



## 1. Problem Statement

- a. Contextual information is often shared through generic platforms (cloud drives, social feeds) that lack spatial awareness as to where the information is actually relevant. This leads to clutter, poor discoverability, and security risks when sensitive or location-specific data (e.g., Wi-Fi passwords or instructions) is shared too broadly. Our application, *Anchor*, addresses this gap by binding digital content to physical locations, ensuring information is only accessible at the right place and time. Unlike existing GIS/maps like Google Maps or Waze, which don't allow file sharing, or social networks like Instagram or X, which don't restrict information to location, this application enforces location-based unlocking combined with group-based permissions, making it ideal for local and context-aware information sharing.

## 2. Background Information

- a. *Anchor* operates in the domain of location-based, context-aware information sharing. It is designed for users who want to share information that is only relevant at a specific physical location, such as students sharing Wi-Fi credentials at a party, residents posting laundry room instructions, or gym members logging instructions for using a specific machine. Secondary users include local businesses like cafes or gyms that want to display menus, announcements, or promotions only to users who are physically present.
- b. Several existing systems partially overlap with this space, particularly Google Maps notes, QR codes, shared cloud documents, and social media platforms. While these tools do indeed allow users to attach or distribute information, they lack enforced spatial and access controls. As an example, cloud document links can be forwarded to anyone, QR codes can be scanned remotely once shared, and social media posts are visible regardless of physical relevance. Furthermore, most of these systems do not support automatic expiration, limited unlock counts, or structured group-based permissions to digital items.
- c. *Anchor* addresses these limitations by digitally binding content access to verified geographic proximity and explicit permission rules. Files and other digital media remain encrypted on the backend and are only decrypted when the user's device is within a configured radius of *Anchor*; and the user belongs to the required visibility scope (public, private, or group-based). A spatial backend using geospatial indexing enables efficient proximity checks, while time-based constraints (expiration times/dates, activation windows, and unlock limits) ensure that the information is only available when contextually valid. By combining location validation, group-based access features, and automated lifecycle management, *Anchor* provides a secure and discoverable alternative to existing platforms.

### 3. Backlog

#### a. Functional

- i. As a user, I would like to sign up and log in using email or OAuth so that my Anchors and permissions are securely associated with my identity.
- ii. As a user, I would like to reset my password via email so that I can recover my account if I lose access.
- iii. As a user, I would like to login using existing safe credentials on my device (e.g., FaceID, Touch ID, etc.). *(if time allows)*
- iv. As a user, I would like to manage my identity by updating my username, email, avatar, and bio so that I am recognizable within Circles.
- v. As a user, I would like to log out and revoke sessions so that my account remains secure across devices.
- vi. As a user, I would like to create an Anchor by dropping a pin on a map so that content is tied to a precise physical location.
- vii. As a user, I would like to attach different content types (text, links, images, files) to an Anchor so that information is flexible and useful.
- viii. As a user, I would like to configure an unlock radius (e.g., 10–100 meters) so that Anchors only unlock when users are physically nearby.
- ix. As a user, I would like to set an Anchor's visibility to public, private, or Circle-based so that sensitive content is protected.
- x. As a user, I would like to set expiration parameters (time-based expiration or maximum "unlock count") so that the Anchor automatically disappears after a specific duration or once the maximum number of users have successfully unlocked it.
- xi. As a user, I would like to edit or delete the Anchors I created so that outdated or incorrect information can be removed.
- xii. As a user, I would like to preview how an Anchor will appear to others before publishing it so that I can verify correctness.
- xiii. As a user, I would like to create tags for Anchors so that people can get a brief idea of what the Anchor is about before clicking on it.
- xiv. As a user, I would like Anchors to activate only during specific time windows so that they align with real-world events.
- xv. As a user, I would like to view nearby Anchors on a map so that I can discover relevant information around me.
- xvi. As a user, I would like Anchors to automatically unlock when I enter their radius so that I do not need to refresh or search manually.
- xvii. As a user, I would like Anchors outside my radius to remain hidden or blurred so that location enforcement is preserved.
- xviii. As a user, I would like to receive notifications when new Anchors appear nearby so that I do not miss relevant updates.
- xix. As a user, I would like to save Anchors to a personal library so that I can reference that information forever without being in the same location and worrying about an expiration date.

- xx. As a user, I would like to create unsavable Anchors (special tag) so that sensitive, personal information cannot be saved forever.
- xxi. As a user, I should be able to differentiate between Expired and Non-Expired Saved Anchors in my personal library.
- xxii. As a user, I want to toggle "Ghost Mode" that stops tracking a user's location so that privacy can be maintained if wanted.
- xxiii. As a user, I would like to create Circles (groups) so that I can share Anchors with specific people only.
- xxiv. As a user, I would like to invite or remove members from a Circle so that access control remains accurate.
- xxv. As a user, I want to see a "Global Search" for public Circles, so that a user can discover public groups.
- xxvi. As a user, I would like to upvote/downvote anchors to provide a signal for the credibility/usefulness of an anchor. *(if time allows)*
- xxvii. As a user, I want to see how many people have unlocked my Anchor so that social proof is established.
- xxviii. As a user, I would like to create "Scavenger hunts" by linking Anchors in a sequential process where unlocking one Anchor reveals the next clue. *(if time allows)*
- xxix. As a user, I would like to track my progress through a Scavenger hunt so that I know how many steps remain. *(if time allows)*
- xxx. As a user, I would like to view a leaderboard for hunts so that participation is engaging and competitive. *(if time allows)*
- xxxi. As a user, I would like to report inappropriate Anchors so that the platform remains safe.
- xxxii. As an admin, I would like to review reported Anchors so that I can take moderation actions.
- xxxiii. As an admin, I would like to disable or remove abusive users so that misuse is prevented.
- xxxiv. As a system, I would like to maintain an audit log of critical actions so that abuse investigations are possible.
- xxxv. As a user, I would like to view Anchors in an AR camera mode so that I can see distance and direction visually. *(if time allows)*
- xxxvi. As a user, I would like AR Anchors to update in real time as I move so that navigation feels accurate. *(if time allows)*
- xxxvii. As a user, I would like to filter based on tags, content type, expiration status, etc, so that the map view remains legible in dense areas.
- xxxviii. As a user, I would like to view a "List View" of the nearby Anchors so that I can browse content without solely relying on the map. *(if time allows)*
- xxxix. As a user, I would like to block users so that I do not see their Anchors *(if time allows)*

b. Non-Functional

- i. The system shall unlock Anchors within 500 ms after a user enters the configured radius.
- ii. Map and nearby Anchor queries shall respond within 1 second under normal load.
- iii. The backend shall support ~10,000 concurrent users without degradation.
- iv. The system should rate-limit Anchor creation so that spam is minimized. (*if time allows*)
- v. The spatial backend shall support efficient geospatial queries using indexing.
- vi. The system shall be horizontally scalable to handle increasing Anchor density in urban areas.
- vii. The service shall be available 24/7 with at least 99% uptime.
- viii. Anchors and permissions data shall be persisted reliably with automated backups.
- ix. All Anchor content shall be encrypted at rest and in transit.
- x. Unauthorized users shall never receive decrypted Anchor content.
- xi. Authentication tokens shall expire and be revocable.
- xii. Location spoofing attempts shall be mitigated using consistency checks.
- xiii. New users shall be able to create their first Anchor within ~2 minutes of onboarding.
- xiv. The UI shall be consistent across Android and iOS platforms.
- xv. The app shall provide clear visual feedback for locked vs. unlocked Anchors.
- xvi. The backend shall follow a modular FastAPI architecture.
- xvii. The system shall support future extensions such as AR HUDs and new Anchor types without major refactors.
- xviii. The app shall cache metadata for nearby Anchors to allow discovery in areas with poor connectivity (*if time allows*)