Spin&Swing: Spatial Interaction with Orientation Aware Devices

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Abstract. We present Spin&Swing, a spatial interaction technique that leverages user's orientation as an active input to interact with mobile applications. With Spin&Swing, a user can trigger a variety of mobile operations by orienting her spatially aware mobile device with in the sphere around her. In our current prototype this 360° circular orientation is mapped into a temporal dimension enabling users to browse and visualize historical interaction with an application in context. The demo showcases a prototype application where we have utilized this technique using a mobile device to visualize and browse the historical information recorded by a digital memory augmented shoe in a personal travel log application.

Keywords: Spatial Interaction, Orientation Awareness, and History Browsing.

1 Introduction

The proliferation of sensor-rich and location-aware mobile phones enables us to build imaginative new forms of interaction technique that has the potent to dramatically enhance user experiences [1]. In this paper, we present Spin&Swing, a spatial interaction technique that utilizes orientation as an input mechanism to interact with mobile applications. Users can orient the mobile device within the 360° sphere around her to trigger a range of operations in the mobile phone like shortcuts [2]. The 360° circular orientations can be mapped in many different ways with different granularities depending on the context of the application. In our current prototype, we have mapped the spatial orientation into a temporal dimension using the metaphor of a clock. This mapping is useful for the applications where users need to browse and visualize historical experiences (e.g., revisiting the location-trails, activity-trails etc.) spread across time and space. Fig. 1 shows the fundamental concept of Spin&Swing where users orientation corresponds to the update of the visualization presented in the device. Such spatial browsing and consequent visualization spread across time and space could be very useful for applications where interactions, and data are associated with temporal and spatial significance, e.g., city tour guide, museum guide, etc. In addition, the technique could also be used for visualizing sensor data collected over a period of time for a quick overview and browsing.

A proof-of-concept application is developed to evaluate the usability of Spin&Swing using a sensor augmented shoe and a mobile phone in the context of a personal travel log application. In the next section, we describe the application context and the technical details of Spin&Swing.

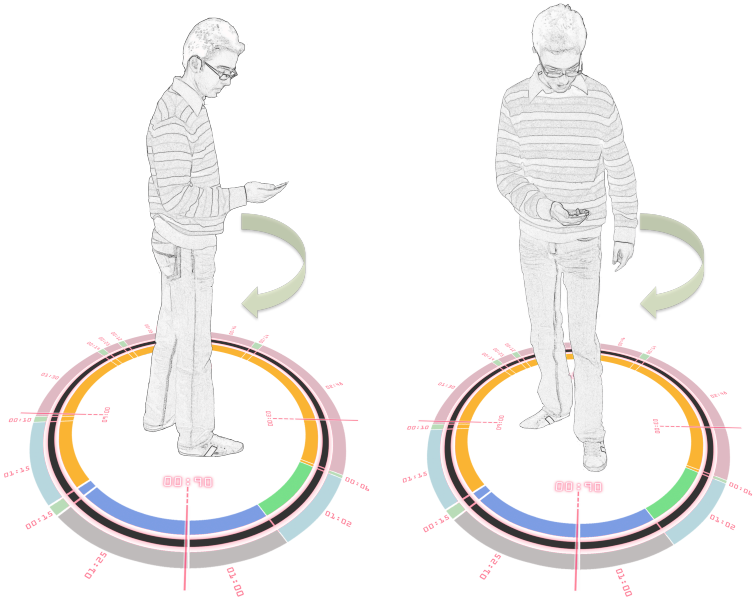

Fig. 1. Spin&Swing Concept - User's Orientation is mapped into a Clock Metaphor Enabling Users to Browse Historical Information Seamlessly.

2 Prototype Implementation

In the section, we first describe the application scenario and then explain the technical components that implement the scenario employing Spin&Swing.

2.1 Personal Travel Log Application

Personal Travel Log is a “life long memory” driven mobile application that aims to record the outdoor activities of a person in the form of activity-location trails and present them in a pleasurable fashion. The application exploits the Spin&Swing technique to enable users to browse through their past activities and locations through spatial interaction, i.e., orientation. For instance, users could orient their mobile device towards 45° west to retrieve their activities and corresponding location of three hours earlier. This application utilizes a rich set of sensors to record user’s activity and tagged it with temporal location data.

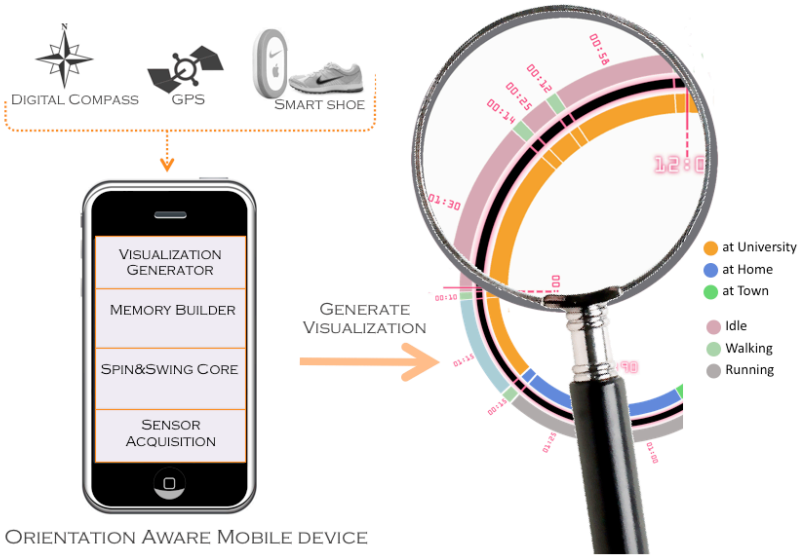

Fig. 2. Architectural Schematics of Personal Travel Log Application employing Spin&Swing

2.2 Application Components and Structure

Fig. 2 depicts the architectural building blocks of the Personal Travel Log application which consists of the following:

2.2.1 Smart Shoe: A regular shoe is augmented with Nike+ sensor kit[1] (containing a piezoelectric accelerometer and a built-in transmitter and antenna). The sensor detects every step the person takes and broadcasts this information along with the timestamp to the receiver. An iPhone 3GS[2] is used as a receiver and the real time data are pulled to the browser application.

2.2.2 Orientation Aware Mobile Device: In our current prototype, an iPhone 3GS is used as the primary mobile device implementing Spin&Swing. Although, the magnetic heading of the embedded compass of the iPhone is enough to implement Spin&Swing per se, in the context of Personal Travel Log, iPhone is used for four purposes layered across four components as shown in Fig 2.

Acquisition of Sensor Data: GPS, and compass data along with shoe's accelerometer data is tracked by this module and passed to the *Spin&Swing Core*.

Spin&Swing Core: The compass data is separated and orientation-to-time mapping is applied. The orientation data expressed in degrees with directions are mapped to a 12

[1] http://nikerunning.nike.com/nikeos/p/nikeplus/en_GB/
[2] http://www.apple.com/uk/iphone/

hours day clock. A memory index is generated and delegated to the *Visualization Generator* component to facilitate appropriate visualization corresponding to the users orientation. The GPS and accelerometer data from the Nike+ kit are extracted and passed to the *Memory Builder* module to generate the memory of the application.

Memory Builder: Memory records are generated from the raw GPS and Nike+ accelerometer data applying a simple algorithm. Timestamps of the GPS trails are coupled with the Nike+ step count data to reason users higher-level activity and location at a specific time.

Visualization Generator: The memory visualization as shown in Fig 2 is expressed in terms of nested colored closed circles spread across space and time. Every memory record occupies relative area of the outer circle and is distinctively colored according to the type of activity. The inner circle indicates location information for each memory record. The visualization is altered according to the orientation that enables users to browse through the memory over the temporal dimensions, i.e., if users orient the device towards 45° west the visualization will present the snapshot of user's activities of three hours earlier. To provide joyful user experience, the current prototype extends the regular visualization by applying augmented reality, so users are offered a real time camera preview over which they could browse their activity giving them a more natural user experience. Fig. 3 shows the Spin&Swing in action with Personal Travel Log application.

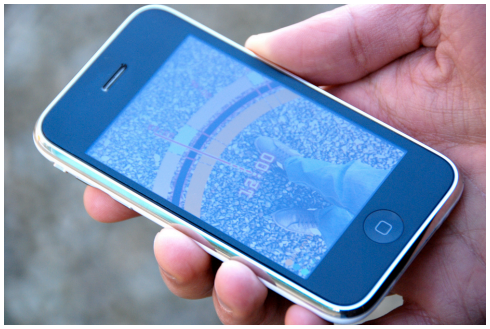

Fig. 3. Spin&Swing with Personal Travel log

3 Conclusion

We present Spin&Swing, a spatial interaction technique for the orientation aware devices. The demo will showcase this technique in the context of a personal travel log application that enables browsing personal activity-location trails visualized through a clock metaphor. An immediate future avenue of our work is to conduct a user study to uncover the usability aspects of this technique.

References

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