Measuring the engagement of a museum visitor in interactive museum exhibits

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***Abstract*—Modern interactive museums offer visitors a dynamic learning environment, promoting exploration and encourage the excitement of discovery as visitors learn new concepts, as they are free to interact with the exhibits. In this paper we propose an architecture for an interactive learning environment (ILE) using a collection of commodity devices: a set of displays where different content is presented, a set of mobile devices for each visitor to interact and a Kinect sensor. The engagement affective state is predicted using various classifiers and a database of readings from the Kinect sensor. The architecture also addresses the problem of content distribution among devices. A case study of an interactive exhibit held in classrooms. The participants were students of Technologic Institute of Tijuana. Experimental results show that the proposed approach can predict the engagement affective state.**

***Keywords*—Interactive, Environment, Kinect 2.0, Affective.**

I. Introduction

A museum is a public or private institution at the service of the society and its development. These exhibit sets of objects and information that reflect some aspect of human existence or its environment. The museum dates back to the Greco-Roman period, since museums have undergone many changes in terms of how to present the information thanks to technological advances that have emerged, this change has been most noticeable in the last century to date.

In addition to technology there are new techniques and methods to improve the user experience in these museums as interaction, user preferences, virtual and mixed realities among others. Since its beginnings the main objective of museums has been to preserve the cultural heritage, but also make information shown attractive to public in general, this part is a big challenge because each person thinks and assimilates information differently and one of the ways to solve this problem is by making the content adaptive. Interactive museums have been multiplying in recent year, many of which the idea of attracting the public using new technologies, currently there are studies that seek ways to solve the problem of making more attractive exhibits for the museum visitors as it does (aoki 2002; aoki 2002) where their electronic guidebook allows users to share auditory information (They hear each other) using a technologically mediated audio eavesdropping mechanism.

Reilly 2007 uses another approach oriented towards audio-visual experience where literary information shows through high large screens where the user can interact with the museum with touch screens.Others besides dealing with how to present information have involved more with the user from using their personal information to use methods to predict the state of mind. In affective computing there are several affective states but one that goes hand in hand with learning which is the engagement, like all state of mind is difficult to identify.Allen tell us how to design exhibits and how not make it anti-engagement like using lots of content in multiple displays. In this paper we propose the architecture of an interactive environment which consists of the distribution of multimedia content in an exhibit where the content is displayed in sets of learning objects which we call environmental learning object, a simple sequenced implementation which will make the task of a museum guide establishing the order of the learning activities. And finally we use the second-generation Kinect sensor to capture video of the user and predict an emotion based on this catalog the exhibition state as something that engages the user or something that does not engage the user. To test this architecture we conducted an experiment in an interactive museum where we generate a learning activity, at the end of the activity we surveyed the user to obtain information from the user experience and affective state and compare it against the pronostic of the affective state and identify the least interesting activities.

Pending

II. Background

A. Interactive museums

Museums at the present are exploring new digital and mobile technologies to enhance the visitor experience. Initiatives go beyond technology within exhibits, but also include more widespread use of technology to create interactive experiences for visitors throughout a museum and remote experiences for those who can not get there.

B. Intelligent Learning Environments

Intelligent Learning Environments (ILE) are based in learning environments where students and teachers can create knowledge. In other words, the environment represents a cognitive space for a learning community. The ILE seeks to provide adaptive navigation and adaptive sequencing as is commented on [**rondon89**], [10] and [15].The adaptive navigation presents the content of a course in optimized order, where the optimization criteria takes into consideration the learner's backgrounds and performance, whereas adaptive sequencing is defined as the process for selection of learning objects from a digital repository and sequencing them in a way which is appropriated for the targeted learning community or individuals.

C. Affective Computing

Affective computing is the human-computer interaction in which a device has the ability to detect and respond to the emotions of the user and other stimulus properly. A computing device with this capability could gather the signals to the user emotion from a variety of sources. Facial expressions, posture, gestures, speech, strength and pace of keystrokes and temperature changes of hand on a mouse all can mean changes in the emotional state of the user, and these can be detected and interpreted by a computer. A camera is used to capture images of the user and the data is processed algorithms to produce meaningful information. Voice recognition and gesture recognition are some of the other technologies being explored for affective computing applications.

D. Learning Objects

E. Kinect 2.0

III. Method

IV. Study Case

As a case study we conduct 2 experiments the first to test the acceptance of different types of users in the environment, The first experiment took place in the interactive museum ”El Trompo” of Tijuana where the user was introduced in an environment which had to perform a sequence of activities and at the end of the activity was a survey below is explains in detail each of the parts of the experiment. The technological part of the experiment (Devices) consisted of 3 projectors, 2 computers, one tablet and headphones como se observa en las figuras 1 y 2. Users who participated in the experiment

Fig 1. User interacting with the environment.

consisted of a set of 21 users between the ages of 6 and 48 years. divided into 2 sets the first 11 users with 11 or more years and the second set with users under 11 years. the reason to separate them at this age because the environment was showed different information depending on the age of users. The theme chosen for use in the activity was determined for the following reasons, was an early date to a holiday about children called ”El dia del nio” and we think of something that will raise awareness of children that affects the world. So we prepare the ”Water” as its main theme where information

Fig 2. Front view.

was displayed as the care that must be taken with water, in that it benefits, health, pollution, energy producing, etc.

The second experiment was to explore the impact of the exhibit on the users, a convenience sample of 40 students and teachers of Tecnologico de Tijuana aged between 18 and 40 years where the most frequent age was 19 years was undertaken. Participating students completed the activity shown on the exhibit. Which consisted of two videos with the themes of video games and movies, users used the display for a period of 4 minutes 20 users on the first day and 2 on the second day. Each user was shot with a film camera and a special camera that takes additional attributes like engagement , if not watching the display and positions of the eyes or mouth .

V. Results

VI. Conclusion

Conclusion aqui.

Appendix A
Proof of the First Zonklar Equation

Some text for the appendix.

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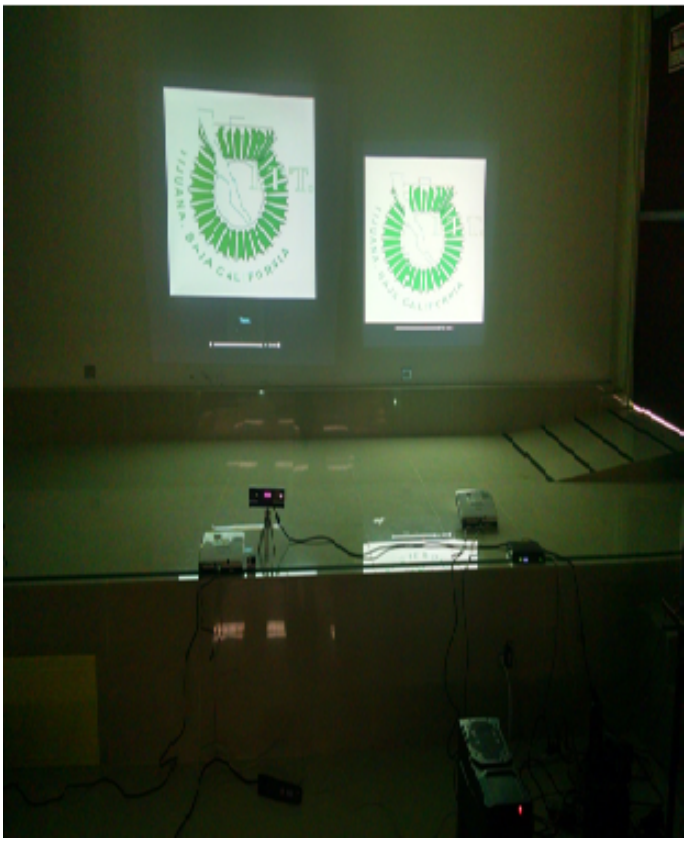

Fig 3. Front display.