Journal of Mathematics and Computing Science, 10 (2). 116-126, 2024

eISSN: 0128-0767

Enhancing Tourist Experiences through a Web-Based Scavenger Hunt: A Case Study of Kota Bharu's Self-Guided Tour System

Arinah Izzati[1], Ainul Azila Che Fauzi[2]*, Asiah Mat[3], Auni Fauzi[4], Syerina Azlin Md Nasir[5] and Mohamad Syauqi Mohamad Arifin[6]

[1,2,3,5]Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA Kelantan, Bukit Ilmu, Machang, Kelantan, Malaysia
[4]Faculty of Ocean Engineering Technology and Informatics, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia
[6]Faculty of Information Management, Universiti Teknologi MARA Kelantan, Bukit Ilmu, Machang, Kelantan, Malaysia

Authors' email: 2020834486@student.uitm.edu.my, ainulazila@uitm.edu.my*, asiahmat@uitm.edu.my, p4155@pps.umt.edu.my, syerina@uitm.edu.my and mohdsyauqi@uitm.edu.my

*Corresponding author

Received 17 November 2024; Received in revised 18 December 2024; Accepted 28 December 2024
Available online 30 December 2024
DOI: https://doi.org/10.24191/jmcs.v10i2.4514

Abstract: The tourism industry is a thriving sector globally, contributing significantly to economic growth and employment opportunities. Beyond the financial benefits, tourism enables individuals to immerse themselves in diverse cultures, languages, and histories, fostering cross-cultural understanding and enriching experiences. However, tourists often encounter challenges such as limited facilities and ineffective marketing strategies, which can hinder their overall travel experiences. To address these issues and enhance tourist experience, this study focuses on the development of a web-based system known as the Kota Bharu Self-Guided Scavenger Hunt and Tour. Following the System Development Life Cycle (SDLC) methodology, specifically the waterfall model, this project aims to create an interactive and engaging platform for tourists. The web-based system offers a range of features designed to facilitate seamless exploration and enjoyment of tourist attractions. Users can easily access information about popular destinations, historical sites, cultural landmarks, and other points of interest. The system incorporates Google Maps integration, providing guided directions to ensure visitors easy navigation. Additionally, the platform allows users to upload photos, manage store and owner profiles, and access lists of players, store owners, stores, and checkpoints. By leveraging these functionalities, tourists can select specific categories of interest and embark on an exciting scavenger hunt adventure. Looking ahead, one future recommendation for further system enhancement is the exploration of a mobile application. Developing a mobile app would offer greater accessibility and convenience, allowing users to access the scavenger hunt and tour features directly from their smartphones. This would enable on-the-go access to information, navigation, and real-time updates, enhancing the overall user experience.

Keywords: Future system enhancement, Gamification, System development life cycle (SDLC), Tourism industry, Web-based system

1 Introduction

Tourism is a social, cultural, and economic phenomenon involving individuals traveling to destinations beyond their usual environment for personal or professional purposes. In the era of globalisation, advancements in information and communication technology (ICT) significantly influence how tourism companies and organisations engage with and manage tourists. The tourism industry not only makes a substantial contribution to gross domestic product (GDP) but also plays a vital role in job creation,

poverty alleviation, income distribution, increased demand for products and services, additional tax revenue, and foreign exchange reserves for governments.

With increasing globalisation and opportunities, many countries are employing various strategies to achieve their economic growth objectives, with tourism emerging as one of the most significant tools for this purpose. Numerous studies have expanded knowledge of tourism demand from diverse perspectives, such as mapping tourism economics knowledge [1], analysing the inertia of the tourism-led economic growth hypothesis [2], evaluating the methodological advancements and prospects in tourism demand forecasting [3], and addressing critical issues in econometric tourism demand studies [4].

However, tourists often face challenges, such as not knowing which attractions to visit. Additionally, some tourists become lost due to the lack of adequate facilities, such as signboards and updated maps. This issue can negatively impact economic stability as unsatisfied tourists may discourage others from visiting, particularly in Kelantan. According to a Berita Harian article, a tourist noted that it is difficult to enjoy the natural beauty of Kelantan due to the lack of provided facilities [5]. They hoped to experience unique traditional activities in Kelantan but were disappointed by the unavailability of such opportunities. Another tourist mentioned hearing rumours before visiting Kelantan about the challenges of travelling in the region [5]. A shortage of tourist facilities, such as road signs across the state and the absence of maps or brochures highlighting tourist attractions, left visitors feeling disoriented and inconvenienced. In response, an e-travel mobile application has been developed, leveraging geofencing technology to help tourists locate nearby attractions and receive relevant information about these places.

Another issue is the lack of effective travel marketing. Travel marketing is crucial to attracting tourists during their trips. If the information provided is outdated or incorrect, tourists may feel disappointed for expending effort on unreliable information. They not only waste their energy but may also spend money unnecessarily on transportation. If their plans are disrupted, they may decide not to return to that destination.

Previous studies have highlighted the critical role of internet marketing in advancing digital tourism [6,7], specifically addressing the utilization of social networks in this domain [8]. Additionally, research has investigated the motivations of Greek tourists for adopting digital marketing platforms such as Airbnb [9]. Furthermore, a comprehensive literature review has examined the ecosystem of travel blogs, focusing on their contributions to the evolution of digital marketing [10], while also presenting recent developments and strategic recommendations in digital and influencer marketing [6,11].

Motivated by the issues above, a project called the Kota Bharu Self-Guided Scavenger Hunt and Tour is developed. It is a web application aimed at guiding and attracting tourists while promoting the local economic growth. The web application is designed to optimise time efficiency for tourists by offering curated destinations and creating memorable travel experiences. By incorporating mobile technology, the project intends to enhance the enjoyment and excitement of travel through an interactive scavenger hunt, particularly appealing to travellers. This innovative concept not only improves tourist experience but also contributes positively to economic development, making a strong case for the implementation of the system.

2 Literature Review

These case studies explore different applications of augmented reality (AR) and gamification techniques to enhance user experiences in various contexts.

A Case Study 1: Scavenger Hunt based on Audio Augmented Reality in Morocco

Some researchers have introduced a model that combines audio-augmented reality with serious game principles to enhance visitor experience at Jnan Sbil, a historical garden in Fez City, Morocco [12]. This

involved designing an AR game tailored to align with the garden's scenario. The AR reality system discussed in this study integrates virtual objects into a real environment, operates in real time, and facilitates interactive experiences. Additionally, it ensures seamless alignment between real and virtual objects.

The game combines artificially generated sounds with authentic audio, dynamically adjusting the sounds in real time based on the visitor's location. Artificial sounds are spatially positioned to correspond with real objects, creating the illusion that they originate from specific locations. Throughout the game, players are immersed in a variety of sounds. The first type includes ambient or musical sounds that accurately replicate the natural auditory environment of the visited object. The second type comprises vocal comments, offering audio descriptions of the visited object or presenting thought-provoking questions related to it.

SARIM (Sound Augmented Reality Interface for visiting Museum) is based on a theoretical model comprising three main components. The first component is the sound landscape, which is presented at three levels: physical, virtual, and semantic. The second component represents the visitor, modelled across multiple levels. The final component is the navigation engine, composed of three concentric layers that govern the visitor's interaction with the sound environment and provide varying levels of interactivity. Figure 1 below illustrates the SARIM model.

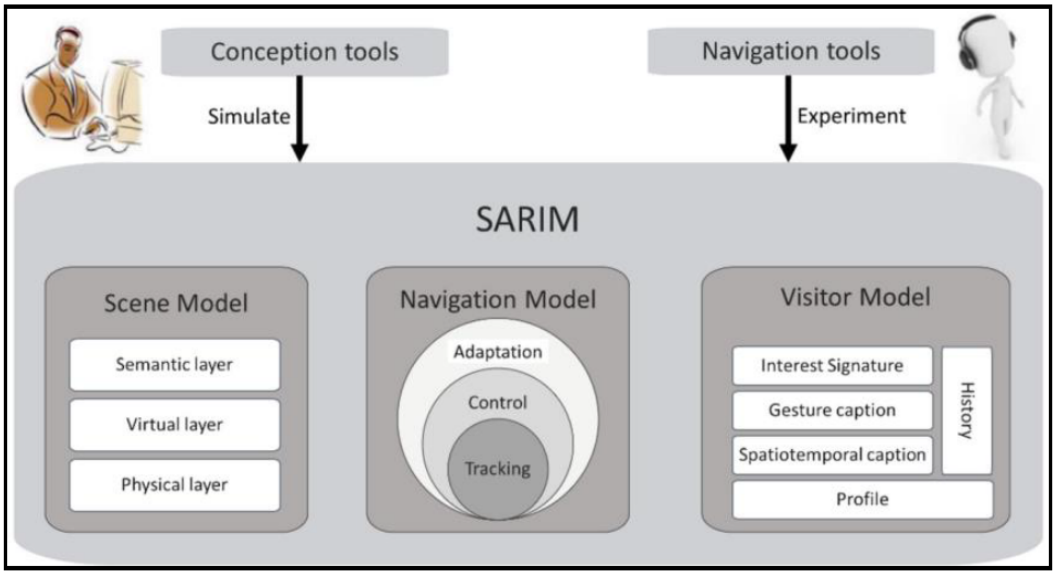

Figure 1: SARIM Model

B Case Study 2: Library Treasure Hunt using Augmented Reality Game in Alabama

Jacksonville State University (JSU), a public university in northeast Alabama, conducted a pilot study to welcome new students and engage those unfamiliar with academic libraries. The study introduced a self-paced Augmented Reality Library Treasure Hunt game. For many first-year college students, the academic library can feel unfamiliar and overwhelming. However, library orientation programs offer valuable opportunities for students to become acquainted with library facilities. Research has shown that such orientation programs effectively reduce library-related anxiety and boost students' confidence in using the library [13].

In order to enhance students' exploration of the library, the Metaverse application tool was used to develop an AR Treasure Hunt game. This self-guided AR tour, accessible via smartphone instructions, provides an authentic learning experience by allowing students to choose their interactions and areas of interest [13]. Moreover, it reduces the workload of library staff involved in organising similar events.

During the game, students solve six puzzles, one from the first mission and five from the second mission. Successfully completing these puzzles earns them six "letter" keys, which they must arrange in the correct sequence to unlock a virtual chest. Once the correct code is entered, a congratulatory image appears on their phone, enabling them to claim their prize. At the conclusion of the game, students are encouraged to provide feedback on their overall experience. Figure 2 below illustrates the flow of the library treasure hunt game.

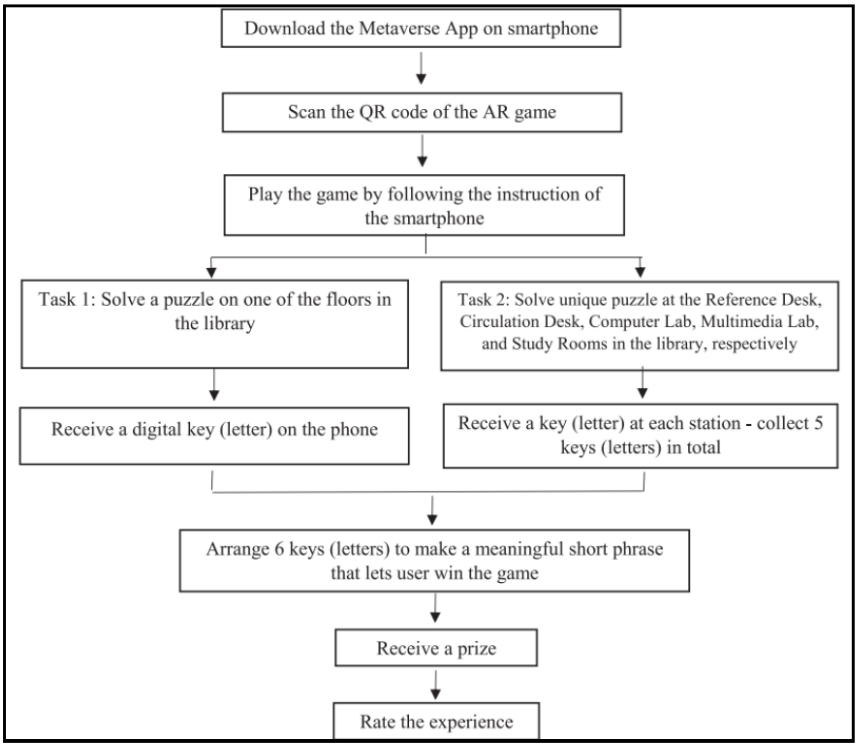

Figure 2: Library Augmented Reality Treasure Hunt

C Case Study 3: Treasure Hunt Game in Jakarta, Indonesia

The article titled High-Order Thinking Skills: The Educational Treasure Hunt Game examines the development of the HOTS Game, an educational video game designed to enhance higher-order thinking skills (HOTS) in elementary school children. Combining the genres of treasure hunt and adventure puzzle, the game focuses on fostering complex cognitive abilities such as creativity, critical thinking, and problem-solving [14].

The authors address the challenges posed by a lack of perseverance and motivation when individuals face mathematics-related problems. They emphasise the effectiveness of video games as a learning tool, especially in the digital age, where games are both accessible and engaging. By blending entertainment and media through smartphone devices, video games provide an interactive platform for problem-solving activities [14].

Designed for Android mobile devices, the HOTS Game incorporates adventure and puzzle elements involving math problems that require HOTS. The game aims to stimulate cognitive development and thinking skills in young players while offering an immersive exploration of Indonesian regions. The experience is enriched by music and an atmosphere that highlights Indonesia's cultural and national identity.

This research also highlights the importance of user interface (UI) and user experience (UX) in video games. The UI serves as the interaction medium between players and the game, focusing on usability and consistency. The graphical user interface (GUI) plays a critical role in delivering visual information and creating a pleasant experience for players. Meanwhile, UX emphasises the overall quality of the players' engagement with the game, ensuring the interface is enjoyable and intuitive to use [14].

3 Methodology

The waterfall model was employed throughout the project's development, as seen in Figure 3 below. The waterfall technique is a stringent linear model consisting of distinct phases that emphasises explicit objectives. The model is termed a waterfall due to its systematic progression from one phase to the subsequent phase in a descending manner. This model is organised into phases, where the output of one phase functions as the input for the subsequent step. Each step must be finalised prior to progressing to the subsequent one, and no phases may coincide.

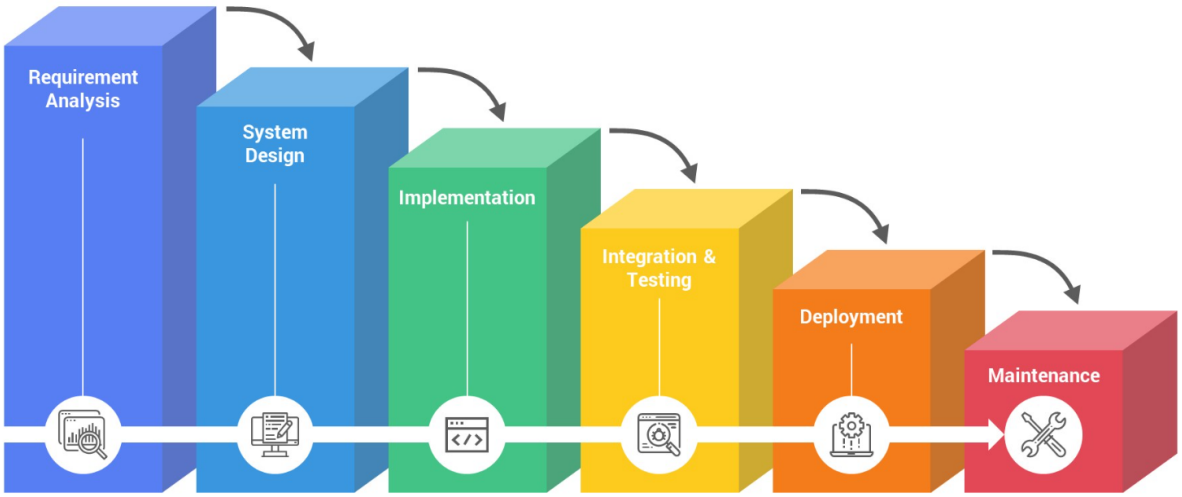

Figure 3: Waterfall Model

The rationale for adopting this waterfall model is that, early in the project, requirements were fulfilled, enabling the team to delineate the complete project scope, establish a comprehensive timeline, and architect the entire application. Moreover, it constitutes a superior system design as the users' needs, requirements, and deliverables are comprehensively understood, ensuring that project development proceeds successfully and efficiently.

The documentation is predominantly static, facilitating the tracking of changes and the reversion of material to a prior state. Documents are associated with a specific stage; thus, upon the completion of that stage, the corresponding documentation is expected to be finalised and may serve as input for the subsequent step. The waterfall model establishes development operations into several project phases, which are planning, requirements, design, implementation, testing, and maintenance [15].

A System Requirements

Software

- Text editor: Visual Studio
- Database tool: Mygp

- Word processing: Microsoft Word
- Designing tools: Figma and Draw.io

Hardware

- Platform/OS: Windows 11
- Processor: Intel Core i5-1135G7
- RAM: 8.00 GB
- Storage: 480 GB

B Framework Design

The framework offers users an overview of the system's operation. In the Kota Bharu Self-Guided Scavenger Hunt and Tour system, there are three distinct user roles: administrator, player, and store owner. Figure 4 below illustrates the system's framework design.

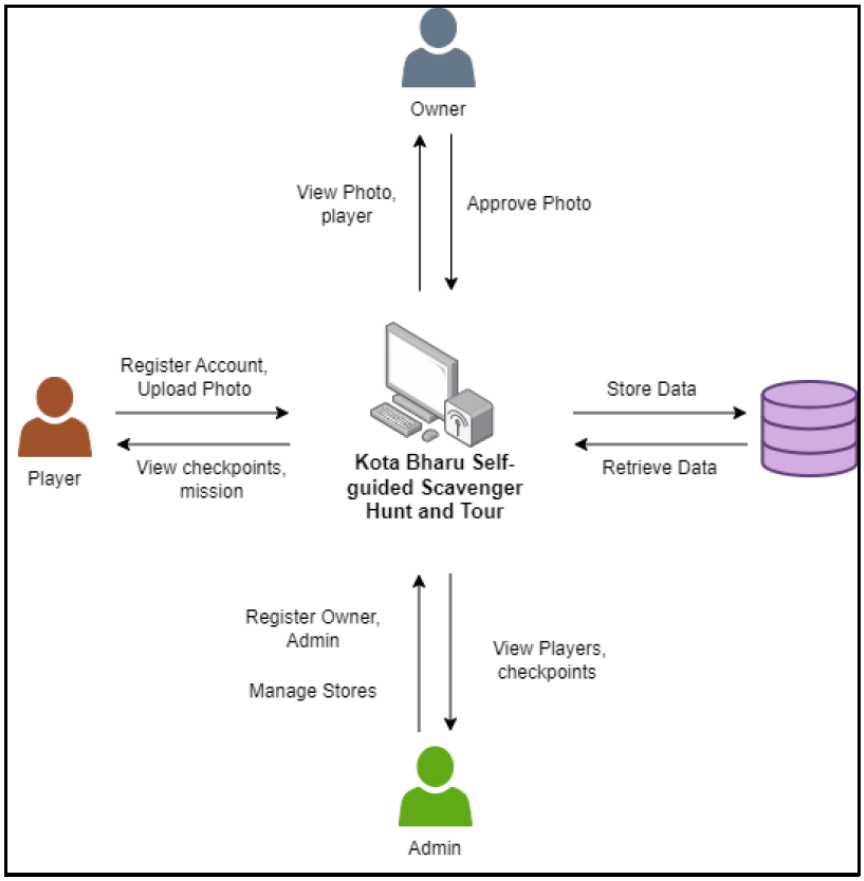

Figure 4: Framework Design

The player must register an account before they can log in to the system. They can also view checkpoints and upload photos of missions. Additionally, store owners can review and approve mission photos. They can also view the players who visited their stores. Administrators can register accounts for store owners and other administrators. They are responsible for managing store information, including creating, editing, and deleting data. Administrators can also view players, checkpoints, and stores. All data will be stored in the database and can be retrieved as needed.

4 Results

This section presents the interfaces of the Kota Bharu Self-Guided Scavenger Hunt and Tour. These system interfaces facilitate interaction between users and the system, enabling users to make decisions while allowing the system to process them efficiently. The interface plays a crucial role in ensuring smooth and user-friendly interactions. The system includes three user categories: players, store owners, and administrators, each with distinct roles and responsibilities.

A Main Interface

Figure 5: Landing page of Kota Bharu Self-Guided Scavenger Hunt and Tour.

Figure 5 illustrates the main page of the Kota Bharu Self-Guided Scavenger Hunt and Tour, designed for players, store owners, and administrators. The users need to click the login button to proceed to the login and register page.

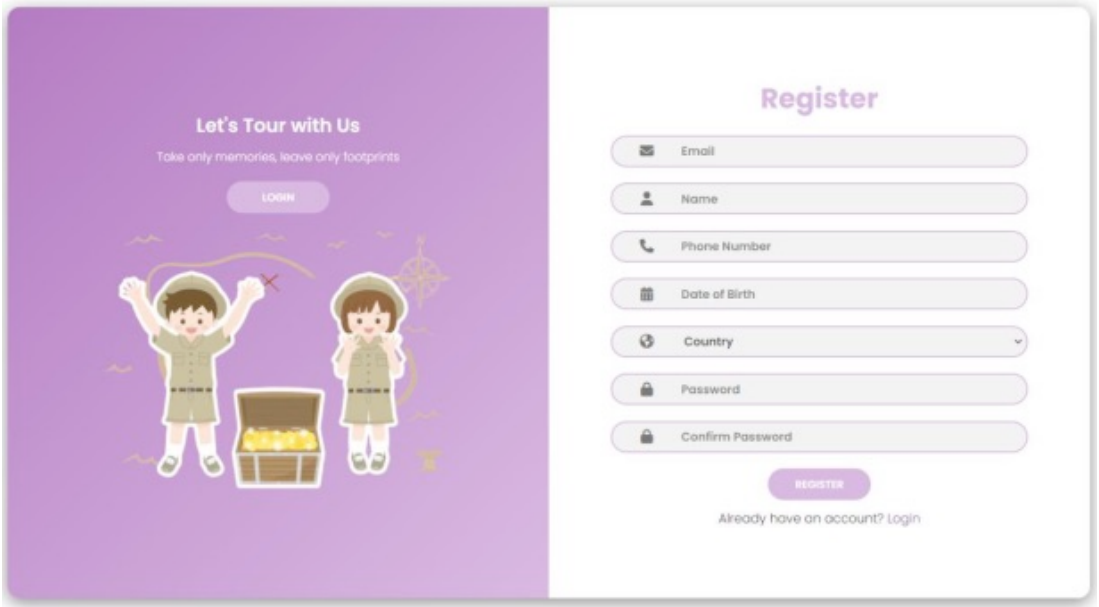

Figure 6: Register page.

Figure 6 displays the register page for players. To complete the registration process, players are required to fill in the provided form with their personal information, including email, name, phone

number, date of birth, country, password, and confirmation password. If the player already has an account, they can click the login button.

A Player Interface

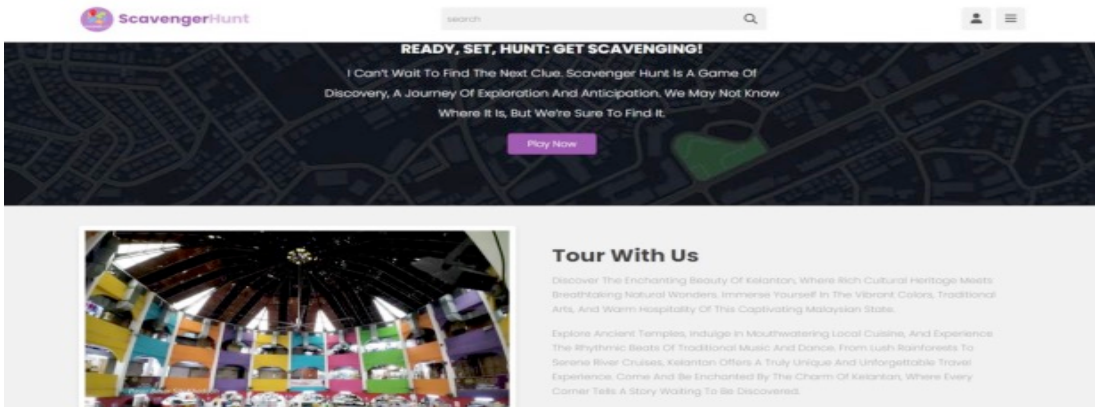

Figure 7: Player home page.

Figure 7 shows the home page for players. On this page, players need to click the "Play Now" button to select the categories of travel activities they wish to engage in.

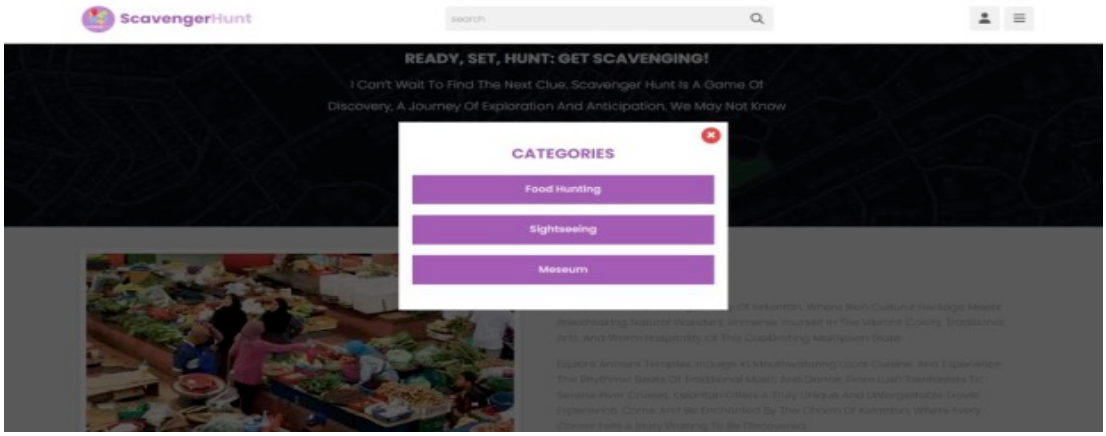

Figure 8: Categories popup page.

As shown in Figure 8 above, after clicking the "Play Now" button, a "Categories" page will appear as a popup. On this page, players can view a list of categories representing different travel activities.

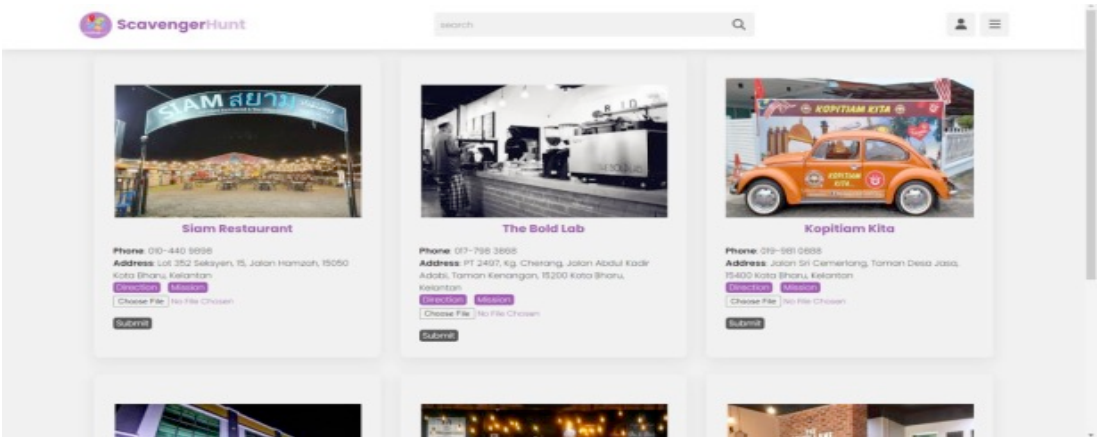

Figure 9: List of food hunting category.

Figure 9 shows a list of checkpoints available to players. Players can choose any checkpoint they wish to visit. Once they have made their decision, they can click the “Direction” button, which will direct them to Google Maps for navigation purposes.

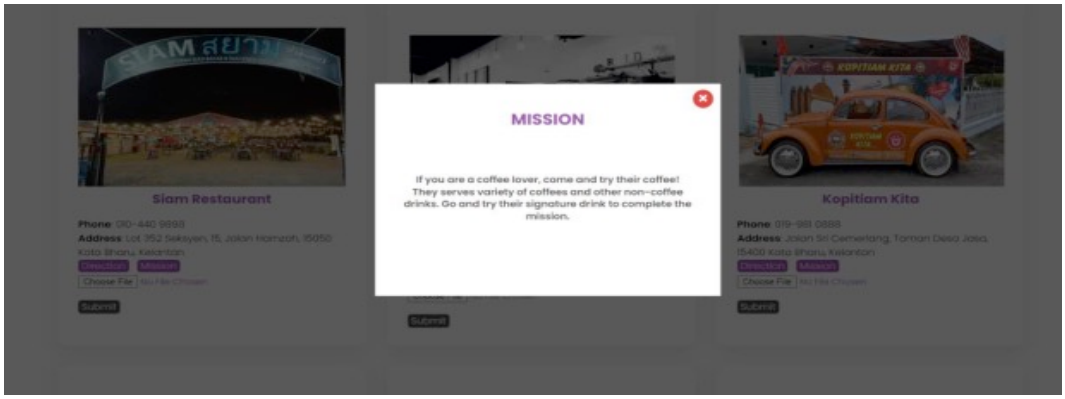

Figure 10: Checkpoint’s mission.

Based on Figure 10 above, when players click the “Mission” button, a popup will appear presenting the mission for the checkpoint. Players must successfully complete the given mission to progress to the next checkpoint.

C Administrator Interface

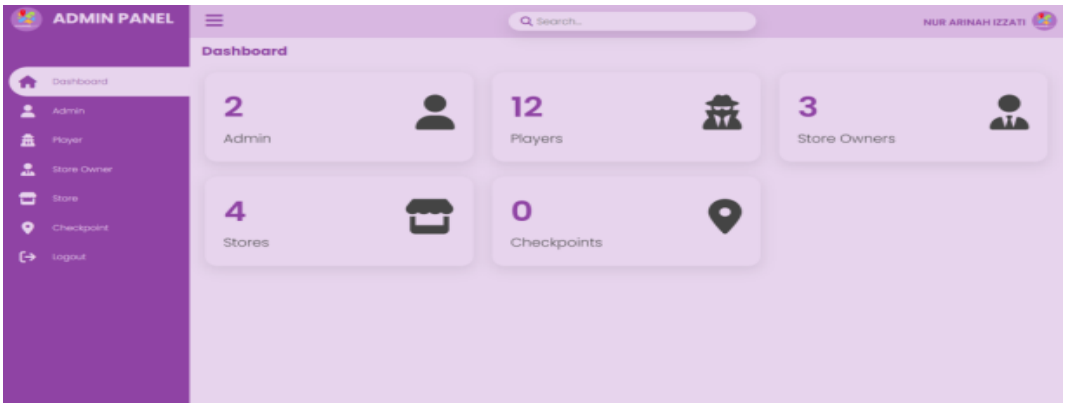

Figure 11: Admin dashboard page.

Figure 11 shows the admin dashboard page, providing an overview for the administrator. The admin can access information about the total count of admins, players, store owners, stores, and checkpoints in the system from this page.

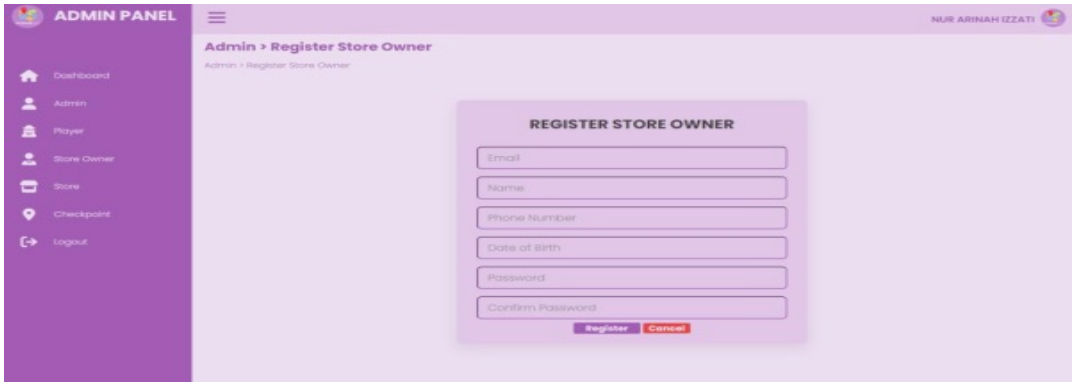

Figure 12: Register for store owner.

Figure 12 shows the registration form for store owners. Store owners are required to provide their email, name, phone number, date of birth, password, and confirmation password in order to register. Once the registration process is completed, the newly registered store owners can proceed to log in to the system. Administrators can add, update and delete store owners.

5 Conclusion

The Kota Bharu Self-Guided Scavenger Hunt and Tour has successfully fulfilled its main objective to build a web application designed to guide and attract tourists. This idea facilitates time efficiency for tourists by offering curated destinations while also promoting unforgettable travel experiences. Furthermore, it enhances the local economy by producing favourable economic effects. The study's significance lies in its objective to ensure that tourists experience the enjoyment and thrill of a public game by employing mobile technology designed to enhance the tourist experience for young people through an interactive scavenger hunt. This scavenger hunt concept has numerous advantages that enhance and enrich tourists' travel experiences. Furthermore, it will significantly influence economic growth. These advantages provide persuasive rationale for the establishment of such a system.

Acknowledgements

This research received no specific grant from any funding agency in the public, commercial, or private sectors.

Conflict of Interest Statement

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

References

[1] H. Song, L. Dwyer, G. Li, and Z. Cao, "Tourism economics research: A review and assessment," *Annals of Tourism Research*, vol. 39, no. 3, pp. 1653-1682, 2012.

[2] H. Zhang, H. Song, L. Wen, and C. Liu, "Forecasting tourism recovery amid COVID-19," *Annals of Tourism Research*, vol. 87, p. 103149, 2021.

[3] H. Song, R. T. R. Qiu, and J. Park, "A review of research on tourism demand forecasting: Launching the Annals of Tourism Research Curated Collection on tourism demand forecasting," *Annals of Tourism Research*, vol. 75, pp. 338-362, 2019.

[4] U. Gunter, I. Önder, and E. Smeral, "Scientific value of econometric tourism demand studies," *Annals of Tourism Research*, vol. 78, p. 102758, 2019.
[5] Berita Harian, "Kelantan gagal sediakan kemudahan pelancongan," Mar. 16, 2016. [Online]. Available: https://www.bharian.com.my/taxonomy/term/2645/2016/03/131584/kelantan-gagal-sediakan-kemudahan-pelancongan
[6] N. Chorna, N. Korzh, A. Kiziun, N. Onyshchuk, and K. Antoniuk, "The role of digital technologies in the transformation of the tourism business: Prospects for development and impact on the country's economy," *AD ALTA: Journal of Interdisciplinary Research*, vol. 14, no. 1, pp. 136-140, 2024.
[7] M. Tairova, O. Khurramov, and N. Odinaeva, "An important role of Internet marketing in digital tourism," *Scientific Publications Center (buxdu.uz)*, vol. 5, no. 5, 2021.
[8] K. O. Kayumovich, "Particular qualities of using social media in digital tourism," *Gwalior Management Academy*, vol. 28, no. 1, pp. 21-28, 2020.
[9] L. Tsourgiannis and S. Valsamidis, "Digital marketing in tourism: Why Greek tourists use digital marketing applications like Airbnb," *International Journal of Culture, Tourism and Hospitality Research*, vol. 13, no. 4, pp. 473-486, 2019.
[10] M. H. Dewantara, S. Gardiner, and X. Jin, "Travel vlog ecosystem in tourism digital marketing evolution: A narrative literature review," *Current Issues in Tourism*, vol. 26, no. 19, pp. 3125-3139, 2023.
[11] K. Skagias, D. Belias, L. Vasiliadis, and C. P., "Digital tourist marketing: The latest developments and recommendations on how Mykonos can take advantage of digital and influencer marketing," in *Transcending Borders in Tourism Through Innovation and Cultural Heritage: 8th International Conference, IACuDiT, Hydra, Greece, 2021*, Cham: Springer International Publishing, 2022, pp. 1007-1020.
[12] M. Fakhour, A. Azough, F. Z. Kaghat, and M. Meknassi, "A cultural scavenger hunt serious game based on audio augmented reality," *Advances in Intelligent Systems and Computing*, pp. 1-8, 2020.
[13] Y. Tang, "Help first-year college students to learn their library through an augmented reality game," *The Journal of Academic Librarianship*, vol. 47, no. 1, p. 102294, 2021.
[14] Y. Udjaja, S. Sasmoko, J. Moniaga, and K. Bay, "High order thinking skills: The educational treasure hunt game," *Advances in Science, Technology and Engineering Systems Journal*, vol. 5, pp. 196-202, 2020.
[15] IONOS, "Waterfall methodology: The classic approach to project management," IONOS. [Online]. Available: https://www.ionos.com/digitalguide/websites/web-development/waterfall-methodology/.