A Trial of Prevention of Physical and Social Frailty for Older People via Chatting Bot Installation on Moving Stall

Yoko Nishihara
Col. of Inf. Sci. and Eng.
Ritsumeikan University
Shiga, Japan
email: nisihara@fc.ritsumei.ac.jp

Junjie Shan
Ritsumeikan Global Innovation Research Org.
Ritsumeikan University
Shiga, Japan
email: shan@fc.ritsumei.ac.jp

Yihong Han
Dept. of Inf. Sci. and Eng.
Ritsumeikan University
Shiga, Japan
email: is0387ps@ed.ritsumei.ac.jp

Abstract—This research uses information science approach for preventing the physical and social frailty of older people living in an aging community with a low birthrate. In this study, we hypothesize that older peoples' physical activity and sociable communication will increase if they have more interactions with others and the outside environment. We believe that by raising their interest in the surrounding daily activities could help improve their interaction with the outside society. This study is conducted in Yogo Town in Shiga Prefecture, Japan as an area of an aging community with a low birthrate. Yogo Town provides a moving stall for older people to assist them in purchasing daily necessities. We install a chatting bot in the moving stall to attract older people to visit it. If older people visit the moving stall more, their physical frailty could be prevented through these increased physical activities. If older people could interact and communicate more with others through the enjoyment of conversations and games with the chatting bot, their social frailty also has the chance to improve. This paper describes the issues discussed in this study, introduces a developed chatting bot, and reports on plans for future experiments.

Keywords-frailty prevention; physical and social frailty; chatting-bot; elderly care

I. Introduction

Japan is facing an aging society with a low birthrate. People request to prevent older people's frailty [1]. Frailty is a condition in which the mind and body weaken due to aging. There are three types of frailty; (1) physical frailty, (2) social frailty, and (3) cognitive frailty. To reduce the progression of frailty, older people need to raise motivation of frailty prevention through exercises [2]. However, it is difficult for them to maintain awareness continuously because they have physical constraints and low communication with their neighbor, especially for those older people who live away from urban areas. It is desirable to increase the amount of physical activity and sociable communication. In this paper, we use an approach of information science to try to increase the intention of older people's physical activity and sociable communication to help them prevent frailty indirectly.

A. Targeted Field

This study is conducted in Yogo Town in Shiga Prefecture in Japan as an area of an aging community with a low birthrate. The percentage of residents aged 65 years and older is 43.1%, and the rate of them aged 80 years and more senior is 18.5% (as of December 1st, 2021). In the last few years, the problem of frailty has become more severe due to Covid-19 infection control. The area is facing an urgent need to understand the current situation regarding the physical and mental health of older people and to take measures to address this issue.

Yogo Town provides a moving stall for older people to assist them in purchasing daily necessities. Though the residents in the town use automobiles every day, the older people have returned their driving licenses due to their low physical and cognitive ability. Therefore, the moving stall is indispensable for their lives. The moving stall carries foods and daily necessities in the back and goes to community meeting spaces and doorsteps of individuals. The older people can conduct a walking exercise on their way to the moving stall and back. They can also conduct conversations with others around the moving stall. A saleslady actively talks to the older people coming to the moving stall. She also takes a role in providing daily attention and care for the community.

B. Our Approach for Frailty Prevention

We hypothesize that physical activity and sociable communication will increase if older people have more interactions with others and the outside environment. We believe that by raising their interest in the surrounding daily activities could help improve their interaction with the outside society. To achieve the above, we install a chatting bot in the moving stall. Chatting bots have been used in counseling [3], coaching [4], and conversations with people [5]. However, there is few case of chatting bot used for prevention the physical and social frailty. The chatting bot has functions of conversation and playing a game. We hope that older people could be interested in the chatting bot. If they visit the chatting bot, their physical activity will increase, which prevents their physical frailty. If they enjoy conversations with a chatting bot, their sociable communication will also increase, which prevents their social frailty. This study is approved by The Ritsumeikan University Ethics Review Committee for Medical and Health Research Involving Human Subjects.

II. Proposed Method

This section describes an interaction pattern and a developed chatting bot.

A. Interaction Pattern between Chatting-bot and Older People

Figure 1 illustrates the interaction pattern between our chatting bot and older people. The chatting bot changes its
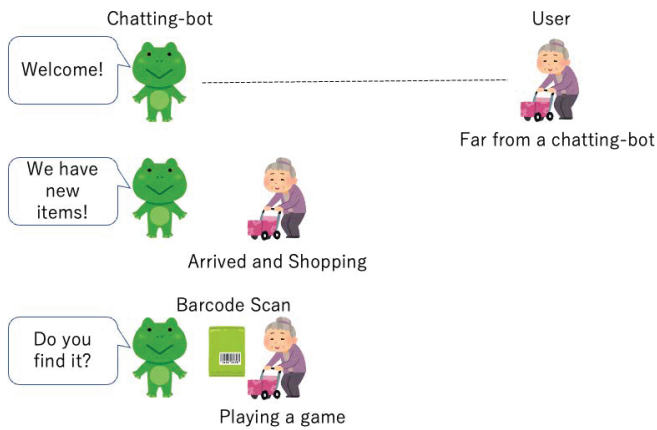
Figure 1. Interaction pattern between our chatting bot and older people.

Figure 2. Inside of a moving stall (left). Foods and daily necessities are sold. Developed chatting bot as a stuffed frog (right).

behavior according to the distance from older people to attract them closer to the chatting bot. If the older person is far from the chatting bot, he says a greeting to draw their attention. If they approach the chatting bot, he will announce new items and invites them to play a game with him. If the person is close to the chatting bot, he welcomes to enjoy the game.

B. Developed Chatting-bot

Figure 2 shows the appearance and construction of the chatting bot. The chatting bot mainly has two functional components: (a) human and object detection by a camera and (b) a speech function using a pair of speakers.

C. Human and Object Detection

For human and object detection, the chatting bot uses a camera to capture real-time frames. YOLO is used for human and object detection. For human detection, the chatting bot will first detect whether a person is in the frame. If a human is found, the chatting bot will estimate the distance from the human to determine whether the older person is far from or close to him. The estimation result is used for the interaction pattern's selection.

In object detection, the chatting bot recognizes the barcode of items to judge whether they are newly listed. A list file is prepared to store the information of the barcode and a the item's name. If a recognized barcode is included in the list, the item is judged as a listed new good. If not, the item will be judged as a former product. The judgment result will be used for speech response selection.

D. Speech according to Detection Result

The chatting bot gives speech responsens depending on the human and object detection result. There are two situations of human detection results; older people are far from the chatting bot or close to it. If the older people are far from the chatting bot, the chatting bot gives speeches designed to attract their attention. For example, "Hello, please come here," and "Welcome to our shop" are given with a synthesized voice. In contrast, if they are close to the chatting bot, the chatting

bot gives speeches to prompt new items and invites playing a game. For example, "New goods are coming" and "Please find it" would be given with a synthesized voice.

There are two results of the selected items' detection: a newly listed product or a former product. If the selected good is a new one, the chatting bot gives a speech "That is correct. The good is a new one called (good's name)." Conversely, if the selected good is not a new one, the chatting bot gives a speech "That is not correct. Please find it again."

III. CONCLUSION AND FUTURE WORK

This paper proposes an installation of a chatting bot on a moving stall to prevent the physical and social frailty of older people living in an aging community with a low birthrate. The chatting bot attempts to interact and make conversations with older people. If older people are interested in the chatting bot, the chance of physical exercises and sociable communication will increase, which prevents physical and social frailty.

We ask the residents in Yogo Town (Shiga, Japan) to join the experiments with the chatting bot. We will survey the effect of the installation of the chatting bot for the prevention of frailty.

REFERENCES

[1] X. Li, Y. Zhang, Y. Tian, Q.Cheng, Y. Gao, and M. Gao, Research Progress on the Intelligent Health Management of the Cognitive Frailty of the Elderly. In Proceedings of the 2nd International Symposium on Artificial Intelligence for Medicine Sciences, pp.53-57, 2021.

[2] Z. Sáenz-de-Urturi and O. C. Santos, User Modelling in Exergames for Frail Older Adults. In Adjunct Publication of the 26th Conference on User Modeling, Adaptation and Personalization, pp.83-86, 2018.

[3] N. Suresh, N. Mukabe, V. Hashiyana, A. Limbo, and A. Hauwanga, Career Counseling Chatbot on Facebook Messenger using AI. In Proceedings of the International Conference on Data Science, Machine Learning and Artificial Intelligence, pp.65-73, 2022.

[4] J. Casas, E. Mugellini, and O. A. Khaled, Food Diary Coaching Chatbot. In Proceedings of the 2018 ACM International Joint Conference and 2018 International Symposium on Pervasive and Ubiquitous Computing and Wearable Computers, pp.1676-1680, 2018.

[5] M. E. Kamali, L. Angelini, D. Lalanne, O. A. Khaled, and E. Mugellini, Multimodal Conversational Agent for Older Adults' Behavioral Change. In Companion Publication of the 2020 International Conference on Multimodal Interaction, pp.270-274, 2021.