

Salinity Map

VE441 Design Presentation

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Climate group | July 4, 2020

“Increasing Salinity is likely the largest chronic water quality impairment to surface and groundwater.”

Water Education Foundation



Saline Water are drunk in rural places

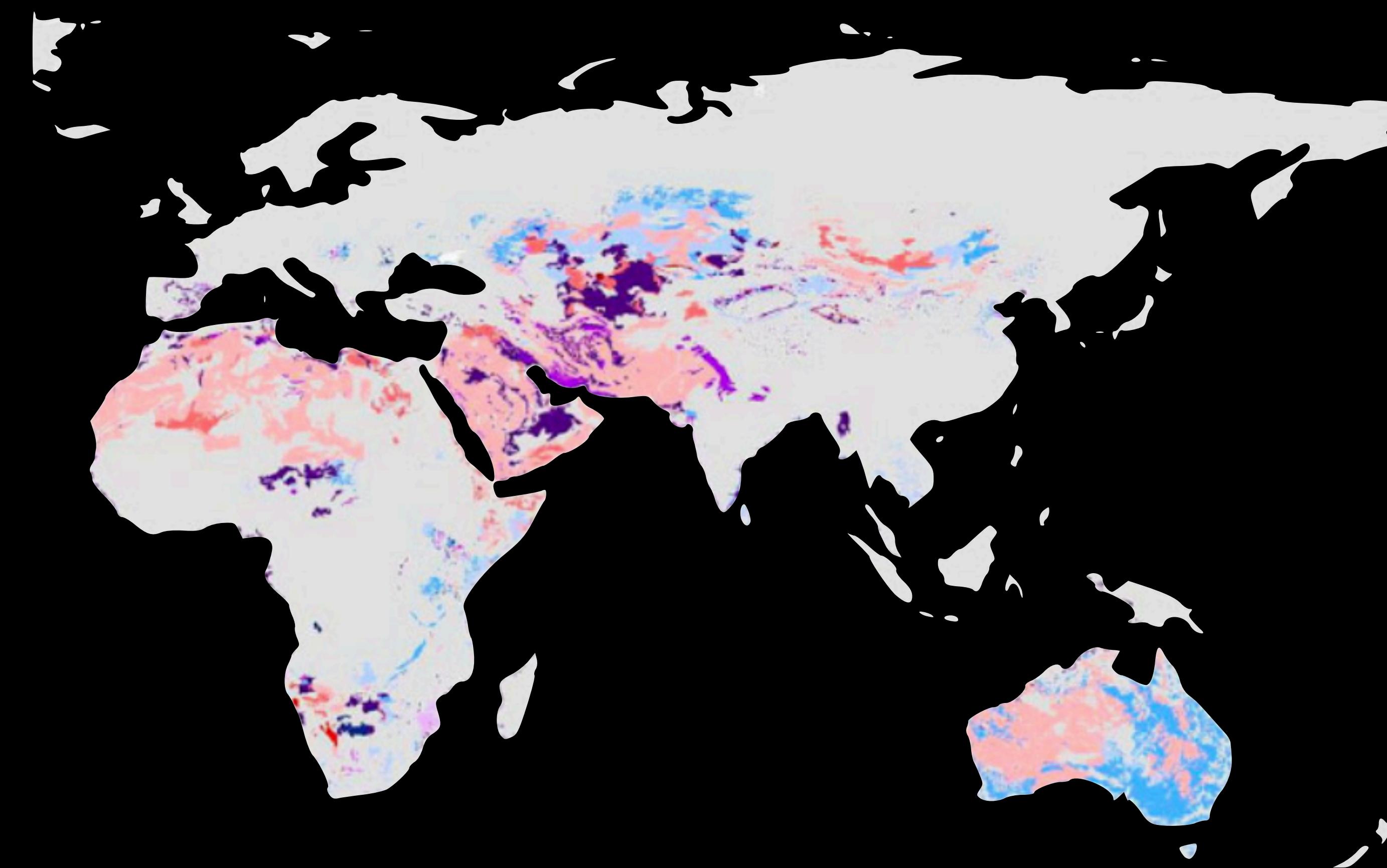
Salinity Overdose

Kidney Stone

High Blood Pressure

Organ Failure

Water Salinity Affects Agriculture, Economy, and Everything...



The distribution of saline, sodic and saline-sodic soils in the world. Source: Energy Environ. Sci., 2011, 4, 2669-2681

**Residents and researchers require a way to
track and visualize the water salinity status in
the regions they show interest**

General Requirement

Salinity Map

An app to guide millions of people to safe water

Business Model Canvas | user requirements



Coastal Residents

Route to nearby safe water station

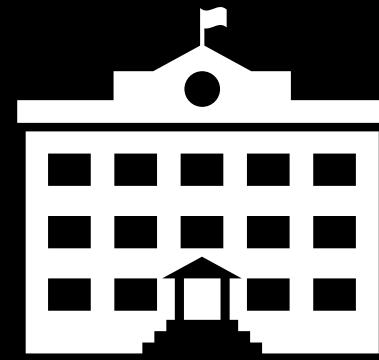
Navigation system



Researchers

Platform to manage and share data

Interactive database

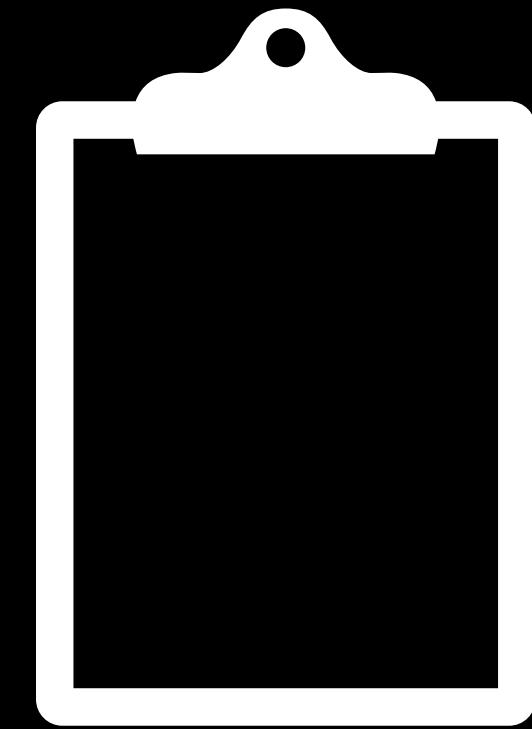


Government & NGO

Information on climate for urban planning

Real-time weather index

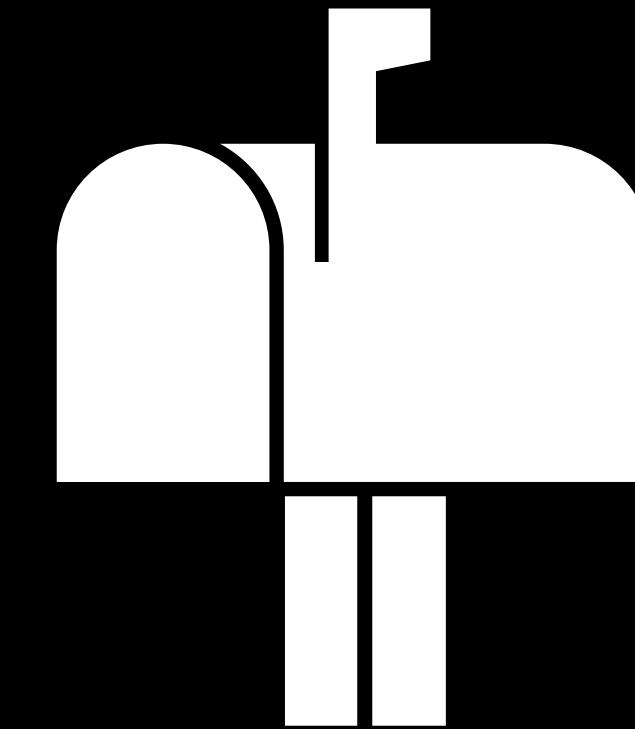
Salinity Map | Design features based on user requirements



Online Survey



SMART Techniques



Communicate

Salinity Map | High-level User Requirement

As a local resident, I can see the water salinity level near me.

As a local resident, I can tell which locations are best to take water

As a local resident, I can compare water salinity in locations that I chose

As a local resident, I can zoom in to certain region for detailed info on water salinity

As a local resident, I can pin my favorite water station

As a local resident, I can write/read reviews on certain water sources

As a researcher, I can get access to previous water salinity data in certain locations

As a researcher, I can input new water salinity data I gathered

As a researcher, I can zoom in/out to see water salinity data in different scopes

As a researcher, I can delete wrong salinity data

As a researcher, I can modify inaccurate salinity data

As a researcher, I can use color to highlight abnormal data

Salinity Map | Specific features

the water salinity level

previous water salinity data

route to safe water source

input new water salinity data

detailed info on water salinity

delete wrong salinity data

pin my favorite water station

modify

write/read reviews

color to highlight

Salinity Map | User Stories

input new water salinity data

Feature: Add new data to database

- As a researcher
- So that I can report and upload measured salinity level results
- I want to have a form to add new data
- Given that I open the application
- Then the application will show a plus button on the bottom right
- When I click the plus button
- Then a form will pop out and ask the user to fill in the blanks.
- When I fill in the form and submit it
- Then the uploaded new data will be added to database, and a new dot will appear on the provided location

Salinity Map | Specific features

the water salinity level

previous water salinity data

Route to safe water source

input new water salinity data

detailed info on water salinity

delete wrong salinity data

pin my favorite water station

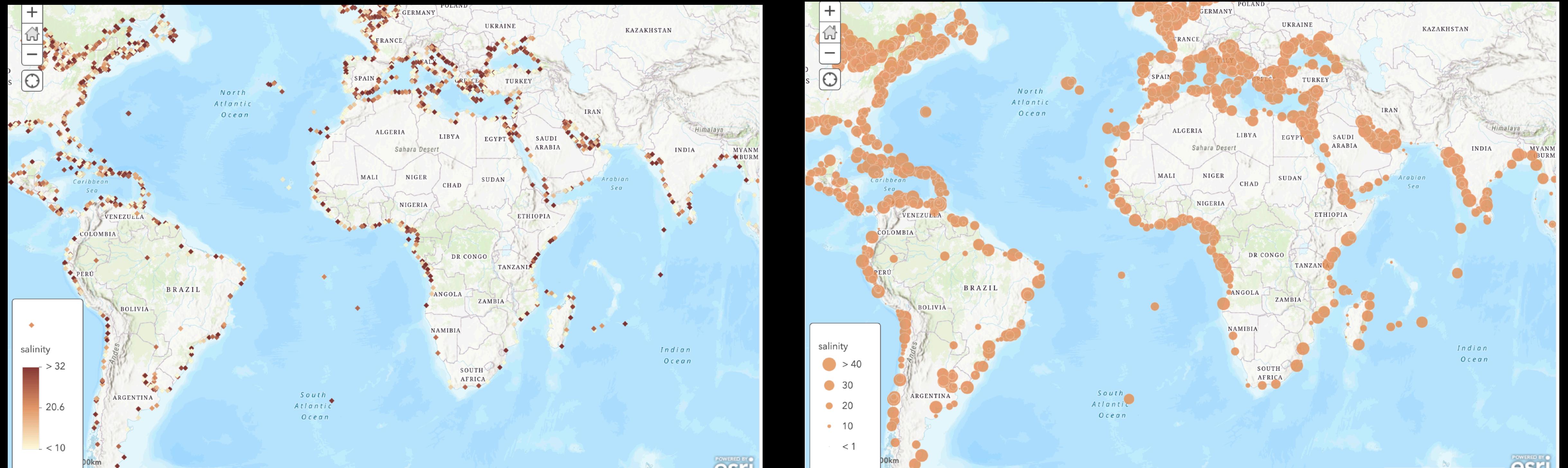
modify

write/read reviews

color to highlight

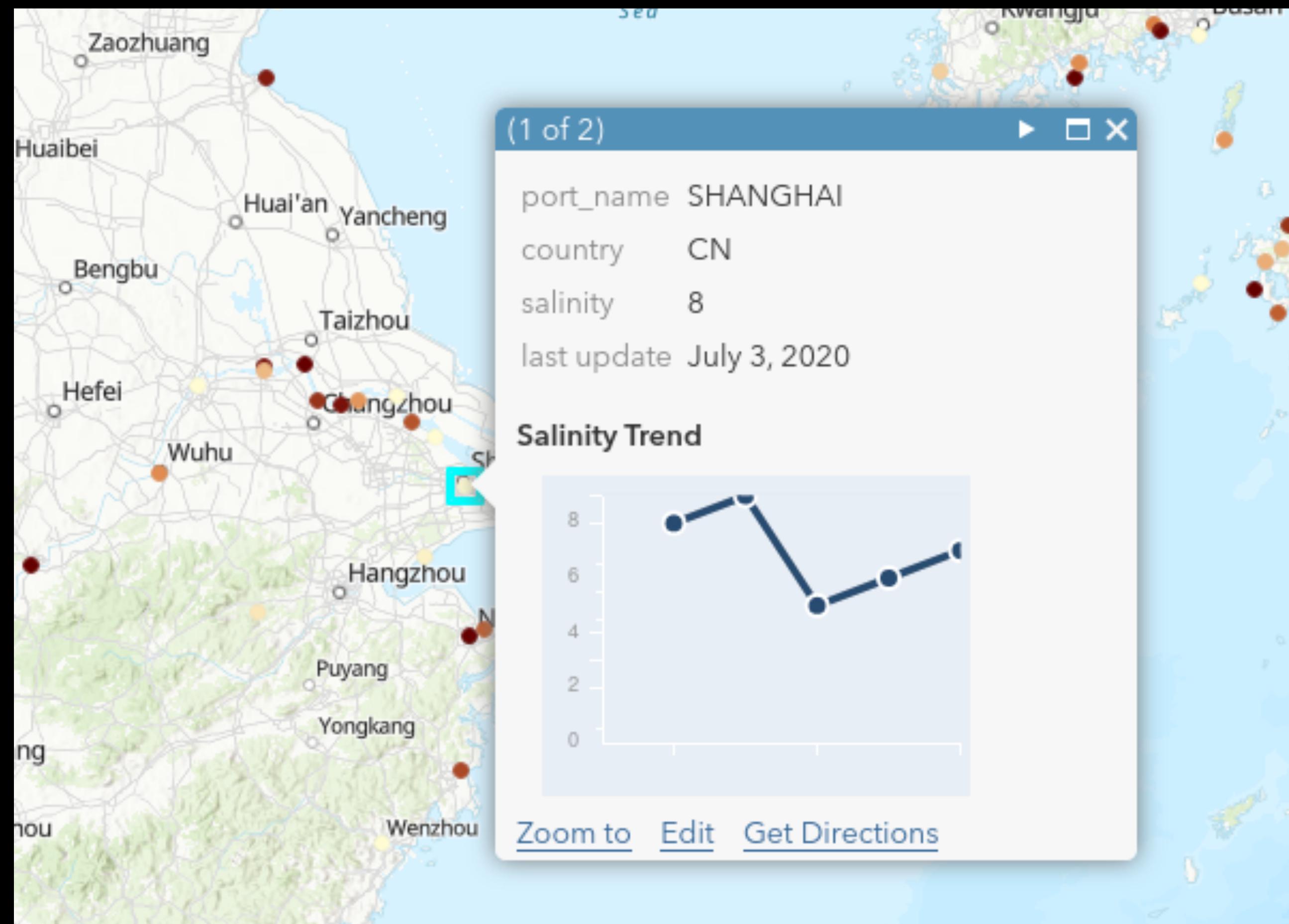
Interface Design

Salinity Map | Interface Design



Salinity Map Interface Options

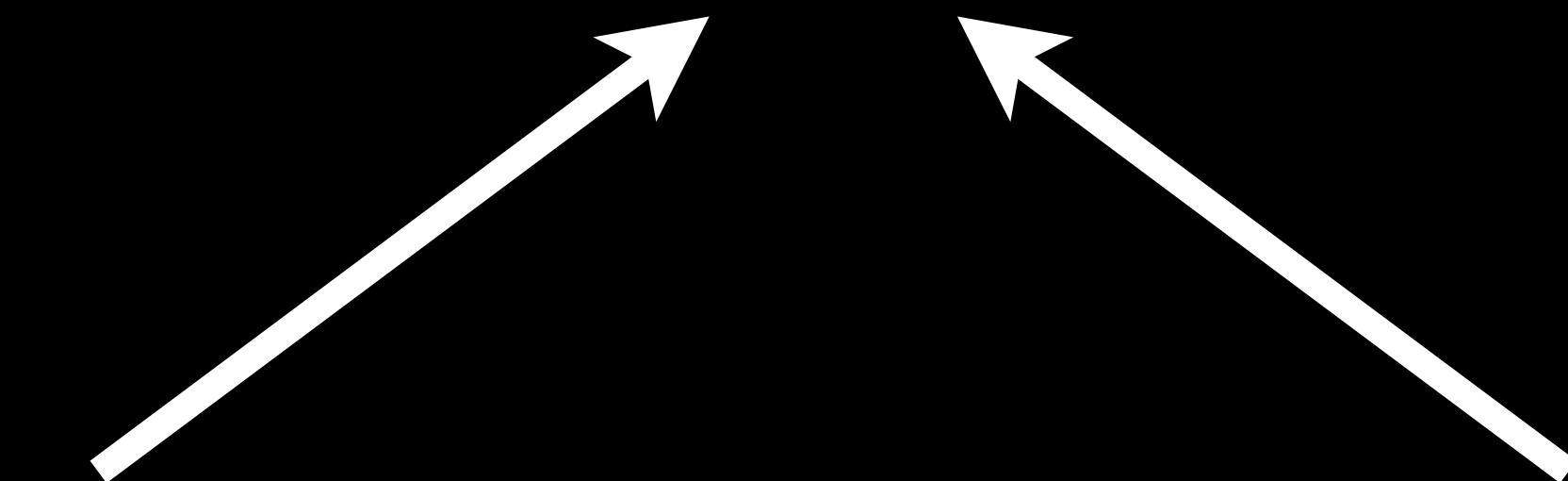
Salinity Map | Interface Design



Detailed Info in Pop-up Window

The data shown is made up for demonstration purpose

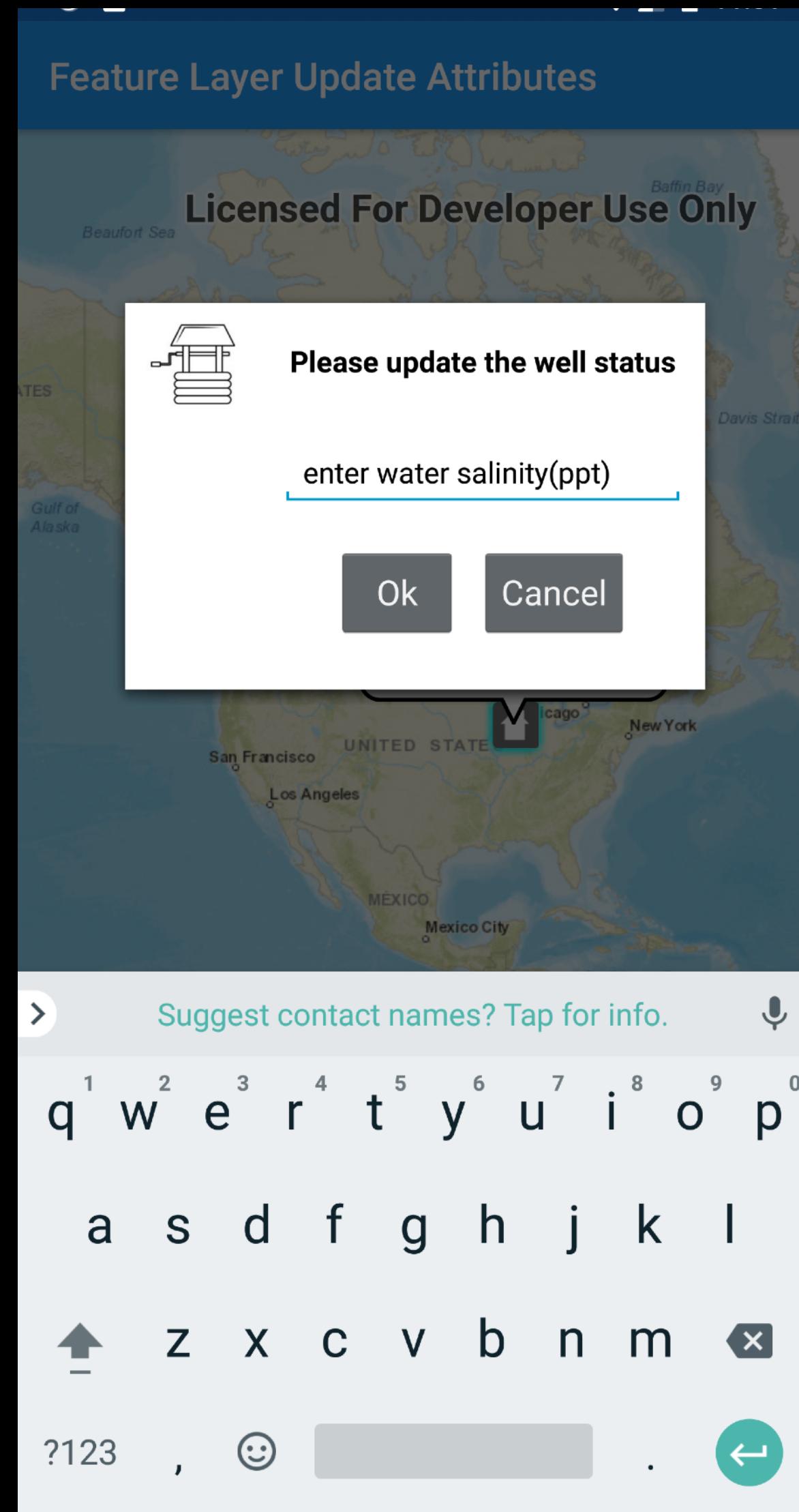
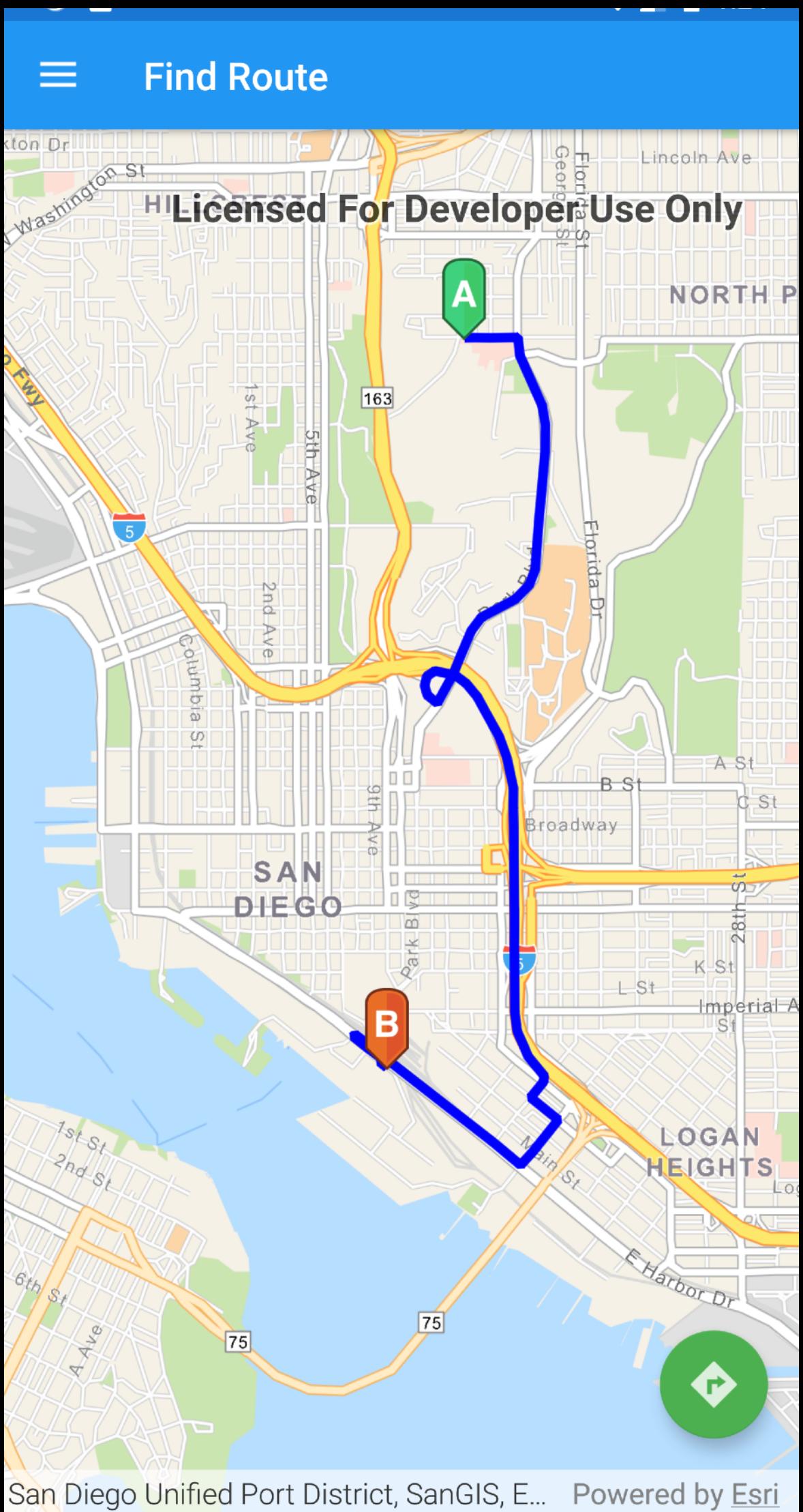
Interface Design



Researcher

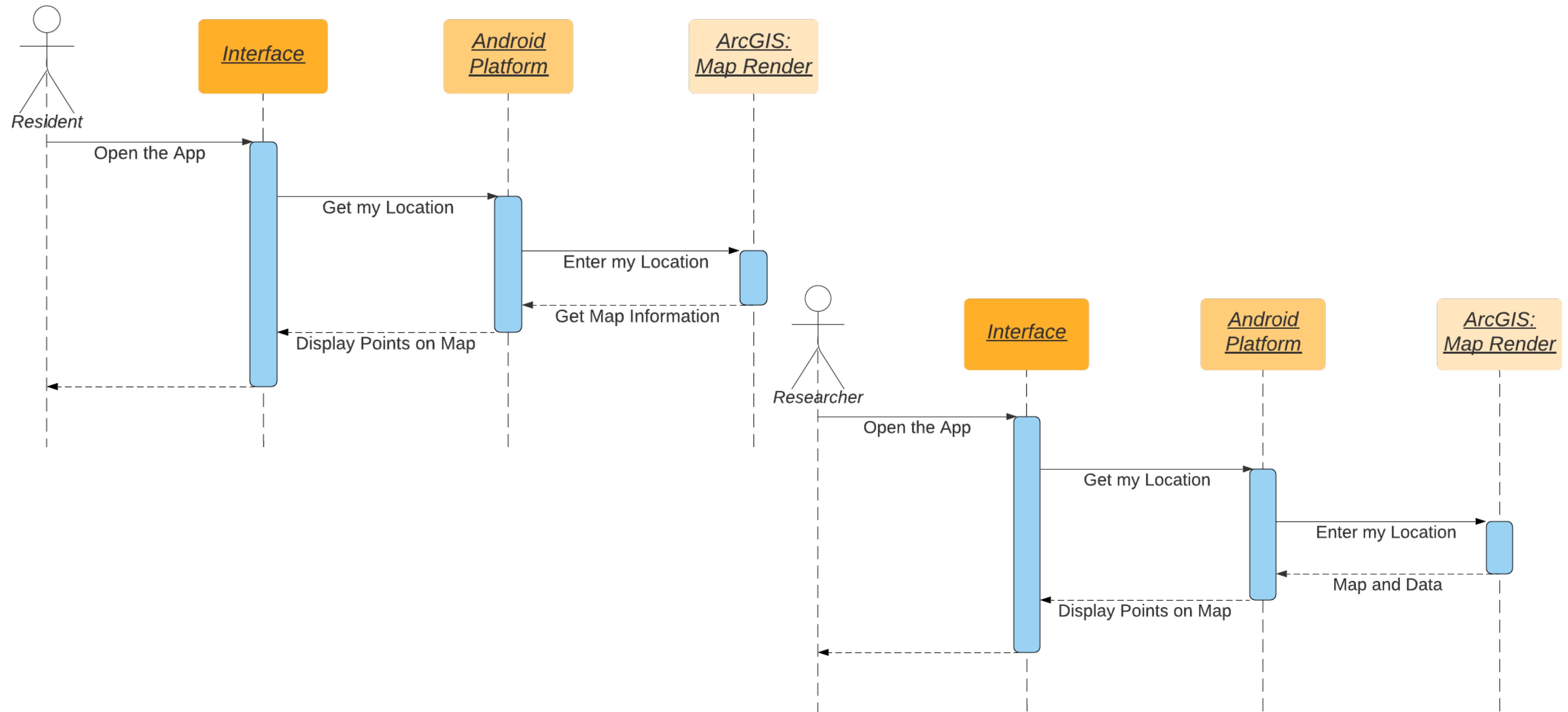
Local Residents

Salinity Map | Interface Design

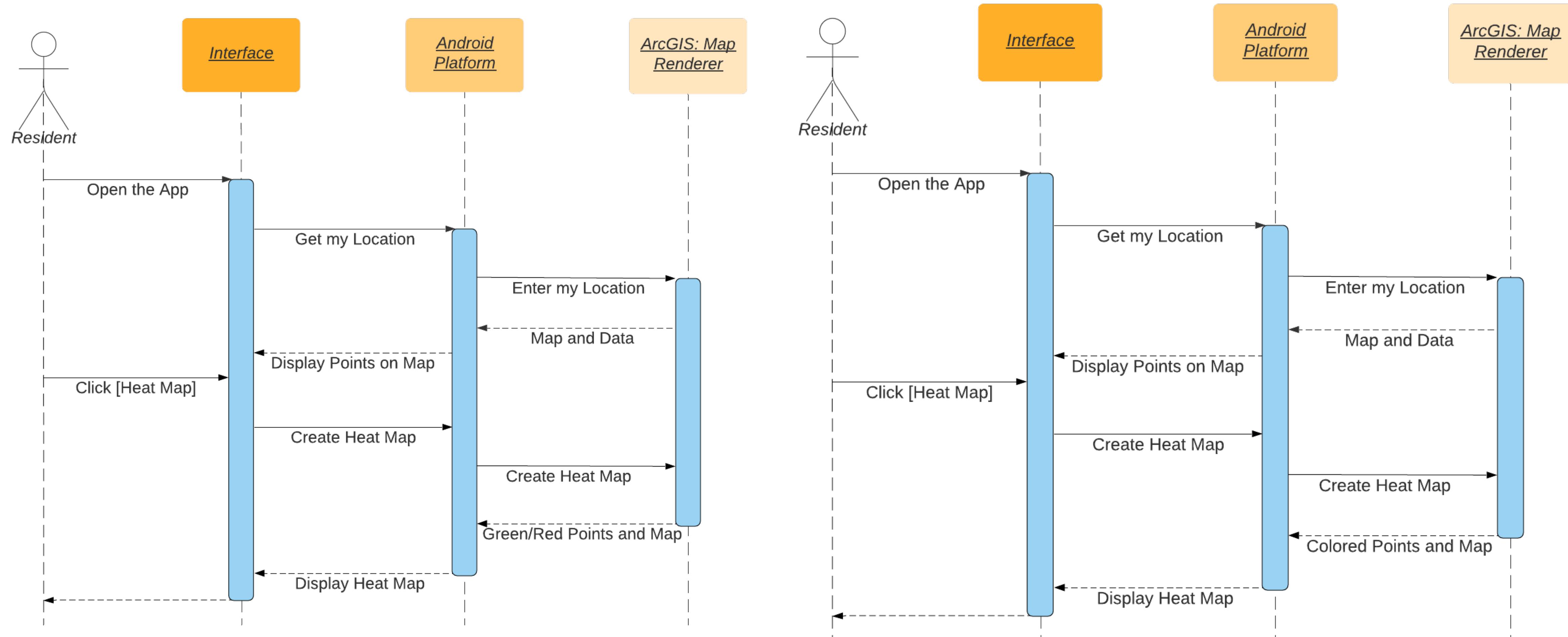


Initial Software Design

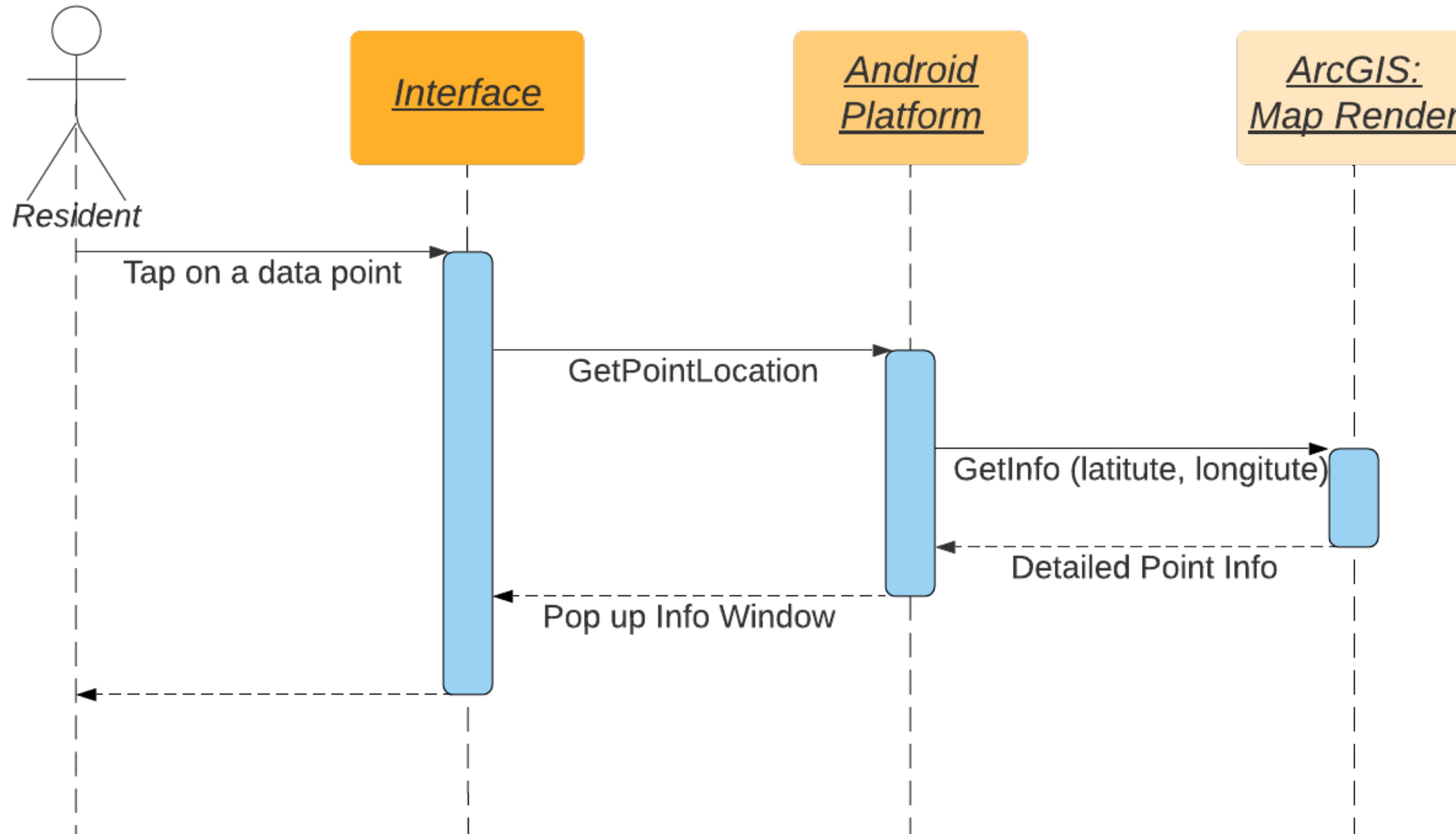
Show points of salinity data on the map for residents and researchers



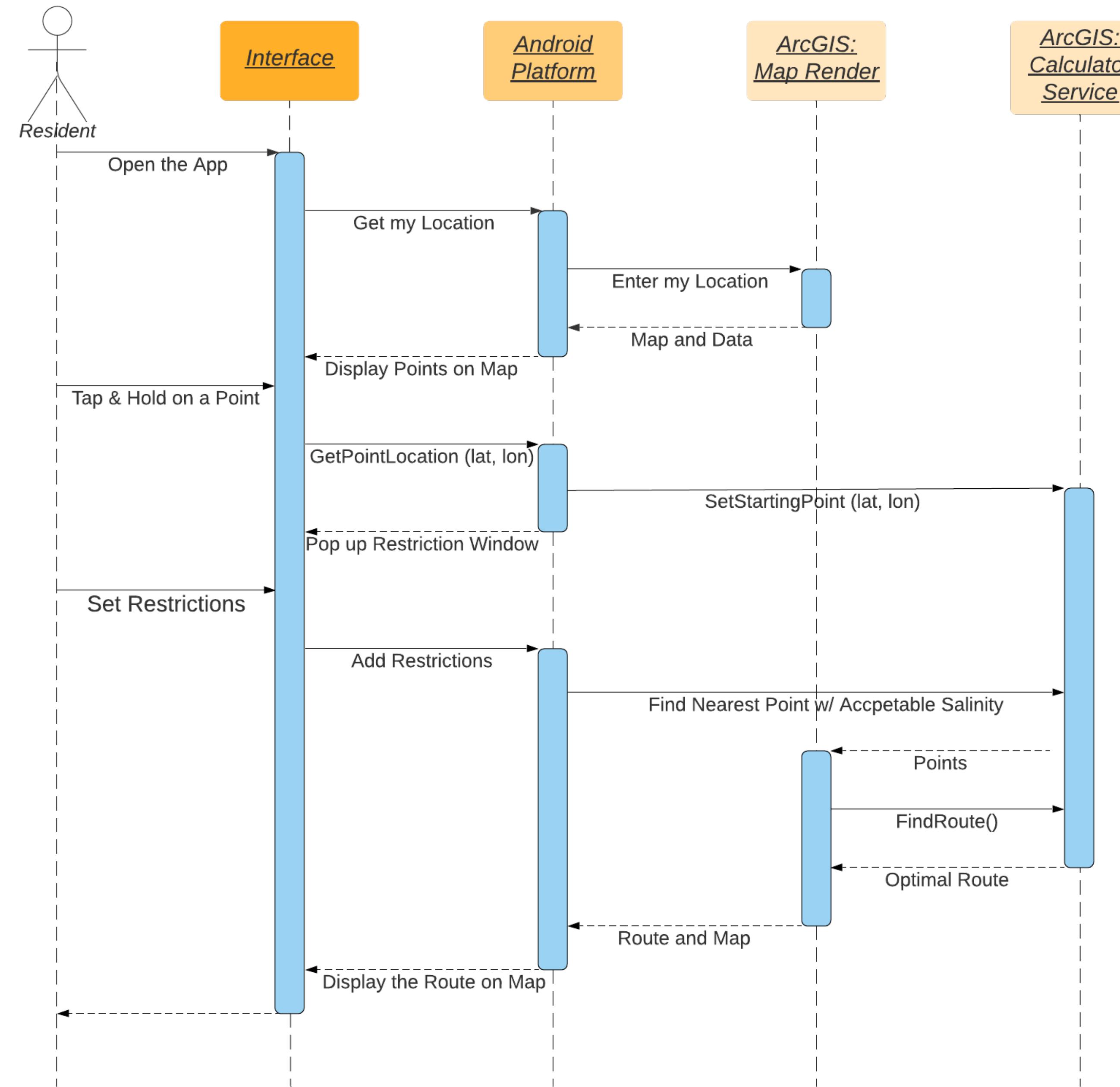
Apply heat map to show salinity concentration for residents and researchers



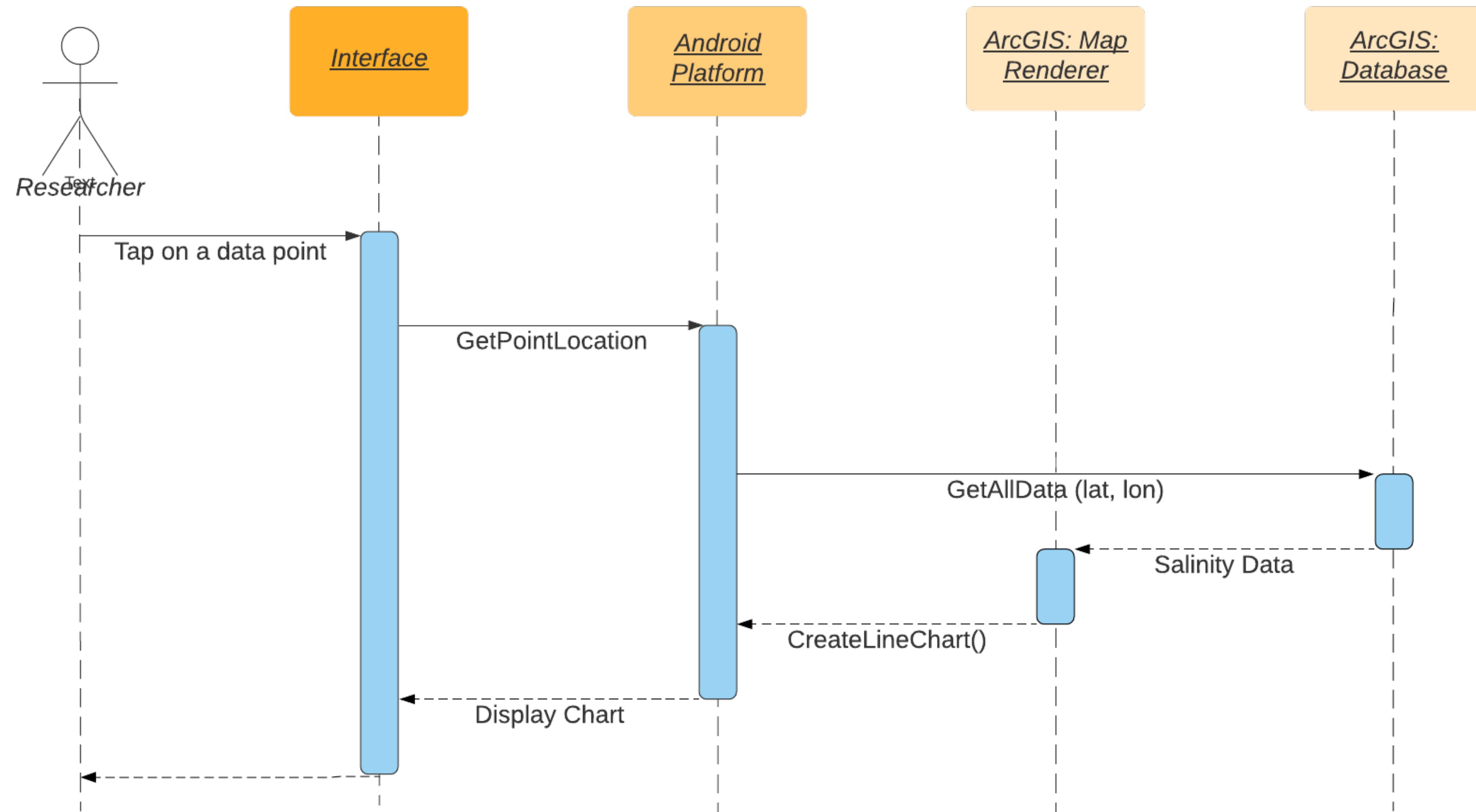
Show detailed information of water salinity for a resident



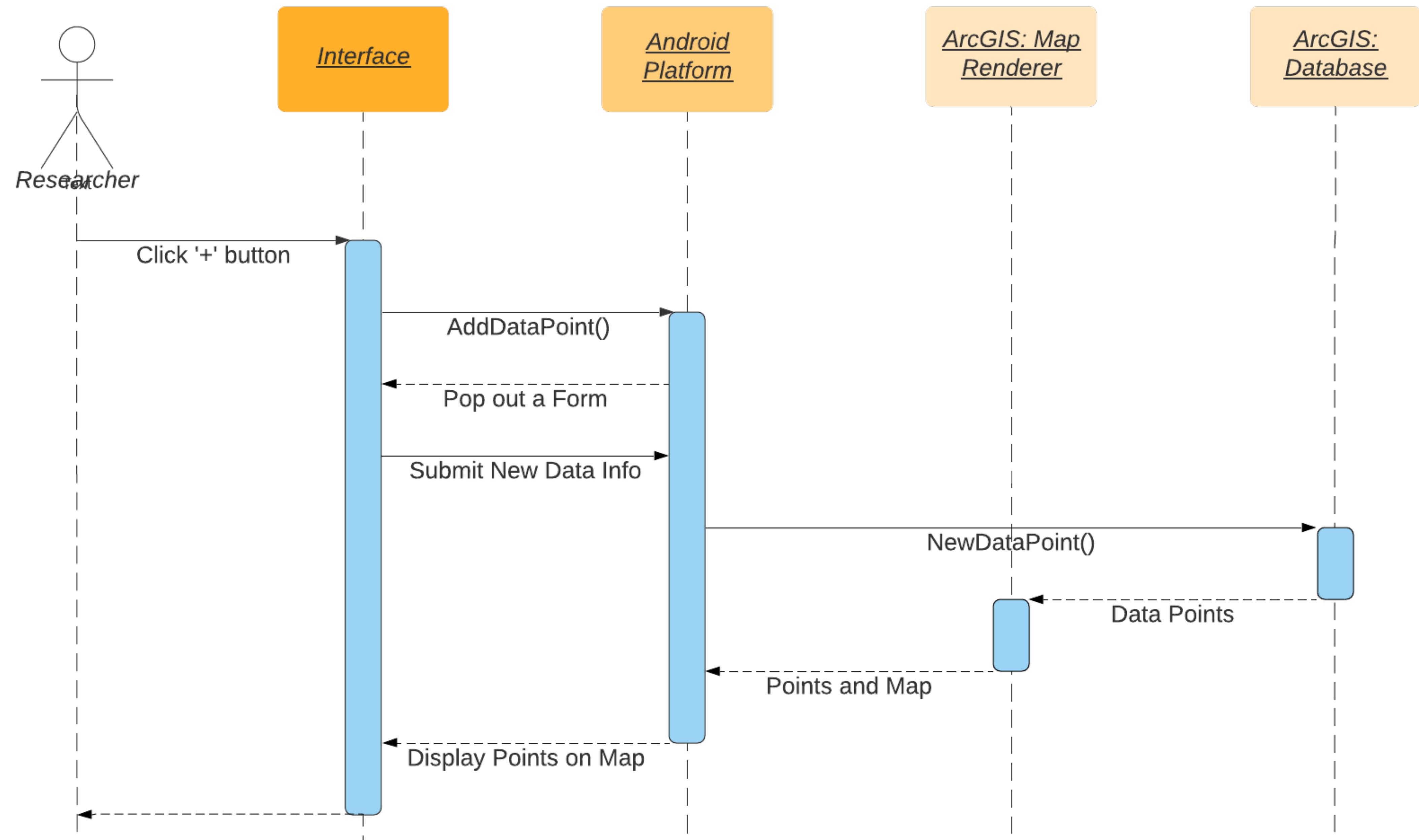
Show the route to the nearest acceptable water source for a resident



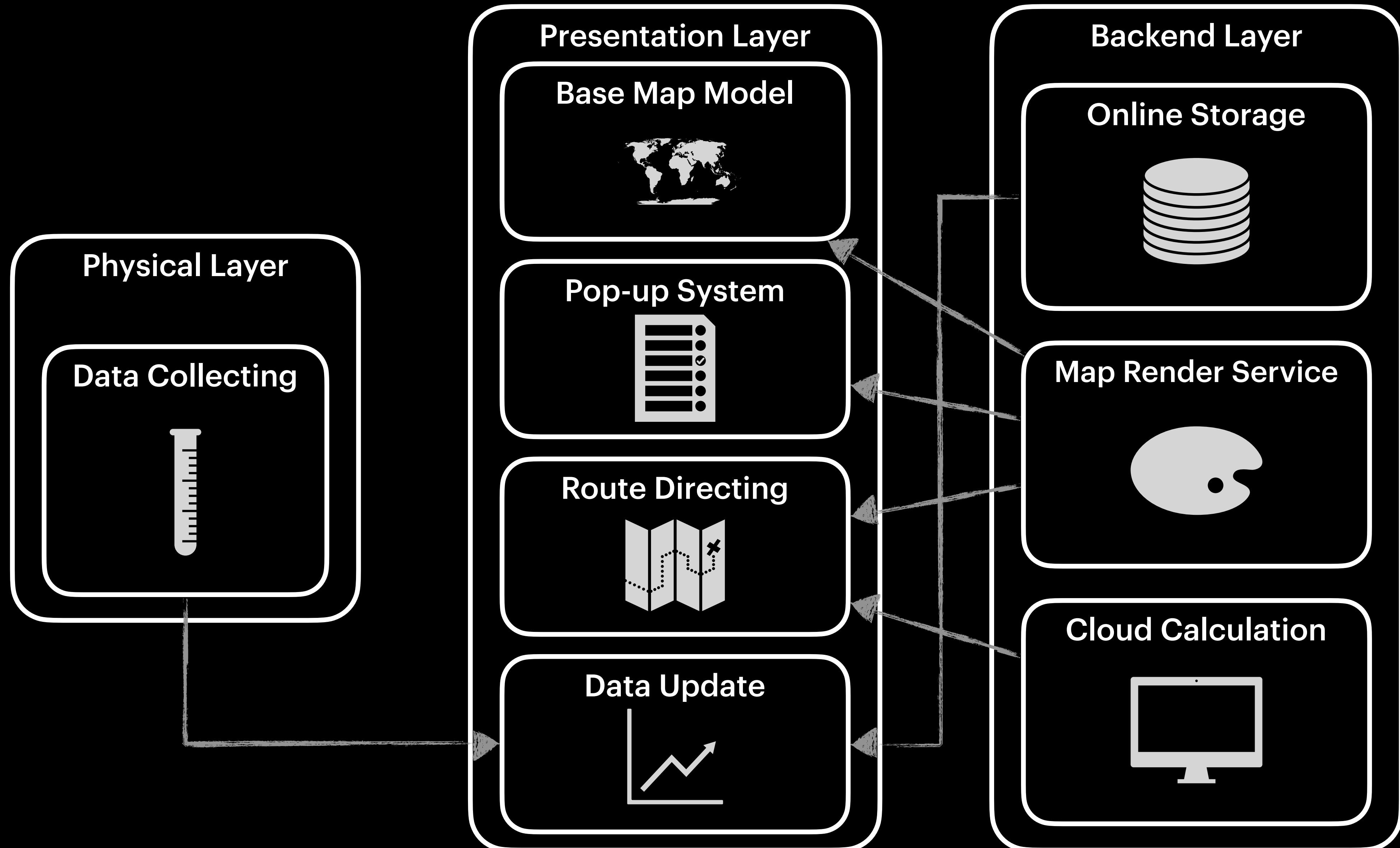
Show a line chart of salinity data history at a point for a researcher



Add new data to the database for a researcher



Software Architecture



Physical Layer

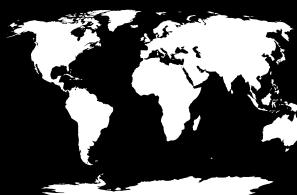
Data Collecting



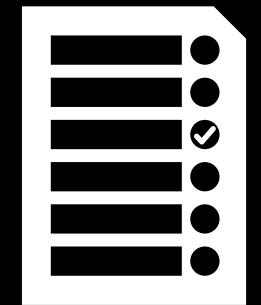
- Salinity measure device
- Native measuring

Presentation Layer

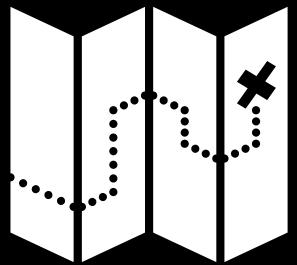
Base map model



Pop-up system



Route Directing



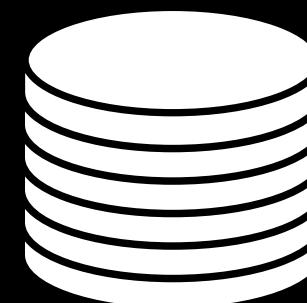
Data Update



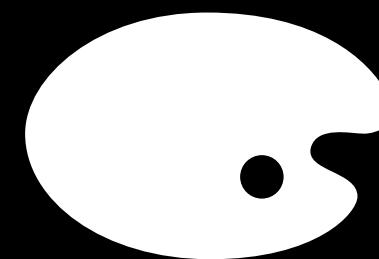
- Android studio environment
- Basic water salinity information with a base map
- Option to see further information of data points in pop-up windows
- Destination directing for the nearest water source of lowest salinity
- Update the data of certain water source with access to database

Backend Layer

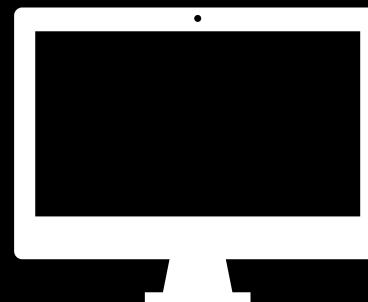
Online Storage



Map Render service



Cloud Calculation



- ArcGIS web stack
- ArcGIS online storage – database
- Map render and visualization – ArcGIS render API
- Cloud service – ArcGIS runtime APIs

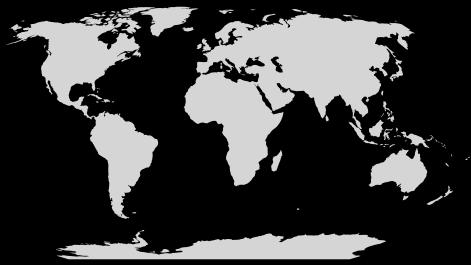
Architecture Choice

- Layer Pattern: physical part <→ client end <→ backend service
- Independent modules and functions in each layer
- Integrated backend environment – ArcGIS online service
- Communication between layers – API functions

Implementation Considerations

Implementation Consideration

ArcGIS



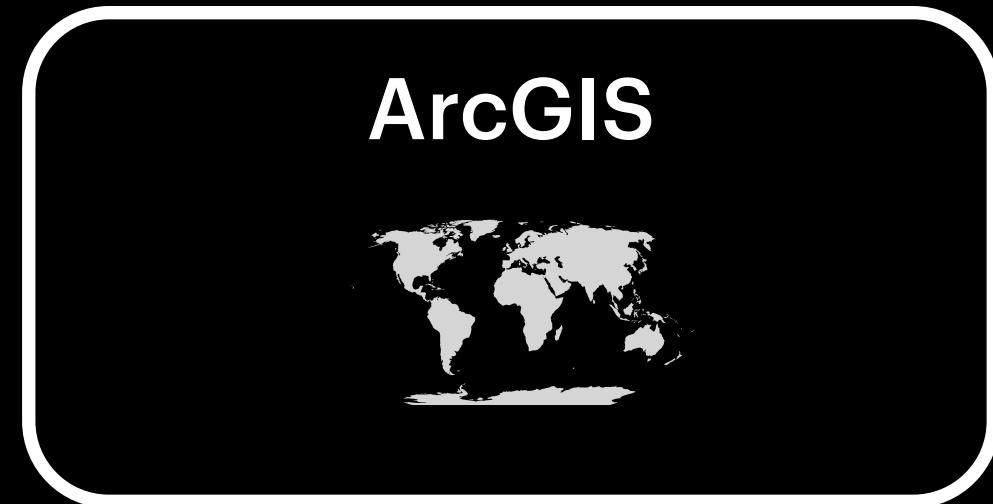
Choice of Framework

Android



Choice of Platform

Choice of Framework



- Physical Layer: More data format available
- Presentation Layer: Better interaction experience
- Backend: Support more functionality

Choice of Framework | Physical Layer

	Mapbox Studio	ArcGIS	Leaflet
Data format supported	MBTiles, KML, GPX, GeoJSON, ShapeFile, CSV	GPX, GeoJSON, ShapeFile, CSV, TXT	GeoJSON
Map styling	Mapbox Studio	ArcGIS	Leaflet

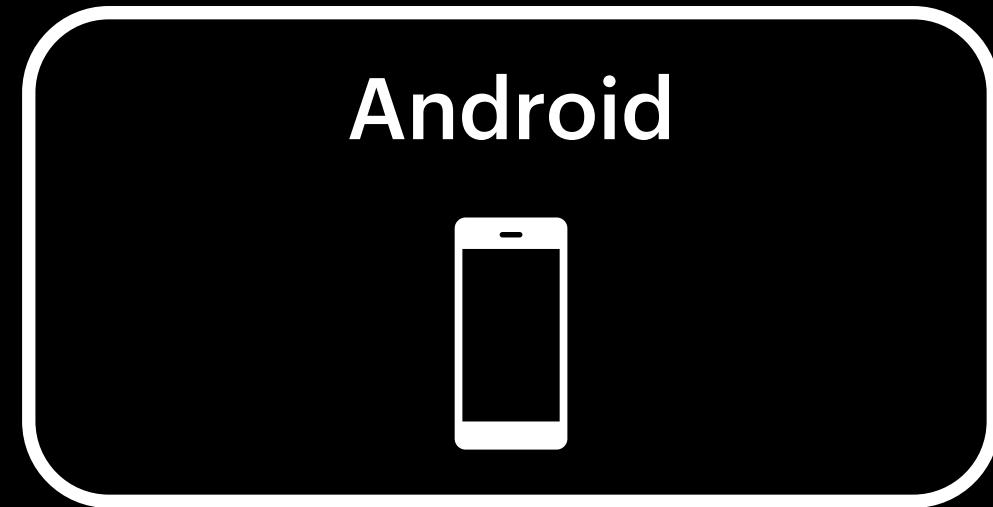
Choice of Framework | Presentation Layer

	Mapbox Studio	ArcGIS	Leaflet
Interaction Experience	Allow the following interactions: pinch, rotation, single tap, double tap, two-finger tappan, two-finger drag, One-finger zoom.	Able to Rotate map, set initial center and scale, show map extent, show map scale, swipe, swipe basemaps, navigate from view model, and etc.	Mouse/touch interaction enabled. Zoom and attribution controls.

Choice of Framework | Backend Layer

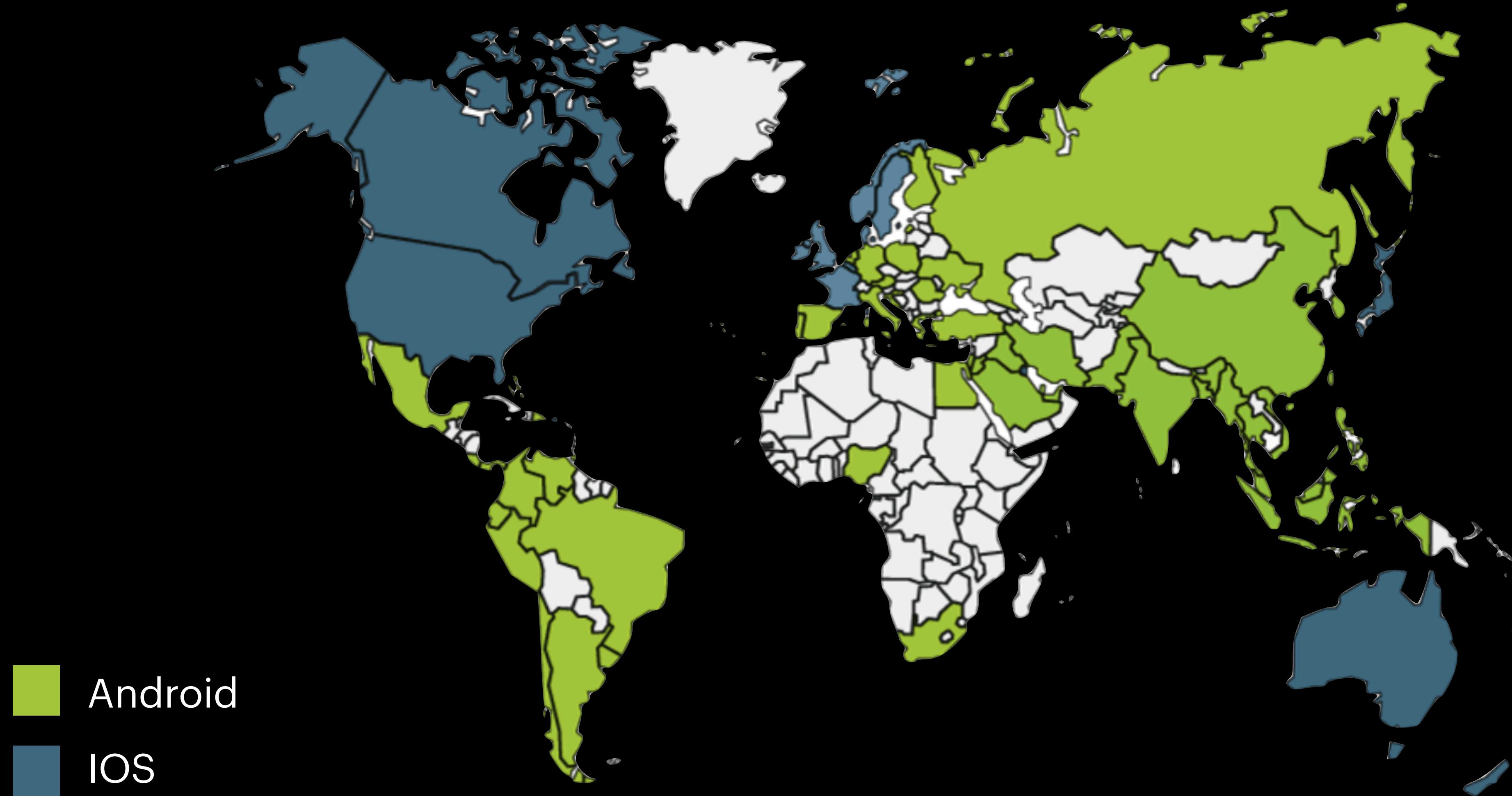
	Mapbox Studio	ArcGIS	Leaflet
Functionality	<ul style="list-style-type: none">1. Offline maps2. Add marker on the map3. Runtime styling4. Support augmented reality navigation.	<ul style="list-style-type: none">1. 2D and 3D visualization2. Search and geocode3. Advanced cartography and symbology4. Directions and Routing5. Geometry operations6. Offline data access and app usability	<ul style="list-style-type: none">1. Can add markers, basic shapes2. Support Popups.3. Support event handling

Choice of Platform

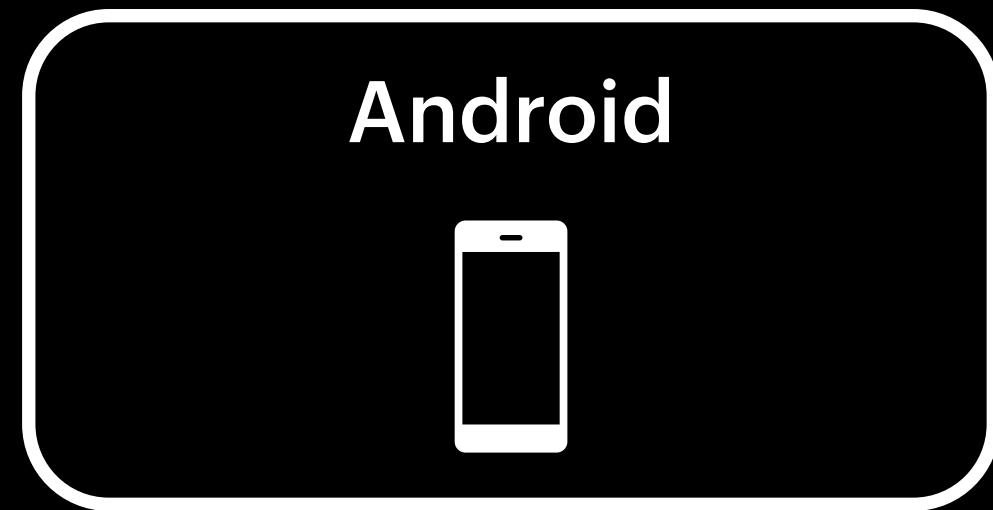


- Android have the greatest global market share
- Our developer is more familiar with Android platform
- Android allows more flexibility with features.

Choice of Platform



Choice of Platform



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Key Partners

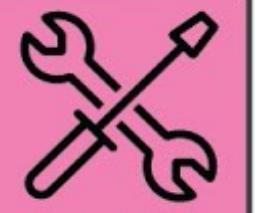


GIS framework
Vendor

Climate & weather
data provider

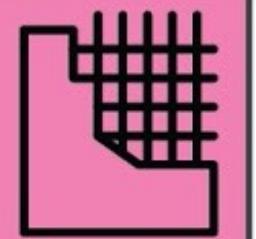
Database and cloud
service provider

Key Activities



Development
Maintenance

Key Resources



GIS Framework

Public weather
information

Cloud storage

Value Propositions

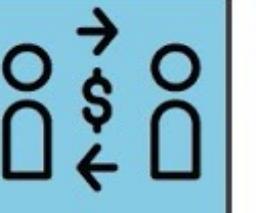


Help **resident** find
safer water in a
convenient way

Provide **researcher**
with a better insight
of the data

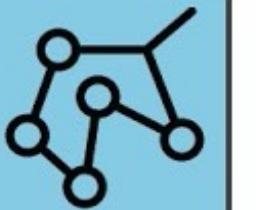
Give **government**
and **NGO** sense of
climate change and
support urban
planning

Customer Relationships



Feedback and
Improvement

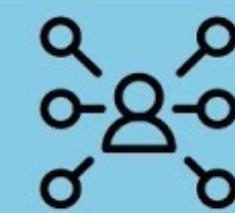
Channels



Online web map
and database

Mobile App

Customer Segments



People who care
effects brought by
water salinity and
climate changes

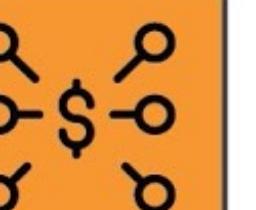
Researchers who
study the effect of
climate change on
wellness of ordinary
people

Government and
NGOs that need
climate data to
support their
activities

Cost Structure

MVP stage: free

Potential cost: Advanced GIS functions and scalable
cloud service



Revenue Streams

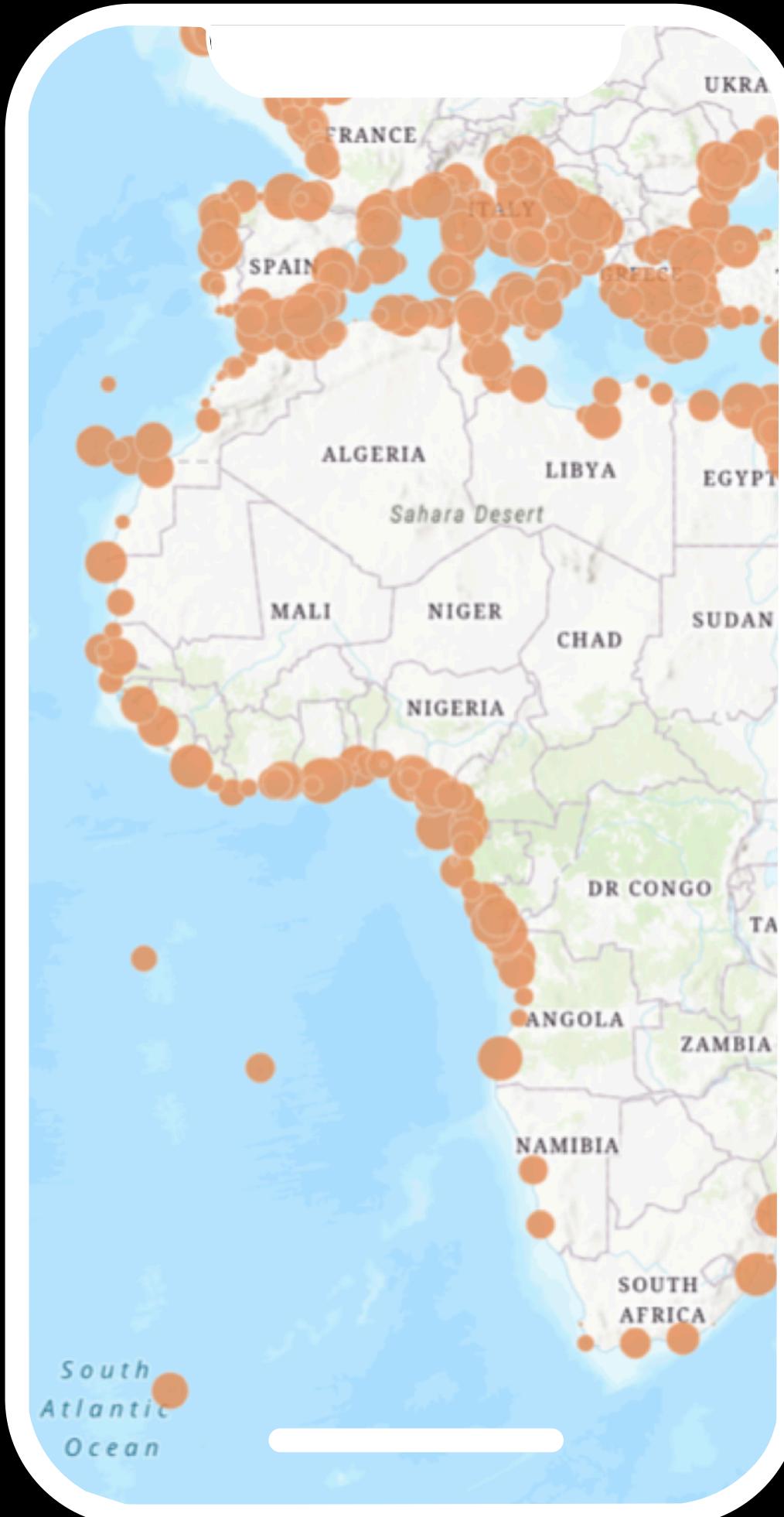
Funds from governments, researchers and NGO



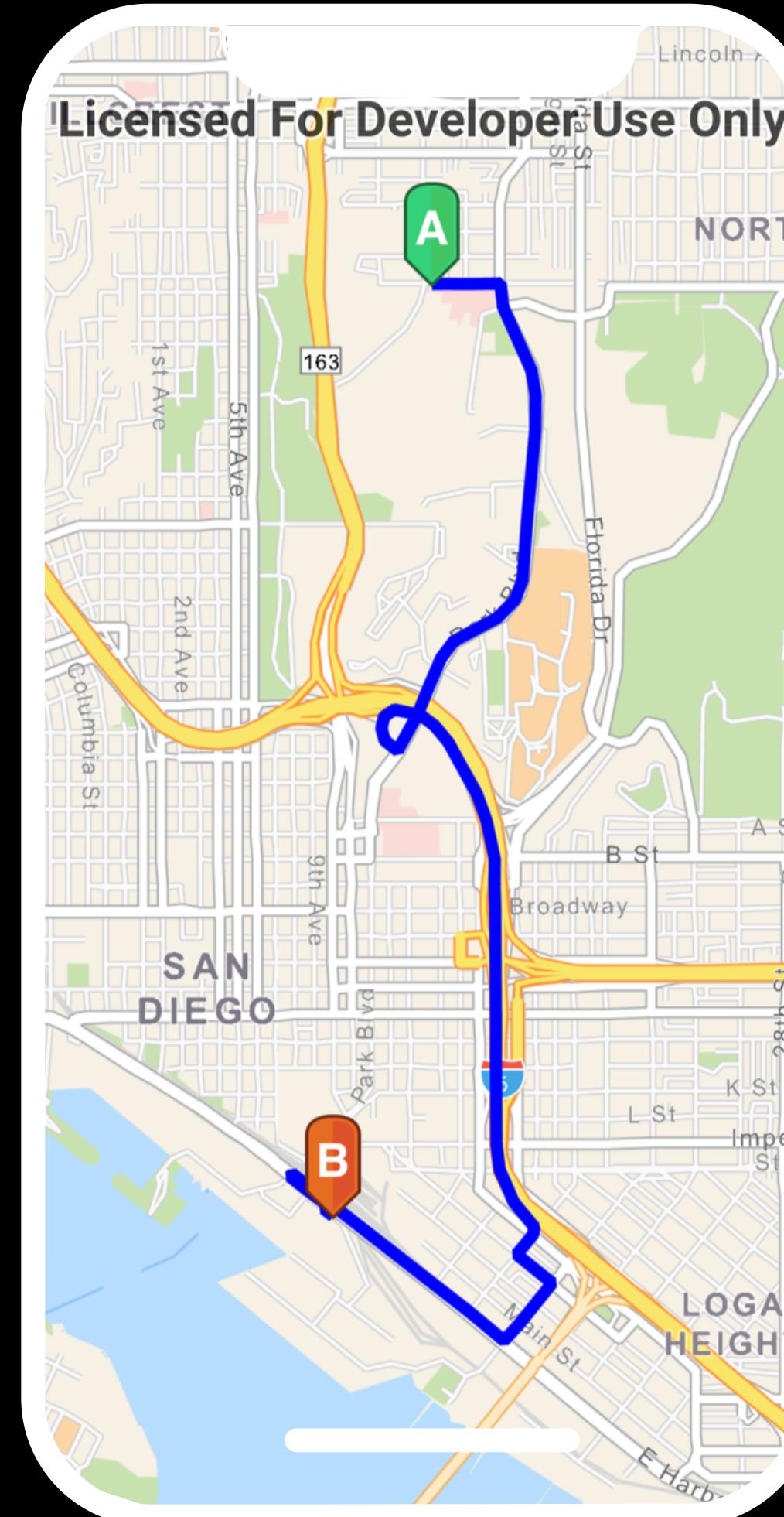
Customer Interview | progress and results

Time	Interviewee	Prototype	Takeaways
Jun 5	Mentor [as general user]	Design	<ul style="list-style-type: none">• Set basic requirements for a map app• Apply different features for different target groups
Jun 30	Volunteer [as resident]	Demo 1	<ul style="list-style-type: none">• Use color for salinity value instead of size• Add nearest data point navigation
Jul 26	Data scientists [as researcher]	Demo 2	<ul style="list-style-type: none">• Set access for researchers to updating database
Jul 30	Mentor [as general user]	MVP	<ul style="list-style-type: none">• Add real-time weather related information• Interface suggestions: self location, dot color

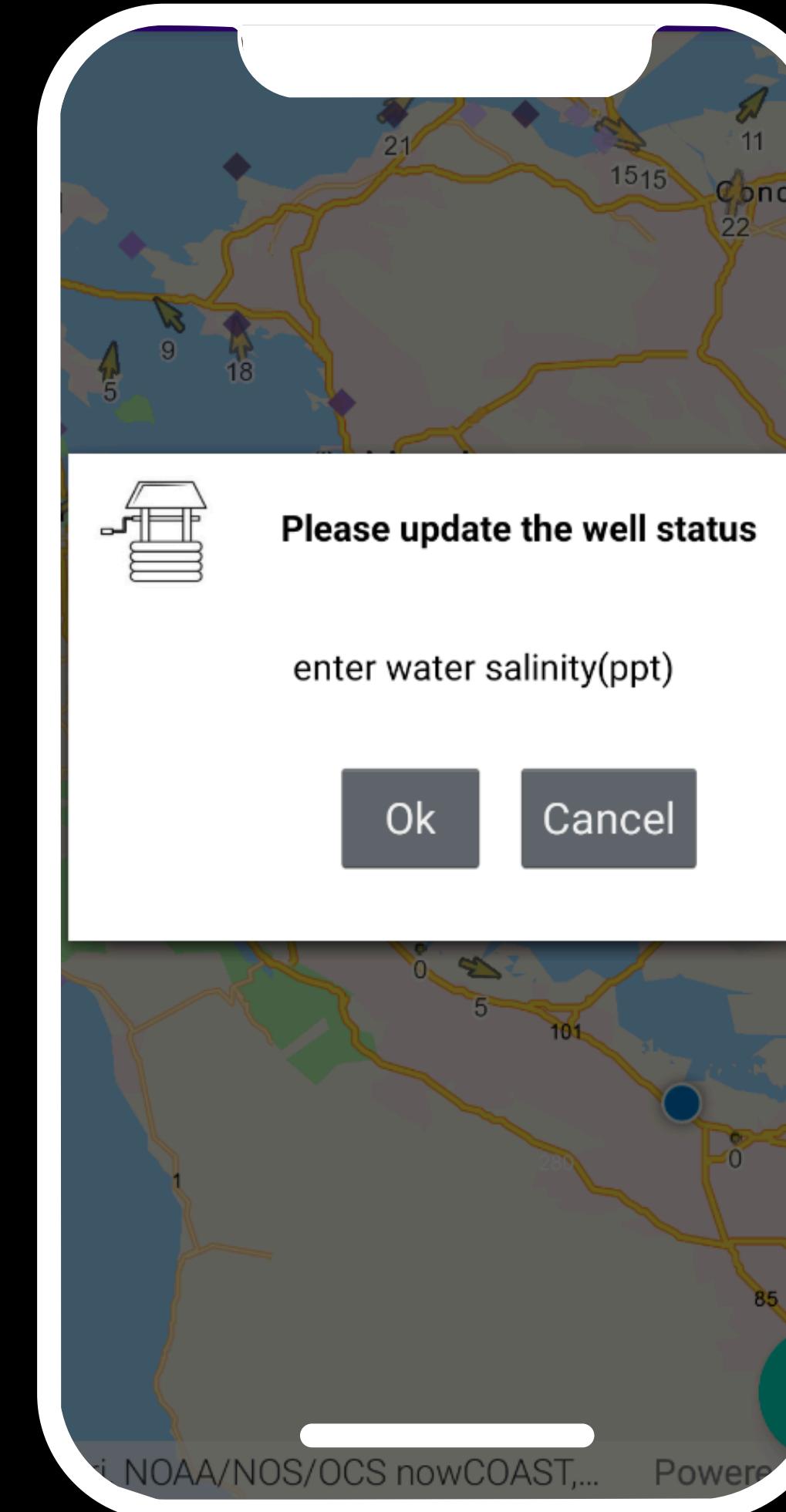
Agile Developing | design highlights



Salinity info



Navigation

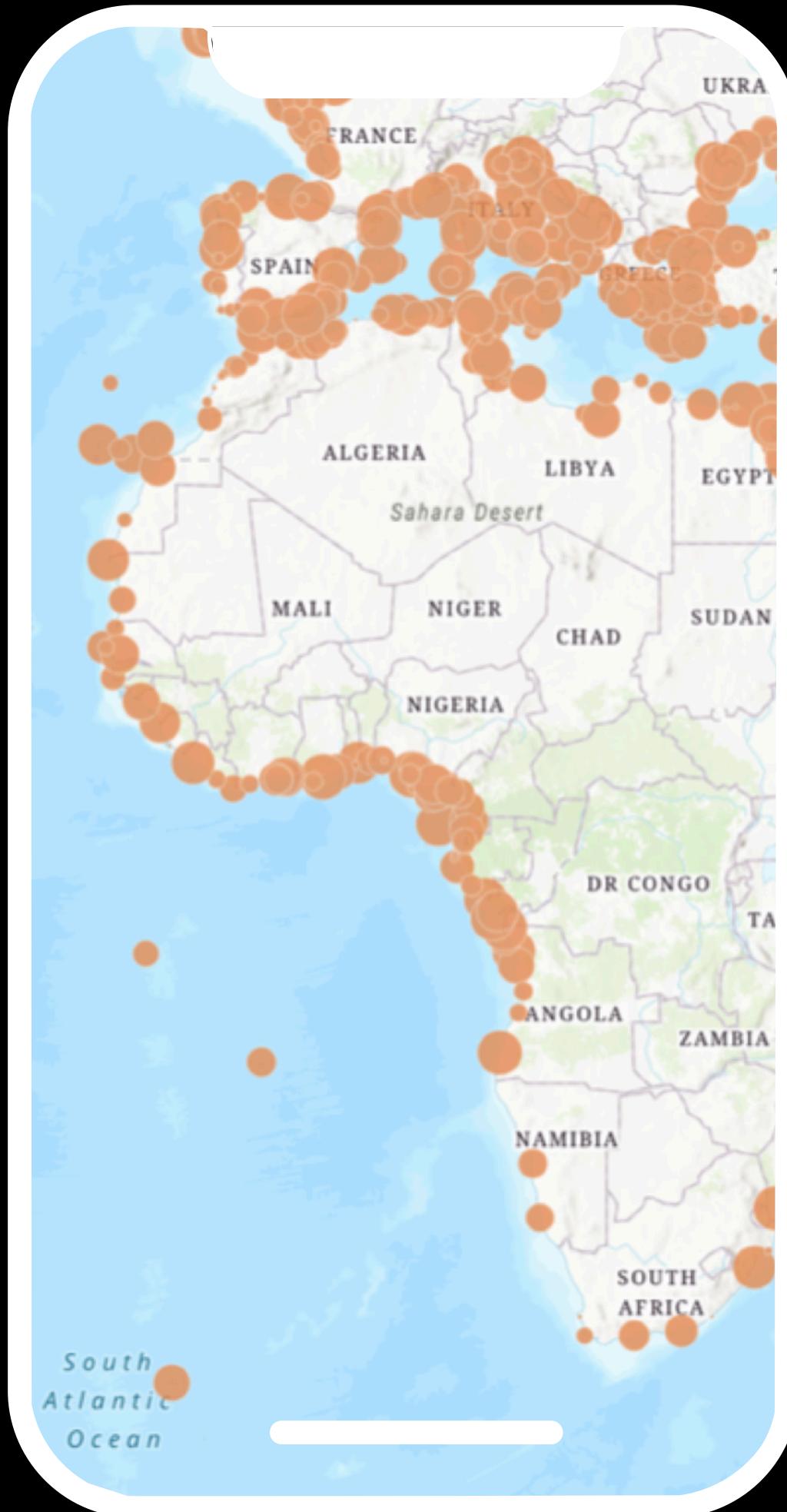


Database

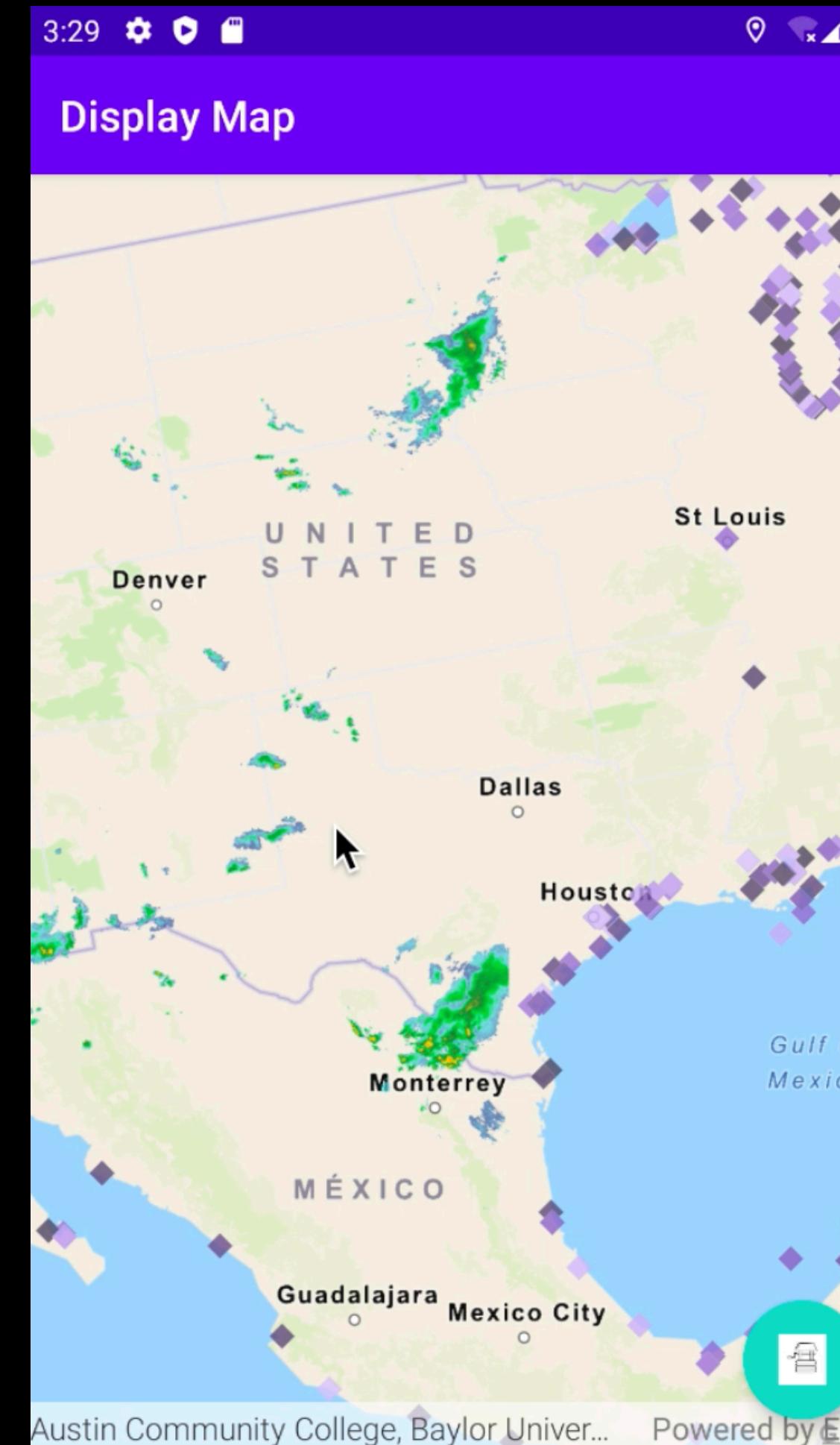
A sign-up page for an account. It features three input fields: "Username: username", "Password: password", and "Institute: institute". Below the fields is a large grey "SIGN UP" button. The page has a light gray header and footer.

Account

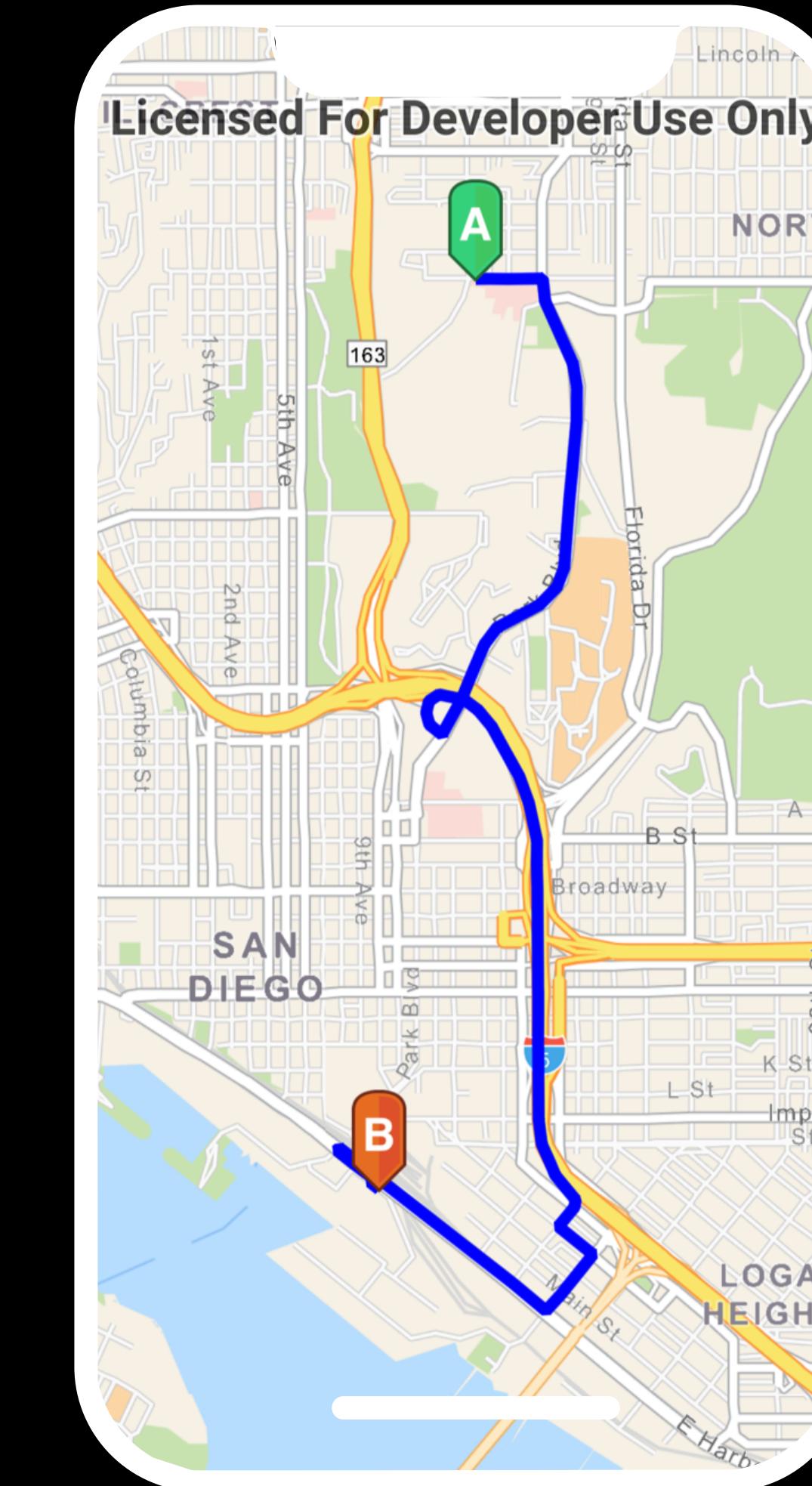
Agile Developing | comparison among different prototypes



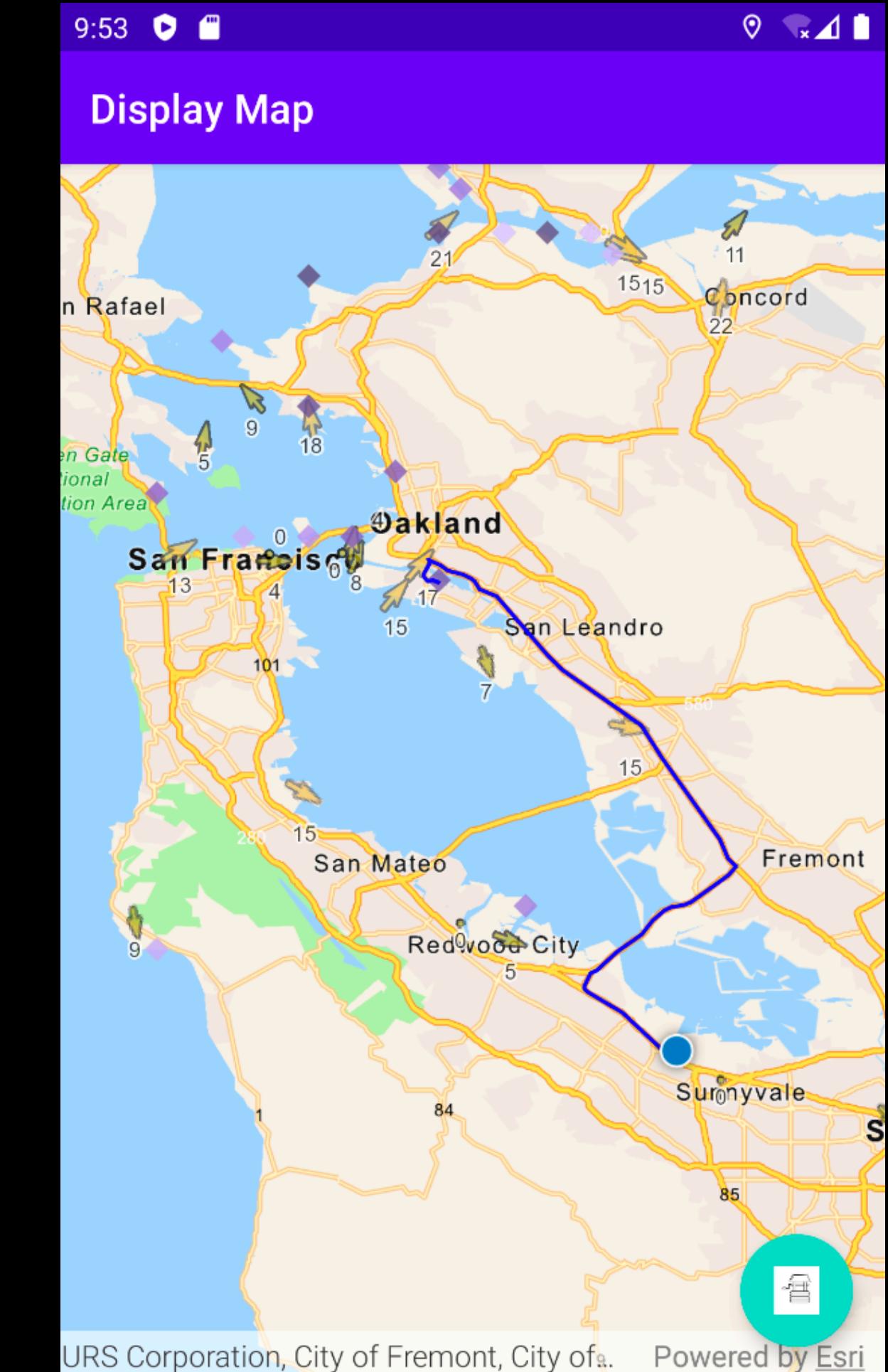
Draft



MVP

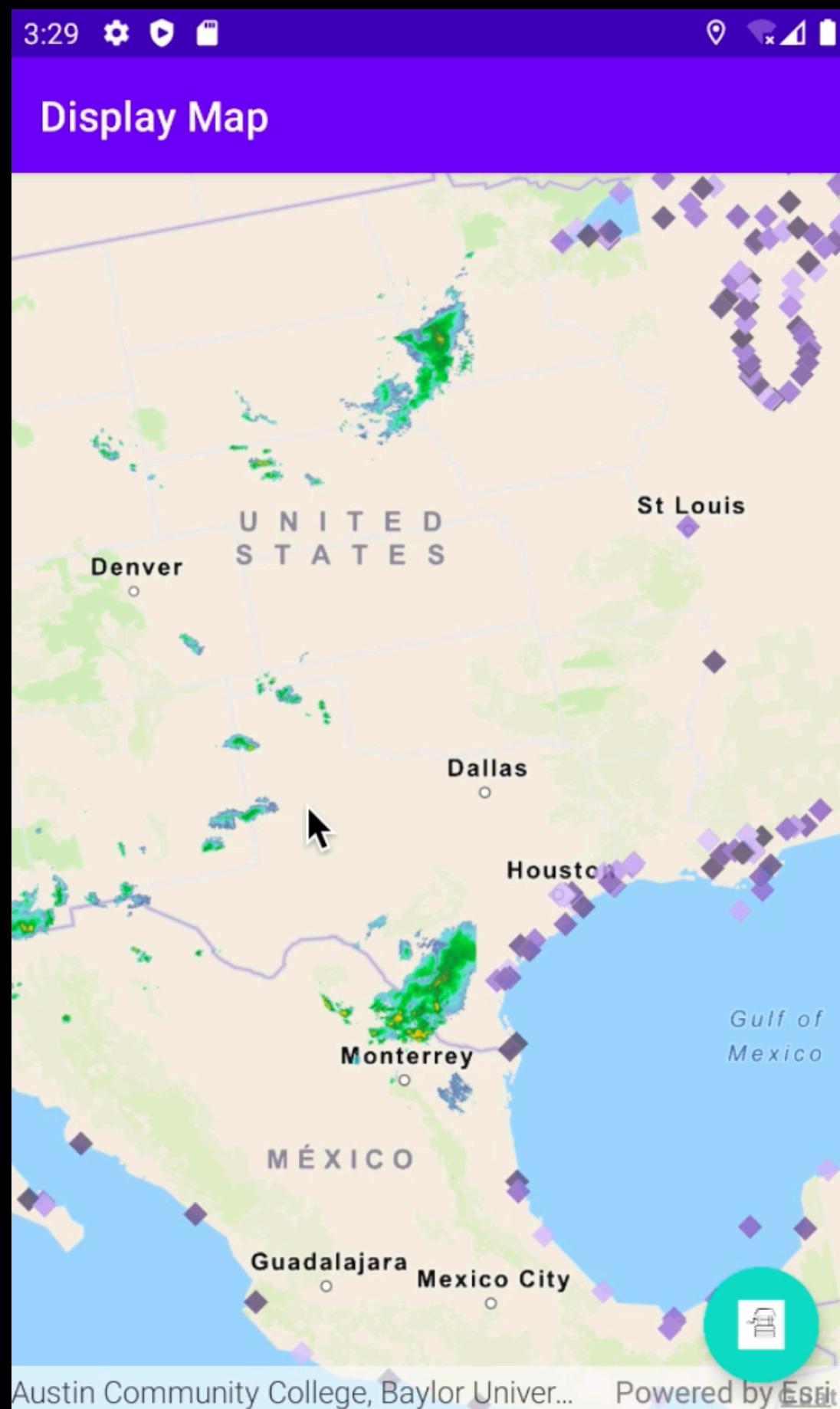


Draft

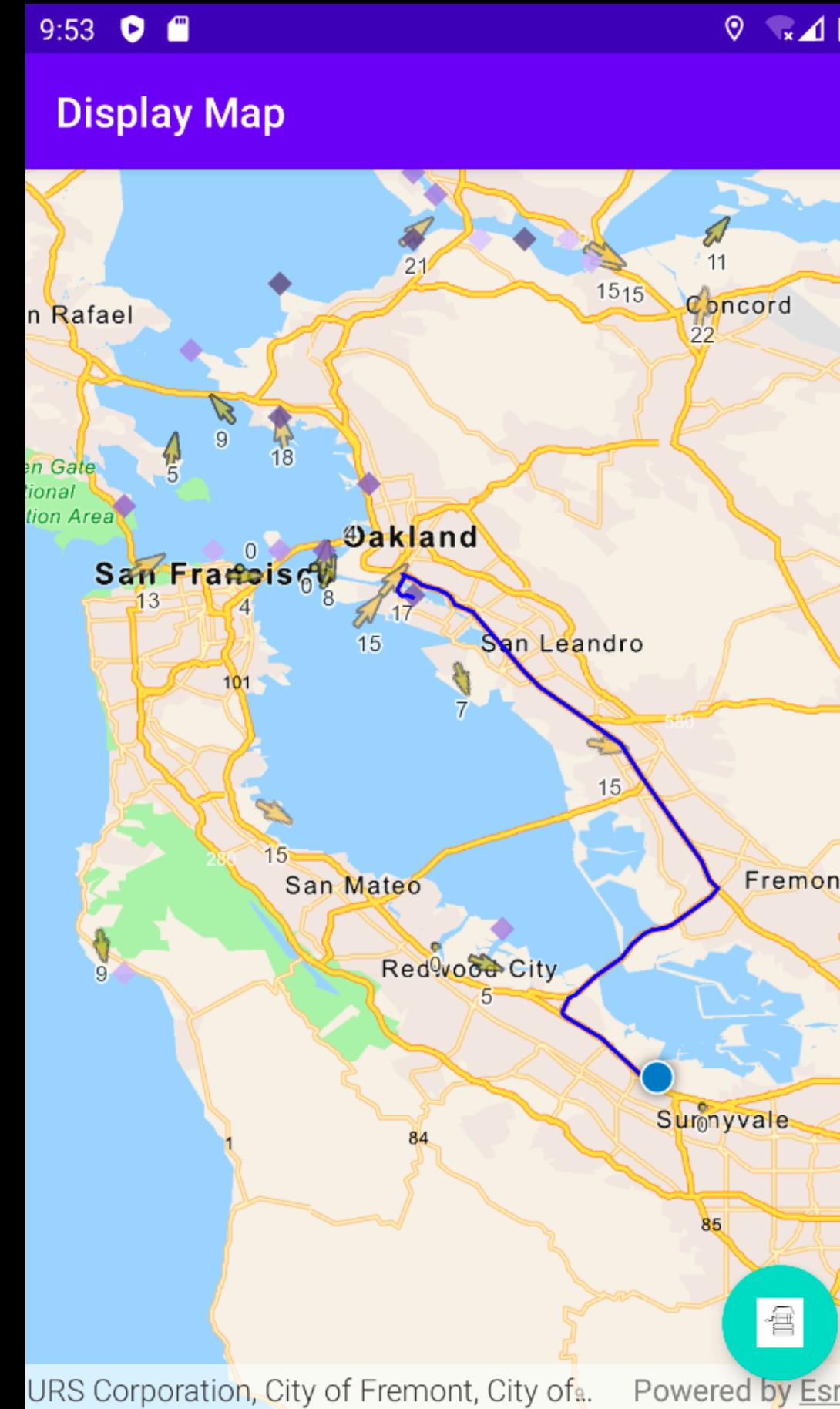


MVP

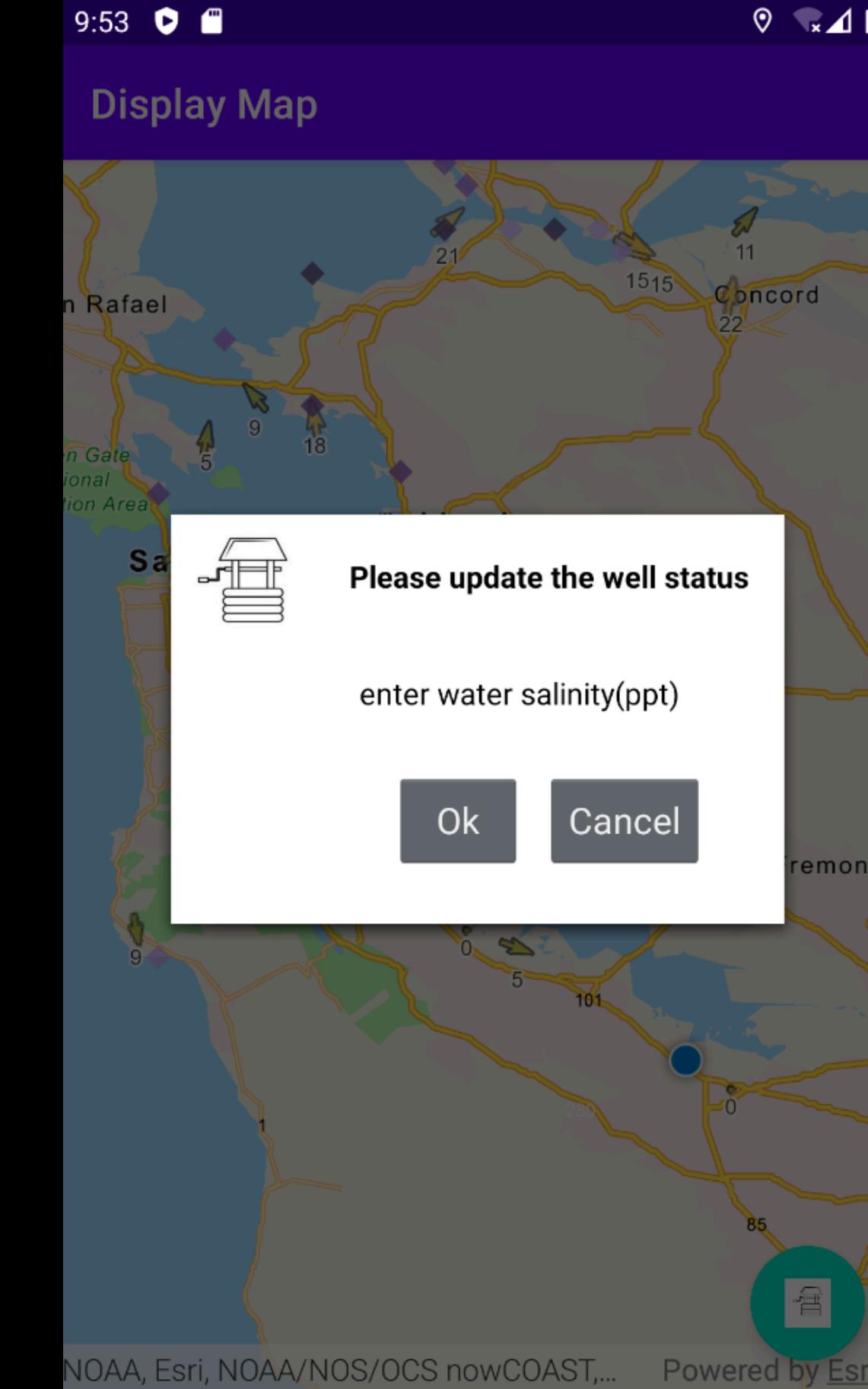
Agile Developing | mvp highlights



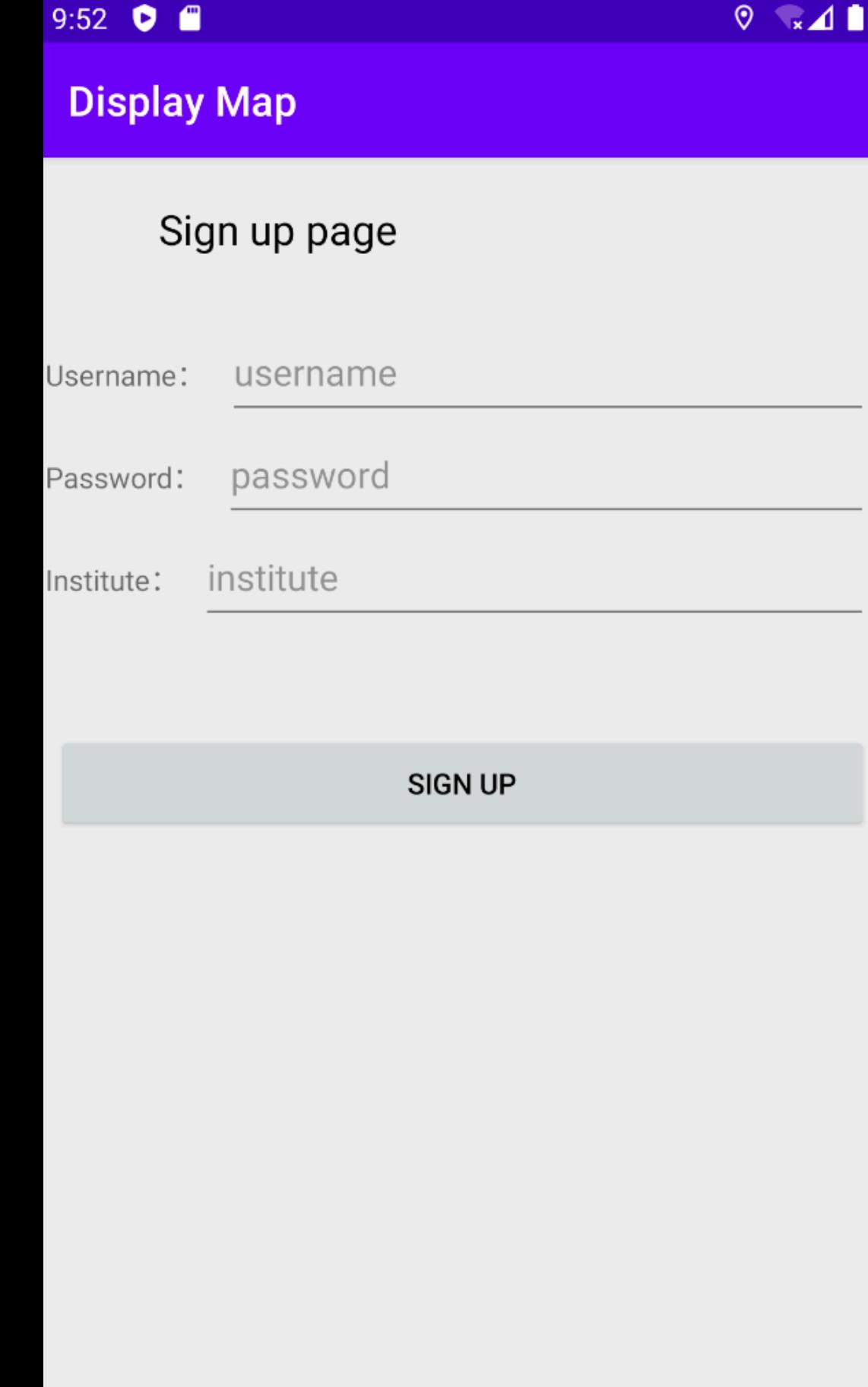
Salinity info



Navigation



Database



Account

Salinity Map

Q&A

Haoxuan Zhu

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Climate group | July 4, 2020