Adaptive Augmented Reality Model: Local Context with Storytelling Adaptation in Heritage

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ABSTRACT: Adaptive Augmented Reality responds to the user's characteristics, interests and context with useful and effective real-time information. Users' needs are crucial in enhancing their interaction experience. Currently the emerging technology allows such better support. However, one of the problems identified is the lack of a formal definition of a model required by such technology to adapt to local context and environment. Furthermore, storytelling as a mechanism to enhance users' experience while interacting in such augmented reality space is rarely included. Therefore, the main aim of this research is to propose a formal definition of such model in the forms of user, context, interaction and environment models. These models will then be implemented in an archaeology field as a proof of concept. The main aim of this research is tp propose a formal definition of AAR model in the forms of user, context, interaction and environment models.

INTRODUCTION

Heritage is an identity and history of a nation that have to be preserved so that it can be a lesson learned to the future generation. Technology have been mediator in museum and cultural heritage site for quite some time. Ranging from website, multimedia presentation and the emerging technology that had been applied for this field is Augmented Reality and it has been showing positive result (Pendit, Zaibon, & Bakar, 2014).

BACKGROUND

Augmented Reality (AR) has recently been applied in many fields and context (Keil et al., 2013; Kipper & Rampolla, 2013). It allow user to see the real world while interacting with computer-generated content (Haller, Billinghurst, & Thomas, 2007; Lee, 2012) through device such as smart phone, Head Mounded Display unit, or see through glass devices. Nowadays, the advancement of the AR technology has also expanded to mobile and wearable Internet applications.

Usually, signage is used in providing information and story. However, with AR it is possible now to allow more effective ways to experience the stories by "living through" the story digitally (Bimber, Encarnação, & Schmalstieg, 2003). In AR, the information is provided to the user through interaction tracking and sensor on the wearable device. This technology is still in its infancy, therefore, a study to explore positive ways of providing relevant information that can enhance user experiences is urgently required (Hervás, Bravo, García-Lillo, Fontecha, & Villarreal, 2011; Keil et al., 2013).

Adaptive augmented reality (AAR) is the latest concept of the augmented reality that responds and adapts to a real-time context and the characteristics of the user (Damala et al., 2012; Tenemaza, de Antonio, & Ramirez, 2015). AAR concept is said to provide adaptation of 3D augmented reality and a better engagement to the users (Damala & Stojanovic, 2012). These could help for instance, the museum visitors, to be more immersed to the exhibition or artifact based on their emotional experience. Personalization and emotion are also among of

the important elements in storytelling. The use of emotion in the digital story is to engage and draw audiences more into the digital storytelling (Lambert, 2006; Ohler, 2008; Tenh Hock Kuan, 2013). AR technology with the inclusion of digital storytelling elements is seen as a helpful combination in cultural heritage information presentation to increase user experience.

PREVIOUS STUDY

There had been a few research recently that relate to AAR in various fields including cultural heritage, disabilities and elderly.

The latest a study of AAR in helping people with mild intellectual disability in Ecuador (Tenemaza, De Antonio, Ramírez, Vela, & Rosero, 2016). The newly explored concept has been use to locate the patient when they are lost and help them return home. The app developed benefit both patient and the caretaker, because it also acknowledge the caretaker when patient is lost. This noble application is an expansion of the researcher previous work (Tenemaza et al., 2015).

Another study that elderly related is on application of AAR in helping old people living alone in doing daily chore (Hervás, Bravo, Fontecha, & Villarreal, 2013). An evaluation on user experience in done with 20 respondents that difference knowledge level in technology. The result turn out that the average rate are high in most items except for item related to user interface.

Lastly, AAR is apply in context of AR guide for museum visiting (Damala et al., 2012). This research was aimed at enhancing information presented to visitors based on their psychological state. ARtSENSE is a prototype system that measure the a visitor level of interest toward the artworks sensing through the visitor's gaze, auditory, and bio signal (heart rate, skin conductance and brainwave activity) in realtime. The information is process by the system to produce a suitable information related to the artwork.

These study done in AAR and been beneficial to the related field. However, formal definition in the form of local user, context, interaction and environment models to assist the creation of such assisted technology has yet to be proposed (Tenemaza et al., 2015).

RESEARCH OBJECTIVIES

The main aim of this research is to propose a formal definition of AAR model in the forms of user, context, interaction and environment models. Therefore, the following objectives are formed:
i.   to identify the components of the formal model definition.
ii.   to suggest the relevant adaptive augmented reality model with respect to local context.
iii.   to examine the effects of storytelling elements on the proposed adaptive augmented reality model.

METHODOLOGY

This study adapts the design science research methodology as the generally accepted methodology. The methodology from Vaishnavi and Kuechler (2007) is adapted to achieve the proposed objectives. There are 4 main stages to accomplish the goal of the study, (i) awareness of problem, (ii) suggestion, (iii) evaluation, and (iv) conclusion. The followings are details of explanation:

Phase 1: Awareness of Problem
The problem statement of this study is extracted from the literature review and comparative study on adaptive augmented reality components. Next, the preliminary study will be conducted to determine the user, context, interaction and environment models in adaptive augmented reality. The data will be gathered as the first phase of data collection to build the background strength of this work.

Phase 2: Suggestion
Suggestion on the components will be defined as a formal model of adaptive augmented reality in a local context. The expert consultation is conducted to support the idea for constructing the model. This model will provide details

elements of Adaptive Augmented Reality. In addition, the aspects of user, local context, interaction and environment models will be taken into considerations. Focus group discussion and meetings will be the important activities at this stage. In addition, data verification with the cultural heritage authorities will be also conducted for further clarification.

Phase 3: Evaluation

The evaluation phase will be conducted to examine the effects of storytelling elements on the proposed adaptive augmented reality model. This study uses the user experience evaluation. It involves tourists for measuring the influence of the Adaptive Augmented Reality model.

Phase 4: Conclusion

The final phase is co nclusion where the results of evaluation will be analysed and explained. The iteration of the proposed model will be performed for the last time to visualize the final form of the model in accordance to user and expert feedback. Once the last iteration is done, finally, as the proposed model will be completed, the direction and future research to promote improvement on the study will be elaborated as part of the conclusion phase.

CONCLUSION

AAR is a relatively new concept that been shifting from the previous use of AR. AAR is providing a suitable information based on context and the characteristics of the user. There are a few study in AAR for disability, elderly and cultural heritage. However, there is no model of AAR is proposed. A study on this particular direction will be planned. The study will be focus on providing a model to assist the development of AAR application bring together storytelling specifically in cultural heritage.

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