Software Engineering Lab
Assignment 5

SLOT: L21+L22
COURSE CODE: BCSE301P

Q.1. a. Design and demonstration of test cases. (4 Marks)
Required: Define test plan and test design after that execute it for your project.

1. Define Test Plan:

- Objective: The objective of the test plan is to ensure that all functionalities of DeepBlue EcoGuard (underwater waste detection, aquatic habitat assessment, and water quality classification) perform accurately and reliably.

- Scope: The scope includes testing the YoloV8 Algorithm, the rule-based classifier, and the Machine Learning model.

- Approach: The testing approach will include both manual and automated testing methods.

- Test Environment: The tests will be conducted in a simulated underwater environment, using relevant datasets and tools for each functionality.

- Testing Tools: Depending on the testing needs, tools like YoloV8 implementation for waste detection, libraries for rule-based classification, and machine learning frameworks for the ML model will be utilized.

- Test Data: Various datasets comprising underwater images for waste detection, chemical properties for habitat assessment, and water quality data will be used for testing.

- Testing Criteria: The testing criteria will include accuracy, precision, recall, and F1 score for waste detection; adherence to EPA and WHO guidelines for habitat assessment; and accuracy in classifying water quality.

2. Test Design:

- Underwater Waste Detection Test:
  - Test Case 1: Verify that the YoloV8 Algorithm accurately detects different types of underwater waste (plastic, metal, etc.).
  - Test Case 2: Evaluate the algorithm's performance in various underwater lighting conditions.
  - Test Case 3: Assess the algorithm's ability to detect waste at different depths.

- Aquatic Habitat Assessment Test:
  - Test Case 1: Verify that the rule-based classifier correctly assesses aquatic habitat based on chemical properties.
  - Test Case 2: Ensure that the classifier adheres to EPA and WHO guidelines for habitat assessment.
  - Test Case 3: Test the classifier's robustness against variations in water composition.

- Water Quality Classification Test:
  - Test Case 1: Evaluate the Machine Learning model's accuracy in classifying water as fit or unfit.
  - Test Case 2: Test the model's performance on a variety of water quality parameters.
  - Test Case 3: Assess the model's generalization ability on unseen data.

3. Execute Test:

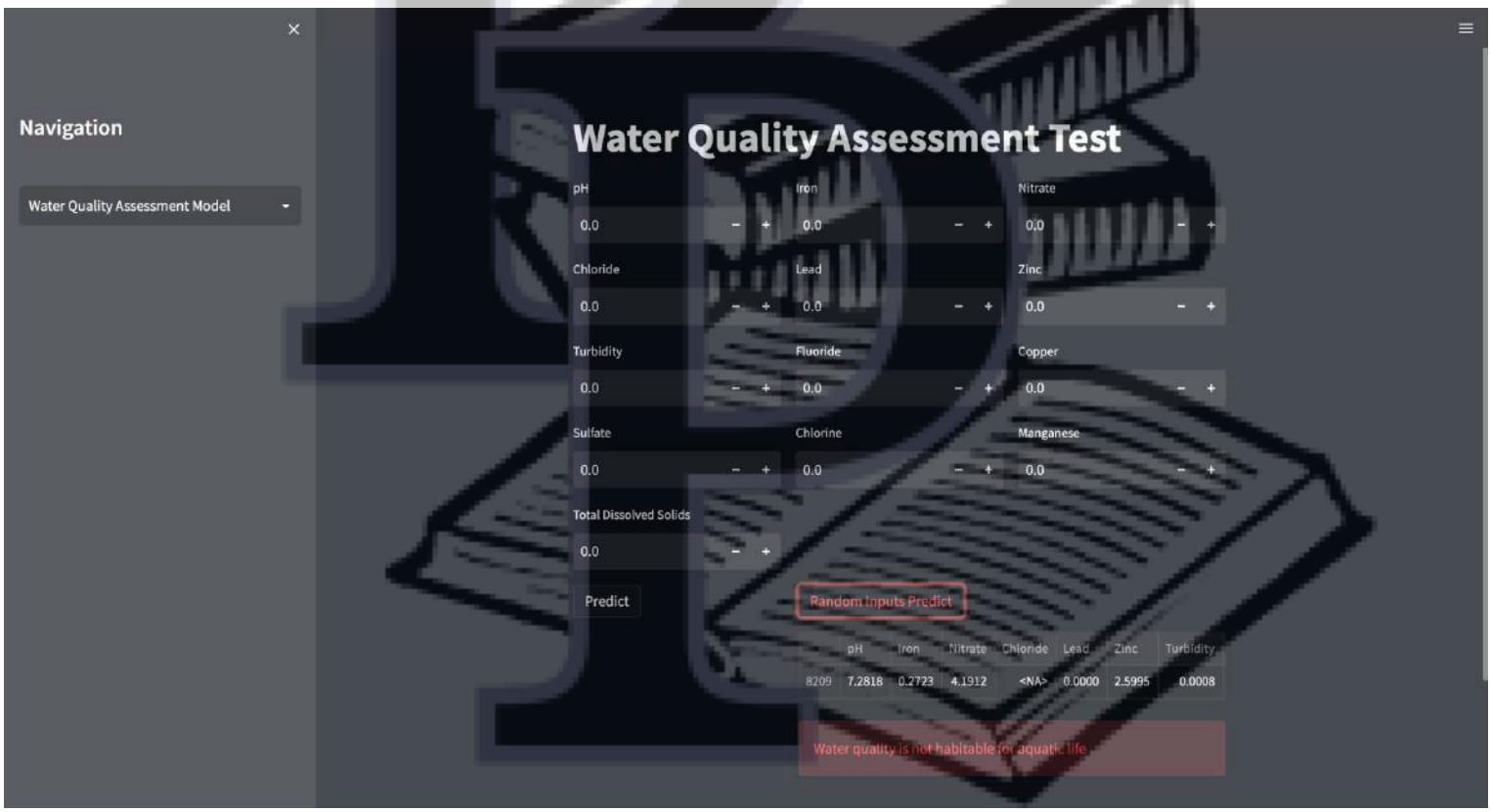
- Underwater Waste Detection Execution:
  - Implement YoloV8 Algorithm on test images and assess detection accuracy.
  - Validate performance under different lighting conditions and depths.

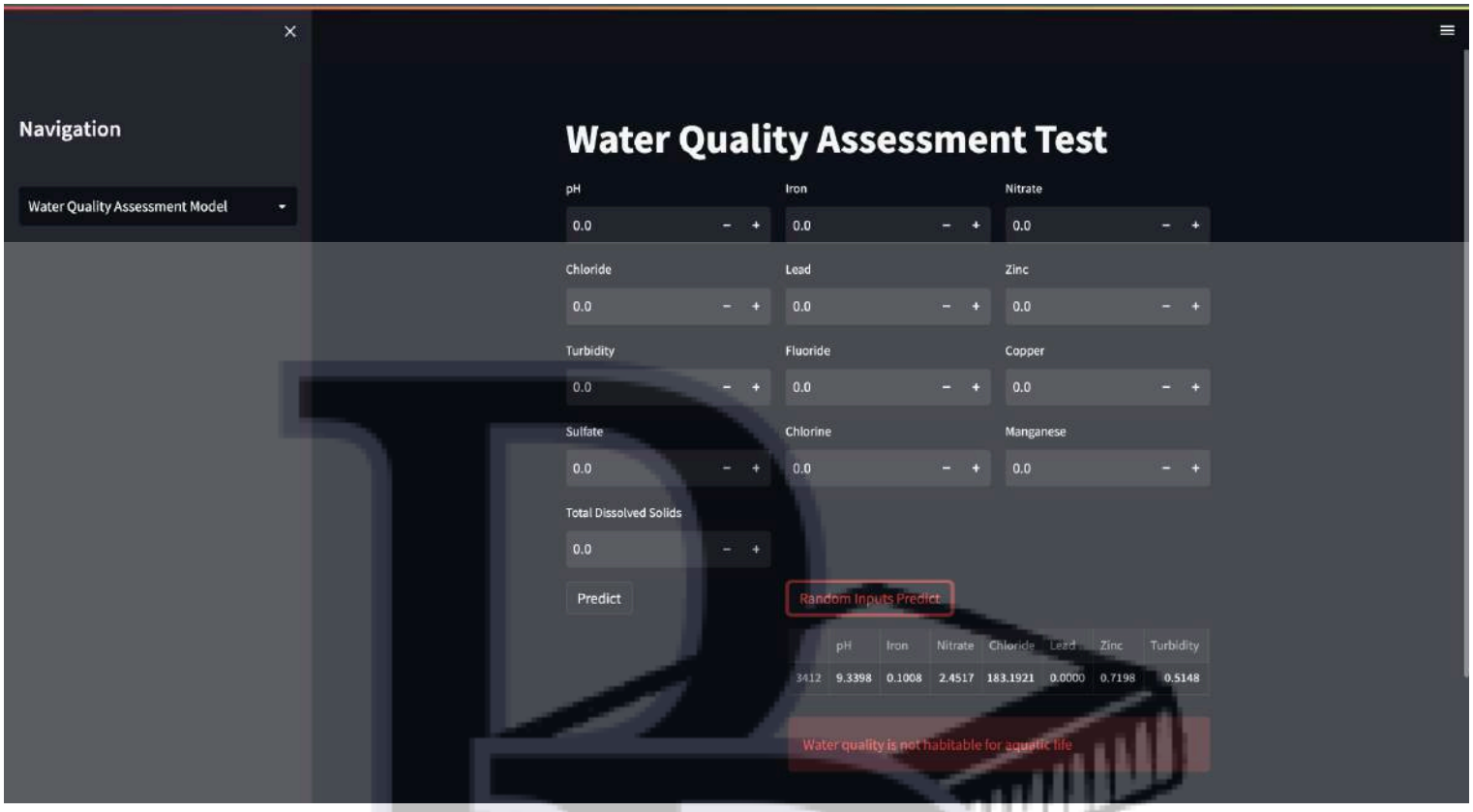
- Aquatic Habitat Assessment Execution:
  - Apply the rule-based classifier on test data and verify habitat assessment accuracy.
  - Check adherence to EPA and WHO guidelines.

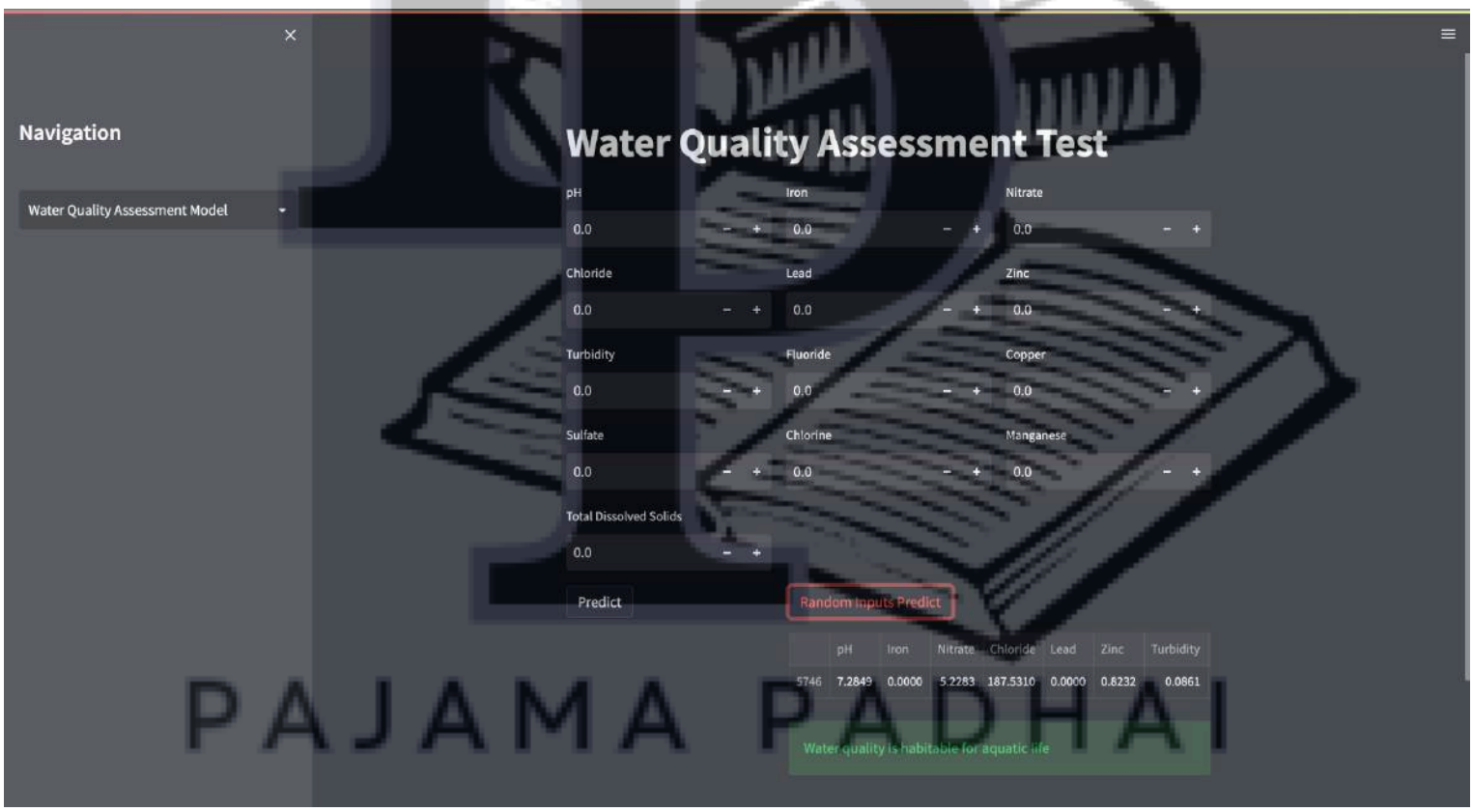
- Water Quality Classification Execution:
  - Deploy the Machine Learning model on test datasets and evaluate classification performance.
  - Validate model accuracy across various water quality parameters.

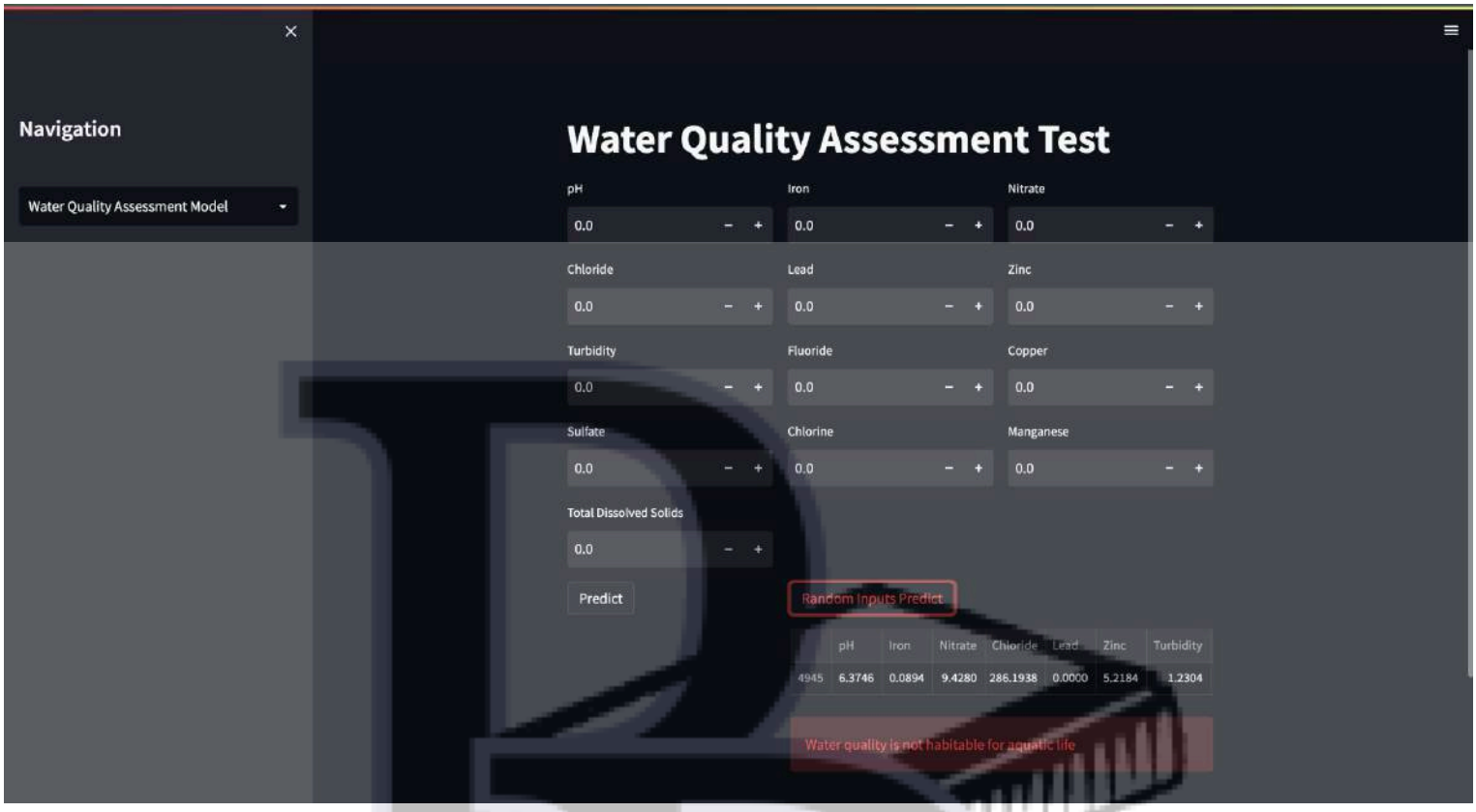
Following this plan, we can ensure thorough testing of DeepBlue EcoGuard's functionalities, providing confidence in its effectiveness in safeguarding marine environments.

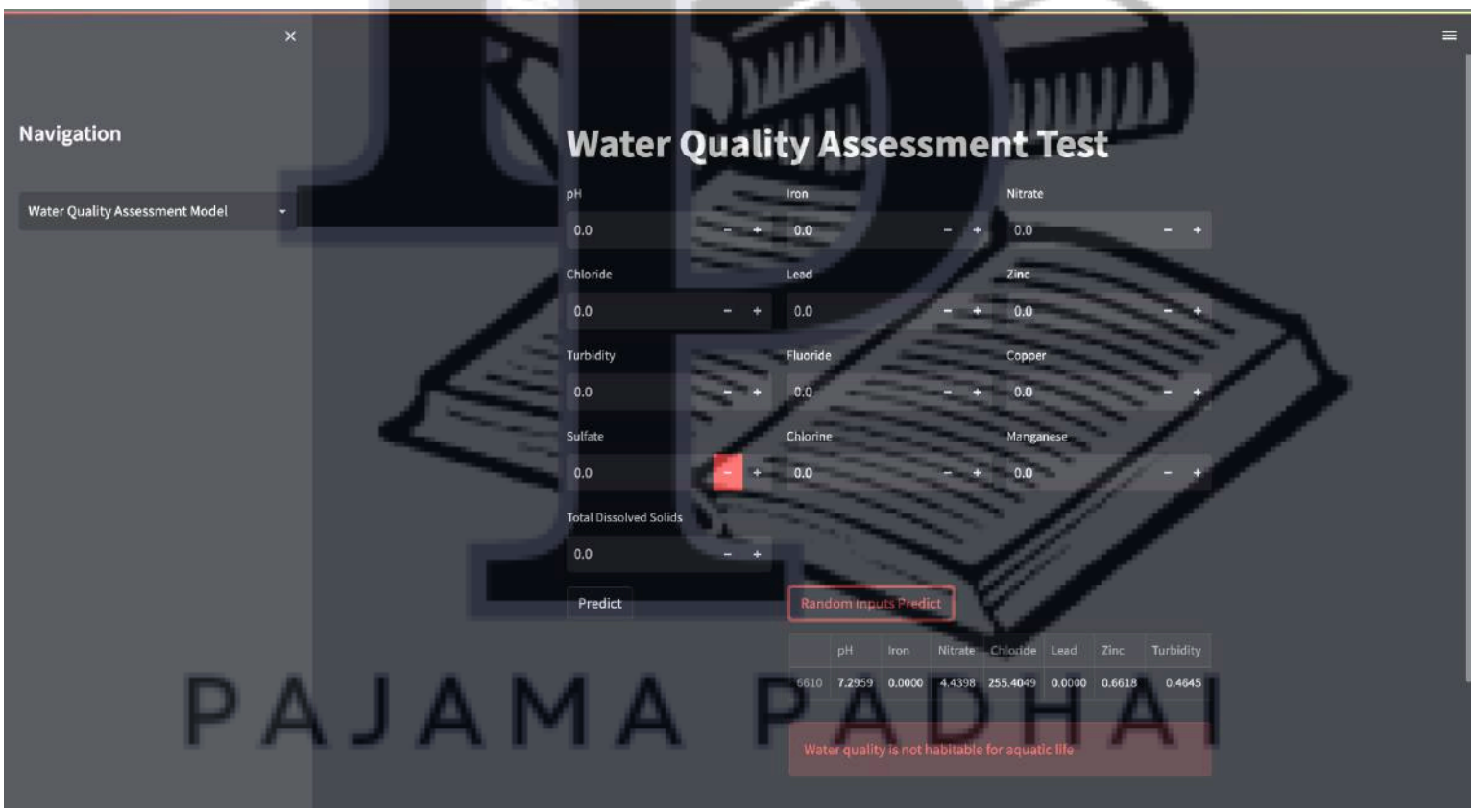
WATER QUALITY ASSESSMENT TEST :

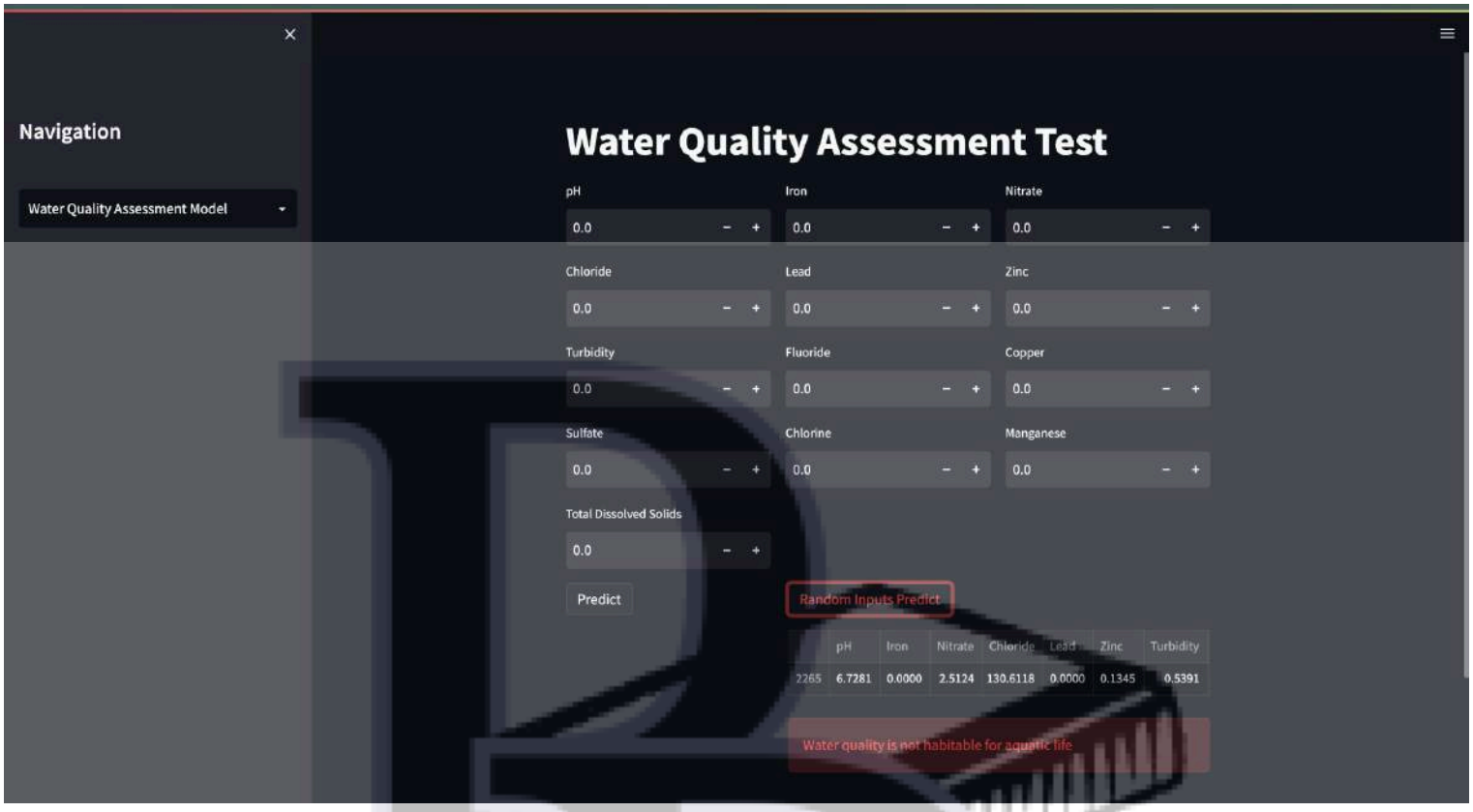


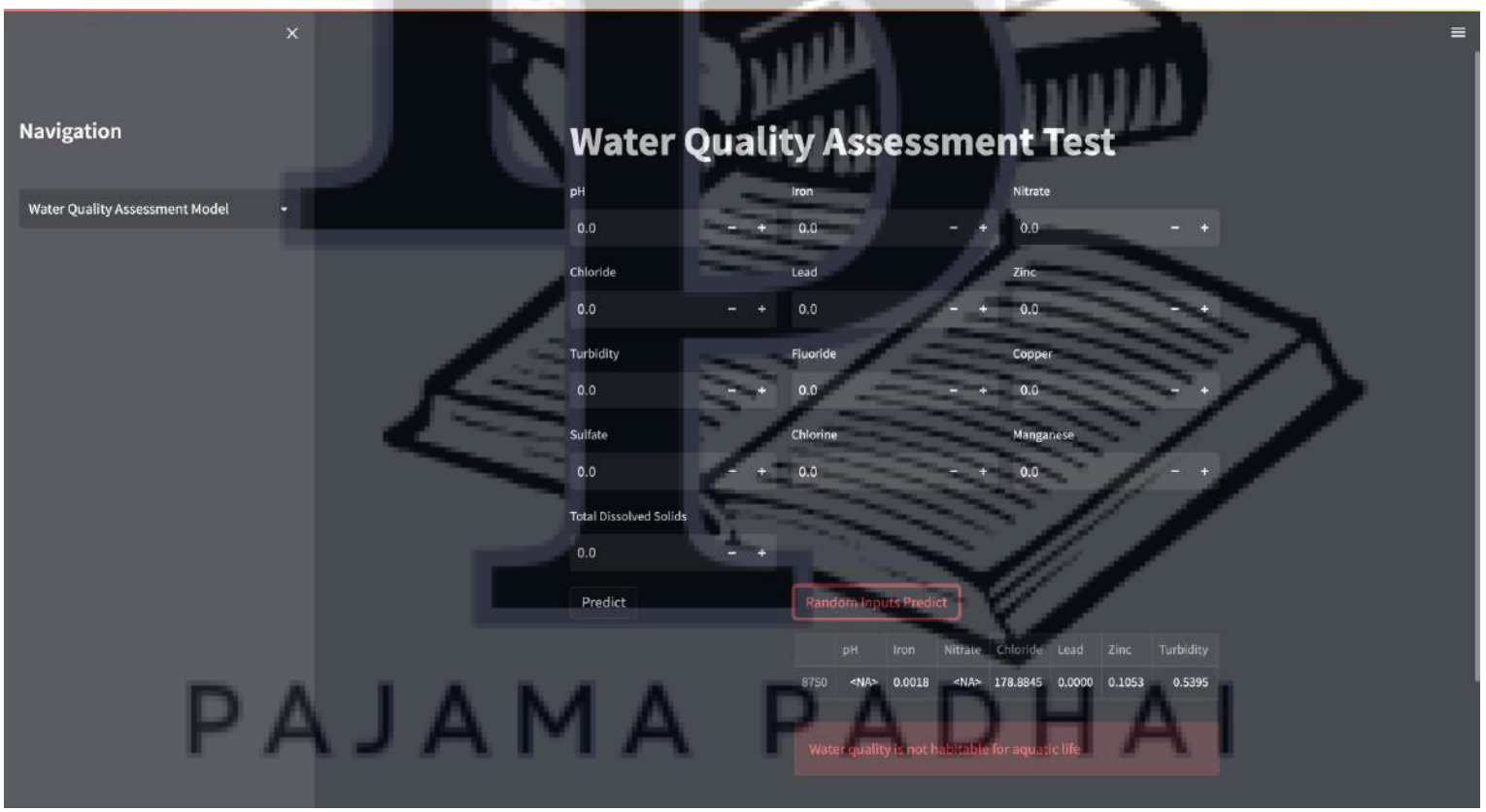


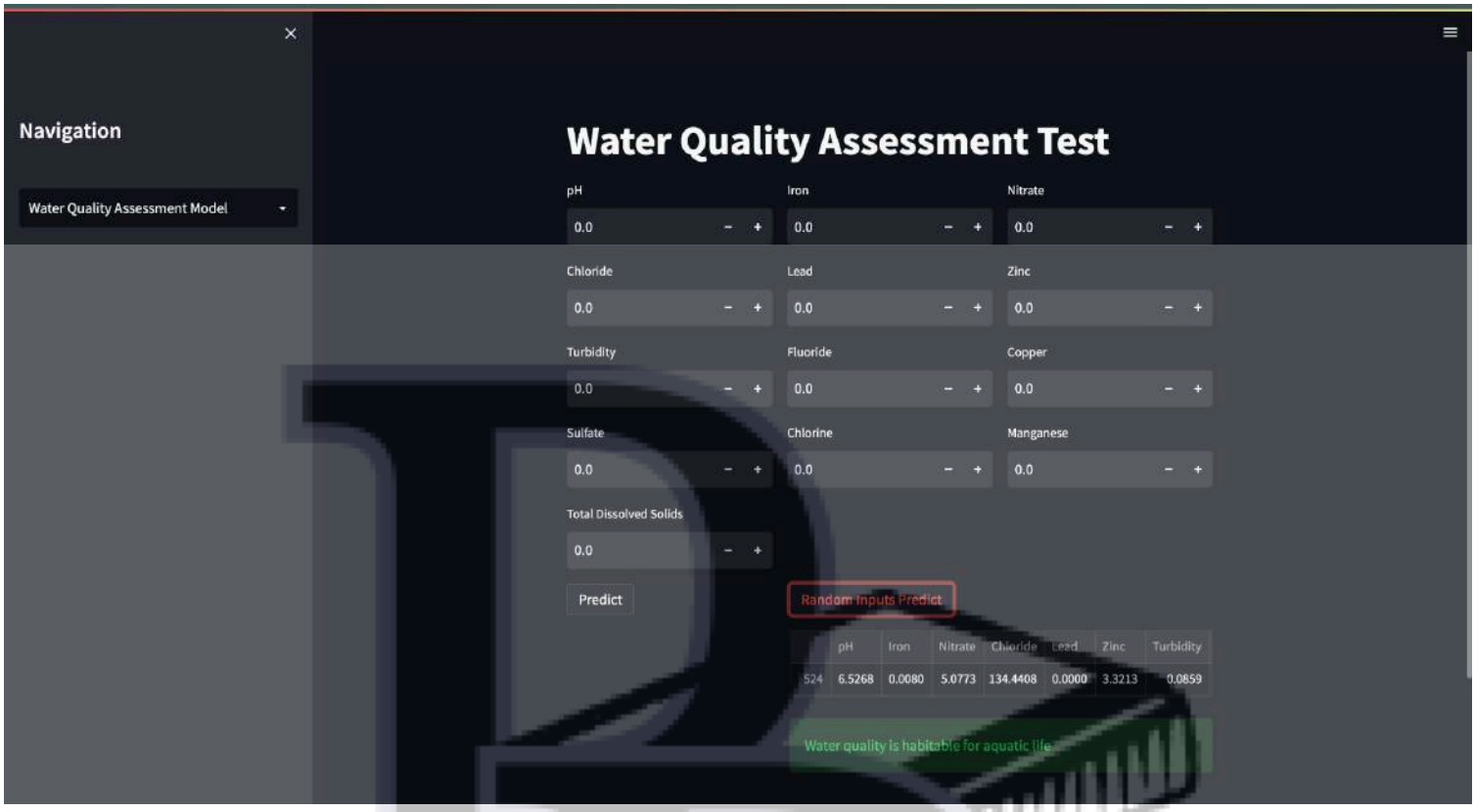




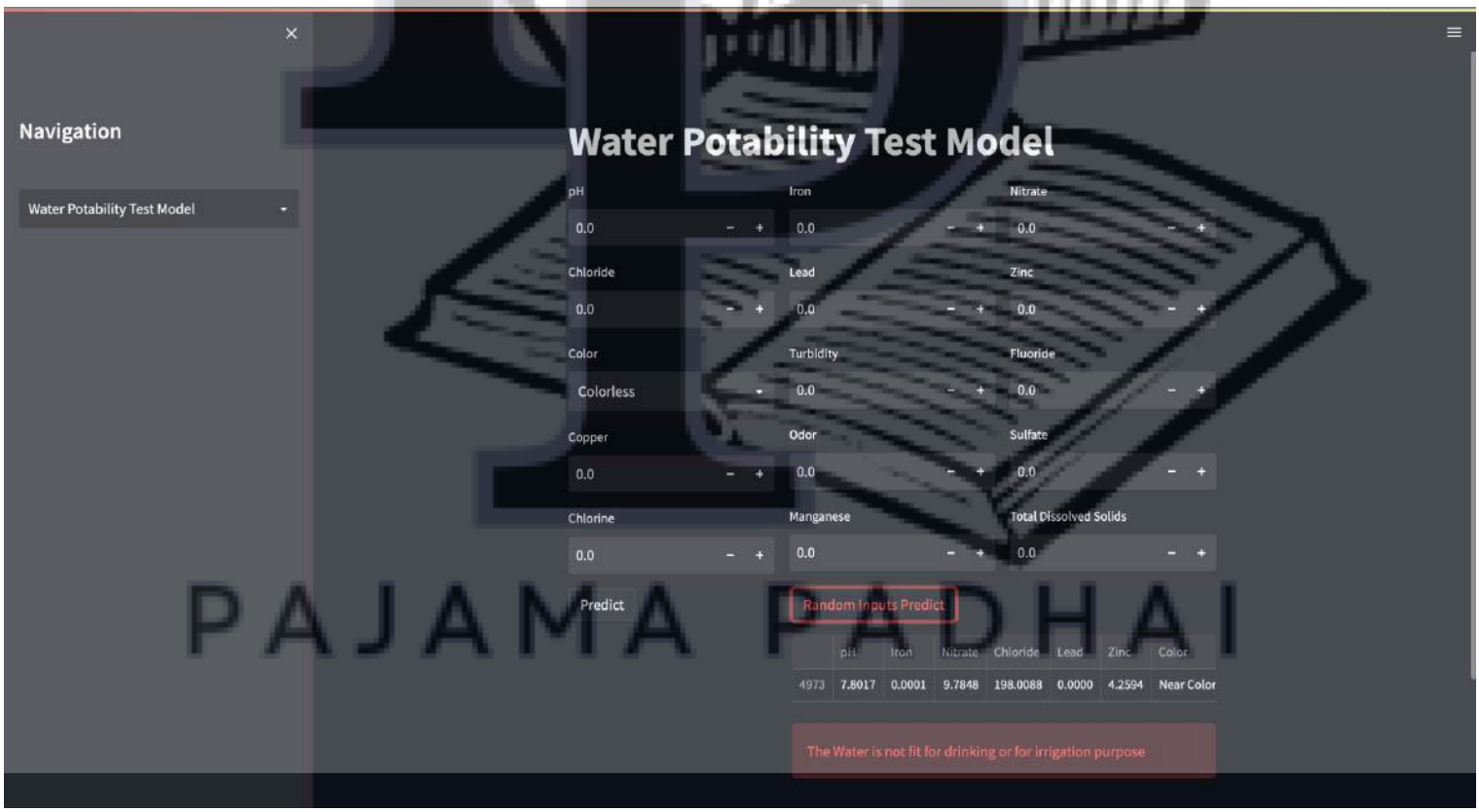


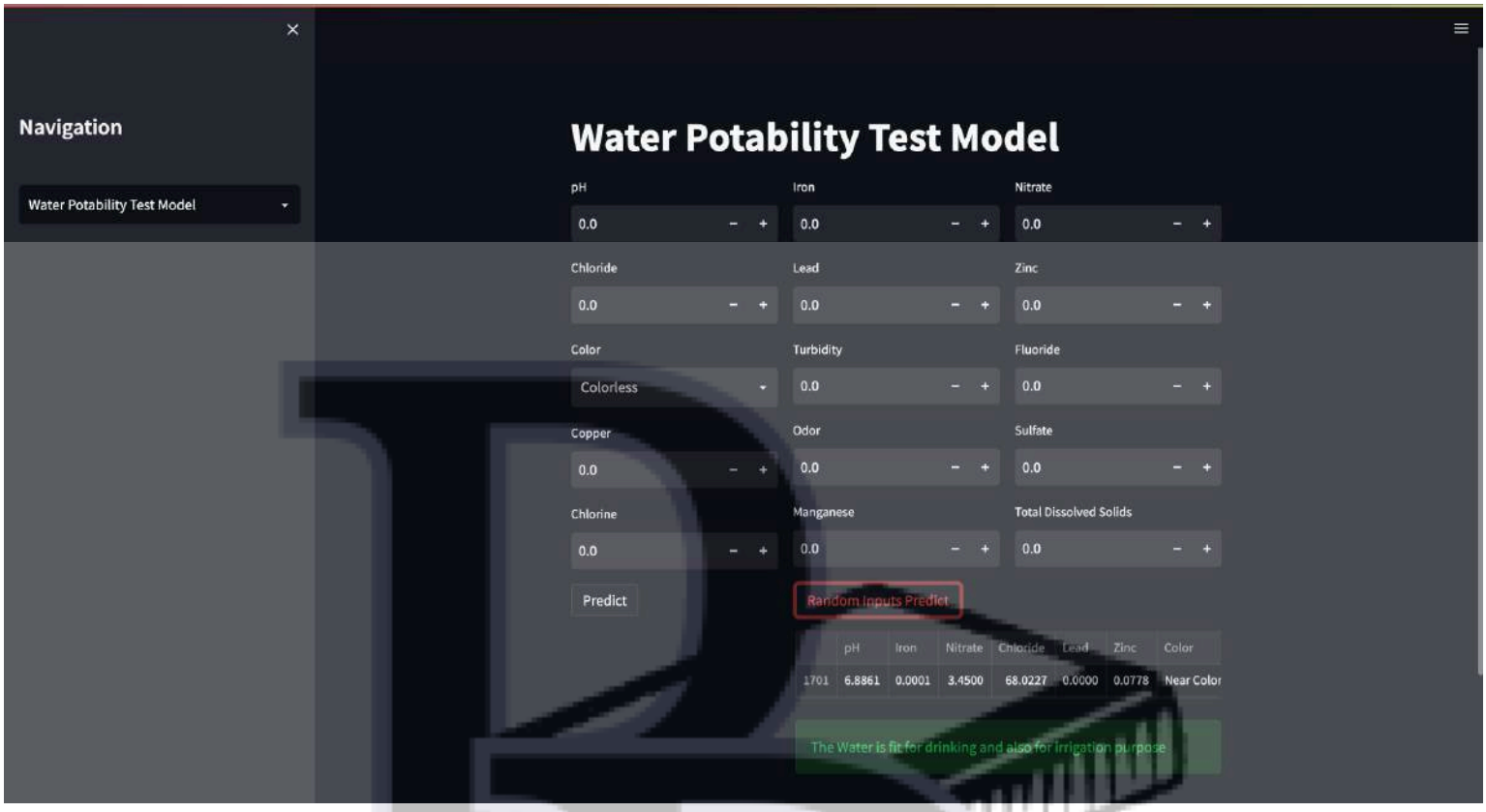


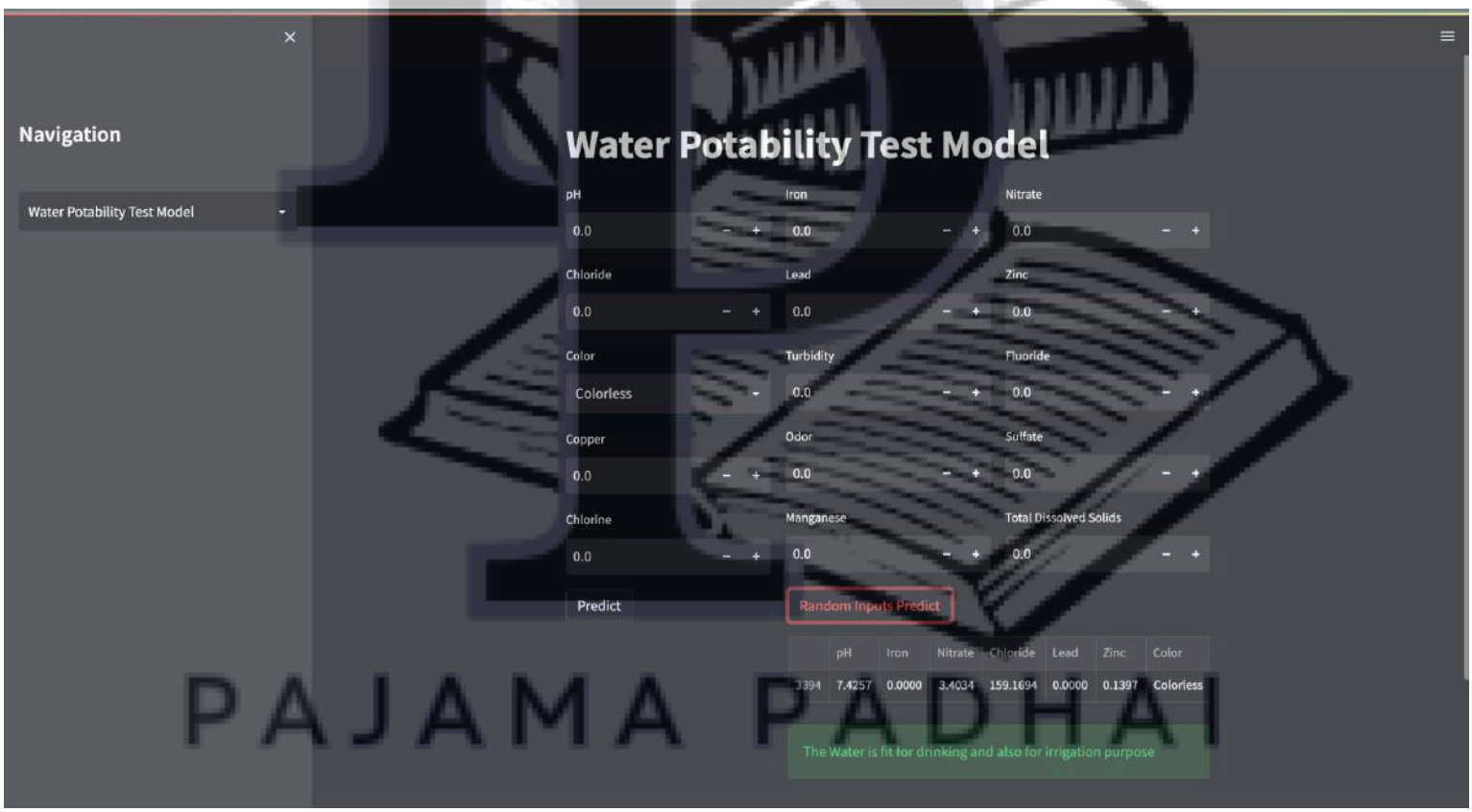


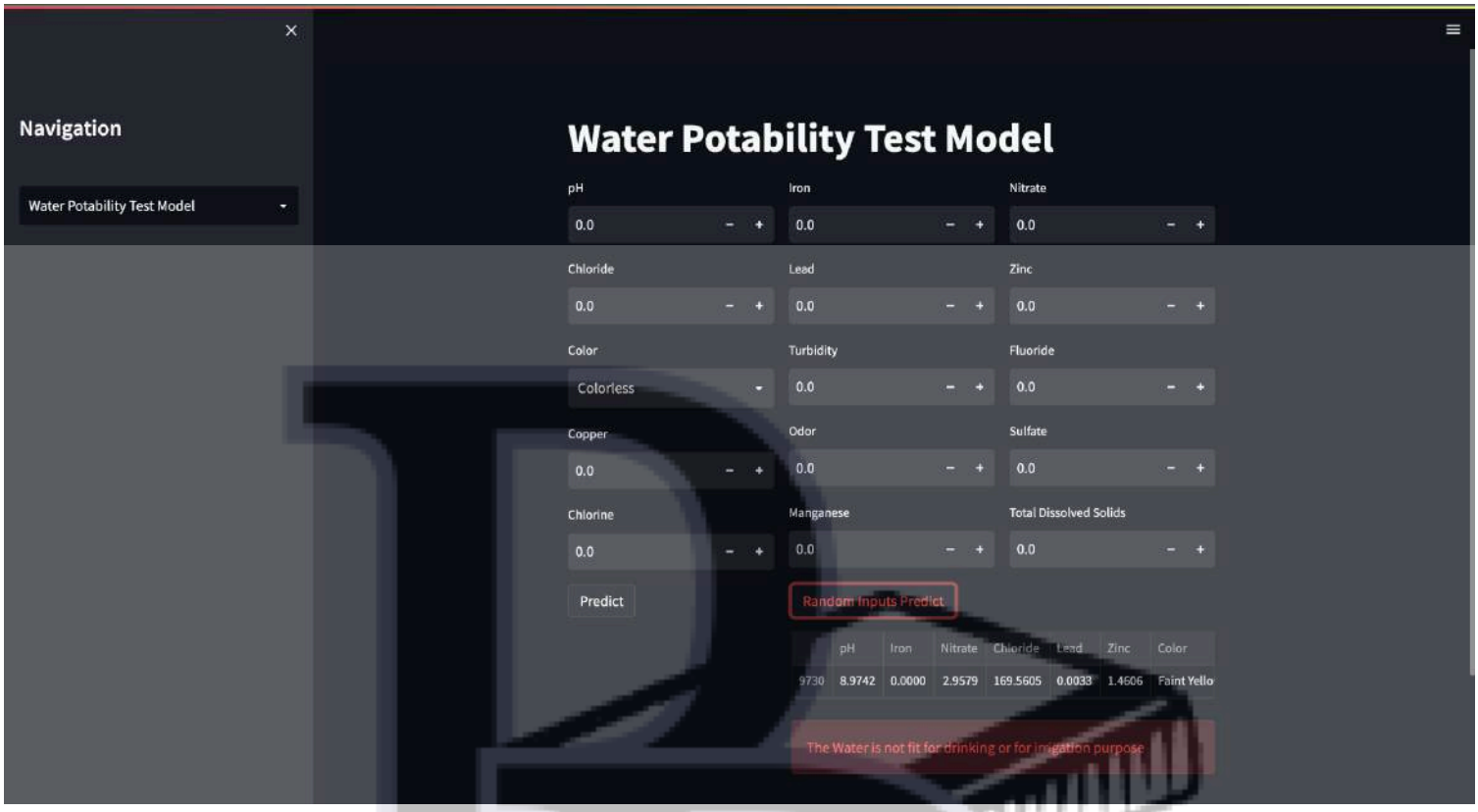


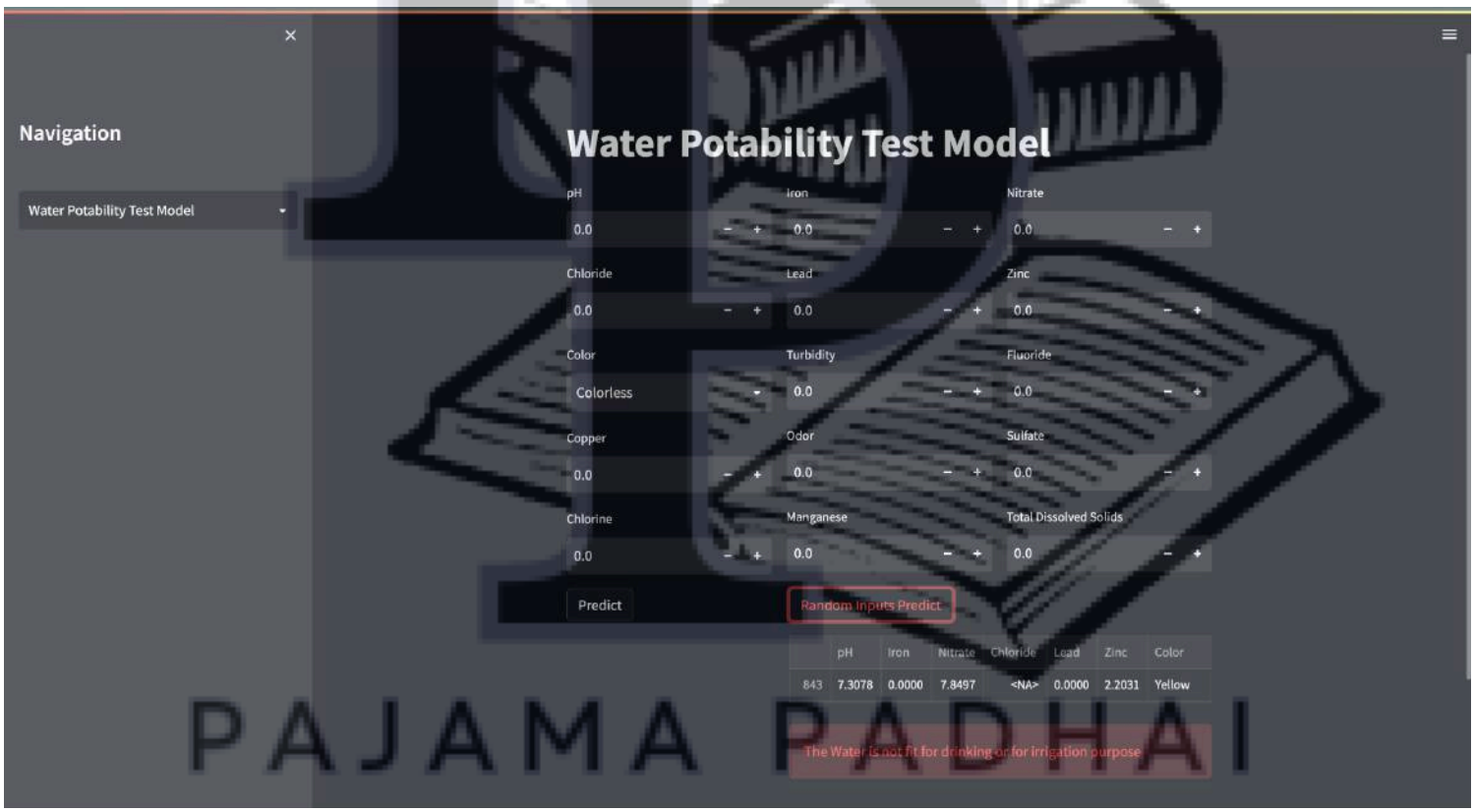
WATER POTABILITY TEST :











Q. 1. b. Functional Testing and Non- Functional Testing. (3 Marks)
Required: Apply Functional and Non- Functional Testing on your project.

Applying functional and non-functional testing to DeepBlue EcoGuard:

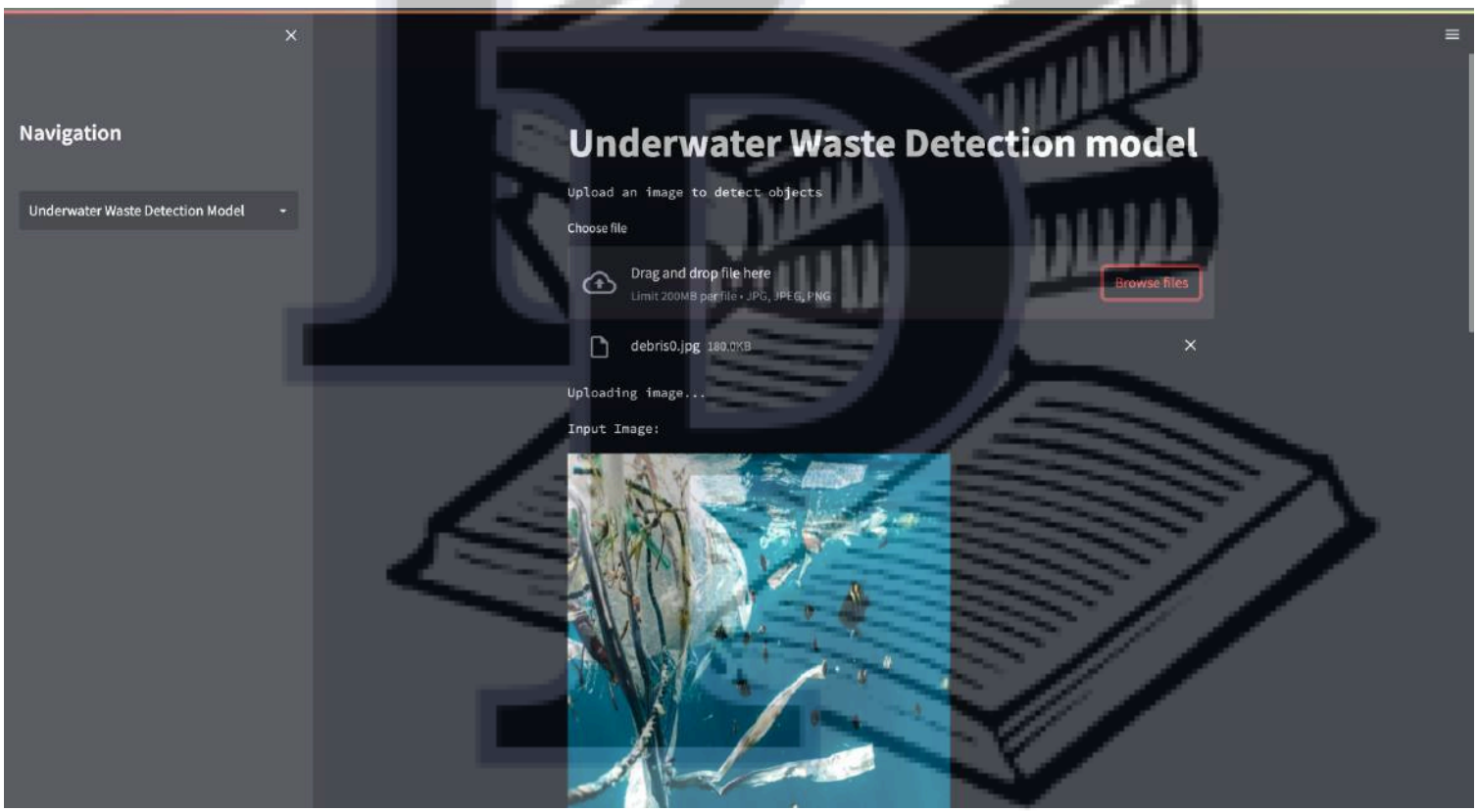
1. Functional Testing:

Functional testing ensures that the system functions according to the specified requirements. For DeepBlue EcoGuard, we'll test each functionality individually.

- Underwater Waste Detection:
  - Verify that the YoloV8 Algorithm accurately detects and identifies underwater waste.
  - Test different types of waste (plastic, metal, etc.) to ensure comprehensive detection.
  - Validate detection performance under various environmental conditions (lighting, depth, water clarity).

- Aquatic Habitat Assessment:
  - Confirm that the rule-based classifier assesses aquatic habitat based on chemical properties accurately.
  - Test the classifier with different water samples to ensure consistency.
  - Validate adherence to guidelines from authoritative sources like the US EPA and WHO.

- Water Quality Classification:
  - Ensure that the Machine Learning model classifies water quality correctly as fit or unfit.
  - Test the model with diverse water quality parameters (pH, dissolved oxygen, pollutants concentration).
  - Validate classification accuracy against known water quality standards.



Navigation

Underwater Waste Detection Model

Removing noise from input...

Running the model...

Output Image:

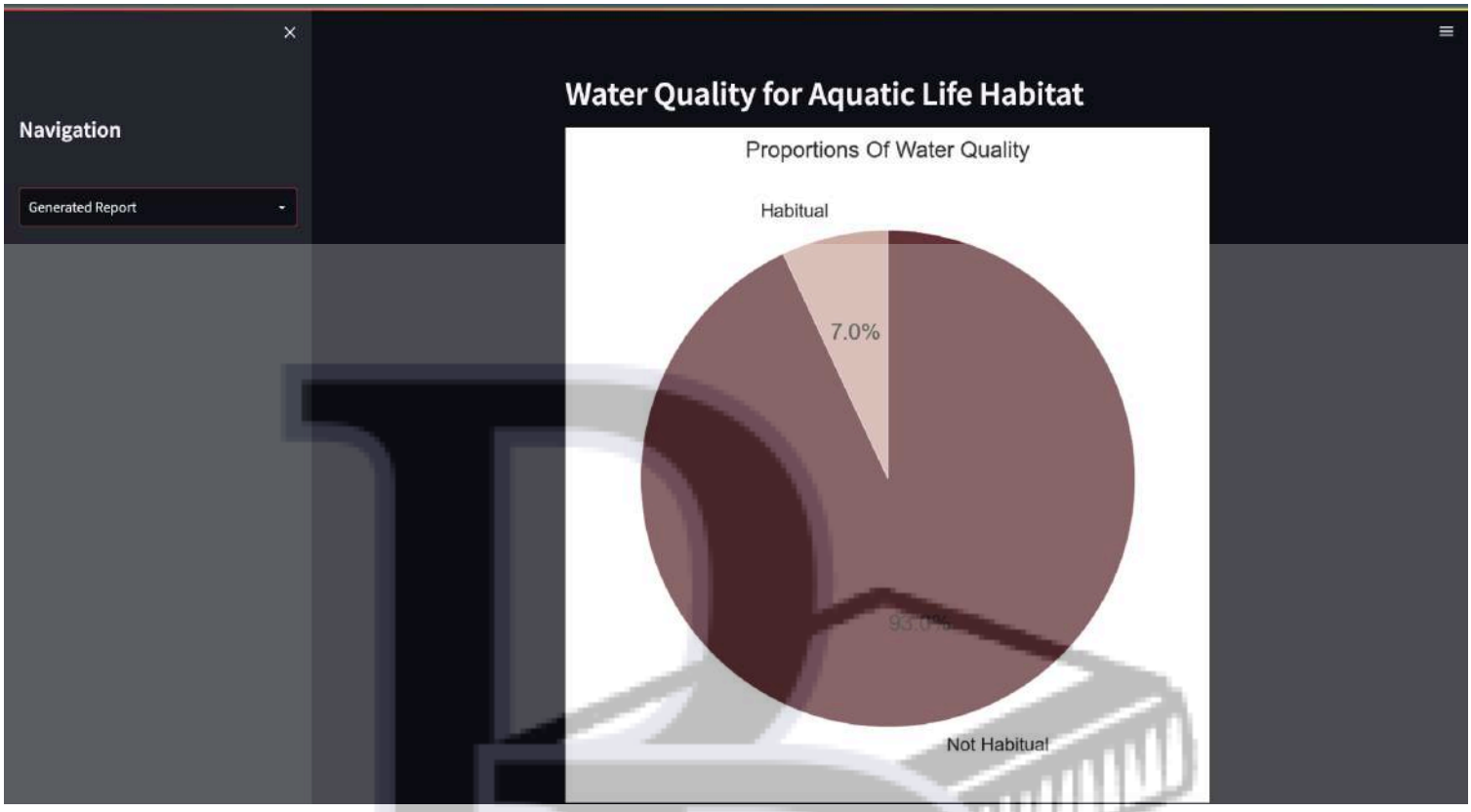
Navigation

Underwater Waste Detection Model

Running the model...

Output Image:

The water is clear!!!



2. Non-Functional Testing:

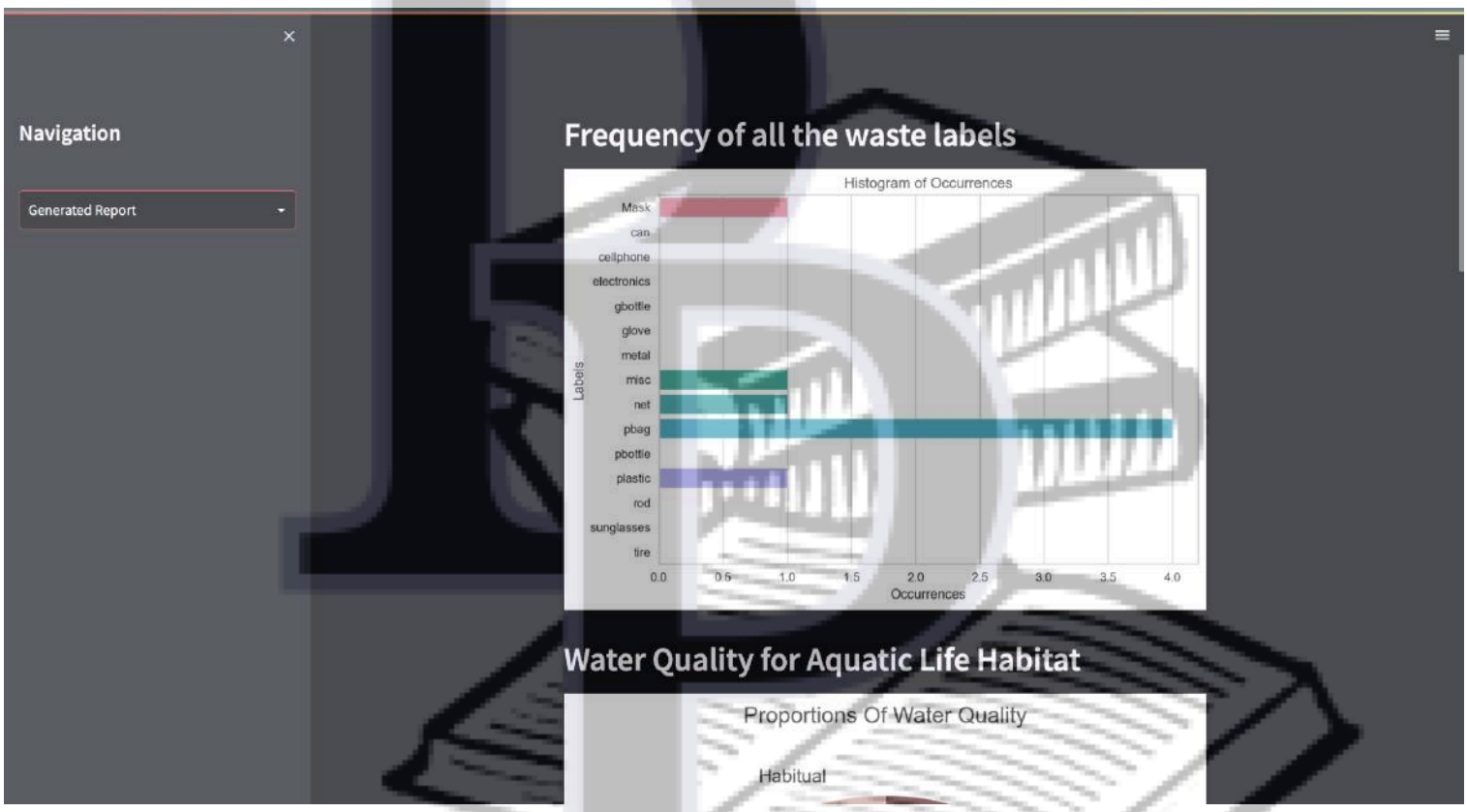
Non-functional testing evaluates aspects of the system other than specific behaviors or functions. For DeepBlue EcoGuard, we'll focus on performance, reliability, and usability.

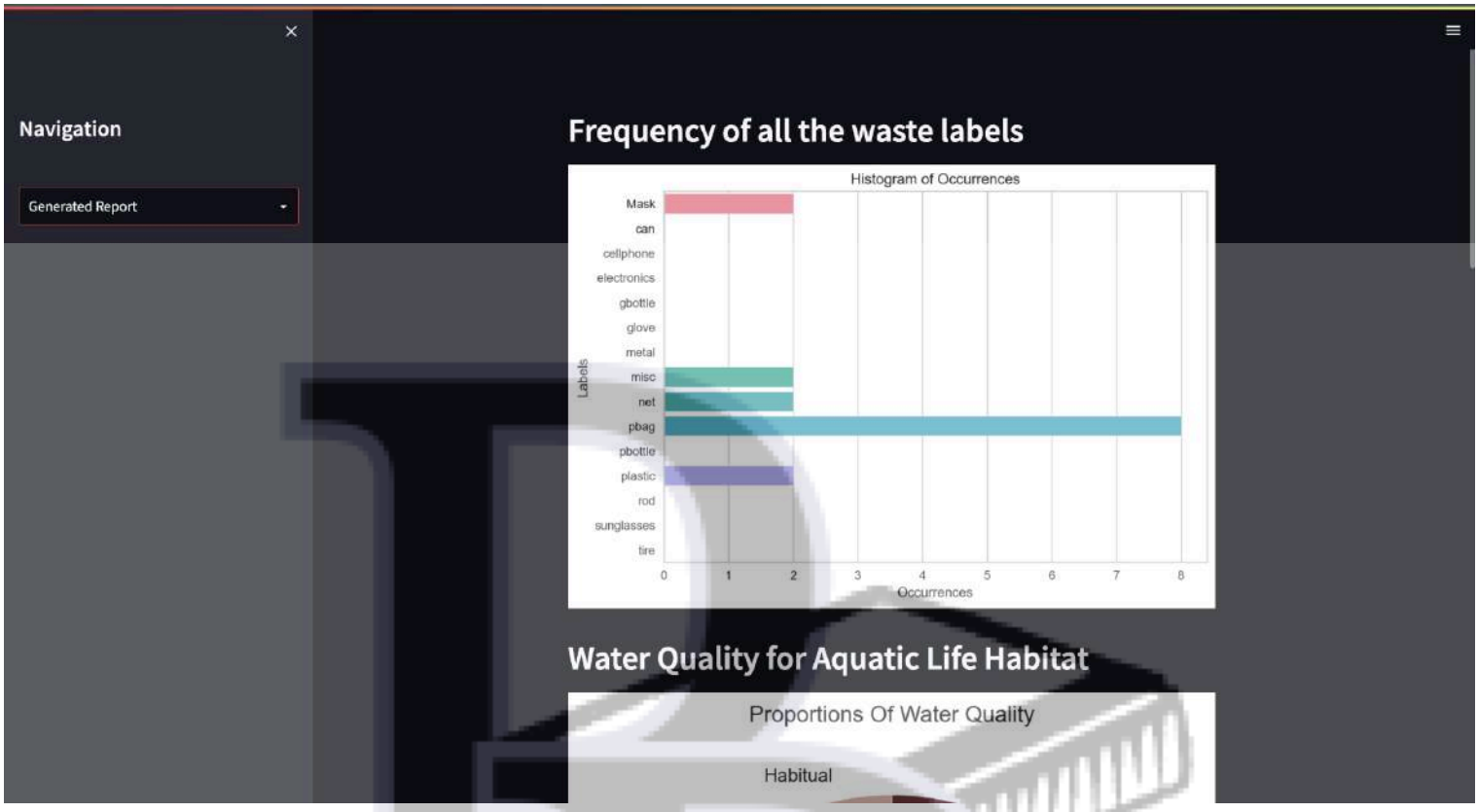
- Performance Testing:

- Evaluate the speed and responsiveness of the YoloV8 Algorithm for waste detection.
- Measure the processing time for habitat assessment and water quality classification.
- Assess system performance under different loads and stress conditions.

- Reliability Testing:
  - Test the robustness of the system by introducing unexpected inputs or scenarios.
  - Verify the system's ability to handle errors gracefully and recover without data loss.
  - Assess the system's stability over prolonged periods of operation.

- Usability Testing:
  - Evaluate the user interface for ease of use and intuitiveness.
  - Test the system's documentation and support materials for clarity and completeness.
  - Gather feedback from potential users to identify areas for improvement in user experience.





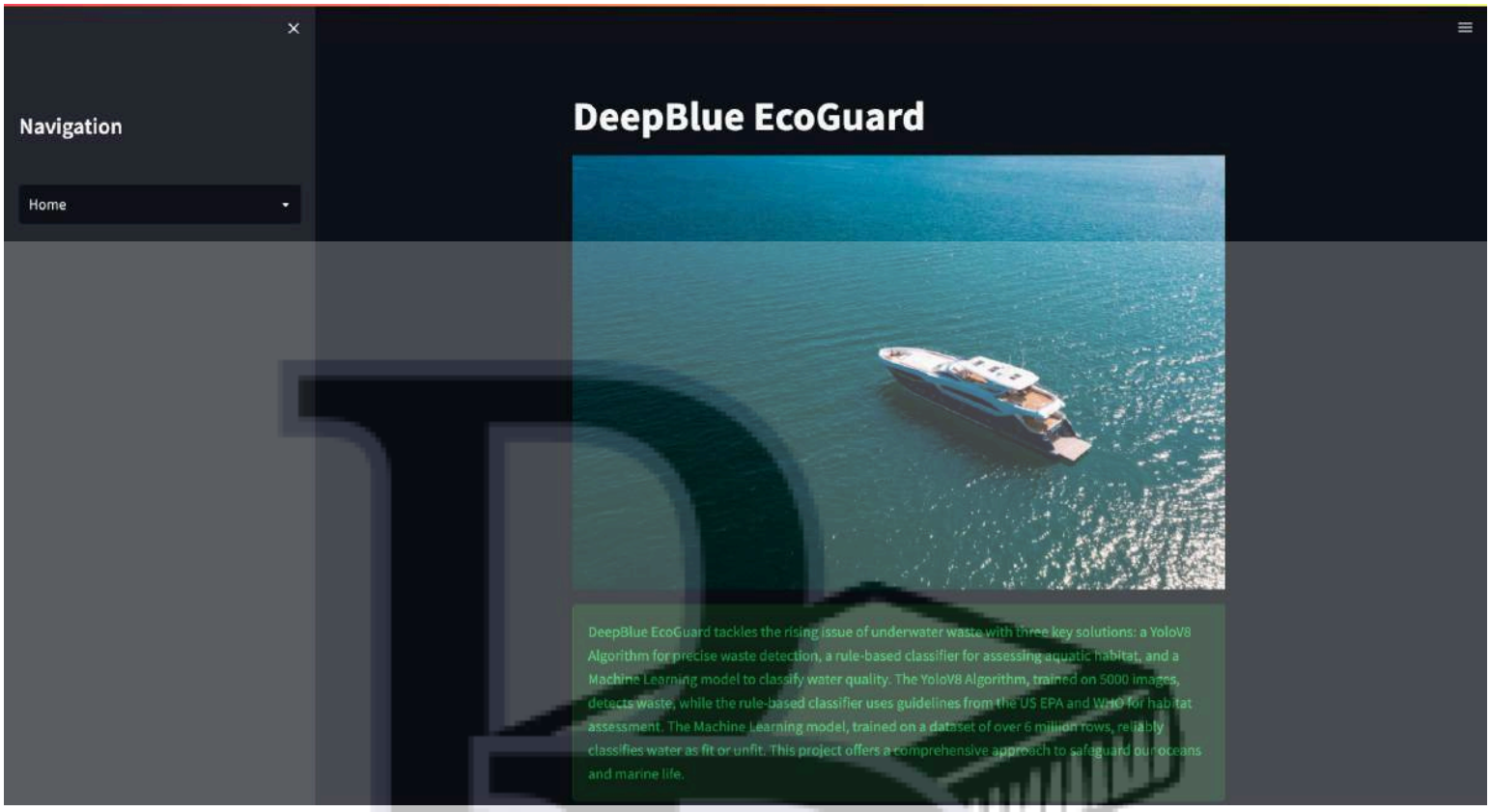
By conducting both functional and non-functional testing, we can ensure that DeepBlue EcoGuard not only meets its functional requirements but also delivers a reliable, high-performance solution that is user-friendly and effective in safeguarding marine environments.

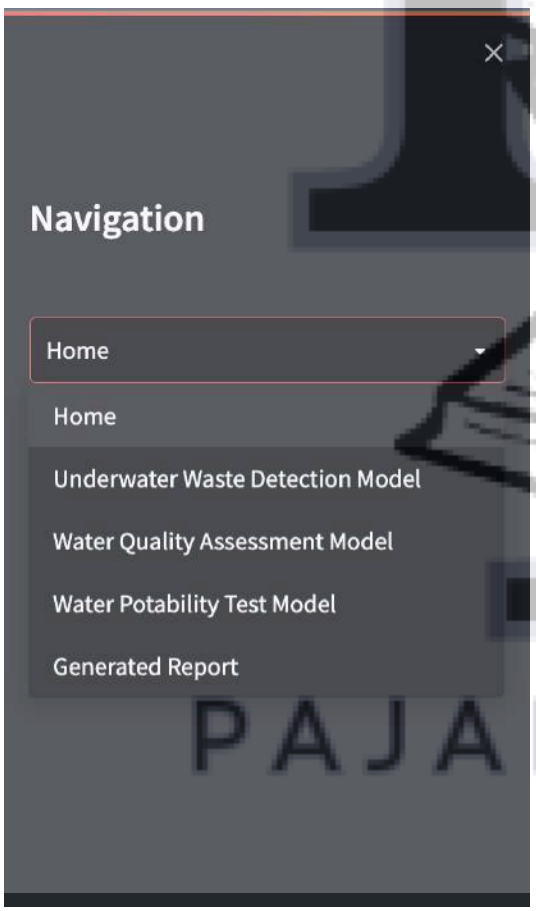
Q. 2. Story Boarding and User Interface design Modeling. (3 Marks)
Required: Show the diagram (image) of GUI of your project and elaborate its functionalities (working).

GUI Description:

The GUI of DeepBlue EcoGuard is designed to provide users with intuitive access to the system's functionalities for underwater waste detection, aquatic habitat assessment, and water quality classification. Here's a textual representation of the GUI layout:

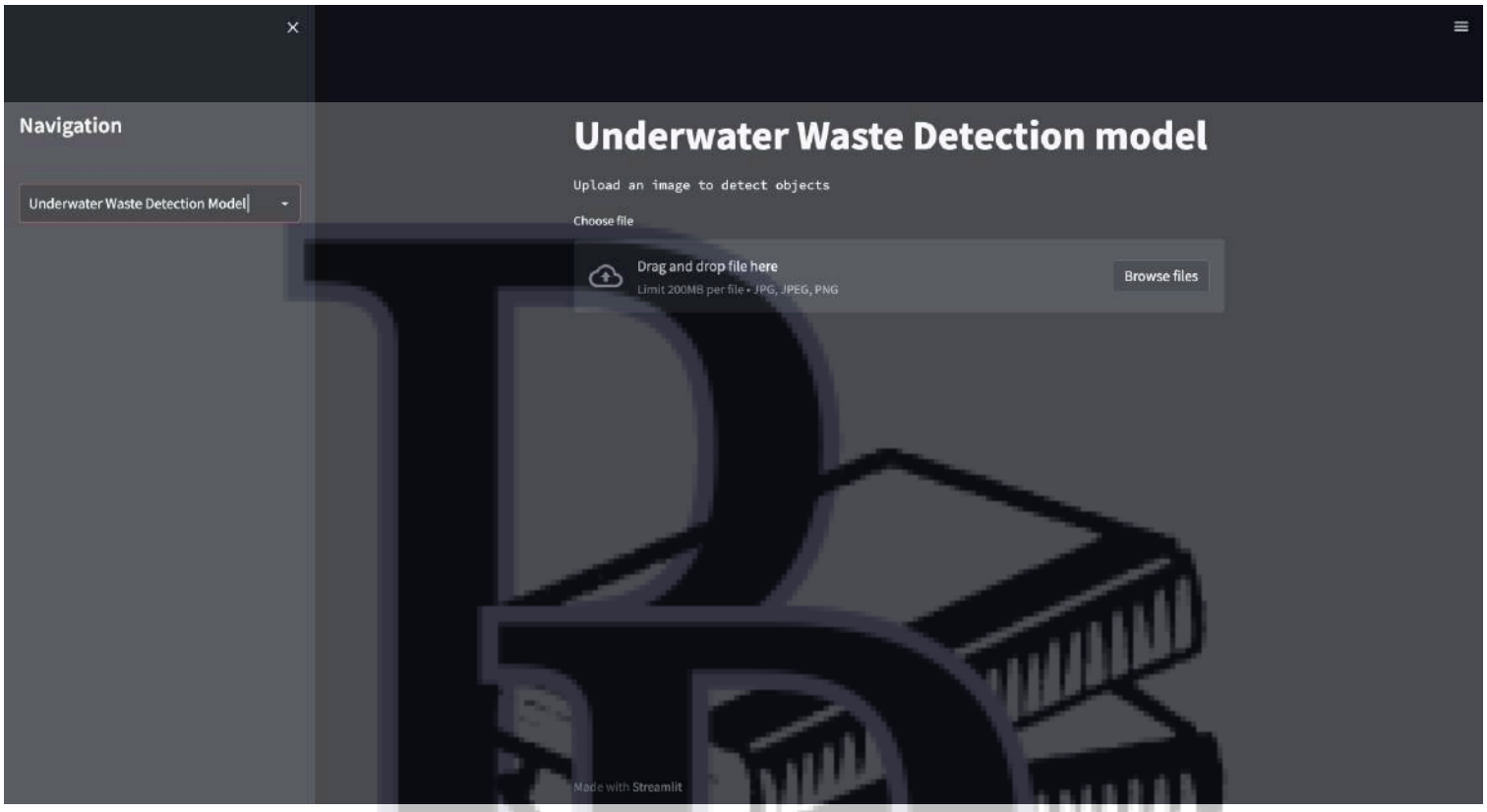
1. Main Dashboard:
   - The main dashboard serves as the central hub for accessing different functionalities.
   - It displays key metrics and indicators related to the health of the marine environment.





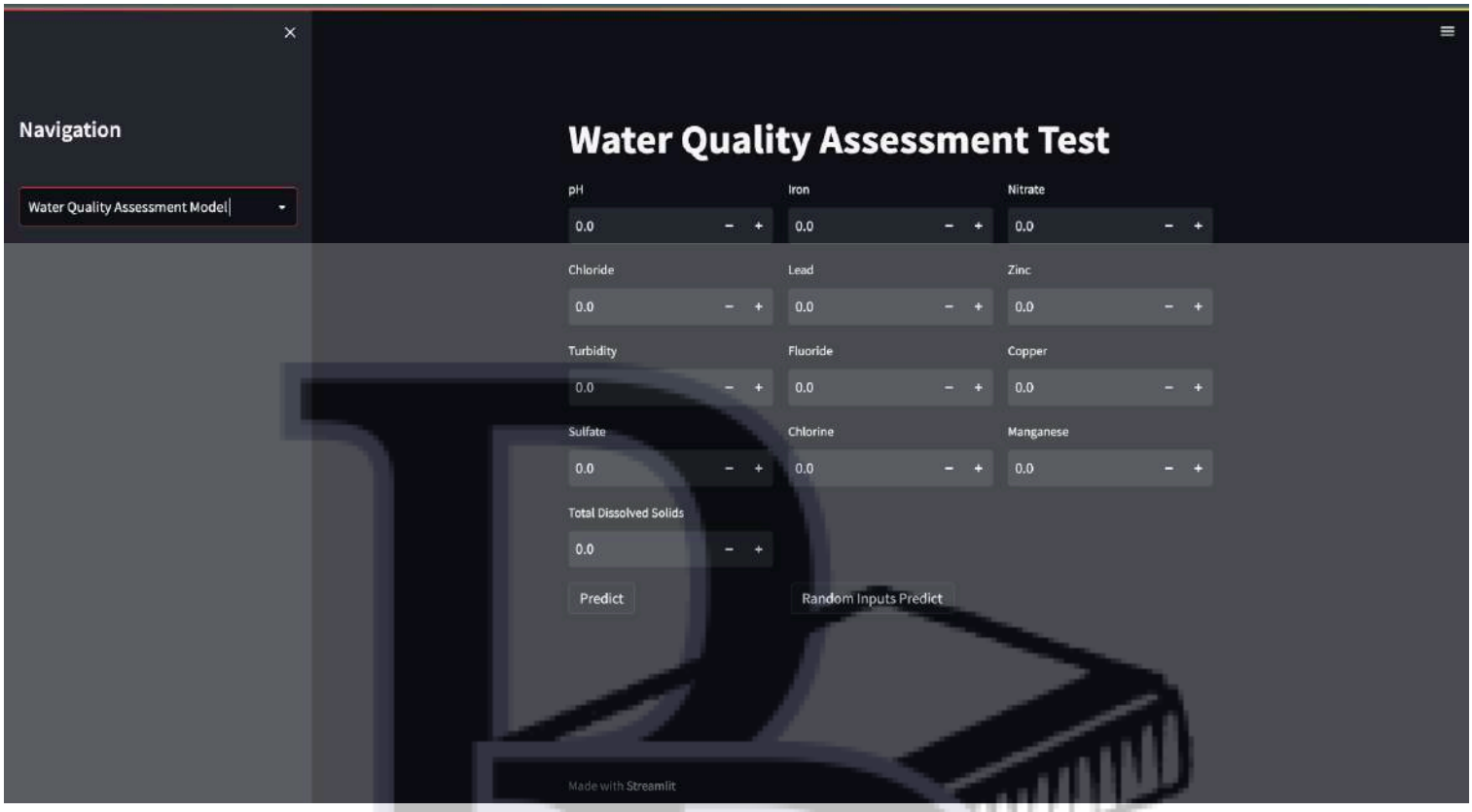
2. Underwater Waste Detection:
   - This section allows users to upload underwater images or connect to live feeds from underwater cameras.

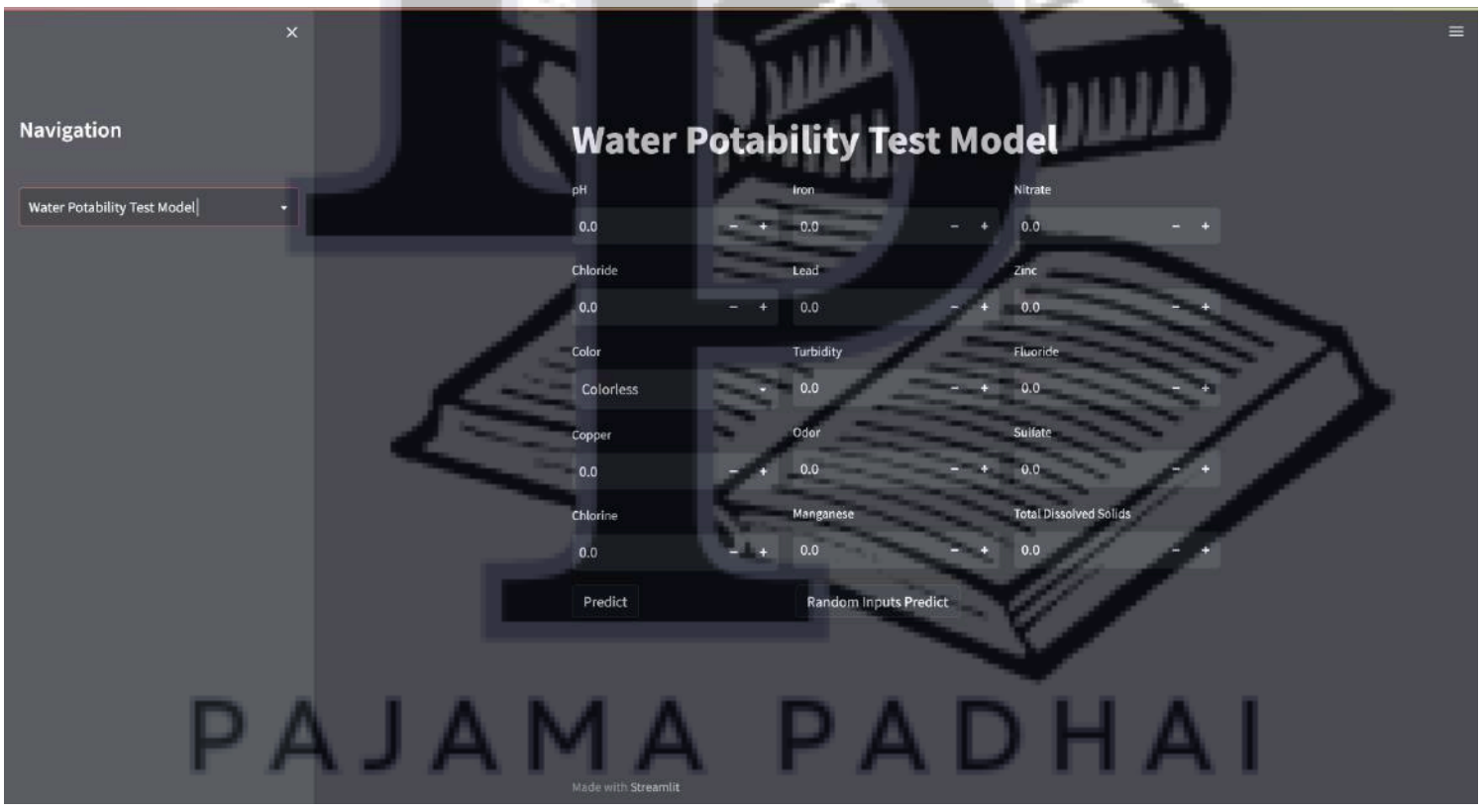
- Upon uploading or streaming, the GUI displays the detected waste items overlaid on the image or video feed.
- Users can interact with the detected waste items to view details such as type, size, and location.

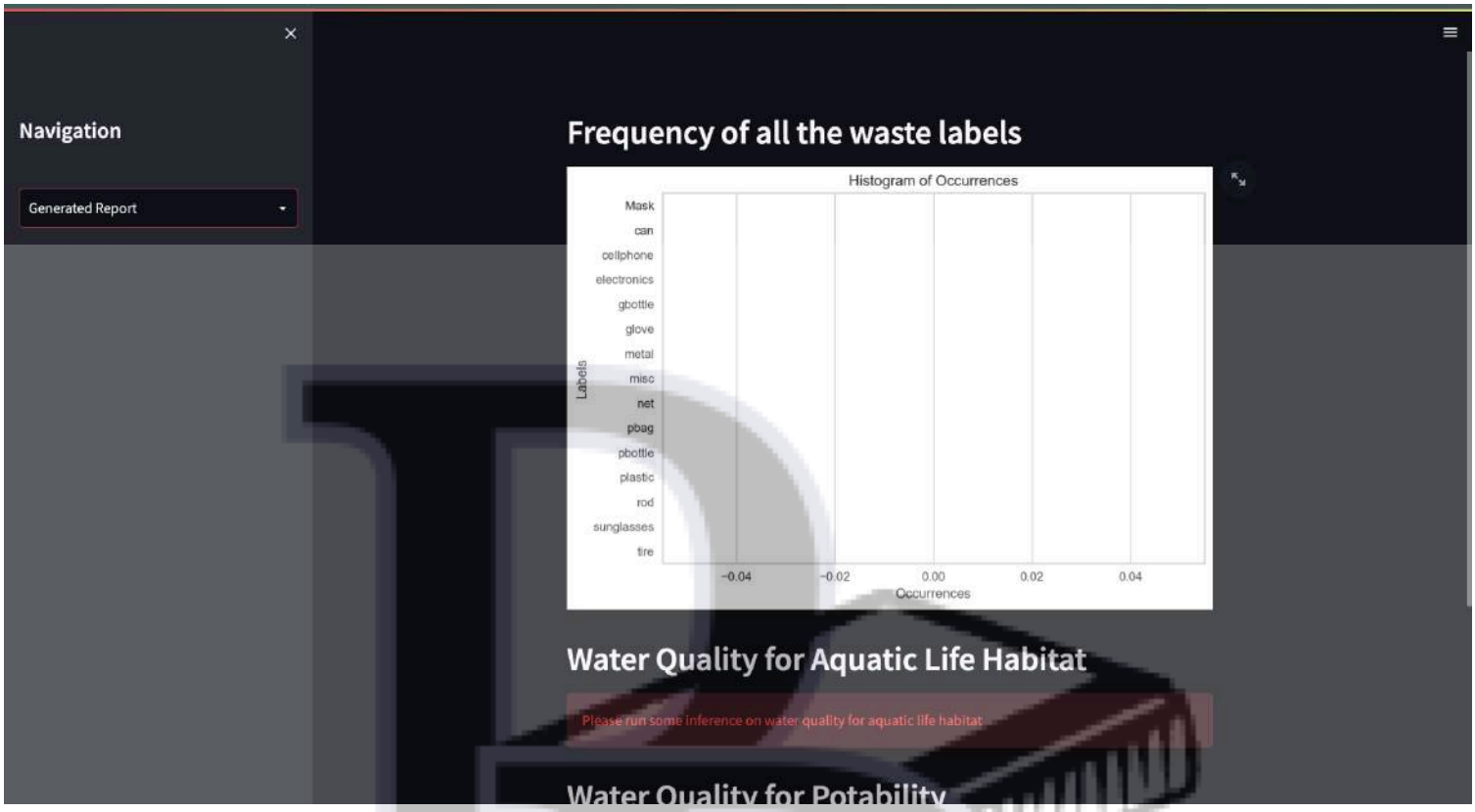


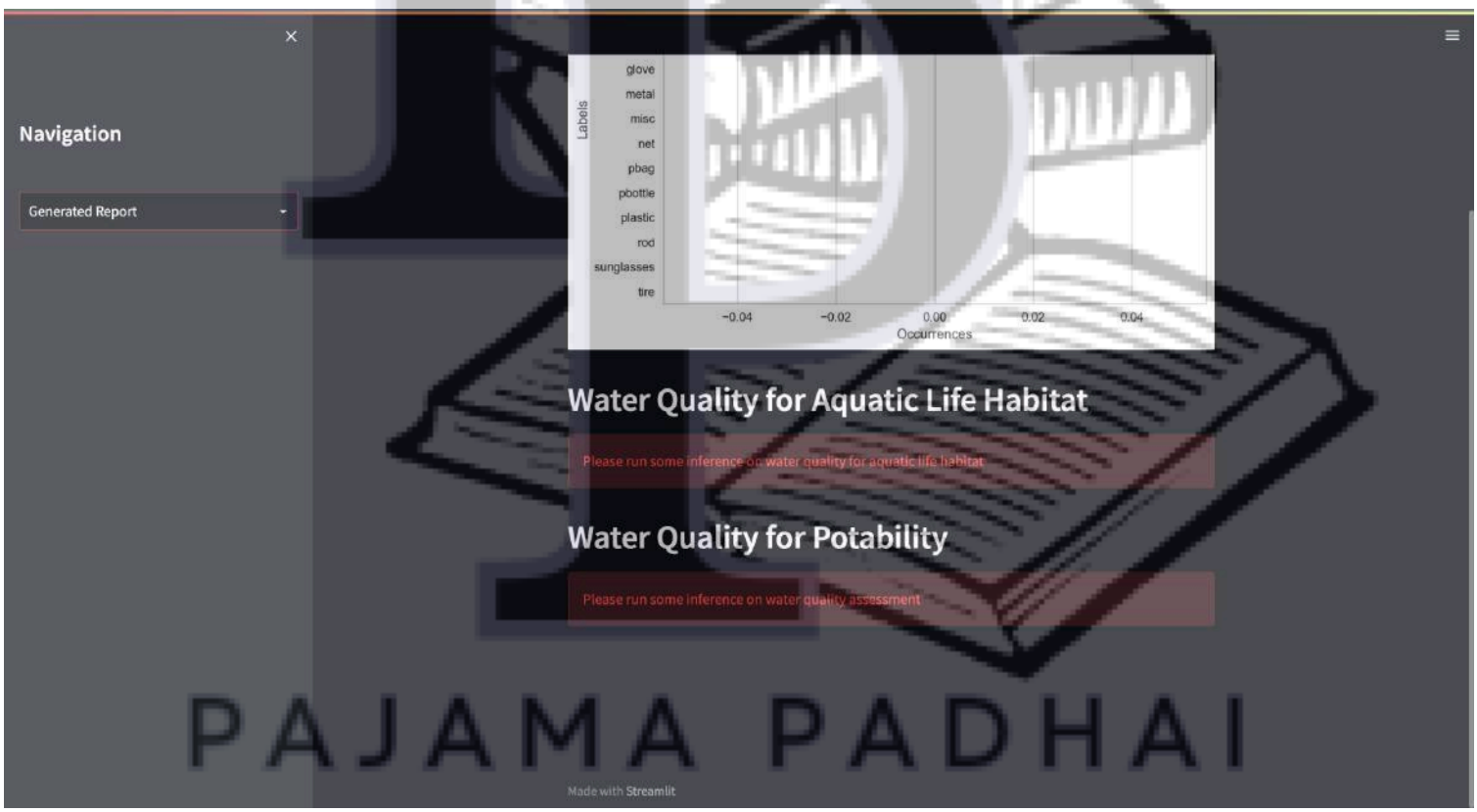
3. Aquatic Habitat Assessment:
- In this section, users can input water quality parameters such as pH, dissolved oxygen, and pollutant concentrations.
- The GUI provides visual feedback on the assessed habitat quality based on the input parameters.
- Users can view recommendations or guidelines from authoritative sources like the US EPA and WHO regarding habitat management.

4. Water Quality Classification:
- Users can input water quality data or select predefined datasets for classification.
- The GUI displays the classification result as fit or unfit for various uses such as drinking, recreational activities, or marine life habitat.
- Additionally, users can view detailed insights into the factors influencing the water quality classification.









5. Settings and Preferences:
   - This section allows users to customize settings such as threshold values for waste detection, display preferences, and data sources.
   - Users can also access help documentation, tutorials, and support resources from the GUI.

Functionality Elaboration:

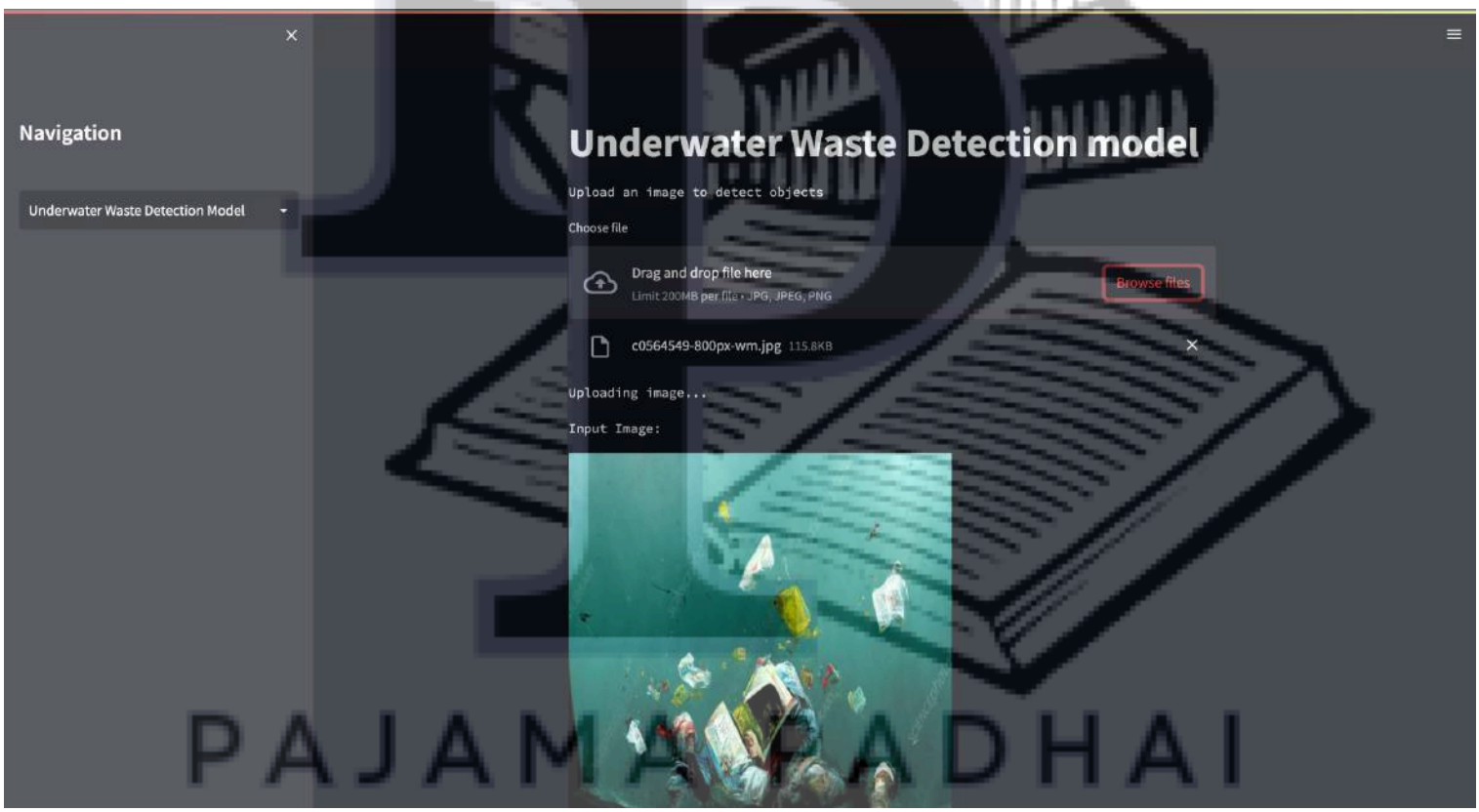
- Underwater Waste Detection: Users can upload underwater images or connect to live feeds to detect and identify waste items in real-time. The system utilizes the YoloV8 Algorithm to accurately detect various types of waste, providing insights into the presence and distribution of pollutants.

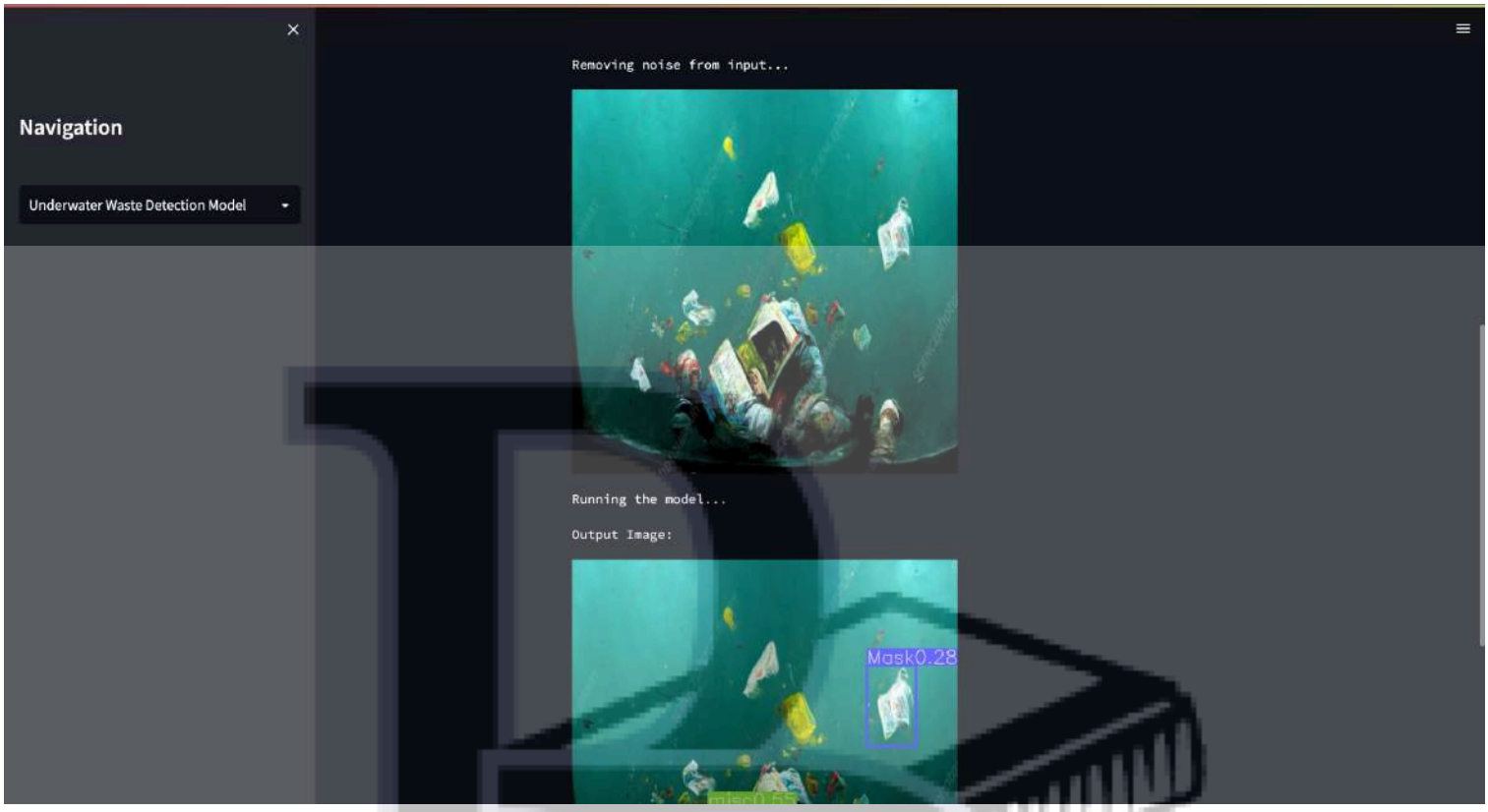
- Aquatic Habitat Assessment: Users can assess the habitat quality of aquatic environments by inputting water quality parameters. The system employs a rule-based classifier based on guidelines from authoritative sources to provide feedback on habitat health, aiding in understanding the impact of pollutants on marine ecosystems.

- Water Quality Classification: Users can classify water quality as fit or unfit for various purposes based on input data. The system utilizes a Machine Learning model trained on extensive datasets to provide reliable classification results, crucial for monitoring and managing water resources.

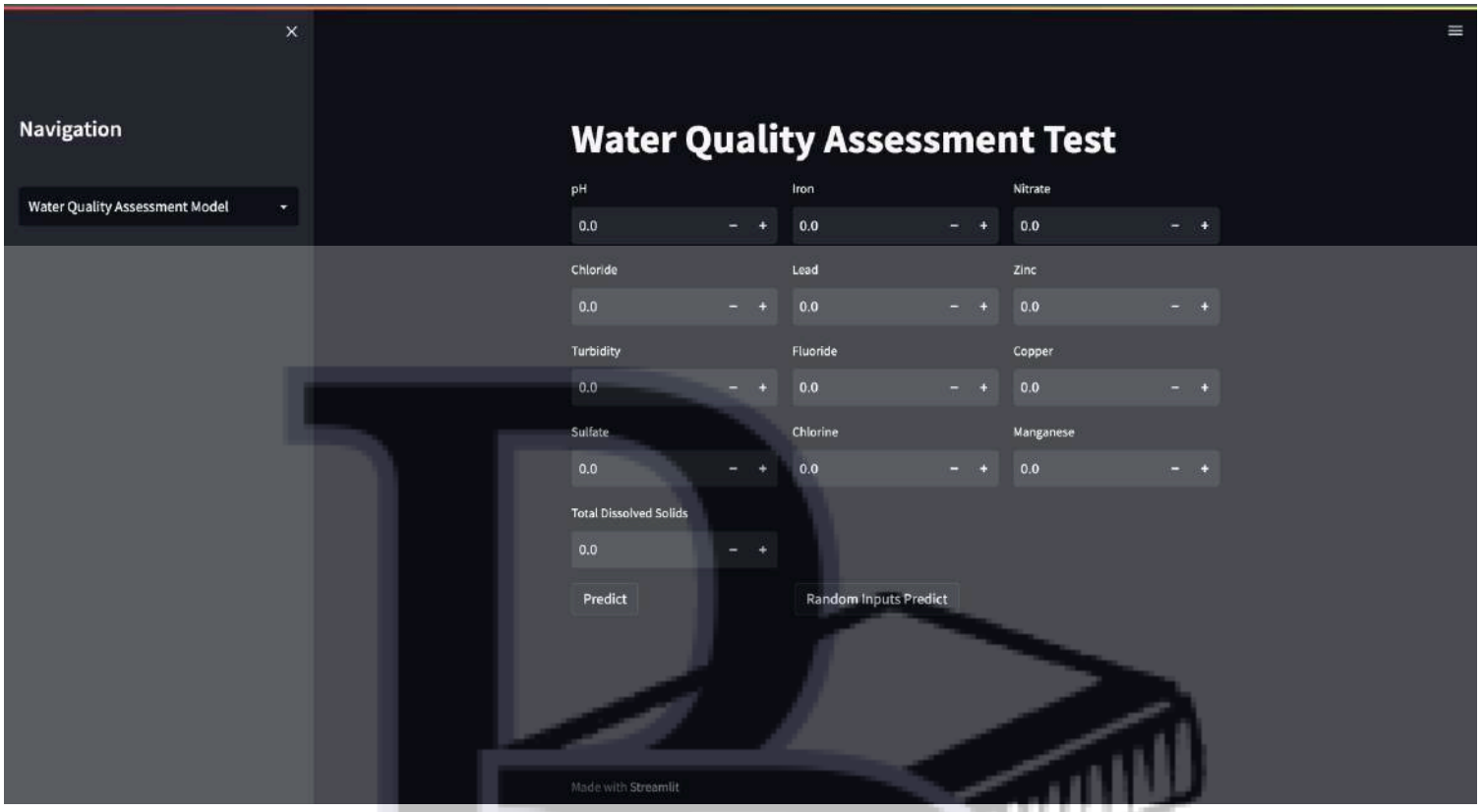
The GUI of DeepBlue EcoGuard aims to provide users with a user-friendly interface to interact with the system's functionalities effectively, empowering them to contribute to the safeguarding of oceans and marine life.

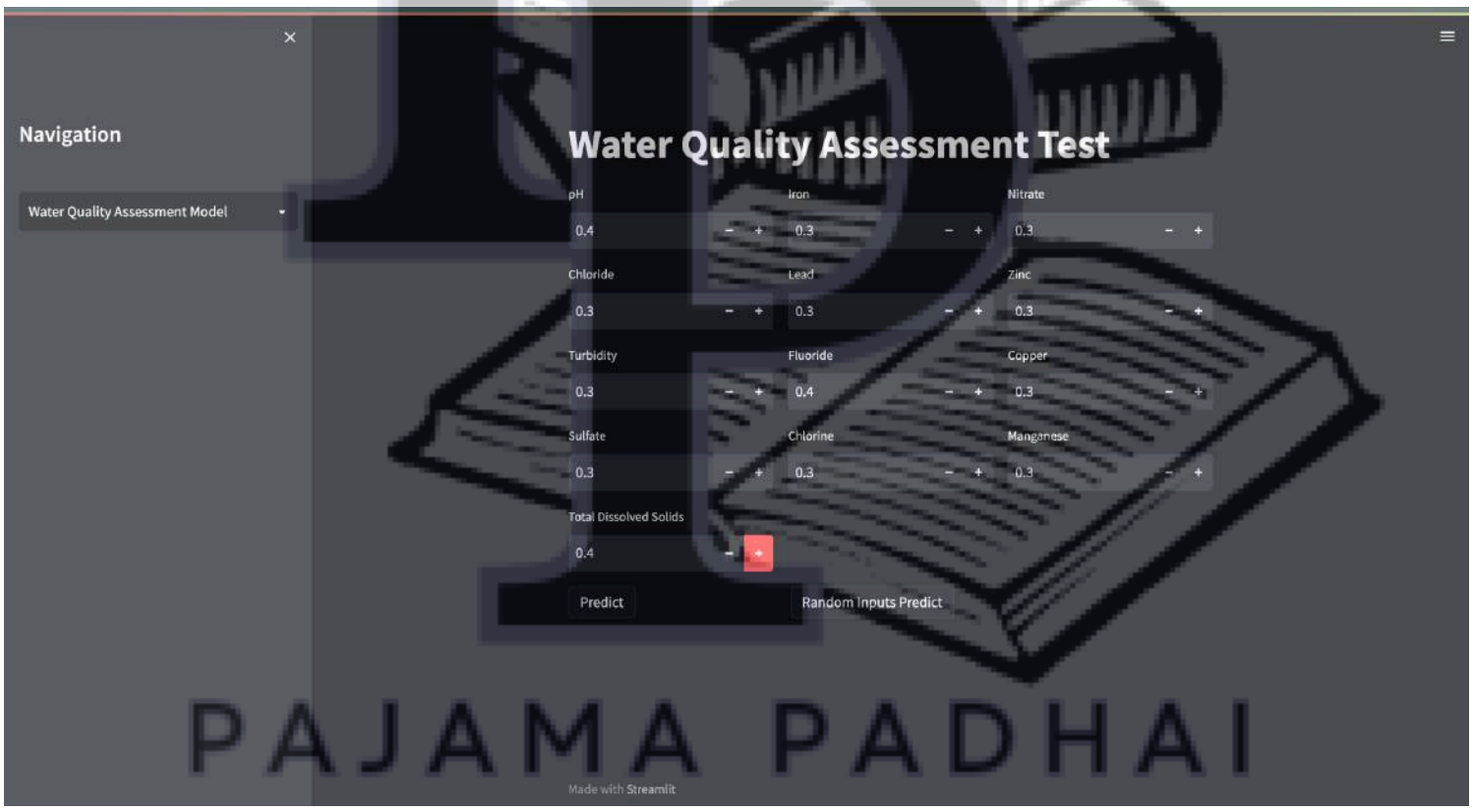
1. Underwater Waste Detection Model:
   - This section allows users to upload an image or connect to a camera feed to detect objects underwater.
   - Users can upload an image and trigger the detection process.
   - The system will then utilize the YoloV8 Algorithm to detect and identify objects, providing real-time insights into the presence and distribution of pollutants.

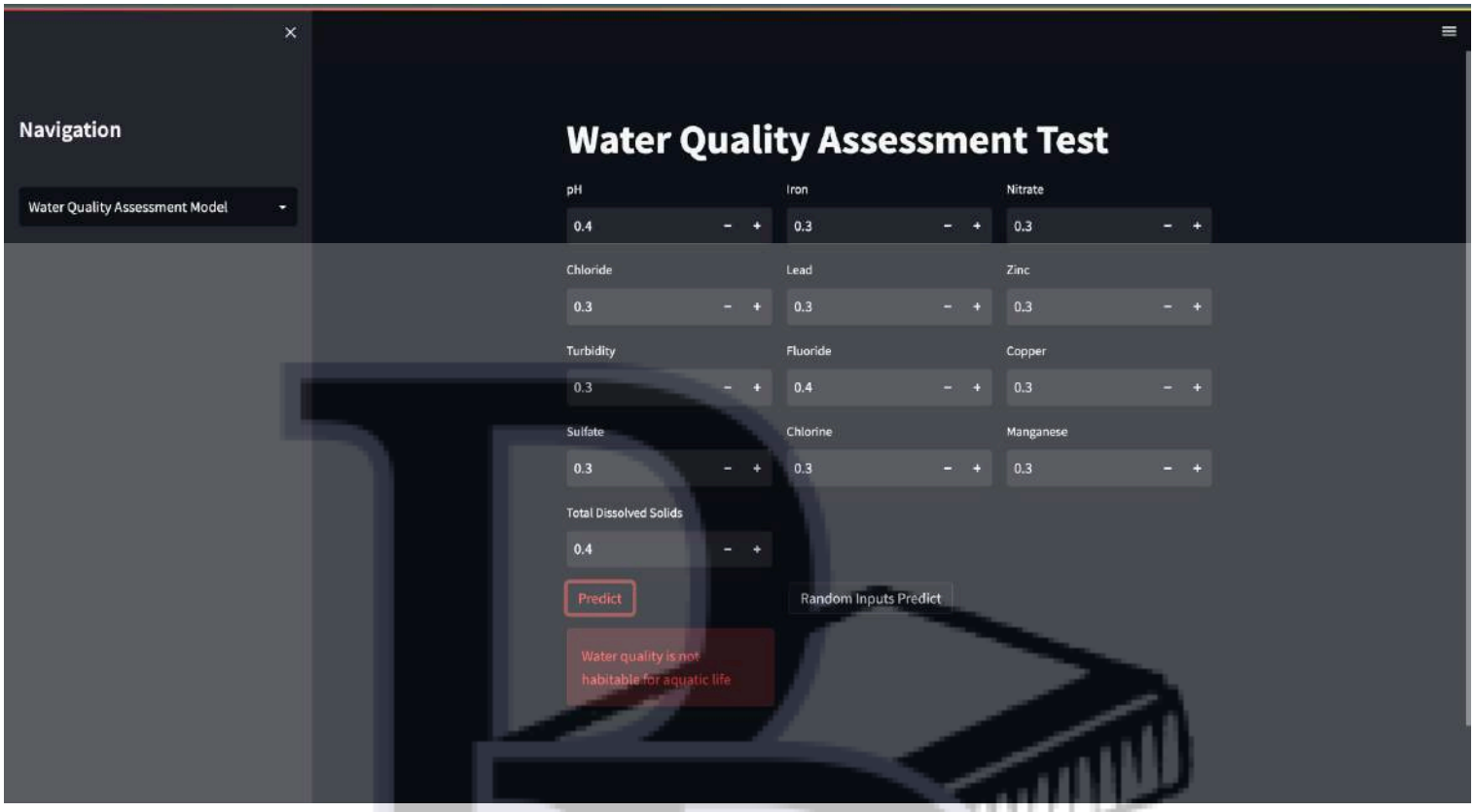


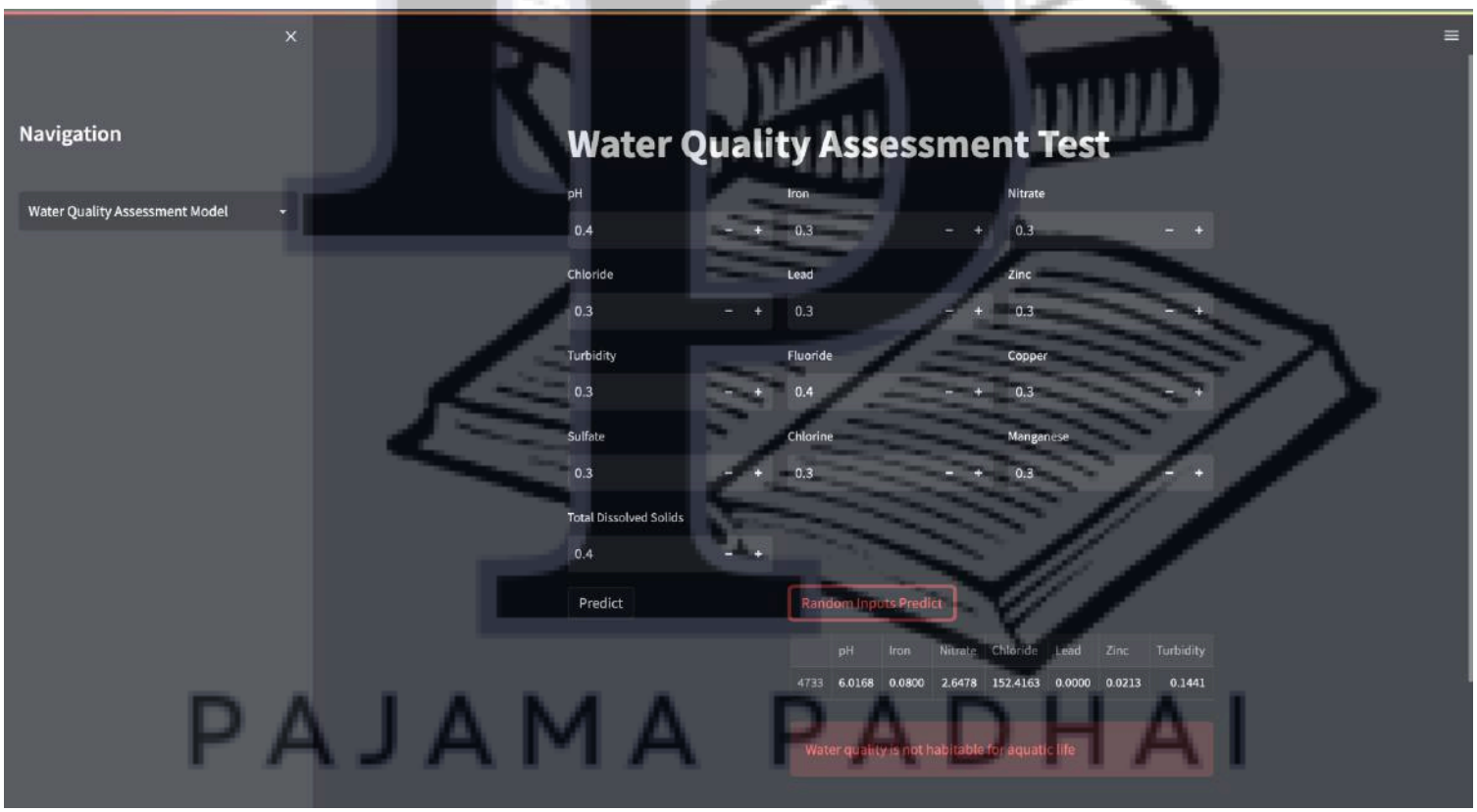


2. Water Quality Assessment Test:
   - Users can input various water quality parameters such as pH, chloride, turbidity, sulfate, total dissolved solids, iron, lead, fluoride, chlorine, nitrate, zinc, copper, and manganese.
   - After entering the values for these parameters, users can trigger the assessment process.
   - The system will analyze the input data and provide feedback on water quality based on the provided parameters.

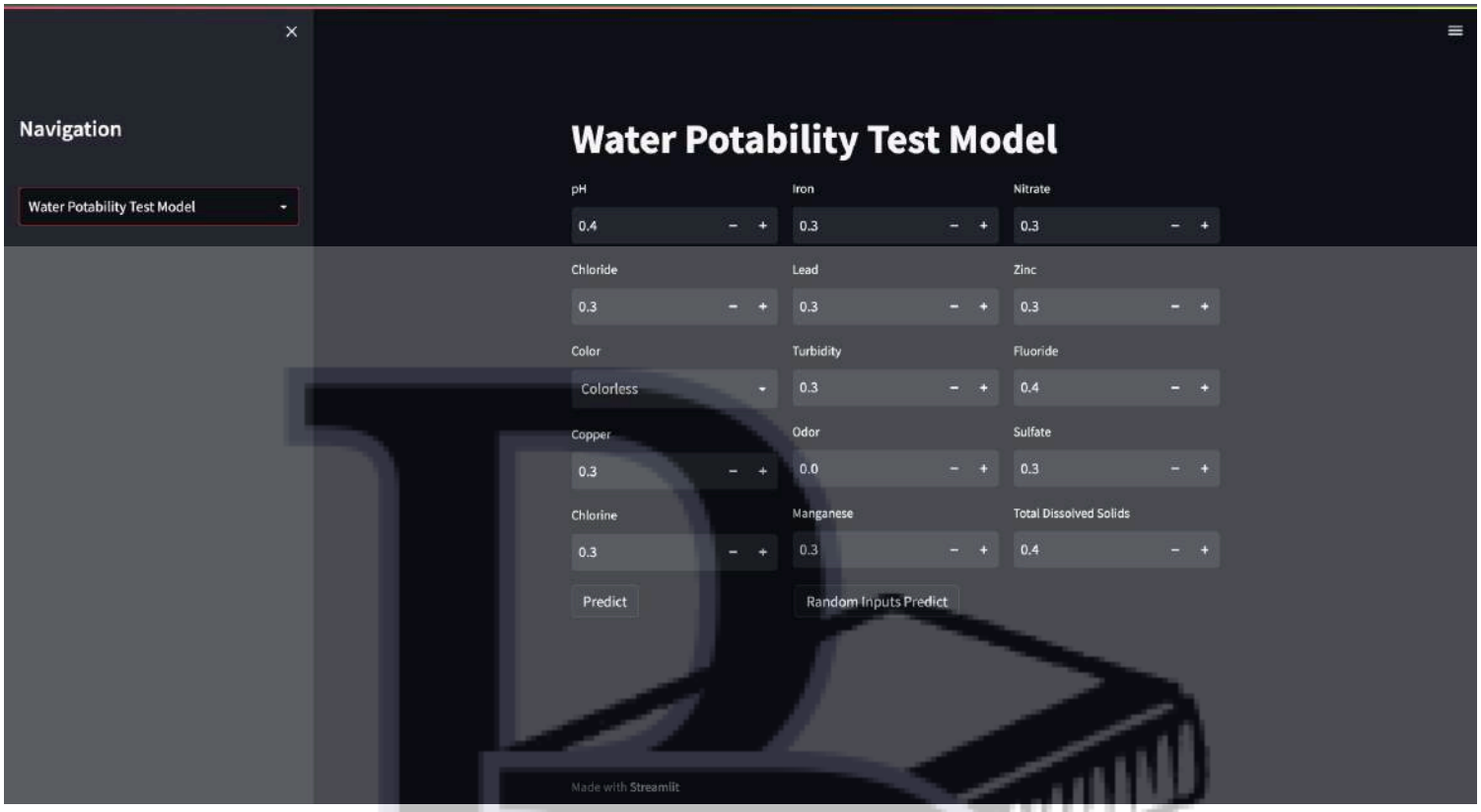


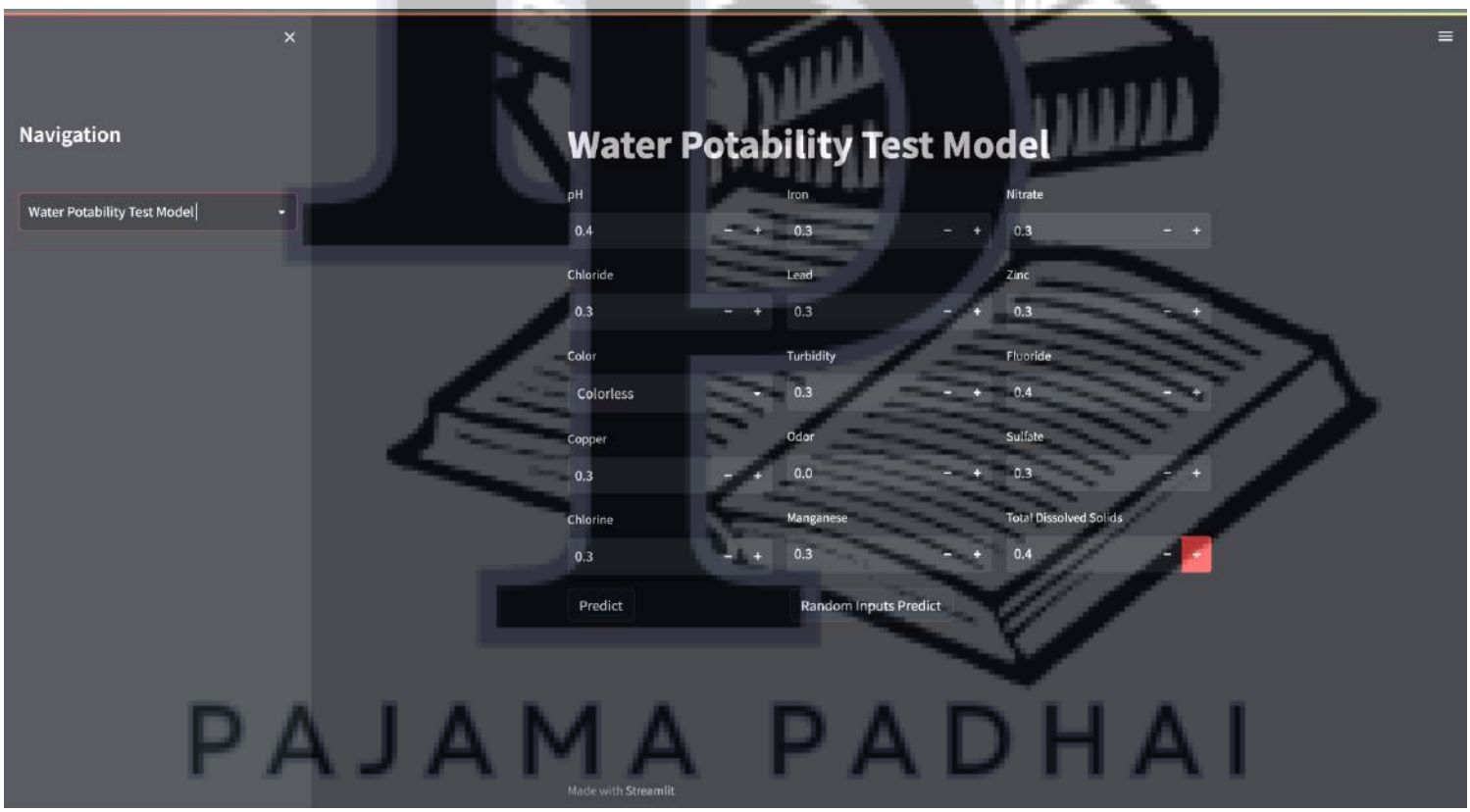


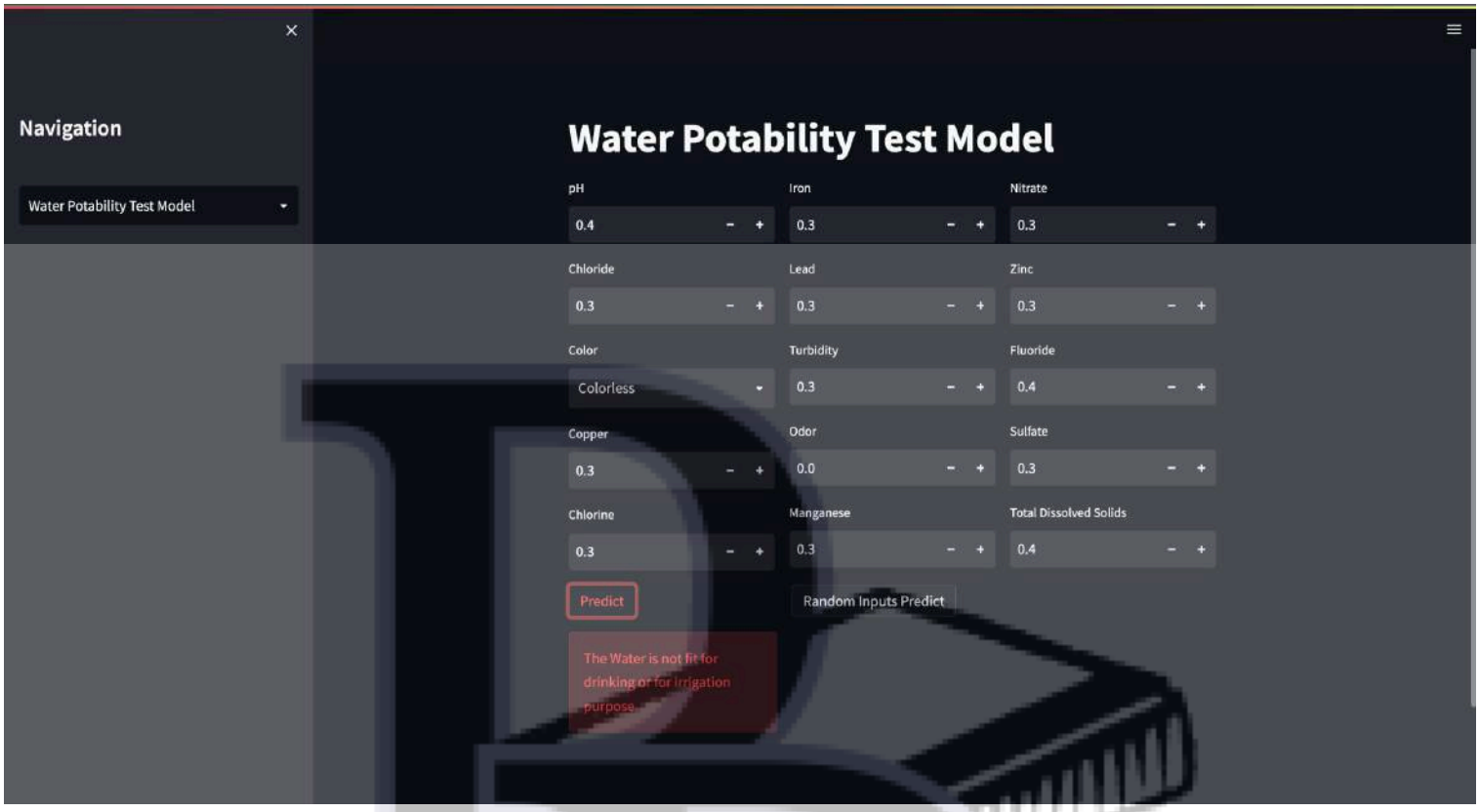


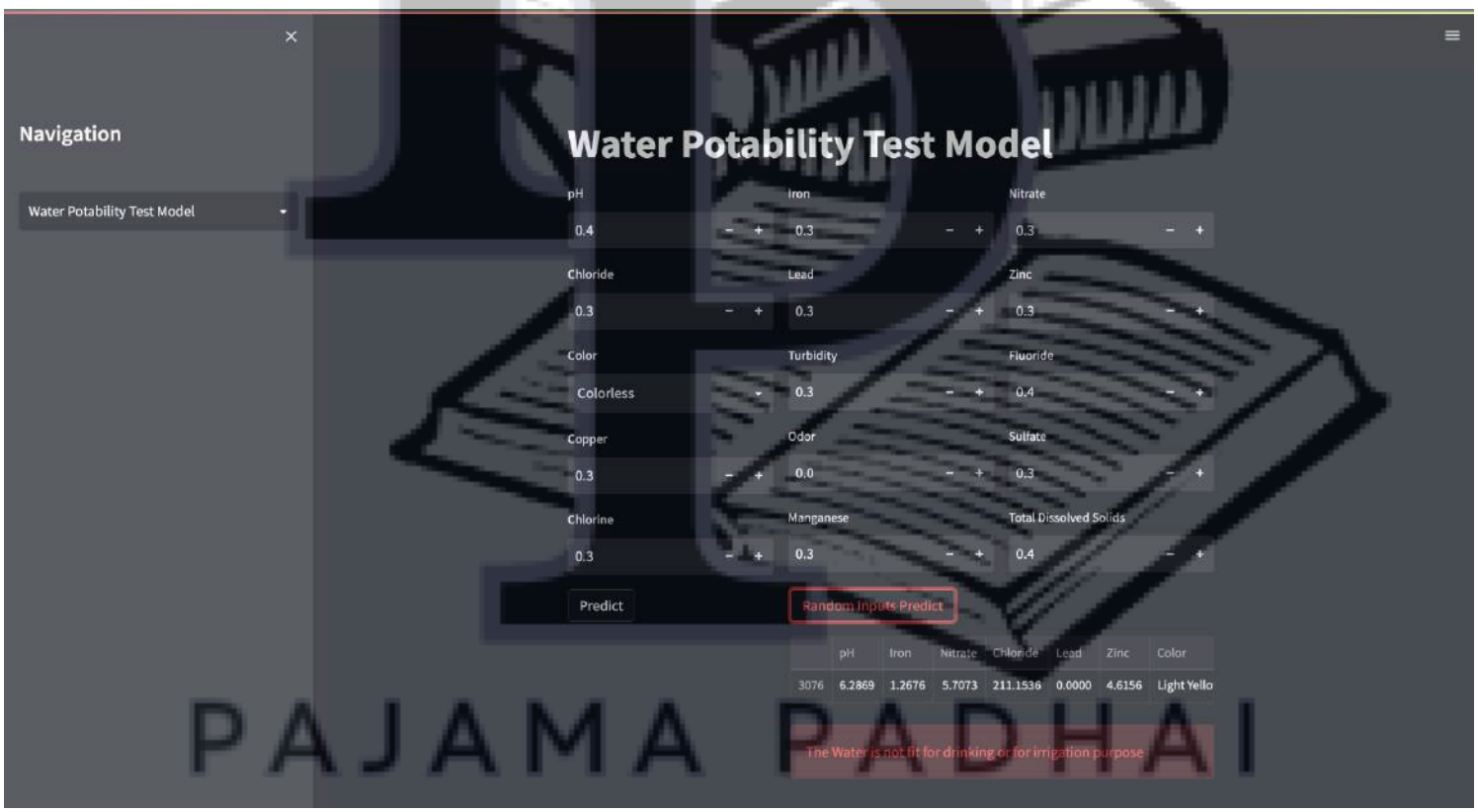


3. Water Potability Test Model:
   - This section is dedicated to assessing the potability of water, i.e., whether it is suitable for drinking.
   - Users can trigger the potability assessment process by clicking on the corresponding option.
   - The system will analyze the input data and provide a classification result indicating whether the water is fit or unfit for drinking.







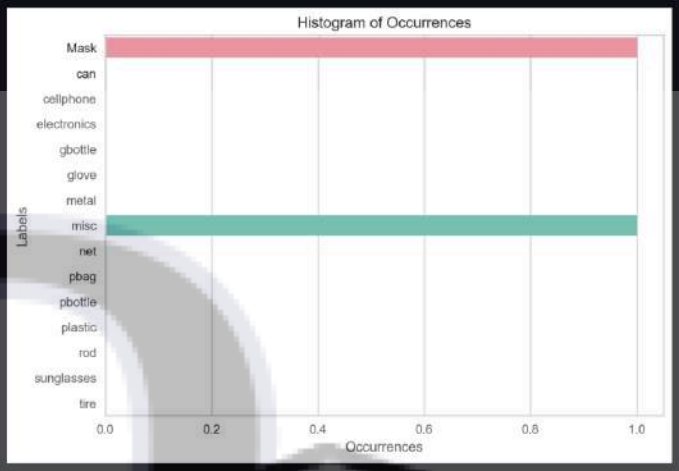


4. Generated Report:
   - This section displays the generated report after running various tests and assessments.
   - The report includes the frequency of all waste labels detected in underwater images.
   - Additionally, it prompts users to run inference on water quality for aquatic life habitat and potability assessment.

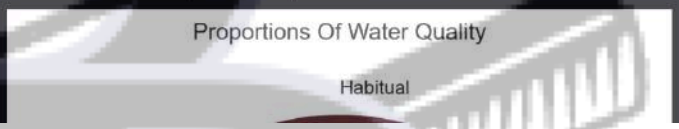
Navigation

Generated Report

Frequency of all the waste labels



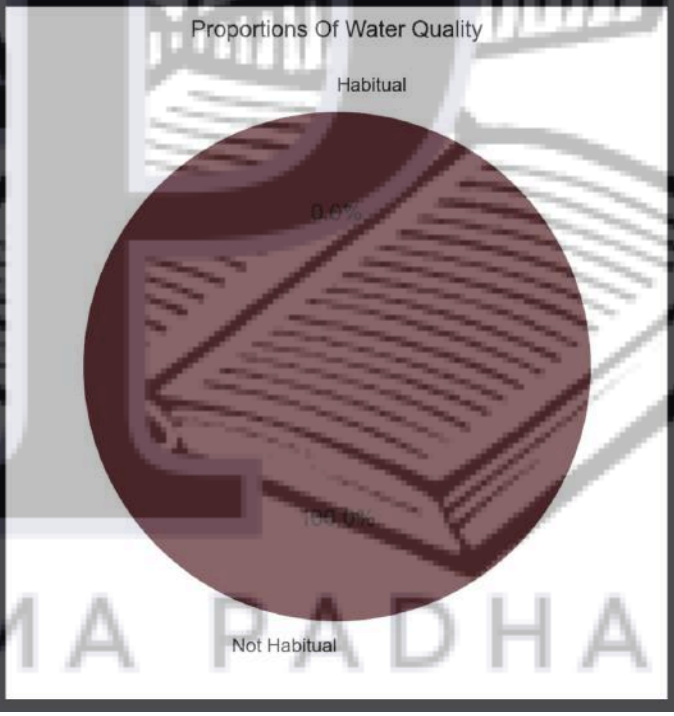
Water Quality for Aquatic Life Habitat

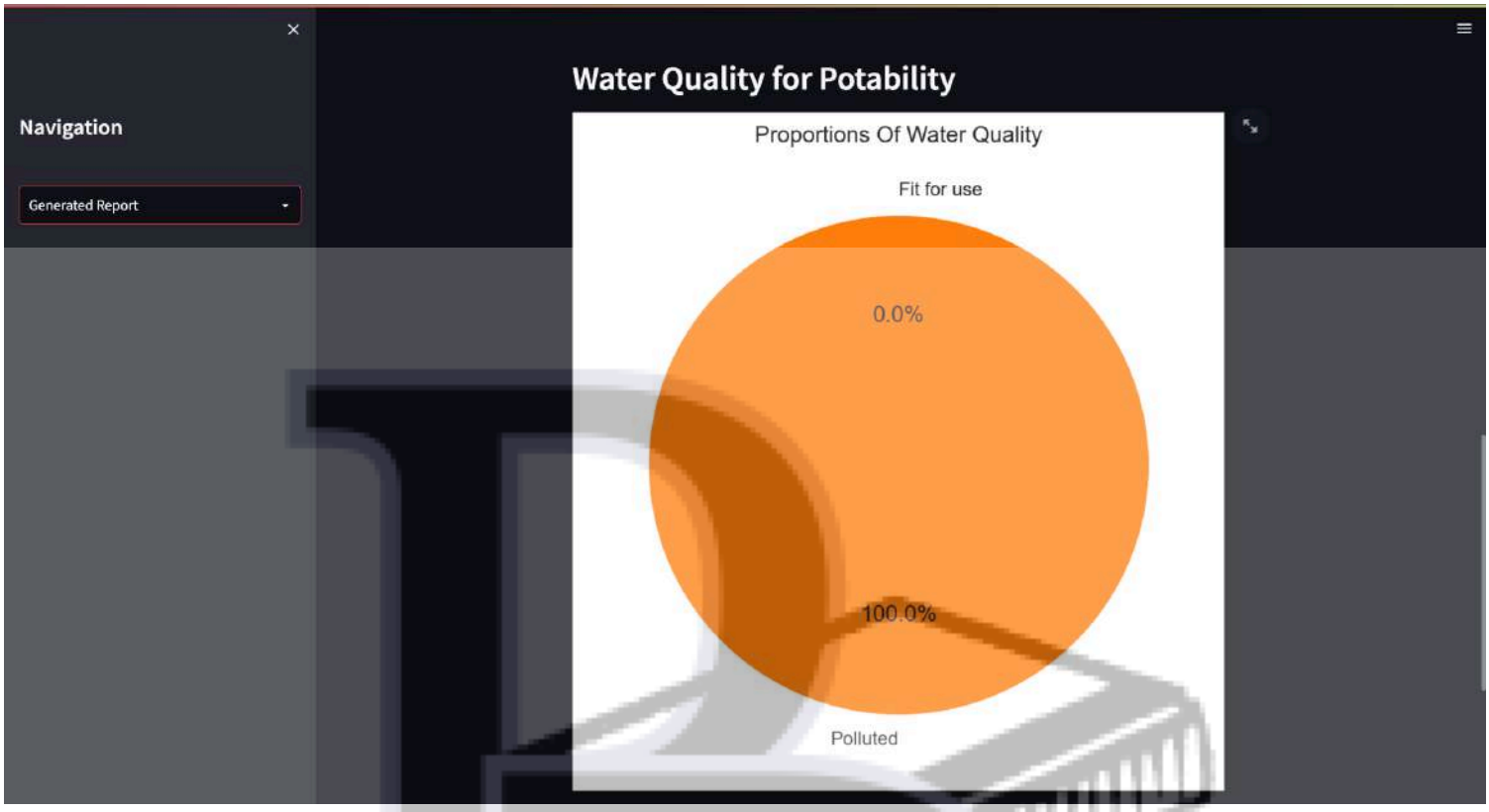


Navigation

Generated Report

Water Quality for Aquatic Life Habitat





Overall, the navigation dropdown on the left side provides users with easy access to different models and functionalities of the system, including waste detection, water quality assessment, and potability testing. Users can input data, trigger assessments, and view generated reports seamlessly through the graphical user interface, making it intuitive and user-friendly.