

***Florida International University
Knight Foundation School of Computing and Information
Sciences***

Software Engineering Focus

Final Deliverable

Biscayne Bay Visualization

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Abstract

This document presents the information necessary to gain a good understanding of the Biscayne Bay Visualization website. This document describes the building of the site from its original predecessor. User stories that were finalized as well as user stories that were created but not finalized are listed in chronological order. This document will describe shortcomings of the project and give additional information on ways to improve the existing site.

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Introduction

In August 2020, a fish kill in Biscayne Bay caused about 27,000 fish to wash up ashore at multiple locations throughout the bay. The fish kill was first reported on August 10, 2020, and more reports came in as days passed. On August 13, 2020, a team of researchers from various institutions and non-profit organizations collected data about the water quality at different locations of the bay. This data was collected over several days to determine the root cause of the fish kill. This project is the visualization of that data, along with the creation of a front-end website to bring attention to the issues currently affecting the bay.

Current System

The previous system was a [webpage](#) that included a visualization utilizing a mapbox API to illustrate some of the data points that were collected. This webpage was a good starting point since it incorporated a video file that was created by another group of FIU students that were part of collecting the data from Biscayne Bay. The website used a sandbox site from FIU that implemented the mapbox API, but it was not very intuitive and had some bugs that caused it to not display the data parameters properly.

Purpose of New System

The new system is a website built from scratch that is in a public GitHub [repository](#). It relies on a new mapbox token and API that offers improved functionality over the original visualization. The system now allows users to toggle between the different parameters, view them simultaneously, and uses mapbox API layer calls to hide the different parameters. The interactive buttons for the parameters are easier to utilize and more intuitive than the original design. In addition, a scaling effect has been added to the output of the parameters within the mapbox token so that areas of concern in the bay can be easily identified by the user. Furthermore, the visualization now has overlays of legend information for each parameter so that users can reference what they see displayed on the map. Lastly, the social media section was improved significantly and was tweaked to only display posts that are relevant to FIU's Institute of Environment.

User Stories

1. Use this site as a case study: <https://senseable.mit.edu/>
2. Learn about [Mapbox](#)
3. Determine efficient UX/UI visualization examples so that they can be proposed for the mapbox of the bay's data. "Have a visualization that is more engaging for users of the site."
4. Determine if the data points can be overlaid so that two data sets can be visualized at the same time
5. **Plotting Data**
 - a. As a User, I want to be able to see the data on the map
6. **Visualize Data**
 - a. As a User, I want to be able to see and understand the data clearly through colors and/or size
7. **Different Camera Angles**
 - a. As a User, I would like to view the data through different angles
8. **Easy to Read Data**
 - a. As a User, I want to be able to see the data clearly, without the visualization being ugly or confusing
9. **Data Heights**
 - a. As a User, I want to see the data visualized beyond just color, altitude would help in making the data easier to understand
10. **Helpful Information**
 - a. As a user I want to understand more about the categories. Like what is turbidity or what temperature is good for the ocean. I want the website to have explanations that are short and easy to understand.
11. **Useful Legends**
 - a. As a user, I want legends to explain what the visualizations mean, otherwise, I will not understand what the colors mean at all.
12. **Alternative Color Schemes**
 - a. As a user, I want to be able to choose alternative color schemes if I have difficulties viewing the current color scheme.
13. **Improve legend**
 - a. As a user; I would like to understand the legend much better and not spend to much time thinking about it

14. Multiple legends at once

- a. As a user; I want to see multiple legends depending on how many categories I choose; so that it is easier to understand

15. In Order buttons

- a. As a user; I want to know which button I selected last by having a different color. And I also want that if I uncheck the last button, then the previous button gets a different color. This would help me understand the buttons I pressed

16. Multiple Information

- a. As a user, I want to have the information of all the categories I have clicked so that I do not have to go back and forth

17. Social Media Section

- a. As a user I want to see social information about this project and what people have reported, so that I am up to date with the information

18. Category Information

- a. As a user I want to be able to know about each of the categories displayed on the map and how it affects the ocean

19. Add interactive graphic banner

- a. As a user I want to see a graphic on the collection of the data from biscayne bay.

20. Increase social media section

- a. As a user I want to be able to know about to product owner's social media accounts, and have access to buttons that link to those sites

Implemented User Stories

1. Use this site as a case study: <https://senseable.mit.edu/>
2. Learn about [Mapbox](#)
3. Determine efficient UX/UI visualization examples so that they can be proposed for the mapbox of the bay's data. "Have a visualization that is more engaging for users of the site."
4. Determine if the data points can be overlaid so that two data sets can be visualized at the same time
- 5. Plotting Data**
 - a. As a User, I want to be able to see the data on the map
- 6. Visualize Data**
 - a. As a User, I want to be able to see and understand the data clearly through colors and/or size
- 7. Easy to Read Data**
 - a. As a User, I want to be able to see the data clearly, without the visualization being ugly or confusing
- 8. Helpful Information**
 - a. As a user I want to understand more about the categories. Like what is turbidity or what temperature is good for the ocean. I want the website to have explanations that are short and easy to understand.
- 9. Useful Legends**
 - a. As a user, I want legends to explain what the visualizations mean, otherwise, I will not understand what the colors mean at all.
- 10. Improve legend**
 - a. As a user; I would like to understand the legend much better and not spend too much time thinking about it
- 11. Multiple legends at once**
 - a. As a user; I want to see multiple legends depending on how many categories I choose; so that it is easier to understand

12. In Order buttons

- a. As a user; I want to know which button I selected last by having a different color. And I also want that if I uncheck the last button, then the previous button gets a different color. This would help me understand the buttons I pressed
 - i.

13. Multiple Information

- a. As a user, I want to have the information of all the categories I have clicked so that I do not have to go back and forth

14. Social Media Section

- a. As a user I want to see social information about this project and what people have reported, so that I am up to date with the information

15. Category Information

- a. As a user I want to be able to know about each of the categories displayed on the map and how it affects the ocean

16. Add interactive graphic banner

- a. As a user I want to see a graphic on the collection of the data from biscayne bay.

17. Increase social media section

- a. As a user I want to be able to know about to product owner's social media accounts, and have access to buttons that link to those sites

Pending User Stories

1. Different Camera Angles

- a. As a User, I would like to view the data through different angles

2. Data Heights

- a. As a User, I want to see the data visualized beyond just color, altitude would help in making the data easier to understand

3. Alternative Color Schemes

- a. As a user, I want to be able to choose alternative color schemes if I have difficulties viewing the current color scheme.

Project Plan

Our plan was to develop milestones in 2 weeks sprints and follow the iterative agile software development paradigm. The plan began with the conducting of research on mapbox documentation as well as water quality data points research. Once the team was versed in the mapbox API, we poured our efforts into developing a professional looking website that would showcase our mapbox token.

Hardware and Software Resources

The following is a list of all the hardware and software resources that were used in this project:

Hardware:

	HP Notebook		
Processor	2.3 GHz Intel Core i3-6100U		
Memory	8 GB		
Storage	1TB HDD		

- Internet-enabled device (i.e. PC, MAC) that has access to a browser capable of running WebGL.

Software:

- HTML
- CSS
- JavaScript
- jQuery
- GitHub
- Mapbox API
- Visual Studio
- Live Server Extension
- GeoJSON
- Google Chrome
- Mozilla Firefox

Sprints Plan

Sprint 1 (8/31/2021)

Start time: 10 A.M.

End time: 10:45

After discussion, the velocity of the team was estimated to be:

Velocity was not able to be estimated on our first meeting according to our Capstone II scrum master.

The product owner chose the following user stories to be done during the next sprint. They are ordered based on their priority:

Our current goal is to research how to improve the visualization of the data displayed on this [sandbox site](#). To do so, we have the following tasks:

1. Use this site as a case study: <https://senseable.mit.edu/>
2. Learn about [Mapbox](#)
3. Determine efficient UX/UI visualization examples so that they can be proposed for the mapbox of the bay's data. "Have a visualization that is more engaging for users of the site."
4. Determine if the data points can be overlaid so that two data sets can be visualized at the same time

Sprint 2 (9/13/2021)

Start time: 10:00 am

End time: 10:30 am

After discussion, the velocity of the team was estimated to be 50

The product owner chose the following user stories to be done during the next sprint. They are ordered based on their priority.

User Story

- **Plotting Data**
 - As a User, I want to be able to see the data on the map
- **Visualize Data**
 - As a User, I want to be able to see and understand the data clearly through colors and/or size
- **Different Camera Angles**
 - As a User, I would like to view the data through different angles
- **Easy to Read Data**
 - As a User, I want to be able to see the data clearly, without the visualization being ugly or confusing
- **Data Heights**
 - As a User, I want to see the data visualized beyond just color, altitude would help in making the data easier to understand

Sprint 3 (9/27/2021)

Start time: 6:00 pm

End time: 6:30 pm

After discussion, the velocity of the team was estimated to be 13.

The product owner chose the following user stories to be done during the next sprint. They are ordered based on their priority.

- 1) Helpful Information (8 user story points)
As a user I want to understand more about the categories. Like what is turbidity or what temperature is good for the ocean. I want the website to have explanations that are short and easy to understand.
- 2) Useful Legends (7 user story points)
As a user, I want legends to explain what the visualizations mean, otherwise, I will not understand what the colors mean at all.
- 3) Alternative Color Schemes (5 user story points)
As a user, I want to be able to choose alternative color schemes if I have difficulties viewing the current color scheme.

Sprint 4 (10/11/2021)

Start time: 6:00 P.M.

End time: 6:40 P.M.

After discussion, the velocity of the team was estimated to be 10 user story points.

The product owner chose the following user stories to be done during the next sprint. They are ordered based on their priority.

- 1 Improve legend (10 User story points)
 - As a user; I would like to understand the legend much better and not spend too much time thinking about it
- 2 Multiple layers at once (10 User story points)
 - As a user; I would like to have the ability to display 2 categories at once and have them overlaid on top of each other
- 3 Multiple legends at once (10 User story points)
 - As a user; I want to see multiple legends depending on how many categories I choose; so that it is easier to understand

Sprint 5 (10/25/2021)

Start time: 11:00 AM

End time: 11:30 AM

The product owner chose the following user stories to be done during the next sprint. They are ordered based on their priority.

- 1) Multiple legends at once (10 User story points)
 - As a user; I want to see multiple legends depending on how many categories I choose; so that it is easier to understand
- 2) In Order buttons (5 User story points)
 - As a user; I want to know which button I selected last by having a different color. And I also want that if I uncheck the last button, then the previous button gets a different color. This would help me understand the buttons I pressed
- 3) Multiple Information (5 User story points)
 - As a user, I want to have the information of all the categories I have clicked so that I do not have to go back and forth
- 4) Social Media Section (7 User Story points)
 - As a user I want to see social information about this project and what people have reported, so that I am up to date with the information

Sprint 6 (11/8/2021)

Start time: 11:00 AM

End time: 11:30 AM

After discussion, the velocity of the team was estimated to be <13>.

The product owner chose the following user stories to be done during the next sprint. They are ordered based on their priority.

- **1) Social Media Section (7 User Story points)**
 - As a user I want to see social information about this project and what people have reported, so that I am up to date with the information
- **2) Category Information (5 User Story Points)**
 - As a user I want to be able to know about each of the categories displayed on the map and how it affects the ocean
- **3) Alternative Color Schemes (5 User Story Points)**
 - As a user, I want to be able to choose alternative color schemes if I have difficulties viewing the current color scheme.

Sprint 7 (11/22/2021)

Start time: 11:00 AM

End time: 11:30 AM

After discussion, the velocity of the team was estimated to be <13>.

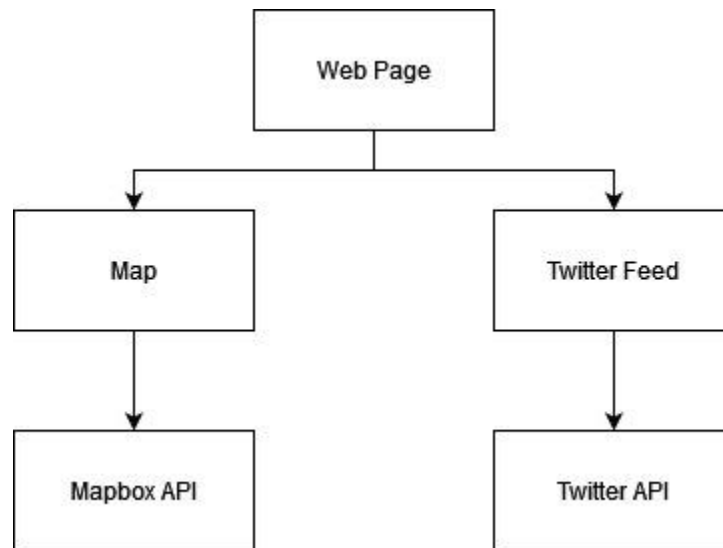
The product owner chose the following user stories to be done during the next sprint. They are ordered based on their priority.

- **1) Add interactive graphic banner (5 User Story points)**
 - As a user I want to see a graphic on the collection of the data from biscayne bay.
- **2) Increase social media section (5 User Story Points)**
 - As a user I want to be able to know about to product owner's social media accounts, and have access to buttons that link to those sites
- **3) Alternative Color Schemes (5 User Story Points)**
 - As a user, I want to be able to choose alternative color schemes if I have difficulties viewing the current color scheme.

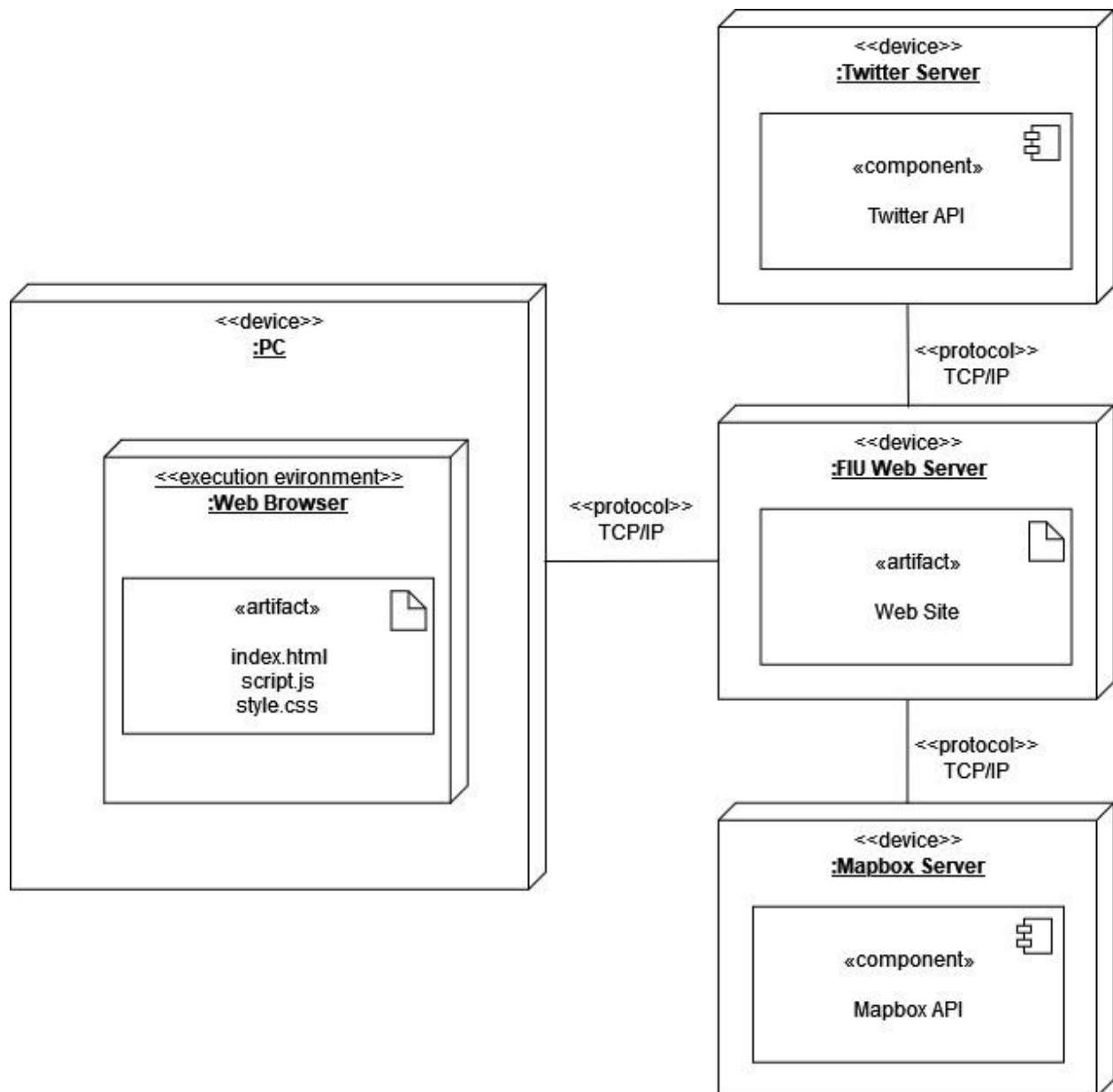
System Design

Our website was basic in its implementation. We utilized an html, css, and JavaScript file to construct the site from scratch. The site was designed to focus on the mapbox asset. The mapbox asset was designed in the mapbox studio platform and integrated into the site using JavaScript.

System and Subsystem Decomposition



Deployment Diagram



System Validation

Case	Purpose	Precondition	Expected Result	Actual Result
Improve data visualization	Express the data collected by the Biscayne Bay Buoys in a more effective manner	Mapbox API working as intended	An easier to understand visualization on the water quality data on the map	Improved data visualization on the map
Improve map legend	To communicate the areas of concern in the Biscayne Bay more efficiently	Mapbox API working as intended	An improved visual on which areas of the Biscayne Bay of concern	Improved visual which effectively communicates the Biscayne Bay areas of concern
Include category information	To inform users of meaning of the various data categories represented on the map	Browser working as intended	Information displayed below the map that informs user of the meaning of the various data points	Toggle-able category information displayed below the map
Implement social media feed(Twitter)	To inform users of the latest info regarding the Biscayne Bay using social media(twitter)	Twitter API working as intended	Twitter feed displayed at the bottom of the page with the latest information	Twitter feed displayed at the bottom of the page, keeping users updated with the latest information

Glossary

API – Application Programming Interface. Defined set of rules that explain how computers or applications communicate with each other.

Geolocation – track a device's latitude and longitude using GPS.

GeoJSON – a format for encoding a variety of geographic data structure

HTML – Hypertext Markup Language – a standardized system for tagging text files to achieve font, color, graphic, and hyperlink effects on World Wide Web pages.

JavaScript – a programming language that conforms to the ECMAScript specification. JavaScript is high-level, often just-in-time compiled and multi-paradigm.

Mapbox – Mapbox is an American provider of custom online maps for websites and applications such as Foursquare, Lonely Planet, the Financial Times, The Weather Channel, Instacart Inc. and Snapchat

Mapbox Token – An access token provides access to Mapbox resources on behalf of a user. The Mapbox Tokens API provides you with a programmatic way to create, update, delete, and retrieve tokens, as well as list a user's tokens and token scopes.

Node.js – open source server side platform Javascript runtime environment.

Scrum Master – role on a team that is responsible for ensuring that the team is aligned with Agile practices.

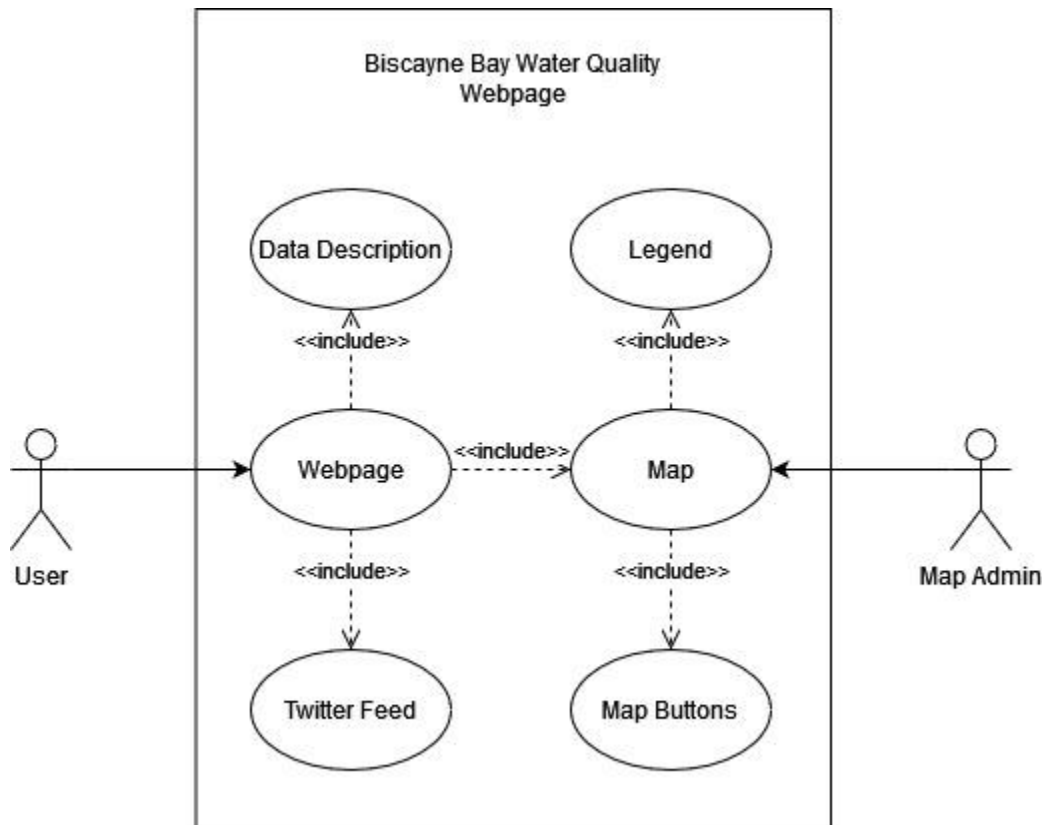
UI – User Interface – the space where interactions between humans and machines occur

UX – User Experience which encompasses all aspects for a mobile app users' interactions with the app, company and services.

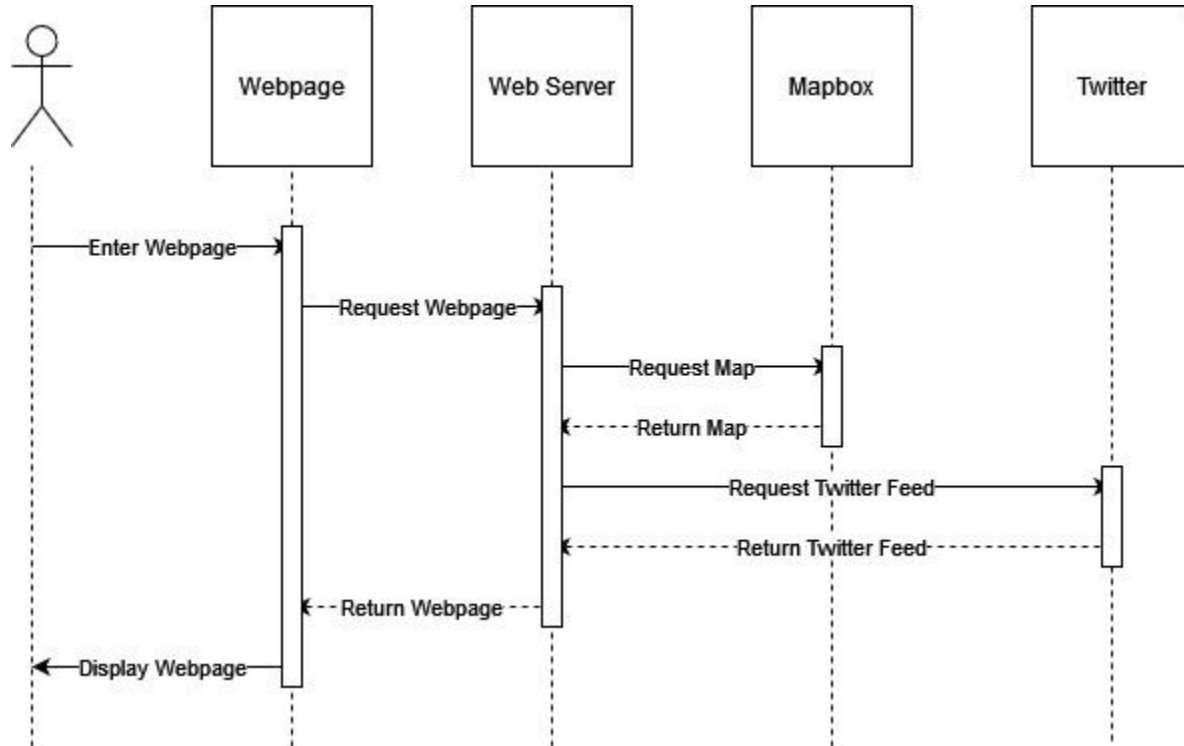
Appendix

Appendix A - UML Diagrams

Use Case Diagrams



Sequence Diagram

**Appendix B - User Interface Design****Appendix C - Sprint Review Reports****Appendix D - User Manuals, Installation/Maintenance Document, Shortcomings/Wishlist Document and other documents**

Please see shortcomings in the video part of the final deliverable.

References

Staletovich, J. (2020, August 25). *'decades of warning signs' preceded Biscayne Bay Fish kill*. WUSF Public Media. Retrieved December 2, 2021, from <https://wusfnews.wusf.usf.edu/environment/2020-08-23/decades-of-warning-signs-preceded-biscayne-bay-fish-kill>.