CMU History Through Augmented Reality
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Motivation
- To provide historical context to locations in and around CMU campus
- To make students and visitors feel more connected to the university
- To augment the campus experience and present the marvelous 120 year history of the university

Project Overview
An Android application that
- Presents a virtual gallery of historical pictures of CMU through augmented reality
- Plays audios about the stories behind the pictures
- Displays different 3D pictures according to users’ current location
- Shares the same AR experience with multiple users at the same time

Architecture
Hosting Mode (Admin)
- ARCore
- Detect feature points and planes
- Generate room ID
- Place object & get anchor ID
- Store room ID & anchor ID
- Get Location
- Resolve anchor to display object

Resolving Mode (User)
- ARCore
- Match location to room ID
- Get anchor ID by room ID
- Get anchor ID & display object

Implementation
- SLAM and OpenGL libraries from Google ARCore
- 3D modeling with 3DS MAX
- Fused-location based localization
- Text-To-Speech audio synthesis
- Firebase backend database

Challenges
- GPS resolution and accuracy discrepancy between outdoor and indoor
- No out-of-the-box 3D modeling tools compatible with ARCore on Android
- Limited online documentations and support for building an Android AR product from scratch

Future Improvements
- Render 3D footprints to guide towards frames
- Offloading 3D object rendering to cloudlet
- Using an interactive 3D model with animations

Results
- An interactive AR mobile application
- Audio-visual history of CMU
- Localization-based 3D picture anchoring and resolution

Another Research Attempt
Functionality
- Timed computation offloading to cloudlet server
- RTT, FPS, and GPS location data collection
- 2D image overlay on both client and server

Architecture
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Experiment & Results
- FPS over time with timed WiFi offloading
- End-to-end processing delay distribution