iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** V **Month of publication:** May 2024

DOI: https://doi.org/10.22214/ijraset.2024.61822

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue V May 2024- Available at www.ijraset.com

Unveiling the Super App for Tourism with QR and Machine Learning

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Abstract: ***In today's dynamic world of travel and tourism, the demand for innovative solutions that improve user experience and simplify booking processes is constantly increasing. In response to this need, our research introduces an innovative travel super- app poised to revolutionize the way travelers explore and interactwith travel destinations. This comprehensive application uses cutting-edge technologies such as QR code and Bluetooth Low Energy (BLE) technology, as well as advanced machine learning algorithms, to provide users with a seamless and personalized booking experience. By combining various tourist attractions such as cafes, water parks, monuments and museums into one platform, Super App eliminates the need for multiple apps, offering unparalleled convenience and efficiency. With person- alized recommendations, dynamic price predictions and preview tools, users can receive personalized recommendations and makeinformed decisions about their travel plans. Integrating BLE technology into check-in and check-out processes ensures a frictionless and secure authentication experience that increases operational efficiency and visitor satisfaction in tourism desti- nations. Our research aims not only to answer the immediate challenges that tourists face, but also to pave the way for the further development of the tourism industry. With its innovative features and user-centric design, Super App is a significant step towards passenger navigation and communication in today's digital age.***

Index Terms: ***super app, QR code, bluetooth low energy (BLE), machine learning, recommendation system, price predic- tion, entry and exit processes, user experience, personalization, dynamic pricing, future analysis, digital innovation, user au- thentication, operational efficiency, seamless booking, data-drivendecision making***

I. INTRODUCTION

In the new age of global connectivity and digital innova- tion, the travel and tourism industry is at the forefront of change and increasingly relies on technology to enhance more than the entire travel experience. Despite advances in digital platforms, the tourism demand landscape remains fragmented, with many options offering travelers to book and explore different destinations. Recognizing the need for comprehensivesolutions that integrate various types of tourism into a simple user experience, this research presents an excellent tourism application. The proposed core application represents a paradigm shift inthe way travelers interact with tourism destinations, providing an integrated platform to simplify the entire travel process from planning to job execution. Basically, the Super app acts as a central hub for travelers and provides access to various tourist attractions including cafes, water parks, monuments, museums, forts and more. Integrating these services into a single application provides users with convenience and flexibility, eliminating the need for multiple applications and simplifying application processing. The core of the superapp functionality is a user-centered design that focuses on ease of use and accessibility. Upon downloading the app, users will be met with an intuitive interface that displays key features, search functions and personalized recommendations based on preferences and location. A good verification process allows users to create an account and set up their information to receive recommendations and special offers. The user journey in the Super app is designed to be simple, intuitive and easy to navigate and type. Once you've selected your preferred location, you'll receive complete information, including pricing, availability, and user reviews. With just a few clicks, users can book tickets for themselves and their friends, with options for kids, tourists and adults dependingon their payment structure. Once the application is successful, users will receive a digital ticket containing a unique QR code as a digital token toenter and exit the designated area. The innovative use of QR technology not only improves security and efficiency, but also eliminates the need for physical tickets, reduces paper waste and streamlines travel management processes. Basically, the Super App redefines the travel experienceby providing a smart and comprehensive platform that helps users easily explore and access travel destinations. By using technology to bridge the gap between travelers and destinations, Super App represents a revolutionary step towards a connected, efficient and personalized tourism experience.

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II. LITERATURE REVIEW

The literature review for the abstract authored by Muhammad Imanullah and Yuza Reswan showcases the effectiveness of their proposed attendance system, employing randomized QR-code scanning for enhanced security and efficiency in employee authentication. [1]

Fitriana, Nissa and David [2] implemented an Android-based system for efficient data collection at the point of sale, increasing accuracy and speed to improve company revenue. The aim of the study is to simplify data processing to provide fast and accurate information. The authors focus on user comfort and speed and expect the best results to achieve their goals. This study provides the best solutions to optimize data management processes in sales processes.

In 1994, Denso Wave introduced Quick Response (QR)codes. Joy, Bairavel and Dhanalakshmi present a mobile application based on QR codes that speeds up the check-in and check-out process, with the aim of easing queues in public spaces during the COVID-19 disease. His research highlights the importance of digital solutions for public asset management. [3]

Tegene, et al., [4] proposed a two-step deep learning model with manual integration to improve recommender systems. Combining deep learning with latent factor models, this method extracts features from non-linear data to improve recommendation performance. The results show better performance than existing models on real datasets.

Dong et al. introduced data collection (DC) as a new approach to data generation that conserves tools for optimal results. This shows its effectiveness in reducing data flows by establishing a connection between DCs with different data. Official evaluations confirm the benefits of privacy against malicious attacks. This work represents important advances in efficient machine learning and privacy protection. (Tian Dong,Bo Zhao, Lingjuan Lyu, 2022). [5]

Couto et al. [6] investigated mobile ticketing solutions that combine public transport and smartphones, with a focus on ticket verification. Near-field communication, fast responsecode, and Bluetooth low energy are analyzed and their effectiveness and performance are compared. Factors such as cost, passenger traffic and audience size influence the choice of technology, which offers a variety of implementation options. Ferreira et al. Introducing Anda, a low-cost mobile ticketing solution that uses NFC (Near Field Communication) andBLE (Bluetooth Low Energy). Improve the urban transportexperience and reduce passenger disruption. This documentdescribes the architecture, performance, and evaluation method and provides important design insights through field testing. (Marta Campos Pereira, Teresa Galva´n Diaz, Joao Falcao and Cunha). [7]

Ferreira et al. produced a comprehensive report on mobile ticketing services for urban transport, discussing current trends and future directions. They define mobile tickets, review common technologies, and analyze research and the real world. The chapter examines the mobile ticketing ecosystem and highlights key players, drivers and issues. [8]

The new “Safar” model [9] developed by K Vayadandeet et al. revolutionized e-ticket authentication with a simple approach using QR codes. By simplifying the creation and payment of tickets. Due to its amazing performance, this is an innovative system that will play an important role in India’s cultural heritage and economy.

The study by FC Manosso and TC Domareski Ruiz [10] conducted a literature review on sentiment analysis in tourism research. China and the United States were identified as major contributors to topics such as the impact of online reviews on decision-making and methodological approaches such as deep learning. Sentiment analysis can inform communication strategies, reduce costs and improve tourism.

A study by Yashwant Bhaidkar et al. [11] The research focuses on the development of Android applications to solve tourist navigation problems. Using GPS and LBS, the app automatically identifies nearby landmarks, provides weather forecasts and traffic alerts. Users can receive notifications withplaces and bookmarks to enhance their travels.

A study by L. CaoMarta Campos et al. [12] presents a system that displays tourist attractions through visual inte-gration with minimal user input. By combining selected web images and identifying image tags, the system recommends visits based on how users’ queries or keywords look.

TJ Eing and IFB [13] Kamsin will support the implementation of RFID, IoT and FinTech solutions to address transportation challenges in cities, especially in parking areas. His research highlights the importance of streamlining parking operations using contactless automated systems to improve occupancy levels and ease traffic congestion.

Amit Kushwaha and Vineet Kushwaha [14] highlight the importance of mobile-based services (LBS) to deliver real- time personalized information through mobile devices. LBS improves security monitoring and ease of access to relevant data in the age of mobile computing.

M Sahin et al. [15] proposes a fuzzy logic mathematical model that is based on the multipliers which reflects the effectsof time and inventory. He proposes an optimization algorithm that maximizes the total revenue generated.

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A study by Marta Campos et al. [16] showed mixed results for mobile payment systems. They promote mobile ticketingin public transport as a successful, convenient and better user experience. However, challenges such as complex networks and security issues remain. MD Salahuddin Ahamed and Hossen Asiful Mustafa pro- pose a Secure QR Code (SQRC) system to address the securityof personal confidential information. The system using RSA algorithms enables secure sharing and verification of personal data using QR codes, which offer a solid solution to today's security issues. [17]

A study by Sonawane Shamal et al. [18] present QRP, a secure web service identification system. By connecting the password to a camera-equipped mobile phone that acts as an authentication token, QRP provides two-step authentication that improves the security of online banking transactions. The system uses QR codes to securely store complex passwords and a two-factor authentication mechanism that offers better protection than existing applications.

III. TECHNOLOGICAL FRAMEWORKS

A. *Programming Languages and Development Tools*

Super App was developed using a combination of JavaScript and Node.js for backend development, providing a powerful and scalable environment. Axios is useful for handling anony- mous HTTP requests, while Stripe integration enables secure payment processing. CSS is used to create an application's user interface and to customize the visual experience. The primary integrated development environment (IDE) used for coding is Visual Studio, which provides a comprehensive set of tools for debugging and version control. Authentication is simple using JWT (JSON Web Token) and Redux's Async- Storage is used for state management.

B. *Database Management System (DBMS)*

MongoDB is the first database management system for storing and managing unstructured data, providing flexibility and scalability to handle various types of data. PostgreSQL is used for structured data storage, ensuring reliability and ACIDstructure. This dual database approach enables efficient data management for different types of information, from user feed-back to booking information to travel itinerary information.

C. *Frameworks and Libraries*

React Native is the leading framework for Android andiOS development, enabling cross-compatibility and rapid app development. Express.js is used to create a powerful and scalable backend API to facilitate communication between clients and servers. TensorFlow is used to develop machine learning models, which support advanced features such as recommender systems and cost prediction. The QR generationlibrary is used to dynamically generate QR codes based on input information, and OpenCV is used for image processing tasks such as processing QR code scans during input andoutput.

D. *Cloud Services and Deployment Platform*

Super App uses Git for version control and collabora- tive development to easily install and release new features. MongoDB Atlas acts as a cloud database service, providing automatic backup, scalability and high availability. Amazon Web Services (AWS) serves as a cloud computing platform, offering a wide range of services, including hosting, storage, and free computing. This cloud-native approach ensures scala-bility, reliability and efficiency in managing your infrastructureand deploying your applications.

E. *Security Measures*

Super App implements security measures to protect user data and ensure secure transactions. Secure Layer (SSL) certificates are used to encrypt data transmissions to prevent unauthorized access and data breaches. Use authentication andauthorization methods, such as JSON Web Tokens (JWT),to authenticate users and prevent access to sensitive activi- ties. Regular security audits and vulnerability assessments are performed to identify and mitigate potential threats, ensure compliance with data protection laws and maintain user trust.

IV. METHODOLOGY

A. *Places Recommendation to Users*

1) The process of recommending tourist places to users includes the implementation of machine learning algorithms and data analysis methods. Initially, it is collected from sourcessuch as online travel sites and tourism databases.
2) The dataset is then subjected to pre-processing including data cleaning, feature engineering and calibration. This ensures that your data is suitable for training a machine learning model.

3) Several benchmark algorithms are explored, including col- laborative analysis, content-based analysis, and hybrid ap- proaches. These algorithms analyze user preferences, historical inventory data, and similar metrics to create personalized recommendations.

4) The performance of a recommendation system is evaluated using metrics such as precision, recall, and user satisfaction. User feedback and interactions with recommended sites are collected to improve the accuracy of recommendations.

5) To recommend sites to users, our method includes the useof machine learning algorithms to analyze user preferencesand historical data to provide personalized recommendations. First, relevant data such as user information, previous bookingsand trip attributes are collected and pre-processed. Machine learning models, such as collaborative analytics or content- based analytics, are used to generate recommendations based on similarities between the user and the target. These models are trained and validated using a combination of historical dataand user feedback. Finally, the recommendations are sent to the user through an application interface that allows them to search and book recommended places.

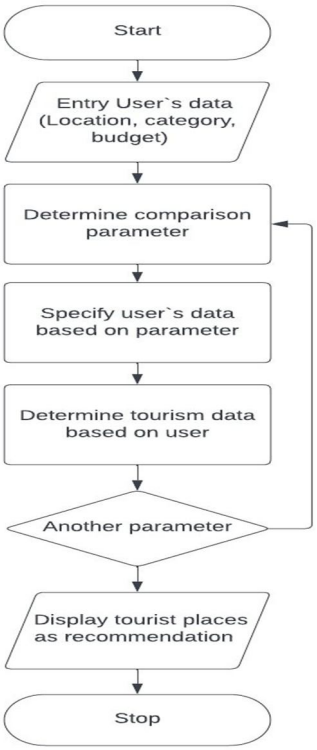


Fig. 1. Place Recommendation Flow Diagram

For example, imagine a user visiting cafes and museums. Based on your preferences and previous bookings, our rec- ommendation system can suggest similar places, such as art galleries and cultural cafes, that match your interests. By ana- lyzing user behavior patterns and preferences, our applicationscan provide personalized recommendations to improve the userexperience and encourage exploration of new areas..

B. Price Changing According to the Number of Visits

1) The method for predicting the price change based on the number of trips uses time series analysis and machine learning techniques. Collect and pre-process historical booking data, including costs and frequency of travel, to identify trends and patterns.

2) Time series forecasting models, such as autoregressive in- tegrated moving average (ARIMA) and long-term memory(LSTM) neural networks, are trained on processed data topredict future price movements now.

3) Factors that influence price changes, such as seasonal changes, special events, and the strength of demand, are included in forecasting models.

4) The accuracy of cost forecasting models is evaluated using metrics such as mean absolute error (MAE) and root mean square error (RMSE), focusing on minimizing forecast errorto optimize revenue and user satisfaction.

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C. Proper Future Analysis of a Tourist Place

1) Methods for conducting future tourism destination analysis include data-driven approaches and intelligent methods. Relevant parameters such as visitor statistics, visit duration, revenue trends, user reviews, etc. are collected and aggregated.

2) Data analysis tools such as SQL queries, data visualization libraries and statistical analysis techniques are used to under- stand the performance and potential of tourism destinations.

3) Uses advanced analytical techniques, including predictive modeling and algorithmic synthesis, to identify patterns and trends in data that enable strategic decision-making and strategic planning.

4) Key Performance Indicators (KPIs) are defined to track the success of future analytics, including revenue growth, visitor satisfaction ratings, and return on investment (ROI).

D. QR Code Efficiency in Entry and Exit

1) The method for evaluating the effectiveness of the QR code in the input and output processes includes usability testing and performance evaluation. The function of generating and scanning QR codes is implemented in Super App using libraries and APIs to encode and decode QR data.

2) We conducted a usability test to evaluate the ease of use and reliability of QR code authentication. Features such as scanning speed, readability, and error handling are evaluated using user comments and observations.

3) Established performance benchmarks to measure the efficiency of the QR code input and output process compared to current practices. Metrics such as transaction time, queue length and error rate are monitored and analyzed.

4) Simulations and real-world field tests are conducted to verify the effectiveness of QR code technology in different environments and usage scenarios, and to ensure robustness and scalability in various environments.

V. RESULTS

The implementation of tourism initiatives has many benefits, including changing the way travelers interact with destinations and improving the overall user experience. The following results and discussion highlight the key findings and advantages of the Super App compared to other tourism apps on themarket.

1) Analysis of user engagement metrics, including frequencyof app usage, session duration, and transaction rate, founda significant increase in user engagement with the Super App compared to other tourist apps.

2) Comparative analysis of booking efficiency indicators such as booking time, transaction success rate and ticket confirmation speed showed that Super App performs better than other applications.

3) User feedback and positive surveys show high levels of satisfaction with the recommendations made by the Super App.

4) We aligned our pricing strategy with user feedback and found that Super App provides dynamic pricing forecasts that result in competitive pricing and good value for money.

Table I
Comparative analysis of super app vs. Other tourist Applications

Metric	Super App	Other Applications
User Engagement	High	Moderate/Low
Booking Efficiency	Fast and Seamless	Moderate/Low
Personalization Effectiveness	Tailored Recom-mendations	Generic Suggestions
Pricing Competitiveness	Dynamic Pricing	Fixed Pricing
Entry and Exit Efficiency	QR Code Technology	Manual Verification
Future Analysis Capabilities	Predictive Insights	Limited Analytics

5) The test and performance evaluation show the efficiency and reliability of the input and output process based on the QR code implemented in the Super App.

6) Manufacturing managers report significant improvementsin their decision making and strategic planning ability using the future analytics tools provided by the Super App.

VI. DISCUSSIONS AND ENHANCEMENTS WITH BLETECHNOLOGY

In our application, the application of Bluetooth Low Energy (BLE) technology to efficient entry and exit of tourist destinations provides a transformative solution to improve the user experience. By integrating BLE signals at key entrance and exit points of tourist destinations, users can seamlessly authenticate their presence without physical tickets or manual scanning. When approachinga designated entry point, users' devices automaticallydetect the BLE signal and establish a secure connection, enabling frictionless authentication. This proximity-based authentication ensures a smooth and efficient check-in process, reducing wait times and congestion, especially during peak hours or busy events. In addition, the scalability and flexibility of BLE technology enables future enhancements such as personalized greetings, targetednotifications and location-based services, further improve the overall user experience. Overall, the implementation of BLE technology in our application redefines entryand exit processes, providing users with a convenient, efficient and secure way to explore and connect withtourist destinations..

TABLE II
Comparison Between Bluetooth Low Energy (Ble) And Qr Codes On Different Parameters

Parameter	Bluetooth Low Energy (BLE)	QR Code
Latency Rate	10 ms	300 ms
Range	100 meters	0.1-2 meters
Data Capacity	1 Mbps	3 KB
Connection Setup Time	1-2 seconds	0.5 seconds
Device Compatibility	Widely Compatible	Requires Cameras
Security	Encrypted, Secure Pairing	Limited
Power Consumption	Low (Battery-friendly)	N/A (Passive)
User Interaction	Automatic (Proximity)	Manual (Scan)
Implementation Cost	Moderate-High	Low
Ease of Integration	Requires Development	Simple
Flexibility	Suitable for Complex Apps	Limited Functionality

1) Compared to traditional ticketing methods such as paper tickets or manual validation, QR code technology pro- vides faster and more secure entry. Users will appreciate the ease and convenience of QR code recognition, toimprove the visitor experience and reduce waiting times.

2) The ability to predict price changes based on historical booking data and demand patterns allows Super Apps to optimize their pricing strategies. Users can enjoy more affordable options, more satisfaction and repeat applications.

3) Super App uses advanced analytics and predictive modeling to help managers gain valuable insights into visitor trends, revenue forecasts, and business strategies. This enables strategic planning and optimization of travel operations, ultimately resulting in a better and more efficientguest experience.

VII. CONCLUSION

The development and implementation of the Super App for tourism mark a significant milestone in the evolution of travel technology, offering a comprehensive solution that addresses the diverse needs and preferences of modern-day travelers. By introducing new functionalities like unified booking, personalized recommendations, dynamic pricing, QR codeticketing, and future analysis tools to enhance convenience, efficiency. The results of our study demonstrate clear advantages of the Super App over other tourist applications in the market. Increased user engagement, improved booking efficiency, enhanced personalization, optimal pricing strategies, efficient entry and exit processes, and insightful future analysis capabilities distinguish the Super App as a frontrunner in the tourism industry.

With the help of machine learning algorithms and QR code technology, the Super App delivers a top-notch user experience that streamlines the travel process from concept to completion. Users benefit from personalized recommendations, competitive pricing, and streamlined entry and exit processes, resulting in greater satisfaction and loyalty. Moreover, the Super App offers tourist place administrators valuable insights and tools to improve their business strategies, enhance visitor experiences, and foster sustainable growth. With data-driven approach and proactive planning, tourist destinations can tap into their potential to increase revenue or remain competitive in a constantly changing tourism landscape. In summary, the Super App has revolutionized the way travelers engage with tourist attractions, providing them with unparalleled convenience, personalization, and efficiency. As we continue to innovate and evolve, the Super App will shape the future of tourismand help travelers and destinations unlock new opportunities and experiences in world travel.

VIII. FUTURE WORK

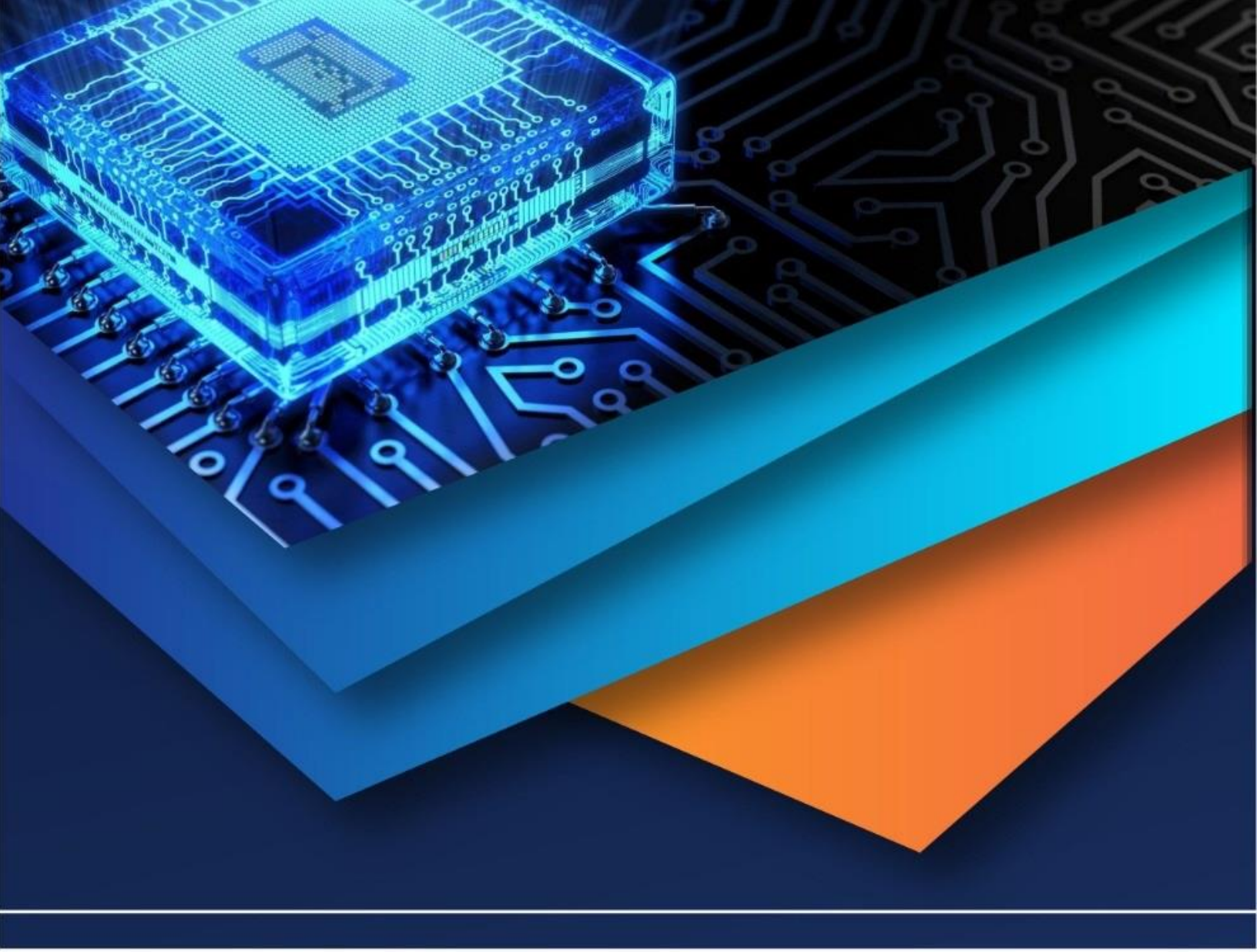
In the direction of further development of the Tourism Superior App, one promising method is to explore Bluetooth Low Energy (BLE) technology as an alternative to QR code systemsin the arrival and departure processes of travel destinations. BLE technology offers a number of potential advantages over QR codes, such as greater coverage, faster connectivity anda better user experience. A value-based comparison of BLE technology and QR codes can provide valuable insights into their advantages and disadvantages that will inform future development and deployment strategies for Super App. As part of future scope, conducting empirical studies and real-lifeexperiments to confirm these findings can further explore the feasibility and effectiveness of implementing BLE technology in Super App. In addition, exploring synergies between BLE technology and other Super App features such as personalized recommendations and dynamic price predictions can open up new opportunities to improve the overall travel experience.

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