

Chatbot System for Data Management: A Case Study of Disaster-related Data

J.Y. Chen^a, M. Tsai^b, C. Yang^c, H. Chan^b, and S. Kang^c

^a Department of Civil Engineering, National Taiwan University, Taiwan

^b Department of Civil Engineering, National Taiwan University of Science and Technology, Taiwan

^c Department of Civil and Environmental Engineering, University of Alberta, Canada

E-mail: yie@caece.net, menghan@gapps.ntust.edu.tw, chenghsuan@ualberta.ca, katrina.hyc@gmail.com, sckang@ualberta.ca

Abstract -

This research aims to explore the effectiveness of chatbot system for highly-complex data management. With the growing popularity of mobile devices, the conversational information technology (IT) service, such as chatbot, has permeated into our daily life. Conversation-based systems are now widely utilized for helping the user to access the data they need or control other devices more intuitively. Although lots of systems have been developed for personal assisting, such as Siri, Alexa, and so on, or customer services, seldom of them are used for data management. Therefore, this research will focus on exploring the application of chatbot system for the management of complex data. We used the disaster-related data and a chatbot system developed in the previous work as a case study. A one-year field test was conducted for figuring out the feasibility and effectiveness of chatbot system for data management. After the field test, we found that the number of users of the developed system was doubled within six months. The usage of the system increased approximately 2.5 times with six months. We also found that the users now rely on the chatbot system for their daily tasks. The results reveal that the chatbot system may be a promising direction for highly-complex data management due to its intuitive data accessing process.

Keywords –

Data Management; Conversational System; Chatbot

1 Introduction

Data management has always been a critical issue in the field of engineering. Recently, the fast development of the internet and high computational hardware bring the explosion of digital data. Around 2.5 exabytes of data are created each day in 2012 [1]. Therefore, how to effectively translate those massive amounts of data into

the knowledge that can improve the decision-making and performance is essential and worth for detailed research. To deal with the massiveness and diversity of the data, many information technologies were developed within these years. For instance, the Lesson Learn Center proposed by Kang et al. provided all the historical disaster data in Taiwan for decision-makers' reference [2]. Terroso-Saenz et al. proposed an IoT platform for the management of energy data in 2019 [3]. Carmona et al. used the IoT technology in the data collection of the construction site for enhancing the productivity of constructions [4].

Although IT related systems have been developed, the user interface and the data retrieval approach of these systems seem unintuitive and inconvenient for users. Therefore, studies have recently started to focus on developing conversation-based systems [5, 6] by considering user involvement [7]. The Siri, Amazon Alexa, and Google are the most famous examples. Those conversational systems play the role of personal assistant that allows users to check the weather, traffic, email, and so on. Ko and Lin used a chatbot system as a virtual assistant for business card management [8]. Besides personal assisting, such systems are also widely utilized as customer services. For instance, Thomas and Gupta et al. both utilized the chatbot for the customer service for e-business [9, 10]. Despite that chatbots have been developed for different purposes, the application of the chatbot system in complex data management is rarely discussed.

2 Previous research

To explore the feasibility of applying the conversational system on data management, we developed a chatbot, named Ask Diana, for water-related disaster in 2018 [11]. Among different types of data, disaster-related data is one of the most difficult for managing due to its following characteristics [12]:

- large number of producers and consumers of information;
- time sensitivity of the exchanged information;
- various levels of trustworthiness of the information sources;
- lack of common terminology;
- combination of static and streaming data;
- heterogeneous formats, ranging from free text to XML and relational tables.

Ask Diana was designed as a keyword-based chatbot system for disaster data management. It consists of a disaster database, a user-intent understanding mechanism, and a mobile-based user interface (Figure 1). The system allows the disaster-related personnel to access the data they need through directly using inputting keywords. Building on a popular communication platform, LINE, also allows the user to forward the data to others easily.

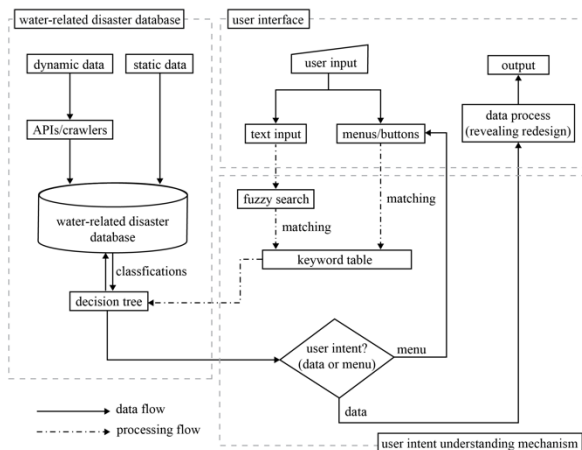


Figure 1. The system structure of Ask Diana [11]

Ask Diana improved data management of disaster data delivery process and allow decision-makers to access real-time disaster data by themselves. During emergency operation period, rapid response is essential. Decision-makers require real-time disaster data to make decisions. However, decision-makers are high-level government officials, who are not the first line operators who operate the disaster response system. Therefore, in real emergency operation process, decision-maker would ask their major supervisors to provide disaster data which required no emergency response personnel's judgement or confirmation. Then, the supervisors would ask emergency operators and their cooperation team to provide disaster data. After cooperation team fulfils the requirement, they would provide disaster data to operators. Operators would then deliver the data to major supervisors. Finally, the major operators would deliver the related information to decision-makers for further decision making. The delivery process is very time-

consuming which would usually cost more than one hour. It may somehow make the disaster data hard to deliver in time.

Ask Diana was validated to have higher efficiency in disaster data retrieving through a six-month field test. Ask Diana has an easy user interface to allow user access to real-time disaster data by themselves. Therefore, decision-makers could require disaster data just by click Ask Diana's menu or input simple disaster keywords. Ask Diana would provide feedback in just seconds without long-time latency. The related personnel were thus willing to use Ask Diana for their daily tasks. Three hundred eighty-one users have used Ask Diana for disaster response activities. Twelve thousand seventy-eight using records were collected within six months (Figure 2).

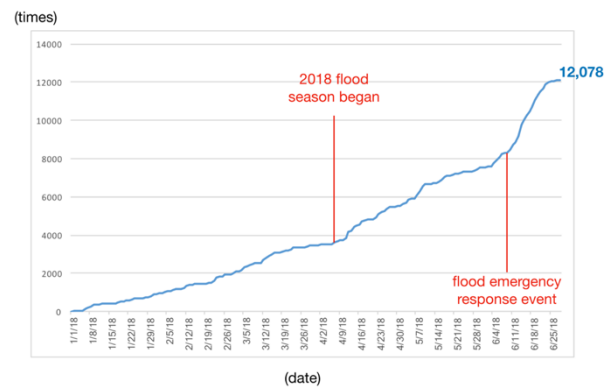


Figure 2. The user records of the field test [11]

3 Research Objectives

This research aims to explore the feasibility of utilizing the chatbot system on data management. A field test of utilizing the developed system into an actual field was conducted. The user's behaviours were all recorded for further analysis. After the field test, the advantages and the shortage of chatbot system for data management would be concluded.

4 Field Test

For feasibility test, we cooperated with the government of Taiwan (Water Hazard Mitigation Center) to have a six-month field test in our previous research. In this research, we extended the duration of the field test to one year for more detailed observation of the user behaviours. The background of the users and the usage of Ask Diana were all recorded for analysis.

Based on the user log, 790 users have added Ask Diana as their Line friend at the end of 2018. The number is doubled within only six months, which represents the

willing to using Ask Diana for their tasks is gradually increasing. Figure 2 illustrates the distribution of the registered user role. Among the 790 users, 95% are disaster response personnel, 2% are system developers, 2% are system managers, and 1% are decision-makers.

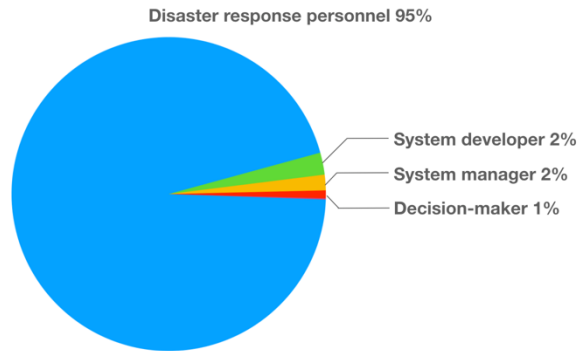


Figure 3. The distribution of the user role

Ask Diana collected totally 31,355 records from actual users within a year (Figure 3). The usage is around 2.5 times increasing compared with the first six months. In Figure 3, we can find that the usage will have a significant rising when major disasters happened.

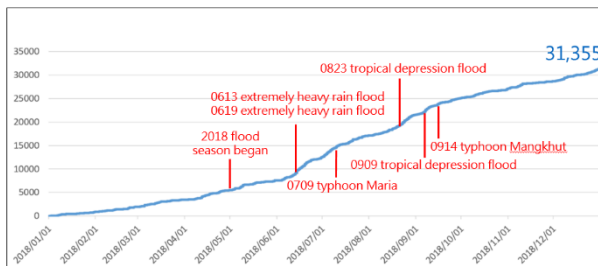


Figure 4. The cumulative usage graph of Ask Diana during Jan. 1st, 2018 to Dec. 31th, 2018

Besides the user logs, we also collected the user feedbacks during the field test. According to those feedbacks, three major comments were concluded:

1. Ask Diana provides an intuitive platform for the user to access data easily and efficiently. With the low threshold operation, the willing of the user to use it for actual disaster response activities were increased.
2. The keyword-based mechanism of Ask Diana did not allow the user to get the data through hierarchical questions. Therefore, they needed to provide Ask Diana with the keyword of the data specifically.
3. The user expected that Ask Diana could have some emotional responses. For example, when the user inputted “Hi Diana, I would like to know the

flooding situations now,” instead of just providing the flooding information, it will be better if Ask Diana can reply “Taipei is now having serious flooding, please keep your attention at any time!”

5 Conclusions

This research explored the feasibility and effectiveness of the chatbot system in data management. Through a long-term field test on disaster-related data with user feedbacks collected, we found that the chatbot system can have high performance and efficiency in data management, even for highly-complex data. Due to the intuitive operation process of chatbot system, the willing of the user to use such a system can be significantly increased. More discussions can be found in Ask Diana: A Keyword-Based Chatbot System for Water-Related Disaster Management [11]. However, as a chatbot system, the user will expect it to have a more human-like response with emotions. Also, for the complex data, the user may need to retrieve the data through hierarchical queries. In conclusion, the chatbot system can effectively be utilized for data management meanwhile provide an intuitive platform for users to access the data.

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