Self-Information System: A context-aware scheduler with visualization module based on self-information

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Abstract: Developing a personalized, user-centric system is one of today's challenging issues in ubiquitous network-based systems. Such a personalized system has to identify the user's current needs dynamically and proactively based on the user's current context such as location, current activities and current local time. In order to personalize services to users, most services providers today basically count on what users provided. However, due to privacy considerations, users do not tend to supply exact personal information such as preferences, interests, book wish-list, favourite artists. Therefore, a new system in which users can manage their personal information without anxiety of privacy problem becomes more necessary than ever. This paper will describe the concept of building that system called Self-Information System(SIS). SIS allows users to store planned events as well as help them track their personal activities in the past. A GPS-based location tracking module is embbeded in this system to identify what users are currently being and what they were as a activity log. Based on these information and by considering the context, user profile with preferences, which stored in standard format supplying by users, services providers will be able to provide more personalized services to individuals. A visualization module which supporting users to track how precisely they have followed the predefined schedules by displaying on map also help them customize plans more effective.
Keywords: self information, context awareness, personal information manager

1. Introduction

With the advance of current information technology, developing a personalized, user-centric system is now becoming more essential than ever. At present, most service providers are independently collecting customer's needs identification in order to provide a better service to their customers. To archieve it, the most difficult matters which they have to deal with is that customers tend to provide fake information such as needs, hobbies and interests. It leads to a problem that those service providers can not accommodate their users' needs due to incorrected data provided by customers. In spite of the fact that customers like to get more personalized services and remove spam, or unrelated to users' interests, services by providers, it is still a case that they tend not to supply correct personal information to service providers. It is due to many personal information losing problems occurred recently on the internet, the reliance on service providers become lessen. Therefore, this paper aims to propose a methodology of constructing a platform so that users can independently manage planned and actual events as well as personal interests, and preferences by themselves. This standard format will help other service providers and companies easily supply a more suitable, specific service to individual customer. By attaching those information with other context such as location, date time, current health condition (pedometer as a solution), it can be used as a daily-life supportive system, or a self-health management system.

So far, many today personalized system are limited, with some important deficiencies. One is that user preferences are not shared or understood by current web service systems. One of the reasons is that they are hard-coded in the system. These preferences are neither visible nor accessible. These limitations drive our research to develop a personalized system that enables a web-based agent personal agent to search and return necessary contents based on user's planned events. Our proposed system differentiates itself from traditional context aware system in that the system individually interacts with the user to support a more personalized, individual focus. For example, users can store their personal daily schedules as planned and actual events in local computer instead of storing those personal information in the database server of many service providers. In other words, all privacy information are stored and managed by user himself. Consequently, when catching a favourite service, user can actively share those information to providers, and a more personlized service is then provided as a return.

The rest of this paper is organized as follows. Section 2 provides an overview of the framework and core structure of our self-information system. To show the posibility of the idea proposed in this paper, how the protype system is implemented and applied will be specified in section 3. The paper finishes with concluding remark and future plans in section 4.

2. System architecture

2.1 Need identification

The need-awareness model proposed in this paper was constructed based on associative theory. Associative theory has traditionally been considered as an important approach to observing causality in developmental psychology (Dickinson & Shanks, 1985). Based on associative theory, a personal agent has been constructed based the following pricinples:

- The strength of the association is determined by predefined user preferences and planned events.
- This paper selects the user's location, schedule (planned event) as sources of user context.

In this paper, *strong push* and *weak push service* methods are applied based on the strength of association. Strong push autonomously inserts a content that relates to user's planned events; in a weak push sytem, only dynamic hyperlinks appear in the user's scheduler to be unobtrusive.

2.2 Context awareness

Context can be divided into external context and internal context. External context means social or physical environment that can have an impact on certain behavior. Internal context means psychological context that does not appear externally (Sperber, 1986). Internal context can be acquired by inferencing user's behavior and external context. Among those, our system is based on external context to approach context awareness. SIS adopted GPS technology for location tracking, and pedometer for user's current health condition. Such extenal context will help user to manage himeself or sharing information with other web service providers without any difficulty.

2.3 Conceptual framework of Self-Information system

This section proposed a conceptual framework for our Self-Information System (SIS): a calendar-liked system . SIS is a platform that allows user storing their planned and actual events in a standard format in local computer. The model can be shown in the figure 1 below.

In this system, a user allows an agent to reside on his calendar-like system; the agent continously checks the contents in the schedule that a user stored as planned events. At this time, the user agent may identify a particular planned events as internal context, or if neccesary, will aquire the input content in text format. We will this term internal to mean that the context can be acquired in the same sytem; hence no networking capabilities to deliver the context are needed. After an authentication step, the agent can acquire the user's profile and scans the user's planned events.

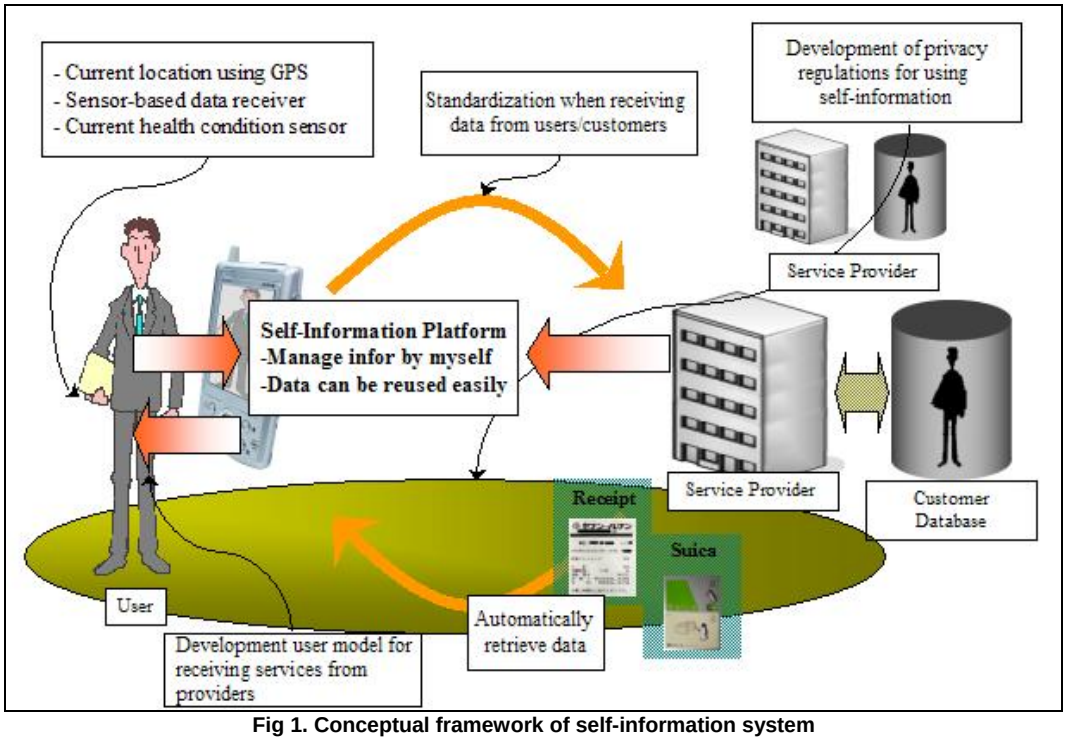

Fig 1. Conceptual framework of self-information system

Consideration to the standardization which we acquired later, all the planned and actual events are entered in well-formatted form. By standardization, extracting keywords which entered by user can be retrieved easily. By throwing those keywords to specific search engine, or perdefined web service providers, the user agent will acquire more abundant external resources which are more suitable to user's neeeds. Alternatively,, the agent may get the user's current external context which can be delivered from wireless connected sensors, or devices. These sensors can track user's current context such as location, current datetime (using GPS-embbeded devices) or blood pressure, heartbeat (using pedometer). By invoking web service, once the user agent eventually identifies sellers who are in the vicinity of the user's current location, and at the same time can provide items or services in the user's planned events, SIS can alert user through his personal devices such as mobile.

Nevertheless, visualization module is adopted as a efficient way of supporting user to review his planned activities and actual activities in map. As stated more detail in section 3, part 2, after recording actual events to system, which including location, time and other external resources, user can preview his activities on map.

3. Implementation

To reveal the feasibility of the system proposed in this paper, we developed a calendar agent called SIS (Self-Information system). The scheduler-based agent is mainly written in Java Platform, version 5.0plus and SOAP (Simple Object Access Protocol) as a webservice. Meanwhile, location data was taken from GPS-device named Compact Flash GPS Receiver 2 (CFGPS2 in short), as shown in figure 2, connected to a small laptop. With light weight 60g, frequency receiver 1575.42MH, compatiable with most Windows OS and high accuracy (within 10m), it is suitable for our experiment in tracking user's actual movement. At present, the system consists of two different components as the following, other components such as pedometer, suica (Super Urban Intelligent Card is a popular railway card issued by Japan Railway Company) will be plugged to system in the future.

Fig 2. Compact Flash - GPS Receiver 2

3.1 Scheduler agent

Our main purpose is to create a scheduler-liked agent that enables users to store both planned and actual events. Other data like sensor-based moving, heartbeat is in development so that all these external information can be managed in one place by user. Event editing/adding screen is shown as figure 3. The interface of this is similar to MS Outlook Express which also allowing user to choose proiority, category. Geodetic log data can be seen in figure 4. Location data can be acquired from a GPS-embeded module shown in previous section.

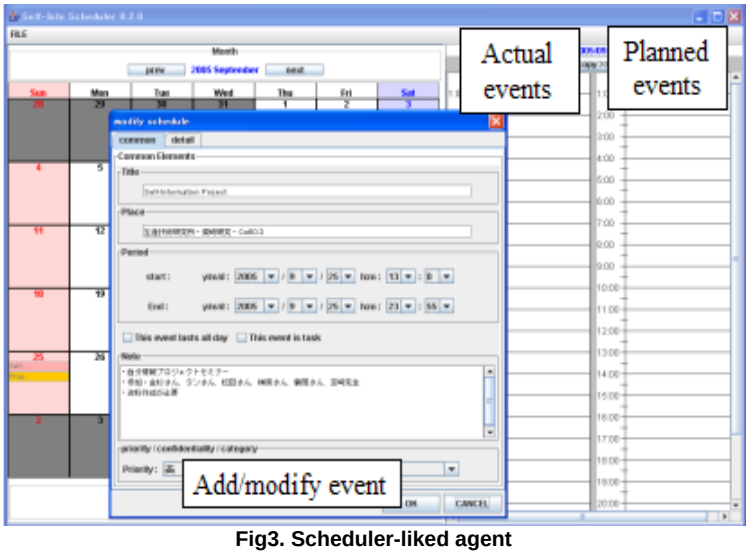

Fig3. Scheduler-liked agent

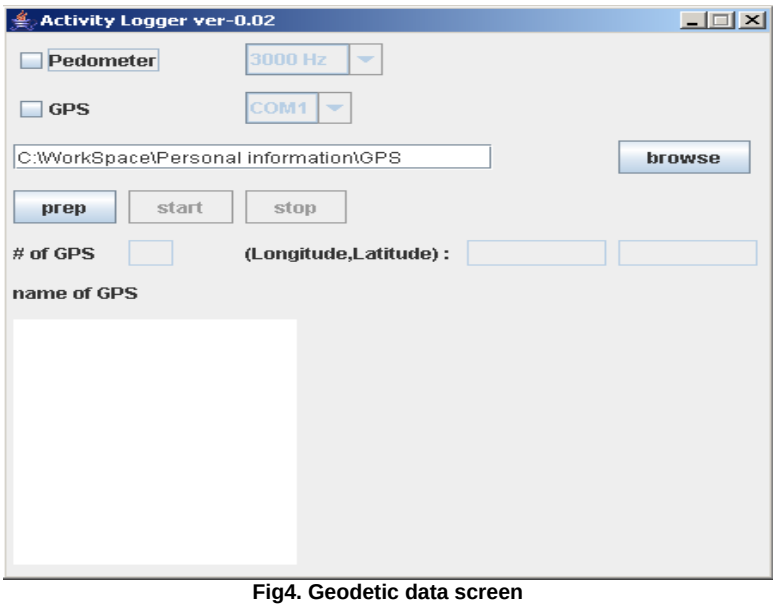

Fig4. Geodetic data screen

3.2 Visualization of User Acitivily Log

The main idea of this visualization module is to help users track how precisely they followed the predefined schedules by displaying on a digital map. It enables them to overview and customize personal plans more effectively. In order to implement this, we adopted the free beta map service provided by Google Inc. Google Map Application Program Interface (API) lets developers embed Google Maps in their own web pages with Javascript. Adding overlays to the map, which including markers and polylines, displaying shadowed and the like) can be done easier and more effectively.

Procedures for conducting this can be shown as follow:

- Extracting the planned events data in xml format from the scheduler, named plannedEvt.xml
- Convert raw GPS data to xml file with simple elements such as longitute, latitude, alitude and datetime, extra information (activity, url link to pictures, etc), named actualEvt.xml
- Mapping the datetime element between plannedEvt.xml and actualEvt.xml to find out the movement of the user. This step should be done bacause we try to remove all redundant information taken from raw GPS data. The new file is named as logMap.xml,
- Display logMap.xml on Google Map using API issued by Google.

Below is the experiment result that we have conducted by walking out in the downtown in Tokyo with GPS-embedded device along (see figure 2). XML-formated log file after extracted from raw GPS data can be shown as figure 5. Follow the rules stated above, figure 6 illustrated the trace of us. Each location marker in the map contains specified data such as an event and how long the event lasted at the location. Nevertheless, zooming map or changing from map type to satellite type can be done easily by clicking icon on the right map.

```
<?xml version="1.0" ?>
<History xmlns:xsi=http://www.w3.org/2001/XMLSchema-instance>
  <Run idx="1000">
    <Track>
      <Trackpoint>
        <Position>
          <Latitude>35.777321</Latitude>
          <Longitude>139.832308</Longitude>
          <Altitude>31.6</Altitude>
          <Extra>Taking picture</Extra>
        </Position>
        <Time>2005-09-17T00:24:46Z</Time>
      </Trackpoint>
      <Trackpoint>
        <Position>
          <Latitude>35.7773451</Latitude>
          <Longitude>139.832376</Longitude>
          <Altitude>45.5</Altitude>
          <Extra>Shopping:: buying book</Extra>
        </Position>
```

```
        <Time>2005-09-17T00:24:47Z</Time>
      </Trackpoint>
      [more data here]
    </Track>
  </Run>
</History>
```

Fig5. Extracting GPS data as XML file

Fig6. Tracking user movement in Tokyo

4. Conclusions

This paper showed a conceptual methodology for constructing a new personal information manager platform, called SIS. An actual system is being in development to reveal the feasibility of our concept. At present, SIS allows user to store and manage his personal information such as planned and actual evnets. So far, based on data taken from a GPS device connected to laptop, one may be able to review all actual movements in map. In the future work, we will continue to develop the context-aware based scheduler as stated below:

- Integrating visualization module into scheduler agent
- Improving scheduler agent so that it can autonomously extract keywords and insert necessary service to user's scheduler
- Developing a methodology so that the information provided by users can be used widely among service providers
- All the above components need to be satified by Privacy Protection Regulations issued renewly on 2004 in Japan.

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