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The Expo Framework

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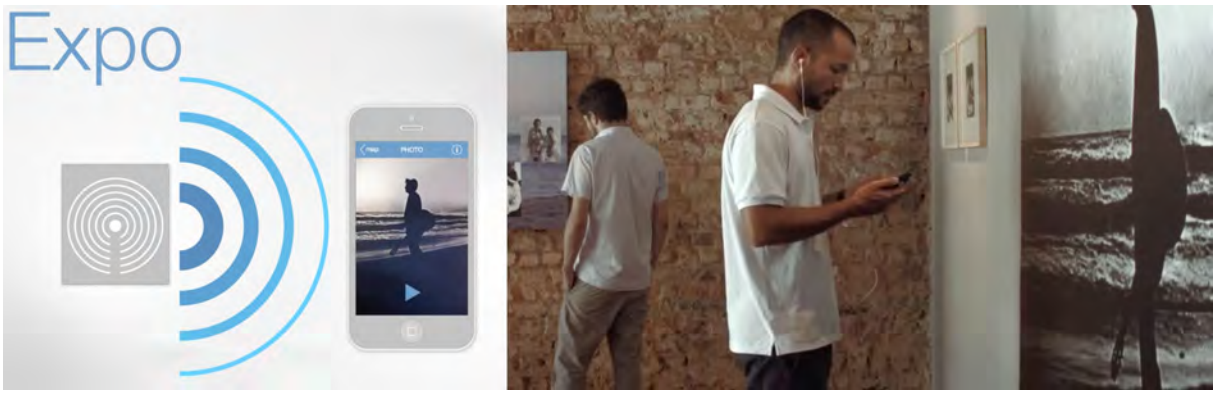

Figure 1: *Visitor of Tom Jobim's Music and Nature exhibit using a mobile device to interact with multimedia content.*

Abstract

The Expo Framework takes advantage new technologies available in mobile platforms to turn a museum exhibit into an interactive experience. Different interactions can be easily created for each desired piece of the collection, which are activated as the visitor explores the space.

CR Categories: H.5.4 [Information Interfaces And Presentation]: Hypertext/Hypermedia —Architectures

Keywords: exhibits, mobile, micro-location

1 Introduction

In recent years, developments in networking, computing and related technologies, as well as, advances in software methodologies started a deep revolution in our society. More specifically, the emergence of mobile platforms are enabling a plethora of new media with great impact in many areas of applications.

Mobile devices have changed the everyday life of people because of they incorporate a set of features not available before, such as, portability, computing power, connectivity, natural interfaces, high fidelity audio-visual I/O and multiple sensors.

The above characteristics transformed smartphones, tablets and other devices into ubiquitous resources that link users with a remote digital data infrastructure and the physical environment.

Particularly, location-based capabilities provide for a wide range of applications. While GPS is applicable outdoors, Wi-Fi and Bluetooth are suitable for indoor areas.

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In this context, the combination of location and multimedia can be used to create mobile applications for museums, extending traditional exhibits beyond the physical collection. These Apps have the potential to operate radical changes in social education and cultural heritage because they allow personalised interaction with information and media content, while maintaining the sense of presence through a direct relation with the physical space.

2 The Framework

To make application development more effective it would be desirable that museum curators and exhibit designers could employ an authoring environment taylored to their creative needs. The Expo Framework aims to achieve this goal, providing a flexible structure that uses as a language the visitor's experience, and at the same time, hides unnecessary technological details.

The Framework is based on three main features: micro-location; wireless communication; and interactive multimedia. Bluetooth Low Energy (BLE) Beacon technology situates the visitor within the exhibit's space. WiFi networking gives access to content streamed from museum servers. Multitouch input coupled with audio-visual output enables natural interaction with the collection. Figure 1 shows a visitor experiencing content of Tom Jobim's expo.

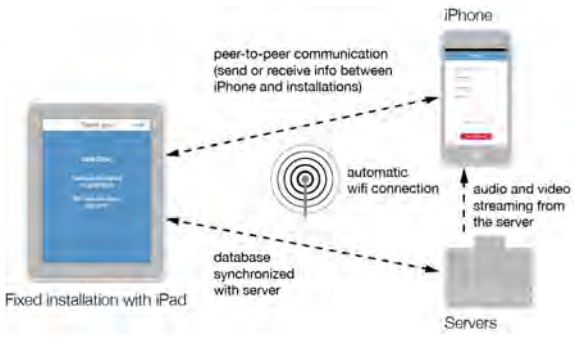

Figure 2: *Expo Framework exploits different communication mechanisms for content interaction.*

Different communication mechanisms, such as client-server and peer-to-peer, are integrated to provide transparent access to related digital data without requiring local storage in the device. Figure 2 illustrates a possible usage scenario, where audio and video are streamed from the server, while the interaction between an exhibit's iPad display and the visitor's iPhone share direct communication but are synchonized with the server.

The design of individual interactions with particular items of the collection relies on Beacon micro-location: as the visitor approaches different areas of the exhibt, actions associated with that content are enabled. The Beacon location operates in two different modes: *Region Monitoring* that sends a notification when the device enters the area near a set of beacons and *Beacon Ranging* that reports the proximity of individual beacons.

The Expo authoring architecture is based on a Finite State Machine (FSM) such that Beacon Events and User Actions trigger changes of state and set the context to specific interactions. The Framework employs a hierarchical FSM in which the first level corresponds to the main logical flow of a visitor through the exhibit, while the higher levels correspond to interactions with individual areas of the exhibt.

In that respect, the main flow comprises the following states: *outside*; *check-in*; *idle*; *in-spot* and *check-out*. Transitions from outside to check-in and inside to check-out are signaled by Beacon Monitoring events. Transitions from idle to in-spot and vice-versa are controlled by Beacon Ranging. Other transitions are generally derived from user actions. Figure 3 shows the first level of the Expo state machine.

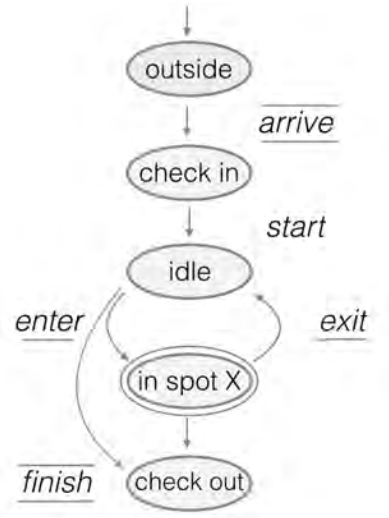

Figure 3: *Expo framework level 1 state machine for exhibit.*

The higher order levels of the state machine are dependent on content of the collection, as well as, the desired interactions with it. Consequently, they shape the "personality" of the App experience. They are the principal focus of curators and designers. The Expo framework provides a Data Model, including the entities: Visit; User; Spot; Item. Interactions can fully exploit the mobile device sensors and multimedia capabilities, for example motion sensing and cameras to create an augmented reality experience. Figure 4 depicts a simple interaction where the visitor can play some media content related to an exhibt area.

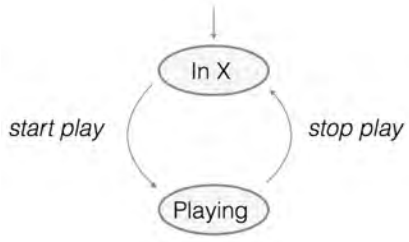

Figure 4: *Simple state machine for exhibit spot.*

3 Example Applications

The effectiveness of the Expo Framework has already being tested with great success in the design of two exhibit Apps by the author.

The fist App is *Tom Jobim Music and Nature Expo* [Velho 2015b], that shows Tom Jobim's life trajectory and artistic pieces, throughout the many phases of his career. Photos, panels, projections, manuscripts, music scores and his personal items illustrate the most important moments of his life and are expanded into interactive contents for the visitor's appreciation (See Figure 5).

Figure 5: *Tom Jobim Expo App.*

The second App is *Olhar 3D* [Velho 2015a] of the exhibit "A View in Spaces of Dimension 3", about visualization of 3-manifolds, shown at the Museum of Astronomy in Rio de Janeiro (See Figure 6).

Figure 6: *Olhar 3D App.*

References

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