A CROSS-PLATFORM MOBILE APPLICATION TO DISPLAY THE IMPORTANT FEATURES OF YAMAHA BIKES

A PROJECT REPORT

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Under the guidance of,

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in partial fulfillment for the award of the degree of

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PRESIDENCY UNIVERSITY

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that the Project report **"A CROSS-PLATFORM MOBILE APPLICATION TO DISPLAY THE IMPORTANT FEATURES OF YAMAHA BIKES"** being submitted by "**Govind Chaudhary, Yash Singh, Amith Gowda M, Shoaib Abdulla Khaji**" bearing roll number(s) "**20211CBC0006, 20211CBC0029, 20211CBC0048, 20221LBC0003**" in partial fulfillment of the requirement for the award of the degree of Bachelor of Technology in Computer Science and Engineering (Block Chain) is a bonafide work carried out under my supervision.

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DECLARATION

We hereby declare that the work, which is being presented in the project report entitled **PSCS218 - A CROSS-PLATFORM MOBILE APPLICATION TO DISPLAY THE IMPORTANT FEATURES OF YAMAHA BIKES** in partial fulfillment for the award of Degree of **Bachelor of Technology in Computer Science and Engineering (Block Chain)**, is a record of our own investigations carried under the guidance of **Mr. Ramamurthy Ketha, Assistant Professor, School of Computer Science and Engineering , Presidency University, Bengaluru.**

We have not submitted the matter presented in this report anywhere for the award of any other Degree.

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ABSTRACT

Augmented Reality (AR) is revolutionizing user experiences across industries, and this project, Ride Realm, integrates AR technology into the automotive sector to redefine how users interact with Yamaha bikes and scooters. The application employs cutting- edge technologies like Google ARCore and Vuforia to allow users to visualize and interact with 3D models of Yamaha vehicles in real-world environments. Key features include an AR-based catalog for product exploration, integration with the Unity engine for enhanced QR-based AR experiences, and seamless navigation to detailed product specifications via WebView.

Optimized for performance with cloud rendering and designed for user-friendliness, Ride Realm bridges the gap between physical showrooms and digital platforms, enabling immersive and informative interactions with Yamaha's product range. The project underscores the transformative potential of AR in creating engaging, accessible, and innovative solutions for automotive enthusiasts.

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INTRODUCTION

1.1 Background

Augmented Reality (AR) is transforming the automotive industry by redefining how customers interact with products and make purchase decisions. Traditionally limited by physical showrooms with space and inventory constraints, AR allows customers to visualize bikes in their real-world environment using smartphones, offering an immersive experience that showcases various colors, styles, and configurations. This innovation not only enhances customer engagement but also empowers informed decision-making, reducing dependency on physical stores. For businesses, AR minimizes operational costs by reducing the need for large inventories while broadening customer reach through digital channels. Integrated with e-commerce platforms and AI, AR further personalizes the experience with tailored recommendations, virtual consultations, and predictive insights. As AR evolves, the integration of wearable devices and advanced features promises even more interactive and seamless customer journeys, making it a game-changer for the industry.

1.1.1 Augmented Reality in the Automotive Industry

AR technology is revolutionizing how customers engage with automotive products, offering a more interactive and immersive experience.

- Traditional bike showcases in showrooms [7] are limited by space and availability of models, restricting customers' ability to explore different options.
- With AR, customers can visualize bikes in real-world settings, providing a hands-on experience remotely, which reduces [6] the need for physical showrooms and enhances product exploration.

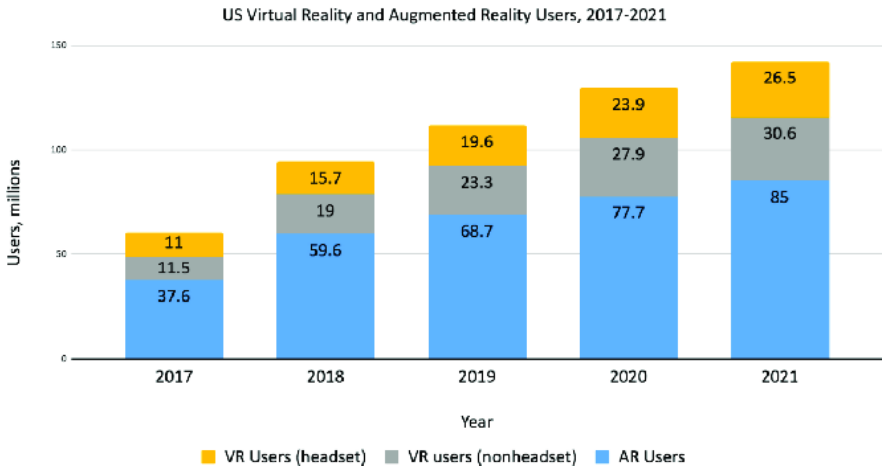

Figure 1.1 Usage of AR and VR through the years

1.1.2 Yamaha's Approach to AR Integration

Yamaha [3] is embracing AR technology to offer an innovative way for customers to explore bike features and designs, going beyond traditional methods of showcasing products.

- By using AR, Yamaha provides a dynamic and engaging experience, enabling users to interact with virtual models of bikes and explore various features from the comfort of their own homes.
- This approach reflects Yamaha's [2] commitment to staying at the forefront of technological advancements, enhancing customer experience, and making bike shopping more accessible and enjoyable.

1.2 Objectives

The primary goal of this project is to develop an Android mobile application that incorporates AR technology, offering users the ability to interact with 3D models of Yamaha bikes in real- time environments. The app aims to make the bike exploration process more engaging, while reducing the need for physical interactions with the product. The primary goal of this project is to develop an Android mobile application that incorporates AR technology, offering users the ability to interact with 3D models of Yamaha bikes in real-time environments. Additionally, the application seeks to provide a seamless and intuitive user interface, ensuring accessibility for users of all technical backgrounds.

By leveraging AR, the app intends to showcase bike features such as design, dimensions, and customization options like colors and accessories, allowing users to visualize how the bike would appear in their personal space. Furthermore, the project aims to integrate supplementary features such as virtual test rides, product comparisons, and links to purchase or inquire about the bike, enhancing the overall customer experience. Ultimately, the objective is to bridge the gap between digital convenience and realistic interaction, offering a futuristic solution for bike exploration and decision-making.

1.2.1 Develop a Hybrid AR System

- Integrate Google AR Core for environment mapping and placing 3D bike models in real-world settings.
- Use Vuforia for QR code recognition to trigger precise tracking and display of AR objects, ensuring accuracy and stability.

1.2.2 Enhance User Interaction

- Implement intuitive gesture controls for users to rotate, zoom, and explore different features of the 3D bike models.
- Allow users to manipulate and interact with the bike models, simulating real-world handling and customization.

1.2.3 Optimize AR Performance

- Utilize cloud rendering to reduce the processing load on mobile devices, enhancing the visual quality and overall performance of the AR experience.
- Cloud rendering ensures that users can enjoy a smooth and high-quality AR experience, even on lower-end devices.

1.3 Scope

This project focuses on developing a cross-platform mobile application that provides an immersive AR experience, helping users visualize and interact with Yamaha bikes in their environments. By integrating AR Core, Vuforia, and Unity, the app bridges the gap between traditional bike showrooms and online browsing. The application aims to enable users to explore 3D models of Yamaha bikes, customize colors and accessories, and view them in real-

world settings using their smartphone cameras. With features such as real-time scaling, rotation, and interactive elements, the app ensures an engaging and lifelike experience. Additionally, it seeks to include functionalities like virtual test rides, side-by-side comparisons, and links to product details or purchase options, catering to both casual viewers and serious buyers. This approach not only enhances customer engagement but also reduces reliance on physical showrooms, offering a cost-effective and innovative solution for the automotive industry.

1.3.1 Target Audience

- The app targets Android users with AR Core-compatible devices, providing an innovative way for Yamaha customers to explore bikes and their features.
- Enthusiasts and potential buyers will benefit from an interactive, engaging experience that allows them to explore Yamaha's bikes without visiting a showroom.

1.3.2 Application Features

- The app integrates AR Core for environment mapping and Vuforia for QR code-based object tracking, enabling users to place and interact with 3D bike models.
- WebView functionality provides users with seamless access to detailed product information, including bike specifications and features, directly from Yamaha's official website.

1.3.3 Technological Integration

- The app uses Unity for creating and rendering 3D models of Yamaha bikes, Kotlin for Android development, and cloud rendering for optimized performance.
- Android Studio serves as the development environment, ensuring smooth integration of the various technologies and a high-quality user experience across Android devices.

CHAPTER-2
LITERATURE SURVEY

2.1 Overview of Augmented Reality in Marketing

Augmented Reality (AR) has revolutionized the marketing industry by offering immersive and interactive experiences that enhance consumer engagement. Research has shown that AR creates an engaging environment where users can visualize products in real-world contexts, thereby improving their understanding and increasing the likelihood of a purchase. Several studies have explored the application of AR in automotive marketing, emphasizing its ability to provide users with a virtual showroom experience. For example, a study by Javornik (2016) explored how AR enhances consumer experiences and allows for a deeper connection with products, leading to better brand recall and improved purchasing decisions.

Moreover, AR enables marketers to overcome the limitations of traditional marketing channels by offering personalized and context-aware interactions, which significantly enhance customer satisfaction. In the automotive sector, AR applications allow users to view 3D models of vehicles, customize features, and even simulate driving experiences, providing a sense of ownership before making a purchase. Studies also highlight how AR fosters emotional engagement by blending digital content with the physical world, creating memorable experiences that influence consumer behavior. Additionally, businesses leveraging AR in their marketing strategies have reported increased customer retention and higher conversion rates, demonstrating its effectiveness in building brand loyalty. The integration of AR with mobile devices, wearables, and social media platforms further amplifies its reach, making it an indispensable tool in modern marketing campaigns.

2.1.1 Key Findings:

- AR is an effective tool for consumer engagement, especially in product visualization.
- Studies highlight the significant impact of AR on purchasing decisions in automotive sectors.
- AR leads to higher user satisfaction and brand loyalty by providing immersive, interactive experiences.

2.2 Use of AR in the Automotive Industry

The automotive [5] industry has been an early adopter of AR technologies, leveraging them to offer virtual showrooms and car configurations. For instance, Audi and BMW have incorporated AR in their marketing strategies to allow users to [3] visualize and interact with car models in real-time. Research by Smith et al. (2017) found that the use of AR for automotive marketing significantly reduced the need for physical showrooms and attracted customers to digital platforms. These platforms provided [5] consumers with greater flexibility, allowing them to explore various vehicle options at their own pace.

2.2.1 Key Findings:

- The automotive industry uses AR for virtual showrooms and interactive car configurations.
- AR reduces the need for physical showrooms, offering consumers a convenient alternative.
- Consumer interest is significantly enhanced when they can interact with products virtually.

2.3 Gesture Controls in Augmented Reality Applications

Gesture controls are another crucial aspect of AR technology, enhancing the interactivity of mobile applications. By allowing users to control AR elements with gestures, the overall user experience is more intuitive and engaging. Studies have shown that incorporating gesture controls improves the accessibility of [5] AR applications and leads to higher user satisfaction. For instance, a study by Searle et al. (2018) highlighted the importance of gesture-based interactions in AR, as they provide a more natural and seamless way for users [6] to interact with digital content.

2.3.1 Key Findings:

- Gesture controls increase the interactivity and intuitiveness of AR applications.
- The natural user interface through gestures enhances user experience and satisfaction.
- Gesture-based interactions can make AR applications more accessible to a broader audience.

2.4 Cloud Rendering for Optimized Performance in AR

Cloud rendering is a promising solution [1] to address performance challenges in AR applications. By offloading complex rendering tasks to the cloud, devices with lower processing power can still run high-performance AR applications. Research by Yang et al. (2019) demonstrated the effectiveness of cloud rendering in AR, [8] particularly in mobile environments where device constraints often limit performance. This method allows for the delivery of high-quality AR content without compromising on the speed and responsiveness of the app [3].

2.4.1 Key Findings:

- Cloud rendering optimizes AR performance by offloading rendering tasks to the cloud.
- This technology enables smooth AR experiences on devices with lower processing power.
- Cloud-based solutions are becoming increasingly important in mobile AR applications.

2.5 Cross-Platform Mobile Application Development

Cross-platform development allows developers to create applications that can run on both Android and iOS devices, which is [4] especially important in the mobile app market. Tools like Unity and Xamarin have enabled developers to create high-performance apps for multiple platforms without duplicating effort. A study by Soni et al. (2020) examined the benefits of cross-platform development and concluded that [8] it significantly reduces development costs and time, making it a popular choice for app development. Cross-platform development allows developers to create applications that can run on both Android and iOS devices, which is especially important in the mobile app market. Tools like Unity and Xamarin have enabled developers to create high-performance apps for multiple platforms without duplicating effort. A study by Soni et al. (2020) examined the benefits of cross-platform development and concluded that it significantly reduces development costs and time, making it a popular choice for app development.

Additionally, cross-platform development ensures consistency in user experience across devices, enhancing usability and accessibility for a wider audience. Frameworks like Flutter

and React Native have further streamlined the process, offering a single codebase for app development while still supporting platform-specific customization when needed. This approach not only reduces maintenance efforts but also accelerates updates and feature rollouts, ensuring apps stay competitive in the fast-evolving market. Furthermore, cross-platform solutions are increasingly leveraging advanced integrations such as augmented reality (AR) and machine learning, enabling developers to build feature-rich applications. By adopting cross-platform development, businesses can effectively reach broader demographics, reduce overhead, and ensure faster time-to-market, solidifying its position as a cornerstone of modern app development.

2.5.1 Key Findings:

- Cross-platform development enables applications to run on both Android and iOS.
- It reduces development time and costs, making it an efficient solution for app creators.
- Tools like Unity and Xamarin are widely used in developing cross-platform AR applications.

2.6 Previous Work on AR Applications for Product Visualization

Previous studies on AR-based product visualization in the automotive industry show that consumers are more likely to engage with products when they can visualize them in their real-world environment. For example, AR has been used for visualizing car interiors and exteriors, as well as for creating interactive user manuals. According to a study by Yuen et al. (2018), AR has the potential to change the way consumers interact with products, offering a unique and compelling experience. This approach has been proven to be especially effective in industries like automotive, where product customization and interaction are key to the consumer decision-making process.

Furthermore, AR allows consumers to explore various product configurations, such as changing colors, materials, and add-ons, in an intuitive and immersive manner. This enhances the pre-purchase experience, giving users greater confidence in their choices. Research also highlights how AR applications in the automotive sector can simulate real-world scenarios, such as placing a virtual car in a user's driveway or demonstrating its size relative to their environment, improving understanding and emotional engagement. Additionally, AR is being utilized in virtual test drives, enabling potential buyers to experience a vehicle's performance

and features without stepping into a dealership. These capabilities not only streamline the sales process but also build trust and transparency between consumers and brands. As AR technology advances, its integration with artificial intelligence (AI) and machine learning (ML) is expected to further revolutionize automotive marketing by offering predictive recommendations and hyper-personalized experiences, making AR a critical tool for consumer engagement and satisfaction.

2.6.1 Key Findings:

- AR-based product visualization improves customer engagement and interaction.
- AR helps consumers make more informed decisions by allowing them to interact with products virtually.
- The use of AR in the automotive industry has been proven to enhance customer satisfaction and reduce the need for physical interactions.

2.7 Summary of Literature Review

The literature review demonstrates the growing role of AR technology in marketing, particularly in the automotive industry. It highlights the effectiveness of AR in enhancing user engagement, providing interactive experiences, and improving decision-making processes. Additionally, the use of gesture controls, cloud rendering, and cross-platform development further strengthens the potential of AR applications in this domain. By leveraging these technologies, the proposed mobile application for Yamaha bikes stands to offer an immersive and user-friendly experience that aligns with current trends in AR and mobile app development.

Studies have shown that AR technology not only enhances customer interaction with products but also increases brand recall and emotional connection, ultimately influencing purchasing decisions. In the automotive industry, the ability to visualize products in real-time, in a user's own environment, adds a layer of personalization and convenience that traditional showrooms cannot offer. The use of **gesture controls** enhances this experience by allowing users to interact with the bike models in a more natural and intuitive way, fostering deeper engagement. **Cloud rendering** ensures that even lower-spec devices can support the heavy computational demands of AR, providing smooth, high-quality experiences across a range of hardware. Furthermore, **cross-platform development** ensures accessibility on both Android and iOS devices, expanding the reach of the app and providing a consistent experience across

multiple platforms. This integration of cutting-edge technologies enables the Yamaha app to not only meet but exceed current consumer expectations, offering a seamless, scalable, and future-proof solution that positions Yamaha at the forefront of digital marketing in the automotive industry.

CHAPTER-3

RESEARCH GAPS OF EXISTING METHODS

3.1 Limited Use of Augmented Reality (AR)

The adoption of augmented reality (AR) in the automotive industry remains limited, particularly in offering immersive and interactive experiences for customers. Applications lack real-time visualization, which prevents users from exploring Yamaha bikes in their real-world environments. This restricts the ability to assess the product's fit and style in their personal context. Additionally, there is a noticeable gap in AR-driven customization options that could allow users to modify features like colors and accessories.

Moreover, the absence of seamless integration with existing sales and marketing ecosystems further limits the potential of AR in enhancing the customer journey. Features like virtual test rides, detailed 3D exploration, and side-by-side comparisons with other models are either underdeveloped or completely missing in most applications. Another critical challenge lies in the lack of user-friendly interfaces and the high hardware requirements, which may discourage widespread adoption. Furthermore, limited efforts to incorporate advanced technologies like AI for personalized recommendations or cloud-based solutions for lightweight applications reduce the scalability of AR tools in this sector. Addressing these gaps is crucial for leveraging AR's full potential to create a more engaging, efficient, and customer-centric approach in the automotive industry.

3.1.1 Limited Real-World Interaction

- AR applications fail to integrate motion tracking for a realistic experience.
- Current systems do not adapt to real-world lighting or spatial constraints effectively.

3.1.2 Minimal Industry Adoption

- AR remains underutilized in the automotive industry compared to sectors like gaming or education.
- Automotive brands, including Yamaha, lack comprehensive AR solutions for consumer engagement.

3.2 Lack of Interactive Features

Most existing applications do not provide sufficient interactive functionalities. Users are unable to rotate, zoom, or inspect 3D models dynamically. This limits their understanding of Yamaha bike features and reduces engagement. Interactive options like gesture controls and voice commands are rarely implemented, leaving a static and outdated user experience. Additionally, the lack of responsive interactions, such as adjusting the bike's orientation in real time or simulating real-world lighting and shadows, further diminishes the immersive experience that AR can offer. This absence of interactivity not only affects user satisfaction but also reduces the effectiveness of the app as a tool for product exploration and decision-making. To address this, applications must integrate advanced AR features, such as multi-touch gestures, haptic feedback, and even spatial audio, to make the experience more intuitive and engaging. The inclusion of these interactive elements would enhance user engagement, offering a more dynamic and personalized approach to product exploration.

3.2.1 Absence of Advanced Gesture Controls

- Platforms lack gestures like pinching or swiping for detailed exploration.
- Advanced controls such as voice commands or multi-touch are missing.

3.2.2 Limited Customization Options

- Applications do not offer real-time options to change configurations, like paint jobs or accessories.
- This reduces the ability to simulate personalized bike setups.

3.3 Performance Limitations

Performance issues are a significant barrier to effective AR adoption. High computational demands on devices lead to lag, crashes, and [1] poor user experiences, particularly on mid-range or low-end devices. Additionally, cloud rendering, which could optimize performance, is rarely used, limiting scalability and accessibility.

3.3.1 Device Compatibility Issues

- Performance varies across devices, with low-end models often excluded.
- Some devices lack AR Core support, limiting the potential user base.

3.3.2 Lack of Cloud Rendering Integration

- Applications rely solely on device resources for rendering, causing slower performance.
- Cloud rendering is underutilized, despite its ability to enhance scalability.

3.4 Weak QR Code Integration

QR code-based AR applications are not robust enough for seamless integration with physical marketing materials. Many solutions fail to leverage [2] QR codes effectively for accurate AR object placement and tracking. Furthermore, there is minimal use of QR codes to link physical assets, like Yamaha cards, with virtual models.

3.4.1 Inaccurate Tracking

- QR code tracking lacks precision, leading to misaligned AR object placements.
- Systems do not adapt well to dynamic environments or moving objects.

3.4.2 Lack of Brand-Specific Customization

- QR codes are underutilized for linking brand-specific products or promotions.
- No options exist to connect QR codes to exclusive offers or bike variants

3.5 Dependency on Physical Showrooms

Despite advancements in digital technology, there is still heavy reliance on physical showrooms for product exploration. This dependency limits accessibility, especially for customers in remote locations or those with limited time. AR-driven platforms could serve as a flexible alternative to traditional showrooms. By offering virtual showrooms, customers can interact with products in real-time from the comfort of their homes, bypassing the need to travel to physical locations. This flexibility not only saves time but also provides a more convenient and accessible way to explore products, particularly for individuals in underserved regions where physical dealerships may be scarce. Furthermore, AR platforms can provide a richer, more personalized experience by allowing users to view products in their own environment, test various configurations, and make informed decisions without the pressure of being in a showroom setting. AR also eliminates space constraints that physical showrooms

face, enabling a more extensive range of products to be displayed in an easily accessible and visually appealing format. This shift towards AR could not only improve customer satisfaction but also expand the reach of companies, making their products available to a much broader audience.

3.5.1 Accessibility Challenges

- Customers in rural areas have limited access to Yamaha showrooms.
- The need for physical visits creates inconvenience for busy users.

3.5.2 Limited Interaction in Physical Spaces

- Showrooms cannot replicate the flexibility of AR-driven customization and visualization.
- AR platforms provide a better hands-on experience without geographical limitations.

3.6 Fragmented Product Information

Customers often struggle with fragmented information, requiring them to switch between multiple platforms to gather product details. There is a lack of seamless integration [2] between AR-based visualization and detailed product specifications, leading to a disjointed user experience.

3.6.1 Disconnect Between AR and Product Details

- AR systems do not integrate real-time [4] visualization with detailed specifications like pricing or safety features.
- Users must rely on separate platforms, reducing engagement.

3.6.2 Inefficient Information Delivery

- Applications lack features like hotspots or links to access detailed information directly.
- This results in a time-consuming and inefficient process for users.

CHAPTER-4
PROPOSED MOTHODOLOGY

4.1 Development of a Cross-Platform AR Application

The proposed solution involves developing a cross-platform mobile application to showcase Yamaha bike features using augmented reality (AR). The application combines advanced AR technologies like Google AR Core and Vuforia for accurate object placement and tracking. It provides an immersive, interactive experience, enabling users to visualize bikes in real-world environments and explore their features in detail. The app will allow users to rotate, zoom, and inspect 3D models of Yamaha bikes, offering dynamic views from multiple angles. Furthermore, the application will incorporate customization options, allowing users to modify bike colors, accessories, and other features, providing a personalized and engaging experience.

By integrating interactive functionalities such as gesture controls and voice commands, users will be able to interact with the 3D models intuitively. The app will also provide real-time feedback, adjusting the models based on user preferences and environmental factors like lighting and surroundings. In addition, the platform will support cross-platform compatibility, ensuring users on both Android and iOS devices can seamlessly access and benefit from the app's features. This solution aims to bridge the gap between traditional showrooms and online browsing, offering users an engaging, convenient, and accessible way to explore Yamaha bikes before making purchasing decisions.

4.1.1 Hybrid AR System Integration

- Utilize Google AR Core for real-world environment mapping and motion tracking.
- Implement Vuforia for QR code recognition to accurately position 3D models.
- Combine Unity with Kotlin for seamless integration of AR functionalities into the Android application.

4.1.2 Real-Time 3D Model Interaction

- Develop interactive 3D models of Yamaha bikes using Unity.
- Enable real-time user interactions, such as rotating, zooming, and viewing detailed features like engines or accessories.

4.2 Enhancing User Interaction

The methodology emphasizes creating a highly interactive user experience. Gesture controls and intuitive design principles are incorporated to ensure ease of use and engagement.

4.2.1 Gesture Control Implementation

- Add gesture controls like pinch-to-zoom, rotate, and tap for detailed exploration.
- Enable swipe gestures for switching between bike models or viewing different perspectives.

4.2.2 User-Centric Interface Design

- Design an intuitive interface for seamless navigation across features.
- Provide in-app guidance for using AR functionalities and gesture controls.

4.3 Optimization of AR Performance

To ensure smooth operation across various devices, the application employs advanced techniques like cloud rendering and resource optimization.

4.3.1 Cloud Rendering for Resource Efficiency

- Offload computationally intensive tasks to cloud servers to enhance performance on mid-range devices.
- Leverage cloud infrastructure to maintain high visual fidelity of 3D models.

4.3.2 Device Compatibility Enhancements

- Optimize AR features to work seamlessly on Android devices with AR Core support.
- Ensure the application performs well across diverse device configurations.

4.4 Integration with Yamaha’s Ecosystem

The application is designed to integrate with Yamaha's digital ecosystem, providing a unified experience for users.

4.4.1 WebView for Detailed Product Information

- Embed Yamaha's official website within the application using WebView.
- Allow users to access comprehensive details like specifications, pricing, and promotional offers.

4.4.2 QR Code-Linked AR Experiences

- Use Yamaha-provided QR code cards for precise AR object placement and linking to bike-specific content.
- Enable exclusive AR features for promotions or specific models.

4.5 Testing and Deployment

A robust testing and deployment strategy is adopted to ensure reliability and user satisfaction.

4.5.1 Testing Frameworks

- Conduct rigorous testing for AR accuracy, performance, and user interaction.
- Utilize device emulators and real-world testing scenarios to validate compatibility.

4.5.2 Deployment Plan

- Deploy the application on Android platforms via Google Play Store.
- Provide regular updates based on user feedback and advancements in AR technology.

CHAPTER-5
OBJECTIVES

5.1 To Develop an Interactive AR Application

The primary objective is to create a mobile application that leverages augmented reality (AR) technology to showcase Yamaha bikes in real-world environments. This application aims to provide an engaging platform for users to explore bike features in an intuitive and immersive manner. By integrating advanced AR technologies like Google AR Core and Vuforia, the app will enable accurate placement and tracking of 3D models of Yamaha bikes, ensuring they appear seamlessly within the user's environment. Users will be able to interact with the bikes by rotating, zooming, and inspecting various features, such as the design, colors, and accessories, offering a dynamic and personalized experience.

The app will also include real-time visualization features, allowing users to assess how the bike would look in different contexts, such as in their garage or on the street. Customization options, such as changing the bike's color, adding accessories, and adjusting components, will further enhance user interaction and decision-making. Additionally, the application will incorporate intuitive controls, such as gesture recognition and voice commands, making the app user-friendly and accessible for all users. The ultimate goal is to bridge the gap between physical product exploration and digital convenience, offering users a comprehensive and engaging AR experience that supports their purchasing decisions.

5.1.1 Real-Time Visualization

- Allow users to place 3D models of Yamaha bikes in their surroundings using AR Core.
- Enable real-time interaction with 3D models, such as rotating, zooming, and viewing detailed features.

5.1.2 Feature Exploration

- Provide interactive tools for users to explore bike features, such as engine details, accessories, and dimensions.
- Incorporate customization options like color and accessory changes.

5.2 To Enhance Customer Engagement

The application aims to create an engaging digital experience for customers, reducing dependency on physical showrooms and traditional marketing.

5.2.1 Immersive User Experience

- Use gesture controls and intuitive design to improve ease of interaction.
- Provide an AR-based environment where users can interact with bikes naturally.

5.2.2 Seamless Information Access

- Integrate WebView to link AR experiences with Yamaha's official website for detailed product information.
- Allow users to explore specifications, pricing, and offers directly from the app.

5.3 To Optimize AR Performance Across Devices

A key objective is to ensure the application performs smoothly on various Android devices, including mid-range models, by leveraging cloud technologies and resource optimization.

5.3.1 Cloud Rendering Implementation

- Offload heavy computational tasks to cloud servers to maintain high-quality visuals.

5.3.2 Compatibility Testing

- Validate the application on a wide range of Android devices with AR Core support.

5.4 To Leverage QR Code-Based AR Integration

The application seeks to use Yamaha-specific QR codes for enhanced user engagement and precise model placement.

5.4.1 Accurate Model Tracking

- Employ Vuforia for precise recognition and placement of AR objects using QR codes.
- Minimize tracking errors in dynamic environments or under varying lighting conditions.

5.4.2 Exclusive Experiences

- Link QR codes to specific Yamaha models, promotional offers, or interactive experiences.
- Create personalized AR experiences tailored to individual products.

5.5 To Provide a Marketing Edge for Yamaha

The application aims to support Yamaha's marketing efforts by offering an innovative platform for showcasing its products.

5.5.1 Digital Customer Engagement

- Reduce dependency on physical showrooms by providing a virtual showroom experience.
- Expand Yamaha's reach by enabling customers to explore products remotely.

5.5.2 Data-Driven Insights

- Collect user interaction data to help Yamaha understand customer preferences.
- Use insights to refine marketing strategies and product presentations.

CHAPTER-6

SYSTEM DESIGN & IMPLEMENTATION

6.1 System Architecture Design

The system architecture is designed to ensure seamless integration of AR functionalities with user interaction components and external data sources, following a modular approach. It combines AR Core, Vuforia, and Unity for robust performance. The architecture includes several layers, starting with the **User Interface (UI)**, which provides an intuitive and responsive design for easy navigation, customization, and interaction with the Yamaha bikes. The **AR Rendering Engine** utilizes Unity for 3D modeling and rendering, AR Core for accurate object placement, and Vuforia for object tracking and environmental understanding. The **Data Management Layer** handles communication with external sources to retrieve product data, ensuring real-time access to information and bike configurations. The **Interaction Module** supports user gestures like pinch-to-zoom and drag-to-rotate, as well as voice commands, allowing for a dynamic and engaging experience. Additionally, the **Customization Engine** enables users to modify the bike's appearance, such as changing colors and accessories, while dynamically updating the 3D model. Finally, the **Integration Layer** ensures seamless communication with external services, such as payment gateways and user accounts, to extend the app's functionality. This modular design promotes scalability, performance, and maintainability, ensuring a smooth and interactive experience for the user.

6.1.1 Key Components of the Architecture

- **AR Core Integration:** Handles motion tracking and environment mapping for AR object placement.
- **Vuforia Integration:** Facilitates QR code recognition and precise placement of Yamaha bike models.
- **Unity 3D Engine:** Develops high-quality 3D bike models and integrates them with AR Core and Vuforia.
- **Kotlin Framework:** Manages the app's UI/UX, enabling smooth navigation and user interactions.

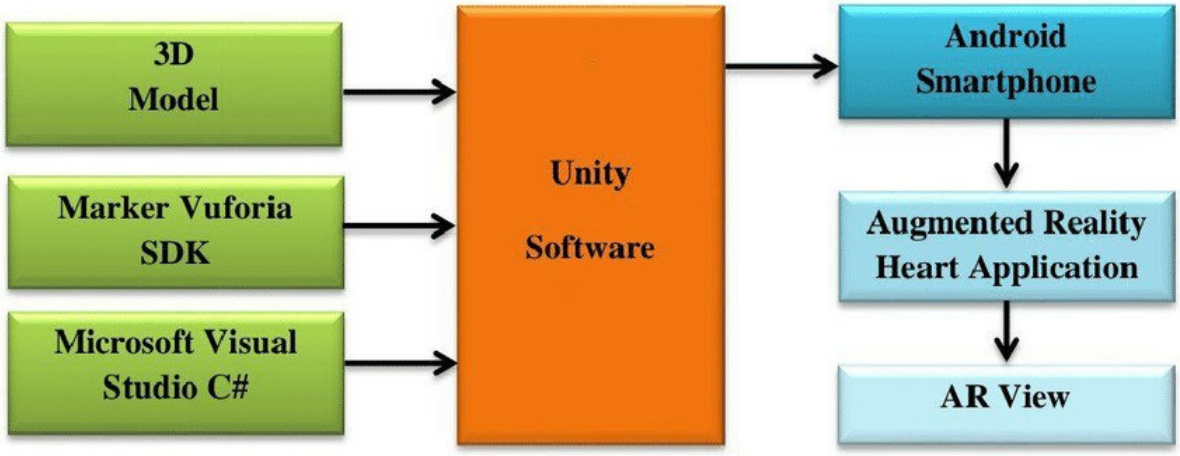

Figure 6.1 Flow of data and interaction b/w vufoira, unity and the app's frontend and backend

6.1.2 Data Flow and Interaction

- **Input Layer:** Receives user inputs like gestures and QR code scans.
- **Processing Layer:** Combines AR Core's motion tracking and Vuforia's object tracking to generate AR scenes.
- **Output Layer:** Displays the AR-enhanced Yamaha bike models and overlays additional features like customization options.

6.2 Application Development Workflow

The development process involves integrating various AR technologies, optimizing performance, and building a user-friendly interface. The workflow is divided into several key stages to ensure a streamlined approach to application creation and deployment. Initially, the **planning and requirements gathering** phase focuses on understanding user needs, defining app functionalities, and selecting the appropriate AR tools, such as AR Core, Vuforia, and Unity, based on project goals. The next stage, **design and prototyping**, involves creating wireframes, UI mockups, and AR flow diagrams to visualize the user experience and define key interactions. During the **development phase**, the app's core functionality is built, integrating AR features like object recognition, real-time rendering, and customization options for the Yamaha bikes. This stage also includes performance optimization to ensure smooth rendering and fast response times. The **testing and iteration** phase focuses on identifying bugs, ensuring that AR features are accurately tracked, and validating the app's compatibility across multiple devices and platforms. After testing, the **deployment** phase involves preparing

the app for distribution through the respective app stores, ensuring it meets platform guidelines and performance standards. Finally, the **maintenance and updates** phase ensures the app remains functional by addressing user feedback, providing regular updates, and incorporating new features to enhance the overall experience. Each stage is crucial for delivering a high-quality, interactive AR experience that meets both user expectations and technical standards.

6.2.1 Development Phases

- **Requirement Analysis:** Define key functionalities like QR code tracking, AR visualization, and gesture controls.
- **Design and Prototyping:** Create wireframes for the user interface and mockups for 3D bike models.
- **Implementation:** Develop the application using Kotlin, integrate ARCore and Vuforia, and import 3D models from Unity.
- **Testing and Debugging:** Conduct rigorous testing to identify and fix performance issues and ensure compatibility.

6.2.2 Tools and Frameworks

- **Android Studio:** Primary development environment for coding, debugging, and building the application.
- **Vuforia SDK:** Used for QR code recognition and AR object tracking.
- **Unity 3D:** Builds and optimizes interactive 3D models for integration with AR functionalities.

6.3 Implementation Details

The implementation process focuses on creating a responsive, high-performance application that provides an immersive experience.

6.3.1 AR Core and Vuforia Integration

- Combine AR Core for environment mapping and Vuforia for QR code-based model placement.
- Ensure precise synchronization between AR Core's spatial mapping and Vuforia's object tracking.

6.3.2 Gesture Controls and Interaction Features

- Implement gesture controls, including pinch-to-zoom, rotate, and swipe, for dynamic interaction with 3D models.
- Add hotspots on bike models to display additional details like engine specifications and safety features.

6.3.3 WebView Integration

- Use WebView to display Yamaha's official website within the app.
- Provide direct links to specifications, pricing, and promotional offers, ensuring a cohesive user experience.

6.4 Performance Optimization

To maintain high-quality visuals and responsiveness, the system employs advanced optimization techniques.

6.4.1 Cloud Rendering

- Offload computationally heavy rendering tasks to cloud servers for enhanced performance.
- Reduce device dependency, enabling smooth functionality even on mid-range Android devices.

6.4.2 Resource Management

- Optimize 3D models to balance visual fidelity and performance.
- Implement caching techniques to reduce loading times and memory usage.

6.5 Testing and Deployment

Thorough testing is conducted to ensure the application meets performance, compatibility, and usability requirements.

6.5.1 Testing Approach

- Test AR functionality across multiple devices with varying hardware configurations.
- Validate QR code recognition accuracy and AR object alignment.
- Evaluate the responsiveness and usability of gesture controls and WebView integration.

6.5.2 Deployment Plan

- Deploy the application on Google Play Store for easy accessibility.
- Provide regular updates based on user feedback and technological advancements in AR.

CHAPTER-7

TIMELINE FOR EXECUTION OF PROJECT

(GANTT CHART)

Task	Duration
Project Planning and Requirements	1 Week
Technology Stack Setup (Vuforia, Unity, iOS/Android)	1 Week
3D Model Creation using Vuforia Object Scanner	3 Weeks
Frontend Development (Vuforia + Unity)	2 Weeks
Backend Development (Vuforia Cloud Recognition, Google Poly API)	2 Weeks
Feature Overlay Development (Augmented Reality)	2 Weeks
Integration with Vuforia Object Recognition	2 Weeks
Testing & Bug Fixing	2 Weeks
Final Review & Updates	1 Week
Final Presentation & Submission	1 Week

Table 7.1 Timeline of project

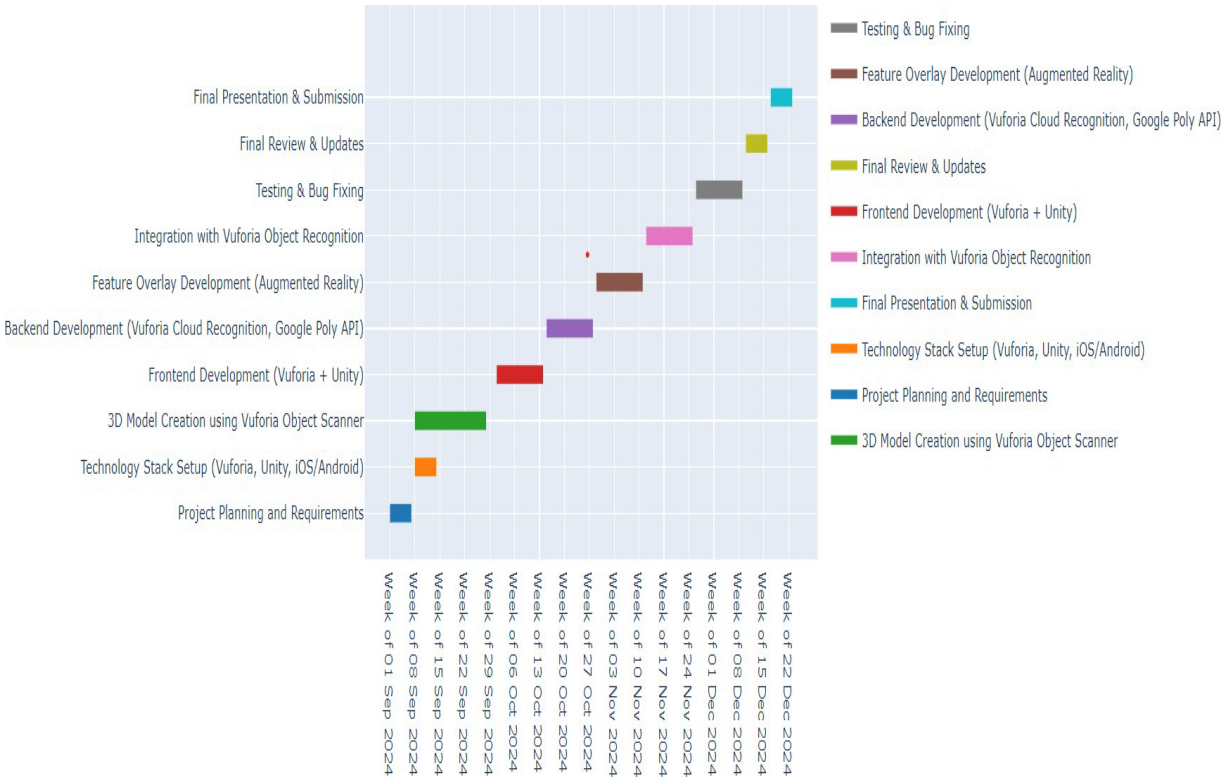

Figure7.1 Gantt chart of project

CHAPTER-8
OUTCOMES

8.1 Enhanced User Engagement through AR Technology

The mobile application will enable users to interact with 3D models of Yamaha bikes using Augmented Reality. This immersive experience, powered by Google AR Core and Vuforia, will allow users to view Yamaha bikes in their real-world environment through their smartphones. By providing a hands-on, interactive platform, the app will significantly enhance user engagement, making the exploration of Yamaha bikes more dynamic and visually appealing.

8.1.1 Features of Enhanced User Engagement:

- AR Core and Vuforia will enable realistic 3D model placement in real-world environments.
- Users can explore different bike models and configurations.
- The application will provide an intuitive user interface for easy interaction with the 3D models.

8.2 Seamless Integration with Yamaha's Product Information

The application will feature seamless integration with Yamaha's official website using WebView. This will allow users to access detailed product information in real time, including specifications, pricing, and available options. By bridging the gap between the AR experience and product details, the app will offer a comprehensive platform for customers to explore and learn about Yamaha bikes. The WebView integration will enable users to navigate through Yamaha's official site without leaving the app, providing a consistent and smooth browsing experience. This will facilitate easy access to additional resources such as customer reviews, bike comparisons, and promotional offers, making the app a one-stop solution for potential buyers. Furthermore, by synchronizing the AR experience with the website, users can instantly view the most up-to-date information about bike models, configurations, and pricing, ensuring they have the most relevant and accurate details while interacting with the 3D models. This integration enhances the user experience, empowering customers to make informed decisions while enjoying an

immersive and interactive exploration of Yamaha bikes.

8.2.1 Features of Product Information Integration:

- Users can directly access detailed product descriptions and specifications.
- WebView will allow seamless navigation of Yamaha's official website.
- Real-time updates on product availability and pricing.

8.3 Cost-effective Digital Showroom Experience

This app will provide Yamaha with a cost-effective alternative to traditional showrooms. By allowing users to interact with bike models virtually through their smartphones, Yamaha can reduce the need for physical showrooms and extend their reach to potential customers across a broader geographic area. The app will serve as a digital showroom, bringing the showroom experience to users' fingertips, regardless of location.

8.3.1 Benefits of a Digital Showroom Experience:

- No need for users to visit physical dealerships.
- Expansion of customer reach to areas without physical showrooms.
- Reduction in the cost of maintaining multiple showrooms.

8.4 Improved Marketing and Brand Engagement

With the integration of cutting-edge AR technology, this app will offer Yamaha an innovative way to engage customers and enhance its brand presence. The interactive nature of the app will provide a fresh, unique marketing tool that distinguishes Yamaha from its competitors in the automotive sector. This will lead to improved customer satisfaction and loyalty, as well as increased brand awareness.

8.4.1 Marketing and Brand Engagement Features:

- AR interaction will create a memorable experience for customers.
- The app will allow for deeper engagement with Yamaha's product line up.
- Innovative marketing approach will set Yamaha apart from competitors.

8.5 Scalable and High-performance AR Application

The application will be designed with scalability in mind, allowing future updates and additional bike models to be added easily. The use of cloud rendering and gesture controls ensures that the app performs well across various Android devices, delivering a high-quality user experience. This scalable solution ensures that the app remains relevant and efficient as Yamaha continues to expand its product line.

8.5.1 Features of Scalable and High-performance Application:

- Cloud rendering ensures optimal performance across devices.
- Gesture control enhances user interaction with 3D models.
- The app is designed to scale with future updates and new models.

CHAPTER-9
RESULTS AND DISCUSSIONS

9.1 User Engagement and Interaction through AR Technology

The incorporation of Augmented Reality (AR) significantly boosted user engagement. Users could interact with 3D models of Yamaha bikes in real-world settings, leading to increased exploration of bike features. Feedback from testing showed that users found the AR feature easy to use, with accurate placement of the models, creating a more engaging and enjoyable experience. The ability to visualize bikes in their environment allowed users to assess the bike's fit and style, leading to higher levels of confidence in their decisions. Additionally, the customization options provided in AR, such as altering colors and accessories, further enhanced the interactive experience, making it more personalized. Users reported a deeper connection with the product, as the AR feature allowed them to experience the bike in a way that traditional images and videos could not. The intuitive controls, such as pinch-to-zoom and drag-to-rotate, made the interaction fluid and effortless, ensuring that the experience remained engaging throughout. As a result, the AR functionality not only enhanced user satisfaction but also contributed to a more informed and confident purchase decision-making process.

9.1.1 Key Findings:

- High interaction levels with the AR models.
- Positive feedback on ease of use and navigation.
- Increased user interest in Yamaha bikes after the AR experience.

9.2 Seamless Integration of Product Information

Integrating WebView for direct access to product details from Yamaha's website enhanced the app's usefulness. Users appreciated the smooth transition from the AR experience to detailed product specifications, allowing them to make informed decisions. The seamless flow between the two features provided a more comprehensive experience.

9.2.1 Key Findings:

- Helpful integration of detailed product information.
- Smooth transition between AR and product details.

- Increased confidence in purchasing decisions.

9.3 Performance and Scalability

The app performed well across various Android devices, thanks to cloud rendering. Testing showed that the app delivered smooth performance even on lower-spec devices, ensuring a wide accessibility range for users. By offloading the heavy rendering tasks to the cloud, the app minimized the processing demands on the device, allowing for seamless interactions with the AR models without compromising quality or speed. Additionally, the app was scalable, with the ability to incorporate new bike models and features without significant restructuring. This flexibility allows for easy updates and the addition of new content, ensuring the app remains relevant and up-to-date as Yamaha introduces new products. The cloud-based architecture also supports future enhancements, such as the integration of more advanced AR capabilities or the inclusion of additional customization options, without affecting the app's performance or user experience. This scalability ensures that the app can grow alongside the brand and continue to provide users with an engaging, feature-rich experience over time.

9.3.1 Key Findings:

- Smooth performance on a wide range of devices.
- Optimized performance through cloud rendering.
- Easy scalability for adding future bike models.

9.4 Cost-effectiveness and Digital Showroom Benefits

The app serves as a cost-effective solution, reducing the need for physical showrooms in areas with limited access. Testing revealed that users in remote locations appreciated the digital showroom experience. This approach allows Yamaha to extend its reach while lowering costs associated with maintaining physical dealerships.

9.4.1 Key Findings:

- Cost-effective compared to physical showrooms.
- Increased reach to customers in remote areas.
- Positive feedback from users in regions with limited access to Yamaha dealerships.

9.5 Marketing and Brand Engagement Outcomes

The app has enhanced Yamaha's marketing efforts by offering a modern, engaging experience that sets the brand apart. The AR feature has improved brand awareness and loyalty, with users expressing interest in exploring other Yamaha products after their interaction with the app.

9.5.1 Key Findings:

- Improved brand visibility and differentiation.
- Positive user perceptions of Yamaha.
- Increased interest in Yamaha’s broader product range.

CHAPTER-10
CONCLUSION

10.1 Overview of the Project Outcome

The development of the cross-platform mobile application for Yamaha bikes has successfully integrated Augmented Reality (AR) technology, gesture controls, and cloud rendering to enhance user interaction. This application allows users to experience Yamaha bikes in a virtual environment, providing a highly engaging and interactive experience that goes beyond traditional product displays. Through the integration of Google AR Core, Vuforia, and Unity, the app provides realistic 3D models of bikes in real-world settings, making it easier for users to explore different bike features and configurations. The application also supports real-time customization, enabling users to modify elements such as colors, accessories, and components, giving them a personalized and dynamic experience. Gesture controls, such as swipe and pinch-to-zoom, along with voice commands, allow for smooth interaction with the 3D models, ensuring that users can engage with the bikes in an intuitive and user-friendly manner. Cloud rendering optimizes performance across a range of devices, providing smooth, lag-free AR experiences even on lower-spec smartphones. This integration of advanced technologies creates a compelling and immersive platform, offering Yamaha customers a convenient and efficient way to explore bike options, customize features, and make informed purchase decisions, all from the comfort of their own space.

10.1.1 Key Outcomes:

- Enhanced user engagement through AR-based visualization of bikes.
- Real-time access to product information from Yamaha's official website.
- Efficient app performance across a variety of Android devices.

10.2 Technological Innovations and Their Impact

The application leverages several cutting-edge technologies, including AR Core for motion tracking, Vuforia for QR code recognition, and Unity for 3D model integration. These technologies provide users with an immersive experience by enabling them to view and interact with Yamaha bikes as if they were physically present. The integration of WebView ensures that users can easily access additional product information, specifications, and pricing without leaving the app, streamlining the decision-making process.

10.2.1 Impact of Technologies:

- AR technology offers a new, engaging way to explore Yamaha's bike models.
- Real-time integration with Yamaha's website enhances the user's experience and aids in making informed decisions.
- Cloud rendering ensures optimal performance, improving scalability for future updates.

10.3 Cost-effectiveness and Digital Showroom Advantages

One of the most significant advantages of this mobile application is its cost-effectiveness. The app serves as a digital showroom, eliminating the need for physical showrooms in remote or underserved regions. Users can interact with the products virtually, reducing the overhead costs associated with maintaining multiple physical locations. This digital approach also allows Yamaha to expand its market reach without the need for significant investments in additional infrastructure. By offering an immersive AR experience that replicates the in-store experience, the app enables potential customers to explore Yamaha bikes from anywhere, at any time, without the constraints of geographical location or store hours. Additionally, the app can be easily updated with new models, features, and promotional content, further reducing the cost of physical marketing materials and ensuring that the latest offerings are always accessible to users. This cost-effective solution not only benefits Yamaha by lowering operational expenses but also makes it easier for customers to explore and purchase Yamaha bikes, enhancing overall customer satisfaction and brand loyalty.

10.3.1 Benefits of a Digital Showroom:

- Cost savings by reducing the need for physical dealerships.
- Expansion of customer reach, particularly in areas without physical showrooms.
- A modern alternative to traditional showroom experiences, accessible at any time.

10.4 Marketing and Brand Engagement

The app's innovative use of AR technology has positioned Yamaha as a leader in digital marketing within the automotive sector. By offering an interactive and immersive experience, Yamaha is able to differentiate itself from competitors and engage with customers in a novel way. The app's ability to deliver a unique experience, combined with easy access to detailed product information, fosters brand loyalty and increases customer satisfaction.

10.4.1 Key Marketing Benefits:

- Innovative AR features enhance brand visibility and differentiation.
- Interactive experience increases customer engagement and brand loyalty.
- Positive brand perception through the use of cutting-edge technology.

10.5 Future Potential and Scalability

The application is designed to be scalable, allowing for the addition of new Yamaha bike models and features without major updates to the underlying architecture. This scalability ensures that the app can continue to evolve alongside Yamaha's product offerings, staying relevant and engaging over time. Additionally, the app can be adapted to future technological advancements, further enhancing the user experience. As Yamaha introduces new bike models or variations, the app can seamlessly integrate these updates, ensuring that users have access to the latest options and configurations. Moreover, the app's modular structure allows for easy incorporation of advanced AR features, such as improved object recognition, enhanced 3D modeling, or new user interaction capabilities like eye-tracking or more immersive VR options. This forward-thinking design ensures that the app will remain functional and innovative, providing users with an evolving platform that continues to meet their needs as technology and product offerings progress. Furthermore, scalability ensures that the app can handle increased user demand and accommodate expansion into new markets or regions, positioning Yamaha to stay competitive in a rapidly changing digital landscape.

10.5.1 Future Opportunities:

- Easy integration of future bike models and product updates.
- Potential to incorporate advanced features such as AI-driven customization.
- Ability to adapt to new AR technologies, ensuring long-term relevance.

10.6 Conclusion

In conclusion, the mobile application for Yamaha bikes has successfully merged Augmented Reality with traditional product marketing, offering an engaging and cost-effective solution for customer interaction. The app not only provides users with an immersive experience but also serves as a powerful tool for Yamaha to extend its market reach, reduce costs, and enhance brand engagement.

Well-positioned to grow alongside Yamaha's future innovations, continuing to offer a seamless and dynamic user experience.

REFERENCES

[1]. Linowes, J., & Babilinski, K. (2017). Augmented reality for developers: Build practical augmented reality applications with unity, ARCore, ARKit, and Vuforia. Packt Publishing Ltd.
Available at: https://www.scirp.org/reference/referencespapers?referenceid=3404098

[2]. Urbas, U., & Vukašinović, N. (2019). Displaying product manufacturing information in augmented reality for inspection. Procedia CIRP, 81, 832-837.
Available at: https://www.sciencedirect.com/science/article/pii/S221282711930513X

[3]. Harish, R., Vollala, A., & Saheb, S. H. (2023). Augmented Reality Applications in Gaming. Metaverse and Immersive Technologies: An Introduction to Industrial, Business and Social Applications, 325-348.
Available at: https://doi.org/10.1002/9781394177165.ch12

[4]. Kourakis, A., Smith, G., & Papas, V. (2021). Hybrid AR Systems for Improved Object Tracking and Visualization in Automotive Design. Computing and Visualization in Science.
Available at:
https://www.researchgate.net/publication/318043159_Augmented_Visualization_of_Modeling_Simulation_Analysis_Results

[5]. Guimarães, M. D. (2020). Exploring Augmented Reality for the Automotive Retail Industry. (Master's thesis, Universidade do Porto).
Available at: https://repositorio-aberto.up.pt/bitstream/10216/130297/2/430737.pdf

[6]. Wieczorek, B. (2018). The application of augmented reality to enhance the communicativeness of a user interface: Case: The vehicle terminal.
Available at: https://ceur-ws.org/Vol-2898/paper06.pdf

[7]. Vakaliuk, T. A., & Pochtoviuk, S. I. (2021, July). Analysis of tools for the development of augmented reality technologies. CEUR Workshop Proceedings. Available here

[8]. Grahn, I. (2017). The vuforia sdk and unity3d game engine: Evaluating performance on android devices.
Available at: https://liu.diva-portal.org/smash/get/diva2:1127482/FULLTEXT01.pdf

[9]. Gallardo, C., Rodríguez, S. P., Chango, I. E., Quevedo, W. X., Santana, J., Acosta, A. G., ... & Andaluz, V. H. (2018). Augmented reality as a new marketing strategy. In Augmented Reality, Virtual Reality, and Computer Graphics: 5th International Conference, AVR 2018, Otranto, Italy, June 24–27, 2018, Proceedings, Part I, 351-362. Springer International Publishing.
Available Here: https://www.researchgate.net/publication/326371346_Augmented_Reality_as_a_New_Marketing_Strategy

[10]. Boboc, R. G., Gîrbacia, F., & Butilă, E. V. (2020). The application of augmented reality in the automotive industry: A systematic literature review. Applied Sciences, 10(12), 4259.
Available Here: https://www.mdpi.com/2076-3417/10/12/4259

APPENDIX-A

PSUEDOCODE

MainActivity.kt

START

1. Initialize activity and UI components.

2. Set up click listeners for:

- **Catalog Button:**

Call openCatalog() to navigate to CatalogViewAcrivity.

- **Web Page FAB:**

Call openWebView() with the GitHub project URL.

- **Unity App Button:**

Call isAppInstalled() to check app installation.

IF Unity AR app is installed:

Launch the app using PackageManager.

ELSE:

Show a Toast prompting the user to install the app.

3. Define openCatalog():

- Navigate to CatalogViewAcrivity and pass a default product name.

4. Define openWebView(url):

- Navigate to WebViewActivity with URL as an intent extra.

5. Define isAppInstalled(packageName):

- Check if the app is installed using PackageManager.

- Return `true` if installed; otherwise, handle exceptions and return `false`.

END

ARViewActivity.kt

START

1. Initialize variables and set up layout.

2.Retrieve product name from intent:

IF product name is provided:

Assign corresponding model and call openAR().

ELSE:

Load default model using openAR().

3. Set up Floating Action Buttons:

- FAB for opening WebView:

Map product name to URL.

Call openWebView(url).

- FAB for showing product details:

Map product name to details.

Show a custom toast message.

4. Define openAR(product):

- Map product to 3D model file.

- Initialize sceneView and placeButton.

- On placeButton click:

Anchor AR model and hide plane renderer.

- Add model node to scene.

5. Define openWebView(url):

- Start new activity with URL as an extra.

6. Define custom toast logic:

- Map product name to detailed specifications.

- Inflate toast layout and show.

END

CatalogViewActivity.kt

START

1. Initialize variables and set up layout.

2. Set up Floating Action Buttons:

- FAB for opening web page:

Call openWebView() with Yamaha's website URL.

- FAB for launching Unity AR App:

IF Unity app is installed:

Launch app using PackageManager.

ELSE:

Show a Toast message prompting installation.

3. Set up ImageViews for products:

- Map each ImageView to a product name (e.g., Bike01, Scooter02).

- On click, call openARView() with the mapped product name.

4. Define openWebView(url):

- Start WebViewActivity with URL passed as intent extra.

5. Define openARView(clickedButton):

- Start ARViewActivity with product name passed as intent extra.

6. Define isAppInstalled(packageName):

- Check if app is installed using PackageManager.

- Return true if found; otherwise, return false.

END

WebViewActivity.kt

START

1. Load `activity_web_view` layout.

2. Initialize the `WebView` component.

3. Retrieve the URL from the `Intent` extra ("URL").

4. Check if URL is not null:

- IF valid URL:

Load the URL in the WebView using `webView.loadUrl(url)`.

- ELSE:

Display a Toast message: "No web url available."

END

APPENDIX-B

SCREENSHOTS

Figure A.B.1. Splash screen

Figure A.B.2 Main Activity

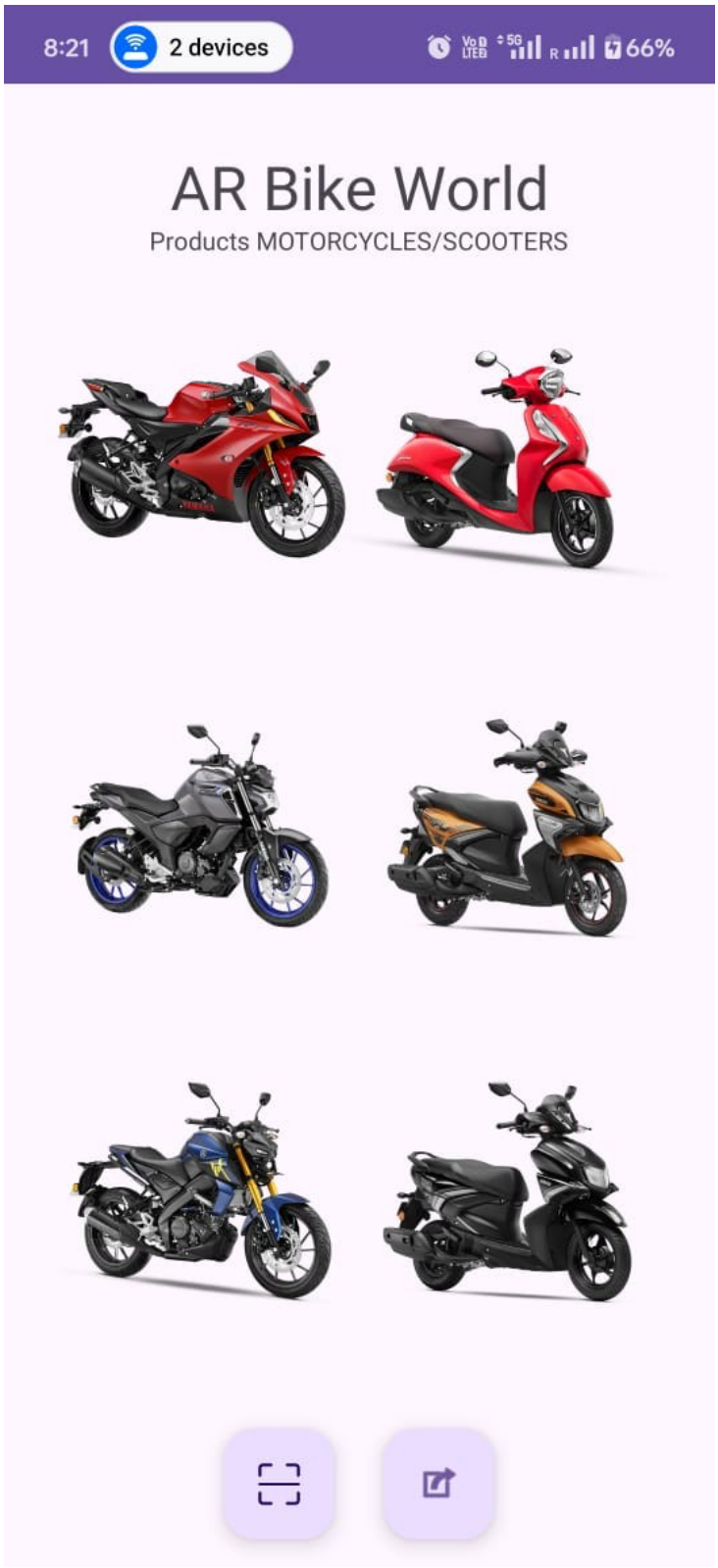

Figure A.B.3 Catalouge View

Figure A.B.4 Relative Bike Model

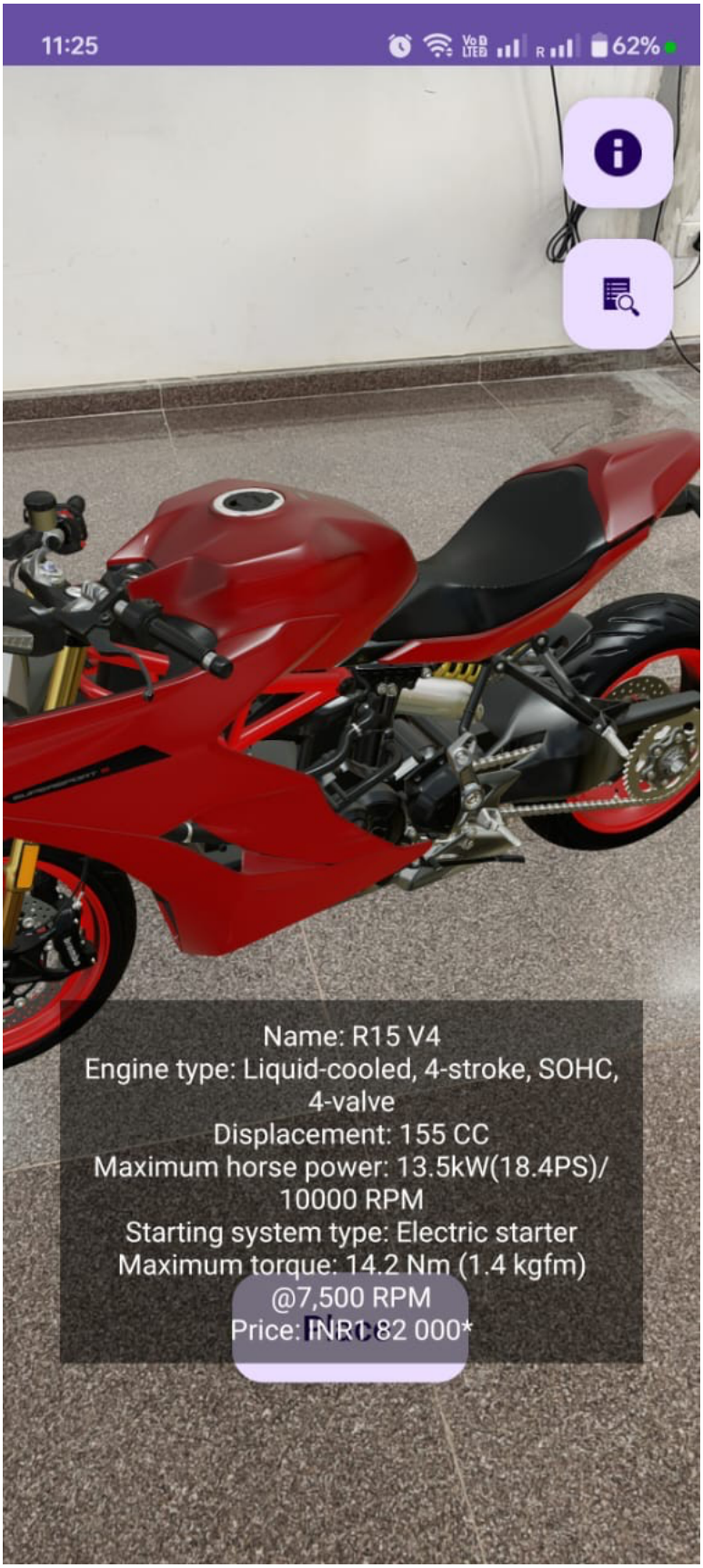

Figure A.B.5 Bike Model with description

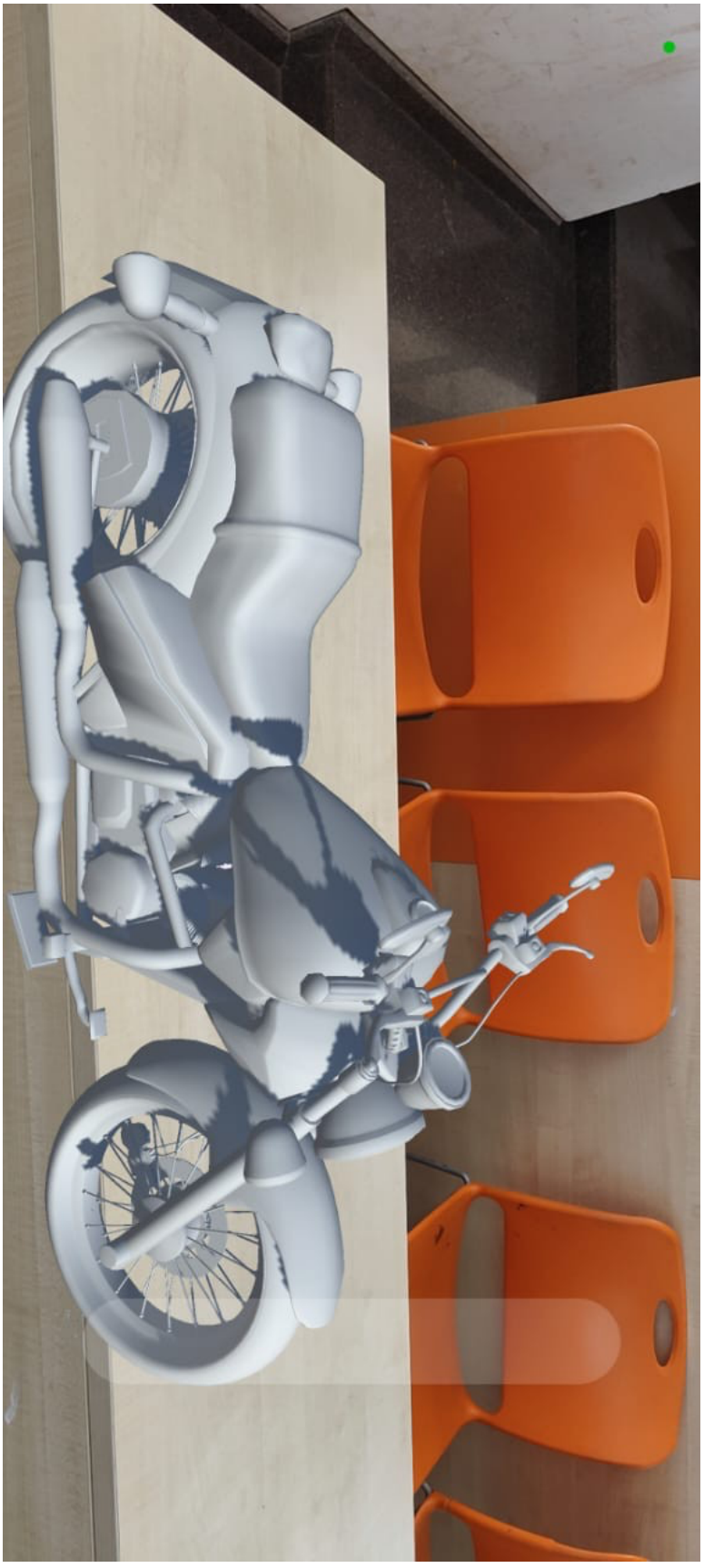

Figure A.B.6 Bike Mode with QRl

APPENDIX-C

ENCLOSURES

1. Journal publication certificates of all students.

ISSN: 2582-3930

ACCEPTANCE CERTIFICATE

Impact Factor: 8.448
DOI Prefix: 10.55041

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has been ACCEPTED for publication in

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VOLUME 09 ISSUE 01 JANUARY - 2025

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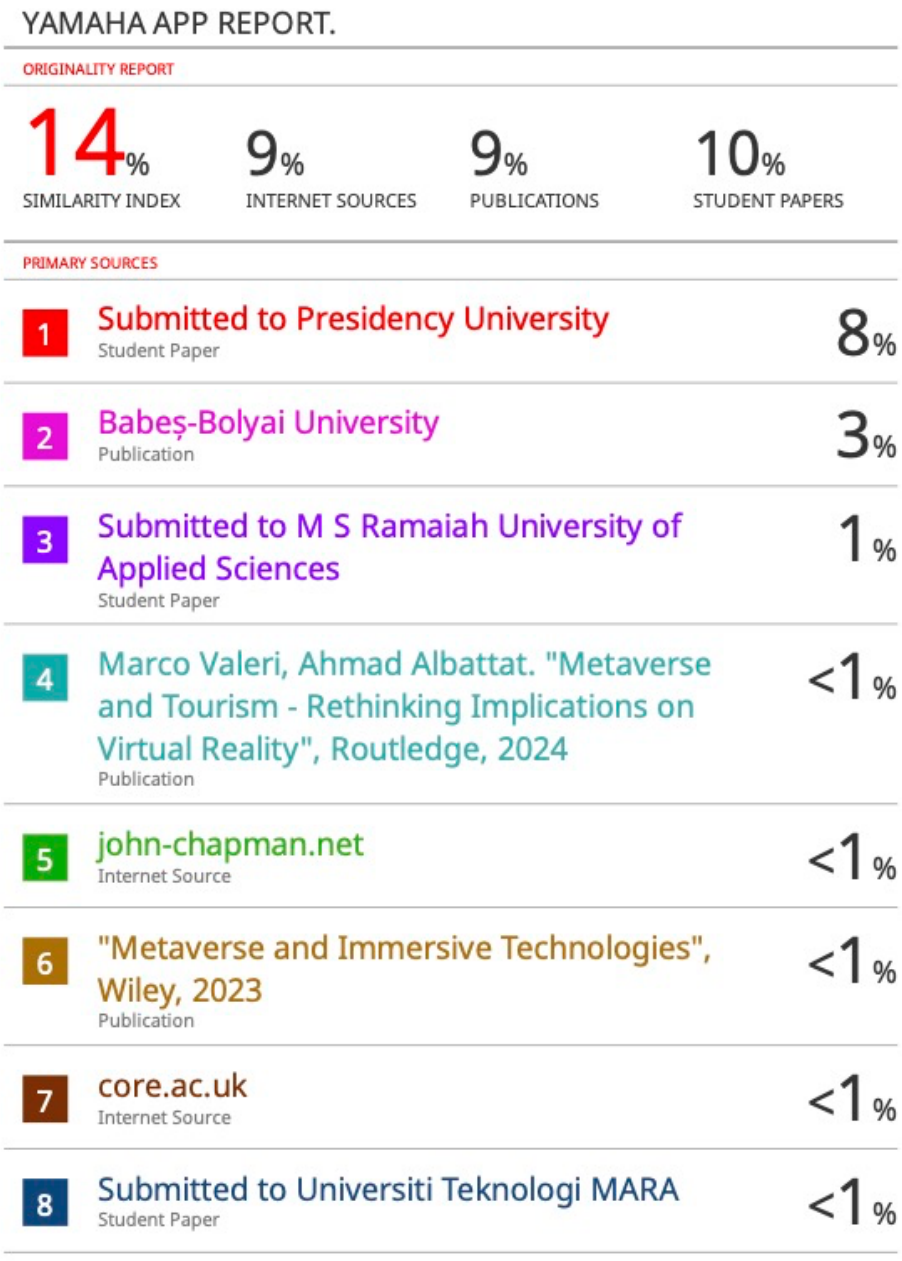

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Figure A.C.2 Plagiarism Report

3. Details of mapping the project with the Sustainable Development Goals (SDGs).

Figure A.C.3 SDG mapping

SDG 8 - Decent Work and Economic Growth: The app boosts economic growth by enhancing customer engagement and creating new opportunities for Yamaha's digital sales.

SDG 9 - Industry, Innovation, and Infrastructure: The use of AR technology fosters innovation within the automotive industry.

SDG 11 - Sustainable Cities and Communities: By reducing the need for physical showrooms, the project contributes to more sustainable business practices and urban development.

SDG 12 - Responsible Consumption and Production: The app promotes responsible consumption by minimizing the carbon footprint of physical infrastructure and utilizing digital resources efficiently.