

# Interactive Augmented Reality Game Development Using Lens Studio

Tewani Bhavin Vasudev

Department of Computer Science Engineering

Guide: Shivangi Valand | Industry Mentor: Urjit Dave

## Abstract

Augmented Reality (AR) has rapidly become an important part of modern digital applications by combining virtual elements with the real-world environment to create interactive and immersive experiences. AR is widely used in gaming, education, shopping, and social media because it increases user engagement and improves real-time interaction. This research paper focuses on the development of interactive AR games using Lens Studio, a professional platform developed by Snap Inc. for creating AR lenses and camera-based experiences. The project includes the creation of several AR games such as Knife Hit Game, Dart Throw Game, Head Quiz Game, and Garment Changing AR system. These applications use advanced features like face tracking, image tracking, object collision, score calculation, animation control, and physics simulation to provide smooth and engaging gameplay. JavaScript scripting and 3D asset integration were used to manage game logic, user interaction, and visual effects. The development process also included testing, debugging, and optimization to improve overall performance on mobile devices. The results show that AR games developed using Lens Studio offer highly engaging user experiences and demonstrate strong potential for future applications in entertainment, education, and virtual shopping systems.

**Keywords** — Augmented Reality, Lens Studio, Snap AR, Face Tracking, Image Tracking, Interactive Gaming, AR Development, Real-Time Interaction.

## I. INTRODUCTION

Augmented Reality (AR) is a modern technology that combines virtual objects with the real-world environment to create interactive and immersive user experiences. It is widely used in gaming, education, retail, and social media because it allows users to interact with digital content in real time. AR has become highly popular due to the increasing use of smartphones and camera-based applications.

Lens Studio, developed by Snap Inc., provides a powerful platform for creating AR games and experiences using features such as face tracking, image tracking, object interaction, and physics simulation. Unlike traditional mobile games, AR games offer more engaging gameplay by allowing users to interact physically with virtual objects through camera-based environments.

This research focuses on developing interactive AR games such as Knife Hit Game, Dart Throw Game, Head Quiz Game, and Garment Changing AR experience using Lens Studio. The main objective is to improve user engagement, create immersive gameplay, and demonstrate the practical use of AR technology in entertainment, education, and digital applications.

The system integrates concepts from several computer science domains:

- Augmented Reality (AR)
- Computer Vision
- Real-Time Interaction Systems
- JavaScript - Based Game Development

The main objective of this research is to design, develop, and evaluate AR-based interactive games that improve user engagement, provide immersive gameplay experiences, and demonstrate the practical applications of AR technology in entertainment, education, and digital commerce.

## II. LITERATURE REVIEW

The concept of Augmented Reality (AR) applications has developed rapidly over the past few years. Earlier AR systems were mainly used in industrial training, medical simulations, and military applications, but recent research has

focused on its growing importance in gaming, education, retail, and social media platforms. AR allows digital objects to be placed in real-world environments, creating more interactive and immersive user experiences [1].

Studies on AR-based gaming show that real-time interaction improves user engagement and makes gameplay more effective compared to traditional mobile games. Features such as face tracking, image tracking, object collision, and motion-based controls increase user participation and provide a more realistic experience. Research also suggests that users prefer AR applications because they create natural interaction through camera-based environments and physical movement [2].

Development platforms such as Lens Studio and Unity have simplified the process of building AR applications by providing tools for object spawning, physics simulation, animation control, and real-time scripting [3]. These platforms help developers create mobile-friendly AR experiences with better performance and smoother interaction.

Recent studies also focus on performance optimization in AR systems, including reducing lag, improving tracking accuracy, and maintaining stable functionality across smartphones. Proper testing, debugging, and scene optimization are necessary to ensure smooth execution of AR applications. This research builds upon these concepts by developing interactive AR games such as Knife Hit Game, Dart Throw Game, Head Quiz Game, and Garment Changing AR experience using Lens Studio, combining immersive gameplay with practical AR implementation.

### III. METHODOLOGY

The development of interactive AR games was done using a simple and step-by-step process that included planning, designing, scripting, testing, and improving the final output. The main goal of the project was to create engaging AR-based games such as Knife Hit Game, Dart Throw Game, Head Quiz Game, and Garment Changing AR experience using Lens Studio. Each game was designed to provide real-time interaction and better user experience through camera-based gameplay.

#### A. Application Architecture

The system was developed using different working layers:

- User Interface Layer — Score display, buttons, game instructions, and restart options
- Interaction Layer — Face tracking, image tracking, touch input, and object collision
- Logic Layer — JavaScript scripting, score calculation, game rules, and physics effects
- Asset Layer — 3D objects, animations, sounds, and image markers

Lens Studio was used as the main platform for building the games and managing all AR features. JavaScript was used for scripting game logic such as object movement, score updates, collision detection, and game events. Different 3D assets and animations were added to make the games more interactive and visually attractive.

#### B. Development Process

The project was developed one module at a time. First, the basic AR scene and tracking system were created. After that, gameplay features like object throwing, score counting, collision detection, and user controls were added. Then, user interface elements such as score text, game over screens, and restart buttons were implemented. Finally, testing and debugging were performed to remove errors and improve game performance so that the applications could run smoothly on mobile devices.

### IV. SYSTEM ARCHITECTURE

The AR game system is made of different modules that work together to create smooth and interactive gameplay. The games were developed using Lens Studio, where users can interact with virtual objects using the mobile camera. Features like face tracking, image tracking, object movement, and score calculation help make the games more interesting and realistic.

#### A. User Interface Module

This module shows the score, game instructions, restart button, final result screen, and other controls needed during gameplay. It helps the user understand the game easily and improves the overall playing experience.

#### B. Game Logic Module

This part controls the main working of the game such as object throwing, dart movement, knife hit actions, score counting, collision detection, and game over conditions. JavaScript is used to manage all these game functions.



Fig . 1 : Ball Game



Fig . 2 : Dart Throw



Fig . 3 : Knife Hitting

### C. Asset Management Module

This module manages all 3D objects, animations, sound effects, and image markers used in the games. It helps in making the game look attractive and ensures smooth loading of all visual elements.

### D. Tracking and Interaction Module

This part handles face tracking, image tracking, touch input, and object collision. It allows users to control the game using camera movements and real-world interaction, making the gameplay more engaging.

### E. Performance Optimization Module

This module is used for testing and fixing errors in the game. It helps improve speed, reduce lag, and make sure the game runs smoothly on different mobile devices.

## V. GAME CONTROL AND INTERACTION SYSTEM

The main feature of the AR games is the control and interaction system, which allows users to play the game using real-time movements and camera-based actions instead of only touch controls. This makes the gameplay more interactive and enjoyable..

### A. System Design

The game uses different control methods such as:

- Face Tracking — used for controlling the Head Quiz Game through head movement
- Image Tracking — used for detecting the bullseye target in the Dart Throw Game
- Touch Input — used for throwing knives, darts, and selecting options
- Object Collision — used for detecting hits and updating scores

First, the system detects the user's face or image marker using Lens Studio features. After that, JavaScript controls the game actions like object movement, collision detection, and score counting based on the user's actions. This helps create smooth and interactive gameplay.

### B. Scoring and Game Response

The scoring system gives points when the player hits the target or performs the correct action. In the Dart Throw Game, hitting the bullseye increases the score. In the Knife Hit Game, successful knife hits increase points, but wrong hits can end the game. The system also shows the score, final result, and restart option to make the game easy to play and more engaging.

## VI. SYSTEM PERFORMANCE AND TESTING

Performance and testing are very important in AR game development because the game must run smoothly on mobile devices without lag or errors. Since AR games use camera tracking, object movement, and real-time interaction, proper testing is needed to give users a better gameplay experience.

### ***A. Game Performance***

The games were tested to make sure that object movement, face tracking, image tracking, and collision detection work properly. Features like knife throwing, dart hitting, score updates, and game controls were checked many times to ensure smooth gameplay. Performance optimization was also done by reducing unnecessary objects and improving scene management.

### ***B. Error Detection and Debugging***

During development, errors like wrong collision detection, score problems, tracking issues, and object spawning mistakes were found and fixed using JavaScript debugging and Lens Studio testing tools. This helped improve game performance and made the gameplay smoother and more stable.

### ***C. User Experience Improvement***

The user interface such as score display, final result screen, restart button, and game instructions were improved to make the game easy to understand and play. Smooth animations, proper object placement, and responsive controls were added to make the gameplay more interactive and enjoyable.

### ***D. Device Compatibility***

The games were tested on different mobile devices to make sure they work properly with different camera settings and screen sizes. This helped maintain stable performance and better AR tracking across multiple smartphones.

## **VII. USER INTERFACE AND ACCESSIBILITY**

A simple and clear user interface is important in AR games so that users can easily understand and enjoy the gameplay. The project was designed with user-friendly screens such as score display, game instructions, restart button, final result screen, and game over messages. This helps players understand the game without confusion.

The interface was created to work smoothly on mobile devices with proper button placement and easy controls. Text visibility, object size, and screen layout were adjusted so users can interact comfortably during gameplay. Clear score updates and quick response make the game more engaging and enjoyable.

The design also allows easy modification for future improvements such as adding new levels, new game modes, and extra visual effects without changing the main game logic. This makes the system flexible and easy to expand in the future.

## **VIII. GAME INTERACTION AND USER EXPERIENCE**

The AR games provide an interactive experience where users can play using camera movements, touch controls, and real-time object interaction. The system is designed to make gameplay simple, engaging, and easy to understand for all users.

### ***A. Game Interaction***

Users can interact with the game by throwing knives, aiming darts, moving their head for quiz control, and using image tracking for target detection. Features like face tracking, touch input, and object collision help create smooth gameplay and improve user involvement during the game.

### ***B. User Experience***

The game includes score updates, final result screens, restart buttons, and clear instructions to help users play without confusion. Smooth animations, proper sound effects, and responsive controls improve the overall experience and make the AR games more enjoyable and realistic for mobile users.

## **IX. RESULTS AND SYSTEM EVALUATION**

Testing of the AR game project showed that all main features worked correctly and provided smooth gameplay on mobile devices. The games such as Knife Hit Game, Dart Throw Game, Head Quiz Game, and Garment Changing AR experience performed successfully using face tracking, image tracking, touch input, and object collision features.

The scoring system, object movement, collision detection, and game controls worked properly during testing. Features like knife throwing, dart aiming, score updates, game over screens, and restart buttons responded correctly without major errors. Face tracking and image tracking also worked accurately, making the gameplay more interactive and realistic.

Performance testing showed that the games ran smoothly with good response speed and stable tracking on different smartphones. Users were able to understand the gameplay easily without extra instructions, which improved the overall user experience. The project proved that Lens Studio can be effectively used for developing interactive AR games with engaging real-time experiences.

## X. CONCLUSION

This paper presented the design and development of interactive Augmented Reality (AR) games using Lens Studio. The project included games such as Knife Hit Game, Dart Throw Game, Head Quiz Game, and Garment Changing AR experience using features like face tracking, image tracking, touch input, collision detection, and score management. These features helped create smooth, engaging, and real-time gameplay experiences for users.

The results showed that AR games provide better interaction and more immersive experiences compared to traditional mobile games. Performance testing confirmed that the games worked smoothly on mobile devices with stable tracking and responsive controls. The project also showed that Lens Studio is an effective platform for developing AR applications with strong potential in gaming, education, and digital entertainment.

The system can be further improved by adding new game levels, multiplayer features, better graphics, and advanced tracking systems. This research proves that AR technology has a strong future in creating interactive and user-friendly digital experiences.

## XI. FUTURE SCOPE

The AR game project can be improved further by adding more advanced features and better gameplay experiences. Future development can make the games more interactive, realistic, and useful for different applications.

- **Multiplayer Mode:** New multiplayer features can be added so that multiple users can play AR games together in real time.
- **Advanced Tracking:** Better face tracking, hand tracking, and body tracking can be added to improve accuracy and make gameplay more natural.
- **More Game Levels:** Additional levels, new challenges, and difficulty modes can be introduced to increase user interest and long-term engagement.
- **Better Graphics and Animation:** High-quality 3D models, smoother animations, and improved visual effects can make the games more attractive and realistic.
- **Educational and Shopping Applications:** AR technology can also be expanded for learning systems, virtual try-on features, and interactive educational games beyond entertainment purposes.

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