"Life Portal": An Information Access Scheme Based on Life Logs

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Abstract. In this paper, we propose a life log viewer that gives the users new findings from life logs in daily life, and provides seamless integration with external information. We classify life logs into two types. "Unintended life logs" are recorded automatically without the user's direct input; "intended life logs" are recorded purposefully by the user. Based on this classification, we implement a prototype that has two characteristics. First, it can visualize a user's unintended life log from long-term and multi-dimensional points of view. Second, its user interface is designed to visualize the transitions from the analysis results of the unintended life log to event data in the intended life log, and from event data in the intended life log to search results that provide information about the events. We believe that this viewer is a stepping-stone to the "Life Portal" that integrates existing portals with life log analysis to create a stimulus for search initiation.

Keywords: Life log, Visualization, Scheduler, E-mail, GPS.

1 Introduction

Thanks to the rapid growth of the Internet, we can now easily access enormous amounts of information. That includes niche information that we could not imagine accessing decades ago. Needless to say, search engines play a key role. However, they fail to support the user most effectively in that they do not recognize the user's interests or come up with ideas or things that the user wants to know; the user needs to be inspired by acquiring the desire to initiate searches. The miniaturization of mobile terminals with various sensors (e.g. GPS devices and acceleration sensors) has made it possible to continuously collect some kinds of life log over long periods without the user's direct intervention (e.g. position from GPS devices, operation from remote controller). In the MyLifeBits project, for example, Gemmell et al. proposed a platform to manage the personal life log extracted from many information sources [1].

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Our idea is to use recollections as cues to initiate new searches; the result is that all searches start with life log analysis. We call this new search framework, "Life Portal." In this paper, we propose a life log viewer that can extract, for the user, new findings as search cues from the life log of daily life activities, and provides seamless integrated access to external information. For this purpose, we classify life logs into the types of “unintended life logs” and “intended life log”. "Unintended life logs" are recorded automatically without the user's intervention. "Intended life logs" are recorded manually for some specific purpose. Based on this classification, we implemented a prototype that has the following characteristics. Point 1: it visualizes the user's unintended life log gathered over the long-term with multi-dimensional viewpoints. Point 2: its user interface is designed to visualize transitions from the analysis results of the unintended life log to event data in the intended life log, and from event data in the intended life log to search results that provide information about the events. We conduct a simple experiment and confirm that these features of the prototype can give the user new viewpoints (motivation) to access other information.

2 Classification of Life Logs and Usages of Life Log

Generally speaking, we are happier, feel more satisfaction or become excited when we find something that we did not expect. From this point of view, in terms of life log and its usage, we introduce the classification hypothesis shown in Figure 1. There are two types of life log. The intended life log covers blogs, photos, schedules, and so on, all of which are created by the user or intentionally recorded by the user for later use. The unintended life log includes locations obtained by GPS, motions as identified by acceleration sensors, actions obtained by a remote controller, and so on. These are automatically and continuously recorded with no direct user intervention over a long period.

Our idea is that the user is more surprised when we get information from less aware things. Also, the user is more surprised when we can get information that is not included in the life logs. Therefore, user surprise increases in the following order, expected usage of intended life log, unexpected usage of intended life log, and unexpected usage of unintended life log. For example, reviewing old photos (intended life log) is an expected usage, because the users can get no more information than the one included old photos, so the degree of surprise is small. On the other hand, recommendation using user’s life log is one of the most effective usages at this moment, because the user will get unexpected information from unintended life log. The recommendation system of Amazon.com, Inc.[2], for example, proposes several

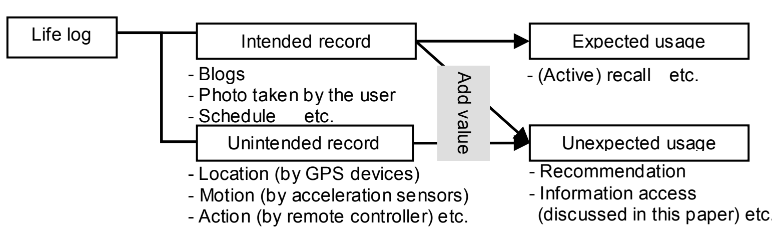

Fig. 1. Value in Life Log Usage

items that are related to an item selected by a particular user. The recommendation is generated based on the tendencies of other users that bought the selected and the tendency is calculated from unintended life log data; i.e., purchase history or URL click logs of other users. The use can get an item information that is not included his/her life log (unexpected usage), and purchase history or URL click logs are recorded automatically without the user's intervention (unintended life log). Our conviction is that new findings or ideas inspired by life log (especially, unintended life log) observations will invoke new searches, another unexpected usage of life log.

3 Concept of "Life Portal"

The dotted frame in Figure 2 shows the current information access framework. The motivations for information access include user's interest or curiosity and are invoked by stimuli from the external world. Users can get information by applying search engines to the Internet or from the feedback to questions proposed to Social Networking Service (SNS). Here, it should be noted that the user is expected to be aware of what he/she wants in the first place; i.e., even if there is a theme that will prove interesting to the user, nothing happens unless the user initiates the search by himself/herself. Another limitation of the framework is that the stimuli that cause user's interest of curiosity mainly come from the external world. Much information in external world is recorded in the form of web page (e.g. news site and shop site) and we can access and use them easily in anytime. Although, human's memory has limitation, so, it is more difficult to access and use his/her memories.

Against these limitations, life log makes it possible to add a new aspect to this framework. First, life log can provide "personal" events that can invoke new searches, because it records what the user, and only the user, experienced. Therefore, the recall of a forgotten event raises the chance that the user will become curious about the event. Second, life log analysis can provide the user with new viewpoints or tendencies, because life log can continuously collect data over long periods from several information sources. By observing the data from long-term or multi-dimensional points of view, the user may reach a finding that differs from those he reached at the time. For example, if the user feels that he is busy today, his understanding can be improved by reference to activities over the last few weeks. Again, the new findings can invoke new searches. The integration of all components, shown by the solid frame in Figure 2, yields the "Life Portal". The visualization of unintended life logs and combination with the current information access framework

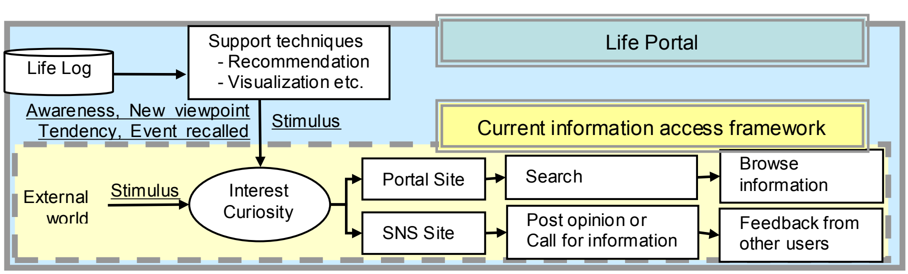

Fig. 2. "Life Portal" and Current Informational Access Framework

will create, in effect, a new information source that can invoke other interests or raise the user's curiosity. Just recording the user's life logs, the user can find such a interests or curiosity and access related information easily.

4 Related Works

Olguin et al. analyzed the frequency of face-to-face communication and the unrecognized behaviors of organizations [3]. They extracted the relationships between the subjects and estimated the subjects' condition. Ushiama et al. studied a method to extract the relationships between life logs collected from different information sources [4]. However, none of these papers discussed approaches to visualizing such life logs.

On the other hand, there are some studies to visualize life logs for recall. Major approaches to the visualization of different kinds of life log include time lines and mapping. Rekimoto proposed an approach that uses time lines to visualize the files in a PC [5]. Aizawa et al. studied the interface needed to access life log holding data of outdoor actions [6]. De Silva et al. proposed a method to visualize and search the life log collected from peoples' activities in a house [7]. The method proposed by Ringel et al. shortens the time taken to search a life log by showing multiple search results on the same timeline [8]. Kim et al. use two axes for displaying a life log; a timeline and a map [9]. According to the result of user's operation on one axis, the life logs displayed on the other axis are automatically changed. Eagle et al. collected life logs of 100 subjects for 9 months by using the sensors on their cellular phone; GPS, Bluetooth, and so on. They visualize the data on a map [10]. As another approach to help the user to understand past events easily, methods that use the comic style have been proposed [11] [12]. However, none of these papers discussed how the user could be given new viewpoints that are one of important functions for “Life Portal”.

In terms of combination of life logs for visualization, Ueoka et al. proposed a method in that the kinds of life log are changed dynamically to match the time granularity [13]. Kapler et al. proposed a method to visualize the activities on a timeline and a map at the same time [14]. However, the main usage of these methods is recall and they do not support integration with current information access frameworks, like having a function to access other sources of information.

5 Prototype System of “Life Portal”

The prototype system was designed to support the following functions:

- Visualization to find new information from unintended life logs
- Seamless integration with the current information access framework

The visualization of unintended life log induces new viewpoints. This raises new interests or curiosity that may trigger the access of other information. By linking the new viewpoints, those the user already recognizes, and external information, the user can access and browse external information through Life Portal.

As a basic function for supporting access to information through the motivation of the stimulus induced by the visualization, we introduce a scheduler. Note that the user enters the 4W attributes (who, what, when, and where) by himself/herself. Although it is not always true that the scheduler items are actually entered, the information is still a good reference for knowing what the user was interested in. Life log sources used by our prototype are the information registered in the scheduler, e-mails sent and received, and GPS data. The following sections introduce "Visualization of unintended life log" and "Access of Information" as provided by this prototype.

5.1 Panoramic View: Visualization to Find New Information from Unintended Life Log

The first main function is "Panoramic View"; its aim is to show the frequencies with which the user contacted each person in each period. The frequencies of contact are calculated from the number of e-mails sent and received and the number of scheduled meetings or contacts. Visualization is implemented as color density (Figure 3). Stronger colors mean higher contact frequencies. Vertical axis plots the time line, and horizontal axis plots the names of the people contacted by the user. In this prototype, frequency is calculated by the following equation (1).

$$f[i] = u[i] / \max_{j=0...n} u[j]$$

$$\left(\begin{array}{ll} i, j: & \text{ID allocated to each person the user contacted} \\ f[i]: & \text{Frequency concerning User } i \text{ for a certain period} \\ u[i]: & \text{Sum of the number of schedule information and e-mails sent and received for} \\ & \text{a certain period, concerning the person whose ID is } i \end{array}\right) \quad (1)$$

The first characteristic is to show long-terms trends and to permit comparisons among other people at the same time. Both attributes are important in finding new viewpoints. For example, a manager can find any imbalance in his business communication by comparing the contact frequencies of his subordinates. That is, we visualize these frequencies on two axis; time and people, not just timeline. The second characteristic is that data calculated on different granularities are displayed at the same time. For example, though a user got 100 e-mails from a certain person, receiving 100 e-mails on just one day in a month has quite different meaning from receiving 3 or 4 per day for a month. Therefore, we consider that it is important to display multiple levels of data at the same time.

5.2 Scheduler View: Seamless Integration with Current Information Access Framework

The second main function is "Scheduler View"; its aim is seamless combination with the current information access framework. This is achieved by using the information in the user's scheduler (Figure 4 (A)). The characteristic is that the user can access related information and browse it in the "Scheduler View" since the schedule information is automatically linked to the visit location extracted from GPS data.

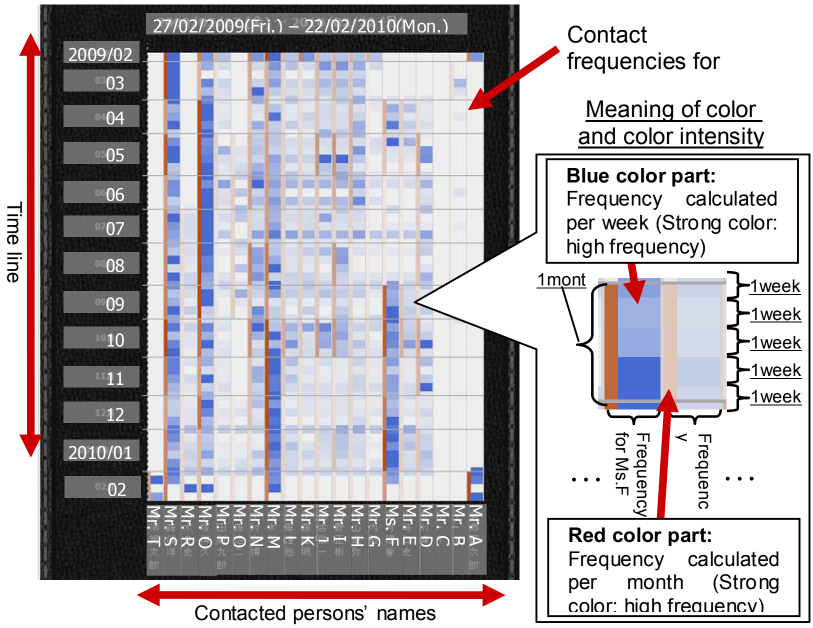

Fig. 3. Overview of "Panoramic View"

This prototype provides two kinds of information through the "Scheduler View" according to the date of the schedule information;

- Actual visited place and time corresponding to the selected schedule information (An example of the other kind of the user's life log)
- Information of shops near the place scheduled to visit (An example of information other than the user's life log)

When the user selects the schedule information of past events, actual visited addresses and times are displayed on a map (Figure 4 (B)). There is sometimes a difference between the information entered in the scheduler and the real action in terms of time. Also, it is sometimes difficult to identify the address from just the information in the scheduler, because the place names sometimes consists of just a part of an address (e.g. "Tokyo", "Osaka") or alternate terms (e.g. "Office") from which it is difficult to identify the address of visited place (e.g. "Yokosuka Kanagawa, Japan").

Therefore, this prototype determines the visited place as that which corresponds to the selected schedule information using the time attribute. At first, this system extracts visited place and time from GPS data using the method proposed in [15], and calculates the similarity defined by equation (2) for each extracted visited place. We assume that the visited place that had the highest similarity $s(u,v,y,z)$ to the real action corresponded to the schedule information. The resulting matched pairs (e.g. Place name entered in scheduler: "Office" --- Corresponding address: "Yokosuka Kanagawa, Japan") are stored in a database, and this is used for estimating the place at which a future event will occur (mentioned below).

$$s(u,v,y,z) = e^{-\left(\left|\frac{z-y}{v-u}-\frac{v-u}{z-y}\right|+\left|\frac{(v+u)-(z+y)}{2\cdot(v-u)}\right|\right)} \quad (2)$$

[u: Planned start time registered in scheduler, v: Planned end time registered in scheduler
y: Start time the user stayed in the place, z: End time the user stayed in the place]

When the user selects the information about a future event as entered in the scheduler, this system shows on map information of the shops near the place where the user will be staying (Figure 4 (C)); this information is an example of information that supports the user's future action. The system uses the place attribute (address) of selected schedule entry in the database to conduct a search. In the example mentioned above, when the user registers the schedule information whose place name is "Office", the system presumes that the scheduled event will be conducted at "Yokosuka Kanagawa, Japan". The prototype then displays the shop information near the address.

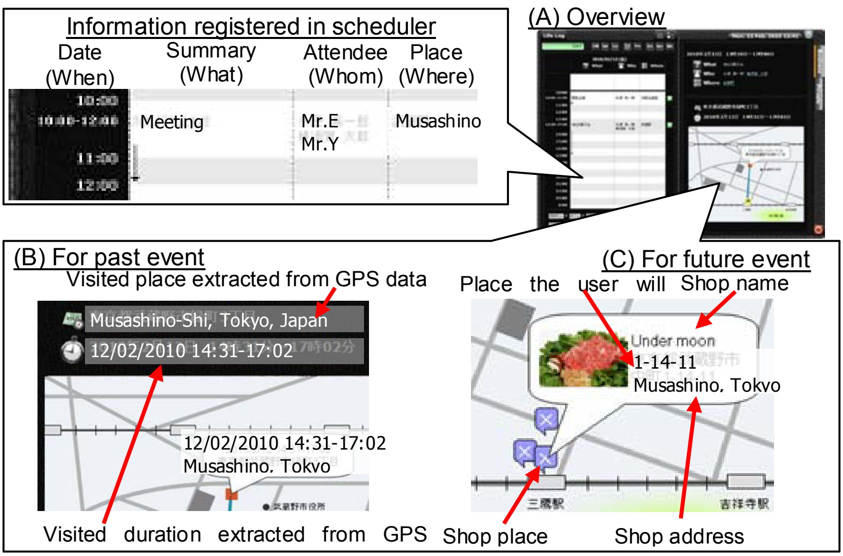

Fig. 4. Overview of "Scheduler View"

5.3 Example of Usage Flow

Figure 5 shows an example of usage flow. The user browses the frequency of contact in "Panoramic View" in Figure 5 (i). When the user clicks the contact frequency for certain person in a certain period (Figure 5 (A)), the frequency in the selected term is displayed in numerical value (Figure 5 (B)). Its range is from 0.0 to 1.0, 1.0 is the highest frequency. By clicking the button in Figure 5 (C), the prototype displays a summary of schedule information for the selected term. When the user selects a certain summary of schedule information (Figure 5 (D)), details of the selected item (date, summary, attendee and place information) are shown (Figure 5 (iv)). By clicking the place associated with this schedule information (Figure 5 (E)), the user

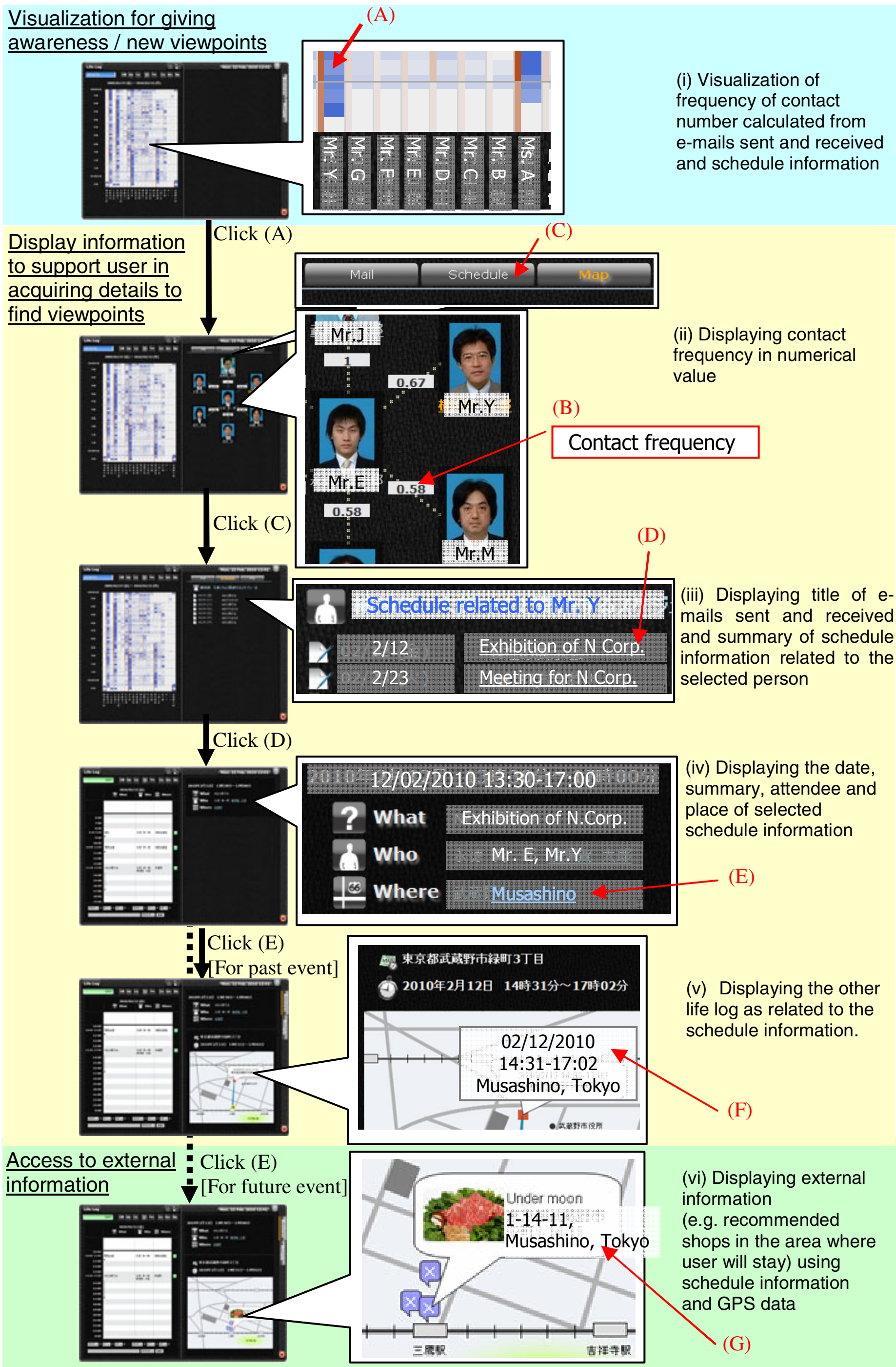

Fig. 5. Example of Flow in Usage of Prototype

can access other life log or information other than the user's life log. From the information about the past event, actual visited place, and time corresponding to the selected schedule information are shown; see Figure 5 (F). On the other hand, from the information of future events, some information about shops near the scheduled meeting spot is displayed (Figure 5 (G)).

6 Visualization of Actual Life Log

We entered one subject's life logs (scheduler entries, e-mails received and sent for business, and GPS data) gathered over a 2-year period into the prototype (The subject is one of the authors). The subject then used this system and reported his experiences in using the prototype. The subject pointed out that "Panoramic View" allowed him to more clearly recognize the key turning points, which had been recognized only vaguely before. We can see that the subject exchanged e-mails and had meetings mainly with Mr. Q until October 2009 (Figure 6 (A)); however, from October 2009, the main contact person changed from Mr. Q to Mr. M and Ms. F (Figure 6 (B)). His work content actually changed around this time. He also pointed out the difference between the completion time of a project between the information in the schedule (intended life log) and that in the contact frequencies (unintended life log). He discovered that although the scheduler indicated that the project had already been finished, he continued to frequently contact the person in charge for some time (Figure 6, right). These results indicate that "Panoramic View" can stimulate new interests or satisfy curiosity by accessing other information.

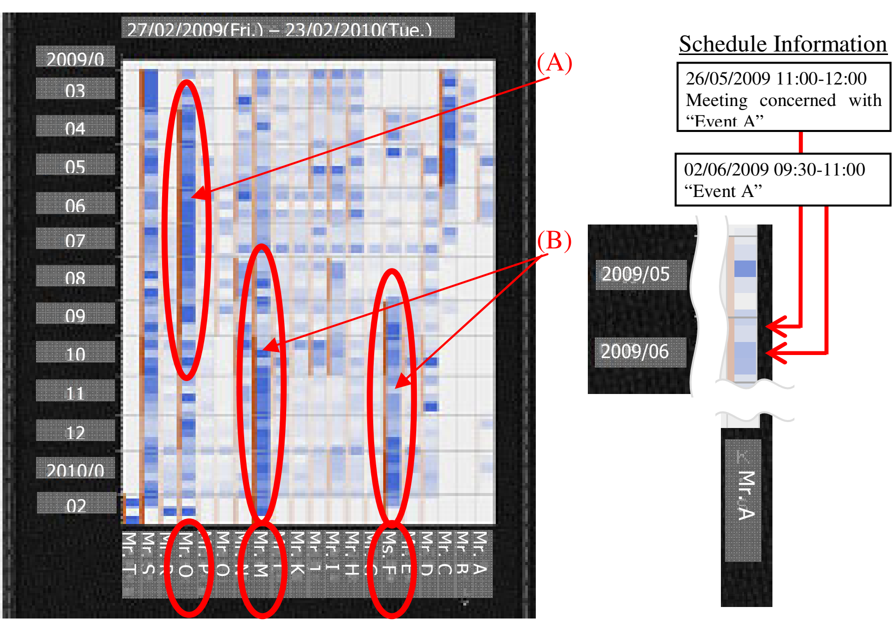

Fig. 6. Example of Frequency of E-mails Sent and Received

7 Conclusion and Future Works

This paper introduced the framework of "Life Portal" as a new value of "Unexpected usage" of life logs. It allows life logs to yield new motivation for accessing information. In the "Life Portal" framework, we classify life logs in two types. "Unintended life logs" are recorded automatically without the user's intervention; "intended life logs" are deliberately recorded by the user. Based on this classification, a prototype was developed that could visualize the unintended life log in panoramic view, combine unintended and intended life logs, and provide seamless access to related information through schedule information. We conducted a simple experiment and confirmed that the prototype could give the subject new viewpoints that motivated him to access other information.

In the future, we will conduct more detailed experiments to investigate the influence of visualization in finding new viewpoints. We will also develop a function to access information other than shop information.

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