"Knock Knock, Here Is an Answer from Next Door": Designing a Knowledge Sharing Chatbot to Connect Residents

Community Chatbot Design Case Study

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ABSTRACT

Our purpose is to investigate the potential use of chatbots for information sharing and social connection within a co-living space. To this end, we designed a chatbot for residents of a co-living space based on the following principles: (1) The range of shared information is limited to three areas derived from the similarities of the residents, and it takes a 'give-and-take QnA' structure, where one should answer a question from another resident after they ask a question. (2) Conversation is designed to resemble a human-like dialogue to reveal the presence of other residents. 19 residents of a co-living space used the chatbot for a week through the Wizard of Oz method, and six participants were asked about their chatbot experience through a semi-structured interview after the usage. A total of 58 interactions occurred, and the reply rate of the chatbot's question was 76%. The interview revealed that the users were satisfied with chatbot's provision of information that could only be given by fellow residents, and the chatbot increased the presence of other residents, creating a feeling of social connection. We conclude the paper by proposing design principles for chatbots in collective housing.

CCS CONCEPTS

• **Human-centered computing**; • **Interaction Design**; • **Interaction design process and methods**;

KEYWORDS

co-living space, chatbot, case study

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1 INTRODUCTION

As single-person households are rapidly increasing, co-living spaces are emerging as an alternative housing option due to relatively low costs and possible social contact. *Co-living space* refers to the housing model that combines private living spaces with shared communal facilities, such as dining spaces, parking lots and gyms. Generally, the residents of the co-living spaces are younger adults who expect suitable facilities as well as meaningful social scene [6, 13]. Naturally, smooth communication is a must for a satisfactory co-living experience, as residents need to exchange information related to space use, share opinions with space managers, and also build social relationships with each other. [1, 8].

However, the co-living space we are interested in is different to the typical co-living experience described above. The share space, along with our Living Lab, is located in the Gwanak-gu district of Korea, which is well-known for its abundance of students and job seekers. As of 2020, Gwanak-gu district has recorded the highest proportion of single-person households out of all districts in Seoul and there are more than 600 institutions for examinees and job seekers concentrated in this area [7, 9]. Needless to say, the district exudes a busy atmosphere focused more so on livelihood than social and recreational activities.

Chatbots provide consistent answers quickly and operate 24 hours a day, so users can obtain information easily and efficiently [3, 5, 11, 12, 18], especially in COVID-19 [12, 19]. Managers can save the trouble of individually answering all inquiries. Meanwhile, residents can obtain necessary information instantly while quelling the inconvenience of not being able to directly ask questions because they cannot meet anyone in person. In addition, chatbots can enable social connections between users unlike FAQs or wikis [16, 17]. This shows the potential for chatbots to allow un-burdensome, light social connections.

Taking the current situation into account, our research question is: *How can chatbot enable social connections within a passive co-living space?* We begin with a preliminary study to explore and

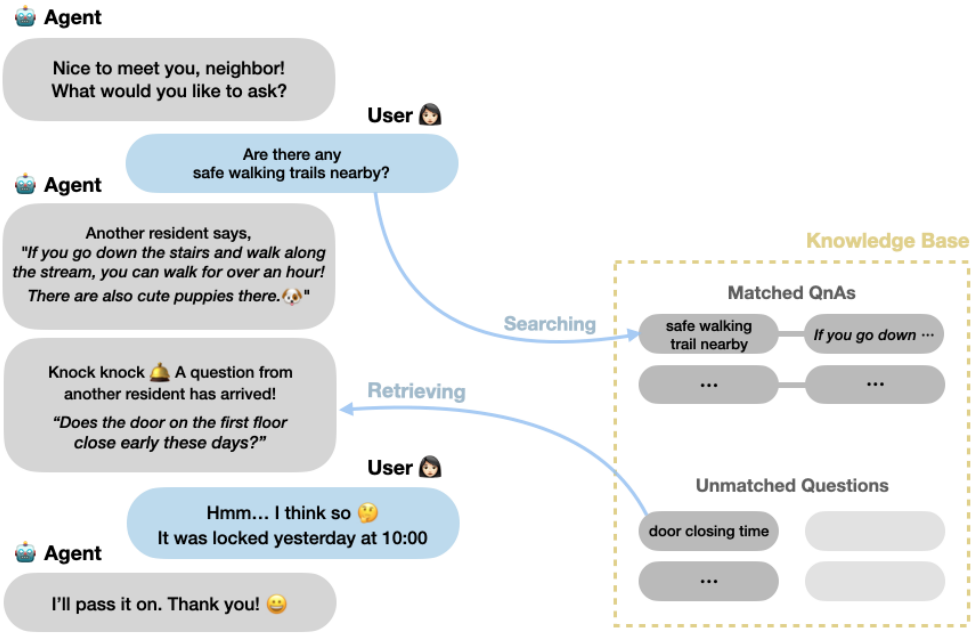

Figure 1: The Structure of *ShareOneWiki*. When a user asks a question, the chatbot searches the answer in the *matched QnAs*. If there is an answer, it is retrieved. If not, the question is saved in the *Unmatched Questions*, later delivered to another user, and the received answer is saved.

understand the communication experiences of the residents, as described in section 2. In the next section, we walk through the chatbot design in accordance to the two considerations and operated it with the Wizard of Oz method to collect initial data. In the discussion section, we suggest our chatbot boundary, structure, and conversation design as engagement factors. We conclude this paper by addressing the limitations and future direction of this research.

2 PRELIMINARY STUDY

Prior to designing a chatbot, we conducted a semi-structured interview with six co-living space residents and two managers to understand their communication patterns. The residents had five to seven months of experience in a co-living space. The findings of the interviews are as follows.

- *Existing communication method*: There are group chats for each floor, comprised of according floor residents and a manager. Four out of six residents said that group chats are mostly used for announcements and not small talks, and that communication is limited to cases that are highly practical such as security issues.
- *Communication between residents*: Four out of six residents wanted to interact with others but they could rarely encounter other residents. This is likely due to their irregular daily patterns and busy lifestyles. Also, there is no opportunity to meet other residents since all the regular meetings have been cancelled due to COVID-19. Two interviewees said that deeper interaction with other residents is unnecessary and is a waste of emotional energy.
- *Inconvenience from lack of communication*: Five residents mentioned that they had experienced inconveniences because they were not aware of instructions or rules concerning shared spaces or facilities.
- *Communication with managers*: Managers can directly contact each resident, and they receive a number of repeated questions about the facilities. Managers felt the need to archive responses to specific questions.

From the results of our preliminary interview, we found the need to accumulate information about the co-living space and the need for light connection between the residents through a medium.

3 MAIN STUDY

For the main study, we designed our chatbot based on two design principles and conducted a case study with 19 co-living space residents for a week. We then conducted a semi-structured interview with six of the participants about the chatbot experience.

3.1 Chatbot Design

Our chatbot, *ShareOneWiki*, was established for the residents of a co-living space. The base process of the chatbot is shown in Figure 1. When a user asks a question, the chatbot searches the answer in the *Matched QnAs*. If there is an answer, it is retrieved. If not, it says '*Hmm. . . I will ask another resident*', and the question is marked as '*Unmatched Questions*'. One of these '*Unmatched Questions*' is later delivered to another user when they use the service. There is also an additional function named '*Random Advice*' that provides a random question-answer pair. The two main design principles cover (1) chatbot boundary and structure, and (2) conversation design.

3.1.1 Chatbot Boundary and Structure. The range of shared information is limited to three areas derived from the similarities of the residents, and it takes a 'give-and-take QnA' structure, where one should answer a question from another resident after they ask a question. Users tend to prefer information provided by similar users [4]. The common features of our participants were that they share the same residence, live alone, and are living in the same area. Hence the three types of information provided were (1) life hacks for single-person households (e.g. 'convenient breakfast for singles'), (2) tips about the shared spaces (e.g. 'whether the books on the ground floor are rentable'), and (3) information about the local area (e.g. 'products on sale at the local supermarket'). These types of information are especially preferred when they are based on actual experience of fellow residents. The give-and-take QnA structure looks to build upon the knowledge gathered from the residents and encourage the residents to share helpful information to the community.

3.1.2 Conversation Design. Conversation of the chatbot is designed to resemble a real dialogue between people to reveal the presence of other residents. Under the aforementioned chatbot structure, the user's speeches are delivered word-for-word(the quotes in Figure 1). User speeches are preceded by a phrase, '*Another resident says*', in order to reveal the presence of other residents. The study by Narain et al. [14] mentions that chatbots are able to provide 'a feel of talking with users, not a chatbot' by bringing out the presence of other users to the fore. Our chatbot utilizes this approach to use the perception of talking to other residents as a means to provide comfort and friendliness to the user. Additionally, our chatbot incorporates various semi-verbal expressions (e.g. "*Hmm. . .", "Knock Knock*") and emojis to appear friendly and approachable [10].

3.2 Study Design

The chatbot was used for a week in the month of October 2020 by 19 residents of a women-only co-living space. The average age of the participants was 26, ranging from 20 to 34. Ten participants were students, six identified themselves as office workers, and three were unemployed. The chatbot was operated in the Wizard of Oz format to collect initial experiential data. Information about the rules of the co-living space was acquired by the manager. The chatbot was based on the mobile messenger '*KakaoTalk*', and it was operated for a total of five days from 8:00 to 22:00. After using the chatbot, the contents of the questions and answers, the types of questions asked, and the number of responses were analyzed.

Six out of 19 participants were selected for semi-structured interviews about their experience with the chatbot. The interviewees were selected based on their duration of chatbot use. We selected two participants from users who logged a single day of use, one participant each from the two- and three-day usage groups, and finally two from the four-day usage group. Interviewees answered questions regarding the strengths and weaknesses of the chatbot. Thematic coding was done afterwards to analyze the interview quotes.

3.3 Chatbot Usage and Interview Results

A total of 58 interactions occurred during the five days of chatbot case study (M=3.05, SD=1.36 per individual). The reply rate of the chatbot's question was 76% (M=.41, SD=.33 per individual). 65.7% of the responses were actual life hacks and information, and 34.2% of the responses were "I don't know." There were 39 questions about the local area, eight questions about their shared space, one question about life hacks, and six questions that asked for a random advice or things outside the chatbot's boundaries. Of the local area questions, 17 were about restaurant recommendations, 13 about nearby points of interest, and three about places to walk. Of the questions about the shared space, five were about the space usage instructions, and three were about password.

The interview results were organized into six topics, which are listed in Table 1 in the order of highest to lowest number of mentions. We will explain this in more details in the following section.

4 DISCUSSION

This study was conducted to investigate how knowledge sharing chatbot enables social connections within a passive co-living space. We suggest the following factors as answers.

4.1 Engagement Factor 1: 'Residents Only' Experience-based Information Sharing

Setting the chatbot boundary to match the residents' surroundings has increased engagement of our service and the community. From the usage logs, we found that demand for information regarding the shared spaces and the neighborhood was high. In our interviews, 5 out of 6 users were pleased that they could find relevant information from people who are similar to themselves, especially in common areas between them. In addition, reflecting residents' actual living radius on the chatbot could induce experience-based QnAs. Two interviewees responded that the chatbot was more reliable for finding local shops or restaurants than internet search results that can include advertisements, and that they were satisfied when they visited in person. This shows the importance of considering the similarities of the users in physically co-located spaces.

In addition, the 'give-and-take' structure allows users to feel the presence of other residents by exchanging questions with each other. This has the potential to act as a factor that encourages engagement not only for the service, but also for the community. Given the fact that users replied to each other's questions in 76% of the time, despite the fact that the residents are strangers to each other show the potential of a cooperative community.

A thorough knowledge base and dialogue management are essential elements for a well-organized and direct responses in chatbots [2]. We present a new direction for the knowledge base and dialogue structure based on the chatbot's boundaries in a shared space for future studies.

4.2 Engagement Factor 2: Designing Human-Like Conversation

We designed a human-like conversation based on three factors to connect residents indirectly and comfortably.

(1) We delivered QnAs just as they were answered, word-for-word. The incorporation of (2) Phrases that reveal the presence of other residents (e.g. *"Another resident says"*) and (3) various expressions like "*Knock Knock*" and "*Hmm. . .*") were meant to further encourage friendliness and in turn, more usage. As all interviewees

Table 1: Six topics derived from the interview results

Topic	Example Quotes
Feeling of Connection	"When it said, 'another resident says,' I thought, 'Wow, I might not have met this person'. . . It was fun." (P01) "Even though I wanted to ask some questions to other residents, it was awkward and I didn't know how to contact them. But since it(chatbot) delivers anonymously, I worried less about asking questions." (P03) "Because the chatbot says 'another resident says,' I felt like I was listening to her experience directly." (P04)
Tailored, Experience Based Information	"I was totally satisfied because this service is only for this house." (P04) "(All users) have a similar life radius, so I could ask or give information based on my experience." (P05)
Friendly Tone	"It felt friendly because the answer wasn't in a mechanical tone. It was like an answer from a friend or an acquaintance." (P02) "It felt like asking a close friend, so it wasn't uncomfortable to ask." (P05)
Sense of Trust	"The Internet has all these ads, but this service gives information from fellow residents who live here, so it's trustworthy." (P02)
Not Always Answered	"There were quite a few questions I couldn't answer." (P03)
Need to Notice the Questioner	"I wanted to know if my question was delivered to others and whether it was answered." (P06)

mentioned, these UX factors provided the residents with increased interest, comfort, and a sense of communication. Furthermore, two out of six interviewees mentioned that they had resolved their minor communication needs, such as "*Even though I wanted to ask some questions to other residents, it was awkward and I didn't know how to contact them. But since it(chatbot) delivers anonymously, I worried less about asking questions.*" (P03) We confirmed that in a situation where face-to-face communication is restricted due to reasons like COVID-19, chatbots are a potential indirect mediator between residents. Over time, the sense of social presence mentioned by the interviewees could extend to become emotional connections between residents [15].

5 CONCLUSION & FUTURE WORK

We designed a chatbot that enables light communication while sharing necessary knowledge between the residents. The range of information shared is limited to three areas derived from the similarities of the residents, and it takes on a 'give-and-take QnA' structure. Human-like dialogues were chosen to reveal the presence of other residents. The reply rate of the chatbot's question was 76%, and the users were satisfied with chatbot's provision of information that could only be given by fellow residents. The residents felt the presence of other residents when using the chatbot and it gave a feeling of social connection. We then proposed design principles for chatbots in collective housing.

In future research, it will be possible to implement a sustainable chatbot by automating the accumulation of QnAs. Also, the limitations that were outlined by the interviews must be resolved. For example, interviewees who gave responses in the 'Not Always Answered' category were asked questions such as *'inexpensive gas stations nearby'* when they do not own a car. It is necessary for the chatbot to deliver questions that fit the user, by predicting the likelihood of an answer. An additional notification function could also be added to solve the problems of 'Need to Notice the Questioner'. Furthermore, other types of chatbot may be attempted for transitioning conversations from digital spaces to physical space.

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