Interactive and Integrated Learning and Teaching System through Mobile Augmented Reality System – An Innovative Approach

M. Durairaj, P. Sagaya Aurelia

Abstract: ***Mobile augmented reality is growing rapidly because of the growth of smartphones. Due to the portable nature of smartphones, mobile augmented reality devices have become the most widely deployed consumer augmented reality display devices. The role of the user is identified and forwarded to the respective module. When a general optical tracking platform provided, the reachability and performance can be increased without affecting the efficiency, which will be done in AllinoneAR. Module. An integrated framework consisting of three above stated modules is proposed in this paper.***

Keyword: ***Augmented reality, Learnability, usability, authoring, Role***

I. INTRODUCTION

Augmented reality is a reasonably recent, but still a large field. It is an innovative form of exposure in which the real world is enlarged by system generated content tied to specific activities or location.AR applications are portable because of mobile device. Moreover, the advantage of the system is proceeding as per the learner's interest. The learnability identification module is a very important role. The combination of Learnability module, Authoring module and AllinoneAR module will make the whole framework a successful one. The paper is organized as following. Section1 gives introduction about mobile augmented reality, section 2 states the identification of role, Learnability factor identification module and AllinoneAR module. Section 3 discusses about the framework and concludes in section 4.

II. MOBILE AUGMENTED REALITY

Augmented reality and mobile computing are interrelated because many mobile environments rely on head mounted display or head-up in order to provide nonstop information mostly combined with hand free operation. Augmented reality as a user interface for mobile computing is particularly powerful when the computer has access to information on location and situation, so it can provide contextual information.

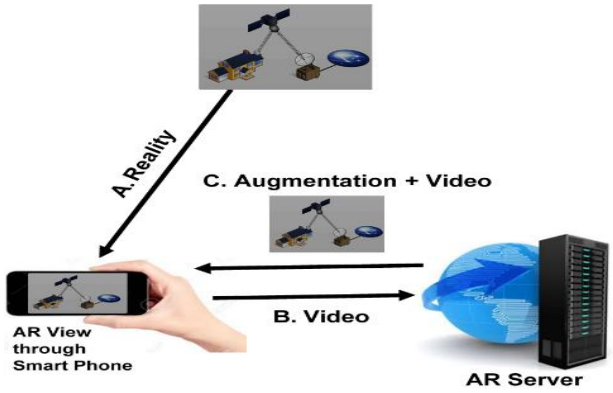

Fig.1 Mobile mixed reality: Interaction of mobile device with backend AR server with wireless connectivity

Compared to the desktop computer, the mobile devices have small memory, small screen, limited computing capability, limited input options while the servers have powerful computing and storage capacity [2] but still mobile technology is more advantages for its various features as portability, accessibility, etc., Using client/server system architecture, which can make full use of the advantages of hardware environments can effectively reduce the system overhead [3]. Figure 1 shows the Mobile mixed reality. AR software's in mobile phone based on android, iOS etc. enables the augmented reality learning Platform to the students in any subject and make presentation about the concept [4]. Innovative methods are must for the wider spread of mobile augmented reality.

III. ROLE IDENTIFICATION MODULE

After the user Authentication module, an evaluation test is conducted to identify the role of the user. Three roles altogether will be offered. The learner and the author are the main two roles and further the author will be sub divided into the programmer and non-programmer module. The programmer phase is more technical and will not be available for all the types of augmented reality. The non-programmer phase is a tool based process used to explore and create content for all types of augmented reality.

IV. LEARNABILITY FACTOR IDENTIFICATION MODULE

Although many factors like efficiency, Effectiveness, Satisfaction, Learnability, Memorability, Errors and Cognitive load are the basic attributes of PACMAD usability model.

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Dr. M. Durairaj, Department of Computer Science, Engineering and Applications, Bharathidasan University, Tiruchirappalli (Tamil Nadu) – 620024, India.

P. Sagaya Aurelia, Department of Computer Science, Engineering and Applications, Bharathidasan University, Tiruchirappalli (Tamil Nadu) – 620024, India.

Learnability is considered as the main attribute of the usability engineering. Learnability is the ease with which a user can gain proficiency with an application. It typically reflects how long it takes a person to be able to use the application sucessfully. In order to measure learnability, the researchers may look at the performance of participants during a series of tasks, and measure how long it takes these participants to reach a pre-specified level of proficiency [6]. Learnability can be determined based on various factors such as interest, motivation, active learning, exploring attitude, time, space, learning environment, content, mental models and these are the default attributes used in mobile learning technology[1]. Cognitive engagement and interactivity are the main two factors of influenced learning where the engagements are focused [1]. This research focuses on tactile or kinetic learner who learns based on experiment based learning. Hence it can also be termed as tactile technology based learning. This paper proposes, appropriate model based on the evaluation of the learnability.

V. ALLINONEAR MODULE

A. Tracking methods differs from each other based on their types and usage.

The main issue in the tracking methods is the isolation. But as a learner or beginner wants explore and create an augmented reality application, coordinating with all the types of AR is the main issue. When a common platform is provided, the reachability and performance can also be increased without affecting the efficiency. All the popular applications and browsers are linked. The AllinoneAR module is shown in figure 2, in which all the common tracking methods are integrated together as one module and it is available under one framework. ID markers are also known as fiduciary markers, which is a result of AR and can be experienced in utilizing the camera on your smart device to scan a visual marker. Barcode are also black and white squares with a pattern but they offer better results because the pattern itself holds the ID of the 3D virtual object it represents, which means no image matching is required. They are optical machine readable 2D representations of data items. Quick Response (QR) code is also flexible and has large storage capacity. A single QR code symbol can contain up to 7089 numeric character, 4296 alphanumeric characters, 2953 bytes of binary data or 1817 Kanji character. QR codes are most widely used in mobile AR applications such as journals, newspapers, and hospital. Data such as text, image, video, vcard , URL, Wi-fi connection, SMS and many more information can be superimposed over QR code [2]. In marker less augmented reality systems, any part of the real environment can be used as the target that can be tracked in order to place virtual objects. It counts on specialized and robust trackers already available and it is possible to extract the environment characteristics and information that may later be used by them. The use of GPS in location based tracking has been very successful but its accuracy is not acceptable in an indoor location. Natural feature tracking can be used almost any image as long as the image is complex enough.

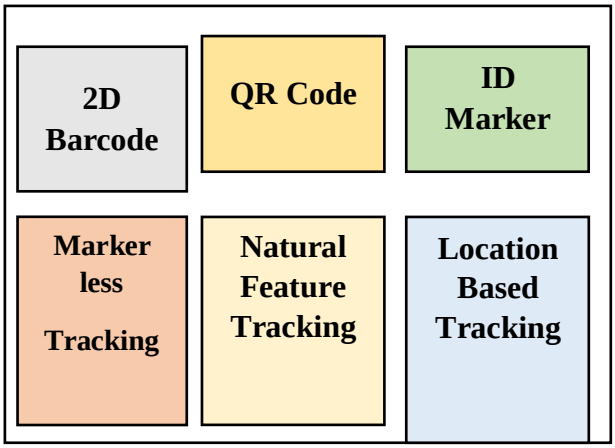

Fig.2 Allinone AR module here

VI. AUTHORING MODULE

A successful AR authoring solution must provide more than an attractive graphical user interface for either an existing or new AR application framework. It must provide conceptual models and corresponding workflow tool which are appropriate and useful specifically within the domain of AR. Augmented reality content, on the other hand, is usually registered in 3D, which requires tools that allows the creation of content in 3D space, usually separate from the actual application itself. Furthermore, compatibility is still a big concern considering that the content is created outside the application and that importing of the content to the application is necessary. Furthermore, most mobile devices does not recognize file format for 3D objects, ad thus, accessibility is another concern in terms of the content. A simulation environment for AR development has additional advantages, such as full control over time and events.

The application framework proposed will provide a higher level of abstraction such that even non-programmer can implement mobile AR applications and games. Programmers will also be given further options to implement more functions. The basic idea will be in a simple cross platform which will allow programmers to implement more advanced AR applications without low level system programming [7].

VII. LEARNABILITY BASED INTERACTIVE MOBILE AUGMENTED REALITY SYSTEM

The proposed framework as shown in figure 3 will be an integration of all the above specified three different modules. In the proposed system, the user authentication module is the first step and is followed by the role identification module which identifies the role of the user either as learner or as author. If the user belongs to the learner group then, he/ she will undergo various learnability factor identification and evaluation phase which will determine which level of AR they exactly belong to and thereby they will be forwarded to the AllinoneAR module. If the role of the user is Author, they are forwarded to the Authoring module which will be further divided into programmer and non- programmer module.

The final output will be compared with the ICT, Virtual reality and proposed interactive mobile augmented reality system.

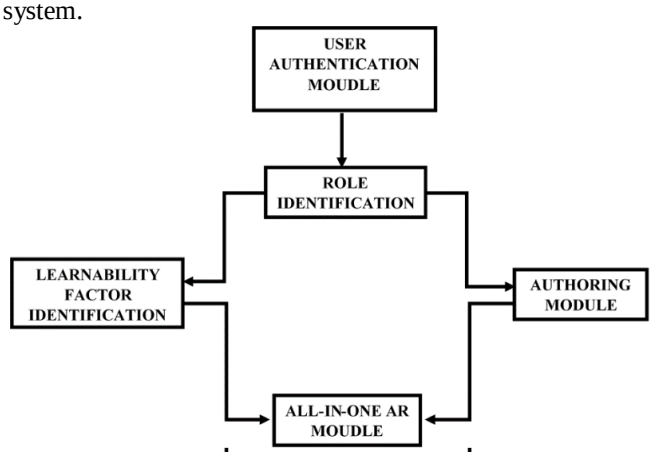

Fig. 3: Proposed framework for Interactive Mobile augmented reality system.

VIII. APPLICATIONS

The usability of augmented reality rapidly increases via Mobile applications. These AR applications merge theoretical and experimental learning hence giving large scope for innovative learning. Even though augmented reality can be used in all the fields, so of the major applications related to learning are

- AR books
- Interactive mobile storytelling [7][8][9][11]
- Smart environment (smart classrooms/ smart homes/ smart exhibition)
- Intelligent campus[9]
- Virtual & Mixed Reality Learning Environments
- Digitally Enhanced Teaching Laboratories
- Smart global and multi-cultural learning environments
- Curriculum Development for Augmented Education systems
- Evaluation of intelligent and Augmented learning environments[10]
- Affective Learning[12]
- AI Tutoring Systems
- Learning clouds.

IX. CONCLUSION AND FRAMEWORK

The challenge of designing usable interfaces for device screens with limited dimensions and invent new interaction modalities is an open issue. All in all, the smart phone ecosystem provides all ingredients to deploy AR as a software-only solution to a mass audience. However, one should not overlook that despite all technical and logistic improvements, there are still major obstacles such as Camera quality and handling, Energy consumption, Network dependency, Localization as an image recognition problem, Texture, Lighting and weather conditions, Large and volatile databases for a large scale deployment of AR applications[5]. Also, by implementing a successful authoring system, it can serve as a foundation for future improvement onto the system, and can be more researchers and developers to delve into developing more powerful applications that can eventually overcome the obstacles of bring augmented reality to the learning system. Our system is suitable for all application which is an added advantage. Surely, the proposed learnability based interactive mobile augmented reality system will take usability of augmented reality to the next level. The research can be further extended by introducing learner based registration algorithm, rendering algorithm and convergence of AR and cloud computing.

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