Virtual Dialogue Agent for Supporting a Healthy Lifestyle of the Elderly

Risako Ono and Yuki Nishizeki and Masahiro Araki

Abstract In this paper, we introduce a dialogue system that supports a healthy daily life of the elderly. This dialogue system proposes actions to be taken by the user from various types of supportive information. To respond to the diverse needs of the elderly, this system has various user adaptation functions, including a grasp of the users interest through a chat dialogue. As a result, it can be used for long periods as well as continuous health monitoring of the elderly.

1 Introduction

In some aging societies, the number of households consisting of a single elderly person is increasing. It is a social problem to raise the quality of life of such elderly people and to prolong their healthy lifespan. To deal with such problems, providing daily support for the elderly via dialog agents is considered to be one solution [1] [2]. By having a daily conversation with a dialog agent, it is expected that the elderly can maintain good cognitive function. Also, healthy daily life can be expected if some physical activity, such as blood pressure measurement and gymnastics exercises, can be encouraged by the system.

However, the needs of the elderly are diverse. Therefore, such a system needs to be appropriately adapted to the user [3] [4]. Also, the ease of customization of a system that can properly deliver information about their place of residence is also an important factor.

Risako Ono
Kyoto Institute of Technology, Japan e-mail: lisaco@ii.is.kit.ac.jp

Yuki Nishizeki
Kyoto Institute of Technology, Japan e-mail: zeki@ii.is.kit.ac.jp

Masahiro Araki
Kyoto Institute of Technology, Japan e-mail: araki@kit.ac.jp

In this paper, we introduce the prototype implementation of a dialog system satisfying these requirements. Also, we discuss how to realize the user adaptation function and the customization capability for different conditions.

2 Approach

2.1 Role of Virtual Agent

This system aims to have the following three roles:(1) Role of <Personal doctor> supporting daily health care, (2) Role of <Family member> that provides various types of information tailored to the user's preference, and (3) Role of <Friend> that provides chat functionality.

First, the personal doctor role has the user measure their blood pressure every day and maintains the data in the database. Then, according to the users previous measurement results, the agent provides advice such as: "Drink more water because your blood pressure is lower than usual." Also, we added a function for the agent to do light gymnastics with the user. The gymnastics data is stored as a set of motion data for a 3D agent. Therefore, the content of the gymnastics can easily be customized to each user. Second, family member role provides various types of information suitable for the user based on data such as the users residential area and preference. This information guides the everyday life of the elderly. For example, the information on regional events encourages the elderly to go out. This scenario is described in detail in Section 4. Third, the friend role conducts a daily chat with the user. The system behaves like a friend that the user can talk to. It opens the conversation by providing the weather information of the day. After that, it continues the conversation with the user by discussing seasonal events or news that the user has an interest in.

2.2 Overall Structure of the System

The flow of our system is shown in Fig 1. The system consists of a main controller, an API wrapper module, and a database which maintains the user's information. As the system interface, we use the MMDAgent[1].

Before opening the chat with the user, the system collects the current information, such as the weather, by calling the information gathering module. When the system finds out the user, it begins a conversation by sending a command to the MMDAgent module.

[1] http://mmdagent.jp/

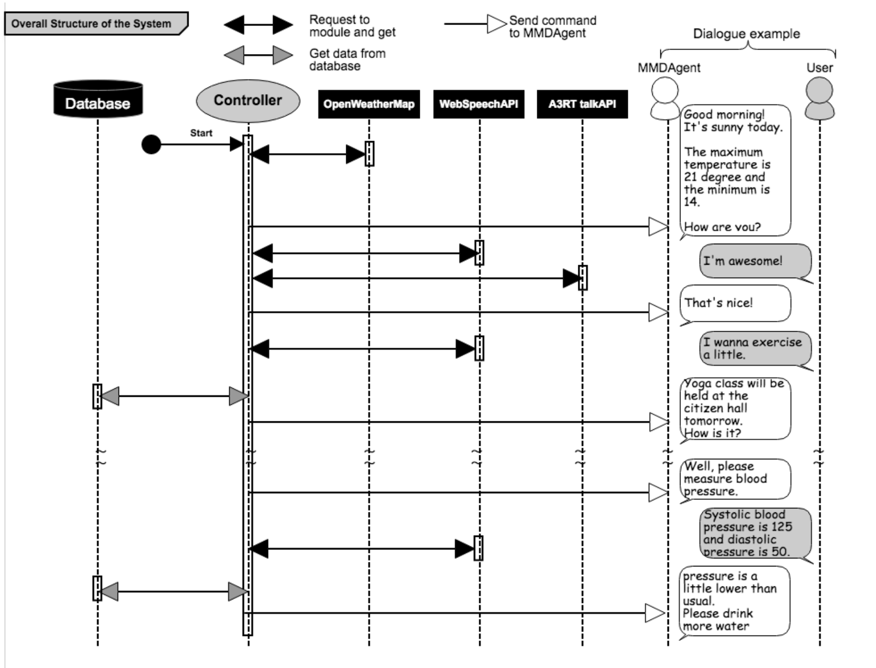

Fig. 1 Processing flow of the system and an example of the dialog

By using the MMDAgent, the user can experience the feeling of talking to people on the screen instead of talking to machines or applications. Our aim is for the user to acquire a feeling of attachment to the system.

In realizing the system described in this section, we implemented a weather information provision function, a chat dialogue function, a gymnastics function, a blood pressure measurement function and a recommendation of regional events function as shown in Fig.1.

3 Realization of support dialogue

3.1 Each function

Our system recognizes user speech using the Web Speech API [2] and generates a response using the A3RT talkAPI [3]. We are planning to extend this module by using the selection method of an appropriate response in chat-oriented dialogue systems

[2] https://developer.mozilla.org/ja/docs/Web/API/Web_Speech_API

[3] https://a3rt.recruit-tech.co.jp/

[5]. In addition, we will integrate the assessment functionality of users interests in a multimodal dialog based on an exchange unit [6]. It enables a users preferred topics to be elicited and reflects this information in the selection of the topic of the chat.

In our system, the agent also has the function of showing users how to exercise to help improving their physical health. The gymnastics used in this system are light and appropriate for elderly people. By following the same movement as the agent, the users strengthen their muscles; thus the system can support the maintenance of their health.

Furthermore, in our system, the users' daily health status is stored in the database to manage the health of the user. Specifically, the system encourages the user to measure their blood pressure at an appropriate time. After that, it asks for the result of the measurement and stores the information in the database. By storing data in the database daily, the system can grasp the mean value of a users blood pressure. Based on this value, it can judge whether "the blood pressure is lower or higher than usual today" and provide appropriate advice to the user. In fact, by providing comments based on the users data, the system is expected to become closer to the user.

3.2 Flexible and Reactive system

We developed the system using web application framework. By using the web application framework, we make it possible to construct a flexible system independent of development environment. In addition, cooperation with other applications developed under the same framework can be made very easy, and it is easy to add new functions. Specifically, we use a framework called Meteor [4] that is a full-stack JavaScript platform for developing modern web and mobile applications. By using this responsive characteristic of the platform, elderly users can reduce time and effort of reloading the web browser and pushing the buttons.

4 Recommendation of regional events

It is difficult for the elderly to find out information about the region from among the various information sources. Therefore, it is necessary to support the elderly by providing them with appropriate information through the system. It is also necessary to provide information according to the preference of each elderly person. In this system, we collected user preferences through the chat and provided information on events tailored to a users preferences.

In our current implementation, we use the information provided in the regional public relations magazine. By using this information, the system better reflects the

[4] https://www.meteor.com/

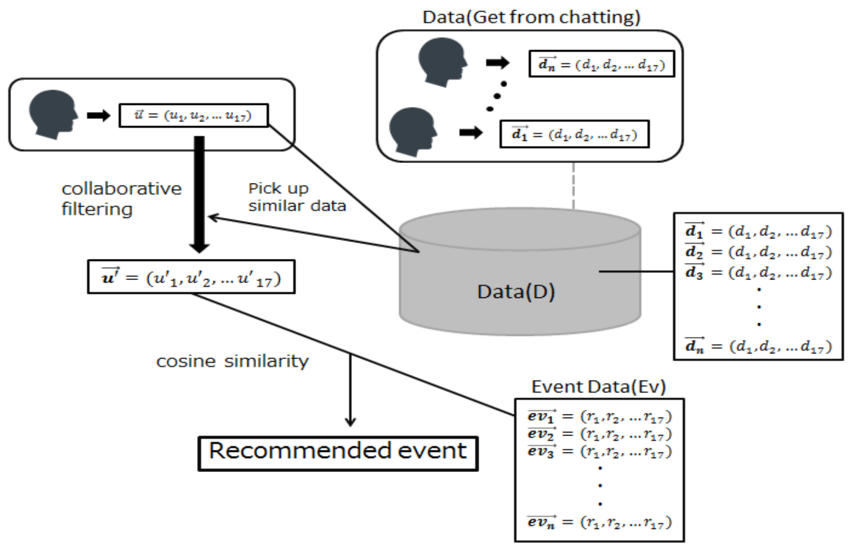

Fig. 2 Recommendation system configuration

region. The data to be used is not currently open or in an open data format, such as RDF. We use this data by converting it into an open data format. This makes it easy to add data if it is released as open data in the future. In this trial setting, we use the information of 133 events as the event data.

The flow of recommendations is as shown in Fig 2. In this system, it is judged whether the user has an interest in 17 genres through chatting. However, in this instance, we collected the data which 30 people are interested in, across 17 genres and used D as the original data. Instead, **d** represents the users interest in the data, and each value represents the degree of interest for each genre. Through chatting, it is determined whether a user has an interest in any of the 17 genres or not. In addition, **u** represents the interests of a user, and each value represents the degree of interest for each genre. It is difficult to get all the user's interest information by chatting. Users interested in the same genre may be interested in similar events. Therefore, we estimate the degree of interest about the genre that could not be determined using the collaborative filtering method. In collaborative filtering, it is possible to estimate the degree of interest of the user based on the data of the user having preference close to the user. For that reason, it becomes possible to recommend information of events that similar users will be interested in. In fact, $\mathbf{u}'$ represents the interest of the user after collaborative filtering. By using this procedure, we were able to obtain information about a users preference. In addition, events were also mapped to other relevant events among the 17 genres. **ev** indicates which genre the event is similar to, and each value represents the degree of similarity to each genre. Both preference information and events of the user are represented by vectors relating to 17 genres.

By calculating the similarity of these vectors, events close to the user's preference information may be acquired. Then, the system calculates the cosine similarity for the acquired preference information vector of the user and the event vector. By this, the score of the similarity between the two vectors can be acquired. An event that provides a user with the event with the highest score is assumed to be the most appropriate.

We provided three event provision modes. The information required for each user is different. Therefore, the user selects the mode. The first mode is a simple version, providing only the event name and date. The second mode is the all information version, and it conveys all of the information. The third mode is a select version and it advances while listening to the user before determining whether to listen to the rest. In addition, the location information is displayed on the screen with a map, and the contacts are also displayed with letters on the screen, in order to provide support.

5 Conclusion

In this paper, we described a dialogue system that supports the healthy daily life of the elderly. This dialogue system has the role of a personal doctor, family member, and friend. In each role, the system provides information that is adapted to each user. As a result, it can be used for long periods for continuous health monitoring of the elderly.

We have a plan to extend this system by combining an advanced module for user adaptation and performing a field test involving the elderly.

Acknowledgements The authors would like to thank the members of MMI-group of Interactive intelligence laboratory at KIT.

References

1. Pinto, H., Wilks, Y., Catizone, R., Dingli, A.: The senior companion multiagent dialogue system. In Proc. AAMAS 2008, pp.1245-1248. (2008)
2. Miehle, J., Bagci, I., Minker, W. and Ultes, S.:A Social Companion and Conversation Partner for Elderly, In Proc. IWSDS (2017)
3. Litman, D.J., Forbes-Riley, K.: Evaluating a spoken dialogue system that detects and adapts to user affective states. In Proc. SIGDIAL 2014, pp. 181-185. (2014)
4. Miehle, J., Yoshino, K., Pragst, L., Ultes, S., Nakamura, S., Minker, W.: Cultural communication idiosyncrasies in human-computer interaction. In. Proc. SIGDIAL 2016, p. 74-79 (2016)
5. Mori, H. and Araki, M.: Selection method of an appropriate response in chat-oriented dialogue systems. In Proc. SIGDIAL 2016, pp. 228-231. (2016)
6. Tomimasu, S. and Araki, M.: Assessment of users' interests in multimodal dialog based on exchange unit. In Proceedings of the Workshop on Multimodal Analyses enabling Artificial Agents in Human-Machine Interaction (MA3HMI '16). ACM, New York, NY, USA, pp.33-37. (2016)