Service Design of Intergeneration Home-Sharing System Using VR-Based Simulation Technology and Optimal Matching Algorithms

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Abstract. Services that allow Share house between elders and young adults are becoming more prevalent to fulfill various needs for different stakeholders. However, various difficulties among the residents who are strangers from different generations are likely to occur. Research aim is to solve this social phenomenon by applying interdisciplinary total design solution. This research suggests an integrative solution to support optimal matching of cohabitants by developing matching algorithm and then implementing spatial mapping and simulation system using VR technology. Service blueprint that represents total service design solution for seamless user experience is suggested. Our system has the potential for industrialization and field application through service packaging.

Keywords: Total service design · Home sharing · VR-simulation · Matching algorithm · Service blueprint

1 Introduction

Intergeneration home-sharing programs have emerged to fulfill the needs for accommodations for the elders who want to reduce loneliness [1], and young adults who want to minimize dwelling expenses. Such services are also called Shared Housing, in which seniors and college students share housings, where students provide maintenance and chore services for the elder homeowners who provide boarding [2]. The concept of shared housing among elders and students occurred since 1980s [3], but due to physical, social, psychological, economic and health consequences of living together, share house services have become more popular since 2000s [4]. The two generations have consensus for sharing living spaces because it is beneficial for both elders and college students. However, conflicts among the residents are likely to occur when sharing a house with strangers of different generations. To prevent conflicts between cohabitants, current home-sharing programs provide matching services [5]. Existing matching services collect inhabitants' profiles and ask questions about residency needs and then pair up people with similar responses [6]. Furthermore, these questionnaires

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do not consider complex social traits of people nor spatial traits of the residency, which is not sufficient enough to solve fundamental problems. Although social interactions between the home shares are crucial, they are actually sharing living space. In the case of home sharing of elders and young adults, the house is pre-owned by the elders with furniture and living space arranged in the current dweller's lifestyles. The new comer is likely to have his or her own furniture with distinct lifestyles including living behaviors and preferences [7]. The moving patterns during daily activities or furniture arrangements caused by differences of life styles between users cannot be predicted by matching services, which are found while living together. Social phenomena caused by gaps in generations due to social structure exists. Our research team aims to provide total design solution by applying interdisciplinary methodologies, by applying technology to simulate home sharing experiences. This research suggests an integrative solution to support optimal matching of cohabitants by developing matching algorithm and then implement spatial mapping and simulation system using VR technology. Specific goals and solution directions will be discussed in the following section.

2 Total Design Solution for Integrative Home-Sharing System

The goal of the research is to provide milestone for developing a comprehensive total service design for potential home sharers including two generations; elders and young adults. The service solution is divided into social psychology aspect and spatial-technological aspect. This study aims to explore the service of home-sharing based on convergence between sociological and science technological approach. The aim of the service is to provide matching between co-habitants through thorough analysis of the potential dwellers, and to provide pre-living experiences through VR based simulation to provide more satisfactory living experiences. Figure 1 shows overall background and solution methods for each aspect that provides guidelines for the total service system.

2.1 Solve Social Problem Through Developing Optimal Matching Algorithm

Providing methods to match home sharers who can live harmoniously is essential. The social approach suggests an optimal matching algorithm which is based on multi-dimensional analysis considering their needs, characteristics, and lifestyle of each parties. Furthermore, a transportation network and residential area analysis is take in place for supporting the matching system more realistically since geographical preferences are crucial factor selecting an accommodation.

2.2 Solve Spatial Problem Through VR Based Interior Support System

Simulation technology will be developed upon human-behavior to carefully examine the matched individuals and provide them close to real experience before moving in.

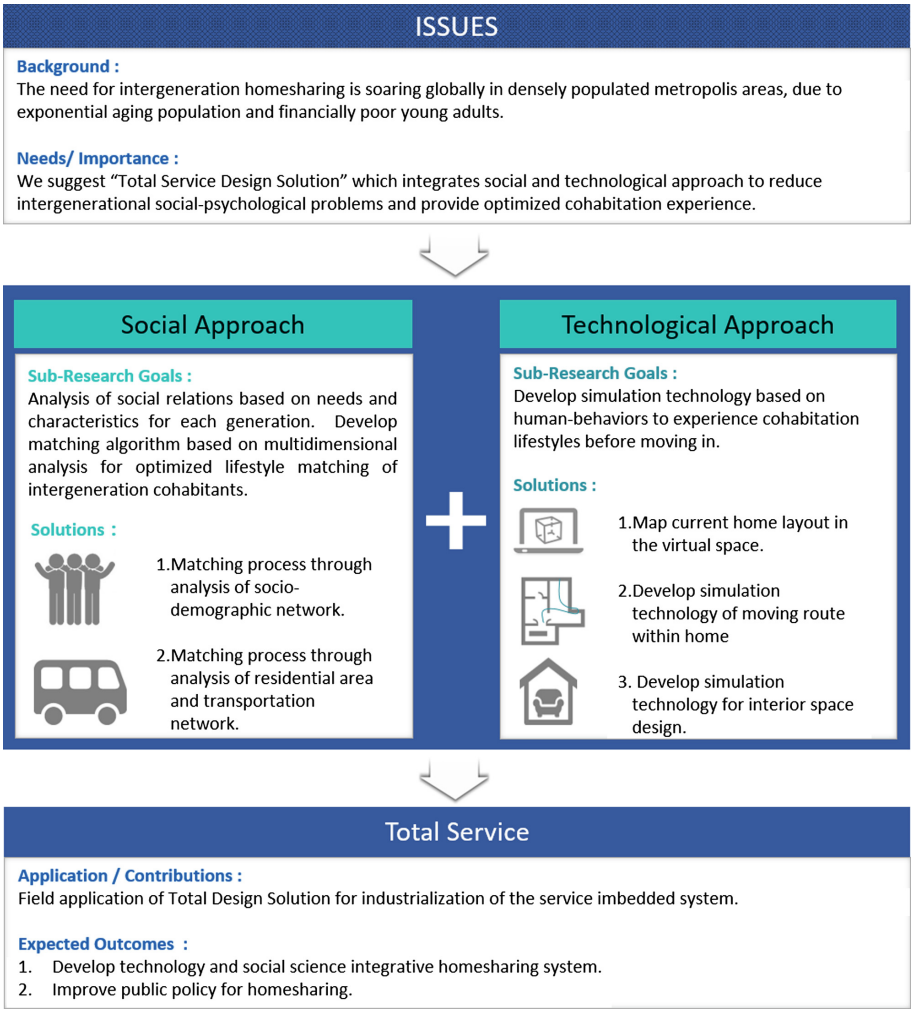

Fig. 1. Total design solution for integrative home-sharing system

And this approach designed in three parts. Augmented Reality based space design framework that arranges furniture will be developed upon the existing accommodation layouts. The simulation technology of moving route of both individuals will be also developed with the simultaneous consideration of furniture arrangement. Third, moving routes and the furniture placement greatly influenced from the matching algorithm and interaction of them. Furthermore, the simulation of a color and texture for the interior wallpaper is implemented to provide a lifelike experience for AR visualization.

2.3 Integrative Total Service System

The total service design for Home sharing service will be designed by integrating these above mentioned social matching and technological simulation approach. Final goal of designing Integrative total service design is for field application of service imbedded system. Expected outcome of implementing the service is development of technology and social science integrated home-sharing system which can lead to improving public policy for home sharing.

2.4 Service Blue-Print for Home-Sharing System

In order to describe more specific procedures of how the services will be implemented, a Service blue-print of total service design that combines matching algorithm system and simulation system based on VR is shown in Fig. 2. The service is targeted for potential homes-sharers. More specifically, the targets users are elders who own houses and young adults who needs residencies. This total service solution consists of four steps. First, user recruitment period to apply people who are interested in home sharing. In this step, people participate in surveys to find optimal pairing up of candidates for home sharing based on their lifestyles, social relationships, and geographical preferences. To implement this steps, the part of social relation and social network analyzes users to recognize their features of characteristic, hobby, ethnographical information, patterns of transportation and residential needs by developing matching system based on multidimensional analysis. Next part shows simulation of spatial interactions based on VR technology. To construct VR simulation for experiencing expected interactions, the simulation system needs to recognize user's flow in the home and interactive features. Then, the system analyzes house owned by the elders to retrieve interior information such as functionality of furniture, floor plan, and such. The second step is individual's home sharing selection period. After the result of best matched pairs is given, potential home sharer selects where and with whom he or she wants to live with. Then, users visit the candidate of selected home. After selecting homes, users experience their home-sharing experiences through VR simulation system constructed by the part of spatial interaction and modeling based on VR. While using tablet PC to simulate how the living will be with home owner and potential home sharer, they can place furniture on the virtual reality system and make consensus of how to use the living space. Furthermore, the system can recommend optimal placements of furniture or moving routes for both dwellers.

Third step is actual home sharing period. When the period of actual home sharing ends in the fourth step, they evaluate and give the feed-backs through the final questionnaire based on the P.O.E. (Post Occupancy Evaluation). Based on the feedbacks, matching algorithm based on life style evaluation and transportation network analysis can be improved. Furthermore, guidelines or methods for improving actual living space and expected living styles can be modified through spatial simulation systems.

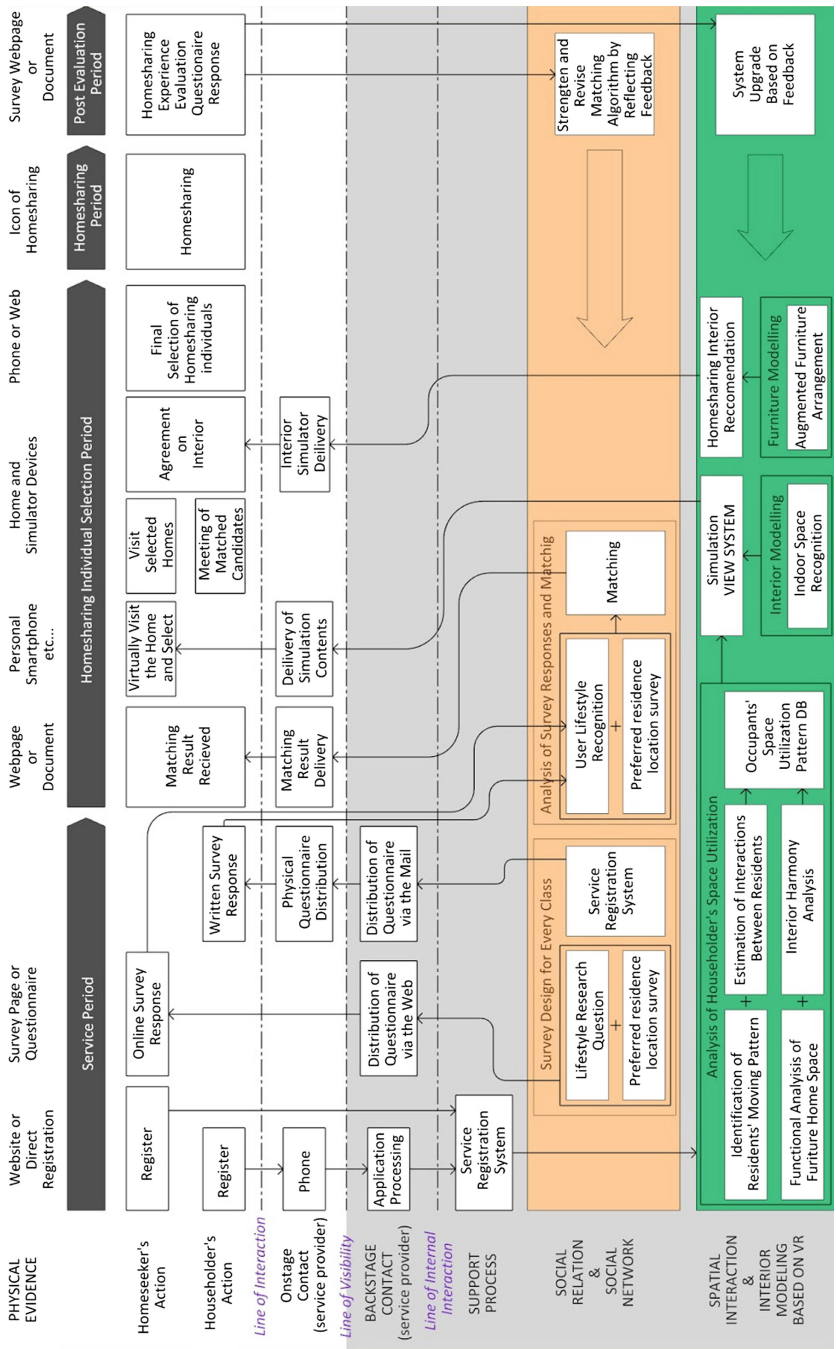

Fig. 2. Service blueprint for total solution for integrative home-sharing service

3 Conclusion and Future Work

This paper describes overall milestone and goals of the interdisciplinary service design, that aims to solve social phenomena; house sharing between the elders and young adults. Although this project is at an initial stage, further research results will be implemented in the system based service as described in the service blue print. Effectiveness of the total design solution will be tested through post occupancy evaluation, which evaluates effectiveness of dwellers' living experience [8].

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