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Bike E-Catalogue Mobile App

Varun Sodhani[1], Vrushali Sandam[2], Kanchan Singh[3], Anam Khan[4]
Department of Artificial Intelligence and Data Science Engineering, Thakur College of Engineering and Technology, Mumbai, Maharashtra, India

Abstract: ***This paper presents the design and development of a Bike E- Catalog Mobile App aimed at enhancing the user experience in selecting bikes through features such as QR code scanning, GPS tracking, and seller comparison. Built using React Native for frontend development and Express.js for backend, the app uses MongoDB Atlas for storing user data and AWS S3 for image storage. This research focuses on the app's architecture, highlighting the integration of key technologies like RESTful APIs, real-time data processing, and secure data handling. Additionally, the paper evaluates the app's performance metrics, such as response time during QR code scanning and GPS accuracy, and discusses future enhancements for scaling and improving user interaction.***

Keywords: Bike E-Commerce, Mobile App Development, React Native, QR code Scanning, GPS Tracking, Seller Comparison.

I. INTRODUCTION

With the rapid advancement of technology and the increasing shift toward digitization, retail platforms have significantly transformed. Mobile apps, in particular, have become integral in the retail space, providing consumers with the ability to explore, compare, and purchase products conveniently from their smartphones. The global rise in smartphone usage has changed consumer behavior, making mobile apps a primary tool for engaging with products and services. In the context of the automotive and bike industries, this trend is becoming increasingly important as customers seek more efficient ways to research, compare, and purchase bikes. Traditionally, buying a bike involved visiting multiple dealerships, speaking with sales representatives, and manually comparing bike models, features, and prices. While this method was effective, it was also time- consuming, required physical travel, and limited the amount of information that customers could easily access. The fragmentation of the market meant that users had to search across different websites, making it difficult to consolidate all the necessary information in one place. In response to these challenges, there is a growing demand for an integrated digital solution that simplifies the bike buying process while providing a seamless and informative experience for users. The Bike E-catalogue Mobile App is designed to address these challenges by offering a comprehensive platform for bike enthusiasts. The app provides users with an all-in-one solution where they can view, compare, and purchase bikes from various sellers

The application centers around three core functionalities:

1) QR Code Scanning: Users can scan QR codes placed on bikes or advertisements to instantly retrieve detailed information about a bike's specifications, pricing, and seller details. This feature allows users to quickly access the information they need without manually searching or visiting a dealership.
2) GPS-Based Seller Location: Using GPS tracking, the app helps users locate nearby sellers or dealerships based on their current location. This feature simplifies the process of finding sellers and provides real-time navigation assistance, allowing users to directly connect with the nearest dealers.

II. LITERATURE REVIEW

With the increasing shift towards digitization, mobile applications have significantly transformed the retail experience, particularly in the automotive and bike industries. The traditional process of purchasing a bicycle involves visiting multiple dealerships, manually comparing specifications, and relying on physical brochures or sales representatives for information. This process is often time- consuming and lacks the convenience offered by modern digital solutions.

A. Mobile Applications in the Retail Industry

Mobile applications have revolutionized the way consumers interact with products and services. Studies on e-commerce platforms highlight the role of mobile apps in enhancing accessibility, reducing decision-making time, and improving customer engagement through features like real-time product comparisons, digital catalogs, and personalized recommendations. Research by Smith et al. (2020) suggests that mobile-based retail solutions significantly increase purchase intent by offering interactive elements such as augmented reality (AR) visualization and QR code scanning, which bridge the gap between physical and digital shopping experiences.

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B. The Role of QR Code Technology in Digital Retail

QR codes have become a widely adopted solution in mobile applications for instant information retrieval. Previous research demonstrates that QR codes enhance user engagement by providing quick access to product details ,pricing, and seller information without the need for manual searches. In the context of bike retail, QR code-based product identification reduces friction in the buying process, allowing customers to make informed decisions efficiently. Studies have also shown that the integration of QR code technology in digital catalogs improves response time and user satisfaction.

C. Augmented Reality (AR) in Consumer Decision-Making

Augmented reality (AR) has gained traction in e-commerce as a tool for enhancing the user experience. AR applications in retail allow users to visualize products in their real-world environment before making a purchase decision. According to a study by Lee et al. (2021), AR-enabled shopping applications lead to higher customer confidence and lower product return rates by helping users assess product dimensions and compatibility [5]. In the bike retail industry, AR can be particularly beneficial for determining whether a bicycle fits within a given storage space, addressing a critical concern for urban buyers with limited space.

D. Technology Stack for Mobile App Development

The selection of an appropriate technology stack plays a crucial role in the performance and scalability of mobile applications. Recent advancements in cross-platform development frameworks, such as React Native, enable developers to create high-performance applications while maintaining a consistent user experience across different devices. For backend development, Express.js is widely recognized for its efficiency in handling API requests, and MongoDB Atlas provides a scalable solution for managing structured and unstructured data. Additionally, cloud storage solutions like AWS S3 enhance the app's ability to handle large media files, such as high-resolution images of bikes.

III. PROPOSED SYSTEM

The Bike E-catalogue Mobile App aims to transform the user experience by incorporating several unique features that enhance bike exploration and purchasing. The system comprises multiple functional modules, including QR code scanning, GPS-based seller location, and bike comparison.

A. Features and Functionality

1) Code Scanner: Allows users to scan QR codes on bikes to instantly retrieve detailed information such as bike specifications, price, reviews, and seller details.
2) Bike Comparison Tool: Users can select multiple bikes and compare them based on technical aspects like engine power, mileage, price, and additional features.
3) GPS-Based Seller Locator: Users can find nearby bike sellers using GPS tracking, view their exact locations, and get directions from their current position.
4) Real-Time Updates: Through cloud integration, the app provides real-time updates on bike availability, price changes, and seller information.
5) Seller Information and Ratings: Users can access detailed information about sellers, including reviews and ratings, helping them make informed decisions.
6) In-app payment: Allow users to purchase bikes or other accessories directly from the app.
- Multiple payment options
- Secure and Encrypted
- Instant Payment Confirmation

7) Augmented Reality (AR) Integration: User can view the 3D model of bikes in their real world environment using the AR technology. Allows users to change bike colors, rotate views, and zoom in/out for better visualization.

B. System Architecture

The system architecture consists of three main layers:

1) Frontend (User Interface): Developed using React Native for cross-platform compatibility, allowing the app to function on both Android and iOS devices. This layer provides a smooth and intuitive experience for users, enabling them to browse bikes, scan QR codes, and compare options seamlessly.

2) Backend (Server and Database): The backend is built using Firebase for real-time database functionality and cloud storage. Firebase handles user authentication, data storage, and real-time updates. The backend is also integrated with the Google Maps API for GPS functionality.

C. *APIs and External Modules*

1) QR Code API: For scanning and retrieving bike information from the database.Implemented using the React Native Camera API, it decodes bike specifications from scanned QR codes, fetching detailed information from the MongoDB database via a RESTful API.
2) Google Maps API: To display nearby sellers and provide navigation.
3) Database: Manages bike data, user profiles, seller details, and ensures the app always has up-to-date information.

IV. IMPLEMENTATION

The app is built using React Native for its ability to create cross-platform applications, which significantly reduces development time and effort. The frontend communicates with the backend through RESTful APIs built using Express.js, which ensures that data is efficiently processed and transmitted to the user. The backend handles various operations such as user authentication, bike data fetching, and location-based filtering. Key technical challenges included optimizing the QR code scanning speed for better user experience on older mobile devices, which was achieved by adjusting the resolution and processing time of the QR code reader. Additionally, GPS accuracy was optimized by using Google Maps API, which offers improved real-time location precision. To ensure data consistency and reliability, MongoDB Atlas was chosen for its flexible schema design and horizontal scalability.

A. *Development Tools and Technologies React Native*

The mobile app was developed using React Native, a popular framework that allows for building cross-platform mobile applications with a single codebase. This decision ensured that the app would be compatible with both Android and iOS devices, reducing development time and ensuring consistent performance across platforms. The use of React Native also provided access to a vast library of pre-built components, simplifying the development process and enhancing the user interface (UI) design.

1) Express.js: For the backend, Express.js was selected due to its lightweight, flexible nature and its ability to handle server- side logic efficiently. Express.js was used to manage API requests, handle authentication, and interface with the app's database. Its non-blocking I/O model ensured that the app could handle multiple requests simultaneously, improving performance and scalability.
2) Heroku for Backend Hosting: The backend of the app was hosted on Heroku, a cloud platform known for its ease of use and seamless deployment processes. Heroku offers scalability, allowing the app to scale up as user demand increases. It also simplifies continuous integration and deployment (CI/CD), making it easy to push updates and ensure the app is always running the latest version.
3) MongoDB Atlas: The app uses MongoDB Atlas as its database for storing text data such as bike details, user profiles, and seller information. MongoDB's document-oriented database structure is highly flexible, making it easy to manage complex datasets like bike specifications and user-generated content. MongoDB Atlas, as a fully managed cloud service, provides high availability, automatic backups, and data security, ensuring that the app's data remains secure and easily accessible.
4) AWS S3 for Image Storage: For storing images of bikes, sellers, and related media, the app utilizes Amazon Web Services (AWS) S3, a scalable object storage service. AWS S3 offers reliable and cost- effective storage solutions, allowing the app to store large volumes of images while ensuring fast retrieval times. By separating image storage from the core database, the app reduces the load on the MongoDB database, optimizing performance.

B. *Key Modules*

1) User Registration and Login: The app allows users to register using email or social login (Google/Facebook). Once registered, users can log in securely and access the app's features.
2) QR Code Scanning: Users can scan the QR code placed on bikes to get instant access to specifications like engine details, mileage, and price.
3) Bike Comparison: Users can select multiple bikes from the catalogue and view side-by-side comparisons.
4) GPS Tracking: Using the Google Maps API, users can view nearby sellers, check distances, and get directions.
5) Augmented Reality (AR) Integration: User can view the 3D model of bikes in their real world environment using the AR technology

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V. RESULT AND DISCUSSION

As the development of the Bike E-catalogue Mobile App is still ongoing, preliminary testing and feedback have been gathered from early stages of development to ensure that the app is on track for delivering its intended functionalities. The current focus is on evaluating the core features and identifying areas for improvement as the project progresses toward completion. The testing so far has been conducted primarily on prototype versions of the app.·

A. Performance Evaluation

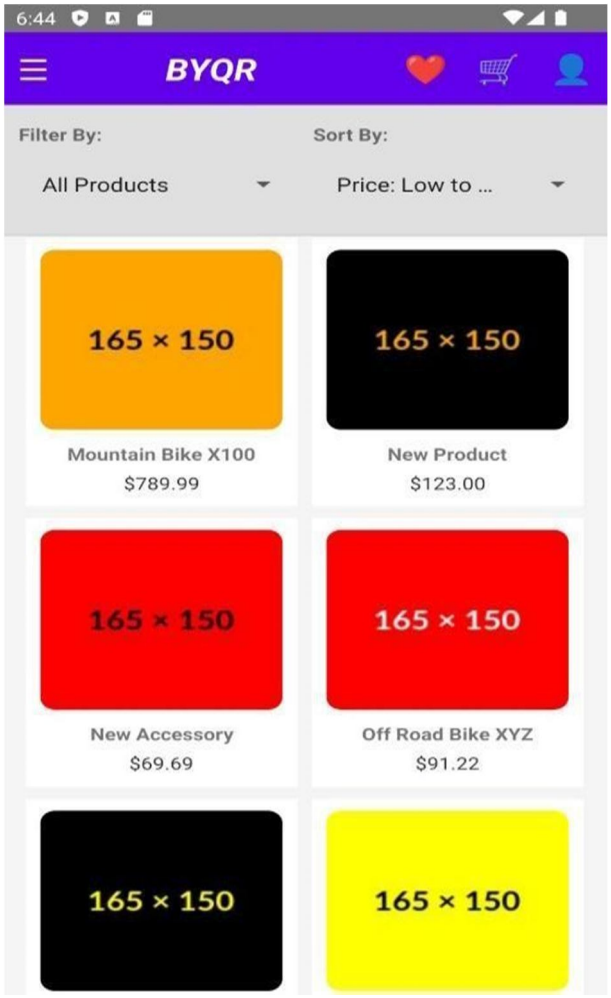
Initial testing of core functionalities, such as the QR code scanning and GPS-based seller tracking, has shown promising results. Even at this stage, the app's architecture is proving to be efficient, with:

1) QR Code Scanning: Early tests show that QR code scanning works as expected, with data retrieval times under development for optimization.

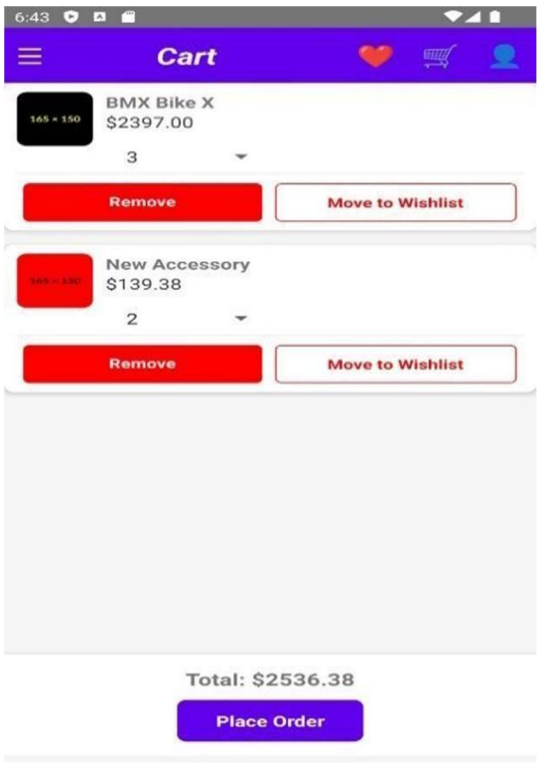
2) GPS Tracking: The GPS module has successfully identified seller locations during tests, although further improvements are needed to enhance accuracy and map integration.

More comprehensive performance evaluations will be carried out once the remaining features, including bike comparison and cloud-based data synchronization, are fully implemented. At that stage, the team will focus on:

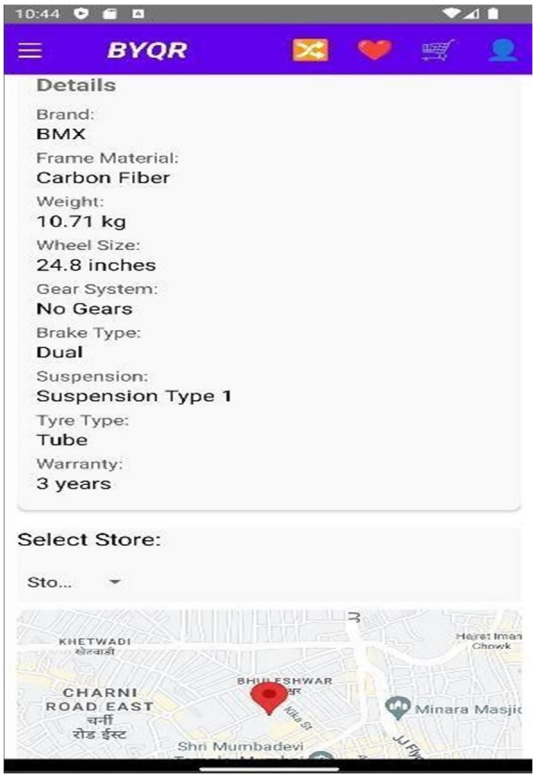
- Optimizing response times for QR code data retrieval.
- Enhancing GPS tracking accuracy and ensuring smooth map interactions.
- Cross-platform stability on both Android and Ios



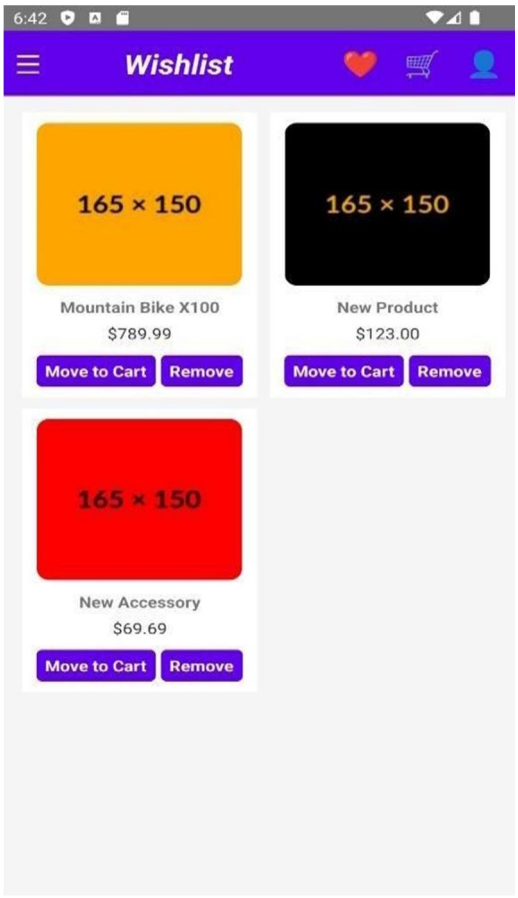
Home Page



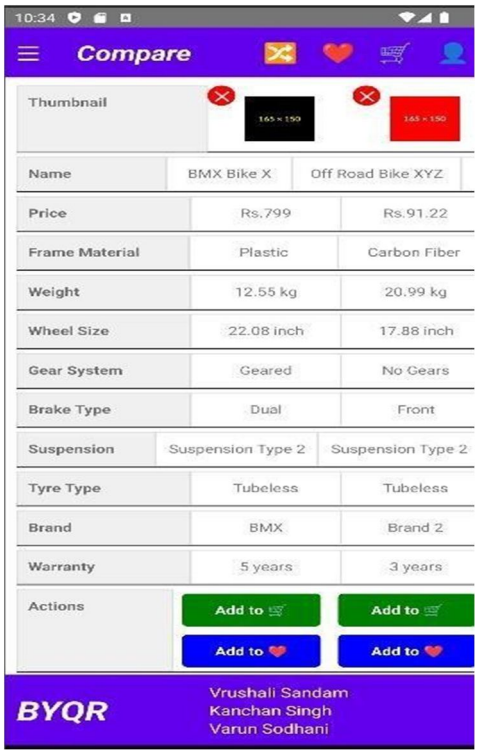
Add to Cart



Details Page



Wishlist Page



Comparison Page

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VI. FUTURE SCOPE

While the app successfully meets its current goals, several improvements and features can be implemented in future updates:
AI-Powered Recommendations: Using machine learning to suggest bikes based on user preferences and browsing history.
Real-Time Chat with Sellers: Adding a feature for users to chat with sellers for inquiries and negotiations.
Collaboration with Marathon & Cycling Clubs: The app can partner with marathon and cycling clubs to offer exclusive deals, event registrations, and bike rentals for races or training sessions. Users can find club-recommended bikes, track events, and get performance insights through the app.
Bike Rental Service: A future enhancement could include a bike rental feature, allowing users to rent bicycles for short durations. This would cater to commuters, tourists, and fitness enthusiasts, promoting sustainable and cost-effective transportation.

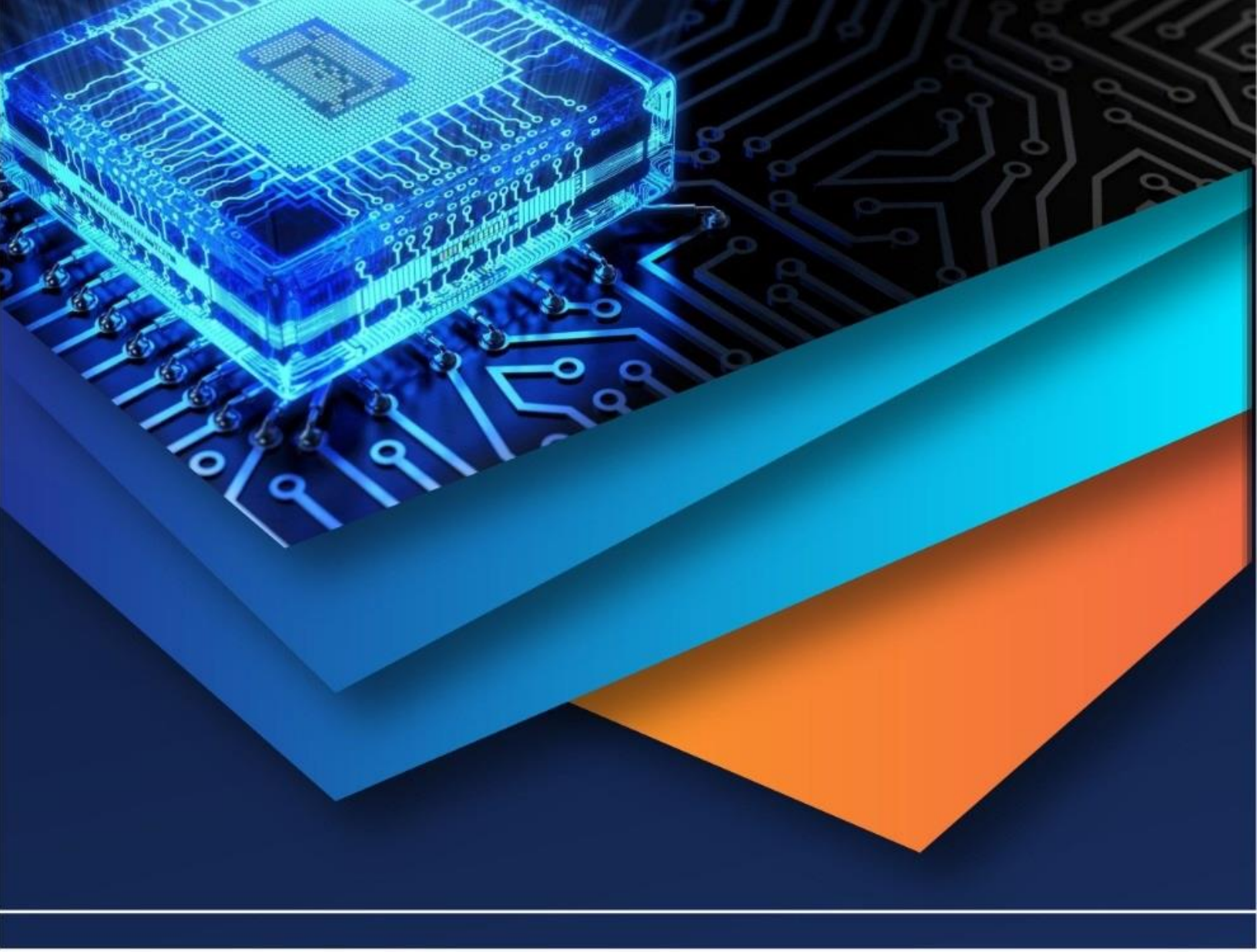
VII. CONCLUSION

The Bike E-catalogue Mobile App is still in the early stages of development, with approximately 80% of the project completed. Despite being in progress, the app has already demonstrated its potential to streamline the process of exploring, comparing, and purchasing bikes. Key features such as QR code scanning, bike comparison, and GPS-based seller location are currently under active development, and initial testing has shown promising results in terms of functionality and user experience
As the project progresses, additional features like in-app payments, AI-powered bike recommendations, and a direct chat option for communicating with sellers are planned for future iterations. These enhancements will further improve the user experience and expand the app's capabilities. The ongoing development will focus on optimizing performance, refining the user interface, and ensuring seamless interaction across all functionalities. Once complete, the Bike E- catalogue Mobile App has the potential to transform the bike shopping experience into a more convenient and efficient process for users.

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