## Applications of Geospatial Data in Digital Communication

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#### Motivation

- Digital communication is important
  - Over 4.5 billion social media users worldwide

## What's the problem?

- We live in the real world!
- Even though 99% of social media is through mobile devices...
- Digital communication mostly independent of the physical space around us

Tying digital interaction to physical proximity increases user engagement

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The goal?

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## The goal?

A social app that gates messaging to proximity

## Background and related work

## Geospatial data

- Data related to a specific geographic position
- Combines location, attribute, and temporal information



#### In social media



## Approach

## Key features

- 1. Main screen showing the user's location and surrounding area
- 2. Ability to leave ephemeral messages at one's location, visibly indicated to all users
- 3. Messages can only be read near coordinates where they were posted

## Why?

## Why?

Messages both spatially and temporally relevant!

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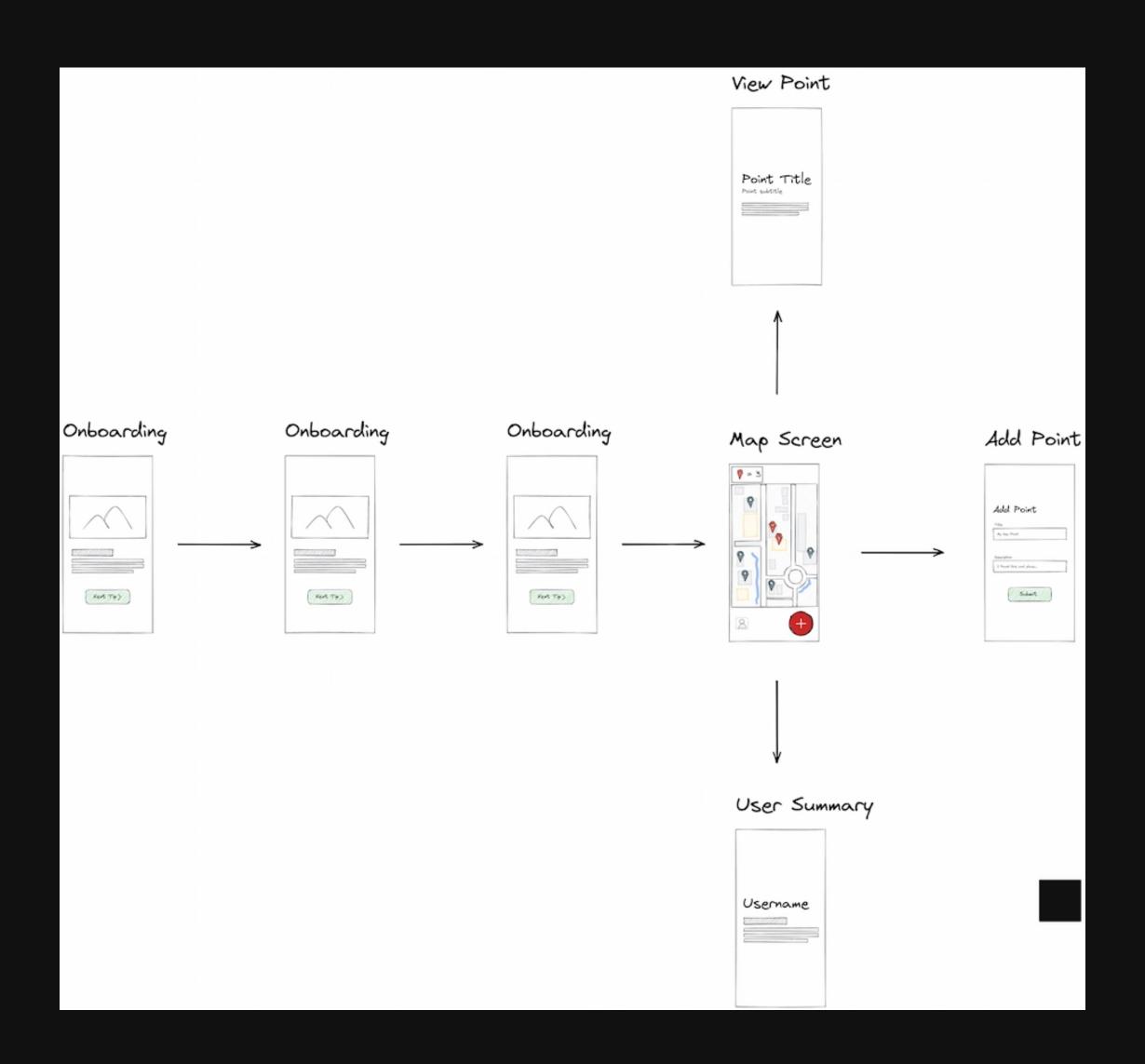
Access directly gated by physical proximity

## Implementation

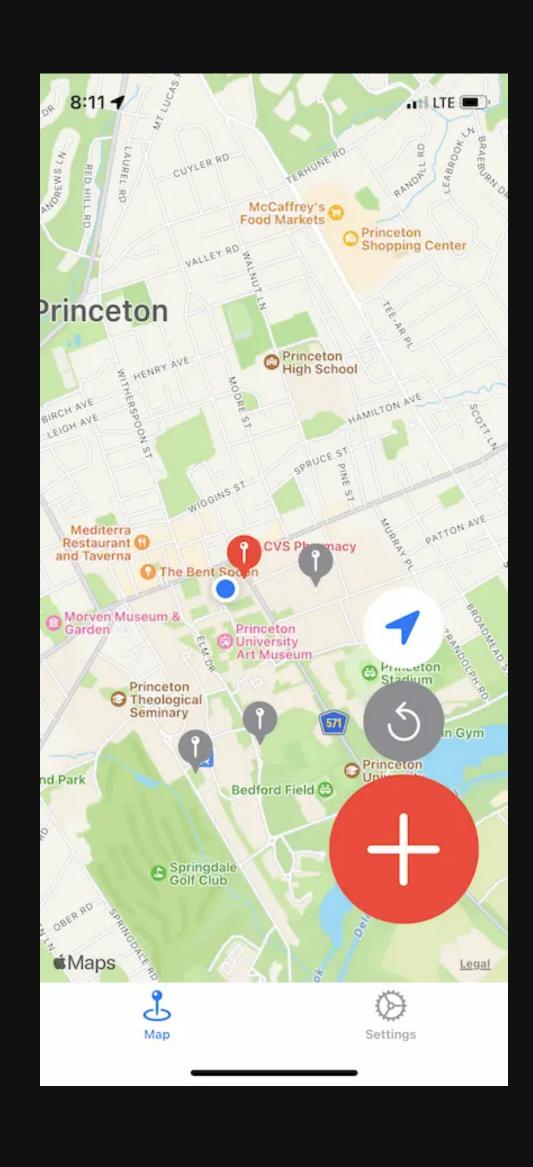
## Project architecture

- Client-server model, client is iPhone app
  - Access to Apple's MapKit and SwiftUI frameworks
- Client handles all user-facing tasks
- Server handles content, authentication, geospatial queries, and other centralized functionality

## From design...



## ...to implementation



#### Client details

- SwiftUI is a declarative framework
  - Describe interface you want, layout engine handles the details!
  - Separates presentation from business logic
- Good fit for MVVM (Model-view-viewmodel) design pattern

#### Shared services

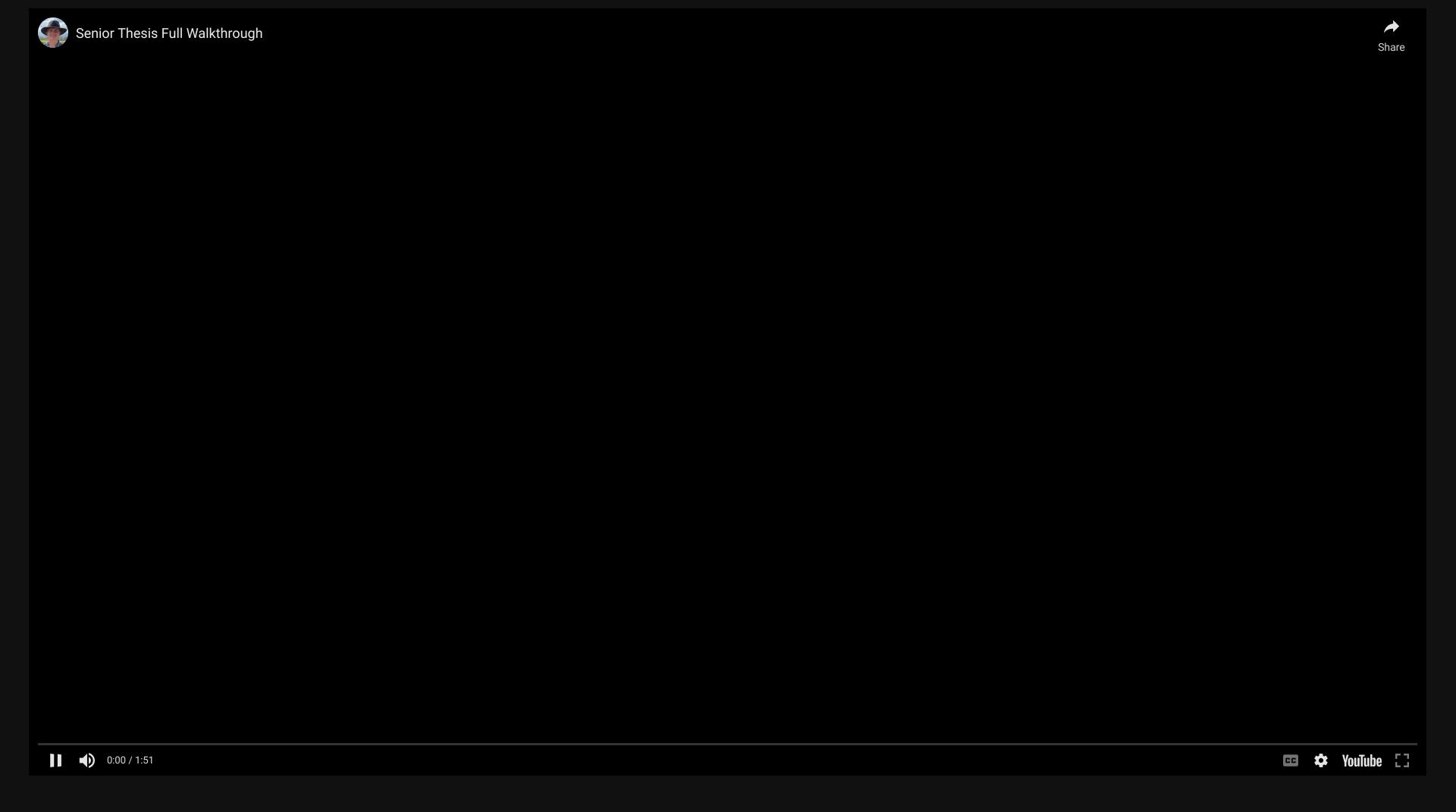
 Wrote managers to represent a shared service layer, injected at startup:

```
@main
struct Geo: App {
   let settingsManager: SettingsManager
   let authenticationManager: AuthenticationManager
    let locationManager: LocationManager
        self.settingsManager = SettingsManager()
        self.authenticationManager = AuthenticationManager(set
        self.locationManager = LocationManager(settingsManager
```

#### Server details

- Containerized application using Docker
- Redis as database
  - Fast  $(O(N + \log M))$  and straightforward geospatial queries
- FastAPI as webserver
  - Entire server is < 200 LOC

## Demonstration



## Evaluation

## Testing logistics

- Deployed server on DigitalOcean Droplet
- Distributed app using Apple's TestFlight service
- Solicited testers on different Princeton listservs

#### How to test?

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- Evaluate off qualitative feedback
- Ask questions to confirm/reject initial hypothesis.

#### Results

- 19 unique users
  - 15 opened app at least once
  - Average of 8.4 sessions/user
  - Average rating of 7/10 on overall UX
- Positive feedback overall
  - Comparisons to geocaching, Pokémon GO
  - Majority agreed with hypothesis
  - 83.3% believed primary purpose would be for status updates

## Negatives

- No tutorial, onboarding flow
  - Unclear on interaction radius, message expiration
- Inability to respond to messages
- Low user population → lack of community

#### Was it a success?

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#### Conclusions

- Intersection of geospatial data and digital communication is relatively unexplored
- Geospatial data can connect people
- Future work?

## Code availability

- Client: https://github.com/thisstillwill/Geo-Client
- Server: https://github.com/thisstillwill/Geo-Server
- Report: https://github.com/thisstillwill/Geo-Thesis

# Thank you!