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cougAR

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abstract

The main focus of this project was to provide location-based AR services to both Android and iOS users. The objective of this AR (Augmented Reality) app is to help CSUSM students and visitors learn about the campus, facilitate navigation around campus, and increase community participation in campus events. The main focus of this project was to provide location-based AR services to both Android and iOS users. We chose to implement this application for both platforms in order to make it available to as many members of the community as possible. Through our research, we discovered that we would need to build and develop natively for iOS and Android individually if we wanted a true multi-platform experience.

android

The Android version of the app was developed using C# in Unity, featuring three main components the GUI, outdoor tour, and indoor navigation.
The outdoor tour utilizes Geospatial anchors at real-world coordinates on campus to display building names. For indoor navigation, scanning a location's QR code renders a 3D model of the building with a dropdown menu for destination selection, overlaying a guided path on a real-world image for user navigation.

iOS

The iOS implementation features the campus directory as it's entry point. For each category, the user is presented with a map marked with pins for the locations along with the associated name. Within this view, the user may request to begin an AR session which is set to render soley the locations in that category. Featured campus events are also visible upon app launch, with an ideal future direction linking event locations to a catalog one, allowing the start of an AR session to locate that specific location via the pathfinding API and visual representation of the path.

the plan

1. Complete iOS application developed using SOLID principles.

2. Augmented Reality implementation using ARKit, with geographic data supplemented by Geospatial API in Google's ARCore.

3. Use existing mapping by Concept3D to query locations and return wayfinding paths pre-designed to avoid obstructions.

4. Linking Featured Events to physical locations in order to provide wayfinding experience in Augmented Reality.

5. Proof-of-Concept counterpart for Android, built in the Unity gaming engine using ARFoundation and Geospatial API.

the tech

Building & Location Cataloging

CSUSM has previously contracted Concept3D for the task of 3D mapping their campus to provide an interactive online directory and map.

Obstruction Free Wayfinding Algorithm

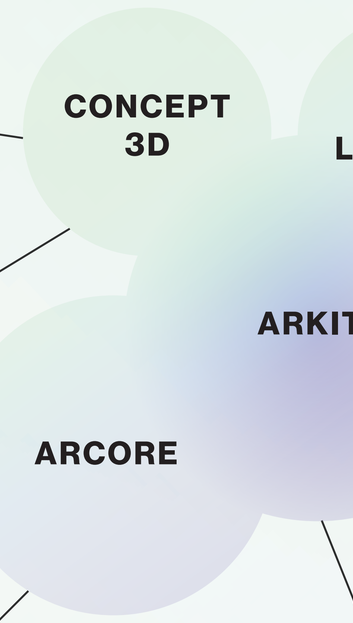
Their API is able to provide paths between two locations free of obstructions and guaranteed to be on paved terrain due to their previous work mapping the campus.

Virtual Positioning System

Street View images from Google Maps, which have been captured around the globe for more than 15 years, are the foundation of VPS.

Geospatial Anchors

Geospatial Anchors can be used to attach content to real-world locations at a given latitude, longitude, and altitude in meters, relative to the WGS84 ellipsoid.



Full Accuracy Location Services

Apple's CoreLocation delivers precise device location data, seamlessly communicated to the Visual Positioning System (VPS), complemented by real-time compass and altitude readings.

Inter-Platform Data Exchange

ARKit provides ARCore with the tracking states and pixel buffers, which ARCore then validates, ensuring synchronized sessions and seamless integration

Unified Node Rendering Control

ARKit takes the lead in node rendering, dynamically updating spatial transforms from ARCore data for a cohesive augmented reality experience.

Light Detection and Ranging (LiDAR)

ARKit leverages LiDAR technology to gain a comprehensive understanding of the physical environment, with precise mapping and recognition of surfaces. This enhances AR experiences by ensuring accurate placement with virtual elements in real-world spaces.

the product

the future

There are a number of features we would like to implement for this application in the future. The next steps in this project include:

- The full Android implementation of this app for users who do not have iOS devices.
- The further development of the indoor navigation functionalities for all buildings on campus.
- Including additional information that may be helpful to users, such as emergency information and evacuation routes.
- Integrating authentication flow with CSUSM's SAML implementation of SSO to make the app more personalized.