

# A Real-Time Life Experience Logging Tool

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**Abstract.** E-memories attempt to digitally encode all life experiences in an archive for later search and real-time recommendation. In this paper we describe a prototype real-time e-memory gathering infrastructure and system, that uses smartphones to gather and organise semantically rich e-memory.

## 1 Introduction

An e-memory is a new concept in digital information management and refers to the digital gathering of life experiences, whether through photos of what we see, videos of what we experience, audio recording of what we hear, or the digital capture of our real-world interactions (e.g. locations, people or actions). Maintaining an e-memory has been alluded to as early as 1945. Vannevar Bush who envisaged a person wearing a forehead mounted camera [1] to gather life experience. Today, the equivalent device is a SenseCam, a small wearable device that passively captures a person's day-to-day activities as a series of photographs [6]. It is typically worn around the neck and is oriented towards the majority of activities which the user is engaged in. The device incorporates on-board sensors to determine when is appropriate to take a photo. Wearing a device like a SenseCam, a wearer can very quickly build large and rich visual e-memories of millions of photos and hundreds of millions of sensor readings per year.

There has been recent research activity in e-memories with the MyLifeBits project at Microsoft gathering and making searchable, a long-term e-memory (incorporating SenseCams) for one individual [5]. Doherty et al. have developed an event segmentation technique and browsing interface [3] for Sensecam archives. However, one drawback of these systems is that the sensing technology is not real-time because the user needs to upload the content periodically to the e-memory archive before it is processed to support search and retrieval. A real-time system would allow for context-based push retrieval from the e-memory, thereby being more suitable as a real-time memory-aid. De Jager et al. [2], have developed a hardware device to enable real-time capture and feedback of life-experiences.

## 2 A Real-Time E-memory Prototype

In this work, we extend prior research by developing a prototype e-memory solution that operates on smartphones to gather data which is then semantically

enriched using both physical and virtual sensors, thereby providing effective search and retrieval facilities in real-time. The prototype system incorporates a smartphone for data capture (worn like a SenseCam passively capturing photos every minute), software for the segmentation and annotation of life experiences, a server for storage of e-memories and a WWW front end to the server. There are a number of key elements that are needed to achieve the e-memory functionality, from life-experience capture using wearable sensors, to experience segmentation and semantic experience annotation through to search support and user interaction. We will discuss each of these elements of our prototype individually below.

**Sensor Capture from wearable sensors.** A smartphone includes sensors that can capture a rich life-experience archive (just like a SenseCam). We mine data constantly from onboard physical sensors; accelerometer, compass, camera, GPS, Bluetooth, microphone, WiFi and communication/media activity sensors. Used alone, such raw readings do not provide much semantic value, but the semantic analysis (below) enriches the collection for enhanced search functionality.

**Experience Segmentation.** Typically, in a full day, we know that a person encounters more than 20 individual *events*, with each event lasting 30 minutes on average [4]. Prior work on event segmentation analyses the sensor streams from SenseCams to generate a segmentation of life-experience into events, post-capture [4]. In this work we take this approach of mining events from sensor streams, but migrate the processing to the smartphone to operate in real-time and upload events to the e-memory archive as they happen.

**Semantic Analysis Engine for sensor streams.** The output of the sensor capture consists of raw sensor streams, as described above. To support real-time analysis, both server-side and smartphone semantic analysis tools are needed; these act as virtual (software) sensors to enrich the raw sensor streams with semantically meaningful annotations. For example, using raw accelerometer values, we can identify the physical activities of a user [7]. We utilise the following virtual sensors; semantic date/time, meaningful location, personal physical activity, social interactions, environmental context, semantic visual concepts automatically identified from the photos and personal context of the user's life pattern. Using these sources, we semantically enrich the annotations of events and construct a narrative to describe each event, needed for both search and presentation.

**Indexing, Retrieval and Presentation.** In order to retrieve life experiences for search or recommendation, either later or in real-time, the experiences and their annotations need to be indexed. In this work we employ an off-the-shelf search engine to index the annotations for every life-experience data and provide keyword search through the e-memory archive, ranking and presenting the multimedia rich life experience data to the user through a WWW interface.

The prototype utilises a smart-selection algorithm to upload events to the server (for indexing and retrieval) in real-time across a wifi or 3G network. If a known wifi network is not available, a minimal event representation is uploaded using 3G, with the remaining data uploaded via wifi later. The WWW interface supports multimodal access and provides search and interaction functionality, as shown in Figure 1.

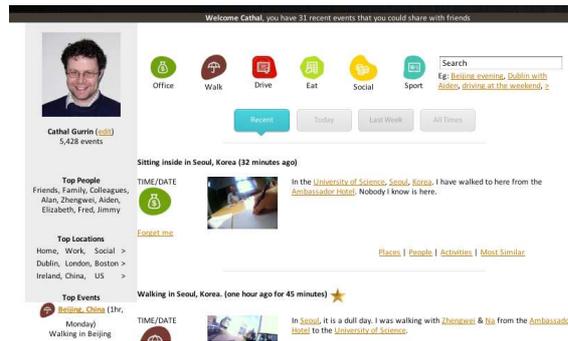


Fig. 1. WWW interface to an E-memory Archive.

### 3 Conclusions

We have presented a real-time e-memory prototype that gathers life-experiences using mobile devices and stores them in a server-based e-memory which supports search and retrieval. The software is operational and gathers data for the e-memory using android smartphones. Work is ongoing to develop context-aware push e-memory recommendations and real-time search from the mobile device.

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