A Web Application for Location Recording and Rescue Request Using Twitter

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Abstract - *We developed a prototype of a web application, which enabled supported users (e.g., elderly and handicapped people as well as children) requiring daily support to share their location coordinates via Twitter. Supporting users (families, relatives, or neighbors of the supported user) can then check the location coordinates of the supported user whenever required. In addition, the supported users can use this application to easily send a rescue request on Twitter whenever required. The rescue request is automatically notified to the service provider's account, which was designed for receiving such requests. Emergency assistance employees (local government workers or rescue experts) can refer to the request, and execute the supporting activities. The application will be helpful for self-assistance, mutual assistance, and public assistance in both the daily and emergency situations. Furthermore, this research reported detailed operational tests of the application.*

Keywords: location information, rescue request, disaster

1 Introduction

Large-scale disasters occur frequently in Japan. The search for missing people occasionally becomes difficult due to lack of information. Many people went missing after the Great East Japan Earthquake, which occurred on March 11, 2011. Although more than five years have passed since this event, approximately 2,560 people still remain missing in the hardest-hit areas [1]. Moreover, the Japanese society is aging rapidly and there have been many accidents involving elderly people who have gone missing [2].

Social media played a crucial role during and after the Great East Japan Earthquake. Numerous tweets, including safety information and rescue requests, were posted on Twitter, allowing many victims to be rescued. The following example demonstrates the usefulness of Twitter. An isolated victim sent an e-mail to her family abroad using her cell phone, the only available means of communication available to her. Her family posted a rescue request on Twitter. Subsequently, the vice-governor in Tokyo who was not in the disaster site found the post. As a result, a rescue team from outside the disaster area was dispatched and the rescue succeeded [3]. Similarly, many posts requesting rescue and relief supplies were posted after the Kumamoto Earthquake [4]. Recently, the use of information available on Twitter when coping with disasters has attracted attention. According to a previous study [5], Twitter recommends including a hashtag, #救助 (meaning #rescue), in posts for rescue requests in emergencies.

We decided to develop an application based on the rescue potential of social media. The location coordinates of supported users (e.g., elderly and handicapped people as well as children) requiring daily support are automatically recorded on the social media, and these users can send a rescue request whenever required. Then emergency assistance employees (i.e., local government personnel or rescue experts) can refer to the request, and execute the supporting activities. To realize the application, we developed a prototype of an Android smartphone application [6]. Using this application, the supported users can share their location coordinates at set intervals via Twitter. Then, the supporting users (e.g., families, relatives, or neighbors of the supported user) can check the location coordinates whenever required. In addition, the supported user can easily use the application to send a rescue request on Twitter by pressing the "Rescue request" button. The rescue request is notified to the service provider's account, which is for receiving such requests.

The developed application has some shortcomings. Since the application is compatible with Android smartphones, the user must own such a phone. Moreover, the application must be installed beforehand. Meanwhile, the service provider must consider how to distribute the application and update the software to follow the version updates of the operating system.

In this research, we address the above-mentioned problems. We have developed a prototype of a web application that can provide functions that are same as those discussed in a previous study [6]. A supported user has access to the web application using any web browser on any smartphone. The application will be of use in bringing self-assistance, mutual assistance, and public assistance in both the daily and emergency situations. Furthermore, this research reports operational tests of the application.

The remainder of this study is organized as follows. Section 2 introduces related technologies and studies. Section 3 provides an overview of the application, describes its features, and reports on the operational tests. Finally, Section 4 summarizes the research.

2 Related technologies and studies

There are several systems that can perform the search and rescue activities for missing people. Hibeacon [7] and AirTalk [8] can share a user's location with smartphones in the vicinity of the user. These systems can transmit a user's current location using a Bluetooth beacon to the smartphones around the user. The information can then be used in executing the search and activities for the missing people. In the total LIFE support system (TLIFES) [9][10], the data obtained from GPS on smartphones are sent to a server and the location information is communicated to a community of participants.

A system that allows a supported person to use a wearable device with a microphone for transmitting emergency signals was proposed in a previous study [11]. When the supported person moves outside a preset area, his or her location information and the sound around him or her, recorded by the microphone, are sent to a server. This information is simultaneously notified to a caregiver via an e-mail. There are several systems for searching aged people who wander off. The systems proposed in previous studies [12][13] were used to avoid losing track of the people who have dementia when they go out. The system uses Bluetooth tags and smartphones with dedicated applications. Aged people with dementia fit the tags to their belongings. Using the Bluetooth beacon device, the location information is sent to the server via the neighboring people who has a smartphone the application installed in it. The location information is then notified to the families of the elderly people. This system may save the people with dementia from going missing. A demonstration of the experiment is shown in a previous study [14].

The service utilized in a previous study [15] involves tracking of the movements of the elderly people and school children going to and leaving school. The system can display the location of the supported person on the map. The supported person must carry a dedicated GPS terminal so that the supporting person can find his or her location. Moreover, the system can automatically notify the supporting person when the children leave school. The service uses the location information service provided by a mobile communication carrier company.

3 Proposed application

In this section, to solve a problem identified in a previous study [6], we developed a prototype of a web application that can provide a function same as that used in that study.

Our application uses Twitter for the following reasons. Unlike Facebook, Google+, and LINE (a famous communication application in Asia), Twitter is an open social media. A system using Twitter is therefore most helpful for mutual assistance and public assistance. In the system proposed in previous studies [9][10], the location information of the supported users is shared with the community participants. On the other hand, using our application, supported users can share the location with people of their choice and can send a rescue request whenever needed. In addition, Twitter has many daily users who are already familiar with it. The use of Twitter may overcome the inherent problem of most existing systems, i.e., not being used on a daily basis. Our application could be a solution to these problems.

3.1 Operation of the application

The prototype of the application was developed using PHP and JavaScript and deployed on a general rented web server. The URL of the application is https://utsuken-applesjp.ssl-netowl.jp/nishi/home.html. The Geolocation API [16] is used to obtain the location information from a user's device.

To use the application, the service provider must create a Twitter account (@testswan5 in this research) for receiving rescue requests. In addition, the supported users must create their own Twitter account for using the application. The account should be protected (only approved followers of the account are allowed to read the timeline) to ensure privacy protection. The supporting user does not need to have a Twitter account. If the supporting user has a Twitter account, he or she should, if necessary, follow the supported user's account.

The supporting user uses the application in the following manner: the supported user accesses the application on the server via a web browser. Then, he or she enters ID and password to log in to Twitter. After the login, the supported user can see the initial screen, as shown in Fig. 1, which was captured by an iPhone SE (Apple Inc.). When the screen appears, the location coordinates obtained by the location information service on the user's smartphone are periodically sent to the supported user's account via the application, as shown in Fig. 2(a). Figure 3 shows an example of a periodical tweet. The supporting user can check the location on the Twitter timeline of the supported user using a web browser or a Twitter client application, whenever required, as shown in Fig. 2(b). Here, the tweet includes the time when the location coordinate was obtained to exactly clarify when the data were acquired. The tweet takes a few seconds to appear on the user's timeline. Moreover, the tweet includes a hyperlink to the Google map based on the obtained location coordinates to help the supporting user.

In an emergency, the supported users can send a rescue request to their Twitter account by pressing the “Rescue request” button, as shown in Fig. 4(c). Figure 5 shows an example of a rescue request post. The post is a “mention” tweet (including @testswan5), i.e., it immediately appears on the service provider’s timeline to notify him or her about the emergency, as shown in Fig. 4(e). The hashtag #救助 (meaning #disaster) is automatically inserted in the post. In addition, the post includes the location information of the supported user, which is similar to the periodical tweet shown in Fig. 3. The supporting users and emergency assistance personnel can obtain the location information of the supported users, as shown in Figs. 4(d) and 4(f).

Fig. 1 Initial screen

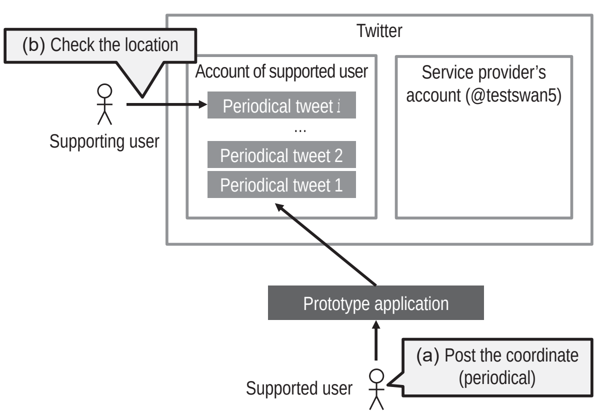

Fig. 2 Operation of prototype application
(Supported user’s current location is periodically sent to the account of supported user on Twitter)

Fig. 3 Sample post (periodical tweet)

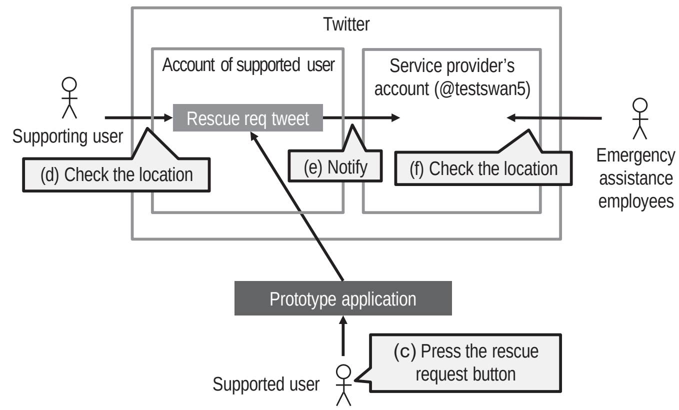

Fig. 4 Operation of prototype application
(Rescue request tweet is notified to the service provider’s account)

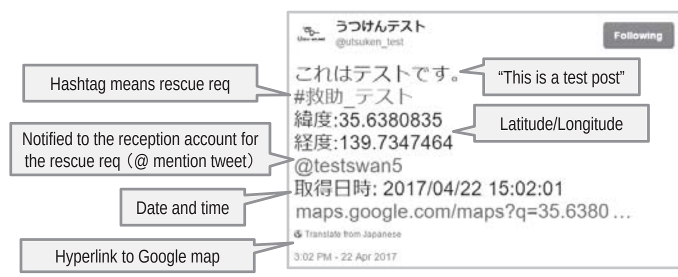

Fig. 5 Sample post (rescue request tweet)

3.2 Operational test of periodical tweets

We performed operational tests of the submission of location coordinates on Twitter using the application. Xperia Z1, developed by Sony Mobile Communications Inc., was used as the testing device. The application submits the location coordinates every 45 s. Twitter accepts up to 2400 tweets from each account per day [17]. Therefore, the time interval should be longer than approximately 36 s (3600 s × 24 h/2400 tweets). We set a timeframe of 45 s, which is longer than 36 s. In the future, we plan to determine an optimal length of the time interval and introduce a function that automatically adjusts the time interval.

Table 1 The devices used in the operational tests

	Terminal	OS	Web browser
(1)	Xperia Z1 (SO-01F), Sony mobile communications	Android 4.4.4	Chrome 57
(2)	Xperia J1 compact, Sony mobile communications	Android 4.4.2	Chrome 57
(3)	Xperia SX (SO-05D) , Sony mobile communications	Android 4.1.0	Chrome 57
(4)	iPhone SE, Apple	iOS 10.0.2	Firefox 7.2

We confirmed the successful operations of the device, as summarized in Table 1. The communication lines of the devices are LTE.

The following discussion focuses on our three operational tests for periodical tweets. A candidate (a man in his 30s) created these tests using device (1), as listed in Table 1.

The first test (operational test #1) was created during the night on April 18, 2017 in the Togoshi-ginza shopping street, Shinagawa, Tokyo, Japan. Many elderly people visit this place for shopping during the day. The candidate walked approximately 600 m along the street wearing the device on which the application was running. Within approximately 10 min, 10 sets of coordinates were posted on Twitter, as summarized in Table 2. Figure 6 shows that the coordinates submitted to Twitter were plotted on a Google map [18] using the web service [19]. As shown in the figure, we can track the movement of the candidate while he is walking on the street. Here, the interval between the ninth and tenth points was 136 s, which was longer than that for other points. A periodical tweet should ideally have been posted during that time. However, the submission may have failed due to instabilities in communication lines.

Table 2 The coordinates submitted in the operational test #1

	Latitude	Longitude	Obtained time	Interval
1	35.6148606	139.7163892	20:12:44	
2	35.6147049	139.7162695	20:13:34	50
3	35.6153231	139.716469	20:14:44	60
4	35.615343	139.7164291	20:15:35	51
5	35.615545	139.7155912	20:16:31	56
6	35.6155483	139.7151523	20:17:23	52
7	35.6156476	139.7149528	20:18:17	54
8	35.6157105	139.7143942	20:19:10	53
9	35.6159003	139.7134366	20:20:03	53
10	35.6163671	139.7112024	20:22:19	136

Fig. 6 Operational test 1 (Togoshi-ginza Shopping Street, Shinagawa, Tokyo, Japan)

The second test (operational test #2) was created in the morning on April 19, 2017 in the Musashi-koyama Palm shopping street, Shinagawa, Tokyo, Japan. Many elderly people visit this place for shopping during the day. This street is approximately 800 m long and has a roofed arcade. The candidate walked along the street from end to end wearing the device on which the application was running. Within approximately 9 min, eight sets of coordinates were submitted to Twitter, as summarized in Table 3. Figure 7 shows that the coordinates submitted to Twitter were plotted on a Google map. As shown in the Fig. 7, we can track the movement of the candidate while he is walking along the street. In this case, some points have deviated several meters away from the street. Because the street has a roofed arcade, the coordinates obtained by GPS may include errors. We performed a test on the same location in a previous study [6]. The application in this research can post the location information with an accuracy similar to that achieved a previous study [6].

Table 3 The coordinates submitted in the operational test #2

	Latitude	Longitude	Obtained time	Interval
1	35.6161868	139.70825	07:01:27	
2	35.6163303	139.70825	07:02:14	47
3	35.6168159	139.7078511	07:03:05	51
4	35.6171978	139.7073723	07:03:56	51
5	35.6176194	139.7068138	07:04:47	51
6	35.6181525	139.7061755	07:05:39	52
7	35.6183985	139.7055372	07:06:30	51
8	35.6194569	139.7044202	07:07:22	52

Fig. 7 Operational test 2 (Musashi-koyama palm shopping street, Shinagawa, Tokyo, Japan)

The third test (operational test #3) was created in the morning on April 21, 2017. The candidate boarded a bus from the Meguro Station (Shinagawa city, Tokyo, Japan) to Takanawa-Keisatsusho-mae (Takanawa Police Station, Minato city, Tokyo, Japan) on route 93 of Toei Bus from Shinagawa route 93. This journey covers a distance of approximately 1.8 km. Many elderly people use this bus route in the daytime. The journey completed within approximately 10 min, during which 12 coordinates were submitted to Twitter, as summarized in Table 4. Figure 8 shows that the coordinates posted on Twitter were plotted on a Google map. As shown in the Fig. 8, we can track the movement of the candidate while he is traveling in a bus. Again, the application developed in this study can post the location information with an accuracy similar to that achieved in a previous study [6].

Table 4 The coordinates submitted in the operational test #3

	Latitude	Longitude	Obtained time	Interval
1	35.6337459	139.7153518	11:14:51	
2	35.6349347	139.7204593	11:15:42	51
3	35.6373738	139.7249286	11:16:34	52
4	35.6375736	139.7252479	11:17:25	51
5	35.638125	139.7264451	11:18:16	51
6	35.6383012	139.7265249	11:19:07	51
7	35.6385927	139.7268043	11:19:57	50
8	35.6365585	139.7284405	11:20:48	51
9	35.6363477	139.7287199	11:21:39	51
10	35.6359945	139.7297176	11:22:29	50
11	35.6362441	139.7312342	11:23:16	47
12	35.6354814	139.7329105	11:24:08	52

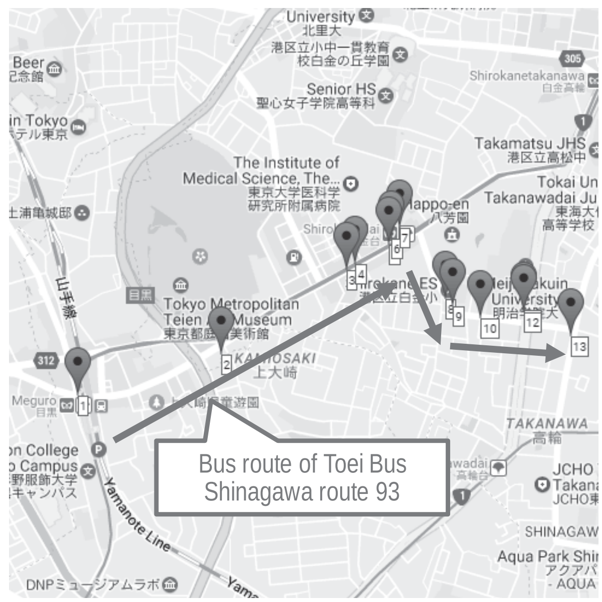

Fig. 8 Operational test 3 (Bus route of Toei Bas Shinagawa route 93, Tokyo, Japan)

3.3 Discussions and further issues

The further issues of the application are as follows.

1. Automatic adjustment of the interval between each tweet:

The submission interval of the location coordinate was set to 45 s in the operational tests. The length was sufficiently small to track the walking speed and the local bus. In practical use, the time should automatically be adjusted according to the movement of the supported user. In the future, we plan to determine how such automatic adjustments would be made. In particular, to minimize the device's energy consumption, the time should be longer than 45 s while the supported user is walking slowly or stopping.

2. Dealing with submission delays and failures due to page reloads:

In the current version of the application, the periodical tweet operation involves page reloading. Page reloading introduces a time delay in the position measurement performed by GPS for submission to Twitter. In addition, if page reloading fails, an error screen is displayed and the periodical tweet submission is stopped. Thus, we plan that the periodical tweet submission occurs without page reloading.

3. Switching to another application stops the position measurement and periodical tweet submission:

When the user switches from the web browser running the application to another application, the position measurement and periodical tweet submission are stopped after several minutes. We plan to solve this issue in our future research.

4. Improvement of the application's user interface:

The initial page of the application is shown in Fig. 2. We plan to introduce a universally acceptable design or an optimal design for user attributes.

4 Summary

We developed the prototype of a web application that enables supported users (e.g., elderly and handicapped people as well as children) requiring daily support to share their location coordinates via Twitter. It enables the supporting users (e.g., families, relatives, or neighbors of the supported user) to check the location coordinates of the supported users whenever needed. In addition, the supported users can easily use this application to send a rescue request on Twitter whenever required. The rescue request is automatically notified the service provider's account which is for receiving such requests. The application will be helpful for achieving self-assistance, mutual assistance, and public assistance in both the daily and emergency situations. The operating tests showed that the application (set at a submission interval of 45 s) can track the walking speed and the local bus. In the future, we plan to improve the application and incorporate the safety confirmation system "T-@npi" [20] into the application.

5 Acknowledgement

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