# MPATH VIEW: AN INTERACTIVE BEHAVIOR HISTORY VIEWER FOR ENHANCING COMMUNICATION

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**Abstract.** *This paper proposes an interactive viewer of behavior histories captured by GPS, digital camera and other pervasive sensors. The viewer assists our memory and communication by showing bird's-eye view map overlaid with user's movement trail and other behavior data. The viewer is characterized by the interactivity in these two cases: interactive focusing on a certain information and interactive setting of the view point with user's orientation.*

## 1. Introduction

Recently, digital technology for recognition and storing of human activity has been applied to the aids of human activity. Such an idea as is initially advocated by Vannever Bush in his Memex vision, is going to be realized with the progress of pervasive computing technologies. There are various researches which capture, store and analyze human activities, and provide adaptive information and services [1][2][4][5]. One of the aims of these researches is the memory assistance by showing ordered activity histories when we recall, talk about, and report what we did in the past. In this paper, we discuss functions of behavior history viewer, and propose mPATH view, an interactive behavior history viewer.

## 2. Behavior History Viewer

As the progress of sensor technologies of human behavior, which is one of the core technologies on pervasive computing environment, utilization of stored behavior has widely discussed. Although simple mapping of stored data for visualization is a widely utilized technique [5][6], this is not enough for enhancing our communication. Since the topic and the situation of our communication tend to keep changing, behavior history viewer should be interactive in terms of following two aspects.

**Interactive Focusing on Interesting Behavior:** When we recall our past activity, we usually focus on a certain behavior. For example, when we talk in a group, we refer to common experiences among

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the group. However, what we focus on changes while we are talking. A behavior history viewer should follow the change interactively.

**Interactive Viewpoint Setting:** Like a navigation system which dynamically updates a map according to a current location, the location of displayed behavior history should be represented intuitively. Therefore, the view should be interactive with a location and orientation of a user.

## 3.   Demonstration

We propose mPATH View: a handy viewer on which personal behavior history such as a movement trail and photographs are shown on a 3D map.

The user can also change behavior data on the viewer interactively through a visual programming interface. Stored behavior histories are shown as icons on the viewer or another PC, therefore user can select data by simple mouse operation. In addition, user can extract interpreted data. Such programmability is realized by the mPATH framework. We introduce the mPATH Framework briefly in the next section.

The location and orientation of the 3D map interactively reflects user's physical point of view. When a user tilts the viewer as shown in Figure 1, a bird's-eye view map depicted in Figure 2 is shown on the viewer. When tilting horizontally, the user get a generic map. The viewer also reflects orientation of a user. When a user rotate with the viewer, the map on the viewer follows user's direction. These functions provide interactivity of viewpoint setting.
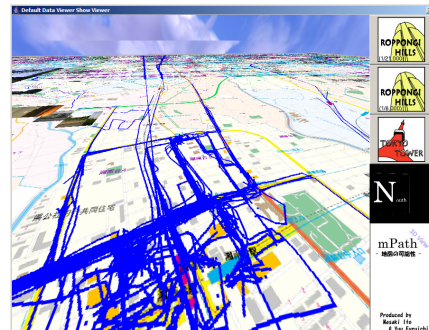


**Figure 1. Usage of the mPATH View**



**Figure 2. Screen Shot**

## 4.   Design and Implementation

The mPATH view is designed as an application on the mPATH framework. We introduce the detail in this section.

### 4.1.   Hardware Architecture

As shown in Figure 3, we utilized NEC VersaPro, a tablet PC as a viewer. On the back of the tablet PC, we attached TruePoint Compass Module, which is equipped with a digital magnetic compass and a 3D acceleration sensor, and a product of Point Research Corporation.

For capturing behaviors, we utilized Garmin eTrex: a handy GPS terminal which store its location periodically. We also utilized a digital camera to capture interests in certain scenery. Captured data are stored as files in a controller in Figure 6.



**Figure 3. A tablet PC with a TruePoint sensor**

## 4.2. mPATH Framework

As a basis of mPATH View, we utilized mPATH Framework[3] which we developed as a programming framework for context-aware applications. The mPATH framework enables interactive composition of analysis and visualization components for behavior histories through a visual programming interface. Figure 4 shows the screen shot of the mPATH framework. We utilize icons of functions shown on the right side of the screen, and connect them on the left top window where selected icons are connected according to the flow of data. The examples of output are shown in Figure 5.
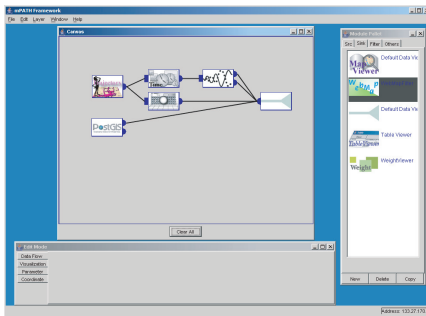


**Figure 5. Output Maps**
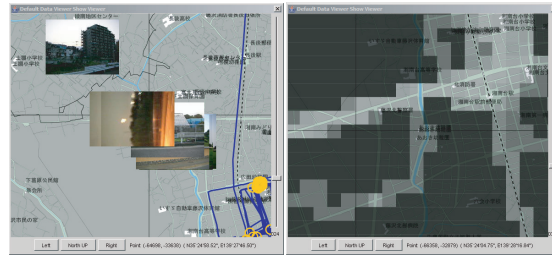
**Figure 4. mPATH Framework**

On the mPATH framework, developers can create a new application as an aggregation of existing and original components. We developed following original components for the mPATH View.

**mPATH Communication Module:** Since the size of the screen of the viewer is too small to show 3D view and a programming panel together, we divided functions of mPATH Viewer into two PCs. We developed communication module for the mPATH Framework which consisted of a sender and a receiver. We designed XML-based communication protocol to exchange data.

**mPATH 3D Viewer Module:** We developed a 3D viewer module on the mPATH framework. Figure 2 shows the output of this module. We rendered output map on a flat surface in the virtual 3D space. The orientation of the viewpoint of the virtual 3D space dynamically reflects the output of the TruePoint sensor attached to the tablet PC.

### 4.3. Composition of the mPATH Viewer

As shown in Figure 6, we composed mPATH View by utilizing several mPATH modules. On the controller PC, we utilized several data modules such as a digital map module which accesses to a GIS database, a GPS log module and a photo module. We also utilize filter modules such as a way point filter which extracts way points from input GPS data. Every output is connected to the sender module. On the viewer PC, a receiver module is connected to a mPATH 3D Viewer module.
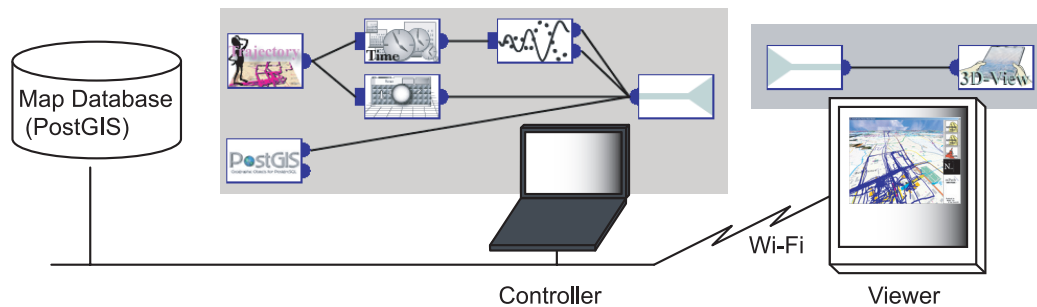


**Figure 6. System Overview**

## 5.  Summary

In this paper, we introduced the mPATH view, which enables interactive retracing of past activities and to enhance our communication. Captured and stored behavior histories are shown on a 3D map in the viewer. User can change the orientation of the 3D map interactively by their movement. User can also interactively select and interpret displayed data by visual programming.

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