ORCHESTRA: AN INTEGRATED ICT PLATFORM FOR CREATING RICH INTERACTIVE CULTURAL EXPERIENCES

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Abstract

Cultural organizations such as Galleries, Museums and Libraries are, traditionally, facing problems of financial sustainability that can be attributed, to a certain degree, to the lack of or difficulty to implement impressive and experiential educational activities for their visitors. Orchestra is a collaborative R&D project that addresses this through the provision of an ICT toolkit and methodologies for rich interactive storytelling deployed in smart spaces. Among the first outcomes of the project is a framework for developing interactive surfaces (e.g., interactive wall or floor).

Keywords: *interactive experiences, interactive multimodal storytelling, smart cultural spaces, interactive surfaces*

Introduction

The Orchestra platform proposes a new type of interactive productions for cultural experiences as well as a new dissemination model for the respective experiences. It adopts an open and horizontal approach to integrating input and output devices in order to better support storytelling. The project designs and develops an orchestration engine that can manage and coordinate all the connected devices in well-defined stories, edited through a visual editor. We intend to support “conventional” sensors and peripherals (e.g., projection systems, audio systems, gesture- interacting systems such as Leap Motion) as well as custom ones, developed by our team. One of latter is an interactive wall system, that can turn a wall, or similar surface, of any size to a multi- touch display.

Overall Concept and Methodology

Orchestra consists of four main components: a) Orchestra Storyteller: a free storytelling editor that enables GLAM (Galleries, Libraries, Archives, Museums) staff to create engaging scenarios without special technical knowledge, b) audiovisual and interaction devices that can transform a room to a smart space (e.g., interactive wall, gesture-interacting systems, proximity/presence sensors, projector, sound system, smart lights), c) Orchestra Appliance: a box coordinating all peripherals and executing the scenarios

loaded and d) Orchestra Gallery: an online marketplace where Orchestra scenarios can be published, shared and sold.

The Storyteller allows visual editing of a scenario along a storyline, by setting actions related to user interaction. It also manages multimedia content and associates content items with specific scenario actions. The scenario editors can also easily find, during edit-time, relevant and useful content from integrated sources. The appliance is actually an embedded middleware that handles all issues related to playout of an experience, e.g., DRM (Digital Rights Management), integration with devices and 3rd party applications, playout control.

Special effort is put on special peripherals enabling touch and gesture-based interaction. The first one is an interactive surface system that is implemented with infrared computer based technology and TUIO framework. This system is currently the most developed one and is further described in the following section. The second one is a wrapper framework for Leap Motion, a popular platform for gesture-based interactions. This wrapper framework applies some more advanced data analysis methods to the standard Leap Motion framework.

The project will build upon open and mature technologies in order to provide the aforementioned functionality. Integration of third party applications and devices will be supported by a well- defined application model and open APIs. Special APIs will support integration of Web games, implemented through Phaser.io framework.

The final system will be assessed by real users, mainly school classes visiting the Music Library of Greece, where a reference deployment will be made. A special evaluation methodology will be designed in the course of the project to allow for identifying problems and opportunities for such systems.

Interactive Surfaces in the Context of ORCHESTRA Platform

In the ORCHESTRA platform the basic requirements regarding the interactive surface are i) operation of the system in horizontal and vertical surface, ii) capability of multitouch and iii) scalability in terms of the surface size.

First of all let's clarify what the term "multitouch" means. Multi-touch (or multitouch) denotes a set of interaction techniques which allow computer users to control graphical applications with several fingers. Multi-touch consists of a touch screen (e.g., computer display, table, wall) or touchpad, as well as software that recognizes multiple simultaneous touch points, as opposed to the standard touchscreen (e.g. computer touchpad, ATM), which recognizes only one touch point (Chanda & Acharya, 2016).

There are five major techniques being employed that allow for the creation of a stable multi- touch interactive displays (walls, tables, floor); Frustrated Total Internal Reflection (FTIR) approach, Rear Diffused Illumination (Rear DI), Laser Light Plane (LLP), LED-Light Plane (LED-LP) and Diffused Surface Illumination (DSI) (NUI Group, 2009).

These five techniques all work on the principal of Computer Vision, where inputs are extrapolated in real time by analyzing a video feed/s through single or multiple cameras. The use of computer vision to obtain and extrapolate input data makes these techniques not only cost effective and high resolution, but also makes them very scalable.

In the context of ORCHESTRAplatform we adopt the Laser Light Plane Illumination (LLP) technique. This technique allows for the implementation of interactive tables and wall-sized interactive surfaces. We utilize IR lasers (780nm) in order to create a plane just above the surface (e.g. wall). Most setups go with 2-4 lasers, positioned on the corners of the touch surface. Laser modules need to have line lenses on them in order to create the light plane. The most common used lenses are those of 90 or 120 degrees. The necessary hardware parts for the implementation of an interactive surface with the LLP technique are the following:

- Projector
- Infrared Lasers
- Line Generating Lens
- Infrared camera
- Computing unit

In the selected design, an IR camera is placed near the projector and captures the projected area. Actually the camera's optical axis is perpendicular to the interactive surface. The camera can be a simple web camera or a camera that allows only one wavelength to pass (in our case filters out all wavelengths and allows 780nm). In the latter case the accuracy of detection is superior than the simple web camera and additionally this setup is more robust in terms of false blob detection and ambient illumination changes. Figure 1 depicts the schematic setup of the interactive wall on ORCHESTRA platform.

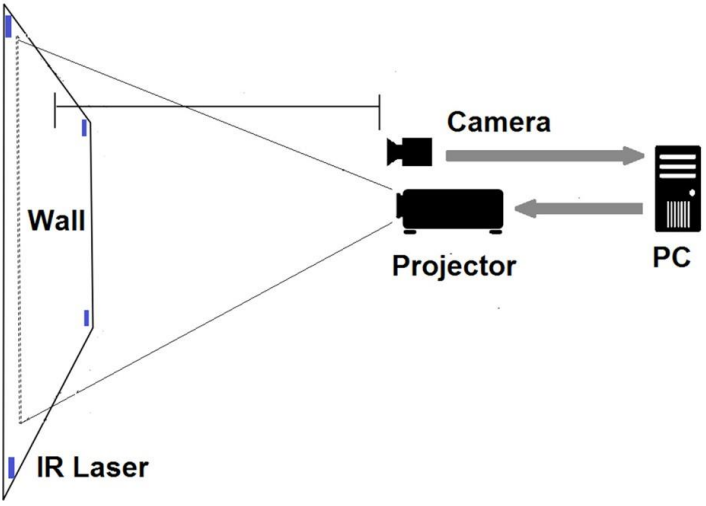

Figure 1

When a finger touches the surface interrupts the light plane and subsequently is illuminated. The infrared camera detects this illumination (see Figure 2).

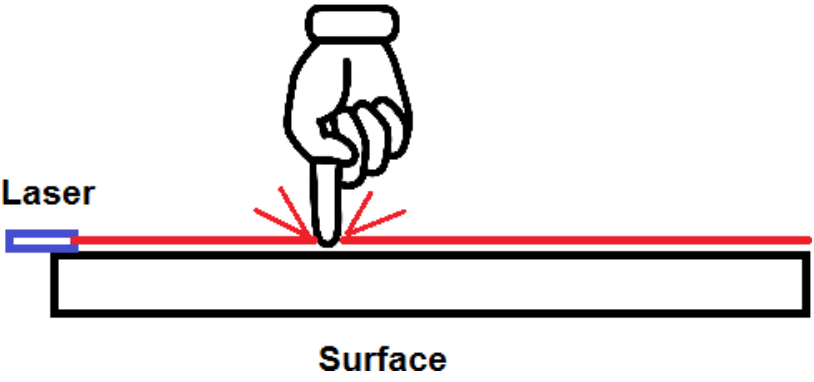

Figure 2

The computer vision software that runs on the computing unit, processes the camera frames and "translates" it as an IR blob. After the calibration procedure is completed (is performed only once in the initial setup phase), the coordinates of the blob are registered and are used for determining (in real time) the coordinates of the finger in the touch surface. The camera captures continuously the surface and the software could process multiple isolated touches (nearly 200).

Conclusions

The present work is still in progress. Until now in terms of "smart peripherals" we have a first prototype of an interactive wall module and a programming framework for controlling smart (WiFi-enabled) light bulbs to control ambient light. In terms of the Orchestra platform architecture we have come to an initial design and are currently running a survey for potential implementation technologies and frameworks. The system prototype will be hosted in the Music Library of Greece "Lilian Voudouri", which is also a partner in this project, together with Tetragon S.A.

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