

DEVELOPMENT AND ACCEPTABILITY OF AUGMENTED REALITY APPLICATION (AR) AND ITS IMPACT ON TOURISM OUTCOMES

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Abstract

This study details the design, development, and evaluation of "Pila Adventures," a location-based Augmented Reality (AR) application intended to revitalize tourism and preserve the cultural heritage of Pila, Laguna. Utilizing a technical framework of AR.js, Leaflet.js, and MySQL, the research addresses the need for interactive digital guidance in historical tourism. The study employed the ISO/IEC 25010 quality model to evaluate system acceptability among users. Key findings indicate that the application achieved a high level of acceptability across all measured dimensions: effectiveness (4.05), efficiency (4.14), satisfaction (4.01), and user experience (4.08). The results further reveal a significant relationship between high system quality and positive tourism outcomes, such as enhanced heritage appreciation and visitor engagement. The study concludes that AR technology serves as an effective tool for sustainable tourism, though it recommends future iterations expand site content and cross-device compatibility to further optimize the user experience.

Keywords – *Augmented reality, heritage preservation, mobile application, Pila Laguna, tourism*

INTRODUCTION

The rapid integration of digital technologies, particularly Augmented Reality (AR), has fundamentally transformed the landscape of cultural heritage tourism by creating immersive, interactive environments that extend beyond traditional physical signage. In the context of Pila, Laguna, where historical sites possess significant cultural value, there is a recognized need for innovative solutions to bridge the gap

between static preservation and modern tourist expectations. The "Pila Adventures" project addresses this challenge by providing a location-based AR experience that overlays digital historical narratives, 3D character guidance, and precise location tracking onto real-world heritage environments. Recent literature underscores that AR is no longer merely a hype-driven technology but a

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transformative instrument for enhancing visitor engagement, accessibility, and heritage interpretation. By integrating digital elements into the physical world, AR allows visitors to interact with cultural artifacts in ways that foster deeper connections to history, effectively turning passive observation into active participation. Furthermore, studies utilizing the ISO/IEC 25010 quality model have demonstrated that system performance and user-centric design—covering dimensions such as effectiveness, efficiency, and satisfaction—are critical determinants of the success and adoption of tourism applications. The primary objective of this research is to design, develop, and evaluate the "Pila Adventures" system to determine its technical and empirical viability in a real-world setting. By examining the application's quality in use, this study provides a framework for leveraging digital innovations to promote sustainable tourism development in Pila. This research contributes to the growing body of knowledge on how mobile-based AR can serve as an effective tool for cultural conservation, ensuring that historical stories remain relatable, memorable, and inclusive for diverse audiences.

OBJECTIVES OF THE STUDY

The general objective of this research was to design, develop, test, and evaluate an Augmented Reality (AR) application and determine its acceptability and perceived contribution to tourism in Pila. Specifically, the objectives of this study were as follows, to with:

1. Design an Augmented Reality (AR) application that presents selected historical and cultural landmarks of Pila, Laguna through interactive digital content and user friendly interface.
2. Develop the AR application using appropriate tools and technologies to implement features such as location-based scanning, multimedia display, and navigation support.
3. Test the developed AR application to ensure its functionality, reliability, and overall system performance across different usage scenarios.
4. Evaluate the acceptability of the AR application based on the ISO/IEC 25010.
5. Assess the acceptability of tourism outcomes derived from the AR Application.
6. Determine the relationship between the Augmented Reality application and tourism outcomes.

METHODOLOGY

This study employed a descriptive evaluative research design to assess the

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development and system acceptability of the "Pila Adventures" application. Research Instrument and Validation The research utilized a non-standardized questionnaire based on the ISO/IEC 25010 quality model. To ensure the instrument’s validity and reliability, the survey form was subjected to expert review and pilot testing before formal administration to the target participants. Sampling and Data Collection A purposive sampling technique was utilized to select participants who actively engaged with the AR application during the testing phase. Ethical considerations were strictly observed by informing all participants of the study’s objectives and the nature of the instrument prior to data gathering. Participation was entirely voluntary, and all collected data confidentiality. Data Analysis were handled with The collected data were analysed using appropriate statistical tools. The mean and standard deviation were calculated to interpret the system's acceptability levels across the ISO/IEC 25010 dimensions. Furthermore, correlation analysis was performed to determine the significance of the relationship between system quality and tourism outcomes.

RESULTS AND DISCUSSION

The study evaluated the AR application based on the ISO/IEC 25010 quality model, with all dimensions receiving a "High" level of acceptability. The data, logically organized in Table 1, highlights the performance of the system across key metrics

Table 1. System Acceptability Result (Quality in Use)

Indicator/ Factor	Overall Mean	Interpretation
Effectiveness	4.05	High
Efficiency	4.14	High
Satisfaction	4.01	High
User Experience	4.08	High

The results demonstrate that the application is effective in providing users with navigation support and accurate historical information. Efficiency and user experience scores indicate that the technical architecture, utilizing tools such as AR.js and Leaflet.js, successfully supports the intended user flow.

Table 2. Respondents’ Assessments on the Tourism Outcome derived from Augmented Reality Application

Indicator/ Factor	Overall Mean	Interpretation
Experience Enhancement	4.05	High
Destination Attractiveness	3.95	High
Cultural Heritage Appreciation	3.89	High
Tourist Engagement and Satisfaction	4.03	High
Behavioral Intention	4.01	

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Based on the results, the Augmented Reality application has a significant and positive impact on tourism outcomes. The consistently high ratings across all indicators underscore the effectiveness of AR as an innovative tool for smart tourism and digital destination marketing.

Table 3. Significant Relation between AR App Quality in Use and Tourism Outcome Derived from AR Application

AR App Quality in Use	Tourism Outcome				
	Experience Enhancement	Destination Attractiveness	Cultural Heritage Appreciation	Engagement and Satisfaction	Behavioral Intention
Effectiveness	$r = .388^{**}$ Low $p = .005$	$r = .373^{**}$ Very Low $p = .007$	$r = .526^{**}$ Moderate $p < .01$	$r = .514^{**}$ Moderate $p < .01$	$r = .693^{**}$ Moderate $p < .01$
Efficiency	$r = .707^{**}$ High $p < .01$	$r = .350^{*}$ Low $p = .012$	$r = .661^{**}$ Moderate $p < .01$	$r = .633^{**}$ Very Low $p < .01$	$r = .732^{**}$ High $p < .01$
Satisfaction	$r = .582^{**}$ Moderate $p < .01$	$r = .153^{ns}$ Very Low $p = .284$	$r = .260^{ns}$ Low $p = .066$	$r = .321^{*}$ Low $p = .021$	$r = .191^{ns}$ Very Low $p = .180$
User Experience	$r = .784^{**}$ High $p < .01$	$r = .085^{ns}$ Very Low $p = .551$	$r = .643^{**}$ Moderate $p < .01$	$r = .822^{**}$ High $p < .01$	$r = .744^{**}$ High $p < .01$

Interpretation of Correlation Coefficient

> 0.90 Very High

0.70 – 0.90 High

0.41 – 0.70 Moderate

0.20 – 0.40 Low

< 0.20 Very Low/Negligible

Note:

****** means significant at 1% level

***** means significant at 5% level

ns means not significant

In terms of the correlation matrix between the attributes of AR App Quality in Use and the resulting Tourism Outcomes the overall data reveals the positive relationship across the variables, it

indicates that higher technical and operational quality in the application generally means a much favorable tourism experience. Majority of the indicators demonstrate moderate-to-high significant correlations, providing that the digital performance of the application is deeply linked to how visitors perceive and interact with the heritage site.

The study established a significant relationship between system acceptability and tourism outcomes, suggesting that the application contributes positively to heritage appreciation and visitor engagement. While these findings align with the objective of promoting local heritage, future iterations should focus on expanding site coverage to address the current limitations of the system.

CONCLUSION AND RECOMMENDATION

The development of "Pila Adventures" confirms that augmented reality is a viable strategy for enhancing tourism in Pila, Laguna. By bridging the gap between digital content and physical heritage sites, the system provides a high level of user satisfaction and effective navigation.

Given these findings, it is recommended that future research focuses

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on increasing the breadth of content for additional historical landmarks. Furthermore, developers should investigate expanding system compatibility to ensure seamless access across a wider range of mobile devices, thereby maximizing the application's potential for sustainable tourism impact.

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