A Digital Diary: Remembering the Past Using the Present Context

MOHSIN ALI MEMON*, SANIA BHATTI**, AND NAEEM AHMED MAHOTO*

RECEIVED ON 13.08.2015 ACCEPTED ON 14.12.2015

ABSTRACT

Lifelog devices have gained much attention in recent past. These devices are capable of recording daily activities of a user such as visited places, calories burnt, heart rate, etc. However, reminiscing the past life from this huge collection has been less of a concern. We aim to assist in remembering similar past events based on the present context or situation. We designed a prototype lifelog device that captures lifelogs in the form of pictures and audio, and associates them with the device wearer's context such as people and objects in the vicinity. The information from the past life may be used to helpusers in their current situation. In this article, we attempt to determine the type of context that is preferred by the device users to remember their past events. We found that the users are more interested to find lifelogs based on the people they meet at specific locations.

Key Words: Lifelogging, Human proximity, Location, Retrieval.

1. INTRODUCTION

The act of lifelogging has a prominent place in today's life as people are eager to accumulate all the events that happen in their life and review them afterwards. Lifelogging was initially employed for treating people with episodic memory impairments [1]. However, with the technology available today, it is imaginable to record entire life events for amusement as well as for reminiscence. The lifelog devices such as Autographer [2] and Narrative [3] capture lifelogs and allow the user to sniff through them anytime. These devices lack the mechanism to recall past events based on user's preferences as they allow the user to access this data in sequential form. Furthermore, they do not assist the users from their past in the current circumstances or context which may be the best way to exploit such a huge personal data store. We aim to utilize the user's life experience by recalling it using the present context.

The term context can be defined here as location, identity of people around a user, time of the day, temperature, etc. [4], [5]. Since the past information reveals noticeable experiences, therefore, people may like to utilize their bad experiences by not repeating the same mishaps. We make it easy for the users to access their past experiences by incorporating their current context. As people are inclined to forget critical details of past events, we allow the users to look into their past lifelogs are similar to their present situation.

*Assistant Professor, and ** Associate Professor,
Department of Software Engineering, Mehran University of Engineering and & Technology Jamshoro.

We designed a prototype lifelog device that captures lifelogs in the form of an image and records audio of 10 seconds in every minute. The device stores the lifelogs (images and audio) on the device temporarily and at the end of the day, these lifelogs are uploaded on the cloud storage. Therefore, the problem of shortage of storage on the device may be eliminated. The cloud servers nowadays allows to store data in terabytes, thus eliminating the chance of consuming this space very quickly. The users may be asked to pay premium to avail these lifelogs for their lifetime. The current prototype device is also configured to capture three types of context elements, which are, (i) location of user (ii) person in close proximity (iii) objects in close proximity. The device user may see the lifelogs via the same device by selecting any of the present context elements that match with the past context elements (Fig. 1). In this way, the users may have a glance at similar past life experiences by just selecting the present context and get relevant lifelogs of the past. The lifelogs captured by the prototype device act like a digital diary that may be referred any time when required by the user. This method of reminiscing past experiences that match with the present situation of the user may assist the user in several ways.

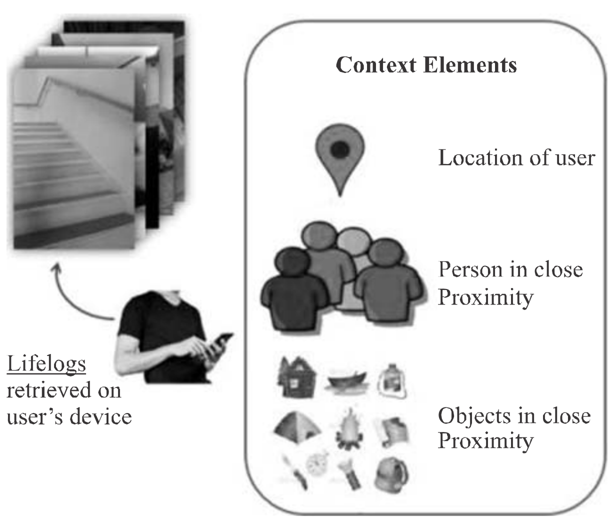


FIG. 1. CONTEXT ELEMENTS AND LIFELOGS

Let us consider a user who visited some tea shop at a shopping mall. While revisiting that mall, the user may like to view the past lifelogs to know the people nearby while the user was at that tea shop. The user may also like to find the lifelogs revealing the menu ordered at that tea shop. Now, if we employ the context of 'location of user', we may be able to retrieve the lifelogs of the previous visits to that tea shop, thus, revealing the people nearby. Employing more than one context element, such as, objects and person in close proximity may help to reminisce a particular event that occurred when the user was at the tea shop. In another situation, a user may like to know previous interactions with an object, for instance, the user would like to know when was the last time he or she took a medicine or used credit card. In these circumstances, our lifelog device may help retrieve the appropriate information required without asking the user about specific details such as the exact date or time.

In recent years, researchers are trying to capture and retrieve a variety of context from people's daily lives, however, less attention is bestowed to compare and determine specific context that may assist the user in reminiscing the past. In this article we provide the users with a variety of context elements and aim to highlight the type of context preferred by them while recalling the past event.

2. RELATED WORK

The study of Wagenaar [6] was concerned with the author's own memory and recalling of past events that occurred in a period of 6 years. His work encouraged us to come up with this prototype device. He recorded events with various aspects such as, who, what, where and when, and they were also used as retrieval cues. The author attempted to recall 2400 events with the help of retrieval cues and concluded that double and triple cuing resulted in better performance. Wagenaar's study revealed that everyday life events were much more slowly forgotten that suggested and the author was able to reproduce memories of people, of words being said, of feelings, emotions, happy times and utter despair. The system proposed by us showed similar results since the users retrieving lifelogs were able to recall the past events. We observed that the users were more interested to retrieve lifelogs related with meetings with people. On the other hand, Wagenaar claimed that 'what' as a single cue was very significant and combining 'what' with 'when' together are effective in recalling the past. We also found that the combinations of context elements to retrieve lifelogs of particular events is very efficient.

A research was conducted by Rhodes, et. al. [7] to wearable computers, in which they developed a system named as "Remembrance Agent" [8]. This system worked on desktop computers and was employed to provide notes that might be relevant in that context without any intervention. There are several recent works which focus on the need to resolve the issue of retrieving lifelogs on a mobile platform [9-11]. While talking about EMI (Episodic Memory Impairments), Lee, et. al. [1] proposed a lifelogging system to help people suffering from this disease and employed Sensecam [12], voice recorder and GPS logger to provide passive logging. However, reminiscing largely depends on the expertise of the caregiver who inputs cues and reveals lifelogs to the person with EMI.

One of the systems was proposed in [13] to trigger episodic memories of past by recognizing the context with infrared beacons that are placed in rooms; attached to persons and objects. However, their approach is not feasible because one cannot implant infrared sensors to each and every object in real world. The information of past is received on a head mounted display in the form of pictures and audio. An audio memory prosthesis named as iRemember was proposed in [14] to create a personal audio archive with contextual information. The system records conversations via microphone and annotates them with associated data such as location, email, and local weather, however, the recording is only made on user request. Imamura, et. al. [15] developed a scheduling system on the smartphone using lifelogs.

In [16], the researchers programmed an Android-based smartphone which collects images, audio, location and accelerometer data. The app was able to annotate multiple tags, daily logs that can be reviewed and segmented into meaningful events. They trained the model using 41 days of data, and then used to predict the remaining one day. It had a drawback, as a considerable time was spent on manually annotating the information. Authors in [17] proposed an algorithm based on non-negative matrix factorization for the improved concept detection accuracy of lifelogs captured by the device. They modeled everyday concept semantics such as reading, cooking, walking, etc. and learn the appearance patterns of those concepts which have low-accuracy detection. A place recognition algorithm was proposed in [18] for identification of places important to the user. The user may view the structured lifelogs to remember the past experiences. The authors in [19] proposed an interactive middleware architecture for lifelog based context awareness in ubiquitous environments, thus signifying the use of context while capturing the lifelogs.

3. PROPOSED SYSTEM

We designed a lifelog device that performs dual functions of capturing the lifelogs as well as retrieving them when required. The lifelogs are captured in the form of images and audio clips that are temporarily stored on the device and later on synced with the cloud storage. The proposed system was designed on the working principle of Sensecam [12]. Sensecam was the first available lifelog camera that captured lifelogs in the form of images.We also attempt to capture the current context of the user, that is, the location, people and objects in close proximity. The lifelogs captured at a moment are associated with one or more context elements sensed by the device at that time. The context elements are not the actual lifelogs but they help to retrieve lifelogs of similar past situations.We made a simple lifelogs retrieval interface to access the entries of the digital diary. The user is provided with the option to select any one or more of the present context elements. The selected context element is compared with previously stored context elements, and as a result, the user is provided with the lifelogs that match with the present context. We believe that in near future lifelog devices will be as popular as smartphones are today and people will be keen to capture their daily activities, thus making their personal digital diaries. In the subsequent sections, we will discuss each contextual element in detail.

3.1 Location of User

By location, we mean the place where the user is situated. There are different levels of location, from very specific, such as street to very generic, which might be country. We attempt to capture location at three different levels, that is, street, city and country along with the lifelogs. This approach has been used by Newman [20]. The location is captured via the GPS sensor of the lifelog device. Later on, the location coordinates are mapped to determine exact street, city and country. We provide two methods for selecting location as context element.First the user may go to a previously visited place and select this context element for lifelogs retrieval,then they are asked to select the location level. Secondly, the user can also manually select a particular location on the map as the context element. With this approach, the lifelogs captured around 100 meter radius of the selected location are fetched. These lifelogs may help reminisce the past experiences about that location.

3.2 Person in Close Proximity

We attempt to identify people around the user wearing the lifelog device and store this context with the lifelogs. The users may later use this context to remember past meetings with those people. Our prototype lifelog device is attached with infrared transmitter that emits unique infrared signals at regular intervals. The device is also attached with infrared receiver to collect the infrared signals and identify one or more people situated around the user. We will discuss in detail about the device configuration for this context element in the next section.

We make it possible to retrieve past lifelogs with a person when we meet him again in the present situation. There can be situations, where a person we are not intended to meet is also recorded by the lifelog device. This issue is resolvable as we may set a threshold timing that if the infrared sensors receive signals for t seconds continuously, only then they are recognized as the 'Person in close proximity'. Furthermore, the person behind the user or at 90 degree angle is not recorded, which also reduces the number of false identification. The infrared sensors work efficiently in all light and weather conditions which makes them ideal to be used in real environment for identifying people around. The lifelog device maintains a list containing name and infrared id of people around the user at a location.

In case of crowded situation, the context of all the neighbor participants is recorded. However, during the retrieval process, the proximity of any one participant (either of the same or different group) will retrieve the lifelogs related with that event. The recognition of participants as "neighbor participants" when they are actually in different groups does not matter in our system, since it is not required that all the participants be present in the current context to retrieve lifelogs of a past event.

3.3 Objects in Close Proximity

The objects around the user are also identified by our prototype device and saved as a context element in real time. The prototype device's camera is used to scan the objects around the user. We could have used other approaches like attaching RFID with objects [21], but this techniques is unrealistic as there are hundreds of objects around the user and one cannot attach sensors with all of them. Other techniques include using infrared rays for recognizing objects in the pocket for reminiscence [22].

We employed computer vision technique for objects identification. For this purpose, we incorporated Moodstocks API [23] to distinguish 3D objects around the user by using their 2 dimensional images. There are several other image recognition engines such as VisionIQ [24], to perform the same task. We store the images of the objects before the experiment into the database of Moodstocks. Later the user can recognize the real world objects with the help of images already stored. Currently, the image recognition engines require sample images. There are chances of failure to recognize the objects, therefore during the experiment, the users were requested to choose objects having vivid patterns for accurate recognition. The rest of the objects around the user were not recognized by the user. In near future, we believe that these recognition engines will be able to recognize objects more efficiently. Thus, in this manner, the context element of objects around is captured by the prototype device and can be used toretrieve accurate lifelogs of the time when the objects were used in the past.

3.4 Selection of Multiple Context Elements

The users of the prototype device are permitted to select one or more context elements. The selection of multiple context elements results in precise lifelogs retrieval, matching the current situation of the user. The user may select any combination of context elements, based on which the prototype device returns the lifelogs matching all of the selected context elements. This approach reduces the number of lifelogs retrieved for the current situation. Furthermore, it also helps to reminisce the similar past situation efficiently.

Let us assume a user visiting a park wearing the prototype lifelogging device. He finds a friend in the park and they start conversation on some topic. After a few days, the user likes to recall the conversation with that friend. The prototype lifelogging application may help in reminiscing that particular moment. The user can use any of the context elements to retrieve the lifelogs for the required past event. For instance, when the user selects location as context element and provides the park location or visits the park after some time, the device fetches the lifelogs of all previous visits to that park. On the other hand, if the user meets with that friend at any other place rather than the park and selects 'person in close proximity' as a context element, then, the lifelog device retrieves the past lifelogs of all the meetings with that friend. In another case, the user selects both location and person in close proximity as context elements, and retrieves the precise lifelogs revealing the conversation that happened with the friend at the park.

This example clearly exposes the benefits of using the context elements for accurate lifelogs retrieval. The user benefits from a lifelog device only when it provides only those lifelogs which are required at a particular moment. Our prototype lifelog device helps the user in reminiscing by providing the lifelogs that match with the current situation. In the next section, we will explore the prototype device designed to serve the above mentioned purpose.

4. PROTOTYPE DEVICE

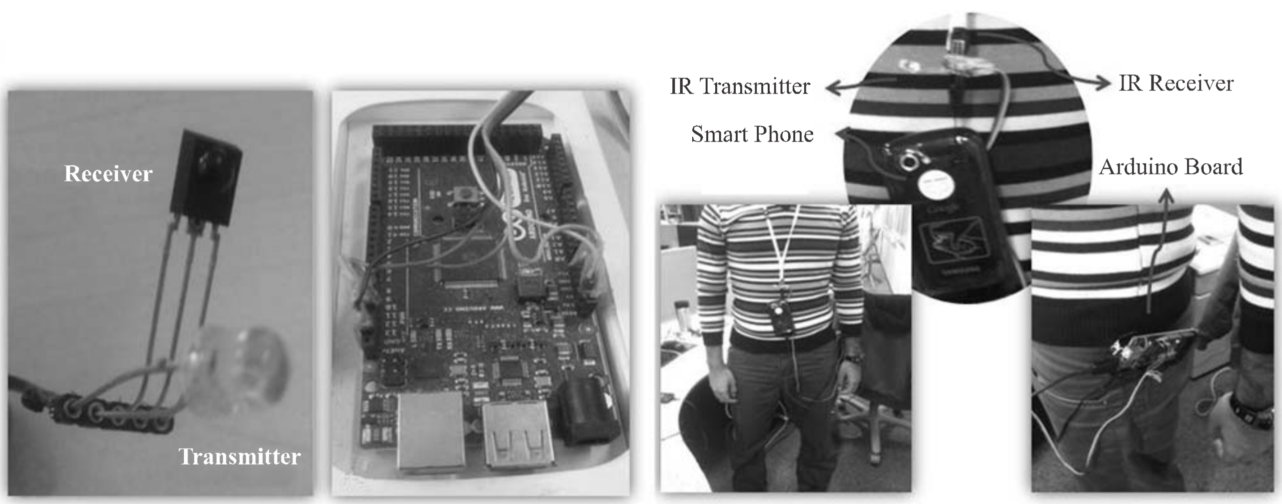
The device setup for lifelogging and capturing context elements all together is a smart phone equipped with infrared transceiver. We configured Nexus S smartphone to take one picture and record an audio clip of 10 seconds every half minute. The audio recording of 10 seconds in every minute was preferred in the prototype device, since small audio snippets contains sufficient amount of data that may help in remembering the past when played back [25]. Moreover, recording audio of 15 seconds or higher will consume more power during recording by the prototype device. It will significantly increase the storage space required to handle such huge amount of data.

For recognizing context elements we employed a variety of approaches. Such as for location, the smartphone's built in GPS sensor was configured. It senses for change in the location of the user and updates the current location accordingly. To capture person in close proximity, the infrared sensors were attached with smartphone via Arduino Mega ADK board [26] (Fig. 2(b)). The Infrared LED (Model No. TLN110) is used as a transmitter, which is programmed to emit a unique infrared ID to identify the user wearing the device. This transmitter is normally used in remote controls and switches. We attached the infrared receiver (model no. PLIRM2121-A538), together with the transmitter to acquire reception from adjacenttransmitters and to send those signals to the smartphone to identify the people around the user (Fig. 2(a)). The device can be worn easily with a neck strap and the ADK board may be attached to the waist as shown in the Fig. 2(c).

This system is similar to our previous system designed for achieving privacy from neighboring lifelog devices [27]. We assume that all users have the prescribed lifelog device, since in our approach, the users are recognized only when the infrared ID is recognized by the devices in the line of sight. There can be several other approaches by which the person nearby can be identified. One way is to use GPS sensor to identify people at a particular location and share it with all the users at that place.

Finally, for detecting objects nearby, Moodstocks API was configured on the smart phone. The smart phone camera performed dual functionalities of taking pictures as lifelogs along with recognizing objects around the user. The objects recognized by the lifelog device are saved in the form of text together with the lifelogs. Later on, the user may acquire the past lifelogs while interacting with the objects that wereaccessed or used in the past.

In this paper, we focused on the retrieval of lifelogs based on the context preferred by the users. The prototype device is designed to help the users in reminiscing the past life by exploiting the context elements. The



(a) (b) (c)

FIG. 2(a). INFRARED TRANSMITTER AND RECEIVER, (b) ARDUINO MEGA ADK BOARD AND (c) PROTOTYPE DEVICE WORN USING NECKSTRAP [27] evaluation experiments were setup in such a manner that the users may feel the need to use the context elements in order to accurately retrieve the past lifelogs. We recorded the context elements mostly preferred by the users in the process of reminiscence. In the next sub-section, we will discuss in detail the capturing of lifelogs together with the context elements.

4.1 Capturing of Lifelogs and Context Elements

The android app designed for lifelogging works in the foreground of the smart phone continuously. It keeps on capturing the lifelogs in the form of images and audio along with keeping the context elements as recognized by the device (Fig. 3).The prototype device captures one image in every minute. The surroundings of the user do not drastically change in a single minute unless that user is in a vehicle and moving at a good pace. Even if the user is in motion, the context element 'location' may detect those changes very efficiently. The commercial available lifelog devices such as vicon revue capture an image every 30 seconds, but they are unable to grasp the valuable context elements around the user. The images taken by the smartphone camera are .jpeg files with resolution 320x240, whereas the audio is in .3gp format. The context elements detected by the device are in text format and can be seen on the device's screen under labels 'Person' and 'Objects'. The location is captured in the background and not shown on the screen. The images are captured autonomously after every minute. Since we presumed that everyone has to wear the prototype device, therefore, the user may identify others once they are is sight of each other. Similarly the objects are recognized by the camera of the device. There can be more than one person, object and location associated with a single image logged by the device. The maximum range within which a person wearing our lifelog device may be identified is 5 meters and that for the object is 1 meter.

We also configured a server with MYSQL database to store the URL of lifelogs and the context elements that were recognized during the capture of the lifelogs. This server helps in the retrieval of lifelogs when the user queries for past information related with the current context. The 'Retrieve logs' button initiates the process of retrieving lifelogs for the user. Our main focus of attention in this article is to determine the context elements that are preferred by the user while retrieving the lifelogs for reminiscence purpose. We will discuss about retrieval oflifelogs in the subsequent section.

4.2 Lifelogs Retrieval Using Context Elements

We benefit the user by retrieving past lifelogs instantly on the lifelog device. The lifelog devices developed so far such as [2-3], do not provide such facility since the user has to transfer all the data to the computer or cloud storage and then view the lifelogs one by one. We, on the other hand, attempt to assist in the recalling of similar events that happened in the users' past life. It has been concluded by various researchers that multimedia such

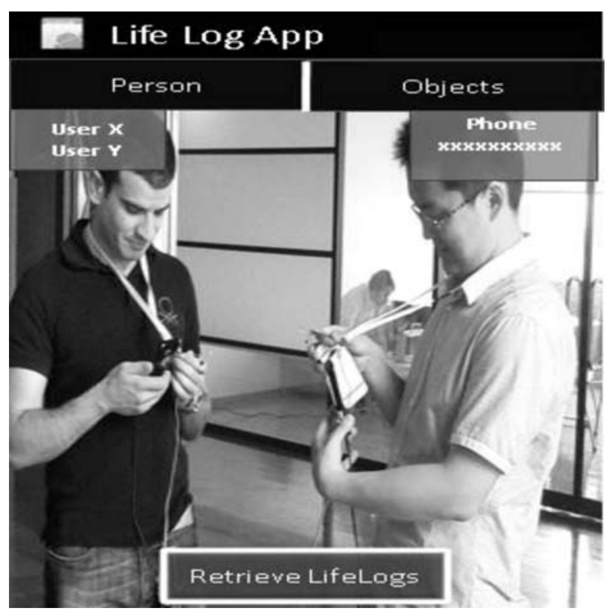


FIG. 3. ANDROID APP TO CAPTURE LIFELOGS AND CONTEXT ELEMENTS

as audio, images and video are very valuable in recalling the past events [28], therefore we came with a system that allows to view the past events instantly in the form images and audio based on the current context. Our prototype device captures present context in the form of location, people around user and objects interacted by the user. Based on the user's preference, that is, selection of one or more of the present context elements (Fig. 4(a)),the precise past event lifelogs are retrieved. We ask the user to select any one or a combination of the context elements. On selection of one context element, the resultant lifelogs may be from isolated but similar events from past, whereas, by selecting multiple context elements may fetch lifelogs that precisely match to the current situation.

The Fig. 4(b) shows the retrieved lifelogs in the form of images in a list with the timestamp and two context elements, that is, people and objectsin the vicinity. In order to listen to the audio and get the exact location where a particular lifelog was created, the user may select the individual lifelog image.

FIG 4. (a) SELECTING CONTEXT ELEMENTS TO GET LIFELOGS, AND (b) RETRIEVING LIFELOGS ON THE DEVICE

Hence, the process to retrieve lifelogs for the current situation is streamlinedto avoid the cumbersome situation of peeping through entire lifelog data and make the most of the one's past experiences. In the next subsection, we will discuss about the experiment carried out on the proposed lifelog device.

5. EVALUATION

An experiment was setup to find out the context element that is mostly preferred by the users to retrieve lifelogs of the past events. 10 Users were asked to wear our prototype device for two sessions in one day and capture lifelogs in the form of images. Each session lasted for 90 minutes. We performed the experiment in two sessions because the prototype device requires recharging after each session. The timing of the morning session is 10:00 am to 11:30 am, while the afternoon session continued from 2:00-3:30 pm. We also requested the users to provide us images of five daily use objects (cell phones, books etc.) in advance so that we can upload them on Moodstocks server for assured objects recognition. All the users were asked to work similar to their usual days and log their life events for two sessions in the day.

The users were asked to retrieve lifelogs for their past events at two stages. First stage of lifelogs retrieval was at the end of afternoon session of the experiment. The second stage of lifelogs retrieval was 23 days after the experiment. The users had to retrieve the lifelogs of any four events that occurred during the experiment sessions of that day. The events recalled during the two stages of retrieval may be different. The users were allowed to use any single or combination of the present context elements to retrieve lifelogs for the events. We documented the total number of recorded lifelogs, the context element/s used for retrieving the lifelogs and the number of lifelogs retrieved by the users for an event.

5.1 Participants

For the experiment, 10 participants (6 male, 4 female) were recruited and divided in to 5 groups (2 users in each group). All the participants studied various departments of the University of Tsukuba, Japan and residents of Tsukuba city. The ages of the participants were between 21 and 34 years (mean=27.2 years). We briefed the participants for 30 minutes about the purpose of this study and applications of the prototype lifelog device. We asked the users of each group to wear the prototype device and capture lifelogs of their daily events in two sessions of the day.

5.2 Results and Observations

Stage-1: Lifelogs Retrieved on the Day of Experiment: Since the users were permitted to choose any past four events recorded during the two sessions and retrieve the lifelogs for these events. They exploited a variety of the context elements to perform this task. A total of 40 events lifelogs were retrieved by the users, out of which 23 events were from the morning session and 17 events were from the afternoon session. The context elements and their combinations employed to retrieve lifelogs of events occurring on the day of the experiment are shown in Fig 5. The most popular context element which was used by all the participants is ‘Person in close proximity’. This context element was used to retrieve lifelogs of 10 events which shows that the users were interested to see the retrieved lifelogs of the person with whom they interacted earlier that day. ‘Objects in close proximity’ was used for retrieving lifelogs of only 2 events, whereas, ‘Location of user’ was used to retrieve lifelogs of 8 events. The users also exploited various combinations of context elements for lifelogs retrieval. The context elements which were very uncommon among users were ‘Person in close proximity’ and ‘Objects in close proximity’ and only one event’s lifelogs were retrieved using this combination. On the contrary, ‘Person in close proximity’ and ‘Location of user’ context elements were exploited together to retrieve lifelogs of 7 events. Only 4 events’ lifelogs were retrieved using ‘Objects in close proximity’ and ‘Location of user’. A part from it, all the present context elements were employed together as well to obtain lifelogs for 8 events. These results are fascinating and depict that the users showed more interest in retrieving lifelogs of events involving meetings with people and the location. Lifelogs related with objects were also retrieved by combining the other context elements.

In Fig. 5 we compare the context elements selected by the users for retrieving lifelogs on the day of the experiment as well as 23 days later. We observed that the events recalled after 23 days of the experiment were produced by using the combination of context elements than the individual context elements. ‘Person in close proximity’ and ‘Location of user’ context elements were used together by all the participants and 10 lifelogs retrieved were related to meeting with people at a place. ‘Objects in close proximity’ and ‘Location of user’ were also used together to retrieve lifelogs of 6 events. There were 7 events that were recalled using all the context elements. We also compared the context elementsexploited by the users on the day of the experiment and 23 days later. It was found that, on the day of the experiment, single context elements were preferred for retrieving lifelogs of events. On the contrary,in the second stage of retrieval, the users were more interested to retrieve lifelogs specific to their current situation by combining various context element combinations.

The users were asked to count the number of lifelogs retrieved for the events. We arranged the average number of lifelogs retrieved per event based on the context elements selected by the users (Fig. 6). The context element that retrieved more lifelogs than the rest was the ‘Location of user’. The reason might be that the users’ location did not change alot during the experiment. The average number of lifelogs retrieved using 'Person in close proximity', 'Objects in close proximity' and 'Location of user' are 11.7, 8 and 31.1 respectively.

It was observed in the experiment that when a single context element was selected, this resulted in more lifelogs retrieved for a past event. However, selecting multiple context elements produced fewer lifelogs for an event. This trend is clearly visible in the graph shown in Fig. 6, as the average number of lifelogs retrieved using multiple context elements are relatively less than when using single context element. Selection of multiple context elements by the users produced the most suitable logs for the present situation. Few users commented that the lifelogs retrieved using multiple context elements are very specific to their present situation.

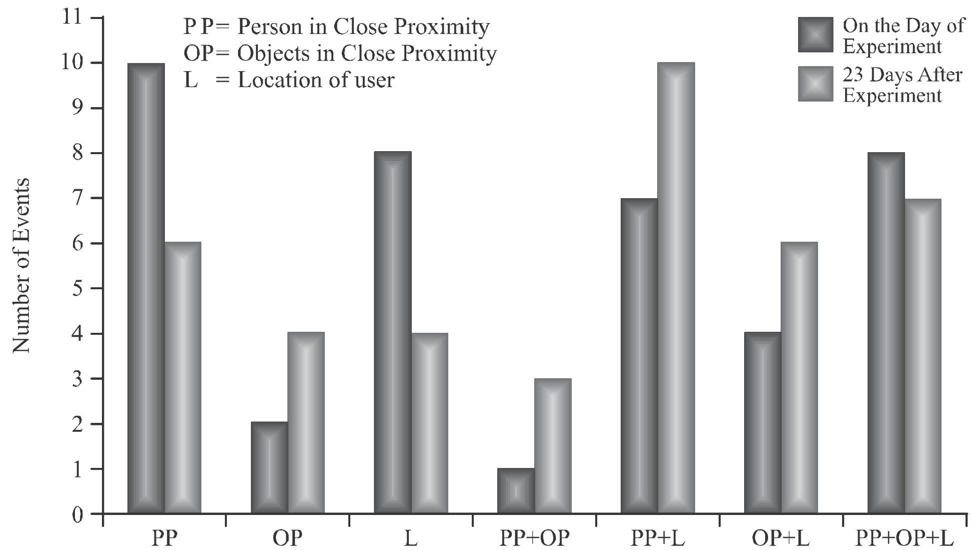


FIG. 5. COMPARISON OF CONTEXT ELEMENTS USED TO RETRIEVE LIFELOGS

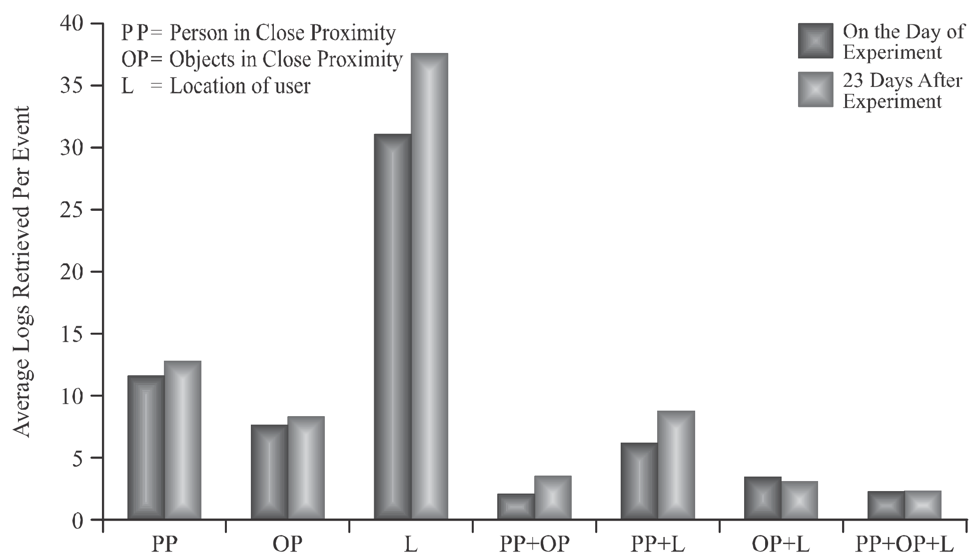


FIG. 6. COMPARISON OF VARIOUS LIFELOGS RETRIEVING USING THE CONTEXT ELEMENTS AND THEIR COMBINATIONS

Stage-2: Lifelogs Retrieved 23 Days after the Experiment: We asked the users to retrieve lifelogs of past four events recorded 23 days earlier while wearing the prototype device. The users employed various context elements and their combinations to retrieve lifelogs of events. The users retrieved lifelogs of 40 events, out of which 27 were old events. By old events we mean that the users had already retrieved lifelogs of those events on the day of the experiment. Besides, 13 new events were also picked for lifelogs retrieval. From the retrieved events, 25 events were logged in the morning session and 15 events were logged in the evening session.

The average number of lifelogs retrieved using various context elements and their combinations on the day of the experiment as well as after 23 days of the experiment were also compared. The graph in Fig. 6 shows that there was no significant difference in the average number of lifelogs retrieved on the day of the experiment and 23 days after the experiment. The users' showed positive response over retrieved lifelogs since they were able to recall all the events correctly on both the occasions. The users were willing to retrieve lifelogs of events involving people and also employed various other context element combinations together with 'Person in close proximity' context element for this purpose. The concept of retrieving lifelogs by employing various context elements and their combinations was supported by the participants and can be incorporated in commercial lifelogging devices.

6. CONCLUSION

We proposed an efficient method to relive past life by providing access to those lifelogs which are relevant to the present situation. The lifelog device is a smart phone configured with an application to record images and audio clips as lifelogs and capture three context elements. The context elements are Location of user, Person in close proximity, Objects in close proximity. A user may exploit any one or all the context elements together to retrieve most relevant lifelogs to the present situation. In the evaluation, we found that 'Person in close proximity' is the most favorite context element among the participants as they like to recall past meetings with the people around them. We further intent to perform experiments on a larger scale and also add more context elements to the lifelogs for appropriate retrieval.

ACKNOWLEDGMENTS

Authors are thankful to Mehran University of Engineering & Technology, Jamshoro, Pakistan, for provision of facilities for this research. Special thanks to Internal and External Referees/Experts, for their valuable comments and suggestions regarding improvement of the paper.

REFERENCES

[1] Lee, M.L., and Dey, A.K., "Using Lifelogging to Support Recollection for People with Episodic Memory Impairment and their Caregivers," Proceedings of 2nd ACM International Workshop on Systems and Networking Support for Health Care and Assisted Living Environments, pp. 1-3, 2008.

[2] Lifelogging Device [Online] Available: http://www.autographer.com/(Last accessed on 18th November, 2015).

[3] Kallstrom, M., "Lifelogging Camera: The Narrative Clip", [Online] Available: http://getnarrative.com (Last Accessed on 18th November, 2015).

[4] Brown, P., Bovey, J., and Xian, C., "Context-Aware Applications: From the Laboratory to the Marketplace", IEEE Personal Communications, Volume 4, No. 5, pp. 58–64, 1997.

[5] Abowd, G.D., Dey, A.K., Brown, P.J., Davies, N., Smith, M., and Steggles, P., "Towards a Better Understanding of Context and Context-Awareness", Proceedings of 1st International Symposium on Handheld and Ubiquitous Computing, pp. 304-307, Springer-Verlag, 1999.

[6] Wagenaar, W., "My Memory: A Study of Autobiographical Memory Over Six Years", Cognitive Psychology, Volume 18, pp. 225-252, 1986.

[7] Starner, T., Mann, S., Rhodes, B., Levine, J., Healey, J., Kirsch, D., Picard, R.W., and Pentland, A., "Wearable Computing and Augmented Reality", MIT Technical Report, Media Lab Vision and Modeling Group RT-355, 1995.

[8] Rhodes, B.J., and Starner, T.E., “Remembrance Agent: A Continuously Running Automated Information Retrieval System”, Proceedings of International Conference on Practical Applications of Intelligent Agents and Multi-Agent Technology, pp.487-495, 1996.

[9] Blum, M., Pentland, A., and Troster, G., “Insense: Interest-Based Life logging”, IEEE Multimedia, Volume 13, pp. 40-48, 2006.

[10] Yeh, R.B., Liao, C., Klemmer, S.R., Guimbretière, F., Lee, B., Kakaradov, B., Stamberger, J., and Paepcke, A., “Butterflynet: A Mobile Capture and Access System for Field Biology Research”, Proceedings of 24th Annual SIGCHI Conference on Human Factors in Computing Systems, pp. 571-580, 2006.

[11] Belimpasakis, P., Roimela, K. and You,Y., “Experience Explorer: A life-Logging Platform Based on Mobile Context Collection”, Proceedings of 3rd International Conference on Next Generation Mobile Applications, Services and Technologies, pp. 77-82, 2009.

[12] Hodges, S., Williams, L., Berry, E., Izadi, S., Srinivasan, J., Butler, A., Smyth, G., Kapur, N., and Wood, K., “Sensecam: A Retrospective Memory Aid”, Proceedings of 8th International Conference on Ubiquitous Computing, pp. 177–193, Springer Berlin Heidelberg, 2006.

[13] Hoisko, J., “Context Triggered Visual Episodic Memory Prosthesis”, Proceedings of 4th International Symposium on Wearable Computers, pp. 185–186, 2000.

[14] Vemuri, S., Schmandt, C., and Bender, W., “iRemember: A Personal, Long-term Memory Prosthesis”, Proceedings of 3rd ACM Workshop on Continuous Archival and Retrieval of Personal Experiences, pp. 65-74, 2006.

[15] Imamura, H., and Nishiyama, H., “Design and Implementation of a User-Support System for Scheduling using a Smart Phone”, Artificial Life and Robotics, Springer, Volume 19, No. 1, pp. 55-60, 2013.

[16] Hamm, J., Stone, B., Belkin, M., and Dennis, S., “Automatic Annotation of Daily Activity from Smartphone-Based Multisensory Streams”, Mobile Computing, Applications and Services, Social Informatics and Telecommunications Engineering, Volume 110, pp. 328-342, Springer Berlin Heidelberg, 2013.

[17] Wang, P., Smeaton, A.F., Zhang, Y., and Deng, B., “Enhancing the Detection of Concepts for Visual Lifelogs Using Contexts Instead of Ontologies”, IEEE International Conference on Multimedia and Expo Workshops, pp. 1-6, 2014.

[18] Kikia, B., Boytsov, A., Boytsov, A., Hallberg, J., Sani, Z.H., Jonsson, H., and Synnes, K., “Structuring and Presenting Lifelogs Based on Location Data”, Pervasive Computing Paradigms for Mental Health, LNCS, Volume. 100, pp. 133-144, Springer Berlin Heidelberg, 2014.

[19] Song, C.W., Lee, D., Chung, K.Y., Rim, K.W., and Lee, J.H., “Interactive Middleware Architecture for Lifelog Based Context awareness”, Multimedia Tools and Applications, Volume 71 No. 2, pp. 813-826, Springer, 2014.

[20] Newman, B., “Emergency PCS System for Identification and Notification of a Subscriber’s Location”, US Patent No. 5, 835,907, 10 November, 1998.

[21] Cheng, Y.M., Yu, W., and Chou, T.C., “Life is Sharable: Blogging Life Experience with RFID Embedded Mobile Phones”, Proceedings of 7th International Conference on Human Computer Interaction with Mobile Devices and Services, ACM, pp. 295-298, 2005.

[22] Shimozuru, K., Terada, T., and Tsukamoto. M., “A Lifelog System that Recognizes the Objects in a Pocket”, Proceedings of 6th International Conference on Augmented Human, pp. 81-88, 2015.

[23] Instant Image Recognition: Moodstocks [Online] Available: http://developers.moodstocks.com (Last Accessed on 18th November, 2015).

[24] Iqengines [Online] Available: http://iqengines.com (Last Accessed on 18th November, 2015).

[25] Brandt, J., Weiss, N., and Klemmer, S.R., “txt 4 l8r: Lowering the Burden for Diary Studies under Mobile Conditions”, ACM CHI Extended Abstracts, pp., 2303-2308, 2007.

[26] Arduino Mega ADK Board [Online] Available: http://www.arduino.cc/en/Main/ArduinoBoard ADK (Last Accessed on 18th November, 2015).

[27] Memon, M.A., and Tanaka, J., “Ensuring Privacy During Pervasive Loggingby a Passerby”, Journal of Information Processing, Volume 22, No. 2, pp. 334-343, 2014.

[28] Sellen, A.J., Fogg, A., Aitken, M., Hodges, S., Rother, C., and Wood, K., “Do Life-Logging Technologies Support Memory for the Past? An Experimental Study using Sensecam”, ACM Proceedings of SIGCHI Conference on Human Factors in Computing Systems, pp. 81-90, 2007.