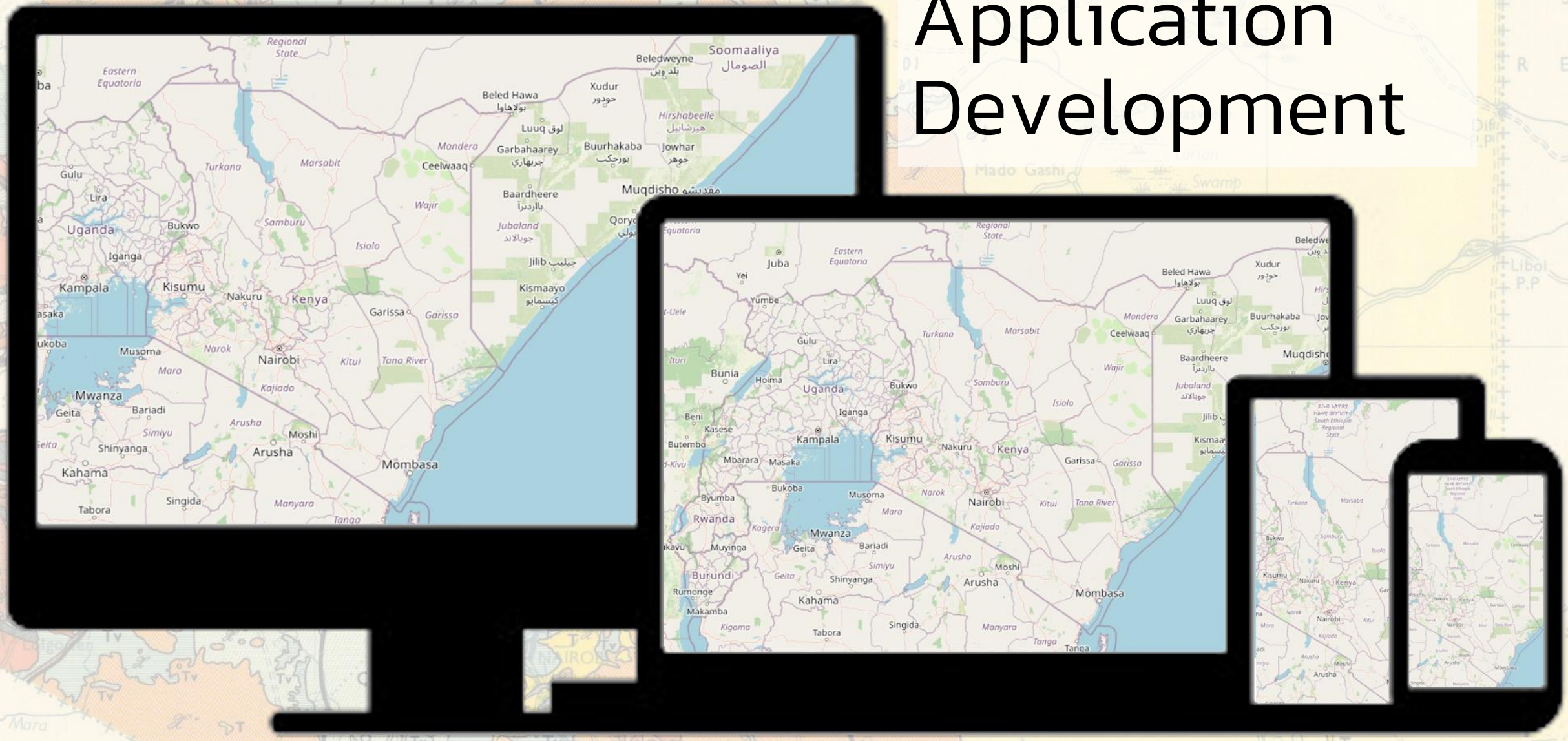
GIS Web Application Development



Introduction

Objectives

- **Understand the Fundamentals**
  - You'll gain a clear understanding of what GIS (Geographic Information Systems) are and their significance in modern geo applications.
  - Learn about opensource core technologies: Leaflet, Bootstrap, and GeoJSON and other alternertives
- **Setup and Environment**
  - Get familiar with setting up a development environment for building GIS web applications.
  - Learn to integrate and use Leaflet, Bootstrap, and GeoJSON effectively.
- **Build a basic Functional Map Application**
  - Learn to create a basic interactive map using Leaflet.
  - Understand how to use GeoJSON for handling geographical data.
  - Use Bootstrap to create a responsive and user-friendly interface.
- **Implement Advanced Features**
  - Explore advanced functionalities such as dynamic data loading, custom controls, and interactive features.
  - Enhance the application with user interactions and customizations.
- **Deployment and Best Practices**
  - Learn the steps for testing and deploying a GIS web application.
  - Understand best practices for maintaining and updating the application.

Introduction – Cont.

Overview of the Session

1. **Introduction to GIS Web Applications**
2. **Setting Up the Environment (**Visual Studio Code**)**
3. **Understanding the Tools(**Bootstrap, Leaflet, and GeoJSON.**)**
4. **Building the Basic Map**
5. **Working with GeoJSON**
6. **Interactive Features**
7. **Example Projects**
8. **Q&A and Wrap-Up**

Introduction to GIS Web Applications

Definition and Importance

- **GIS (Geographic Information Systems)**: A system designed to capture, store, manipulate, analyze, manage, and present spatial or geographic data.
- **Importance**:
  - Enhances decision-making with spatial insights.
  - Facilitates efficient resource management.
  - Supports various sectors like urban planning, environmental monitoring, transportation, and disaster management.

Introduction to GIS Web Applications – Cont.

Real-world Applications of GIS

- **Urban Planning**:Zoning and land-use planning.
  - Urban Redevelopment Authority of Singapore (URA) – https://www.ura.gov.sg/maps/index.html?service=CTRLPLAN#
- **Environmental Monitoring**:
  - Tracking changes in ecosystems - https://www.climate.gov/news-features/event-tracker
  - Managing natural resources.
- **Transportation**:
  - Route optimization. – Google Maps
  - Fleet Management and Realtime Tracking of vehicles. – Vehicle Tracking Software
- **Disaster Management**:
  - Risk assessment and mitigation – https://www.arcgis.com/home/webmap/viewer.html?webmap=df8bcc10430f48878b01c96e907a1fc3#!
  - Emergency response planning
- **Public Health**:
  - Disease tracking and management - https://coronavirus.jhu.edu/map.html
  - Health resource allocation.

Understanding Bootstrap

Bootstrap: An open-source front-end framework for developing responsive and mobile-first web applications. Created by Twitter, it provides a collection of CSS and JavaScript tools.

Key features for responsive design

- **Grid System**: A flexible grid layout system that scales up to 12 columns as the device or viewport size increases.
- **Responsive Utilities:** Classes to show or hide content based on the device's screen size.
- **Pre-designed Components**: Ready-to-use elements like navigation bars, buttons, forms, and modals that are fully responsive.
- **Consistent Design:** Ensures a consistent look and feel across different browsers and devices.

Bootstrap Latest Version

https://getbootstrap.com/docs/5.2/getting-started/introduction/

Understanding Leaflet

Leaflet: An open-source JavaScript library used to build interactive maps for web applications. Lightweight and mobile-friendly, it is widely used for creating dynamic mapping solutions.

https://leafletjs.com/

- Features and advantages.

Simplicity and Ease of Use: Easy to learn and implement with straightforward syntax and documentation.

Lightweight: Compact size ensures fast loading times and better performance.

Extensibility: Supports numerous plugins that extend its functionality, such as heatmaps, geocoding, and drawing tools.

Customization: Allows for extensive customization of map features, including markers, popups, and layers.

Mobile-Friendly: Designed with mobile responsiveness in mind, ensuring maps work well on all devices.

Integration: Seamlessly integrates with other libraries and frameworks, including GeoJSON, Bootstrap, and various mapping APIs.

- Examples of projects using Leaflet.

Wikimedia Maps: Provides interactive maps for Wikipedia articles and other Wikimedia projects using Leaflet(https://maps.wikimedia.org/#4/40.75/-73.96).

Mapbox Studio: A platform for designing custom maps, leveraging Leaflet for interactive map functionality.

Understanding GeoJSON

GeoJSON: A format for encoding a variety of geographic data structures using JavaScript Object Notation (JSON). It is commonly used for representing simple geographical features, along with their non-spatial attributes.

https://en.wikipedia.org/wiki/GeoJSON

- Structure of GeoJSON

Feature Collection: An array of Feature objects.

Feature: Contains a geometry object and properties.

Geometry Objects: Point, LineString, Polygon, MultiPoint, MultiLineString, MultiPolygon, and GeometryCollection.

https://geojson.io/

Understanding GeoJSON – Cont.

- **Use Cases**
- Interactive Maps:
  - Displaying points of interest, routes, and regions.
- Data Visualization:
  - Visualizing geospatial data such as population density, weather patterns, or election results.
- Web Mapping Services:
  - Used in web mapping libraries like Leaflet to add data layers.
- APIs and Data Interchange:
  - Commonly used in APIs for sharing geospatial data between servers and clients.
- Geospatial Analysis:
  - Analyzing spatial data for trends and patterns.

Setting Up the Environment

- Required tools and libraries.
- Code Editor:
  - Recommended: Visual Studio Code (VSCode).
- Web Browser:
  - Recommended: Google Chrome or Firefox.
- Libraries:
  - **Leaflet**:
    - Leaflet.js and Leaflet.css files.
  - **Bootstrap**:
    - Bootstrap CSS and JS files.
  - **GeoJSON Data**:
    - Sample GeoJSON data files.
- Setting up a basic HTML template.
- Integrating Leaflet and Bootstrap.

Integrating Bootstrap and Leaflet

- Designing the layout with Bootstrap.

The tutorial for this is available a: https://kengeospatialist.github.io/Web-Mapping/

- Integrating map with Bootstrap components.
- Adding tile layers

Adding Markers and Popups

- Creating markers.
- Adding popups.
- Customizing markers and popups.

The tutorial for this is available a:
https://kengeospatialist.github.io/Web-Mapping/

Working with GeoJSON Data

- Understanding GeoJSON structure.
- Loading GeoJSON data.
- Styling GeoJSON layers.

The tutorial for this is available a:
https://kengeospatialist.github.io/Web-Mapping/

User Interaction

- Handling map events.
- Interactive layers and controls.

The tutorial for this is available a: https://kengeospatialist.github.io/Web-Mapping/

Example Project

The tutorial for this is available a:
https://kengeospatialist.github.io/Web-Mapping/

Q&A

- Open floor for questions.