# Software Engineering for Developing a Cloud Computing Museum-Guide System

Hadeel Al-Obaidy, University of Bahrain, Bahrain*

Aysha Ebrahim, University of Bahrain, Bahrain

Ali Aljufairi, University of Bahrain, Bahrain

Ahmed Mero, University of Bahrain, Bahrain

Omar Eid, University of Bahrain, Bahrain

## ABSTRACT

The aim of this article proposes an innovative solution for developing a museum-guide system, which employs a voice-activated assistant paired with 3-D hologram displays, that utilizes Amazon web services (AWS) to enhance the visitor experience at the Bahrain National Museum. The proposed system uses software engineering as a service (SaaS) and involves an agile development process model with microservice architecture that adapts cloud computing capabilities to provide scalability, reliability, and maintainability. The proposed system enhances the existing museum infrastructure and databases through a flexible, API-based architecture. The proposed system is highly adaptable and flexible in different desirable aspects of user experience goals. The implementation results proved that the system is highly reliable, adaptable, and efficient and has the potential to improve the user experience by transforming the way museum visitors explore and interact with user interfaces of the museum-guide system.

## KEYWORDS

Agile process model, Cloud Computing, Human-Computer Interaction, Museum-Guide System, Software Engineering, User- experience

## INTRODUCTION

In recent years, the use of technology in the museum industry has been increasing rapidly. From digital displays to Virtual Reality (VR) experiences, museums continuously explore new ways to enhance visitors' experience and provide more engaging and interactive exhibits (Kasemsarn et al., 2023). However, despite these advancements, one area that remains essentially unchanged is providing information for visitors. Traditional methods, such as tour guides or information boards, can be time-consuming and ineffective, causing a subpar experience for visitors. In this respect, visitor experience represents a critical component in the success of the museum operations. Providing positive and informative experiences is increasingly important for visitors in today's competitive museum landscape. Thus, an intelligent tourist guide system is vital for enhancing self-guided tours

*Corresponding Author

and improving tourists' experience during their tour (Yu, 2014). This paper proposes a tour voice-activated assistant, paired with 3-D hologram displays, that utilizes Amazon Web Services (AWS) to enhance visitor experience at the National Museum of Bahrain. It identifies the challenges the museum encounters in providing information for visitors and evaluating the effectiveness of the developed solution for addressing these challenges. Bahrain National Museum is well-known for its rich collection of artifacts and exhibits. However, the Museum faces several challenges in providing an efficient and informative experience for visitors, which often requires additional support in the form of tour guides, and the manual counting process is time-consuming and prone to errors (Jung et al., 2016). The proposed museum-guide system aims to address these challenges by automating the counting process and providing employees with real-time data and predictions for incoming traffic. Additionally, the tour voice assistant with 3-D hologram displays provides visitors with accurate and timely information without additional tour guides.

Software engineering as a service (SaaS) enables the proposed system to adapt the Agile development process model based on a cloud computing environment with AWS services. The proposed solution is also highly adaptable, making it easy to implement in other locations. The proposed museum–guide system, which leverages software engineering development, uses an agile process model and employs a microservice architecture to optimize scalability, reliability, and maintainability. In this system, 3-D holographic displays are a standout feature aiming at transforming user's interaction with museum artifacts. This results in high reliability and adaptability of the system, indicating its potential to improve the user experience. Implementing 3-D holographic displays is an innovative feature to transform and enhance user interaction with museum artifacts. More specifically, these displays allow museum objects and augmented reality (AR) reconstructions related to the artifacts to be viewed by visitors in an immersive and interactive holographic format. This emerging technology aims to provide museum patrons with a vivid, lifelike experience when learning about historical items. The adoption of AWS serverless architectures achieves scalability, resiliency, and efficiency. The system can automatically scale capacity based on demand by utilizing services such as AWS Lambda, Amazon API Gateway, and Amazon DynamoDB in a serverless framework, while only paying for the computing resources used. The service-oriented nature of the museum-guide system presents serverless technology that empowers rapid delivery of critical functionalities to improve the user experience while decreasing operational burdens.

The proposed system provides audio descriptions and text-to-speech options for visually impaired visitors. This system involves describing the exhibit or providing audio guides verbally explaining the contents. Additionally, it supports hearing impairments by including closed captioning or subtitles for any audio content within the AR system. This support ensures that visitors with hearing impairments can understand the information being presented. The proposed system is highly adaptable and flexible. Incorporating features for visually or hearing-impaired users could significantly broaden the system's appeal and utility and enable it to cater to the needs of a diverse range of visitors, including children, seniors, and visitors with disabilities. For the Museum of Bahrain, the proposed system designs a well-architected, scalable, and flexible AWS framework that can adapt to evolving business needs. Using an Agile development methodology and a microservice architecture, along with AWS serverless services, enables the system to be reliable, efficient, and readily scalable. Such an approach allows easy modification and upgrading of the system, ensuring that it can meet the needs of the Museum both now and in the future.

## LITERATURE REVIEW

A museum is an institution that represents heritage, cultural, and artistic treasures for centuries. However, with new technologies and the ever-changing visitor requirements, museums are expected to evolve to remain relevant and engaging. A study by Kasemsarn et al. (2023) used a systematic literature review and reviewed the interrelationship between cultural tourism, inclusive design, and

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