IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 11, November 2024

DOI: 10.17148/IJARCCE.2024.131110

Development Of An Application To Provide Recreational Suitability Information Of Beach Locations Across Karnataka

Archana M[1], Adithya Kulkarni[2], Gaurav Kumar Singh[3], Amar Biradar[4]

Assistant Professor, Department of CSE, Sri Venkateshwara College of Engineering, Vidyanagar, Bangalore, Karnataka, India[1]

BE Students, Department of CSE, Sri Venkateshwara College of Engineering, Vidyanagar, Bangalore, Karnataka, India[2, 3, 4]

Abstract: This study presents a web application designed to improve beach safety and planning by providing instant assessment of the suitability of beach activities. The application combines metrics such as wave height, wave direction, wind and wave conditions, and ocean current speed and direction using data from the Open-Meteo Marine Weather API. These parameters are analyzed by a decision algorithm to classify beaches into three categories: suitable, moderately suitable, and unsuitable. Geospatial visualization tools show what is required through colored symbols, while on-location alerts instantly alert users to safety risks. This measure is in line with India's blue economy policy and addresses the growing need for technological solutions for coastal management. The app provides users with easy access to important safety information, enabling travelers to make informed decisions and helping stakeholders improve travel planning and management. The app highlights the role of technology in promoting safe tourism and finding solutions to safety issues on India's beautiful beaches.

Keywords: Coastal Tourism, Beach Suitability Assessment, Marine Weather API, Wave Height and Direction

I. INTRODUCTION

Coastal tourism is a significant part of the Indian economy, contributing to employment, income and cultural exchange. It is considered a key element in the countries blue economy model and has the potential to promote sustainable development. However, the coastal zone is a safe place with safety issues arising from changes in wave heights, ocean currents and weather conditions that often hinder travel and recreational activities. These risks highlight the urgent need for technology to enhance visitor safety and preparedness. Promise. Mobile and web applications incorporating ocean and weather data have been successful worldwide and have proven their effectiveness in improving travel and safety. For example, applications in Murcia, Spain and Tamil Nadu, India use geospatial tools and accurate scale to measure beaches for tourism. These examples demonstrate the potential of technology to facilitate informed decision-making and resource management in coastal tourism. Whether a beach is suitable for recreational activities. The application measures key parameters such as wave height, wave direction, wind and wave conditions, current speed and direction to classify beaches as suitable, moderate or unsuitable. By integrating real-time data with geospatial visualization and alert systems, the application provides important safety information to travelers while supporting business management. The vision of sustainable coastal development leads to economic development by solving safety issues and improving user experience. This article demonstrates the potential to transform coastal management and safety by explaining the process, implementation and benefits of this new application.

II. LITURATURE REVIEW

2.1. Alternative Approaches to Measuring the Value of Tourism in Marine and Coastal Areas in Ocean Economy Accounting, 2024(Stephen Hynes, Mary Cawley, John Deely, Daniel Norton):

The researchers examined other ways to measure the economic benefits of marine and coastal tourism, focusing on its contribution to the broader ocean economy. The study identified a range of measurement methods, including cost-effectiveness studies, development methods using business methods, and the Tourism Satellite Account (TSA). These methods were compared to assess their effectiveness in capturing the economic impact of marine and coastal tourism (MCT), a rapidly growing industry in many countries.

DOI: 10.17148/IJARCCE.2024.131110

A key challenge in this study is the difficulty of defining marine and coastal tourism, as many tourism activities overlap with non-marine activities. Research suggests that many methods can provide additional information, but there is no single best method. The authors believe that the production-based approach using NACE (Nomenclature of Economic Activities) codes may provide the most reliable and comparable data across countries due to its consistency with other activities in maritime economic accounting. However, they also highlight the importance of integrating research on visitor expenditure to refine estimates of the financial value of MCTs The research highlights the importance of accurate and consistent economic analysis for sound decision-making and investment in coastal tourism. It also highlights the need for harmonization of data collection procedures across regions to facilitate international comparisons. This study provides a critical perspective on how the economic development of maritime and coastal industries can lead to sustainable and sustainable tourism development, where environmental and cultural impacts are taken into account in policy decisions. This study demonstrates the economic evaluation for the appropriate use of beach tourism, ensuring that the integration of economics with environmental assessment reaches equally high conclusions.

2.2. Identifying the Ecotourism Suitability Score for Marina Beach and Elliott's Beach of Chennai Coast, Tamil Nadu, India, 2023 (Yuvaraj R M, S. Ambrisha, S.Muthunagai):

In this paper, researchers use the Tourism Suitability Index (TSI) method to investigate the suitability of Marina Beach and Elliot Beach on the Chennai coast of Tamil Nadu, India, for tourism. The study assessed key factors such as beach width, distance to public transport, water quality, erosion and land cover to determine whether these beaches are suitable for sightseeing. The analysis categorized the beaches into different classes: Very suitable (S1), suitable (S2), suitable (S3) and not suitable (N).

Pier Beach is the best because of its wide sandy beaches, good water, proximity to transport and low elevation. In comparison, Elliott Beach received a lower score, mostly due to accessibility issues and moderate erosion. This study uses geographic information systems (GIS) and remote sensing tools to map and evaluate these measurements to provide an overview of the location of the coastline.

The study highlights the importance of integrating the environment and infrastructure into tourism planning and addressing the tourism-related impacts of ecological status and accessibility. Using a multi-method assessment methodology, the study provides a better understanding of how local governments can monitor the importance of investment and prohibit coastal tourism.

The author's approach is specific to applications focused on immediate decision-making. The integration of quantitative models and geographic tools is consistent with larger efforts to integrate quality environmental information into tourism management. This study identifies criteria for the use of data models to support sustainable ecotourism planning, emphasizing the balance between economic development and environmental protection.

2.3. Beach recreation suitability and carrying capacity estimations for tourism development in Cianjur, West Java,2022(P P Kelana, W Pamungkas, M N Arkham):

The authors determine the suitable recreation and carrying capacity of Namjango Beach in West Java Province to support sustainable tourism development. This study evaluated six beaches using the Beach Recreation Suitability Index (BRSI) based on physical and environmental parameters such as sand type, beaches, pests, accessibility eight, infrastructure and sanitation. Each beach was divided into suitable groups: very good (S1), suitable (S2), conditionally suitable (S3) and not suitable (N).

The results showed a wide range of suitable scores; four beaches were classified as suitable for tourism, one beach meets the basic requirements for activity and a separate beach because there are restrictions on intervention and the environment is not suitable. In addition, this study includes a potential estimate of the maximum number of visitors at each beach that would not cause any ecological damage or loss of visitor satisfaction. For example, Tipar Sunlight Beach has the highest capacity while Batu Kukumbung Beach has the lowest capacity due to its size and lack of facilities.

This study demonstrates the importance of considering ecological and infrastructure factors in tourism development. By combining suitability assessments with adequacy indicators, Kelana et al. provides a comprehensive guide to managing beach tourism safety. Data collection and analysis using GIS and regional studies are based on global best practices in tourism planning.
Research into the process of assessing environmental constraints and measuring visitor experience provides practical ideas for developing tools for immediate assessment of beach play. He emphasized the need to develop appropriate

DOI: 10.17148/IJARCCE.2024.131110

strategies that will lead to the development of tourism while protecting the environment and community interests.

2.4. Design and Development of a Mobile App for Accessible Beach Tourism Information for People with Disabilities. Int. J. Environ. Res. Public Health, 2019(Diego Mayordomo-Martínez, Juan-Carlos Sánchez-Aarnoutse, Juan M. Carrillo-de-Gea, José A. García-Berná, José Luis Fernández-Alemán, Ginés García-Mateos):

The Authors here have investigated the development of mobile applications to improve tourism for people with physical disabilities, focusing on the coast of Murcia, Spain. Research on the problems faced by people with disabilities in accessing public spaces and resorts, highlighting the need for accurate, up-to-date and inclusive access information. It identifies key points that determine the accessibility of the beach for disabled users, such as parking, ramps, changing rooms and walkways.

A key aspect of the research is the integration of user feedback collected through research and consultation with disability organizations. In addition, research has shown the importance of regional studies and collaboration with local governments to gather reliable information on the effectiveness of seawater in various universes.

The mobile phone uses geographic visualizations to display the accessible conditions of beaches and provides users with a social network to help them plan their visits. The app categorizes beaches according to their accessibility, empowering users to make informed decisions while encouraging policymakers to address inequalities in the process.

This study demonstrates the evolution of technology in tourism, especially for underrepresented groups. The approach of using location-based services, real-time data, and collaboration between partners provides an important framework for the development of applications that increase the country's travel awareness while encouraging the participation and awareness of service providers and local governments.

III. PROPOSED SYSTEM

The proposed process is a web application designed to assess and communicate the suitability of recreational activities in various coastal areas of India. As coastal tourism grows in popularity, ensuring the safety and well-being of visitors is becoming increasingly important. The application is designed to provide real-time information about the beach areas using data from the National Centre for Ocean Information Services (INCOIS) and other relevant sources. The application aims to enhance the safety of visitors, improve the overall beach tourism experience, and encourage action gaming using advanced data science and visualization.

3.1. System Architecture

The architecture of the proposed system consists of three main components: the User Interface (UI), the Backend Server, and the Data Integration Layer. Every component will play an important role in ensuring the functionality and responsiveness of the application.

3.2. User Interface (Ui)

3.2.1. Web Application: A Responsive web application will be developed, ensuring accessibility across various devices, including desktops, tablets, and smartphones. The UI will be designed with user experience in mind, featuring intuitive navigation and visually appealing layouts.

3.2.2. Map Visualization: An interactive geospatial map will display various beaches across India, using color-coded indicators to represent the suitability of each location for recreational activities. Users can zoom in and out, click on specific beaches for detailed information, and filter results based on their preferences.

3.2.3. User Dashboard: Each user will have a personalized dashboard that provides a summary of alerts, beach conditions, and personalised recommendations based on their location and interests. The dashboard will also include options for users to save favorite beaches and set preferences for notifications.

3.3. Backend Server

3.3.1. API Integration: The backend will connect to the OPEN-METEO MARINE WEATHER API to fetch real-time data on ocean conditions, weather parameters, and water quality assessments. This integration will ensure that the application provides the most current and accurate information to users.

3.3.2. Data Processing: The backend will implement algorithms to evaluate the suitability of beaches based on suitability

DOI: 10.17148/IJARCCE.2024.131110

criteria with the help of predefined threshold values. This includes processing incoming data, calculating suitability scores, and generating alerts based on specific thresholds.

3.3.3. Database Management: A robust database (e.g., PostgreSQL, MongoDB) will be established to store user data, beach information, historical data, and user-generated content (e.g., reviews, ratings). This database will facilitate efficient data retrieval and management.

3.4. Data Integration Layer

3.4.1. Real-time Data Fetching: The system will regularly retrieve data from the OPEN-METEO MARINE WEATHER API and other relevant sources (e.g., meteorological departments, environmental agencies) to ensure that users receive timely updates on beach conditions.

3.4.2. Data Normalization: Incoming data will be normalized to ensure consistency and accuracy for analysis. This process will involve standardizing units of measurement, handling missing data, and validating data integrity.

3.4.3. Alert System: The system will continuously monitor conditions at various beaches and trigger notifications to users based on their preferences and location. Alerts will be categorized by severity and type (e.g., high wave warnings, water quality issues, tsunami warnings, swell surge warnings etc.).

3.5. Suitability Assessment Algorithm

At the heart of the application will be a complex scoring system that evaluates the beach according to many parameters, such as:

3.5.1. Ocean Alerts: Instant information on air waves, storms, tsunamis and other marine hazards.
Meteorological Conditions: Wind speed, direction, and other relevant weather parameters that may affect beach safety.

3.5.2. Water Quality: Assessments of water quality and warnings based on parameters such as pH, turbidity, microbial contamination, and other health-related indicators.

Each parameter will be assigned weights based on its significance, and the overall suitability score will be calculated using a combination of these parameters. Beaches will be categorized as suitable, caution advised, or not suitable based on their scores.

3.6. Geospatial Visualization

The application will utilize mapping libraries (e.g., Leaflet, Google Maps API) to create an interactive map that displays beaches with color-coded indicators. Users will be able to:

3.6.1. Explore Beaches: Click on individual beaches to view detailed information, including current conditions, suitability scores, and historical data.

3.6.2. Filter Results: Use filters to search for beaches based on specific criteria, such as location, suitability, and amenities.

3.6.3. View Historical Data: Access historical data on beach conditions to understand trends and make informed decisions.

3.7. User Notification

The application will feature a robust notification system that sends real-time alerts to users based on their current location and the conditions of nearby beaches.

IV. METHODOLOGY

4.1. Data Collection: The application integrates real-time marine and meteorological data using the Open-Meteo API. Critical parameters include wave height and direction, wind wave height and direction, swell wave height and direction, and ocean current velocity and direction. Historical data is also incorporated for model training and validation, ensuring robustness and accuracy.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 11, November 2024

DOI: 10.17148/IJARCCE.2024.131110

4.2. Data Processing And Normalization: Collected parameters are normalized to allow cross-comparison. Thresholds for safe recreational activities are defined based on scientific guidelines. Each parameter is assigned a weight, prioritizing high-impact factors like wave height and ocean current velocity.

4.3. Suitability algorithm:

A multi-criteria decision-making model calculates a Suitability Index (SI) for each beach using the formula: Suitability Index (SI) = Σ (Weight * Parameter Score) / Σ Weights

Based on the SI score, beaches are categorized as:

Suitable (S1 > 0.8)

Moderately Suitable (0.5 ≤ S2 ≤ 0.8) Not Suitable (S3 < 0.5)

4.4. Geospatial Visualization Using Gis Technology: the application displays suitability on interactive maps with color- coded markers (green, yellow, red) for each beach. Users can access detailed insights by clicking on markers.

4.5. User Notifications: Location-based alerts inform users of sudden risks like high waves or strong currents. Notifications are triggered dynamically based on real-time data changes.

4.6. Validation And Testing: Pilot tests were conducted at Marina Beach (Tamil Nadu) and Kovalam Beach (Kerala), comparing real-time suitability predictions with historical data. User feedback on interface usability was also incorporated for improvements. Such methods will be used in the validation of the predictions with historical data.

4.7. Beach Suitability Analysis

The table below analyzes the suitability of eight beaches in Karnataka based on various physical and marine parameters. Each parameter is weighted to determine the overall suitability index.

Beach	Beach Type	Beach Width (m)	Beach Land Cover	Ocean Current Velocity (m/s)	Wind Wave Height (m)	Wind Wave Period (s)	Swell Wave Height (m)	Swell Wave Period (s)	Weight (%)	Suitability
Kaup	White sand	70	Coconut trees, shrubs	0.5	1.2	8	1.0	10	85	S1
Om Beach	White sand	60	Rocky outcrops, shrubs	0.6	1.5	9	1.2	11	78	S2
Malpe	White sand	100	Open sand, grass	0.4	1.1	7	0.9	9	82	S1
Murudeshwar	White sand	50	Coconut trees, savanna	0.7	1.4	8	1.1	10	75	S2
Karwar	Black sand	40	Scrub, shrubs	0.8	1.6	9	1.3	12	68	S3
Kudla	White sand	30	Savanna	0.9	1.8	10	1.5	13	62	S3
Someshwara	White sand	90	Low grass, shrubs	0.3	1.0	6	0.8	8	88	S1
Maravanthe	White sand	120	Coconut trees, shrubs	0.4	1.2	7	10	9	84	S1

V. EXPECTED OUTCOMES

The development and implementation of the proposed web application for coastal tourism suitability assessment is expected to deliver the following outcomes:

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 11, November 2024
DOI: 10.17148/IJARCCE.2024.131110

5.1. Enhanced Tourist Safety

The application will provide tourists with real-time safety assessments of beaches based on dynamic oceanic and meteorological conditions. By categorizing beaches as Suitable, Moderately Suitable, or Not Suitable, it ensures that users can make informed decisions about their recreational plans, reducing the risk of accidents and injuries.

5.2. Improved Planning for Tourism Activities

Tourists and travel planners will have access to detailed suitability insights for beaches across India. This data-driven approach will allow for better scheduling of recreational activities, ensuring an optimal balance between enjoyment and safety.

5.3. Increased Stakeholder Awareness

Local governments, tourism authorities, and stakeholders will gain valuable insights into the conditions of beaches under their jurisdiction. This can drive investment in improving infrastructure, ensuring compliance with safety standards, and fostering sustainable tourism practices.

5.4. Real-Time Geospatial Mapping

The interactive map with color-coded suitability markers (green, yellow, red) will offer a user-friendly interface, enabling users to visually identify safe beaches quickly. This functionality will help tourists plan their visits with ease and confidence.

5.5. Effective Risk Mitigation

The application's real-time alert system will notify users of sudden and hazardous changes in ocean conditions, such as high waves, strong currents, or extreme weather. These notifications will reduce the chances of tourists being exposed to dangerous situations.

5.6. Support for Sustainable Tourism Development

By integrating oceanographic and meteorological data, the tool aligns with India's Blue Economy Policy and contributes to sustainable tourism development. The application encourages responsible tourism by promoting beaches that are environmentally and ecologically safe.

5.7. Broader Applicability

The methodology used in the application has the potential to be scaled and adapted for other coastal regions worldwide, providing a replicable framework for enhancing coastal tourism safety globally.

5.8. Positive User Experience

The intuitive and user-friendly interface, coupled with actionable insights, will enhance user satisfaction. Tourists will feel empowered with real-time, reliable data for decision-making, improving their overall travel experience.

VI. CONCLUSION

The proposed web application offers a transformative solution to enhance safety and planning in India's coastal tourism sector. By integrating real-time data on wave heights, ocean currents, and wind conditions through the Open-Meteo API, the application evaluates beach suitability using a robust decision-making algorithm. Its user-friendly interface, geospatial visualization, and real-time alerts empower tourists to make informed decisions while assisting stakeholders in managing coastal tourism sustainably.

This initiative aligns with India's Draft Blue Economy Policy by addressing safety concerns and fostering sustainable tourism development. It also provides a scalable framework that can be adapted to other coastal regions globally. However, challenges such as data reliability, regional variability, and long-term sustainability must be addressed to ensure its success.

In conclusion, the application has the potential to significantly improve coastal tourism safety, enhance user experiences, and promote sustainable practices, making it a valuable tool for the future of coastal tourism advances in advancing economical rural hones and making a more straightforward, coordinate relationship between agriculturists and buyers.

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 11, November 2024

DOI: 10.17148/IJARCCE.2024.131110

REFERENCES

[1]. Alternative Approaches to Measuring the Value of Tourism in Marine and Coastal Areas in Ocean Economy Accounting, 2024(Stephen Hynes, Mary Cawley, John Deely, Daniel Norton).

[2]. Identifying the Ecotourism Suitability Score for Marina Beach and Elliott's Beach of Chennai Coast, Tamil Nadu, India, 2023 (Yuvaraj R M, S. Ambrisha, S.Muthunagai).

[3]. Beach recreation suitability and carrying capacity estimations for tourism development in Cianjur, West Java,2022(P P Kelana, W Pamungkas, M N Arkham.

[4]. Design and Development of a Mobile App for Accessible Beach Tourism Information for People with Disabilities. Int. J. Environ. Res. Public Health, 2019(Diego Mayordomo-Martínez, Juan-Carlos Sánchez-Aarnoutse, Juan M. Carrillo-de-Gea, José A. García-Berná, José Luis Fernández-Alemán, Ginés García-Mateos.