THE CREATIVE UX DESIGN FOR AR STORYTELLING: A CASE STUDY OF THAI HERITAGE TOURISM CONTENT

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ABSTRACT

This research concerned the development and evaluation of a creative UX design for augmented reality storytelling: a case study of Thai heritage tourism content. The researcher gathered data by interviewing Thai and foreign tourists who visited the historical park, and analyzed the data to develop and evaluate the prototype for this research. The sample group consisted of 30 experts for the prototype evaluation. The results were analyzed using mean and standard deviation, and heuristic evaluation as the research tool. The evaluation of the prototype development showed that the prototype as efficiency was at the highest level, and it provided functionality which was suitable and in line with the users' requirements. This prototype evaluation will lead to the development of an application for the Thai heritage tourism sector to create an application that presents a different approach to native storytelling, giving the historical park an advantage and distinctiveness from other tourist destinations as well as increasing tourist visits.

Keywords: Human–computer interaction, Augmented reality, Digital storytelling, Heritage tourism, Design thinking

Introduction

Prototypes assist with the design of the interaction between users and the interface. In interface design it is crucial that the design allows users to access information that connects them to the application. Prototype evaluation is used to measure the efficiency of the prototype design, and it is essential for the system development process (Joo, 2017) as it ensures that the prototype can support user interaction (AI Said, et al., 2020). Furthermore, the prototype designers must take into consideration the user experience so that the design is user-centric. The designers must understand the users and the context of the initial stage of system design and development (Putra Prakasa et al., 2020). Therefore, a balanced user interface and user experience will generate effective interactions between the users and the system and will influence the application development (Qasim et al., 2019).

Heritage tourism involves visiting places with historic and heritage value known as tourist attractions. Thailand is a country wherein the development of tourism plays an important role in promoting and preserving its heritage. In line with (Widarti et al., 2020), a mobile application for heritage tourism is designed to attract and encourage tourists to visit such attractions. Another common technique of heritage tourism research is augmented reality technology, which is used to enhance the travel experience and knowledge of users by focusing on aesthetics (Vainstein et al., 2016), (Sabri et al., 2016), (Jung et al., 2018), (Boboc et al., 2019), (Shukri et al., 2017), (Little et al., 2020), and (Baker et al., 2020) to ensure that the information in the digital world transfers quickly (ÖZKUL & Kumlu, 2019). It is widely accepted that storytelling is an important method for attracting and satisfying users (Vrettakis et al., 2019). In the process of creating a digital storytelling experience, storytelling is

integrated with augmented reality, a technique becoming more widely used in tourist attractions to enhance the tourist experience (Jung et al., 2018).

Therefore, the researcher presented the development and evaluation of the prototype with heuristic evaluation. The results of this study will be used to develop an application for the Thai heritage tourism sector so that the application provides a different native storytelling experience, thereby giving the historical park distinctiveness and an advantage over other tourist destinations to increase tourist visits to the historical park.

Research Objective

1. To development of a creative UX design for augmented reality storytelling: a case study of Thai heritage tourism content
2. To evaluation of a creative UX design for augmented reality storytelling: a case study of Thai heritage tourism content

Literature Review

The following is the literature relating to this research on the prototype development and evaluation of creative user experience design for the augmented reality storytelling: a case study of Thai heritage tourism content.

1. User Interface Prototype

The core principles of user interface prototyping are as follows (Sikorski, 2015):

1. User interface prototyping involves building a process model for the application that will be developed. The model demonstrates the interaction between the users and the application as well as its components and functions.

2. User interface prototyping allows the project manager, stakeholders, designers, and users to communicate the features and design of the application.

3. User interface prototyping allows users to test the user interface of the prototype and establishes the requirements of the developed application.

Prototyping with the user-centered design consists of the following:

1. A low-fidelity prototype is designed on paper and has low accuracy. It is used to communicate general ideas of the application.

2. A high-fidelity prototype is a computer-based interactive representation of the system. The prototype is made using specialized software, and is used for testing and establishing new requirements of the stakeholders. Currently, there are several user interface prototyping tools available, including Figma, Axure, and Graphical User Interface Design Studio.

2. Augmented Reality

Augmented reality technology combines virtual-world and real-word environments to display information or virtual objects, including text, images, animation, video, and other types of media. The augmented reality is comprised of three elements: a combination of the real environment and virtual objects, real-time interaction, and three-dimensional (3D) object registration (Azuma, 2015). These three elements reinforce perception and improve the user experience as they allow users to encounter the real world via the augmented reality content. If the augmented reality is displayed on a mobile device, the process is called mobile augmented reality (Sagaya Aurelia et al., 2014).

3. Digital Storytelling

Storytelling is the oldest form of communication and is a part of daily life. Oral communication is a form of storytelling. When storytelling is simple, results can be communicated, and stories created with the right framework. (Design a Better Business,

2018) has developed a storytelling canvas that has been divided into three parts: a beginning, a middle, and an end. A storyteller must take into consideration the subject of the story, the goal of the story, the audience, and their needs. The storytelling canvas is used to combine the elements, suggestions, and storytelling best practices in one framework. The framework consists of two parts—the story and its elements. It generally includes the identification of an audience and their needs using empathy map canvas. The elements section includes a three-level structure comprising a beginning, a middle, and an end, which is in line with the three storytelling practices (Kernbach, 2018).

4. Design Thinking

The core principles of design thinking are to always put the users' needs first and to test the results to prove that the designed solution is practical and can solve the problem. If the designed solution does not solve the problem, the design thinking process can be repeated.

Design thinking focuses on the user-centered design. It aims to solve the users' issues; therefore, the users' critical requirements must be identified to generate suitable solutions. Stanford design thinking model consists of the following five steps: empathize, define, ideate, prototype, and test.

5. Mobile Application in Tourism

The use of a tourism application on a mobile device is essential for successful usage of the application. In the research [7], usability issues were identified including accessibility, coverage, accuracy, orientation clues, conciseness, cultural content, navigation, and graphic. These issues were considered when the researcher designed the tourism mobile application.

6. Heuristic Evaluation

Heuristic evaluation is the evaluation of the user experience during design decisions. It is a qualitative measuring tool for the development of an application. According to (Schrepp et al., 2017) and (Bader et al., 2017), UX dimensions that undergo heuristic evaluation are 1) attractiveness, 2) perspicuity, 3) efficiency, 4) dependability, 5) stimulation, and 6) novelty. The heuristics is presented and connected to the UX dimensions in the user experience questionnaire.

Research methodology

This research was designed in line with the design thinking principles that focus primarily on the user-centered design. There are five steps. Empathize: the process of understanding user groups implies focusing on user experience, creating a brief user persona, and defining user characteristics to make effective design decisions. Define: it is the initial process of thinking about the steps that users take into the product; this could include considering the users' journey and defining all the issues according to how it interacts with the product. Ideate: concept generation and brainstorming. Prototype: user and interface interaction simulation. Test: function testing, usability, and utility for end-users.

Beginning with studying the users' behavior and the context of the initial stage of design and development. Throughout the five steps, user experience is taken into consideration.

1. Empathize

The researcher gathered data from 30 Thai and foreign tourists who visited the historical park by interviewing and assessing their requirements. The interview and analysis showed that most tourists, 21 tourists (70% of all the tourists interviewed), visited the historical park for leisure purposes while five tourists (17%) visited to learn about the history, and four tourists (13%) visited as part of their classes. They suggested that the provided information on the

brochures was not sufficient to learn about the history. The tourists needed the information to be provided in various languages and in a more interesting way. The researcher learned about their pain points, and decided to develop an application and a user persona to improve the service so that tourists could experience something new and different.

To set a guideline for the prototype development, the researcher consulted previous studies relating to the Thai cultural information and history with spatial value from the online database of the Fine Arts Department and information centers for archeological sites.

2. Define and 3. Ideate

Defining the problem statement is the first step in considering how users interact with the application or users' journey, including user interface design, theme details and application, and icon design. Brainstorming is undertaken with the stakeholders to generate their comments and suggestions. The system design focuses on the ease of use. Furthermore, the storytelling canvas helps to realize content with a suitable storytelling framework, thereby creating successful stories more efficiently and ensuring the suitability for the target audience, as shown in Fig 1.

Figure 1. Storytelling canvas.

4. Prototype

The development of the prototype allowed the designer to present the designed application using a representation of the interaction between users and the interface. Figma, which is an effective tool for UX and user interface designers who wish to design an application on a mobile device, was used in this research. The prototype was used to share ideas on the application with the stakeholders as it was designed to satisfy the users. The researcher designed interactive prototypes that connected the components of each screen, as shown in Fig 2 below.
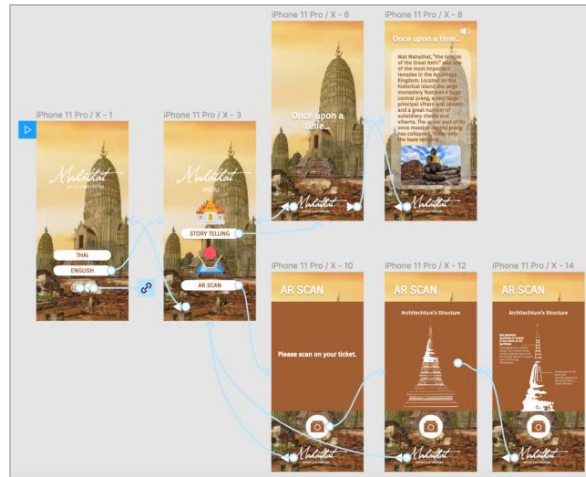
Figure 2. Connections of the interactive prototypes.

Fig. 2 shows the connections of the interactive prototypes to various parts related to the system's functionality. The connections can be described as the following.

1. Interactive prototype of data navigation
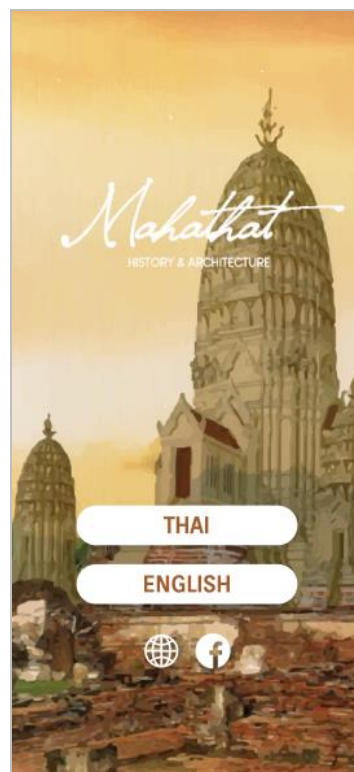
Figure 3. Interactive prototype of data navigation.

Fig 3 shows the first page of the application wherein users select Thai or English language. Below are the links to the related social media.

The interactive prototype of the augmented reality scan function shows content in a 3D model on a real-time 3D environment background. The function helps to increase user perception and engagement with the virtual-world and enhance the visitor experience and perception with a focus on aesthetics, as shown in Fig 4 below

Figure 4. Interactive prototypes of the augmented reality scan function.

2. Interactive prototypes of the digital storytelling function, in which the data in the text, image, and English narrative formats were used to create attractiveness, distinctiveness, and differentiation from other sources. The prototypes created a new learning experience for the visitors and provided information about the history and Thai culture with spatial historical value, as shown in Fig 5 below.

Figure 5. Interactive prototypes of the digital storytelling function.

5. Test

The prototype was evaluated by 30 experts using a heuristic evaluation form. The evaluators are experts in the technology and tourism fields. The results were analyzed statistically using mean ($\bar{X}$) and standard deviation. The evaluation form was a questionnaire with 5-point Likert scale questions.

The heuristic evaluation form was created according to the related research, including (Inostroza et al.,2016) for considering UX dimensions in the user experience questionnaire, heuristic evaluation form from (Nielsen, 1994), (Shneiderman et al.,1987) and (Inostroza et al.,2016). The heuristic evaluation forms from the aforementioned

research were effective for UX (Bader et al., 2017) as they were specifically created for the evaluation and could be used as a guideline for employing heuristics for the evaluation in this research.

Table 1 Results of the assessment for prototype development

Heuristic evaluation	Results of the assessment		
	Mean	*S.D.*	*Prototype efficiency*
Visibility of system status	4.53	0.62	Highest
Match between system and the real world	4.53	0.50	Highest
User control and freedom	4.60	0.50	Highest
Consistency and standards	4.57	0.50	Highest
Error prevention	4.33	0.47	High
Minimization of user memory load	4.40	0.51	High
Customization and shortcuts	4.63	0.62	Highest
Efficiency of use and performance	4.60	0.62	Highest
Aesthetic and minimalist design	4.47	0.51	High
Helps users recognize, diagnose, and recover from errors	4.37	0.61	High
Help and documentation	4.33	0.47	High
Physical interaction and ergonomics	4.60	0.57	Highest
Overall Heuristic	4.50	0.04	Highest

In this research, the developed prototype was evaluated by 30 experts using a heuristics evaluation form. The mean score was 4.50 and the standard deviation was 0.04 ($\bar{X}$ = 4.50, S.D. = 0.04). The results showed that the efficiency of the prototype was at the highest level.

The evaluation results of the prototype are shown in Table 1. The results for the evaluation of the prototype development showed that the prototype design evaluation could provide functions that were suitable and in line with the tourists' requirements and the functions could later be used for application development

Discussion

The developed prototype could fulfill its purposes and was suitable for users' ergonomics. Therefore, the researcher succeeded in designing the system in accordance with the principles of (Widarti et al., 2020). Augmented reality was used in accordance with (Shukri et al., 2017), (Jomsri, 2019), and (Keckes & Tomicic, 2017). Furthermore, storytelling has the potential to transform how people interact with their cultural heritage, and it was widely recognized that storytelling is an important method in digital storytelling for attracting and satisfying users with their cultural heritage (Vrettakis et al., 2019). In line with (Liestol,

2019), augmented reality was used in storytelling and recreating historical events to create memorable travel experiences, remove the limitation of physical access to the sites, and make the sites more interesting.

Contribution
The contribution of this study can be summarized as follows:
1. Developing a prototype using the design thinking principles was an iterative process and it aimed to adjust the prototype to fulfill the requirements of the users who were the tourists.
2. The prototype evaluation was done using a heuristic evaluation form. The evaluation results provided functions which were suitable and in line with the users' needs.
3. The tourists received information and storytelling in a different dimension to increase tourism and future visits to the park.

Conclusions and Future Work
The results showed that the efficiency of the prototype was at the highest level. It could be inferred that the prototype was designed according to the graphical user interface design principles and was easy to use. The researcher will develop an application based on the prototype in the next stage of development. The application had an augmented reality scan function which presented historical information in a 3D model and in real-time, thereby enhancing user perception and virtual interaction. The media used in the digital storytelling function contained text, images, and English narration.

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