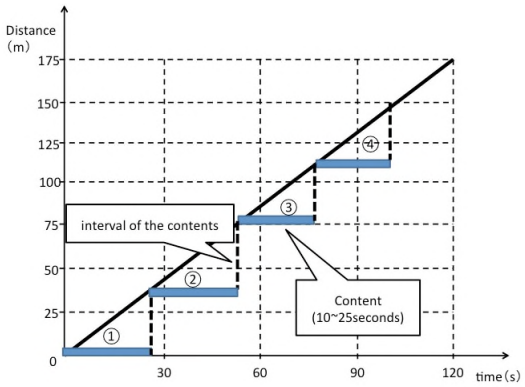

Figure 5. the sample Interval of comments.

IV. COMMENTS FOR SNR

In this experiment, the type of comments suitable for the SNR system is discussed.

A. Comment Collection and Grouping

In order to collect local information of the city, we interviewed people of the city. The location chosen was at the wayside of Enoshima Railway.

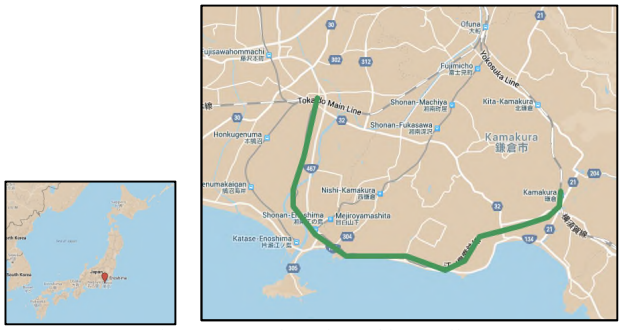

Figure 6. Location of Enoshima Railway.

Many tourist spots and fashion shops are located in this location, which attracts 12 million tourists per year. Apart from being a popular tourist location, the locals are warm and familiar with the many attractive spots.

The interview was carried out by 40 team members from our laboratory. To facilitate the interviewing process, three pieces of information were focused upon:

- Recommended Shops
- Recommended Place
- Other recommendations

We were able to collect 159 pieces of comments through this fieldwork. We studied the text of all comments and grouped them based on the technique of HCD (Human Centered Design). After grouping, it was found that the groups could be classified into four quadrants.

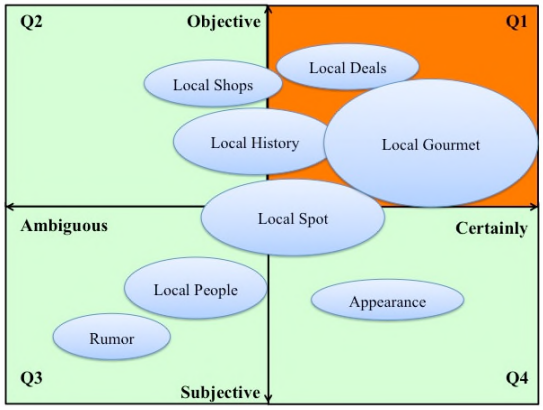

Figure 7. Comments four quadrants.

B. Evaluation

1. Evaluation Method

SNR of Enoshima Railway was created for all 15 Stations with 10 comments per station. These audio comments were created by speech synthesis, and the subjects were students of the laboratory. The comments placed on the map were heard, and the comments in the free description were evaluated. Fig. 8 shows an experimental SNR in the Kamakura station.

Figure 8. Experimental SNR in the Kamakura station.

2. Results and Discussion

From the results of the free description evaluation, opinions were summarized as shown in Table1.

TABLE I. LIST OF DESCRIPTION

- On the street, reliable information is better because it is easy to understand.
- Ambiguous information is bad to hear.
- Information of the local gourmet food increases motivation to go shopping or visit a restaurant.
- Long comments are too long and difficult to listen to.
- Local information of shops and restaurants that only locals know is interesting to hear.

From these results, two points for SNR comments were noted.

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1) The length of the comments

It becomes difficult to hear the voice of the speech synthesis if the comments are very long.

2) The contents of the comment

It is better to include specific comments to present reliable information.

In light of these points, Q1 in Fig. 7 is deemed to be the most suitable quadrant for SNR comments. However, by context of the situation of users and the city, other quadrant comments such as Rumor or Appearance may generate interest for users in the town.

V. EXPERIMENT

SNR based on system design was developed, and a demonstration was performed. Users of SNR and users without SNR walked on the same street and the difference between walking and the user's perspective were verified.

A. Experimental Method

Three students (one male and two females) of KEIO University were subjects. Subjects A and B use the SNR while subjects C did not use the SNR but rather, used Google Map. The experimental location was between Kamakurakokomae Station and Shichirigahama Station in Fujisawa (Kanagawa). This is same place of the comment experimental. The shortest distance of this section is about 950 m, which can be covered in 10 min. This section is also a famous location of SlamDunk - a famous animation in Japan. In this section, there is a branch point to either choose to walk by the sea or climb to hills but most people choose the coastal road. However, there exists many beautiful places along the hills. For example, the location of beautiful views of the sea is lined with beautiful houses that make the walk interesting.

In this section, each subject walked from Kamakurakokomae Station to Shichirigahama Station after which they had drawn a cognitive map.

B. Comments

Comments that were used in the experiment, based on the discussion of the recorded comments were originally created. Comments on both the coastal side street where many tourists visit and the hillside street where locals live were placed. Arrangement intervals of the comments were based on the comment distance of system design. In this experiment, 20 comments were placed on this section. Fig. 9 shows the SNR used in the experiment, while Table 2 shows some example of comments.

Figure 9. SNR in the experiment.

TABLE II. COMMENTS EXAMPLE

If you go up the hill there is a place from where you can see a beautiful view of the sea.
There's a dead end sign but this road leads to the Enoden railroad.
Restaurant Shichirigahama. Drink a beer and enjoy the view of the sea at this restaurant.

C. Behavior Observation

Fig. 11 shows the route that subjects walk around the town. The behavior of each subject is summarized below.

1. Subject A (SNR)

Subject A visited this location once. In Fig. 11-1 we showed the route of Subject A. At Point A, SNR provided the voice "let's go to the hill" and the way of the hill was chosen by the male subject A. At Point B, the directions chosen by the SNR was also chosen. The interest of the male subject was in the local information that "this is the stage of drama" and "beautiful location of scenery", and at Point C, when the location introduced by SNR was found, the subject took a photo. The male subject also reacted to the word "these is Aloe" but it could not be found by the subject. At Point D, SNR provided "There are Stop Signs, but you can come out to Enoden Line". The male subject went through the route and arrived at Shichirigahama Station.

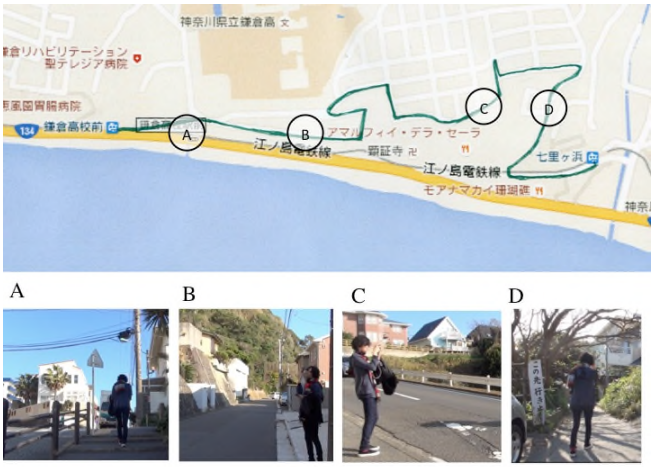

Figure 11-1. Route of Subject A.

Fig.11-2 shows the cognitive map of Subject A. In this cognitive map at Point 1, Subject A recorded a nice view of the sea. At Points 2, 3, and 4, elements that SNR provided were recorded especially at the side of the hill. The "edge" that meant Enoden Line was recorded, but was exceeded in the cognitive map. It was observed that more points could be located than we expected.

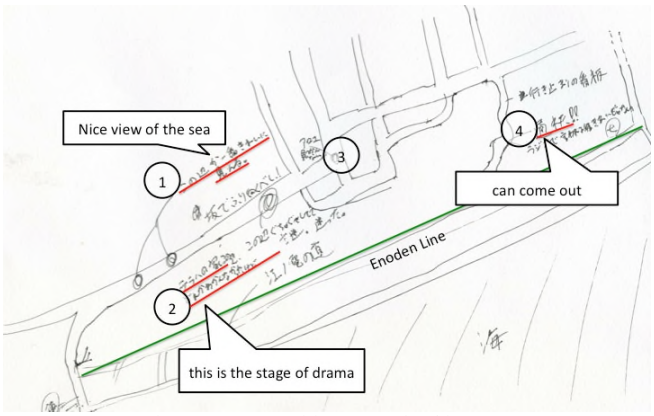

Figure 11-2. Cognitive Map of Subjects A.

2. Subject B (SNR)

Subject B also visited this location once. In Fig. 12-1, the route of subject B is shown. At the branch Point A, SNR provided the voice "let's got to the hill" similar to that of subject A, which was selected by Subject B. At Point B, the street that was further at the top of the hill was selected, which was reached via a walking trail in the woods. When she arrived at the walking trail in the woods, the subject's path was crooked in the forest but a picture was taken at the middle point of the trail denoted as Point C, which overlooked the Sagami Bay. After the walking trail, at Point D, the subject was behind Shicirigahama Station by chance.

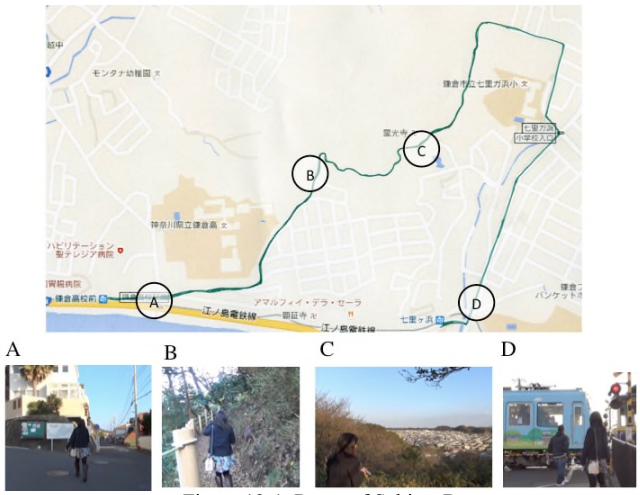

Figure 12-1. Route of Subject B.

In Fig. 12-2, we showed the cognitive map of Subject B. At Point 1, the comment "I wanted to see the view of the sea from the hill" was recorded. Point 2 is where the female subject could see the sea, which she also recorded on the map. Though the subject was lost for a while after this point, the subject recorded "relieved" at Points 3. In this cognitive map, however, the female subject did not write Enoden Line.

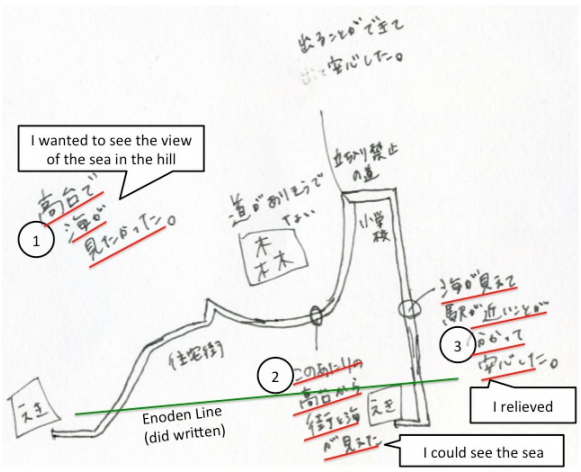

Figure 12-2. Cognitive Map of subject B.

3. Subject C (Google Map without SNR)

Subject C was at this location once as the other subjects. In Fig. 13-1, the route of the Subject C is shown. On the start location, the subject used Google Map to check for the route to Shichirigahama Station, which was found at Point A. The subject decided to choose the way of the seaside and walked a while to Point B before looking over sea and hill. Though the female subject was lost at the branch point of Point C, the female subject used Google Map and found the route to the Station(Point D) instantly. By using Google Map, the shortest route was selected and the female subject arrived at the station in 15 min.

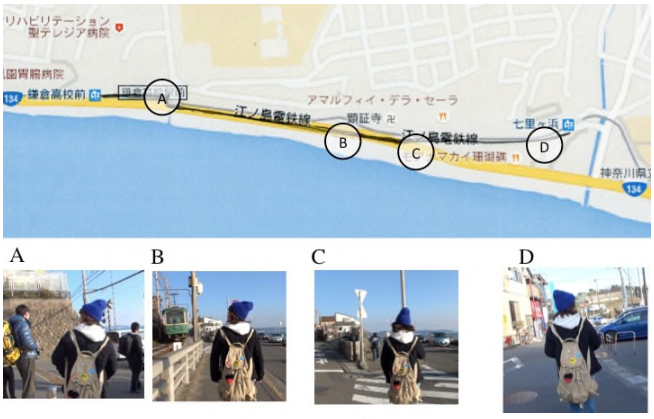

Figure 13-1. Subject C.

Fig. 13-2 shows the cognitive map of Subject C is shown. At Point 1, the female subject commented "There would be residential areas". At Points B and C (Fig.13-1), the female subject also commented forecast too and at Points 2 and 3, elements that were seen by the subject were also recorded. At Point 4, the female subject commented "There would be pizza shop". This female subject also wrote Enoden Line clearly.

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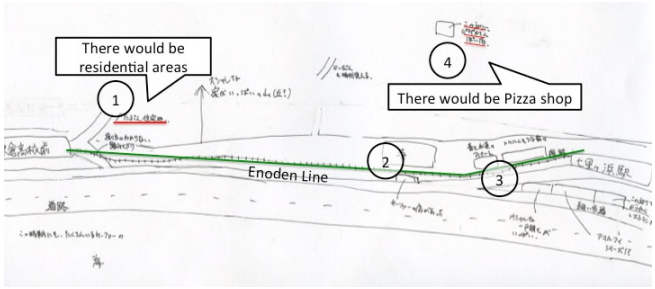

Figure 13-2. Cognitive map of subject C.

VI. DISCUSSION

A. the Effect of SNR

Two effects of SNR were deduced from this experiment.

- A way that was different from usual was chosen.

Subjects of SNR chose a way different from usual. Subject A walked around based on the speech provided by the SNR. By walking via the streets while listening to the local comments in the SNR, the male subject was able to walk through a route that was not provided in Google Map. In addition, Subject B selected the street of hills, and walked via the forest road that was not in the map. In a later interview about walking, the subject noted that the choice was selected because SNR provided a comment "The view of the sea is beautiful from the top of the hill." This comment was created by author intentionally, in order to lead users to choose uncommon routes.

- Change the cognition of the city

From the experimental cognitive map, the most uncommon record of the SNR user was "exceed the edge". Subject C wrote "that may be residential area" near the starting point. Subject C suggested this from the road and line. It is assumed that line of Enoden is "edge" for users who are walking in city.

However, comparing the two subjects of SNR and the subject C, SNR users could exceed this edge. In addition, there is a little difference in height between the hills and the line, and this could be an edge. However, SNR users could exceed beyond the line unconsciously. From this fact, it was found that SNR users could change their cognition and could change behavior from the usual.

B. Know-how of SNR

From this experiment, we can discuss some knowhow about creating SNR.

1. The location and comments

From this experiment, it was discovered that SNR is useful in the two situations of the user, which could either be on the Path or on the Node. On the Path if SNR provides comment about its location, users will look for its comment position and find new discoveries. For On the Node, SNR can provide direction on the node for users to find new routes and be more motivated to walk around than usual. In Fig. 14, the image of these two instances is shown.

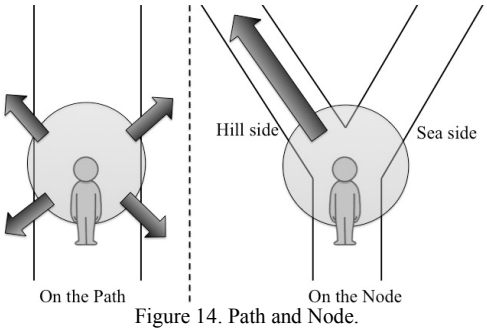

Figure 14. Path and Node.

2. Story of the comments

From the interview results, it was found that users seek to listen to the story of comments. For example, the first comment was about gourmet food, the second comment was also about gourmet food or provided more detailed for the first comment. Relevant comments are easier to hear than independent comments.

VII. CONCLUSION AND FUTURE WORK

In this paper, the concept of SNR was described and its system design. By experimental results, discussion on the effect of SNR and the playing method and comments, it was found that SNR changes both the usual route and the cognitive map of the city. It was also found that using SNR could lead to detour. Furthermore, from experiments, a suitable location to play comments could be found and contents of comments could then be selected.

On the other hand, some improvements about SNR were identified, which can only provide comments to walking users at the moment. However, since there are many people on the move, driving cars, riding on bikes or, in the future, automatic operation vehicles, SNR would have to be suitable to many users on the city who would enjoy the city by detour Therefore an improvement on system design and comments to various users has to be sought for.

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