Operability Improvement of Twitter-based Safety Confirmation System for Disaster Situations

Mariko Abe[1], **Osamu Uchida**[2], **and Keisuke Utsu**[1]
[1]Dept. of Communication and Network Engineering, School of Information and Telecommunication Engineering, Tokai University, Minato, Tokyo, Japan
[2]Dept. of Human and Information Science, School of Information Science and Technology, Tokai University, Hiratsuka, Kanagawa, Japan

Abstract - *Large-scale disasters occur frequently in Japan, and, following such disasters, many people attempt to confirm the safety of their family and friends. However, due to congestion and infrastructure disruptions, many fixed-line phones and cellphones cannot connect to communication networks. We have been developing "T-@npi," a Twitter-based safety confirmation system as a web application that can be accessed by any web browser on any device connected to the Internet. T-@npi enables users to submit and confirm safety information, and post a rescue request via Twitter. This paper reports an improvement to the system. A guidance post using a Twitter card and icons are introduced to improve system operability. In addition, this paper presents the implementation of information mapping using an online map to support rescue and support activities for local governments and rescue experts.*

Keywords: safety confirmation, disaster, social media

1 Introduction

After a large-scale disaster, many people try to confirm the safety of their family and friends. Confirmation is usually attempted using fixed-line and cellphone calls or by e-mail via cellphones [1]. To confirm safety using information devices, the communication infrastructure must be functional. However, Japan has experienced many cases where the communication infrastructure has been disabled for long periods due to large-scale disasters. For example, the Great East Japan Earthquake of March 11, 2011 caused extensive damage to communication infrastructures. After the earthquake, many fixed-line and cellphone calls could not connect to the network, and this situation persisted for a long time in many places. Communication carriers took control of network traffic to prevent congestion.

Immediately after the Great East Japan Earthquake, although phone calls were unavailable due to traffic congestion, many people could communicate over the Internet. For example, Twitter [2], an Internet-based social media application, was used to share information about damage that occurred at the stricken area. A similar situation occurred during the Kumamoto Earthquake of April 2016. Twitter users can post short messages (140 characters) and pictures. In this context, Twitter's most important feature is that users can distribute information easily to their followers. The following is an example of the beneficial use of Twitter. An isolated victim sent an e-mail to her family abroad using his/her cell phone, which was the only available means of communication, and his/her family posted a rescue request on Twitter. Then, a vice-governor of Tokyo Metropolitan, who was not in the disaster area, received the post. Finally, a rescue team from outside the disaster area was dispatched, and the victims was rescued [3].

Recently, the use of Social Networking System (SNS) and Twitter for disaster situations has been attracting attention. Various studies have focused on systems that gather and utilize information across various SNSs [4][5]. We have also studied a web system that enables users to post disaster-related information using smartphones on Twitter, and the posted information is linked to an online map [6].

Considering the above background, we have been developing "T-@npi," a Twitter-based safety confirmation system. The name of the proposed system is derived from the Japanese word "安否" (pronounced anpi), which means the degree of someone's safety. The system is deployed on an Internet server, and users can access the system using a web browser on their smartphone. The system enables users to easily submit and confirm safety information, and post a rescue request on Twitter. Previously, we reported the development of the base system [7]. This paper reports improvement to the user interface. A guidance post using a Twitter card and icons are introduced to improve user operability. In addition, this paper reports an information mapping function using an online map to support rescue and support activities for local governments and rescue experts. The rest of the paper is organized as follows. Section 2 describes existing safety confirmation systems for consumers. Section 3 explains the proposed system T-@npi. Lastly, Section 4 summarizes the paper.

ISBN: 1-60132-466-9, CSREA Press ©

2 Existing safety confirmation system

Disaster Emergency Message Dial 171 [8] and Disaster Emergency Message Board Web171 [9] are services for consumers in Japan. These services are provided by communication carriers when excessive traffic congestion results due to the large number of safety confirmation phone calls. In the Great East Japan Earthquake, both 171 and Web171 were not used by many people because the communication infrastructure had been unavailable for a long time at the disaster site.

Google Person Finder is a web service to help people reconnect after a disaster [10]. The service was first provided in the aftermath of the Great East Japan Earthquake, and 670,000 people were recorded. Facebook, the most popular SNS in the world, also provides a safety confirmation service. The service asks the user in the disaster site to reply to confirm their safety, and the response is sent to his/her friends on their timeline. Facebook is used by many for communicating among individuals rather than with an unspecified number of people because the users generally use their real name. Twitter is more effective than Facebook for communicating with an unspecified number of people. In addition, LINE, which is a famous communication application in Asia, is better than Facebook for confirming one's safety to close friends.

Regarding Twitter, a system that estimates safety based on posts has been proposed [11]. In addition, a system that estimates safety based on life log data has been studied for supporting safety confirmation using SNS [12].

3 Proposed system

User devices are assumed to be smartphones, tablet PCs, or general PCs. This paper assumes the following three user types.

- Sending user: The sending user sends a safety information post.
- Confirming user: The confirming user confirms a safety information post of another individual. The confirming user should follow the sending user's account.
- Supporting user: Supporting users, such as local government staff, confirm the safety of a disaster site.

We adopt Twitter because it enables users to easily post and distribute information. In the existing 171 or Web171 systems, sending users can only communicate safety information. These systems cannot support rescue requests from sending users. Thus, the T-@npi system should support rescue requests. In addition, since Twitter is an open SNS, unlike Facebook and LINE, T-@npi is helpful for self, mutual, and public assistance.

The advantages of using Twitter are as follows. Since Twitter is a very popular service, users are experienced and can use the system easily. Since users do not use existing services, such as 171 and Web171, daily, they are not familiar with how these systems operate, and this has been a bottleneck relative to the acceptance of these systems. The proposed T-@npi system addresses this problem. On the other hand, if systems need to have dedicated applications installed on user devices, the application must be available on the given device's application store. In addition, some users are reluctant to install such applications because they are not used frequently. For supporting users, the proposed system has low cost. Since information exchange takes place via Twitter, the proposed system does not require large-scale hardware. Furthermore, since the identification of individuals is distinguished by Twitter IDs, the T-@npi does not need to maintain individual information.

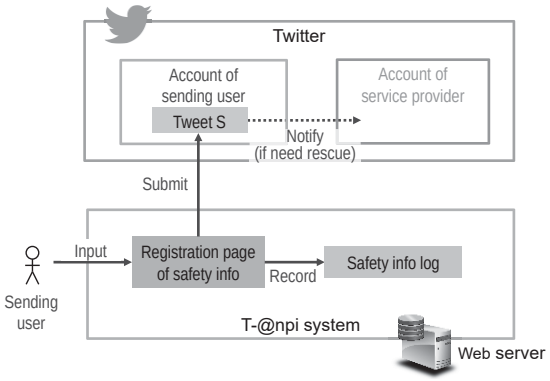
3.1 Guidance post

We introduce a Twitter card to conduct the users to the system. When a large-scale disaster happens, the service provider posts a tweet that includes the Twitter card, as shown in Fig. 1. Users that follow T-@npi alert account can see the post and know that they should submit their safety information to the system. In Japan, an "Earthquake Early Warning" is issued when an earthquake is detected. In future, the system will generate guidance posts automatically when a warning is issued.

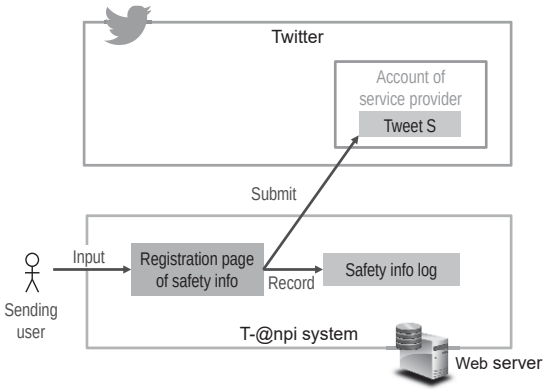
Fig. 1 Guidance post from T-@npi's Twitter account

3.2 System outline

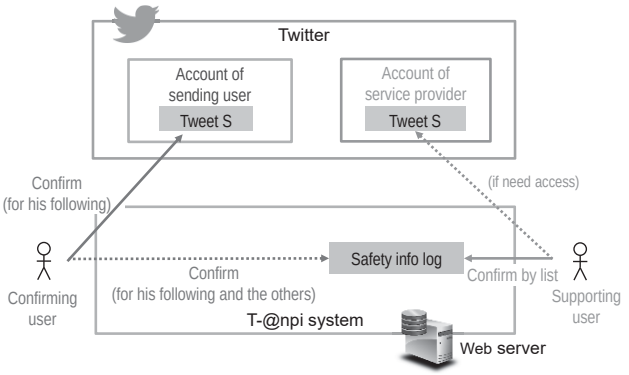
The system comprises programs and web pages written in PHP (Hypertext PreProcessor) and JavaScript. They are deployed on an Internet server. The Twitter API [13] is called by PHP scripts and searches for information on Twitter.



(a) Submitting sending user safety information



(b) Submitting the safety information of an individual other than the sending user



(c) Confirmation of safety information by confirming and supporting users

Fig.2 System outline

The outline of the system is shown in Fig. 2. The sending user can send safety information to a confirming user. The information (Tweet S) is posted on the sending user's account, as shown in Fig. 2 (a). Simultaneously, the information is recorded in system log file. If the sending user requires rescue, the information is notified to the service provider's account (using an @mention tweet). In addition to submission of sending user's own safety information, the sending user can also send the safety information of another individual without logging into the Twitter account, as shown in Fig. 2 (b). In this case, the information (Tweet S) is recorded by the system and posted by the service provider's account. A confirming user can find the safety information of a sending user on Twitter, as shown in Fig. 2 (c). In addition, the confirming user can distribute this information via Twitter. Supporting users can determine the status of the disaster area they support and view a list of safety information submitted by sending users from the system's log file, as shown in Fig. 2 (c).

3.3 System screen transition

This section explains the user screen of the system. Note that the system's instructions are available in English and Japanese. The functions and operations of each page are explained in the following.

Index (Page #1 in Fig. 3)

This page appears when a user first accesses the system via a web browser. This screen has three buttons: "Submit the safety information," "Find the safety information," and "List (for administrators)." The user presses the appropriate button to select the desired operation. In this paper, we introduce "Google Material Icons" on the status selection buttons to improve visibility.

Submission of safety information (Pages #2 and #3 in Fig. 3)

On Page #2, the sending user selects "Submit your safety" or "Submit safety of somebody" (other than the sending user). If they select "Submit your safety," Twitter authentication is required. Otherwise, authentication is not required. The content of Page #3 is as follows.

- Twitter ID: When submitting sending user safety information, the authenticated Twitter ID is displayed. When submitting another individual's safety information, the Twitter ID of that individual must be input. In addition, safety posts include the hashtag #救助_テスト投稿 for a rescue request. Here 救助 (pronounced kyujyo) means a rescue and テスト投稿 (pronounced tesuto toko) means a test submission.
- Selection of rescue request: If sending users require rescue, they select "YES." If they select "YES," the information is notified to the service provider's account.
- Selection of safety status: Sending users can select one or more appropriate check box for their safety status: "I am fine," "There are some damage," "I am at home," and "I am at an evacuation center." The status choices are based on those of Web171. We use "Google Material Icons" for the status choice buttons to improve visibility.
- Additional message: A user may enter a message of up to 40 characters.

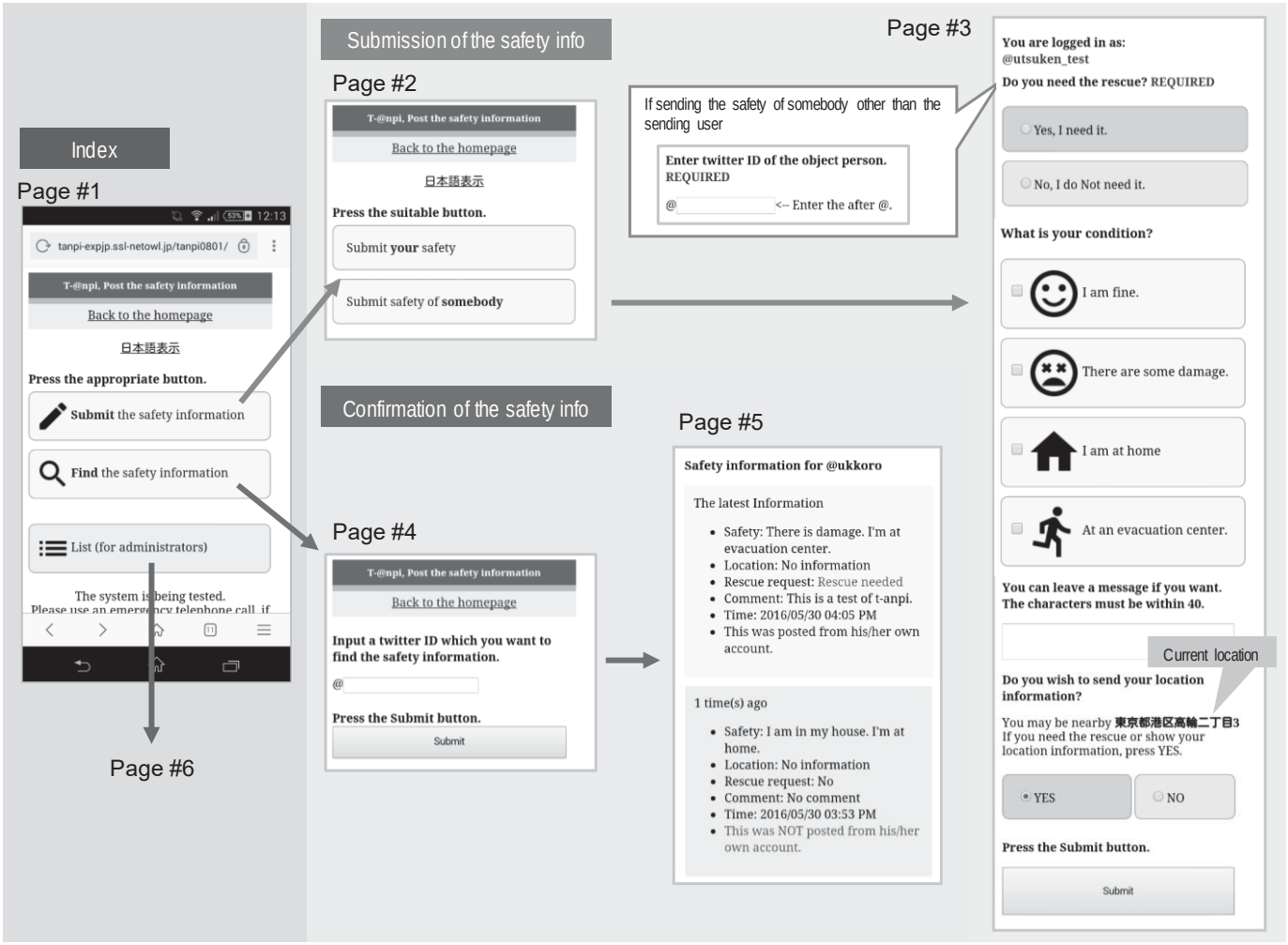


Fig. 3 System screen transition

- User's current location: When the user provides location information, latitude and longitude information is obtained by geolocation systems, which are called by JavaScript. The information is transformed to an address by a reverse geocoding service [14] and displayed. In the current version of the system, address transformation is only available in Japan. When the "Yes" button is checked for "Do you wish to send your location information?" the address is sent with the safety information. Otherwise, "N/A" is sent. In addition, if the user's device cannot obtain its location or the user does not want to provide location information, then "N/A" is sent
- "Submit" button: Once the "Submit" button is pressed, a tweet in Japanese is posted on Twitter.

Figure 4 shows an example safety tweet for a sending user. Since the sending user requires a rescue, the post is notified to the service provider's account. Figure 5 shows an example safety tweet for an individual other than a sending user. This is submitted to the service provider's account.

Confirmation of safety information (Pages #4 and #5 in Fig. 3)

A confirming user can confirm the safety information of a sending user who is followed by the confirming user on Twitter (Pages #4 and #5). In addition, using the system, a confirming user can also confirm the safety information of a sending user they do not follow. On Page #4, the confirming user enters the ID of the sending user they want to search for. Here, the confirming user is not required to log into Twitter. The safety information can be found by searching the system's log file.

List and map view for supporting users (Page #6 in Fig. 6)

As shown in Fig. 6, the system can display the recorded information in a table. This list is useful for supporting users to collect safety information and support victims. A supporting user can filter information by location and sort and view the information. The current version of the system can show safety information posted by sending users who have requested rescue on Page #3 (Fig. 3). In addition to the list, we introduce information mapping using an online map. The

information is mapped on the Yahoo! Japan online map using the JavaScript Map API[15]. As shown in Fig. 7, by clicking the icon marker, the information is displayed in a balloon. The displayed information contains the ID, the safety status of the sending user, the location where the information was submitted, and the date and time the information was submitted.

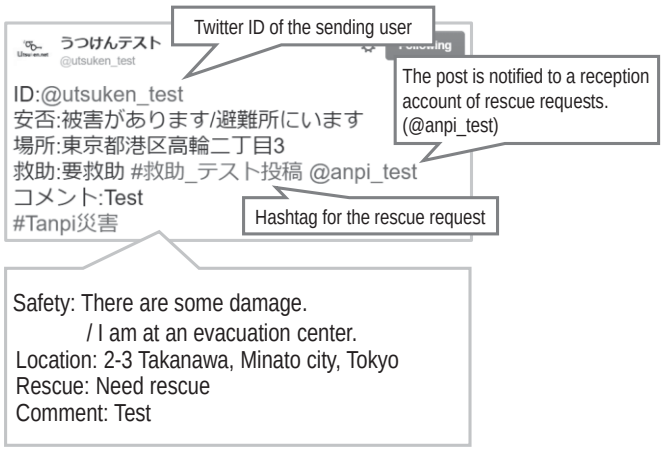


Fig. 4 Example post

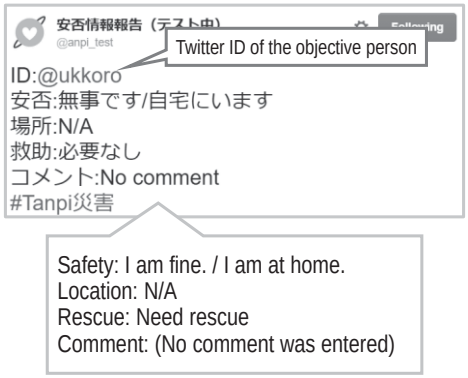


Fig. 5 Example post for a rescue (the post is notified to the service provider's account)

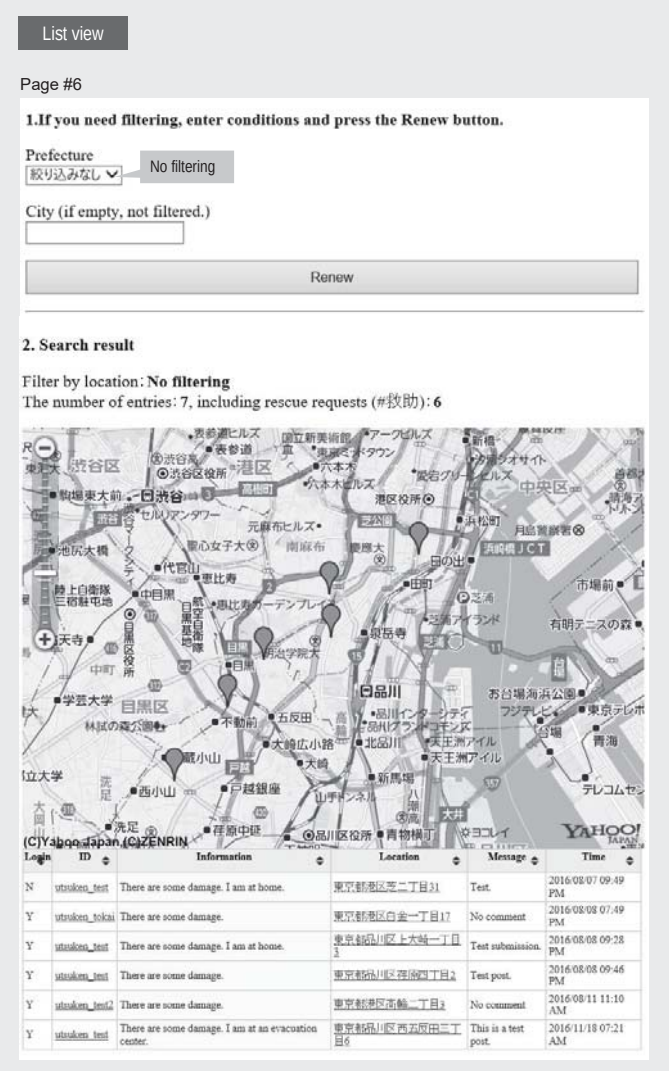


Fig. 6 List and map view for the supporting users

Fig. 7 Safety information with rescue request is displayed in a balloon

4 Summary

We have been developing a Twitter-based safety confirmation system named "T-@npi" as a web application that is accessible by any web browser on any device connected to the Internet. The system enables users to easily submit and confirm safety information via Twitter. In addition, the system enables users to post rescue requests. This paper has reported an improvement to the system's user interface. We have introduced a guidance post using a Twitter card and icon images on the submission page. In addition, this paper has presented information mapping using an online map. In future, we plan to apply the system to disaster prevention drills in collaboration with local governments.

5 Acknowledgments

This study has been supported by Grant-in-Aid for Scientific Research (KAKENHI) 17K12989, Japan Society for the Promotion of Science (JSPS).

6 References

[1] Internet white paper 2011 http://iwparchives.jp/iwp2011

[2] Twitter, Twitter Inc., https://twitter.com/

[3] SHUCHI PHP Online, http://shuchi.php.co.jp/article/943?p=1 (in Japanese)

[4] Takahiro Okuma, Kayoko Yamamoto, "Study on a Social Media GIS to Accumulate Urban Disaster Information: Accumulation of Disaster Information during Normal Times for Disaster Reduction Measures", Socio-Informatics, Vol.2, No.2, pp.49-65, 2013 (in Japanese)

[5] Takuma Murakoshi, Kayoko Yamamoto, "Study on a Social Media GIS to Support the Utilization of Disaster Information : For Disaster Reduction Measures from Normal Times to Disaster Outbreak Times", Socio-Informatics, Vol.3, No.2, pp.17-30, 2014 (in Japanese)

[6] Osamu UCHIDA, Masafumi KOSUGI, Gaku ENDO, Takamitsu FUNAYAMA, Keisuke UTSU, Sachi TAJIMA, Makoto TOMITA, Yoshitaka KAJITA, Yoshiro YAMAMOTO, "A Real-Time Information Sharing System to Support Self-, Mutual-, and Public-Help in the Aftermath of a Disaster Utilizing Twitter," IEICE TRANSACTIONS on Fundamentals of Electronics, Communications and Computer Sciences, Vol.E99-A No.8, pp.1551-1554, 2016

[7] Keisuke Utsu, Rie Abe, Ayami Manaka, Akio Ogata, Yoshiro Yamamoto, Hiroshi Ishii, Osamu Uchida,"T-@npi: A Twitter-Based Safety Confirmation System", Paper ID: 385, Proceedings of the International Conference on 2016 IEEE Region 10 Conference, pp. 2244-2248, Nov. 2016

[8] NTT EAST, Disaster Emergency Message Dial 171, https://www.ntt-east.co.jp/en/saigai/voice171/

[9] NTT WEST, Emergency Message Board Web171, https://www.ntt-west.co.jp/dengon/web171/english/

[10] Google, Google person finder, https://www.google.org/personfinder/

[11] Masakazu Kyokane, Yukio Hori, Yoshiro Imai, "Twitter-based Information Collecting System for Safety Confirmation", IEICE Technical Report, pp. 7-11, KBSE2013-54, 2013 (in Japanese)

[12] Yuji Ikebata, Koji Tsukada, "A Proposal for Safety Confirmation System using Lifelog Data", IPSJ Kansai-Branch Convention, E-20, 2013 (in Japanese)

[13] Twitter API, https://dev.twitter.com/overview/documentation

[14] Reverse geocoding service, National Agriculture and Food Research Organization, Japan, http://www.finds.jp/wsdocs/rgeocode/index.html.ja

[15] Yahoo! JavaScript map API, http://developer.yahoo.co.jp/webapi/map/openlocalplatform/v1/js/