Midterm Design Challenge: Front-End

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This is the front end web development description for the fall 2024 IT490 - Systems Integration midterm design project.

Overview

In order for researchers to interact with the contact tracing data, an interactive and user-friendly interface must be created by the front-end integration. Features like participant listing, infection trend viewing, location mapping, and projection generation will all be available on the front end.

- **Visualize data** retrieved from the back-end system.
- **Provide user-friendly controls** for interacting with the data, including filters, search, and drop-down options
- **Enable real-time updates** to reflect changes in infection status, projections, and participant data. This could also be manually set depending on the allowances on our API calls.

Components

1. **Framework**
    - Use a front-end framework like **React.js**.
    - Use a graphing library provided by the API.
    - Use a mapping library like **Google Maps API** for customizable location visualization.

    > A good example of using custom Google Maps API can be seen here: https://www.youtube.com/watch?v=CdDXbvBFXLY

    - CSS: Use **Bootstrap**, which is an easy to use tool that is open-source and enhance responsiveness and visual design.
2. **Pages and Layouts**
    - **Dashboard Page**
    - **Participants Page**
    - **Map Visualization Page (Google Maps API)**
    - **Projections Page**
3. **API Calls**
    - Integrate with the communication layer to retrieve data for different views.
    - Handle user inputs and filters to refine data retrieval.

Implementation

1. Framework/Library Choice

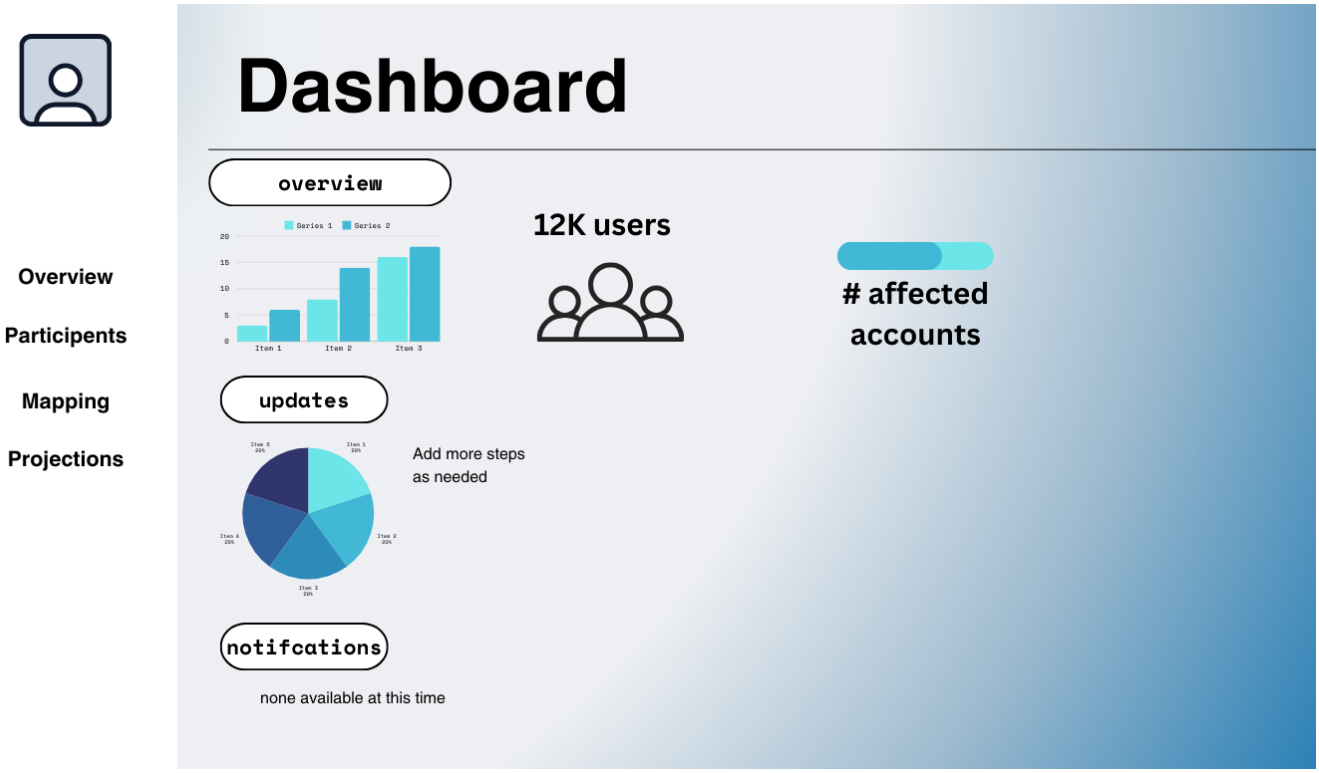
- **React.js** is recommended for this project due to its component-based architecture, extensive ecosystem, and performance optimizations.
- **CSS Framework**: Use a UI framework like **Bootstrap** to build responsive and mobile-friendly layouts.
- **Graphing & Mapping Libraries**:
  - **Graphing**: Whatever the REST API uses to build its graph like matplot for Python.
  - **Mapping**: Use **Google Maps API** for interactive map visualizations, as it's lightweight and highly customizable.

2. Pages and Layouts

Dashboard Page

- Provides an overview of metrics, including total participants, current infection trends, and real-time alerts.
- **Layout**:
  - **Top Section**: Quick stats (total participants, total infections, recoveries).
  - **Middle Section**: Line chart displaying infection trends over time.
  - **Bottom Section**: Real-time notifications for new infections or changes in participant status.
- **API Calls**:
  - `GET /api/dashboard/infections`: Retrieves data for the infection trends chart.
  - `GET /api/dashboard/notifications`: Fetches real-time alerts for updates in participant status.

Sample Layout

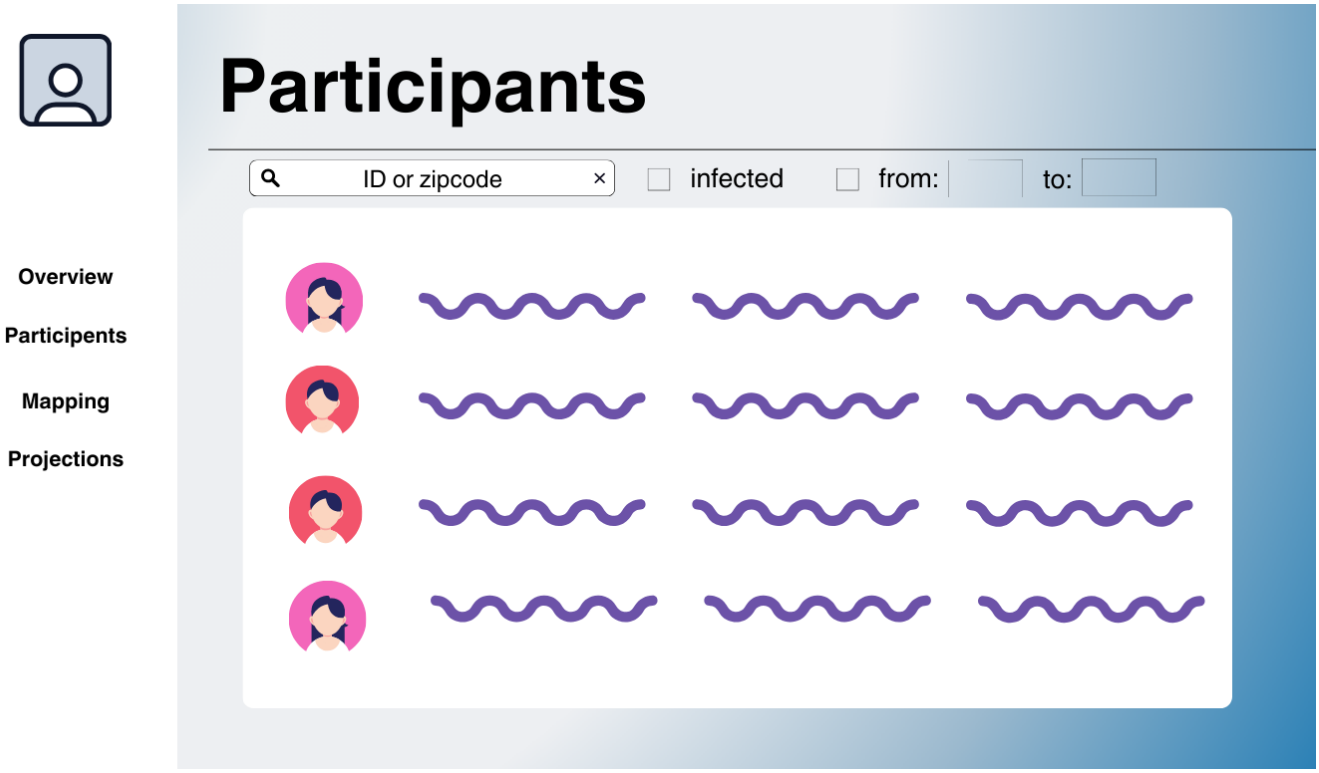


Participants Page

- Allow users to search, filter, and view participants based on health status, location, and time range.
- **Layout**:

- **Top Section**: Search will be mostly on the top page that will populate down to the rest of the page when search is utilized.
    - **Search Bar**: Allows users to enter participant ID or search by zipcode for broader search.
    - **Filters**: Checkboxes or dropdowns for filtering by infection status, age, or time.
- **Main Section**: Data will fill the rest of the page that would have static naming columns for better readability.
    - **Data Table**: Displays participant details with sortable columns.
- **API Calls**:
    - `GET /api/participants`: Fetches the list of participants.
    - `GET /api/participants?infected=not_null`: Fetches only infected participants.
    - `GET /api/participants?ageRange=20-30`: Filters participants by age range.

Sample Layout



Map Visualization Page

- Display the locations of participants and infection hotspots on a mapping API such as Google API.
- **Layout**:
    - **Top Section**: Map filters.
    - **Main Section**: Interactive map showing participant locations (polygon mappingg style).
    - **Mini Pop ups**: Additional participant details will pop up when an area is clicked. It can also function as a zoom or "closer look" inspection that can filter searches in a granular way.
- **API Calls**:
    - `GET /api/locations?id=123`: Retrieves GPS coordinates for a specific participants location.
    - `GET /api/infections/map`: Retrieves data for infection hotspots for overview.

Example Code for API Integration (React.js)

- **Sample interactive map using Google Maps API:**

> The sample provided is from Google Maps API documentation:
> https://developers.google.com/maps/documentation/javascript/examples/boundaries-simple

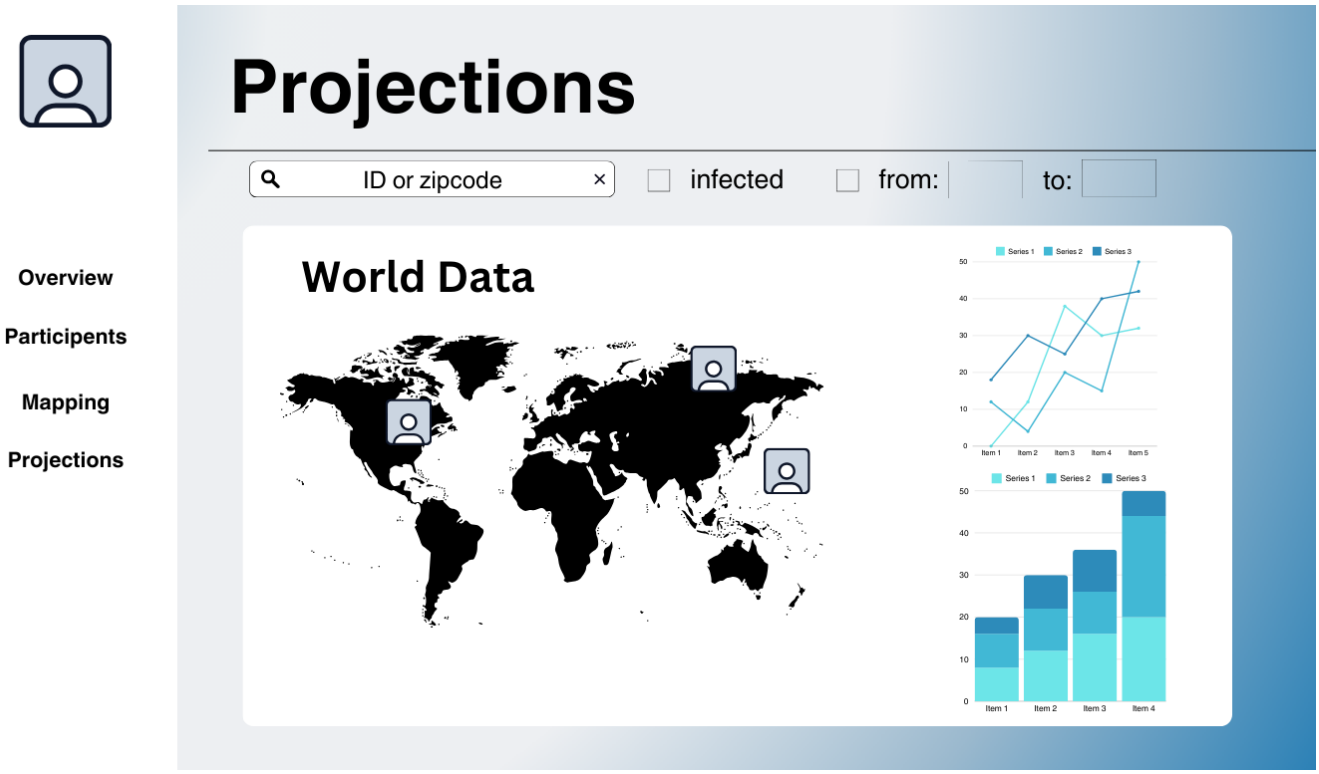
```
let map;
//@ts-ignore
let featureLayer;

async function initMap() {
  // Request needed libraries.
  const { Map } = await google.maps.importLibrary("maps");

  map = new Map(document.getElementById("map"), {
    center: { lat: 20.773, lng: -156.01 }, // Hana, HI
    zoom: 12,
    // In the cloud console, configure this Map ID with a style that
enables the
    // "Locality" feature layer.
    mapId: "a3efe1c035bad51b", // <YOUR_MAP_ID_HERE>,
  });
  //@ts-ignore
  featureLayer = map.getFeatureLayer("LOCALITY");

  // Define a style with purple fill and border.
  //@ts-ignore
  const featureStyleOptions = {
    strokeColor: "#810FCB",
    strokeOpacity: 1.0,
    strokeWeight: 3.0,
    fillColor: "#810FCB",
    fillOpacity: 0.5,
  };

  // Apply the style to a single boundary.
  //@ts-ignore
  featureLayer.style = (options) => {
    if (options.feature.placeId == "ChIJ0zQtYiWsVHkRk8lRoB1RNPo") {
      // Hana, HI
      return featureStyleOptions;
    }
  };
}

initMap();
```

Projections Page

- Enable users to generate and view infection projections over a specified time.
- **Layout**:
- **Top Section**: Fields for choosing filters based on clients search options.
    - **Filter Section**: Input fields for selecting the time range (start and end dates).

- **Main Section**: Data will be displayed here.
  - **Data Section**: Line chart or pie chart displaying projected infection rates over time.
- **API Calls**:
  - `GET /api/projections`: Sends a request to generate projections based on selected time ranges.

Sample Layout



3. API Integration

The front end will interact with the communication layer via REST API.

Example Code for API Integration

- **Sample Request with `javascript`:**

```
import React, { useEffect, useState } from 'react';
import axios from 'axios';

function ParticipantsPage() {
    const [participants, setParticipants] = useState([]);

    useEffect(() => {
        axios.get('/api/participants', {
            headers: {
                'Authorization': 'API_TOKEN_HERE'
            }
        })
        .then(response => {
            setParticipants(response.data);
        })
```

```
            .catch(error => {
                console.error('Error fetching participants:', error);
            });
    }, []);

    return (
        <div>
            <h1>Participants</h1>
            <table>
                <thead>
                    <tr>
                        <th>Participant ID</th>
                        <th>Age</th>
                        <th>Infected</th>
                    </tr>
                </thead>
                <tbody>
                    {participants.map(participant => (
                        <tr key={participant.ParticipantId}>
                            <td>{participant.ParticipantId}</td>
                            <td>{participant.Age}</td>
                            <td>{participant.Infected ? 'Yes' : 'No'}
</td>
                        </tr>
                    ))}
                </tbody>
            </table>
        </div>
    );
}

export default ParticipantsPage;
```