[Practical Paper] Life Log and its Application to Remote Consultation System

Yuya Uesugi†, Jun Sawamoto†, Norihisa Segawa†,
Eiji Sugino†, Takuto Goto‡, and Hiroshi Yajima‡

†Software and Information Science Department
Iwate Prefectural University, Japan
‡Department of Information Systems and Multimedia Design
Tokyo Denki University, Japan
sawamoto@iwate-pu.ac.jp

Abstract -Recently, opportunities that a consumer has to make choices are increasing. And, needs of the remote consultation is rising as a means of making choices efficiently. However, the burden of the expert (consultant) is large in the existing remote consultation, because there is a large difference between numbers of customers and experts. Therefore, it is difficult to carry out a consultation that considers the customer's personality and personal preferences and that matches well to the customer's needs. In this paper, we propose a technique to solve these problems by applying life log for basic data acquisition in remote consultation and present useful application examples.

Keywords: Remote consultation; Life log; Home electric appliance; Care and health consultation; Recommendation

1 INTRODUCTION

Recently, people's needs and values become more multifaceted by diversification of individual lifestyles. As a result, businesses offer various services tailored to customers' individual needs and their opportunities for choice are increasing accordingly. As the means to assist consumers' efficient selection of services, demands for remote consultation are increasing [1]-[3].

In existing remote consultation systems, it is, by its nature, difficult to propose a solution tailored to each individual customer. On the other hand, teleshopping system, for example, Amazon.com [4], can recommend products best fitted to each customer by learning the customer's latent preferences from the customer's checking and purchasing history of products and understanding the customer's characteristics of potential purchases. However, if you attempt a recommendation like this in current remote consultation systems, you ask and enquire preferences from people who are seeking advice or recommendation, and after understanding them from their responses, you recommend products accordingly, or you divide people into patterns by age, sex, yearly income, etc. and make recommendation accordingly. In any case, the procedure that you follow cannot be said better in both efficiency and accuracy.

When making recommendations for customers' individual needs, we need quantitative information that reflects the customers' personality and personal preferences. In the conventional remote consultation system, the main purpose is the problem solving, and it goes along mainly on dialogue between customer and consultant (expert). Therefore, the quantitative information that we can get is limited to data, such as age, annual income, and family structure, which does not reflect customers' preference and characteristics. Such fewness of the customers' personal data indices can be considered causing inefficient and less accurate recommendations of the existing remote consultation system.

In this paper, we intend to facilitate the consultation tailored to individuals, by collecting and analyzing life log from home electric appliances and estimating the latent characteristics of each individual. We will also further consider the application field where our consultation method can be effectively utilized.

This paper is organized as follows: Our preceding work of remote consultation system and related works concerning life log applications are reviewed in section 2. Then, we provide an overview of this research and describe the system configuration in section 3. The method of applying this research to several application areas is given in section 4. Finally, conclusions and the future prospects are described in section 5.

2 RELATED WORKS

2.1 Preceding study

In our preceding research [2][5], we created remote consultation support system using outline generation agent in order to support interrupt and resume of the session in the process of consultation, and to facilitate better individual understanding for both customer and expert. In our research, we use outline to summarize the direction of the consultation, frequency of questions, transit time of consultation, and items that the customer wants to give higher priority by analyzing history of consultation process. Then the system visualizes the process of the consultation and makes the consultation task easier.

However there are some problems remaining with the system. For example, volume of information and efficiency is not sufficient enough because the system deals only consultation record as its analysis target and can get outline information only from customers' input, and also outline is used in limited situation and doesn't make sense in short consultation where interrupt and resume are not required.

2.2 Related study of life log

There are two patterns in study about life log, one study is about a method to get and reprocess life log and the other study is about a method for utilization of life log. Aizawa [6] [7] [8] realized an easy retrieval of life log video data using the query by combining life log video data with sensor data from GPS, gyro sensor, acceleration sensor, brain wave sensor and information database of weather and town etc. to assume context of life log and electronic document data. It is very useful to accumulate life log data combining with other relevant information and acquire life log data relevant to certain events easily. But, there are some problems when we apply life log video data to remote consultation. It can help to know the characteristics of individual customer, but it is a time consuming burden to expert because the data is made up of movie data.

Ito [9] achieved the improvement of the satisfaction and discovery characteristics of TV program recommendation by using the life log, such as viewing time of the TV programs, history of visited places, WWW browsing history. In life log made of "history" like this, there are chances that much valuable information is hiding because the customer does not need to keep a record consciously. If we could use such life log in remote consultation, we can change the current status of consultation where experts make a lot of questions to know the taste, the current state of the customer to the new status where experts acquire customer's data from life log and we can expect to realize more efficient remote consultation.

There are many specific researches to utilize life log to specify preferences of users [10]. But there is no research which applies life log data to remote consultation like our research. If we could use life log to remote consultation, we think we can scale up the range of consultation from cases that allow mistakes to some extent like recommendation of daily products to cases that allow no mistake like health care consultation.

2.3 Home network

Home network technology operates home electric appliances such as refrigerator, home video etc., through home LAN. There are two types of researches of home network. One is the research of the communication protocol between the consumer electronics, and the other is the research about applications that use consumer electronics through the network.

As the example of the former case, ECHONET (Energy Conservation & HOmecare NETwork) is proposed by ECHONET Consortium [11]. It utilizes sensors and controls and manages home electric appliances over network, aiming at facilitation of energy efficiency and home care services. In 2002, "ECHONET Specification version 2.11" was defined and in 2008, "Version 3.60" was issued and also registered as an international standard [12]. Such as automatic lighting on when entering a room is often adhere to this ECHONET standard.

As examples of latter case, Lin et al. [13] proposed UbiREMOTE, and Sekimoto et al. [14] presented BAMBEE. UbiREMOTE displays the spatial layout of home electric appliances and home network on the remote control terminal to create a 3D virtual space, and the user selects the 3D graphics and operation menus to operate appliances by the centralized and intuitive manner. The user does not need to use many remote controls to operate various appliances. BAMBEE is a GUI system displayed on the touch screen. By simple operation, user can create and edit integrated services of home electric appliances. In this system, as well as for professional service providers, also for non-expert end users, it is possible to create applications easily. That can greatly expands the application range of integrated services of home appliances.

In this way, applications via the home network not only make the user's life more convenient but also promote efficient energy usage. However, these applications are mostly intended to send commands to the appliances via home network; we cannot find much study of handling life log and applying to various applications as we intend to do in our research.

3 PROPOSAL OF AN APPLICATION OF LIFE LOG TO REMOTE CONSULTATION

3.1 Outline of the research

Purpose of this research is to take advantage of personal information in daily life. We propose a system to get information of usage log from home electric appliances like TV, refrigerator, mobile phone and etc., then, to accumulate those logs through home network and to use it to remote consultation. We assume Android [17] based home electric appliances to access for getting life log. In addition, by using information obtained from these appliances, we discuss the application field of remote consultation support system to assist in the selection of products or service suited to personal preferences.

3.2 Life log

Typically, the word of life log means mainly video data like home video, and we use big machine like video camera for getting information. Consequently, it is hard to get life log easily from the point of mobility. However advancement of technology like mobile and wearable computer, and etc. enables us to get information with handy devices, e.g., a mobile phone with camera and GPS function. And services that gather and organize acquired information on the network as life log are provided from some providers already [18]. However we must make the log consciously like photo shoot in almost all of these services, and such data is fragmentary depending on the log-taker and log-taker may abandoned some data arbitrarily. Recently, it came to be able to acquire log information without user's consciousness by the appearance of the Android consumer electronic, and the method of using the life log extended greatly. Examples of life log that can be obtained from home electric appliances are shown in Table1.

From home electric appliances with communication function like mobile phone, life log concerning an individual activity history like the sojourn time in a stay place and a specific base etc. can be acquired. From the consumer electronic for the amusement, life log concerning the characteristic of contents that the person watches, the contents type of the favor, and media, etc. most often used can be acquired. Moreover, from the life consumer electronic, a potential characteristic what the person values in life for food and clothing etc. and the life time pattern can be presumed. If the mentioned information can be used for the remote consultation, the difficulty to grasp individual characteristics can be solved.

Table 1: Life log examples from household electric appliances

Type of electric appliance	Name	Life log Data
Communication	Mobile phone	Daily activity log
Amusement	TV	Watched TV programs, Watching hours
	Radio	Listened Radio programs Listening hours
	DVD	Watched DVD software Watching hours and recording information
	CD	Listened music Listening hours
Daily life	Refrigerator	Used hours
	Washing machine	Used hours, weight, wash type
	Microwave	Used hours, cooking menus
Others	Car navigation	Mobile history

3.3 Acquisition of life log from consumer electronics

As an example of life log acquisition from consumer electronics, NTT DoCoMo has provided smart tap [15] and Zojirushi Co. and NTT have introduced watching electric pot (i-pot) that sends a signal to a regional treatment center every time the pour button is pressed [16] etc. The former is plugged into an electric outlet in the house and used, by connecting home appliances to it, to measure the amount of electricity used. The latter is an air pot with wireless LAN to send a signal to the network when the pour button is pressed and the signal confirms to care givers that the elderly persons under their care are safe. Most of these existing products are achieved by giving some external devices. When information is acquired like this, information is not retrieved correctly in some cases. For example, if the device is got off by external shocks, until it is noticed and fixed, information cannot be obtained. Also, the system is weak for arbitrary falsification of information by the customer.

In our proposed system, we process by software as much as possible without using such external devices. Android consumer electronics process interrupt instructions such as pressing a button by installed Android OS. This means that user applications can detect the interrupt instructions to get all the history of buttons used. By using external devices only where not using button operations, the aforementioned information leakage, tampering can be minimized, and it is possible to obtain information of life log close to individuals' real life. Although, Android consumer electronics that are currently sold are very few, for example Android TV, Android refrigerator are in the market, we expect wide variety of Android based appliances come out in the near future.

3.4 Outline of the proposed system

We show framework of the proposed system in Fig. 1. Home electric appliances send life log to cloud service regularly. Cloud service deposits life log data and arranges, processes according to the usage. When the expert requires, processed life log are once sent to the customer, and after customer's approval for the sake of privacy, the life log is forwarded to the expert. By using life log data in this framework, we can utilize remote consultation system applying life log data regardless of the place you stay.

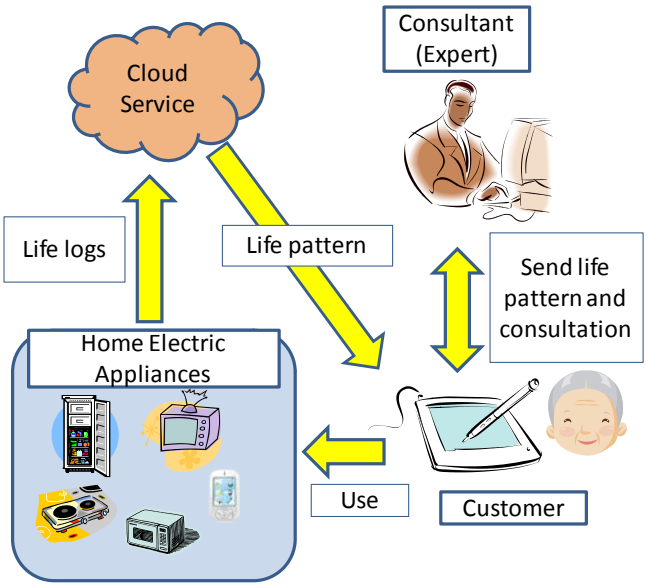

Figure 1: Framework of the proposed system

3.5 Process of life log

In this study, we get life log data from many tools. As a result, the volume of data that we treat in the system becomes very large and there exists a lot of data which identifies each individual. Therefore, when we use the data in remote consultation system, we have to process data and make it easier to apply to the application field (see Fig. 2), and protect the privacy of the customer. The method of data process changes according to the target area of remote consultation. For example, when we apply this system to the area of elderly people's care, we can propose a care plan that match to the customer's life pattern, such as ordinary daily life pattern or specific occasion's life pattern, etc., from life log of mobile phone's mobile history, time record

that the customer used home electric appliances first in the morning, etc.

As an example in the area of care support, the simplest way to create and use a life pattern is shown in Fig. 2. Information acquired is as follows.

(1) Movement history from a mobile phone with GPS
(2) First and last time to use consumer electronics in a day
(3) Duration of usage of appliances related to cooking
(4) Duration of usage of appliances related to entertainment
(5) Duration of usage of bathroom equipments

From (1), the person's movement pattern and habitual outing can be derived. Moreover, a cycle to go out to see a doctor or the time to stay in health-related facilities can be acquired. Based on this information, the future planning for various activities including medical examination, etc. can be efficiently achieved. From (2), person's activity hours can be got. And personalized service can be provided by giving care support according to this time schedule. From (3), food and their time trends can be obtained. By analyzing the equipment used by the customer, you can guess whether the customer is having a healthy diet or the food is cooked properly. For example, the customer doesn't use any electric appliances other than refrigerators, or only the warm menu of the microwave oven is used, you can guess the problem with the dietary habits. As for microwave, because various recipes and variety of cooking function are given, you can get even more information. Based on the information, food policy can be constructed and it becomes possible to determine whether a diet-related services as nursing care should be recommended or not. From (4), the leisure time can be estimated. And health or care visits can be arranged smoothly. From (5), the time to bathe and the person is taking bath properly or not may be determined. Based on the information, whether the bathing care should be introduced, and when should be decided. From various kind of information, daily life patterns can be read, and patterns that differ significantly by the week or by the day of the week can be identified. Then by integrating those patterns and estimating the daily life patterns, various services can be created effectively for the customer.

4 APPLICATION FIELDS

In this section, we take up some of the application fields such as care and health consultation, travel planning consultation and consider about applicability and the convenience for the user in each field.

4.1 Care and health consultation

In Japan, needs of consultation related to physical condition of elderly people are rising from the effect of rapid aging society. For example, consultations about preparation of the care plan which includes what kinds of care support the customer needs, plans for care taker's visit schedule, etc (see Fig. 3). The problem of the consultation is intractableness of getting necessary customer's information because customer is often old and sometimes information is taken from customer's family. They forget many things that are necessary for the consultation, and they don't report all the matter of necessity because they haven't enough knowledge of care. In some cases some people put on an impressive show. For example, they say "It is possible" regardless they can really do it or not. As a result, there are some cases that expert can't specify cause of bad health and the customer can't undergo appropriate treatment.

If we apply life log to care and health consultation, expert can get all the necessary information without customer's burden to record. If we are working on the care plan through consultation, the system can also check the degree of attainment of planned schedule using history of usage of home electric appliances. In this way, when we add life log in care and health consultation, we can realize high quality service and more adapted service to the customer.

Figure 2: Life pattern deduced from life log data

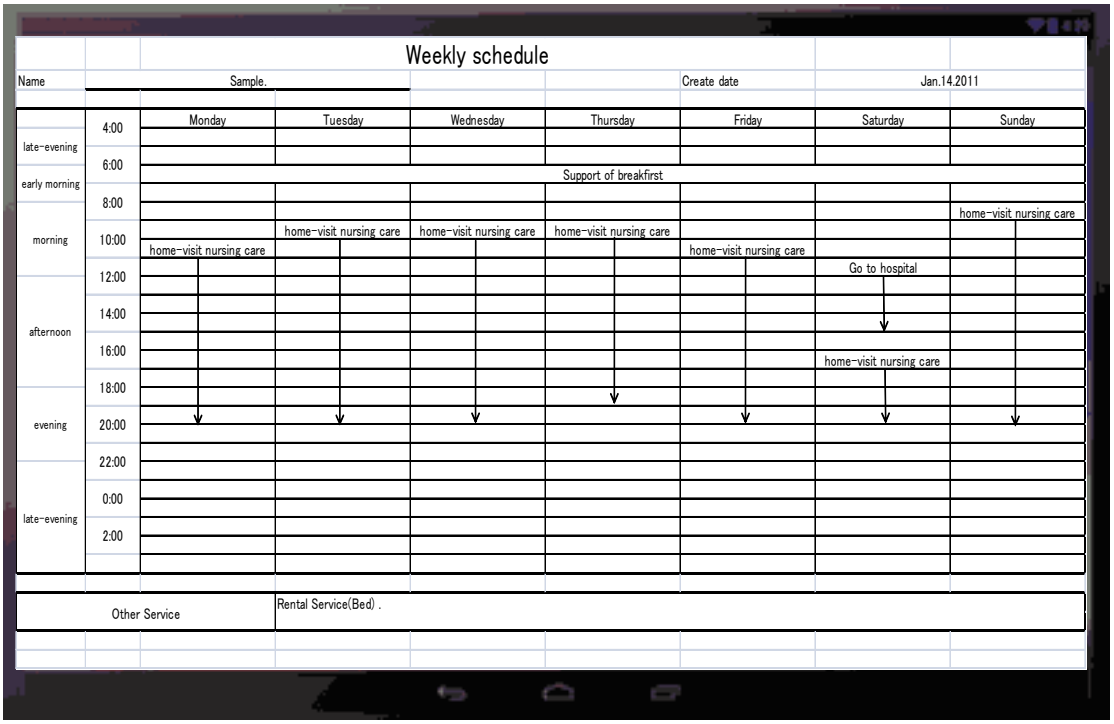

Figure 3: A sample of care plan for elderly people

4.2 Travel planning consultation

We can travel more easily by the spread of service for the trip arrangement using internet. However, researches of travel planning consultation are increasing [19]-[23] because needs of travel consultation for customers who have no specific destination or have specific destination already decided, but have no detailed plan are increasing more widely ever. But in these preceding researches, user's preferences are extracted from some direct enquiries to the customer or certain typical patterns are identified from customer's age, sex, annual income, etc. and recommendations are given based on the patterns. In order to manage a practical travel planning service, we need a huge amount of past user data and user's preferences.

Preceding systems require much effort to match to individual customer's preferences and still hard to achieve detailed consideration about personal preferences such as sojourn time at a certain visiting place. For example, a tourist probably spends more time at the visiting places that fit his/her interest. Also, some older people prefer slower tours. Thus, it is desirable that the system can estimate the time spent at each visiting place by each user, for instance, based on a certain statistical model.

By applying life log data to the consultation, the customer can deliver his preference without complicated input. Therefore, system can make the travel plan that match to customer's preferences without forming stereotypical patterns of customers. And if the system gets stay time at per kind of facilities from GPS data of a mobile phone, the system can match the sojourn time of the destination in facilities to the individual's preference. Trajectory data [19] of a user which

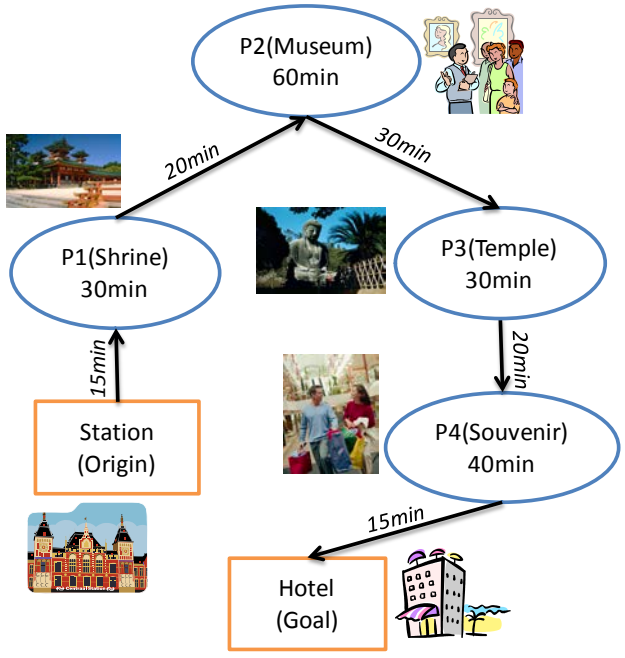

Figure 4: Sample solution for a better tour plan based on the user's preference data

show how much time he/she spends at a certain visiting point should tell something about his preference. More microscopic trajectory data to analyze the user's action in detail, what kind of routes the user prefers and where and how long the user spends time may be very useful. This way, as shown in Fig. 4, we can make up a solution for a better tour plan based on the user's preference data

5 CONCLUSION

In this paper, we presented how to get life log using the home electric appliances and examples of application field such as care health consultation, travel planning consultation. As a result, we could understand that it is very useful and it has a multiplicity of uses in consultation that closely attached to individual life, and in decision that based on individual preference. In the future, we will follow trends of home network and the development of Android-based household appliances further on to pursue feasibility of the proposed concept and system. We will continue to consider effective method of life log data processing and check the further applicability of life log data from the home electric appliances to remote consultation by constructing the actual application systems.

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Yuya Uesugi received M.S. degree in 2012 from Iwate Prefectural University, Japan. Currently, he works for ENTERBRAIN, INC.

Jun Sawamoto is a Professor of Faculty of Software and Information Science, Iwate Prefectural University. He received the B.E. and M.E. in mechanical engineering from Kyoto University in 1973 and 1975. His research interests include ubiquitous computing, human-interface system, multi-agent systems. He is a member of IPSJ, IEEE-CS, and ACM.

Norihisa Segawa received Ph.D. degrees in Information Sciences from Tohoku University, Sendai, Japan, in 2004. Currently, he is working at Faculty of Software and Information Science, Iwate Prefectural University. His research interests are developments of long-range out-door sensor networks.

Eiji Sugino was a researcher at ICOT for the Japanese 5th Generation Computer Project from 1987 to 1990. He received Ph.D. in Information Science from Japan Advanced Institute of Science and Technology in 1997. He is a full-time Lecturer at the Faculty of software and information science, Iwate Prefectural University. His research interests include operating system, parallel software, and dependable computing. He is a member of IPSJ, IEICE, and IEEE.

Takuto Goto received M.S. degree in 2012 from Tokyo Denki University, Japan. Currently, he works for Hitachi Solutions, Ltd.

Hiroshi Yajima received his Ph.D. in Mechanical Engineering from Kyoto University in 1992. He joined Hitachi Ltd. 1980, and contributed development of knowledge bases information system. He was a visiting scholar of Massachusetts Institute of Technology from 1982 to 1983. Now, he is a professor in School of Science and Technology for Future Life of Tokyo Denki University. His research interests are decision making and knowledge based system design.