Project Report

AR Building Info APP: Mobile Augmented Reality Experience

Abstract:

This project delineates the development of a Mobile Augmented Reality (AR) Experience, focusing on seamlessly integrating virtual elements into real-world environments using smartphones or tablets. The project encompasses creating an AR application employing computer vision and real-time rendering techniques to overlay interactive digital content onto users' surroundings.

Key facets of the AR application include markerless tracking, object recognition, and spatial mapping, enabling user interaction with virtual elements within their physical space. Emphasizing usability, the application prioritizes intuitive navigation and manipulation of AR content.

The adaptable nature of the application caters to diverse sectors such as education, entertainment, tourism, and gaming. Its development adheres to user experience design principles to ensure an immersive and engaging AR encounter for users.

In summary, this Mobile AR Experience underscores the potential for augmented reality to enhance user interactions with their environment, showcasing its versatility across various industries and domains.

Introduction:

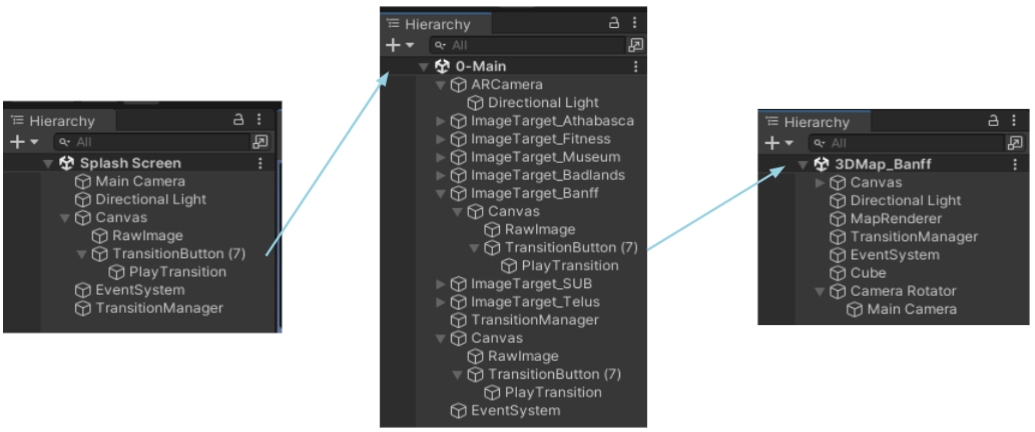
This application redefines how we interact with the architectural marvels that surround us. Our upcoming project is set to introduce an Augmented Reality (AR) app that transforms your smartphone into a portal of knowledge, seamlessly blending the digital and physical worlds. With a simple lift of your smartphone, the application allows you to unlock a wealth of information about the buildings that adorn the skyline. The vision driving our AR app—an immersive experience designed to provide users with real-time insights into the history, purpose, and current significance of the structures around them. Traditional methods of building exploration often rely on static signage or online searches, leaving gaps in the immediacy and richness of information. Our AR app bridges these gaps by offering real-time data overlay and an interactive experience. It transforms buildings into dynamic, ever-evolving entities, each with a story waiting to be told.

Our Approach:

The initial iteration of the application was created utilizing Unity. Presently, the application
employs an internal repository of QR codes, actively scanning the camera feed in real-time
to identify a corresponding match. This functionality is facilitated by the incorporation of the Vuforia Engine package. After the successful detection of the image, users are presented with the choice to access a three-dimensional representation of the building's layout. This interactive map is generated through the integration of the Bing Maps SDK, utilizing latitude and longitude coordinates for precise rendering.

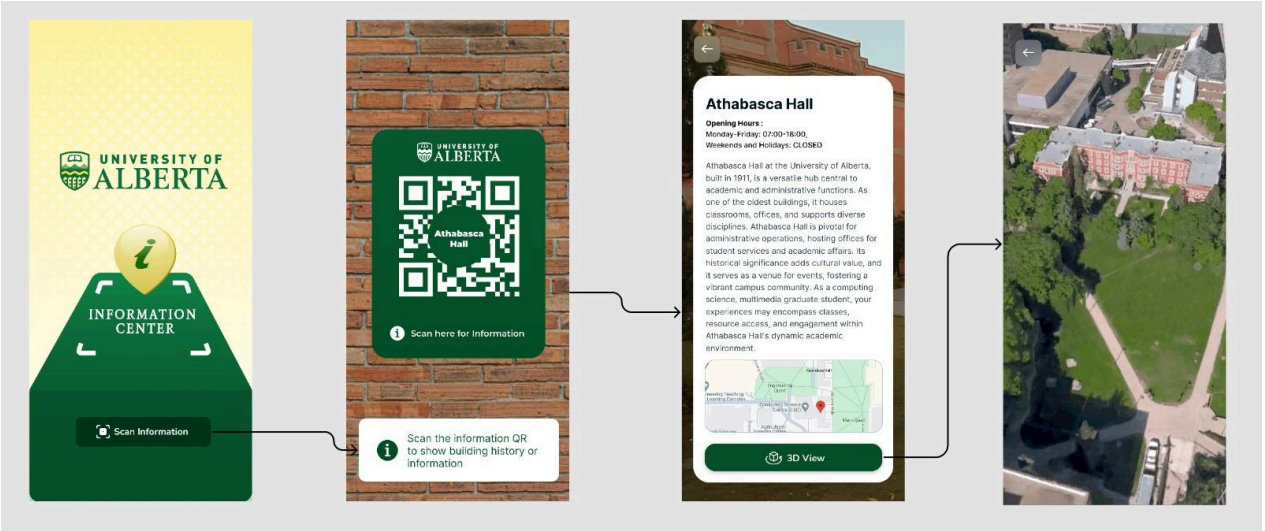
- Vuforia Engine AR Unity framework
  - Augmented reality software development kit (SDK) for mobile devices.
  - It uses computer vision technology to recognize and track planar images and 3D objects in real-time.

- Bing Maps Unity SDK
  - Allows users to see the buildings in 3D, with the added ability to rotate and tilt the angle in addition to panning and zooming.
  - To attempt to achieve near-photorealism, all 3D buildings are textured using composites of aerial photography.

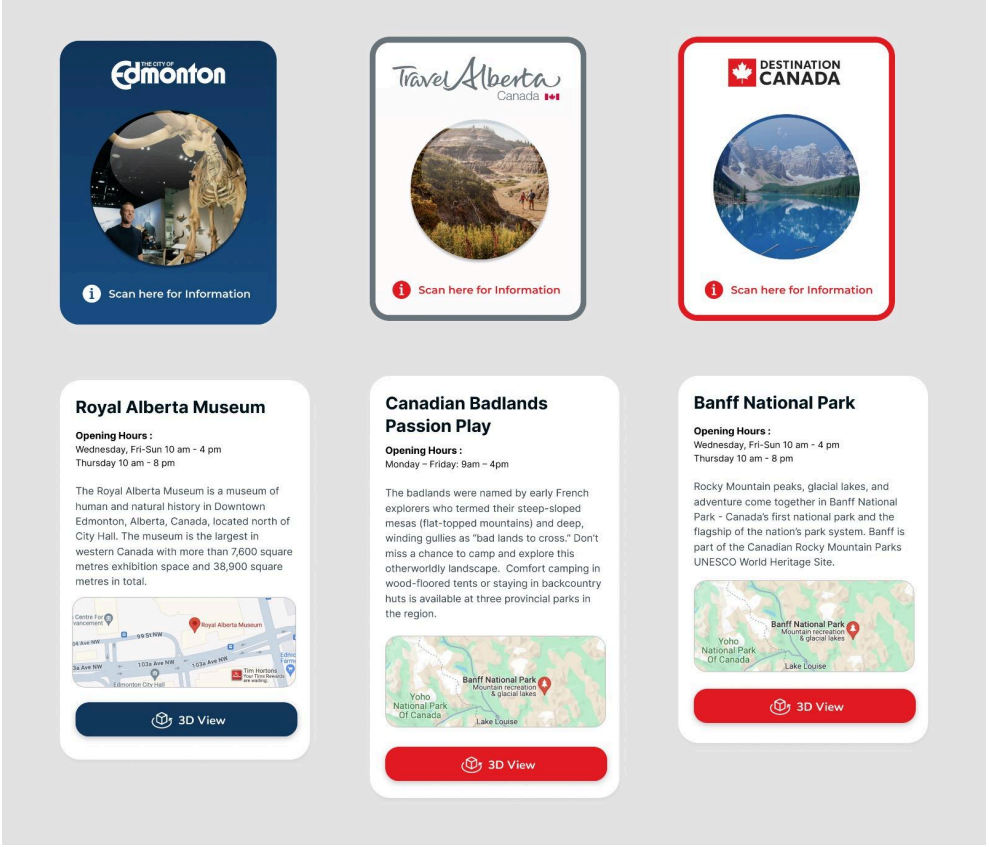


Basic Diagram

Visualization



For Tourists (For Future Work)

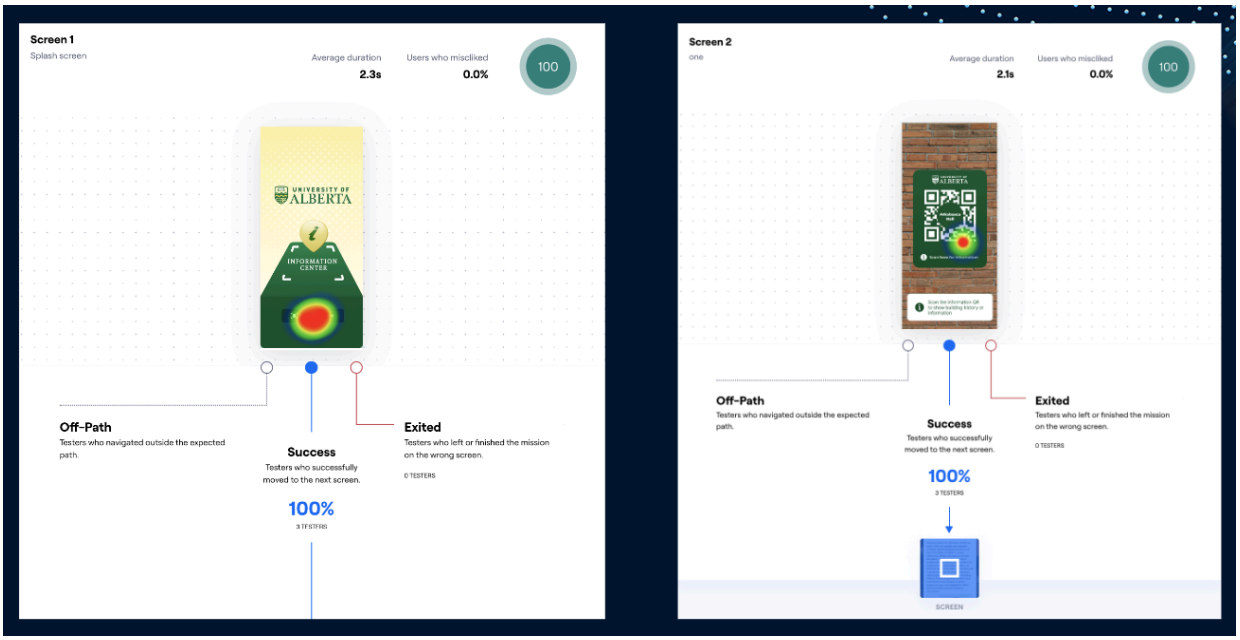


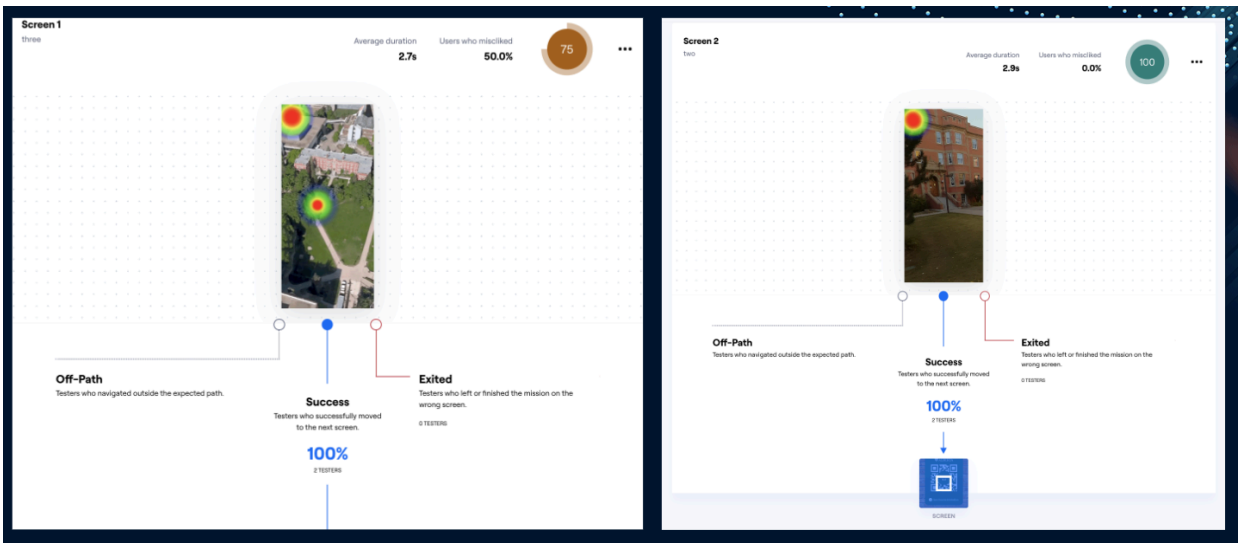
For the University of Alberta

Usability Test

A usability test is a method used to evaluate the ease of use, effectiveness, and overall user experience of a product, service, or system by observing real users as they interact with it. Maze is a platform that provides user testing and usability testing services for designers and product teams. It allows creators to test their designs and prototypes with real users to gather valuable feedback and insights. Here are some reasons why individuals and teams might use Maze.co:

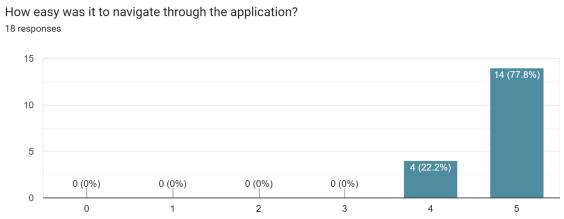
1. Usability Testing: Maze enables designers to conduct usability testing on their prototypes and designs. This involves real users interacting with the product to identify usability issues, user preferences, and areas for improvement.
2. Prototype Testing: Designers often create interactive prototypes before finalizing a product. Maze allows for testing these prototypes to ensure they are user-friendly and effective in meeting the intended goals.
3. Iterative Design: By collecting feedback through Maze's testing, designers can make informed decisions about changes and improvements to their designs. This supports an iterative design process where the product evolves based on user input.
4. Remote Testing: Maze facilitates remote usability testing, allowing designers to reach a diverse group of users regardless of their location. This is particularly useful for obtaining a broader range of perspectives.
5. Analytics and Insights: The platform provides analytics and insights based on user interactions. Designers can access data on how users navigate through their prototypes, where they encounter difficulties, and other key metrics.
6. Time and Cost Efficiency: Traditional usability testing can be time-consuming and expensive. Maze streamlines the process, making it more efficient and cost-effective for designers and product teams.

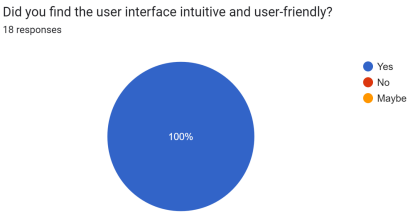




We made use of Maze to perform surveys, but due to its demand of being used as a desktop site or in a laptop, the users found it difficult to use our application and also gave feedback of facing this difficulty repeatedly. Maze is a good app for conducting surveys for all kinds of audiences and the report generated is very detailed. However, due to its technical glitch, not many users could give feedback about the app we are trying to show them.

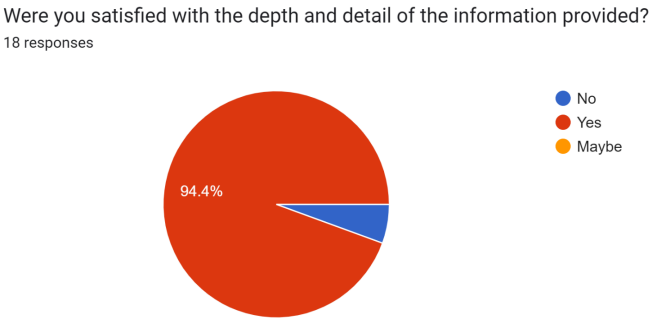
1. In Google Forms, the Usability describes- Usability refers to the effectiveness, efficiency, and satisfaction with which users can interact with a product, system, or service to achieve their goals. It focuses on how easy and intuitive it is for users to use and navigate a product, ensuring a positive user experience.





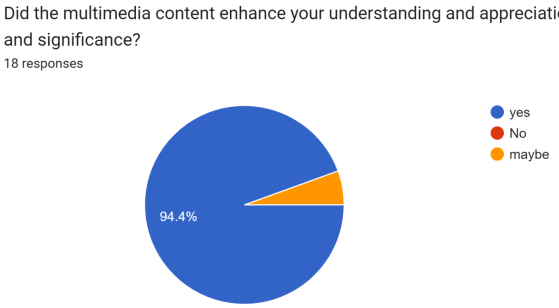
So our rating is 4 and 5 by 22% and 78% for navigating our application and it was user-friendly for almost 100%. So usability was very efficient and effective for the users while interacting with our application.

2. Content quality refers to the overall excellence, accuracy, relevance, and usefulness of the information provided within a product, service, or platform. It encompasses various aspects that contribute to the value and effectiveness of the content in meeting the needs and expectations of the users or audience.



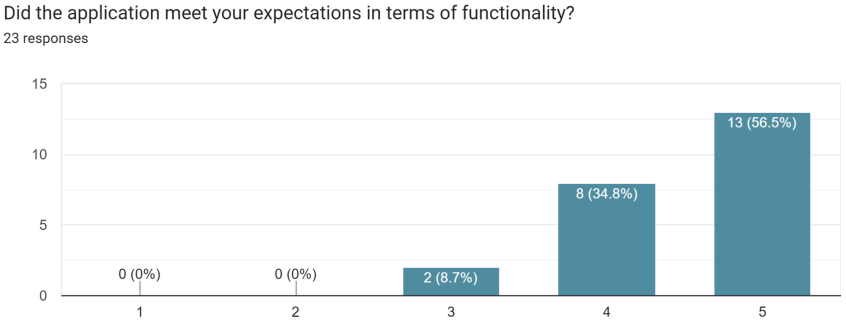
Content quality given by our application was 94% accurate and relevant for most of them and 6% found that it could be improved more.

3. Visuals and media refer to the graphic elements, images, videos, infographics, animations, and any other visual content used to convey information, engage users, or enhance communication within a product, service, or presentation.



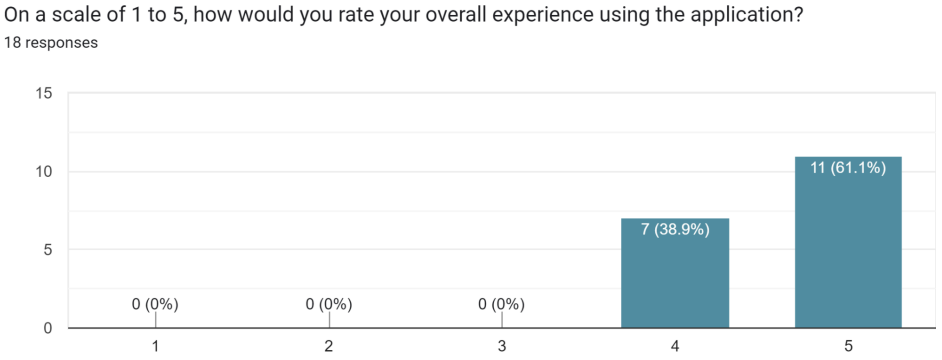
Visuals and media focus on graphic elements like images and video so 94% found it attractive and engaging whereas 6% wanted some more improvements.

4. Features and functionality" refer to the capabilities, characteristics, and operations of a product, system, or service that enable users to perform specific tasks or actions. These attributes determine what the product can do and how effectively it can meet user needs and expectations.



Features and functionality focus on the capabilities and operations of the application and the graph shows that 90% found it understanding and relevant whereas 10% found it that improvement is required a bit more.

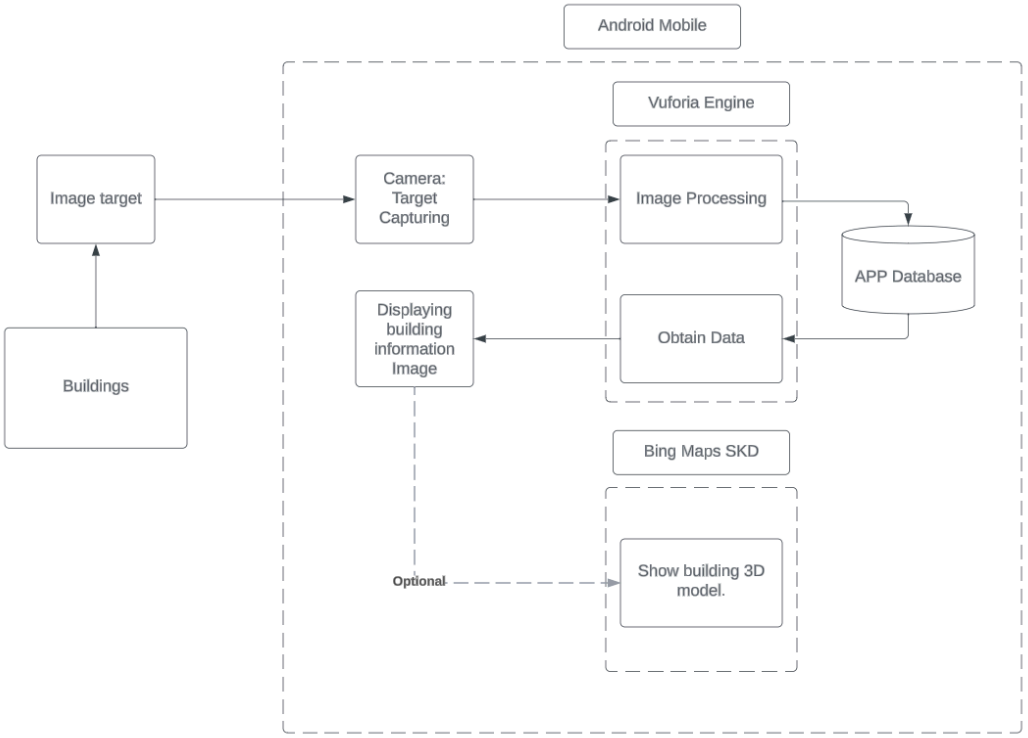
5. "Overall experience" refers to the collective impression, feelings, and perceptions a user or customer has after interacting with a product, service, or system. It encompasses every aspect of the user's journey, including usability, satisfaction, effectiveness, efficiency, and emotional response.



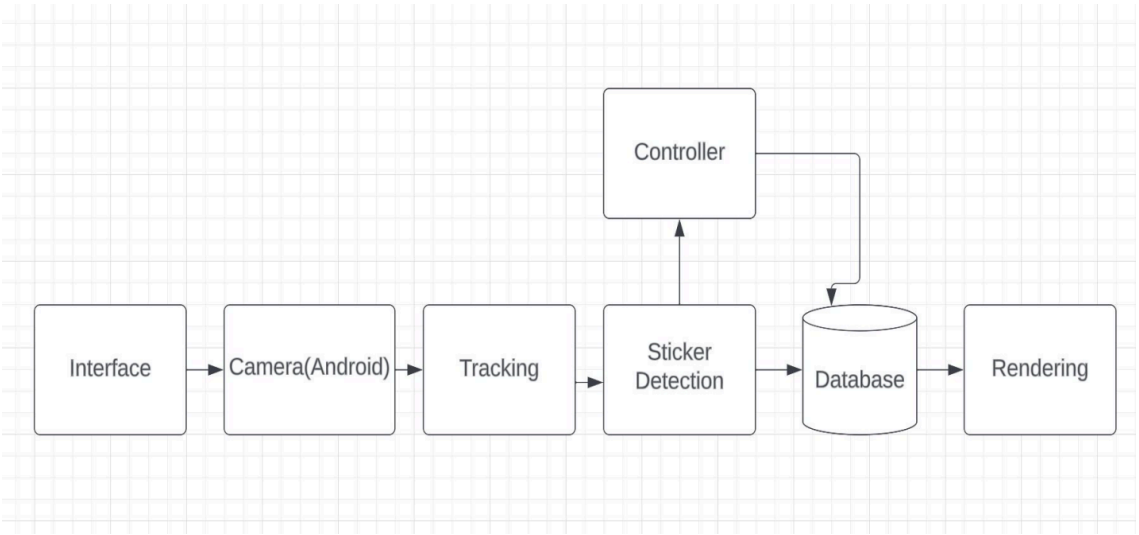
Overall experience refers to collecting the user's impressions or feelings while using our application and their satisfaction. 61% found it connecting and satisfying whereas 39% found it satisfying.

Technologies Used:

Diagram Interface:



System Architecture Diagram:



Tools used:

1. Unity
2. Android phone
3. Vuforia Engine AR Unity framework
4. Bing Maps Unity SDK
5. Maze.co
6. Google Form

Challenges Faced:

1) The capabilities of mobile devices, including smartphones and tablets, need to be improved on AR experiences. Limited processing power, memory, battery life, and sensor accuracy can affect the performance and complexity of AR applications.
2) Accurate tracking of the device's position and orientation in the real world is crucial for AR. However, variations in sensor quality and calibration can lead to tracking inaccuracies or drift, resulting in misalignment between virtual and real-world objects.
3) Mobile AR experiences can be affected by environmental factors such as lighting conditions, reflective surfaces, and obstacles. Inconsistent lighting or highly reflective surfaces can disrupt object recognition and tracking.
4) AR applications often rely on real-time data processing and cloud-based content delivery. Poor network connectivity or latency issues can impede the seamless integration of AR content, resulting in delays or disruptions.
5) Creating high-quality and engaging AR content demands specialized skills and resources. Developing interactive and compelling AR experiences requires expertise in 3D modeling, animation, and programming, which might pose challenges for developers.
6) Developing feature-rich AR experiences may require significant investment, limiting accessibility for smaller developers or organizations. Moreover, the cost of compatible devices might pose a barrier to users accessing AR technology.

Future work:

1) Improving the APP usability, allowing to move the interface by touching the screen.
2) Adding new functionalities such as WebView of constantly updated building information.
3) We are adding new landmarks.
4) Using other sensors, such as GPS, Bluetooth, WiFi, and NFC for accurate location, and giving the user in-depth information.

5) Future mobile devices are expected to have improved processing power, more advanced sensors (such as depth sensors), larger field of view (FoV) displays, and increased battery life. These advancements will enable more immersive and sophisticated AR experiences.
6) Advancements in computer vision, sensor technologies, and machine learning algorithms will enhance tracking accuracy, reducing drift and improving real-time object recognition. This will result in more precise AR content placement and interactions in the user's environment.
7) AR Cloud technology aims to create a shared digital layer of information overlaying the physical world. Future AR applications could leverage this technology for persistent and location-based AR experiences, allowing users to interact with consistent AR content across different locations and devices.
8) Context-aware AR applications will intelligently adapt to the user's context, considering factors like location, time, user behavior, and preferences. Adaptive AR will tailor content dynamically, providing personalized and relevant experiences.
9) AR applications fostering social interaction and collaboration among users in the same physical space are anticipated. Shared AR experiences, multiplayer AR games, and collaborative problem-solving using AR can be significant future developments.
10) Integration of AR with Artificial Intelligence (AI) and the Internet of Things (IoT) will likely expand. AI-driven algorithms can enhance AR content generation, while IoT integration can enable AR to interact with connected devices.

Users Feedback:

Conclusion:

This conclusion summarizes the current state of Mobile AR, acknowledges its achievements, highlights existing challenges, and underscores the promising future possibilities, emphasizing the need for ongoing innovation and collaboration in shaping the trajectory of Mobile AR technology.

Reference:

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