Prototype of Notification and Status Monitoring System Using LINE Smartphone Application to Support Local Communities

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ABSTRACT

Japanese society is aging rapidly, so an increasing number of households currently consists of only elderly single people or couples. To notify local information to elderly or physically disabled people, local governments use brochures, circular notices, bulletin boards, and radio broadcasts, to notify people of local information, such as daily notices, announcements of events, and emergency alerts. However, these means of communication are weak in terms of immediacy and reliability. Furthermore, the confirmation of the safety statuses of elderly or disabled people is currently dependent on telephone calls or visits by social workers and volunteers who are becoming increasingly overstretched, so it is necessary to improve this situation. In this paper, we propose a system that uses LINE (a mobile communication application) for sending notices containing information from local governments to elderly or physically disabled people, as well as for efficient monitoring by local government and social workers of the health conditions and statuses of such people. The system can be used by anyone who has a smartphone with LINE installed. The system can improve the reliability of the notification and safety confirmation, reduce the workload of the workers, and therefore mitigate the problems. We have also conducted an operational test of a prototype of our system.

Keywords

Care, Application, Social media

INTRODUCTION

Japanese society is aging rapidly, so an increasing number of elderly people (65 years of age or more) who live alone or as couples (Cabinet Office, Government of Japan, 2017). Traditionally, people living in close-knit communities helped each other. Today, such social ties are becoming weaker, particularly in urban areas, making it difficult to confirm the well-being of elderly or physically disabled people on a daily basis. In Japan, local governments use brochures, circular notices, bulletin boards, and radio broadcasts, to notify people of local information, such as daily notices, announcements of events, and emergency alerts. However, these means of communication are weak in terms of immediacy and reliability. It is easy for people to miss the information. According to a survey, although people read brochures or magazines for information on administrative services, they have difficulty in asking for information at their local government offices (Minato City, Tokyo, 2011). Therefore, a novel system is required to enable local governments to provide information easily to those people who have difficulty in obtaining such information. On the other hand, the confirmation of the safety statuses of elderly or disabled people is currently dependent on telephone calls or visits by social workers and volunteers who are becoming increasingly overstretched, so it is necessary to improve this situation (Minato City, Tokyo, 2011; The Mainichi Newspapers, 2017). Hence, we must facilitate a way of using smart devices to provide local information and confirm the safety statuses.

In Japan, many people currently use smart devices, such as smartphones and tablets. In 2011, the percentages of smartphone users were 14.6% for all ages, 10% for people in their 50s, and about 0% in their 60s or older. The number of users has been increasing rapidly. In 2016, the percentages became 56.8% for all ages, 66.0% in their 50s, 33.4% in their 60s, and 13.1% in their 70s (The Ministry of Internal Affairs and Communications, Japan, 2017). According to a survey, about 53.0% of people 50–79 years of old use smartphones and the number of users of LINE has been increasing rapidly with 41.5% of smartphones users currently using the application (Impress Corporation, 2017). LINE is a popular communication application in Asian countries, such as Korea, India, and Japan (LINE Corporation, 2018). The service provides instant messaging, telephone calls, etc. LINE is user-friendly, thus even smartphone novices can use it. We expect the number of smartphone and LINE users among the elderly to continue increasing.

In this paper, we propose a system that uses LINE for notifying elderly or disabled people of local information from local governments and for monitoring their health conditions or statuses by the governments or social workers. The system can improve the reliability of the notification and safety confirmation, reduce the workload of the workers, and therefore mitigate the problems. We also discuss our prototype and operational test of the system.

EXISTING SERVICES

Several care services to support elderly people do exist already. The "Kiduna" project in Kita City, Tokyo, is one such service (Evidence-Based Healthcare Council, 2011). A supporter sends a message via email, which is received on the tablet devices of elderly people who live alone and who can reply via email or smartphone applications. Moreover, a similar smartphone application has already been provided for families (Tsunagu Network Communications, 2017). Furthermore, a system using smartphones, illuminance sensors, and Twitter (Hamasaki et al., 2015), a system based on the usage of electricity (Nakano et al., 2015), a system based on the usage of an electric pot (Zojirushi, 2016), and a system using portable sensors for the status monitoring of elderly people (SOLXYZ co., 2017) already exist. In the field of medical care, a system using a private SNSs (Social Networking Services) and an application (Zhang et al., 2017) also already exist. An application has been provided for supporting medication (Jointly, 2017). A common problem with these services are that they require dedicated applications and/or equipment. Some users reluctant to install the applications because they are not used the applications frequently. Smartphones and their applications, which are used daily, are preferable because of their availability during natural disasters. In Japan, the supposedly well-known services for disaster situations and the Emergency Message Board Web171 (NTT East, 2006) are provided by telephone companies. However, service adoption was poor during the Great East Japan Earthquake in March 2011 and the Kumamoto Earthquake in April 2016 (Impress Japan, 2011) because many users were not acquainted with these services, as they were not used on a daily basis.

Taking into account the above problem, a care service using applications that the user uses on a daily basis is preferable. Today, many Internet users use social media and applications, such as Twitter, Facebook, and LINE, on a daily basis. Recently, major local governments have been providing local information using SNSs. LINE is often used to communicate with close relations, such as family and friends. In addition, major local governments use it to provide local information (Higashide, 2018). For example, the official account of Shibuya-ku, Tokyo, uses an AI (artificial intelligence) system to accept questions about childcare (Shibuya-ku, 2017). The official account of Fukuoka City, Fukuoka Prefecture, provides information about disaster prevention, garbage collection schedules, child care, and public relations (Fukuoka City, 2017). The official account of Kumamoto City, Kumamoto Prefecture, also provides such local information (Kumamoto City, 2018). However, these SNSs are used daily, so far, they have not been applied to the status monitoring of elderly or disabled people, because such services are normally provided for communications among users who have common interests or belong to specific communities. Furthermore, there are no case where the SNSs are used for social care and mutual help.

We interviewed government workers at Minato city, Tokyo, and developed a system (Manaka et al., 2015). With this system, the government can send local information and questions with answer choices. The recipients reply using choices to the system server. If somebody were to reply that they were undergoing a health problem or difficulty, the local government or social workers would be able to help. This system can improve the social help and reduce the workload of the workers. In addition, we focused on the fact that major local governments provide local information with Twitter and proposed a Twitter-based status monitoring system (Utsu et al., 2016). With this system, local governments can send local information and questions with answer choices, as similar to the previous version. The recipients reply using the answer choices, which are shared their followers via Twitter. This system can encourage the mutual help. However, there is a problem with this system. To answer a question, the user must access a hyperlink on a Twitter post published by the local government. Those who are not familiar with smartphones experience difficulty using this system. To solve this problem, it is

necessary to adopt LINE that is widespread in Japan.

PROPOSED SYSTEM

We propose a notification and status monitoring system that uses LINE to support local communities. The system can satisfy required use case in the previous version and improve the usability at the same time. The reasons why our system adopts LINE are as follows. First, LINE is user-friendly, widespread in Japan, and the number of users is increasing. Furthermore, several local governments already provide local information via LINE. Second, users who already have LINE installed on their devices do not need to install dedicated applications to use our system. Therefore, it is necessary to adopt LINE to our application.

Outline of the system

We assume that the proposed system is introduced by local governments. There would be three types of users:

● Supported users: such as elderly or disabled people who require support.

● Supporting users: such as family members, local government and social workers who support the supported users.

● Administrator: government workers who manage the system and send local information and surveys to the supported users.

The proposed system was developed with PHP5 scripts and a MySQL database deployed on an Internet server. The administrator must create a proposed system's LINE account on the LINE Messaging API service website (LINE Corporation, 2018). The name of the system is "T-care" while the name of its LINE account is "T-care (test)" in this paper. The supporting and supported users must have smartphones or tablets with LINE installed and must have registered with the proposed system's LINE account as a "friend".

Figure 1 shows the use case of the system. The main operation of the system is as follows.

1. The administrator registers supporting user(s) who can check the answer by each supported user beforehand (Figure 1a).

2. The administrator enters an announcement message (local information) (Figure 1b). Message examples are introduced later.

3. The administrator enters a question and answer choices (Figure 1c). Examples are introduced later. Usually, the question and answer choices are sent immediately after sending the announcement message (process 2).

4. These messages are notified to both supported and supporting users. Then, the supported user checks the messages (Figure 1d) and replies to the question by selecting from the answer choices on the LINE application (Figure 1e).
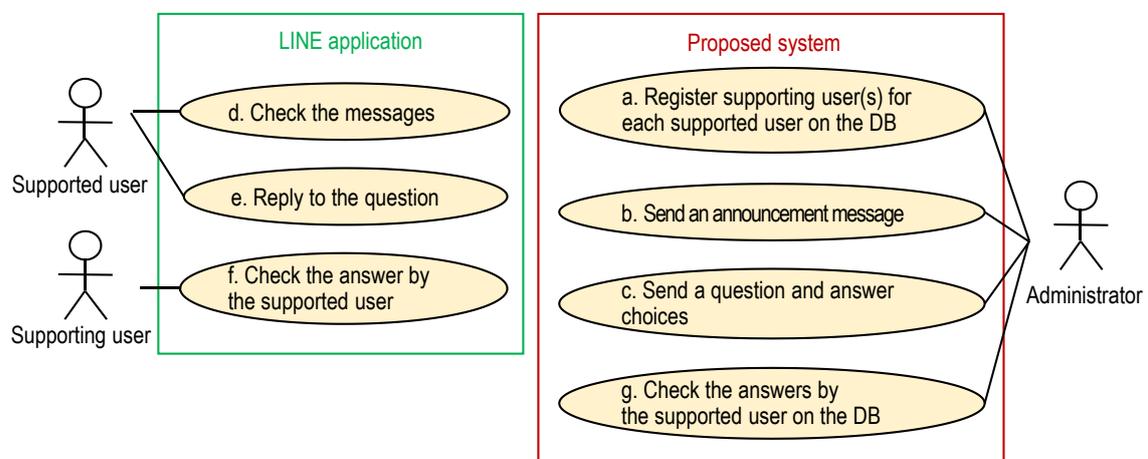
Figure 1. Use case of the proposed system

The answer can be received and checked by the supporting user on the LINE application, as shown in (Figure 1f). If somebody were to reply that they were undergoing a health problem or difficulty, the supporting user would immediately contact to him/her. We assume that the processes 2-5 are held at least once a day. Here, the administrators can check the answers received from the supported users (Figure 1g). They can provide the information to the supporting users when needed.

Examples of messages, questions, and answer choices

Below are some examples of announcement messages and questions/answer choices.

- Example #1: A general notification

  - Announcement message: In Minato City, the temperature will exceed 35 deg C (95 deg F) today. Please be careful about heat stroke.

  - Question: How is your current health condition?

  - Answer choices: Good. /Not good. /I need a consultation. /Somebody nearby is in trouble.

- Example #2: An announcement of an event

  - Announcement message: In Minato City, X festival will be held at X Park at 10:00 a.m. today. Please come and visit.

  - Question: How is your current health condition?

  - Answer choices: Good. /Not good. /I need a consultation. /Somebody nearby is in trouble.

- Example #3: A weather alert

  - Announcement message: A typhoon is coming soon. Please refrain from going outside.

  - Question: How is your current health condition?

  - Answer choices: Good. /Not good. /I need a consultation. /Somebody nearby is in trouble.

- Example #4: An emergency notification

  - Announcement message: We have just experienced a large earthquake in Minato City. A tsunami is not expected to follow.

  - Question: How is your current health condition?

  - Answer choices: Safe and uninjured. /Minor injuries but mobile. /Too injured to move. /Somebody nearby is in trouble.

Here, the examples #1-3 have the same question and answers. Since the main purpose of the function for the question and answer is checking the well-being of the supported users, the administrator should not frequently change the question and answer choices to avoid confusion.

We assume that if somebody were undergoing a health problem or difficulty, or his/her neighbors were in trouble, he/she would press "I need a consultation" or "Somebody nearby is in trouble," and then the supporting user would immediately contact to him/her. Then, if it is an emergency, the supporting user takes appropriate actions (e.g. calling emergency specialists when required).

System operation and screens

The section shows the screens and operations of the system. The screenshots of the administrator pages were captured on a Google Chrome web browser operating on Microsoft Windows 10. The pages for the supporting and supported users were captured on a LINE application operating on an Android 7.0 smartphone (L-01 LGV20PRO).

(1) An announcement message sent by administrators

An administrator presses a "Send a notification" link on the administrator index page, as shown in Figure 2, to send an announcement message to the supported users. The length of a piece of text of information must be 2,000 characters or less.
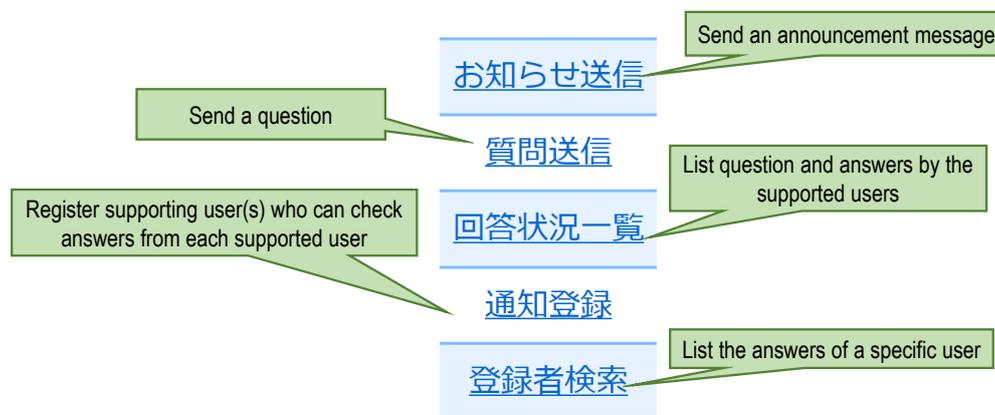
Figure 2. Administrator index page

(2) Questions and answer choices sent by administrators

When an administrator presses a "Send a question" link on the administrator index page shown in Figure 2, the link sends the administrator to a page, shown in Figure 3, where the administrator can enter questions and answer choices. The length of a question must be 60 characters or less. A total of four answer choices must be provided. The number of answer choices is limited to up to four in the LINE services. The length of each answer choice must be as short as possible, within 20 characters or less, because some devices omit long sentences.
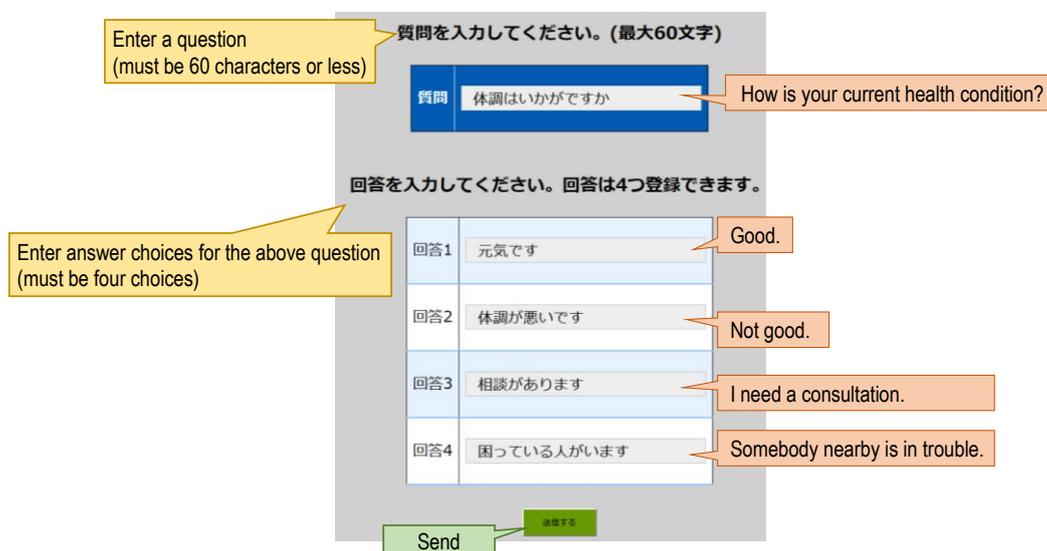
Figure 3. Page for sending questions and answer choices

(3) Announcement message and questions checked by supported users

After an administrator sends an announcement message and questions/answer choices, the supported users can see a push notification on their devices, as shown in Figure 4. When the supported user presses the "View" button, the LINE application appears and the supported user can check the announcement message as shown in Figure 5 and the question as shown in Figure 6.

Figure 4. Notification on smartphone of supported user

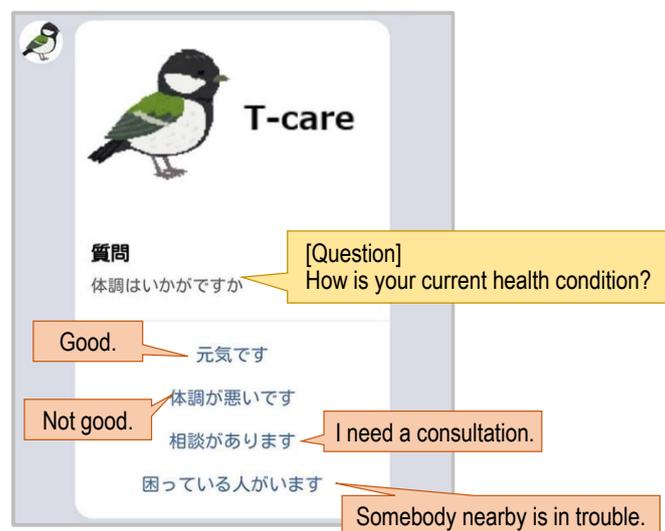**Figure 5. Announcement message on LINE application on supported user's smartphone**

Figure 6. Question and answer choices on LINE application on supported user's smartphone

(4) Questions answered by supported users

The supported user can answer the question by pressing one appropriate choice from the four answer choices, as shown in Figure 6. Then, the selected answer is sent to the system. Even if the supported user presses a choice by mistake, they can still choose and press a different answer.

(5) Supporting users notified of answers of supported users

After a supported user chooses an answer, both the question and the answer are sent via LINE to that user's registered supporting users, as shown in Figure 7. The supporting user can be notified if the supported user requires assistance.
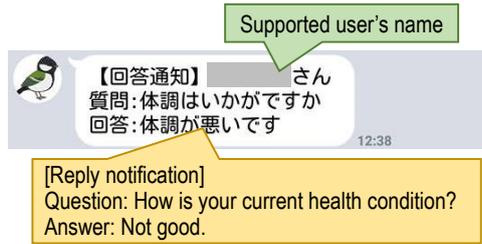
Figure 7. Example of notification sent to supporting user

(6) Questions and answers checked by administrators

When an administrator presses the link to "History of questions and answers," the page shown in Figure 8 will be loaded. On this page, the administrator can check the questions and answer choices sent back by the supported users. The administrator can also check the answers to a specific question by selecting a radio button, as shown in Figure 9, in which the usernames have been masked to protect the privacy of their users. Moreover, the administrator can check the history of the answers of a specific supported user by entering their username on the page shown in Figure 10, after which the page shown in Figure 11 will load and display the history. Using these pages, the administrator can provide the information to the supporting users when needed.

Figure 8. History of questions sent by administrator

Figure 9. List of answers to a question

Figure 10. Page to search for supported users

Figure 11. Answer history of a specific supported user

Discussion

The reasons why we selected the functionalities are to solve the following issues. First, to notify local information to elderly or physically disabled people, local governments use brochures, circular notices, bulletin boards, and radio broadcasts. However, these are weak in terms of immediacy and reliability. Second, the confirmation of the safety statuses of elderly or disabled people is currently dependent on telephone calls or visits by social workers and volunteers who are becoming increasingly overstretched. Therefore, the potential contributions of the system is that it can contribute to improve the reliability of the notification and safety confirmation and reduce the workload of local governments and social workers.

In contrast to the existing similar systems, the existing system provides one-way communication therefore it cannot support social care and mutual help. On the other hand, our system provides bi-directional communication and can support social care and mutual help. A limitation of our system is that the number of answer choice and the length of the massages are limited by the LINE application. This limitation may be a problem to be solved in providing the service in countries outside Japan.

Operational test

We conducted an operational test of the system's ability to send announcement messages and questions/answer choices by an administrator and receiving responses from the supported users. The function of notifying the supporting users of the answers by the supported user had not been installed, we did not test this function in the operational test. The test was conducted every day, except Saturdays and Sundays, from 24 April to 2 May 2018. A student who developed the system at Tokai University, Japan, acted as the administrator and sent out announcement messages and questions/answer choices between 10:00 a.m. to 12:00 p.m. Seven people (a lecturer and six students) acted as supported users for receiving and checking the notifications and questions, as well as responding. The results of this test showed that the functions of sending and responding were successful.

CONCLUSION

We proposed the system that uses LINE application for notifying elderly or disabled people of local information from local governments and for monitoring their health conditions or statuses by the local government or social workers. This paper describes a prototype and an operational test of the system. The test had been conducted only among the members of our laboratory and without the function of forwarding notifications and questions/answer choices to supporting users. For future study, we plan to conduct an operational test with the participation of local residents. Further expansions to this system could include the ability to detect a user's

current location, which would make the application useful as a hotline during an emergency.

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