

# Using Augmented Reality Technology in Learning Archeological Places

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**Abstract**— The purpose of this research is to use augmented reality (AR) technology in learning archeological places of 9 places including Wat Thewarat Kunchorn, Wat Sukhantharam, Wat Benchamabophit Dusitwanaram, Wat Mai Thong Sen, Wat Ratchaphatikaram, Morphon House Palace, Suan Sunandha Palace, Parusakawan Palace, and Wat Bot Samsen. Each place can see the history of the content through VDO and 3-D models that can be viewed 360 degrees. They presented it through the learn archeological places guidebook. The sample groups of the research were 30 students of bachelor's degree in industrial education program, Rajamangala University of Technology Phra Nakhon. The research results showed that the learn archeological places guidebook was at a high level (the mean equaled to 4.36) and the students' satisfaction with the learn archeological places guidebook was at a high level (the mean equaled to 4.13).

**Keywords**—Augmented Reality, Archeological Places, AR Based, Vuforia Unity

## I. INTRODUCTION

Thailand has many archeological places. There are construction characteristics and evidence of perception or understanding of the location, ethnicity, beliefs, religion, customs, and culture of a particular community. It is something that reflects the past as historical information, archaeology, architecture, and fine arts. It shows the ancient history of the community [1]. In addition, there is a connection with traditions, being the pride of people in society, as well as being a source of education and long-life learning. However, many archeological places are suffering from being abandoned and deteriorated. It of a lack of understanding, lack of respect, the restoration of archeological places using the wrong methods, lack of love, cherish, respect, and a true ancient preservation ethic. Public relations of archeological places tourist attractions found that information about tourist attractions in terms of location, and tourist attractions were at a low level, including the incomplete history of archeological places. As a result, tourists do not know the clear history of archeological places to visit.

The changing technology has forced the tourism sector to adapt and prepare to cope with the changes. By having to manage knowledge systematically [2]. Advances in technology have forced the tourism sector to adapt and prepare to cope with changes

through systematic knowledge management, as well as applying technology and innovation to promote tourism appropriately. In particular, AR technology is one speaker that combines reality with the virtual world. The development of technology that combines the real world and the real world through software and connected devices displayed on a computer screen or a display device. The virtual image the appears will interact with the user immediately [3]. It may look either like a 3-D still image or as a medium with sound effects using a 3-D overlay method. Other digital media that are in the virtual world to the images seen in the real world through cameras or other devices such as glasses, tablets, or mobile phones are displayed in real-time [4].

Thus, using AR technology to learn archeological places is thus to convey the history of archeological places and to promote tourism to be more widely known. Let' help create understanding and make your imagination come true, which can be seen through the display screen in mobile phones through AR technology model 3-D that can be viewed in 360 degrees. We can view the history of archeological places in a virtual digital format that emerges from travel guides to increase interest and reduce perception limitations. This research aims to use AR technology in learning archeological places, focusing on facilitating tourists in deciding to make and creating positive attitudes towards tourists, and stimulating the tourism economy.

## II. AUGMENTED REALITY TECHNOLOGY

### A. Augmented Reality (AR)

Augmented Reality is a modern technology that combines the real world and the virtual world. Today, many AR applications are being developed to represent the digitally augmented world. The user can activate the camera of the smartphone to see the real world around them on screen. They used AR applications to enhance that world through digital overlays [5]. AR applications can link animation or contextual digital data in 3-D computer programs to augmented reality "markers" in the real world. A computer device's browser receives digital information from known markers. The application will run the marker code and layer the correct image or image [6]. There is a development process, as shown in Figure 1.

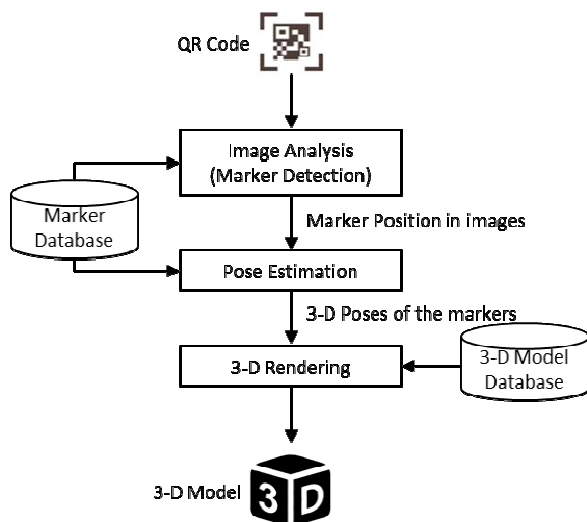


Fig. 1. Architecture Marker-based AR application

Figure 1 shows the architecture marker-based AR application comprises 4 components: 1) image analysis module 2) pose estimation module 3) 3-D rendering and 4) 3-D model database. The image analysis module plays an essential role in the AR application system. When a smartphone having a marker-based AR application scans a pattern such as QR code or a symbol through the camera, the software recognizes it and superimposes analysis of the images on the screen. The image analysis module estimates the position and poses of the QR code from the marker database. The system then generates a virtual 3-D model that will appear precisely on the real pages regarding the position and orientation of the smartphone [7]. The generating 3-D rendering will be transformed to align with the 3-D posed markers. The 3-D model database was constructed with 3-D max software. The database can be accessed and each 3-D model can be retrieved by using QR code.

### B. Application of AR Technology in Education

Using AR paradigms for teaching students is becoming increasingly popular because the student is moving towards a new level of interaction with technologies and there is a need for the student to educational content through the use of attractive technologies [8]. AR technology can attract the attention of students and teachers, creating expectations that users will give participants new ways to interact, possibilities for collaboration, and potentially an increased motivation for learning [9]. Using this application, teachers can help students to teach subjects where they could not feasibly gain real-world first-hand experience and to enhance collaboration between teacher and student. By using the technological approach, hopefully, it can help to foster student creativity and imagination into the subject [10]. Besides that, this method also can help students to take control of their learning at their own pace and on their own path. The adaptation of this application will change teaching and learning, where it can create an authentic learning environment suitable for various learning styles [11].

### III. FRAMEWORK OF ARCHEOLOGICAL PLACES AR APPLICATIONS

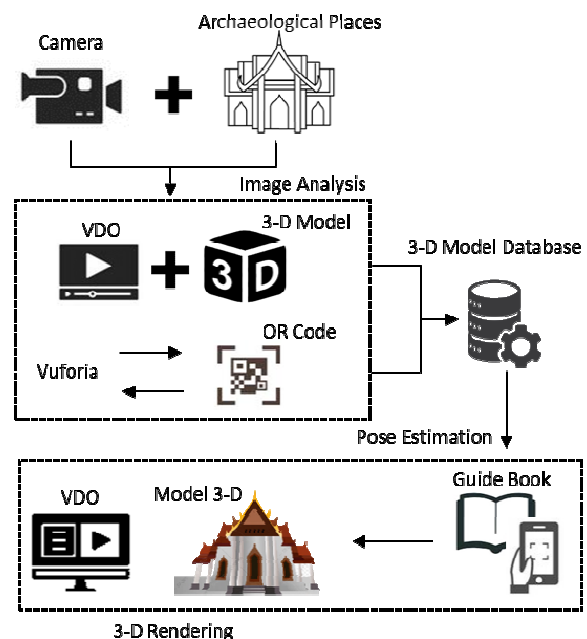


Fig. 2. Framework of archeological places AR applications

Figure 2 shows Framework of archeological places AR applications comprises 3 elements:

1) Database design derived from on-site repository and retrieval from other sources, together with the preparing 3-D models got by converting photogrammetry into measurable data. Dimensions to work, connect with symbols, and remember information for display with technology that further integrates the real world with the virtual world.

2) Symbolization for display technology that combines the real world with the virtual world to locate the 3-D model for the beginning of the historical presentation.

3) 3D modeling got from data collection in the actual place to develop a complete 3-D model.

The design of the learn archeological places on the principles of augmented reality comprises 4 steps: (as shown in Fig 2.)

1) Marker design is the design of 9 places.

2) Marker according to the mock-up that has been designed.

3) Generator marker for creating 3D models of 9 places including Wat Thewarat Kunchorn, Wat Sukhantharam, Wat Benchamabophit Dusitwanaram, Wat Mai Thong Sen, Wat Ratchaphatikaram, Morphon House Palace, Suan Sunandha Palace, Parusakawan Palace, and Wat Bot Samsen.

4) Import the model into vuforia unity program and export program under the name 9Dusit in file format \*.apk for use with the android operating system.

#### IV. IMPLEMENTATION OF PROPOSED METHOD

The learn archeological places use guidebooks as the interface to learn about the history and 3-D Models. However, if they focus a camera on the marker, 3-D Models and VDO pop-up in the smartphone over the real pages. The learn Archeological places of 9 places including Wat Thewarat Kunchorn, Wat Sukhantharam, Wat Benchamabophit Dusitwanaram, Wat Mai Thong Sen, Wat Ratchaphatikaram, Morphon House Palace, Suan Sunandha Palace, Parusakawan Palace, and Wat Bot Samsen. Each model will describe the history of ancient sites. It took 40-60 seconds to present, and the design of the model gave the model color realistically. For the audience to have a feeling of that archeological place. The implementation results are shown in Fig. 3 - Fig. 4.



Fig. 3. 3-D model of archeological places.



Fig 4. Result of using AR technology in learning archeological places.

#### V. RESULTS AND DISCUSSION

##### A. Quality Assessment of Experts' Guidebooks to learning archeological places

The results of using AR technology in learning archeological places including Wat Thewarat Kunchorn, Wat Sukhantharam, Wat Benchamabophit Dusitwanaram, Wat Mai Thong Sen, Wat Ratchaphatikaram, Morphon House Palace, Suan Sunandha Palace, Parusakawan Palace, and Wat Bot Samsen. Each model can be presented as a 3-D model along with a video explaining the history of each archeological place. It has been presented through learning archeological place guidebooks developed to assess the quality of 3 experts, as shown in Table 1.

TABLE I. QUALITY ASSESSMENT OF EXPERTS

Topic	Mean	S.D.	Rate of appropriateness
Context	4.53	0.52	highest
Design and styling	4.20	0.77	high
Benefit to use	4.33	0.49	high
<b>Overall average</b>	<b>4.36</b>	<b>0.59</b>	<b>high</b>

From Table 1, the results of a quality assessment of learning archeological places guidebooks from experts were found that the overall quality of learning archeological places guidebooks was at a high level (the mean equaled to = 4.36, S.D. = 0.59).

##### B. Students' satisfaction with the learning archeological places guidebooks

The researcher brought the learning archeological places guidebooks to experiment with a sample group of 30 students of bachelor's degree of industrial education program, Rajamangala University of Technology Phra Nakhon by installing the application while studying the learning archeological places guidebooks. The results of the study of satisfaction as shown in Table 2.

TABLE II. THE STUDY OF THE STUDENTS' SATISFACTION

Topic	Mean	S.D.	Rate of appropriateness
Context	4.40	0.51	high
Design and styling	3.93	0.70	high
Benefit to use	4.07	0.26	high
<b>Overall average</b>	<b>4.13</b>	<b>0.49</b>	<b>high</b>

From Table 2, the results of the study of the students' satisfaction with the learning archeological places guidebooks showed that the satisfaction with the learning archeological places guidebooks was at a high level (the mean equaled to = 4.13, S.D. = 0.49).

#### VI. CONCLUSION

This research is to use augmented reality (AR) technology in learning archeological places. It is an application of augmented reality technology available on mobile phones to display archeological places in 3-D models and provide information on archeological places in guidebooks, including Wat Thewarat Kunchorn, Wat Sukhantharam, Wat Benchamabophit Dusitwanaram, Wat Mai Thong Sen, Wat Ratchaphatikaram, Morphon House Palace, Suan Sunandha Palace, Parusakawan Palace, and Wat Bot Samsen. Whereof can bring a mobile phone to scan QR code from the learning archeological places guidebook showing the model and video description of the archeological places. In order to promote the public relations and knowledge of the archeological places of more tourist attractions. The application of augmented reality technology can enable students to learn effectively. Therefore, it is a guideline that can

be used to develop teaching materials for teachers to continue.

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