

맞춤형 경보 통지 시스템을 위한 지식기반 메시지 생성기 설계

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Design Of Knowledge-based Message Generator for Personalized Warning Notification System

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요 약

An emergency notification system is essential, for warning the population at-risk and providing them the useful survival tips, so that they can take appropriate steps to escape. In an emergency event, the message contents play an important role in conveying useful information to people. In this paper, we propose a novel design of knowledge-based message generator for personalized warning notification system, using geo-social data. Our proposed design consists of two main parts: offline modeling and online messaging. Offline modeling is designed to generate proper message context for the proper users. In online messaging, message administrator uses the list of users and message pairs generated by knowledge-based message generator module to notify the warning message to the users who are related to an event.

키워드 Knowledge-based Message Generator, Emergency Alert System, Personalized Warning Notification, Geo-Social Information.

I. Introduction

Nowadays an emergency event such as fire, gas leakage, and typhoon, etc. can happen any time, at anywhere. Being aware of the emergency situation and taking appropriate steps are the key point to survive in such event. There is a strong demand of developing an emergency notification system, which sends warning notification as fast as possible to the right

people at the right time, and provides them the useful advices and survival information.

Recently, some researchers worked on development of efficient emergency alert systems. To solve the problem of sending notification message, to a wide range of people in case of bad network traffic, an emergency alert system using android was developed; in which, bulk messages were split to avoid network congestion [1]. In

[2], a SMS-based rural disaster notification system was studied and the work is mostly concern about, the problem of sending notification alert in the rural area. One of the existing researches [3], emergency information broadcasting distribution system was developed for early earthquake warnings. The system uses the existing Cellular Broadcast Service (CBS) to achieve simultaneous information of distribution, when an emergency occurs. Another work [5] aims to build a reliable geo-social notification system called GSFord, which is mainly focused on providing successfully notification in extreme situations, where geographically correlated failures occurred. In [6] an SMS alert and notification system was developed, which monitors the critical signals of its utility systems and notifies to the responsible people in case of critical components failure.

Most of existing approaches mainly focus on message distribution methods and the recipients in the emergency case, but the contents of notification message are not considered appropriately. However, the message content plays an important role in conveying the useful information to user. In an emergency case, sending the right messages to the right person at the right time may save many lives. In order to generate proper messages at the right time for the users who are related to emergency event, we propose a novel design of knowledge-based message generator for personalized warning notification system, using geo-social big data. Our proposed design consists of two main parts: offline modeling and online messaging. Offline modeling is deigned to model user's current and interested location. Knowledge-based rules are designed to generate the personalized warning message for each event-related user. Online mes-

saging use output of knowledge-based message generator, which is list of user and message pair to inform the users who are related to or interested in, a location where the an event is occurred.

II. Knowledge-based Message Generation

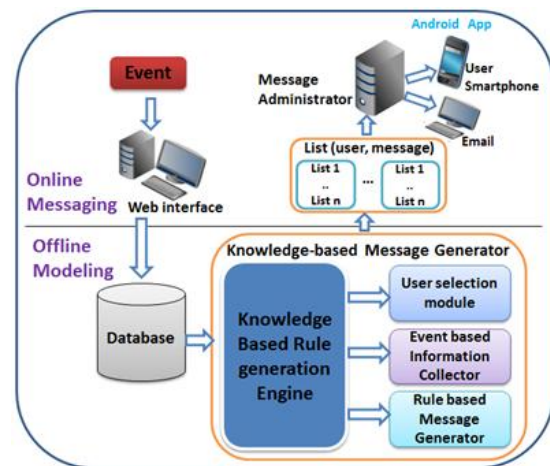


Figure 1. Architecture of Personalized Warning System

Figure 1 shows the general architecture of personalized warning notification system. In our proposed personalized warning notification system, whenever an event happen, system send event information to the knowledge based message generator, which then computes the relative users, event related information to generate a warning message to notify user. Message provides the useful information, which tells user how to get overcome the happening events.

Web interface is designed for registering user, event and to notify the warning messages to the users. Database is designed to store information about the registered user and event, as well as spatial information about the user and the disaster. The user information (id, location, contact information, personal information, etc.) is

saved in user database. Disaster information (preliminary caution, evacuation routes, helplines, etc.) is saved in disaster database.

Our proposed approach consists of two main parts: offline modeling and online messaging. In the offline modeling, we have knowledge based message generator module which is responsible for generating right message for right person. This module contains knowledge based rule generation engine; which is helpful for generating some rules based on knowledge. Three modules are generated based on generated rules. User selection module selects the users who are related to the event, by using their current location and their interested location based on subscription. Event based information collector module is used to collect the information about the event which is occurred. And by using output of user selection module, event based information collector and type of a user the rule based message generator module generates the list of warning message for each user who is related to an event.

In the second part i.e. online messaging, we use the list which is generated by using the knowledge based message generator. List contains the user id of a user to whom we need to notify and generated message for that user. This list of messages is used by message administrator to send right message to the right person. In our approach we provided the utility 'Friends-based notifications', which help users to keep track of their friends and loved ones. For example, a user receives an alert when she's near a friend at a sporting event or concert or when her child is someplace he shouldn't be.

Knowledge based message generator not only creates the message for target user,

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Input   A: notification area
          U: user data set
          D: disaster data set
Output  $\forall i \in U_{event} P(u_i, m_{sg_i})$ 
          #The list of user and message pair who are related to an event.
START
           $U_A =$  list of users who found in A
           $U_S =$  list of users who are safety in charge for A
           $U_{subscription} =$  list of users who are interested in A
           $U_{A\_relatives} =$  list of users who are related to  $U_A$ 
           $U_{event} = U_A \cup U_S \cup U_{subscription} \cup U_{A\_relatives}$ 
          FOR each user in  $U_{event}$ 
            SET  $U\_TYPE(u_i)$  {
              IF ( $u_i \in U_A$ ) THEN  $U\_TYPE = TARGET\_USER$ 
              ELSE IF ( $u_i \in U_S$ ) THEN  $U\_TYPE = SAFETY\_NCHARGE$ 
              ELSE IF ( $u_i \in U_{A\_relatives}$ ) THEN  $U\_TYPE = USER\_RELATIVE$ 
              END IF
            }
             $m_{sg_i} = m_{sgGenerator}(u_i, D, LEVEL\ 1, U\_TYPE)$ 
          END FOR
STOP
    
```

Figure 2. Knowledge based Message Generation

but also for the users who are indirectly related to an event or users who may help target user to get over from affected area of an event. When an event happen the event information is provided to system. System uses the event information to provide input to the knowledge based message generator such as notification area. Knowledge based message generator uses provided event information together with user data set and disaster data set as input to generate a notification message. Knowledge based message generator filters out the users to whom we need to notify about the event and lists out the users who are in the affected area of an event (target user), users who are interested in or subscribed for the location where the event is happening (interested user), the friends or family members of target user (user relative) and users who are responsible for safety for an event (safety in charge). These filtered users are categorized according the user type. Then different message contents are generated for different types of user. Then the knowledge based message generator creates the list of user and message pair. The list of user and message pair contains the user id of a user and the appropriate message for that user. The list

generated by knowledge based message generator is used by message administrator to notify proper user with proper message contents.

III. Conclusion

In this paper, we proposed a novel design of knowledge-based message generator for personalized warning notification system. The system provides users the personalized warning notification message based on knowledge of individual user characteristics such as location, job, interests and the corresponding emergency event data.

For future work, we plan to extend our system in various ways. The message generator can be enhanced to fit with various disaster events using static as well as dynamic message template. The client application can be enhanced with multiple communication channels such as SMS, Email, instant messaging and multicast. Associative rule mining can be applied to our system to predict user's interest location and travel patterns, and then recommend places as well as travel guide for them.

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