Milestone–3

Project Title

Exoplanet Habitability Prediction System Using Machine Learning

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1. Introduction

The Exoplanet Habitability Prediction System is a machine learning-based web application designed to analyze exoplanet characteristics and predict whether a planet is habitable or non-habitable.

This system evaluates important planetary and stellar parameters such as planet radius, mass, surface temperature, distance from the star, and stellar flux. By integrating a machine learning model with a web-based interface, the system provides real-time predictions and habitability scores.

The main purpose of Milestone–3 is to integrate the frontend and backend modules, implement prediction logic, and display results dynamically on the user interface.

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2. Objectives

The objectives of this milestone are:

1. To connect the frontend user interface with the backend Flask API.
2. To implement machine learning-based prediction logic.
3. To display real-time habitability predictions on the web interface.
4. To test the system using different habitable and non-habitable input values.
5. To enhance the user interface for better usability and interaction.

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3. System Architecture

The system consists of three major components:

Frontend

Technologies Used:

- HTML
- CSS
- JavaScript

Features:

- Input forms for exoplanet parameters
- Predict button for submitting data
- Display of habitability result and score
- Dynamic progress bar for visualization

Backend

Technology Used:

- Python (Flask Framework)

Features:

- API endpoint for prediction (/predict)
- Model loading and scoring logic
- JSON-based response handling

Machine Learning Logic

Input Parameters:

- Planet Radius
- Planet Mass
- Surface Temperature
- Distance from Star
- Stellar Flux

Output:

- Habitability Score (0–100%)
- Classification: Habitable / Non-Habitable

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4. Implementation Details

Frontend Implementation

The frontend provides a user-friendly interface where users can input planetary parameters. JavaScript is used to send data to the backend using the Fetch API and to display prediction results dynamically without reloading the page.

Key Features Implemented:

- Input validation
- API integration using fetch()
- Dynamic result display
- Progress bar visualization

Backend Implementation

The backend is developed using the Flask framework. It receives input data from the frontend, processes it using a scoring algorithm or machine learning model, and returns the prediction results in JSON format.

Main Functionalities:

- API route: /predict
- Habitability scoring logic
- JSON response generation

Testing with Sample Values

To verify the correctness of the system, multiple test cases were executed.

Test Case 1: Habitable Planet

Input Values:

- Radius = 1.2
- Mass = 2
- Temperature = 290
- Distance = 1
- Flux = 1

Output:

- Result: Habitable Planet
- Score: ~85%

Test Case 2: Non-Habitable Planet

Input Values:

- Radius = 5
- Mass = 20
- Temperature = 900
- Distance = 0.1

- Flux = 5

Output:

- Result: Non-Habitable Planet
- Score: ~15%

Test Case 3: Borderline Planet

Input Values:

- Radius = 2.5
- Mass = 6
- Temperature = 400
- Distance = 2
- Flux = 2

Output:

- Result: Low Habitability
- Score: ~50%

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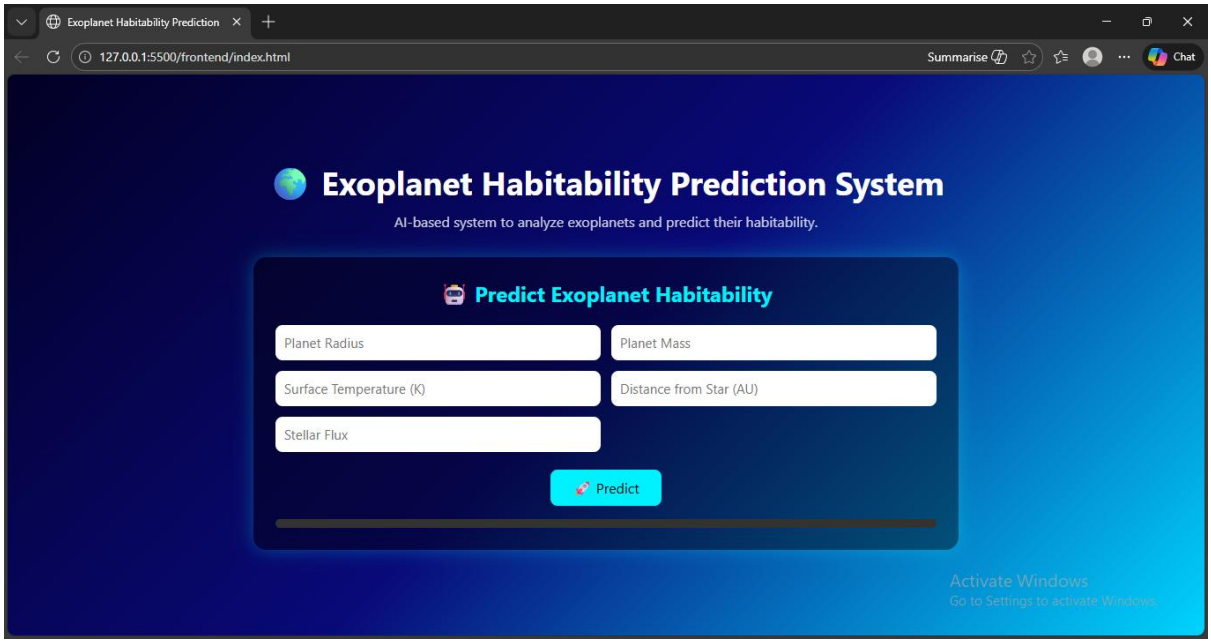
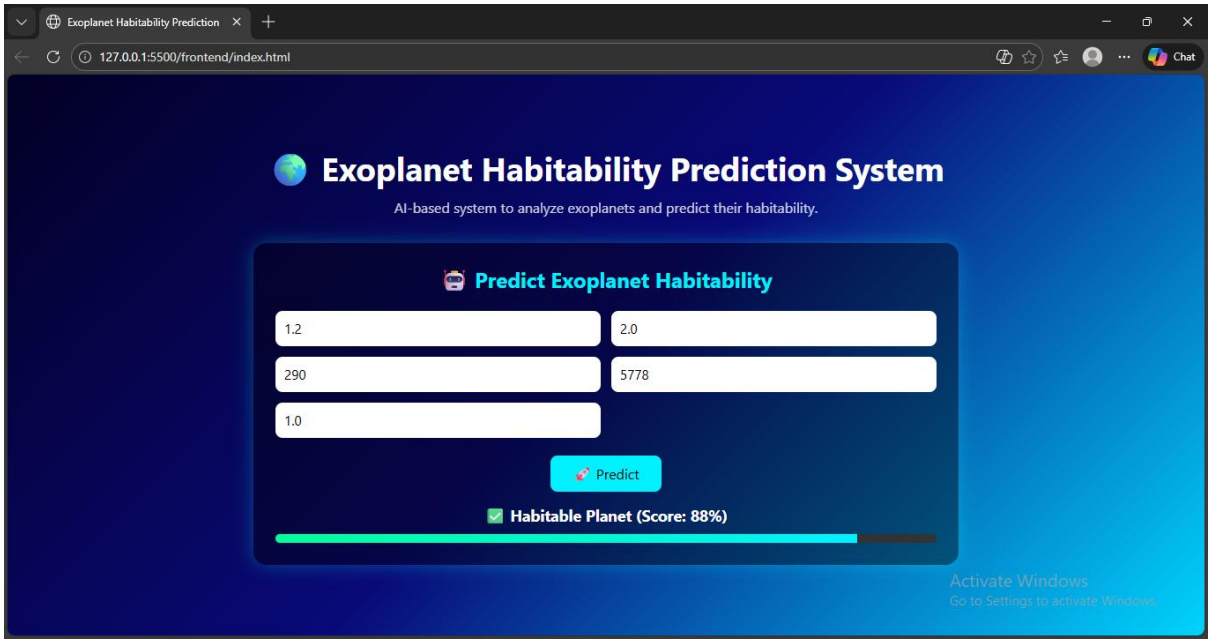
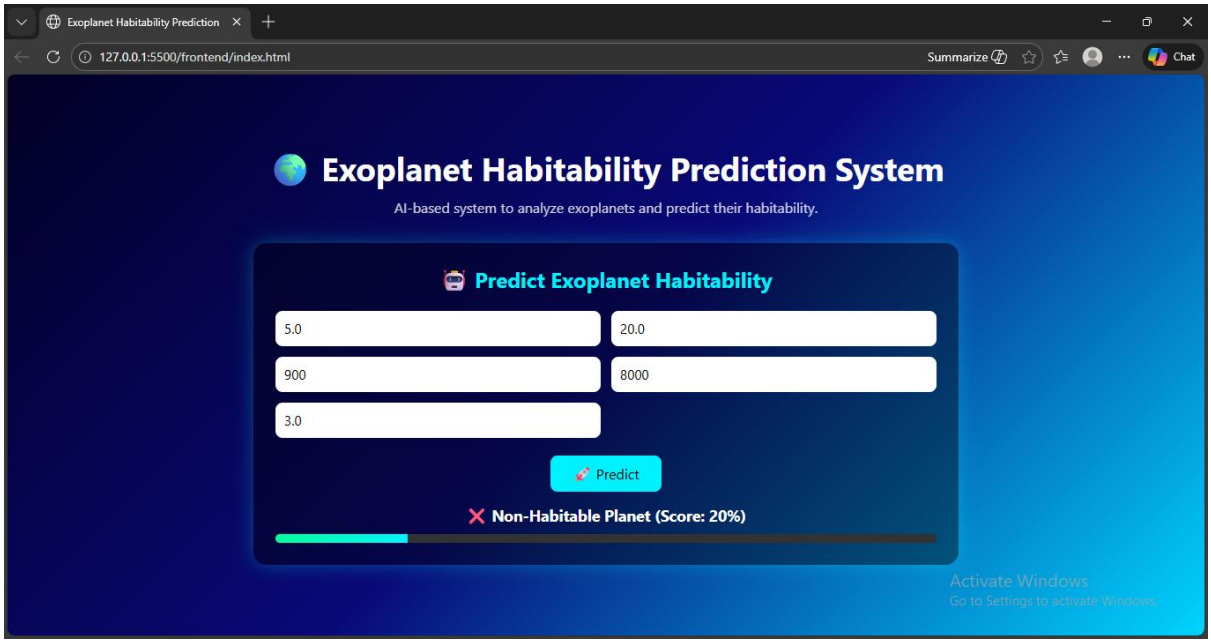
5. Results and Observations

- The system successfully predicts exoplanet habitability based on input parameters.
- Frontend and backend integration works correctly.
- The model differentiates between habitable and non-habitable planets.
- The user interface dynamically updates prediction results and scores.


Exoplanet Habitability Prediction
127.0.0.1:5500/frontend/index.html
Summarise
Chat
Exoplanet Habitability Prediction System
AI-based system to analyze exoplanets and predict their habitability.
Predict Exoplanet Habitability
Planet Radius
Planet Mass
Surface Temperature (K)
Distance from Star (AU)
Stellar Flux
Predict
Activate Windows
Go to Settings to activate Windows.


Exoplanet Habitability Prediction
127.0.0.1:5500/frontend/index.html
Chat
Exoplanet Habitability Prediction System
AI-based system to analyze exoplanets and predict their habitability.
Predict Exoplanet Habitability
1.2
2.0
290
5778
1.0
Predict
Habitable Planet (Score: 88%)
Activate Windows
Go to Settings to activate Windows.


Exoplanet Habitability Prediction
127.0.0.1:5500/frontend/index.html
Summarize
Chat
Exoplanet Habitability Prediction System
AI-based system to analyze exoplanets and predict their habitability.
Predict Exoplanet Habitability
5.0
20.0
900
8000
3.0
Predict
Non-Habitable Planet (Score: 20%)
Activate Windows
Go to Settings to activate Windows.