

Using the Service Contextual Inquiry to Build the Demand for the Household Emotional Interactive Devices for Elderly and family member

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Abstract

In this study we implement service-experience engineering (SEE) framework to analyze the home-based behavior of interaction between elderly with family member, and identify hidden needs for strengthening inter-generational relationships and harmony as a turning point for new product innovations in home-based interactive devices. The service experience observation method is combined with fixed-point observation, while experience interview method is based on the home experience framework, then interaction, tool artifacts, and other entity model are used as action patterns to carry out the potential demand analysis of home interaction device for the elderly. Its overall demand mainly consist of four points: (1) Improvement of inter-generational relationships requires the active care of family members. (2) The improvement of inter-generational emotional interactions requires accurate mastery of parental responsibilities. (3) The chairing design of the living room is used to understand and document parental life practice, (4) Big data parental lifestyle records are analyzed. Based on the above methodology, an interface of interaction device for elderly is designed with Internet of Things (IOT) technology.

Key words: Service Experience Engineering, Home Caring Devices for Elderly, Emotional Interactions between elderly and family member, Iot

Introduction

The interaction between elderly and family member is an important issue in society. Relationship between elderly and family member is weakening because of social changes. Although social changes have led to changes in family life, the elderly may also be separated from their children, but the importance of family relations is more valued and expected by the elderly [1]. For families with elderly members, the emotional support of family members and family communication and interaction are two of the most important issues [2]. The emotional connection and interaction between the elderly and the children is an important indicator of inter-generational relationships. Improvement in interpersonal relationships is more helpful for the mental health of the elderly [3] and effectively reduces the risk of Alzheimer's disease [4].

At present, the design focus of intelligent living space is mainly focused on supporting and monitoring the basic activities of the daily living (ADL), such as the action of the elderly, bathing, toilet, diet, etc. For example, European Union promotes ambient assisted living (AAL) research program [5]

by employing a variety of sensing technologies and electronic products to create a smart home living environment, assisting the elderly to maintain independent living and personal privacy. In other examples, a microprocessor and wires are embedded in the fabric of a smart sensing mat, and the user's foot image and position can be sensed and displayed in the computer [6]; by embedding an optical fiber sensor or a piezoelectric sensor in a wooden floor, a communication system is used to transmit various interactive information in a home environment [7].

Research Method

In this study, the data of elderly, such as their habit, behavior, need, and expectation, were collected with observations and interviews. Observations were conducted during the interviews to observe the life-style of elderly and the day-to-day commodities they used. Their behavior is classified using affinity diagram. After the collection of data, a target group is defined and a target person are selected respondents for further interviews. Since researchers were unable to participate in the interview for a long time, the respondents were allowed to record their lives and emotions in the form of diary. Finally, the final data analysis was conducted with a behavioral model, and the needs of the inter-generational emotional interaction device were summarized and the design guidelines were proposed.

We investigated thirty families in three areas of Taiwan, namely north, central, and south Taiwan. Observations and interviews were conducted in order to understand the needs and difficulties of emotional interaction between the generations of each family. From thirty families of respondents, we summarized four kinds of inter-generational lifestyles, and established a group of representatives. Affinity diagram [8] was used to analyze the data. The data was represented using cards, and the cards were grouped and named as a chart. Through analyzing the data and observation interaction between elderly and family members, four types of lifestyles are found, namely: elderly living together with children, elderly living on their own, children living far, and children living nearby.

We conducted in-depth interviews with the focus group to explore the life and interaction patterns of elderly, and the collected data were sorted and classified using KJ method. Then flow model, sequence model, cultural model, artifact model, and physical model are used to analyze the results of observations to satisfy behavior modelling [9]. Finally, through the affinity graph method, the data is discussed and summarized by the focus group and integrated into the service needs and service opportunities of the products or services that promote and improve the inter-generational emotional interaction.

Findings of Potential Needs

A. Analysis of lifestyle and behavior of elderly

The objectives of the interview are mainly set at two levels. The first objective is to understand the current life habits of the elderly and their daily behavior pattern. In this way, we can understand the elderly lifestyle, as well as the people, things, and objects that they often come to contact with. The second objective is to understand the communicative interaction between the elderly and their family members. We interviewed fifteen respondents, which consist of six children of nine elderly sixty-five years old and above. One-on-one individual interview and group interview of two or three people with friends and relatives were conducted. During the interview, researcher asked questions and respondent took turns answering the questions, while other respondents were allowed to express their opinions. According to the interviews and observations, the areas and events of elderly's regular activities were identified. From the observation, we found that the field of in-depth interaction between elderly and the child was usually a private residential place. The behaviors, events, objects, and relationships in the home activity environment were analyzed from the lifestyle patterns. The interaction between elderly and the children mostly occurred in the living room, and the living room was the area where they spent most of the time. Only the living room served more than one functions, and where the elderly and family member had emotional interactions. The rest of the areas, such as kitchen, bath room, and courtyard rarely served as locations for emotional interactions.

B. Persona

Based on the respondents' lifestyle and their children's living patterns, four categories were derived with the help of an affinity diagram: 1. Living together with their children, 2. Stayed together, but children had their own life, 3. Children lived at different cities, 4. Children lived separately but in the same community. Based on the above categories, six representatives were selected from nine respondents of elderly, and four representatives were selected from six children. Table 1 shows their basic data, education level, daily activity, interaction, personality, and living condition.

C. Potential needs between elderly and family member

After observation, interview, and data collection, the elderly's behavior patterns were summarized through affinity diagram. We identified the issues of inter-generation interaction in the field and everyday objects that elderly interact with in daily life. From the model data above, the behavioral patterns and potential needs of parents and children for inter-generational emotional interactions were summarized. The final four-point service requirements are summarized as follows:

1. Improvement of inter-generational relationships requires the active care of children. From interview and interaction modules, even living together children, they don't know how to express their concern and repeating the same dialogue does not solve any problem for elderly. And after children have their own family, the relation with their parents change from caretaker to caregiver. Because there is still room for interaction between the two groups, the children's attitude towards their parents is

shifted to active care for retired parents, and the inter-generational relationships are not well established.

2. Improvement of inter-generational relationships requires caring for elderly's daily activity routines. From the interview, retired parents complained that children cared and interacted with careless attitudes, and the same interactive discourse was repeated over and over. Elderly will be happy to take care of their children, but at the same time they require children to understand them in order to have good quality of interaction. Therefore, it is possible to provide a product design that is useful for elderly and at the same time able to record elderly's basic physiological information and daily routines, and also let the elderly communicate with their children at any time, even when the children live at a different city.

3. Design a chair of the living room to understand and record parents' life practice. Retired people or elderly spend four to six hours in the living room early in the evening, while bedroom is where they spend the longest time each day. Living room is the area where they spend most of the time interacting with their children. According to the observation, elderly have a habit to use the same chair in the living room every day, and family member will respect each other when they use the chair. Therefore, a chair can be designed to record their daily routines. Physiological information such as weight, heartbeat, and blood pressure of elderly is transmitted to the children through the Internet of Things. Even if they live in different cities, they can monitor and care about their parent's daily routines.

4. Analyze the parental lifestyle data. An application program of smart phone can be designed to check the daily routines and physiological information such as weight, heart rate and blood pressure collected through the chair. The data can be recorded in a cloud database system, and if users' physiological data showed unusual conditions, such as changing 10-20 percent of weight within a week, unusual timing of using the chair, and abnormal heartbeat. By providing parental information to children as the basic data for interacting with parents, the concern is not just superficial greetings, but the understanding of their daily routines of interest and interaction to promote inter-generational caring interaction.

Design Requirements for Smart Caring System

After considering the requirements for enhancing mutual caring interaction and harmony, this study presents the specifications for the design of this interactive home device as a new product innovation opportunity. The development of this interaction device for elderly will be implemented with Internet of Things (IoT) technology concept as shown in Table 1. The technology is divided into hardware and software. The hardware part will be the furniture design with embedded sensors, and the software part will be an app design for smartphones. A smart chair suitable for elderly can be designed to fit their habit. Through the sensors embedded in the chair, data are transmitted to family members' mobile phones via internet, and from the display data, children are able to understand the status and condition of their parents. The main issue of caring for elder people is not entirely about health, but also about their feeling of isolation. Older people really look forward to interacting with their distant children and loved ones, and strengthening their family relationships based on care and

mutual respect. A smart chair can be an answer to their concern.

TABLE I.
Design Requirements for Smart Caring System

Design target	Features	Demand	
User	Elderly	A comfortable and user-friendly chair space	
		Comfortable, sitting and lying down Lighting facilities Simple storage space	
	Children	Understand how parents lifestyle at home, and can effectively interact with parents	
		Transfer parental usage records and analyze usage status via a cellphone app, as basis for caring and interaction The chair is equipped with sensors to detect and record parents' activities	
Property design	Sofa chair	Comfortable chair Will not cause backache Good to sit Simple admission of personal newspapers With lighting equipment	
		Use pressure sensor to record time	
	Sensor device design	Use pressure sensor to detect user weight Use pulse sensor to record heartbeat and blood pressure	
		Time of chair use Change in body weight Heart beat and blood pressure physiological information Unusual use of chair time is presented	
	Parent-child interaction App	User interface design	Unusual change in body weight Unusual physiological information presented Emergency notification
	Server	Record, analyze, and send events to the cloud	Record, analyze, transmit usage time, weight changes, physiological information
	Cloud	Send events to smart devices	

Conclusion and Future work

Employing the service experience engineering method with contextual observation and home experience framework interview, interaction, tool artifact, physical level model, this study analyzed behavior patterns to carry out potential demand analysis of home interaction device of elderly. After considering the requirements for enhancing mutual caring interaction and harmony, this study presents the specifications for the design of this interactive home device as a new product innovation opportunity. The development of this interaction device for elderly will be implemented with Internet of Things (IOT) technology concept as shown in Table 1 and Fig. 1. The technology is divided into hardware and software. The hardware part will be the furniture design with embedded sensors, and the software part will be an app design for smartphones. A smart chair suitable for elderly can be designed to fit their habit. Through the sensors embedded in the chair, data are transmitted to family members' mobile phones via internet, and from the display data, children are able to

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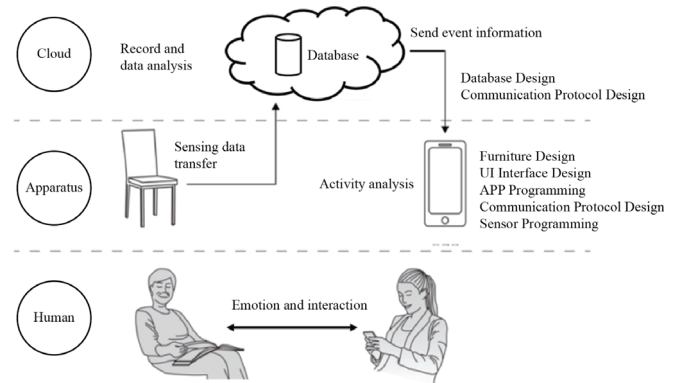


Fig 1. Interactive furniture design framework for family care

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