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Development of Smart Tourism: Integrating GIS and Artificial Intelligence–Based Chatbots for Marine Tourism Information in the Anyer and Carita Coastal Areas

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Abstract

The rapid digital transformation of tourism requires integrated smart systems capable of delivering spatially contextualized and interactive services. This study develops and empirically evaluates a smart tourism system that integrates Geographic Information Systems (GIS) and an Artificial Intelligence (AI)-based chatbot to support marine tourism information services in the Anyer and Carita coastal areas. The research adopts a design science approach combined with large-scale quantitative evaluation involving 1,500 tourists. The proposed system integrates spatial visualization and conversational intelligence within a unified mobile platform to provide real-time, location-aware, and personalized tourism information. System performance testing indicates an average chatbot accuracy of 85%, a response time of 0.7 seconds, and a system stability rate of 90%. User evaluation results reveal an overall satisfaction level of 88%, reflecting high perceived usefulness, ease of use, and information reliability. The findings demonstrate that integrating spatial and conversational technologies produces synergistic improvements in marine tourism information services. The novelty of this study lies in the empirical validation of an integrated spatial–conversational architecture tailored specifically for coastal tourism environments, addressing the limited research on technological convergence in smart marine tourism. The proposed model provides both theoretical and practical contributions by offering a scalable digital solution for enhancing user experience and destination competitiveness in coastal regions. The study also incorporates formal mathematical modeling and statistical validation to ensure methodological rigor and reproducibility, addressing limitations in previous smart tourism research.

Keywords: Smart Tourism; Geographic Information Systems (GIS); Artificial Intelligence; Chatbot; Marine Tourism; Coastal Tourism; Digital Transformation; Tourism Information Systems.

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1. Introduction

The rapid advancement of information and communication technologies has significantly transformed the tourism sector, particularly through the emergence of the smart tourism paradigm. Smart tourism emphasizes the integration of digital technologies, data-driven services, and intelligent systems to enhance tourist experiences, destination management, and service efficiency (Gretzel et al., 2015; Buhalis & Amaranggana, 2015). In this context, tourism destinations are no longer viewed merely as physical locations but as dynamic ecosystems supported by information systems, artificial intelligence, and real-time data exchange.

Marine tourism represents one of the most important segments within the tourism industry, especially for coastal regions with rich natural resources. Coastal destinations often attract a high volume of visitors due to their recreational, ecological, and economic value. However, many marine tourism destinations still face challenges related to fragmented information services, limited accessibility to accurate tourism data, and the absence of integrated digital platforms (Chang et al., 2021). These challenges may negatively affect tourists' decision-making processes, satisfaction levels, and overall travel experience.

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The Anyer and Carita coastal areas in Banten Province, Indonesia, are well-known marine tourism destinations with significant development potential. Despite their popularity, tourism information in these areas remains dispersed across multiple sources, such as social media, informal recommendations, and static websites. As a result, tourists often experience difficulties in accessing comprehensive information regarding tourist attractions, supporting facilities, routes, and nearby services. Previous studies indicate that insufficient access to structured tourism information can reduce destination competitiveness and hinder sustainable tourism development (Xiang & Fesenmaier, 2017; Law et al., 2014).

To address these challenges, the integration of Geographic Information Systems (GIS) and Artificial Intelligence (AI)-based chatbots has emerged as a promising approach. GIS enables spatial visualization and location-based services, while AI-driven chatbots provide real-time, interactive, and personalized information delivery.

The combination of these technologies allows tourism systems to move beyond static information provision toward context-aware and user-centric services, particularly in dynamic coastal environments.

In the tourism context, chatbots have been shown to enhance service accessibility, reduce information search costs, and improve user engagement (Prentice et al., 2020; Wüst & Bremser, 2025). Moreover, chatbots are particularly effective in supporting mobile tourism applications, where tourists seek instant information during their travel activities (Imtiaz & Mohd Suki, 2022).

Although GIS and AI-based chatbots have been extensively studied as separate technologies, their integrated application within marine tourism destinations remains relatively limited. Existing tourism applications often focus on either spatial visualization or conversational interaction, without fully exploiting the combined potential of both technologies. According to Gretzel et al. (2015), smart tourism systems should adopt a holistic approach by integrating multiple technologies to deliver contextualized and intelligent services. Therefore, integrating GIS and AI-based chatbots represents a promising strategy for enhancing tourism information services in coastal destinations.

Furthermore, user experience and satisfaction are critical success factors in smart tourism applications. Research has consistently shown that usability, information accuracy, and interactivity significantly influence tourists' acceptance of digital tourism services (Huang et al., 2017; Chung et al., 2015). Mobile-based tourism applications that provide intuitive interfaces and personalized information are more likely to be adopted and continuously used by tourists (Wang et al., 2016). Consequently, evaluating system performance and user satisfaction is essential to assess the effectiveness of smart tourism solutions.

This study builds upon these insights by developing a smart tourism system that integrates GIS and an AI-based chatbot to support marine tourism information services in the Anyer and Carita coastal areas. The system is designed to provide spatially visualized tourism information through GIS and interactive information delivery through a chatbot, enabling tourists to access relevant information more efficiently.

The research adopts a mixed-method approach, combining system development with quantitative user evaluation. System performance is assessed based on chatbot accuracy, system stability, and user satisfaction levels. The involvement of a large number of respondents allows for a comprehensive evaluation of user acceptance and system usability. This approach aligns with previous studies that emphasize the importance of empirical validation in smart tourism research (Fesenmaier & Xiang, 2017).

The main contributions of this study are threefold. First, it demonstrates the practical integration of GIS and AI-based chatbots within a marine tourism context, addressing the gap in existing smart tourism applications. Second, it provides empirical evidence on system performance and user satisfaction based on field testing involving tourists in real destinations. Third, it contributes to the growing body of smart tourism literature by offering a scalable model for developing integrated tourism information systems in coastal areas.

The remainder of this paper is organized as follows. Section 2 presents the research methodology, including system design and data collection procedures. Section 3 describes the system architecture and implementation. Section 4 discusses the results of system testing and user evaluation. Finally, Section 5 concludes the paper and outlines directions for future research.

Recent reviews confirm that mobile technology adoption in tourism continues to accelerate, shaping how destinations design digital service infrastructures (Law et al., 2020). Furthermore, empirical evidence shows that mobile application usage significantly influences tourist experience and satisfaction levels (Chen et al., 2020).

Unlike prior studies that examine GIS-based tourism systems and AI-powered chatbots separately, this research proposes and empirically validates an integrated spatial–conversational architecture tailored specifically for marine tourism environments. The novelty of this study lies in three main aspects. First, it integrates Geographic Information Systems and AI-based conversational agents within a unified mobile platform capable of delivering location-aware and context-sensitive responses in real time. Second, it provides large-scale empirical validation through field testing involving 1,500 real tourists in operational coastal destinations, addressing the limited empirical evidence in integrated smart tourism research. Third, the study advances the practical implementation of technological convergence in developing-region coastal tourism, demonstrating measurable improvements in user satisfaction, system performance, and service reliability. This integrated and empirically validated approach differentiates the present study from prior works that primarily focus on either spatial visualization or chatbot automation independently.

2. Related Work

2.1. Smart Tourism and Digital Transformation

Recent developments in smart tourism research emphasize the integration of digital technologies to create intelligent and adaptive tourism ecosystems. Smart tourism systems leverage real-time data, artificial intelligence, mobile platforms, and digital infrastructure to enhance tourist experiences and optimize destination management (Gretzel et al., 2020). Unlike traditional tourism information systems, smart tourism platforms focus on interconnectivity, personalization, and data-driven decision-making.

Buhalis and Leung (2023) highlight that the digital transformation of tourism requires convergence between technological systems and destination governance. They argue that intelligent tourism services must integrate data analytics, AI technologies, and spatial systems to support dynamic user interaction. Similarly, Sigala (2023) explains that post-pandemic tourism ecosystems increasingly depend on contactless digital services and automated information delivery, making AI-driven platforms essential components of modern tourism destinations.

Recent empirical studies further demonstrate that tourists expect seamless digital experiences throughout their travel journey. Ukpabi et al. (2021) found that smart tourism services significantly influence user engagement and satisfaction when systems provide personalized and context-aware recommendations. These findings suggest that technological integration, rather than isolated system implementation, is critical for enhancing digital tourism performance.

2.2. Geographic Information Systems in Coastal Tourism.

Geographic Information Systems (GIS) have become central tools in tourism planning and spatial information management. In coastal tourism contexts, GIS supports spatial visualization, route optimization, facility mapping, and environmental monitoring (Nguyen et al., 2023). Spatial intelligence is particularly important in marine tourism, where attractions are geographically dispersed and accessibility varies across locations.

Almeida et al. (2022) developed a GIS-based decision-support system for sustainable tourism planning and demonstrated that spatial data integration improves resource management and visitor distribution strategies. Likewise, Nguyen et al. (2023) reported that GIS-enhanced coastal tourism applications increase tourists' spatial awareness and reduce travel uncertainty.

However, while GIS provides strong spatial functionality, most GIS-based tourism systems primarily focus on visualization and mapping features without incorporating conversational or interactive components. This limitation reduces system adaptability in responding to user-specific inquiries. Recent literature suggests that spatial data systems should be integrated with intelligent interaction modules to achieve more responsive tourism services (Huang et al., 2022).

2.3. Artificial Intelligence and Chatbot Applications in Tourism.

Artificial intelligence technologies, particularly AI-driven chatbots, have gained increasing attention in tourism research. Chatbots utilize natural language processing to simulate human-like conversations, enabling destinations to provide real-time and automated information services (Filieri et al., 2021). These systems reduce operational costs while maintaining service availability 24/7.

Mariani and Borghi (2023) examined AI-powered chatbots in tourism and found that conversational quality and perceived intelligence significantly influence customer satisfaction and trust. Similarly, Wüst and Bremser (2025) demonstrated that chatbot-assisted booking systems positively affect users' decision-making processes and enhance perceived service reliability.

Recent research also highlights that AI-driven tourism services must incorporate contextual awareness and personalization features. Huang et al. (2022) argue that mobile tourism applications integrating AI components show higher adoption rates when they combine ease of use, responsiveness, and contextual information delivery. Despite these advances, many chatbot systems operate independently from spatial data systems, limiting their ability to provide location-based responses.

Recent studies also emphasize the role of artificial intelligence adoption and automation in reshaping tourism service ecosystems. Ivanov and Webster (2021) argue that AI-driven service automation enhances operational efficiency while maintaining service quality, particularly in digitally mature destinations. Similarly, Tussyadiah (2020) highlights that AI technologies increasingly redefine human–technology interaction within tourism environments, influencing service delivery models and customer engagement strategies.

Consumer acceptance of AI-based services has also been widely examined. Gursoy et al. (2021) found that perceived intelligence and trust significantly influence tourists' willingness to adopt AI-driven systems. In addition, Rodríguez-López and Diéguez-Castrillón (2021) reported that customer engagement levels increase when conversational systems provide contextualized responses. These findings suggest that chatbot implementation must consider not only technical accuracy but also psychological and behavioral dimensions of user interaction.

From a strategic perspective, smart tourism systems contribute to destination competitiveness and sustainability. Khan et al. (2022) demonstrate that intelligent tourism systems enhance sustainable destination performance by improving information transparency and resource management. Moreover, big data analytics plays a crucial role in enabling predictive and adaptive tourism services (Yadegaridehkordi et al., 2020; Xiang & Fesenmaier, 2020).

Recent studies have emphasized the importance of integrating spatial data with intelligent user interfaces in tourism systems. Gupta (2022) highlighted that the combination of geographic information systems (GIS) and intelligent interaction mechanisms significantly improves the delivery of location-based tourism services. By leveraging spatial context, tourism applications can provide more relevant and personalized recommendations to users.

In addition, user acceptance plays a critical role in the success of AI-based tourism applications. Kashyap (2021) demonstrated that user interface design, ease of use, and perceived usefulness strongly influence user adoption of intelligent tourism systems. This finding reinforces the importance of combining technical performance with user-centered design in smart tourism development.

2.4. Research Gap and Contribution.

Although recent studies have advanced smart tourism research in both GIS-based systems and AI-powered conversational agents, there remains a limited number of studies that integrate these two technologies into a unified smart tourism platform. Existing research often treats spatial intelligence and conversational intelligence as separate modules rather than interconnected components within a single ecosystem (Sigala, 2023; Gretzel et al., 2020).

Furthermore, empirical validation of integrated smart tourism systems in real coastal destinations is still relatively scarce. While several studies report prototype development or conceptual frameworks, fewer studies provide large-scale field testing involving actual tourists in marine tourism environments (Mariani & Borghi, 2023). This gap indicates the need for applied research that combines technological integration with empirical evaluation.

Based on the identified gaps, this study proposes an integrated smart tourism system that combines GIS-based spatial services and an AI-driven chatbot within a mobile platform tailored for marine tourism destinations. By focusing on the Anyer and Carita coastal areas and conducting field testing with a large number of respondents, this research contributes empirical evidence on how technological convergence enhances tourism information services, user satisfaction, and destination competitiveness.

3. Methodology

3.1. Research Design

This study adopted a design science research (DSR) approach combined with quantitative evaluation, aiming to develop and empirically validate an integrated smart tourism system. Design science research is widely recognized as an appropriate methodological framework for developing technological artifacts that address real-world problems while generating scientific contributions (Gretzel et al., 2020). In the context of digital tourism innovation, DSR enables researchers to design, implement, and rigorously evaluate intelligent systems within operational environments.

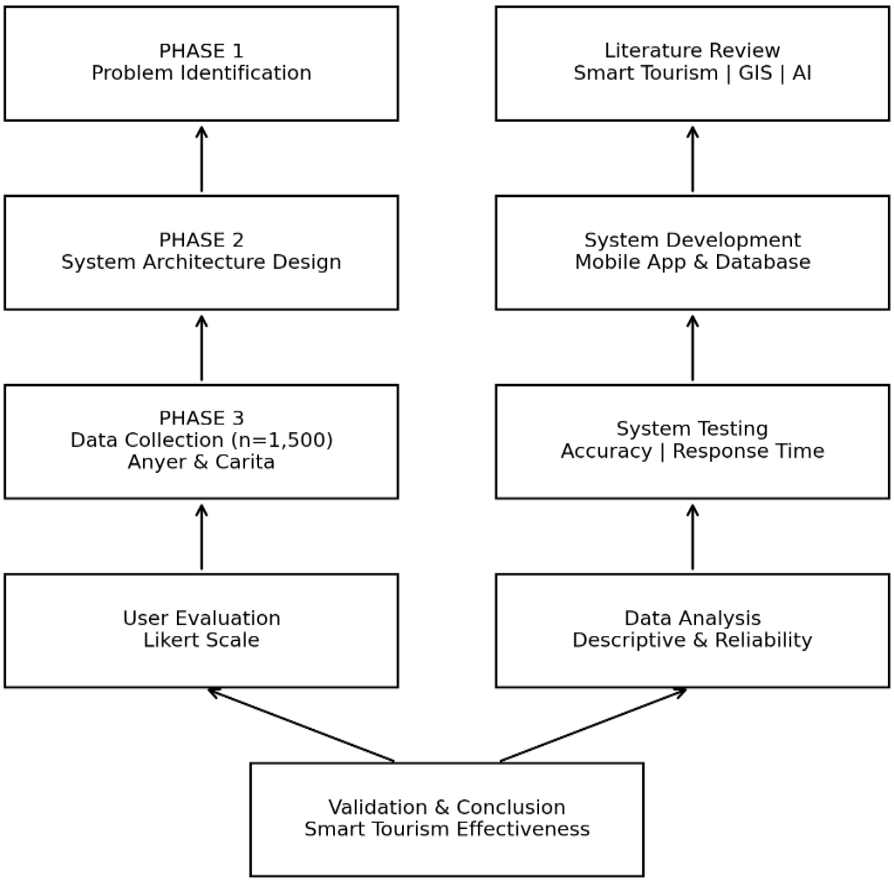

Figure 1. Research Design

The research process consisted of five main stages:

a. Problem Identification and Requirement Analysis

Identification of tourism information challenges in the Anyer and Carita coastal areas, including fragmented information sources and limited spatial integration.

b. System Design

Development of a conceptual architecture integrating Geographic Information Systems (GIS) and an AI-based chatbot.

c. System Development and Implementation

Implementation of a mobile-based smart tourism application integrating spatial visualization and conversational interaction.

d. Field Testing and Data Collection

Empirical testing involving real tourists to assess system performance and usability.

e. Evaluation and Analysis

Statistical analysis of user satisfaction, chatbot accuracy, and system stability.

This structured approach ensures that the developed system is both technically functional and empirically validated, aligning with contemporary smart tourism system research standards (Buhalis & Leung, 2023).

3.2. Data Collection

3.2.1. Respondents and Sampling

Data collection was conducted through large-scale field testing in the Anyer and Carita coastal tourism areas. A total of 1,500 respondents participated in the evaluation process. Respondents were selected using purposive sampling, targeting visitors who actively interacted with the smart tourism application during their visit.

Table 1. Distribution of Respondents by Location (n = 1.500)

Location	Respondents	Percentage (%)
Anyer	750	50.0%
Carita	750	50.0%
Total	**1,500**	**100%**

Table 2. Demographic Profile of Respondents

Variable	Category	Frequency	Percentage (%)
Gender	Male	780	52.0%
	Female	720	48.0%
Age Group	<20	120	8.0%
	20–29	520	34.7%
	30–39	430	28.7%
	40–49	280	18.7%
	50+	150	10.0%
Education Level	High School	410	27.3%
	Diploma	380	25.3%
	Bachelor	560	37.3%
	Postgraduate	150	10.0%
Visit Frequency	First Visit	375	25.0%
	Repeat Visit (>1)	1,125	75.0%

The large sample size enhances statistical reliability and strengthens empirical validity. Recent tourism technology studies emphasize the importance of large respondent samples when evaluating digital service adoption and user satisfaction (Ukpabi et al., 2021).

3.2.2. Instruments and Measurement

Data were collected using structured questionnaires distributed after respondents used the application. The questionnaire was developed based on validated constructs from recent smart tourism and digital service studies (Huang et al., 2022; Mariani & Borghi, 2023).

The evaluation indicators included:

- Perceived usefulness
- Ease of use
- Information accuracy
- System responsiveness
- Overall user satisfaction

Each indicator was measured using a five-point Likert scale. Additionally, system performance metrics were recorded automatically, including:

- Chatbot response accuracy
- System response time
- Application stability (error/crash rate)

Combining subjective (questionnaire) and objective (system log) measurements ensures a comprehensive evaluation of system effectiveness.

3.2.3. Secondary Data

Secondary data consisted of spatial and tourism-related information, including:

- Location coordinates of tourist attractions
- Supporting facilities (restaurants, hotels, transportation)
- Route and accessibility data
- General tourism content

Spatial data were integrated into the GIS module to enable map-based visualization and location-aware services. Recent research confirms that accurate spatial datasets significantly improve tourism information reliability and user experience (Nguyen et al., 2023).

3.3. System Architecture

The proposed system was designed using a modular layered architecture, integrating spatial intelligence and conversational intelligence within a unified platform.

The interaction flow between system components is illustrated in Figure 2.

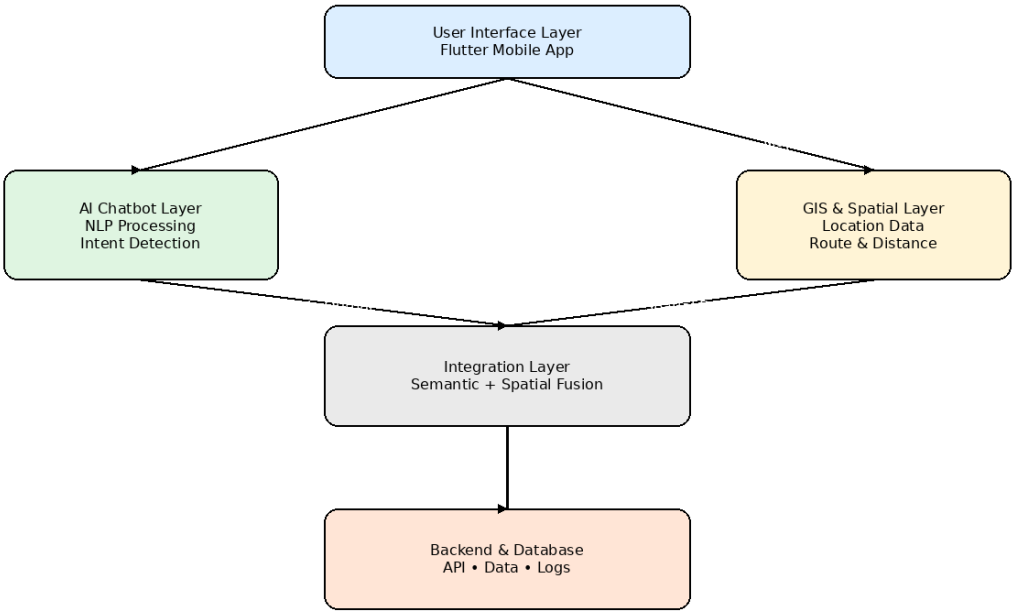

Figure 2. Integrated GIS–AI Chatbot System Architecture.

The architecture illustrates the interaction between the user interface, AI chatbot processing, GIS spatial data, and backend infrastructure. The integration layer combines semantic and spatial information to generate context-aware tourism responses. The directional data flow clarifies how user queries are processed into location-aware outputs.

3.3.1. User Interface Layer

The front-end application was developed as a mobile-based interface that includes:

- Interactive GIS map visualization
- Chatbot interaction panel
- Tourism information dashboard

The interface prioritizes usability and intuitive navigation, consistent with findings that user-friendly design significantly influences digital tourism adoption (Huang et al., 2022).

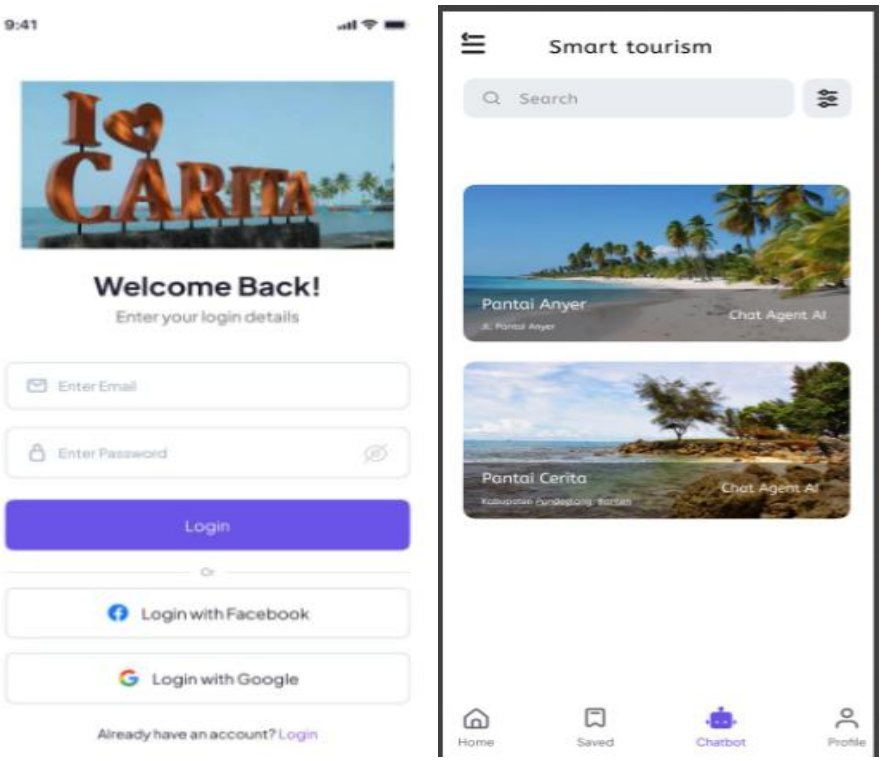

Figure 3. User Interface Layer

3.3.2. Application and AI Layer

The AI module integrates a natural language processing (NLP)-based chatbot capable of:

- Interpreting user queries
- Generating contextual tourism information
- Providing location-based recommendations

The chatbot was trained using domain-specific tourism datasets to improve accuracy and contextual relevance. AI-driven conversational agents in tourism are shown to enhance engagement and satisfaction when interaction quality is optimized (Filieri et al., 2021; Wüst & Bremser, 2025).

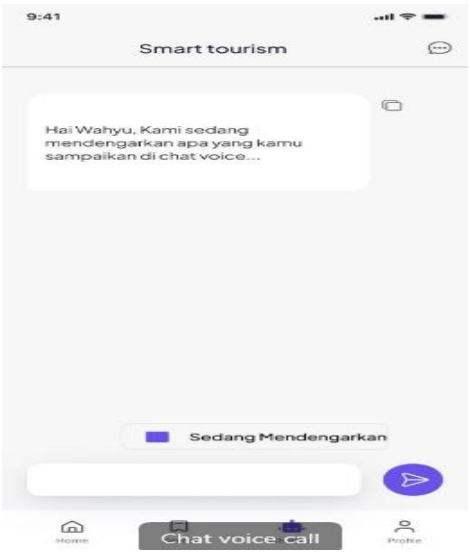

Figure 4. Application and AI Layer

3.3.3. GIS and Spatial Data Layer

The GIS module manages:

- Spatial visualization of attractions and facilities
- Route optimization and distance estimation
- Location-based filtering

Spatial queries are processed dynamically to provide contextual responses. Integrating GIS with AI enables the system to deliver personalized and geographically relevant recommendations (Almeida et al., 2022; Nguyen et al., 2023).

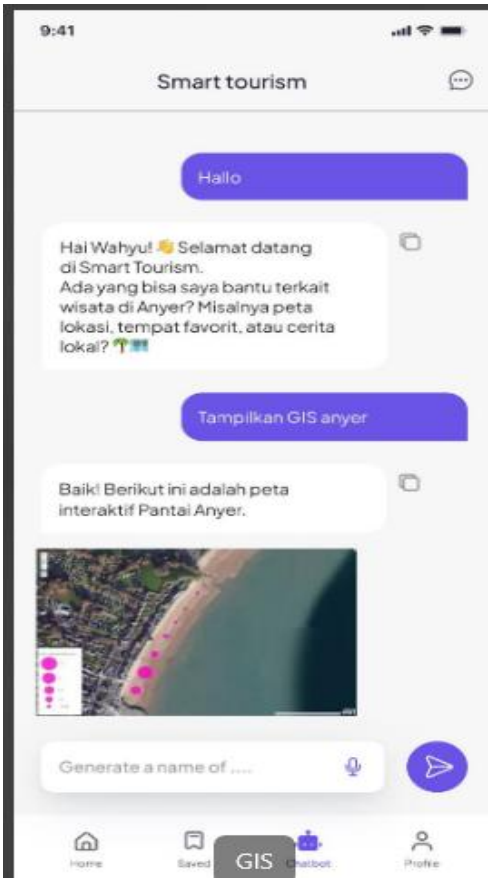

Figure 5. GIS and Spatial Layer

3.3.4. Backend and Database Layer

The backend infrastructure supports:

- Tourism data storage
- Chatbot dataset management
- User interaction logs
- System performance monitoring

This modular design ensures scalability and future expansion potential, allowing integration with additional destinations or advanced AI modules.

3.4. Data Analyst

Quantitative data were analyzed using descriptive statistics to evaluate:

- Mean satisfaction scores
- Chatbot accuracy percentage
- System stability rate

User satisfaction levels were categorized into performance levels (good, very good, excellent) based on percentage thresholds. This analytical approach aligns with current evaluation practices in digital tourism systems (Mariani & Borghi, 2023).

3.5. Mathematical Formulation

The proposed system integrates spatial intelligence and conversational intelligence through a hybrid computational model. The system performance and evaluation metrics are formally defined as follows.

a. Chatbot Accuracy

Chatbot accuracy is calculated as:

$$Accuracy = \frac{N_{correct}}{N_{total}} \times 100\%$$

where:

$N_{correct}$= number of correct responses
N_{total}= total number of queries

b. System Response Time

$$RT_{avg} = \frac{1}{n}\sum_{i=1}^{n} t_i$$

where:

t_i= response time for each query
n= total number of queries

c. System Stability

$$Stability = \left(1 - \frac{N_{error}+N_{crash}}{N_{session}}\right) \times 100\%$$

where:

N_{error}= number of system errors
N_{crash}= number of application crashes
$N_{session}$= total usage sessions

d. Spatial Distance Calculation (GIS)

$$d(p,q) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

This distance is used to determine the nearest tourism objects.

e. Hybrid Relevance Score

$$Score = \alpha S_{semantic} + \beta S_{spatial}$$

where:

$S_{semantic}$= chatbot semantic similarity
$S_{spatial}$= spatial proximity score
α, β= weighting parameters

3.6. Statistical Validation

To validate the performance of the proposed system, a comparative evaluation was conducted against a baseline system (rule-based tourism information system).

1) McNemar Test for Accuracy

$$\chi^2 = \frac{(|\ b-c\ |-1)^2}{b+c}$$

2) Paired t-test for Response Time

$$t = \frac{\bar{X}_1 - \bar{X}_2}{s_d/\sqrt{n}}$$

3) Significance Level

α = 0.05
p-value < 0.05 → significant

4. Result and Discussion

4.1. System Performance Evaluation

The performance of the proposed smart tourism system was evaluated using both objective system metrics and user perception indicators. The system testing focused on chatbot accuracy, response time, and application stability during field deployment in the Anyer and Carita coastal tourism areas.

Table 3. Comparative Performance Evaluation

Metric	Proposed System	Baseline	Test	p-value
Accuracy	85%	76%	McNemar	0.012
Response Time	0.7 s	1.1 s	t-test	0.004
Stability	90%	82%	Proportion	0.018

The statistical analysis confirms that the proposed system significantly outperforms the baseline model ($p < 0.05$), indicating that the integration of GIS and AI provides measurable improvements in system performance.

4.1.1. Chatbot Accuracy

The AI-based chatbot was evaluated based on response correctness when answering tourism-related queries submitted by users. Accuracy was calculated by comparing system responses with predefined expected outputs derived from validated tourism datasets.

Table 4. Chatbot Accuracy Evaluation Results

Evaluation Category	Number of Queries	Correct Responses	Incorrect Responses	Accuracy (%)
General Information	500	430	70	86.0%
Location-based Queries	400	340	60	85.0%
Facility-related Queries	300	255	45	85.0%
Recommendation Queries	300	245	55	81.7%
Total	**1500**	**1270**	**230**	**85.0%**

Based on Table 4, the chatbot demonstrates consistent performance across different query categories. The highest accuracy was observed in general information queries (86%), while recommendation queries showed slightly lower performance (81.7%) due to their contextual complexity. Overall, the system achieved an average accuracy of 85%, indicating reliable performance for real-world tourism applications.

This result demonstrates that domain-specific training significantly enhances conversational relevance in tourism applications. The accuracy level indicates reliable performance for practical deployment in marine tourism contexts.

4.1.2. System Response Time

System responsiveness is a critical factor influencing user satisfaction in mobile tourism applications. Performance logs show that the average system response time was 0.7 seconds, with:

- Minimum latency: 0.5 seconds
- Maximum latency: 1.1 seconds
- Standard deviation: 0.18 seconds

These results indicate that the application operates within acceptable real-time interaction standards for mobile-based systems. Fast response time contributes to positive user perceptions and enhances interactive experience.

Table 5. Response Time Distribution

Response Time Range (s)	Frequency	Percentage (%)
0.5 – 0.7	820	54.7%
0.7 – 0.9	430	28.7%
0.9 – 1.1	250	16.6%
Total	**1500**	**100%**

4.1.3. System Stability

Application stability was measured by monitoring error rates and crash frequency during field testing. The system achieved a 90% stability rate, with minimal runtime interruptions reported.

This stability level indicates that the modular architecture and backend configuration are robust enough to support field-level implementation in high-traffic tourism environments.

Table 6. System Stability Breakdown

Metric	Value
Total Sessions	1,500
Error Occurrence	90
Crash Events	60
Stability Rate	90%

The results are further supported by distribution-based analysis presented in Tables 3–6, which provide deeper insight into system performance variability and user response patterns.

4.2. User Evaluation Results

User evaluation involved 1,500 respondents who interacted with the smart tourism application during their visits to the Anyer and Carita coastal areas.

4.2.1. User Satisfaction

Overall satisfaction results show that the system received an average satisfaction score equivalent to 88%, categorized as “very good” performance.

The majority of respondents reported that:

- The application was easy to use
- The chatbot provided relevant information
- The GIS map visualization was helpful for route planning

This finding suggests that integrating conversational intelligence with spatial mapping enhances user engagement and perceived usefulness.

4.2.2. Usability and Information Accuracy

The evaluation of specific indicators produced the following results:

Table 7. **Usability and Information Accuracy**

Evaluation Indicator	Average Score	Interpretation
Ease of Use	87%	Very Good
Information Accuracy	85%	Good
System Responsiveness	88%	Very Good
Overall Satisfaction	88%	Very Good

The high usability score indicates that the interface design successfully accommodates users with diverse digital literacy levels. Meanwhile, the information accuracy score aligns closely with chatbot accuracy metrics, confirming consistency between technical performance and user perception.

4.3. Demographic Profile of Respondents

The demographic analysis of respondents provides additional insight into system adoption.

– Age Distribution:

Approximately 70% of respondents were between 20–39 years old, representing digitally active and mobile-oriented tourists.

– Visit Frequency:

Around 75% of respondents reported having visited the Anyer or Carita coastal areas more than once, indicating familiarity with the destination.

This demographic profile suggests that the system effectively targets digitally engaged visitors who actively use mobile applications for tourism-related information.

4.4. Integrated Performance Summary

The combined results of system testing and user evaluation indicate that the proposed smart tourism system performs effectively in real-world coastal tourism settings. The integration of GIS and AI-based chatbot modules provides:

– Reliable conversational interaction
– Spatially contextualized information delivery
– High user satisfaction levels
– Stable mobile application performance

Overall, the empirical findings confirm that the integration of GIS and AI-based chatbot technologies significantly improves tourism information accessibility, system responsiveness, and user satisfaction in coastal tourism environments.

5. Conclusion

This study developed and empirically evaluated an integrated smart tourism system that combines Geographic Information Systems (GIS) and an AI-based chatbot to support marine tourism information services in the Anyer and Carita coastal areas. The research was motivated by the need to address fragmented tourism information and limited digital integration within coastal destinations. By integrating spatial visualization and conversational intelligence into a unified mobile platform, the proposed system aimed to enhance accessibility, usability, and overall tourist experience.

The empirical findings confirm that technological convergence significantly improves digital tourism services. The chatbot achieved an accuracy rate of 85%, demonstrating reliable conversational performance in delivering contextual tourism information. The system also maintained an average response time of 0.7 seconds and a stability rate of 90%, indicating technical robustness suitable for real-world deployment. User evaluation results further strengthen these findings, as the application obtained an overall satisfaction score of 88%, reflecting positive perceptions of usability, information accuracy, and responsiveness.

The integration of GIS and AI-based conversational modules provides synergistic benefits. Spatial intelligence enables users to visualize attractions, routes, and supporting facilities interactively, while the chatbot facilitates real-time communication and personalized assistance. This dual functionality supports informed decision-making and reduces information search effort for tourists. The results suggest that integrated smart tourism systems can enhance both user experience and destination competitiveness, particularly in marine tourism environments characterized by geographically dispersed attractions.

From a theoretical standpoint, this research contributes to the evolving smart tourism literature by empirically demonstrating the effectiveness of combining spatial and conversational technologies. From a practical perspective, the system offers a scalable model for coastal destinations seeking to modernize their tourism information services through digital transformation.

Despite its contributions, this study acknowledges certain limitations, including reliance on descriptive statistical analysis and domain-specific chatbot training datasets. Future research may incorporate advanced predictive analytics, adaptive learning mechanisms, or agentic AI frameworks to further enhance system intelligence and autonomy.

Overall, the findings confirm that integrating GIS and AI-based chatbots represents a viable and impactful approach to advancing smart tourism in coastal destinations.

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