**Heart Disease Prediction System User Manual**

**1. Introduction**

This system helps healthcare professionals predict the likelihood of heart disease in patients based on several medical attributes. By leveraging machine learning models, our system offers fast, reliable predictions to aid in early diagnosis. The user interface, built with Python and Flask, allows users to enter patient data and receive instant results.

**2. System Requirements**

Before using the system, ensure the following:

* **Python**: Version 3.7 or higher.
* **Flask**: Installed via pip install Flask.
* **Browser**: A modern web browser (Google Chrome, Firefox, etc.).

**Python Libraries Needed:**

* Flask
* Scikit-learn
* XGBoost
* Pandas
* Numpy
* Joblib (for loading models)

You can install the necessary libraries using the following command:

bash

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pip install flask scikit-learn xgboost pandas numpy joblib

**3. Installation & Setup**

**Step 1: Download the Project Files**

Download or clone the project files from the repository.

**Step 2: Navigate to the Project Directory**

Open your terminal (or command prompt) and navigate to the folder containing the project files.

bash

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cd path\_to\_your\_project\_folder

**Step 3: Run the Flask Application**

To start the application, run the following command:

bash

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python app.py

**Step 4: Access the Interface**

Open a web browser and go to:

arduino

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http://127.0.0.1:5000/

You should now see the heart disease prediction interface.

**4. Using the Heart Disease Prediction Interface**

**Step 1: Enter Patient Information**

You will be prompted to enter several medical attributes for the patient. These may include the following:

* **Age**: The age of the patient (numeric).
* **Cholesterol**: Cholesterol levels in mg/dL.
* **Blood Pressure**: Resting blood pressure in mm Hg.
* **Chest Pain Type**: Options (1, 2, 3, or 4).
* **Fasting Blood Sugar**: If fasting blood sugar is > 120 mg/dL (1 = True, 0 = False).
* **Maximum Heart Rate Achieved**: Numeric value.
* **Resting Electrocardiographic Results**: Numeric values for ECG.

Fill in all the fields as per the patient's medical report.

**Step 2: Submit the Information**

After filling out the patient information, click the **Submit** button.

**Step 3: View the Prediction**

The system will process the data using our four machine learning models (SVM, Logistic Regression, XGBoost, Random Forest) and display the prediction:

* **Result**: "Heart Disease Detected" or "No Heart Disease Detected".

The output is based on the average accuracy of the models to give a balanced prediction.

**5. Understanding the Results**

* **Heart Disease Detected**: This means that, based on the provided patient data, there is a likelihood that the patient has heart disease. Further medical evaluation is recommended.
* **No Heart Disease Detected**: This indicates that the models predict the patient is not at significant risk of heart disease. However, it is essential to use this result in conjunction with other clinical evaluations.

**6. Advanced Features**

**Model Performance Metrics**

For healthcare professionals or researchers interested in model performance, the system also outputs metrics for each model used. These include accuracy, precision, recall, and F1-score. This information can help professionals understand the reliability of predictions in specific cases.

**7. Maintenance & Troubleshooting**

**Common Issues:**

* **Flask Server Not Starting**: Ensure that Flask is installed correctly and that you are using Python 3.7+.
* **Page Not Loading**: Check that the server is running by looking for the following message in your terminal:  
  Running on http://127.0.0.1:5000/

If not, restart the Flask server using python app.py.

**Model Updates:**

To update or retrain the models:

1. Update the dataset in the project directory.
2. Run the model training script.
3. Save the new models using Joblib and replace the existing model files.

**8. Contact & Support**

For questions or support regarding the system, please reach out to our development team at:

* **Email**: support@heartprediction.com
* **Phone**: +1-800-HEART-123