MEMORIA: Personal Memento Service Using Intelligent Gadgets

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Abstract. People would like to record what they experience to recall their earlier events, share with others, or even hand down to their next generations. In addition, our environment has been getting digitalized and the cost of storing media has been being reduced. This has led research on the life log that stores people's daily life. The research area includes collecting experience information conveniently, manipulating and recording the collected information efficiently, and retrieving and providing the stored information to users effectively. This paper describes a personalized memory augmentation service, called MEMORIA, that collects, stores and retrieves various kinds of experience information in real time using the specially designed wearable intelligent gadget (WIG).

Keywords: Intelligent Gadget, Smart Object, Personalized Service, Memory Assistant System, Memory Augmentation Service.

1 Introduction

People seem to have a tendency to record their lives. While keeping diary on the paper or in the computer before, people record and share their lives more actively with the help of electronic machines in the digital era. The representative recording media such as personal homepages and blogs enable people to express their feelings, to give their opinions, and to contain information they are interested in. In addition, digital cameras are prevailed all over now, which record not only images but also moving pictures of personal information. When, where, and what a person did are recorded as images or videos with text information in the form of metadata such as an exchangeable image file format (EXIF) or annotated information. These data can be said that people volunteer to make them with intention.

What's more, information recorded automatically by the power of digital era is also increasing. Closed-circuit televisions (CCTVs) in everywhere record our movement. Where, when, and how much a person spend with a credit card, when and whom a person talked with on the phone, which e-mail a persona received and sent are recording in a digital way. The recorded forms of these kinds of information from our lives are called life logs.

To collect these kinds of various information of the life log from people's daily life, researches for adding the ability of collecting and processing information on the objects are ongoing. One of them is an effort to provide the intelligence into every object with the name of the smart object. In this paper, we use a smart object called a wearable intelligent gadget (WIG) that has the information processing capability. It can be carried or worn at hand in daily life such as a wallet, a bag, and a necklace. WIGs are able to play various roles like collecting information or transmitting data to others.

This paper describes a personalized memory augmentation service model using WIGs, called MEMORIA. It is a real-time application that exploits WIGs, which collect and save experience data and provide users with user friendly interfaces for data retrieval. The service can provide users to recall their past memories, and also strengthens and enhances their memories.

MEMORIA is differentiated from others in that it is a real-time online service. Real-timeness is much more practical especially to the people who need monitoring services such as patients with dementia because it can provide immediate status updates. In addition, MEMORIA expands the possibility of a new business model using WIGs. With the wearable, reconfigurable, and scalable features, it is possible to create a various kinds of services which are more personalized as the trend in the ubiquitous computing era.

2   Related Works

As the personal service areas, recently there has been much research related to the "Life Log" to record everyday experience information. They mainly focus on how to sense personal experience information, how to log such sensed information, and how to query or retrieve the necessary information from the logged data.

The life log video system led by Prof. Aizazwa from Tokyo university used brain wave, movement, recognizing face, position, time, internet, log of using application programs as the factors managing memories [1]. As memory information of a person, not only video and audio but also daily life information recorded from various wearable sensors is used.

The representative example of research using WIGs is TTT(Things That Think) project in MIT [2]. In this project, many researches are being done for the development of thinking objects. For instance, attaching information processing device to objects, attracting people's eyes, recognizing people's voice, and providing information users want is possible in "Invisible Media". MIT also developed bYOB(Build Your Own Bag) which can grab outside environment and service intellectually, a smart bag [3].

Nokia developed and provided Lifeblog connecting to their cellular phones, which is a PC based software [4]. Users save contents made with Nokia cellular phones, or video they take a photograph with their interests using Lifeblog through wireless network. Saved information can be shared with other users if they want. The target of Lifeblog is mainly video and text data, it's still difficult to support other information like environment, the reaction of a living body, and movement.

Microsoft is developing a lifelog service using SenceCam and MyLifeBits Viewer. Users bring SenseCam and collect experience information. Collected information is saved and managed in MyLifeBits which is a PC based application [5].

Canada Queens University's eyeBlog is the system which saves and shows user's video information automatically [6]. EyeBlog measures people's gaze information using a wearable wireless gaze sensor, ECSGlasses(Eye-Contect Sensing Glasses). Using this, it records 1:1 conversation and recorded information can be shown through web. Video is automatically recorded based on user's interests. For example, if it catches somebody looking at the user with ECSGlasses, it thinks that's 1:1 conversation and records the conversation with video. Moreover, it's also possible for users to record the conversation manually with buttons. Newly recorded videos are saved in a certain directory of a web server, web contents are automatically manipulated and uploaded to the blog. Then, users can watch video contents built using preview function. eyeBlog is also an example of using Web 2.0.

3   System Design of MEMORIA

3.1   Wearable Intelligent Gadget (WIG)

WIG is a wearable platform which is reconfigurable, scalable, and component-based. It can be equipped, carried as a personal accessory, or in a certain case, implanted internally into a body. It is used to gather various kinds of personal information, and that can process those gathered information to provide specially personalized services for the ubiquitous computing environment. It also can be installed on diverse ubiquitous environments to gather various environmental information to provide more adequate personal services by analyzing and combining with those information.

For the hardware point of view, WIG consists of a base block and device blocks. The base block is equipped with a processor, a memory, a network, a power and a stack-able interface. The device block consists of a sensor and a stack-able interface. The function of WIG depends on the type of device blocks, and the function of a device block depends on the sensor equipped. WIG can be only a base block itself, or one base block stacked with multiple device blocks.

For the software point of view, WIG consists of a light-weighted operating system and a WIG middleware. The WIG middleware has a component-based modular architecture for the reconfigurability and the scalability. It also allows the logical and physical grouping. The physical grouping is a set of WIGs that compose the physical PAN or BAN, and the logical grouping is a set of WIGs that are grouped by a common attribute.

As shown in Fig. 1, WIG consists with the hardware platform, the software platform, as well as the WIG toolkit.

The WIG toolkit is a set of tools consisted with the hardware toolkit, API, and various utilities that support the WIG hardware platform manufacturers, service developers, and service providers, respectively.

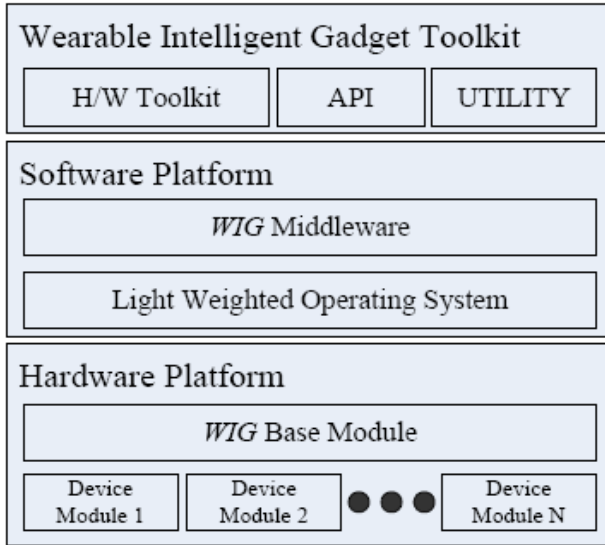For more details of WIG, refer to [7].

Fig. 1. Wearable Intelligent Gadget (WIG) architecture

3.2   Service Environment of MEMORIA

MEMORIA is based on the client-server architecture, which consists of a life log server, logging clients, service clients, and a web server. The life log server (LLS) stores and manages many kinds of data obtained from different logging clients, and provides service clients with relevant data to user queries in real-time. The logging clients gather user-centric information and log it to LLS. The service clients interact with users and request information to LLS if needed according to the user query. The web server enables LLS to be integrated with various web-based services.

MEMORIA is a real-time service that exploits gadgets, which collect, save and provide experience data to users through user interfaces for data retrieval. MEMORIA saves and retrieves various experience data simultaneously. For it, it should work under the ubiquitous computing environment which is connected with wire-wireless network. In other words, it saves a lot of various data in the remote server in real-time and get the necessary data from the remote server.

Fig. 2 shows the service environment of MEMORIA. It consists of Life log server which saves and manages various data and retrieve the queried data, logging gadgets which collect various personal data and deliver to the life log server, service gadgets which interact with users and show the information provided by the life log server, and web server which provide various web-based services together with the life log server. And, WIGs as the logging gadgets and service gadgets can compose WIG network as a PAN (Personal Area Network) or a BAN (Body Area Network).

MEMORIA integrates largely two kinds of services, a logging service and a retrieving service. The former collects personal data and saves into the remote logging server, and the latter retrieves and provides data users find.
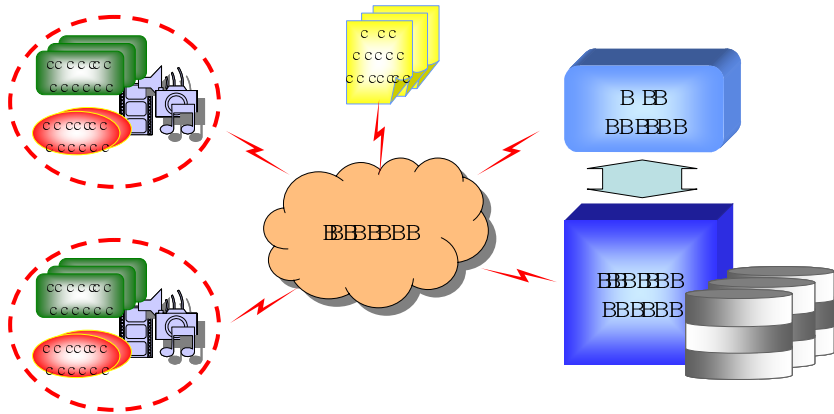
Fig. 2. Service environment of MEMORIA

The process of a logging service includes both logging gadgets collecting personal experience data and sending to the remote life log server in real time, and the life log server saving the given data. To do it, the life log server becomes a server that provide a interface to save experience data, and the logging gadgets be the clients that saves the collected data to the server.

The process of a retrieving service also includes two services. One is the service for service gadgets people have to get the query and to request the relevant data to the life log server, and the other is the service for the life log server to retrieve the relevant experience data and give them to the service gadgets. To do it, they also have a client/server architecture, which the life log server provide an interface which the service gadgets.

3.3 Design of MEMORIA

MEMORIA is a memory augmentation service to trace user's location and scenery information. The logging and service clients are corresponding to the WIGs, called logging gadgets (LGs) and service gadgets (SGs), respectively. WIGs for MEMORIA are all equipped with a ZigBee module for establishing BAN. In addition to LGs and SGs, network gadgets (NGs) that have the wireless Ethernet functionality are used to communicate between LGs and LLS.

Fig. 3 describes the system of MEMORIA. It consists of three parts: Life log logger, Life log server, and Life log viewer. They are corresponding to a logging WIG, a life log server, and a service WIG, respectively.

WIGs are able to be reconstituted and to work together. It means it supports reorganization of service components as well as of hardware.

In this section, the three parts of the MEMORIA system will be explained.

1) Life Log Logger: Fig. 4 shows the life log logging system for the service of MEMORIA. The logger collects GPS and image data with time information in real time which device module of each gadget can process, filters invalid data, and transfers the data to the remote life log server using the interface of the life log server. The kinds of data can be expanded according to the kinds of device modules.
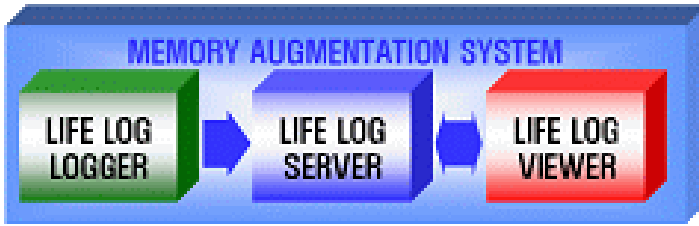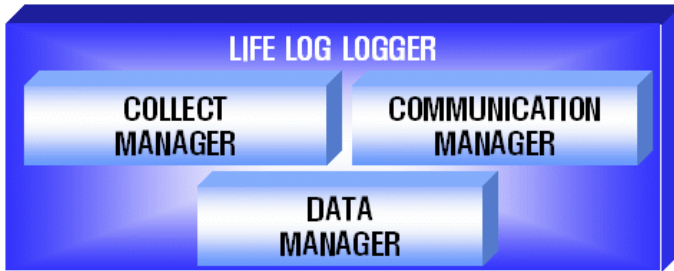
Fig. 3. The system of MEMORIA

Fig. 4. Life Log Logger of MEMORIA

Keeping track of user's location and scenery information, LGs have a GPS module that follows the NMEA 0183 protocol and a camera module that produces JPEG images. They gather GPS and image data, and log them with their system time to synchronize both.

2) Life Log Server: Life log server logs data from the life log logger, process user queries from the life log viewer and gives the retrieved data to the viewer. It supports multiple connections of logging gadgets, service gadgets, and web servers. It also provides interfaces with the logger and viewer.

LLS is implemented on a Fedora Core 5 Linux. It consists of a log, query, DB, and session managers as shown in Fig. 5. The session manager is responsible for managing the connection of both connection-oriented and connectless clients with the thread based multi-processing capability. The db manager maintains DBMS used to handle both metadata of LLS and the indexing information of the logged data. The log manager handles the actual logging process, and the query manager processes client's queries.

3) Life Log Viewer: Fig. 6 shows the SG for the service of MEMORIA, which is also called Life Log Viewer. The viewer plays a role of user interaction and provides search interface for users. It can help users retrieve the experience data using the interface of the life log server. It also manages query and user information from user's input.

Life log viewer has a user interface which can connect life log server and retrieve information a user queries. It transmits user queries to the life log server in real time and provide retrieved information to the users in real time. A user keeps records in a

life log server using his portable WIG. Then, he uses a device which support service providing to retrieve his own experience information.

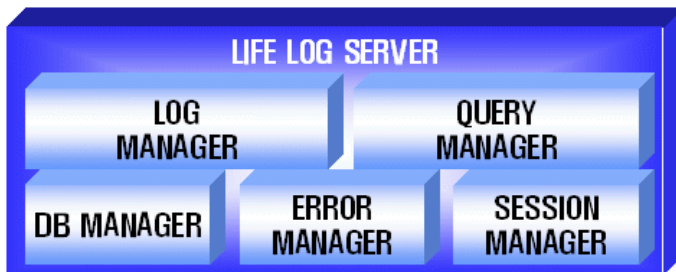SGs, currently used with an ultra mobile PC, provide the web-based graphical user interface for ease of use.

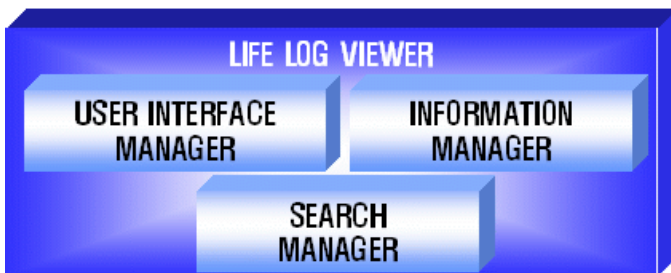**Fig. 5.** Life Log Server of MEMORIA

Fig. 6. Life Log Viewer of MEMORIA

4   Result

Fig. 7 describes a model equipped with devices for life log logging. A camera for image and video data is as her necklace, and a GPS receiver is on her arm as a bracelet. Life log is recorded using these kinds of gadgets which can be equipped naturally as daily accessories as a model in Fig. 7.

Fig. 8 shows a user interface of MEMORIA viewer which support time-based information retrieval and the result of retrieval. In the picture, A is a bar for a time-based query, so that a user can enter. B and C indicate where a user used to be, and D represents the information at each point. E describes what he/she saw at that point.

As the picture shows, a user can retrieve experience from a specific point for certain duration. It keeps records of position information of users and what users see and hear in the life log server. Users can access the server whenever they need, and retrieve memories. In other words, a user can recall memories from the map and the images retrieving the life log server.

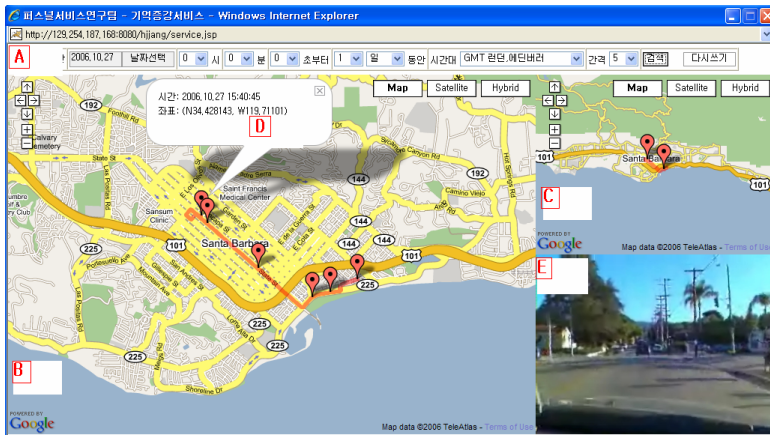**Fig. 7.** A Model Equipped with Logging Gadgets

Fig. 8. The User Interface of MEMORIA Life Log Viewer

5   Conclusion

This paper deals with a personal memento service based on the life log that stores personal experience information, called MEMORIA. It is an example service using wearable intelligent gadgets (WIGs) and life log. WIG is one of smart objects. It has the capability of collecting and processing information, and can be installed or attached into every object we use in our daily life. By wearing accessories attached with WIG, wearer's experience information can be collected without any attention of the wearer, and recorded into a life log in real-time. The collected information can very vary depending on the WIGs attached. Example of them can be what the WIG

wearer has seen, hear, and talk, where the wearer has been, etc. MEMORIA that uses these kinds of personal information to provide a personal memory augmentation is a new service paradigm that can be adapted for the ubiquitous computing service environment. As a result, it can be adapted to various memory augmentation service areas such as assisting dementia patients or monitoring people who need a continuous cares.

Currently, we focus on enhancing and extending MEMORIA by adding wearer's activity information by using WIGs that collects and processes wearer's movement information. With the movement information, we believe that activity based memory augmentation services can be possible.

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