Software Design Document

Disease Pridiction

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Summery

This Software Design Document (SDD) presents the design and architectural overview of the **Disease Prediction System**, a web-based intelligent healthcare application that utilizes machine learning techniques to predict the risk of multiple diseases. The primary goal of the system is to support early disease detection and promote preventive healthcare by providing users with instant, data-driven health risk assessments.

The project is designed to address the growing need for accessible and cost-effective health monitoring solutions, especially in regions where traditional medical diagnostic facilities are limited. By integrating machine learning models with a secure and user-friendly web platform, the system enables users to input basic medical and lifestyle information and receive predictive insights for diseases such as diabetes, heart disease, liver disease, and Parkinson's disease.

This document outlines the key design considerations, including system scalability, data security, usability, and model accuracy. The application follows a modular and layered architecture, separating the presentation layer, business logic layer, machine learning layer, and database layer to ensure maintainability and flexibility. Django is used as the backend framework, while trained machine learning models are integrated to provide real-time predictions.

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1. Application Architecture

1. Introduction

This chapter describes the overall architecture of the **Disease Prediction System**, explaining how different components of the application are structured and how they interact with each other. The purpose of this chapter is to provide a clear architectural view of the system, including the design pattern used, major components, data flow, system models, APIs, external libraries, UML diagrams, and coding conventions followed during development.

2. Architectural Design Pattern

The Disease Prediction System follows the **Model–View–Controller (MVC)** architectural pattern. This pattern is selected to separate the concerns of data handling, user interface, and business logic.

Benefits of Using MVC

1. Improves system maintainability
2. Enhances modularity and scalability
3. Allows independent development of components
4. Simplifies testing and future enhancements

MVC Components Overview

Component	Description
Model	Represents data structures, database entities, and system records
View	Responsible for displaying information to users
Controller	Manages user requests and system workflow

3. Overall System Architecture

The system architecture is designed as a **layered web-based architecture**, where each layer performs a specific role.

Architectural Layers

Layer	Function
User Interface Layer	Accepts user input and displays results
Controller Layer	Handles logic and request processing
Machine Learning Layer	Executes disease prediction models
Data Layer	Manages persistent storage

4. Conceptual System Models

The system uses several conceptual models to manage data and operations. These models define how information is structured and stored in the system.

4.1 User Model

Attribute	Description
User ID	Unique identifier for each user
Name	User’s full name
Email	Registered email address
Password	Encrypted user password
Role	User type (general user/admin)

4.2 Disease Prediction Model

Attribute	Description
Prediction ID	Unique prediction record identifier
Disease Type	Selected disease for prediction
Input Parameters	Medical and lifestyle data
Prediction Result	Predicted disease risk
Prediction Date	Timestamp of prediction

5. Controller Architecture

Controllers act as intermediaries between users, models, and views. They manage the flow of data and system operations.

Controller Responsibilities

Controller	Responsibilities
Authentication Controller	User registration and login management
Prediction Controller	Disease prediction workflow
Dashboard Controller	Data visualization and history display
Chat Assistant Controller	Health guidance interaction
Feedback Controller	User feedback handling

6. Coding and Design Conventions

Although implementation details are not covered in this document, the following design conventions are followed:

Consistent naming standards

Modular design principles

Clear separation of responsibilities

Proper documentation

Reusable and scalable architecture

7. Conclusion

The application architecture of the Disease Prediction System is designed to support reliable, secure, and scalable disease prediction services. By following the MVC pattern and layered architecture, the system ensures efficient interaction between components while maintaining flexibility for future enhancements. This chapter provides a comprehensive architectural foundation for implementing the Disease Prediction System effectively.

2. Data Model Schema

2.1 Introduction

This chapter describes the **data model schema** of the Disease Prediction System. The data model defines how data is structured, stored, and managed within the system. A well-designed data schema is essential for ensuring data integrity, efficient retrieval, secure storage, and smooth interaction between system components.

The Disease Prediction System handles sensitive healthcare-related data; therefore, the data model is designed with a strong emphasis on **security, scalability, and consistency**. The schema supports user management, disease prediction records, prediction history tracking, feedback collection, and system reporting.

2.2 Data Model Design Approach

The system uses a **relational database model** to store structured data. Each entity in the system is represented as a table, and relationships are established using primary and foreign keys.

Design Principles

- Data normalization to avoid redundancy
- Clear entity relationships
- Secure storage of sensitive information
- Scalability to support future disease models
- Maintainability and extensibility

2.3 Entity Relationship Overview

The core entities of the system include:

User

Disease

Prediction

These entities are interconnected to ensure accurate data flow and traceability of user activities.

Key Relationships

One user can perform multiple predictions

Each prediction is associated with a specific disease

Prediction history maintains records of past predictions

2.4 User Entity Schema

The **User** entity stores information related to registered users of the system.

Attribute Name	Data Type	Description
User_ID	Integer	Unique identifier for each user
Full_Name	String	User’s complete name
Email	String	Registered email address
Password	String	Encrypted user password
Role	String	User role (User/Admin)
Date_Created	DateTime	Account creation date

2.5 Disease Entity

Disease entity contains information about the diseases supported by the system.

2.6 Prediction Entity

The **Prediction** entity stores details of each disease prediction request.

2.7 Prediction History Entity Schema

The **Prediction History** entity maintains historical records of predictions performed by users.

Attribute Name	Data Type	Description
History_ID	Integer	Unique history record
Prediction_ID	Integer	Associated prediction
User_ID	Integer	User reference
Result	String	Stored prediction outcome
Created_Date	DateTime	Record creation time

2.8 Feedback Entity Schema

The **Feedback** entity stores user feedback related to system usability and prediction accuracy.

Attribute Name	Data Type	Description
Feedback_ID	Integer	Unique feedback identifier
User_ID	Integer	User submitting feedback
Rating	Integer	User rating (1–5)
Comments	Text	Feedback description

Attribute Name	Data Type	Description
Submission_Date	DateTime	Feedback submission date

2.9 Data Integrity and Constraints

To maintain data integrity, the following constraints are applied:

Primary keys ensure entity uniqueness

Foreign keys maintain relational consistency

Mandatory fields prevent incomplete data entries

Unique constraints applied to email addresses

Encrypted storage of sensitive data

2.10 Data Security Considerations

Given the sensitivity of healthcare data, the system implements:

Encrypted user credentials

Restricted database access

Secure authentication mechanisms

Controlled data retrieval

No storage of raw diagnostic conclusions

2.11 Data Model Diagram (ER Diagram)

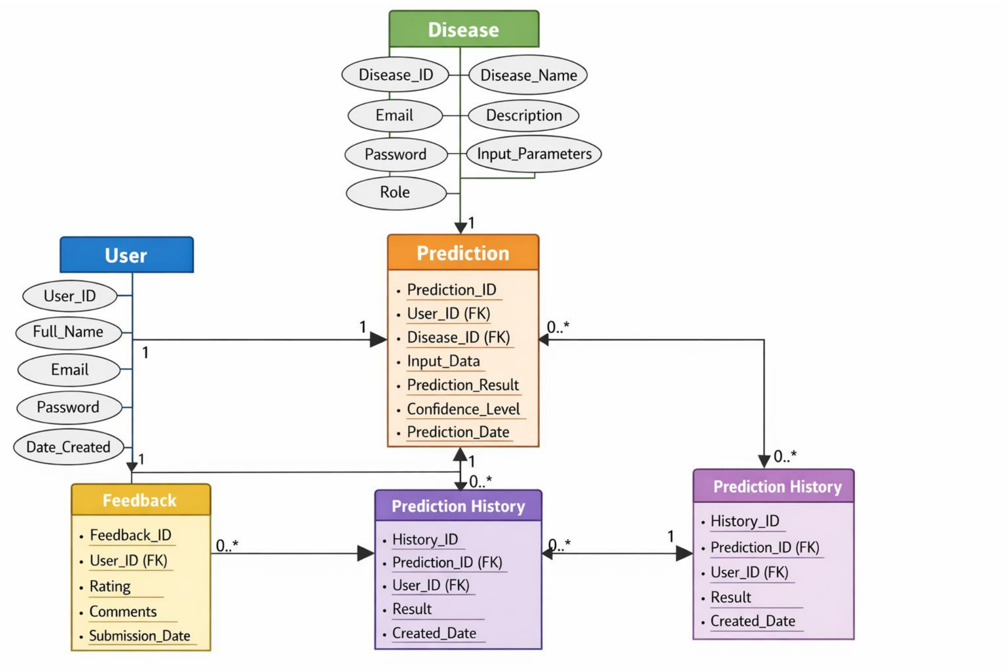
An **Entity Relationship (ER) Diagram** is used to visually represent:

Entities and their attributes

Relationships between tables

Cardinality constraints

This diagram helps in understanding the structure and flow of data within the system.



2.12 Conclusion

The Data Model Schema provides a strong foundation for the Disease Prediction System by ensuring structured, secure, and scalable data storage. The defined entities and relationships support efficient data management, accurate prediction tracking, and reliable system performance. This schema allows the system to grow by incorporating additional diseases, features, and user roles in the future.

3. User Interface

3.1 Introduction

This chapter describes the **User Interface (UI) design** of the Disease Prediction System. The user interface plays a critical role in ensuring usability, accessibility, and effective interaction between users and the system. Since the application targets general users as well as healthcare-related audiences, the interface is designed to be **simple, intuitive, responsive, and user-friendly**.

3.2 User Interface Design Principles

The following design principles are applied throughout the system:

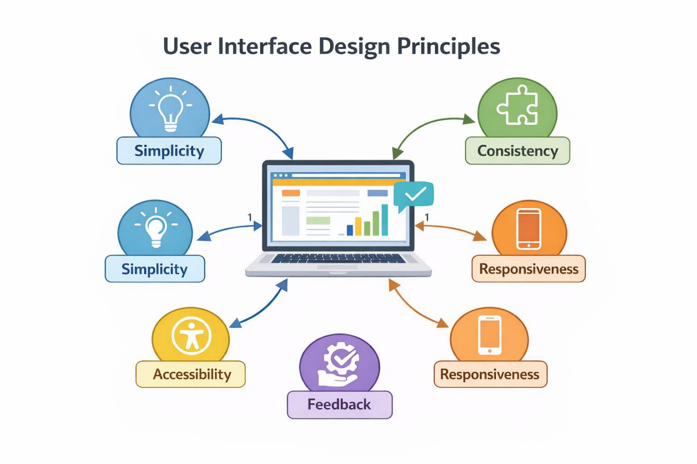
Simplicity: Clean layouts with minimal complexity

Consistency: Uniform colors, fonts, and navigation

Responsiveness: Compatible with desktop and mobile devices

Accessibility: Easy-to-read text and clear input labels

Feedback: Immediate system responses to user actions



3.3 User Interface Flow

The general user interaction flow is as follows:

User accesses the website

User registers or logs into the system

User selects a disease for prediction

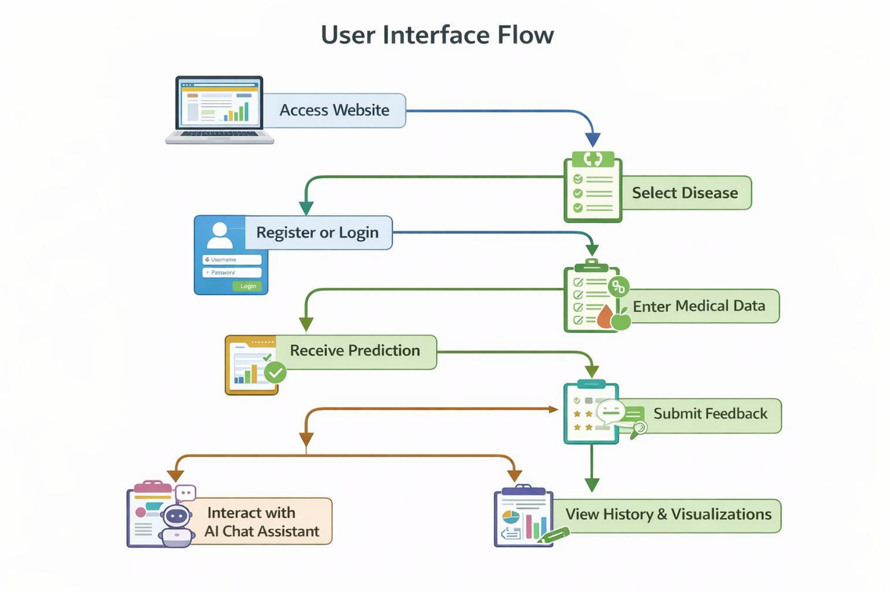
User enters medical and lifestyle data

System displays prediction results

User views history, visualizations, or educational content

User optionally submits feedback

This flow ensures smooth navigation and logical progression between screens.



3.4 Screen Descriptions

3.4.1 Home Page

The Home Page acts as the entry point of the application.

Key Elements:

System title and description

Navigation menu

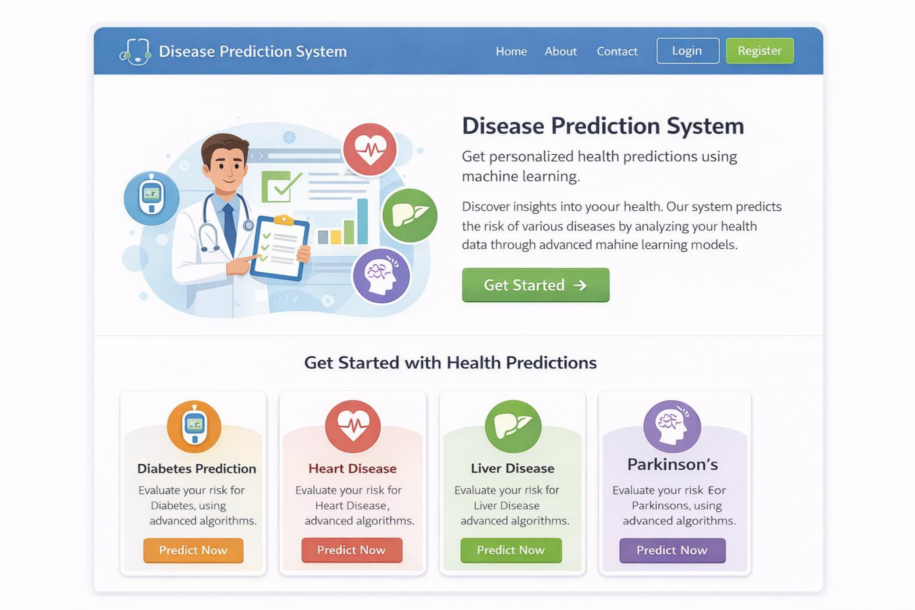
Login and registration buttons

Brief overview of supported diseases

Purpose:

Introduce the system

Guide users toward authentication or exploration



Disease Prediction System

Get personalized health predictions using machine learning.

Discover insights into yoour health. Our system predicts the risk of various diseases by analyzing your health data through advanced mahine learning models.

Get Started with Health Predictions

Diabetes Prediction

Evaluate your risk for Diabetes, using advanced algorithms.

Heart Disease

Evaluate your risk for Heart Disease, advanced algorithms.

Liver Disease

Evaluate your risk for Liver Disease advanced algorithms.

Parkinson's

Evaluate your risk Eor Parkinsons, using advanced algorithms.

3.4.3 User Login Page

Registered users authenticate through this page.

Input Fields:

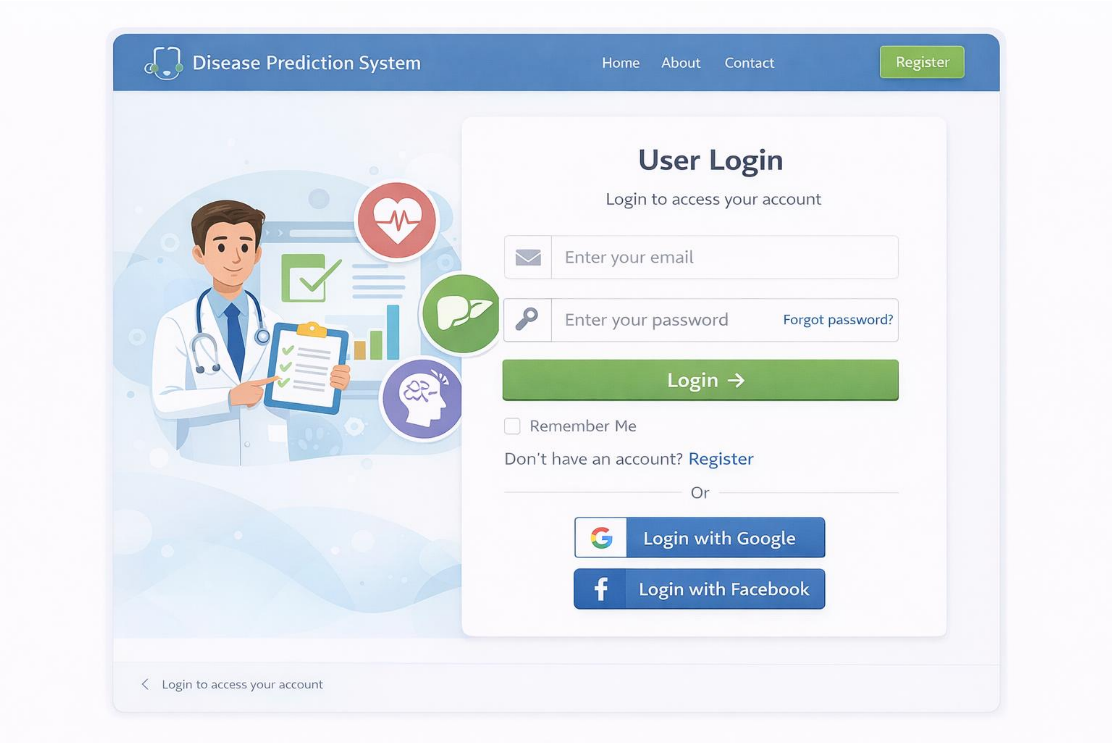
Email

Password

Purpose:

Validate user credentials

Redirect authenticated users to dashboard



Disease Prediction System

User Login

Login to access your account

Enter your email

Enter your password

☐ Remember Me

Don't have an account? Register

Or

Login to access your account

3.4.4 Disease Selection Page

This page allows users to select the disease for prediction.

Features:

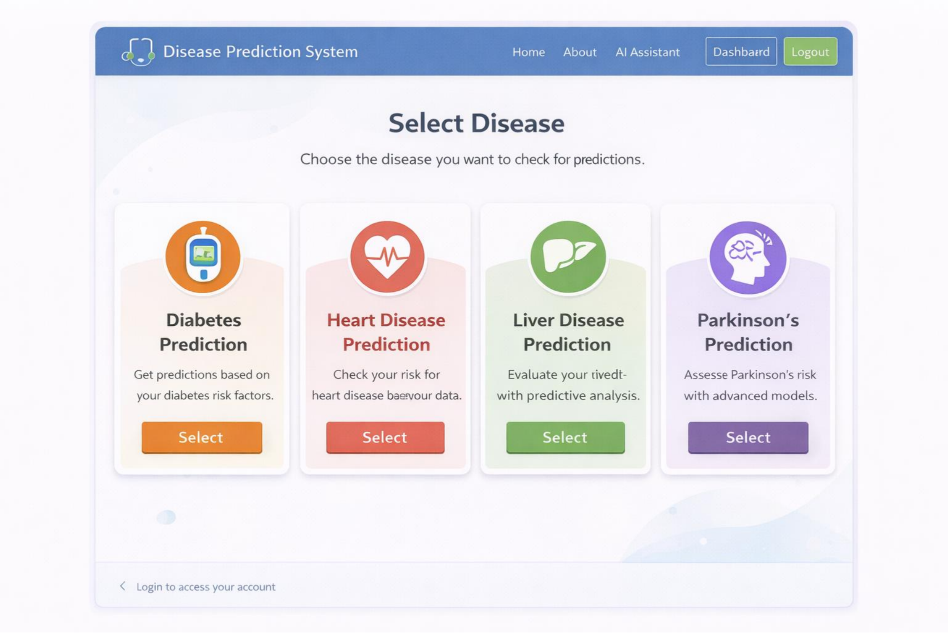
List of available diseases

Brief disease descriptions

Selection buttons

Purpose:

Guide users to appropriate prediction forms



Select Disease

Choose the disease you want to check for predictions.

Diabetes Prediction

Get predictions based on your diabetes risk factors.

Heart Disease Prediction

Check your risk for heart disease baevour data.

Liver Disease Prediction

Evaluate your tivedt- with predictive analysis.

Parkinson's Prediction

Assesse Parkinson's risk with advanced models.

3.4.5 Medical Data Input Form

This page collects disease-specific medical and lifestyle information.

Characteristics:

Clearly labeled input fields

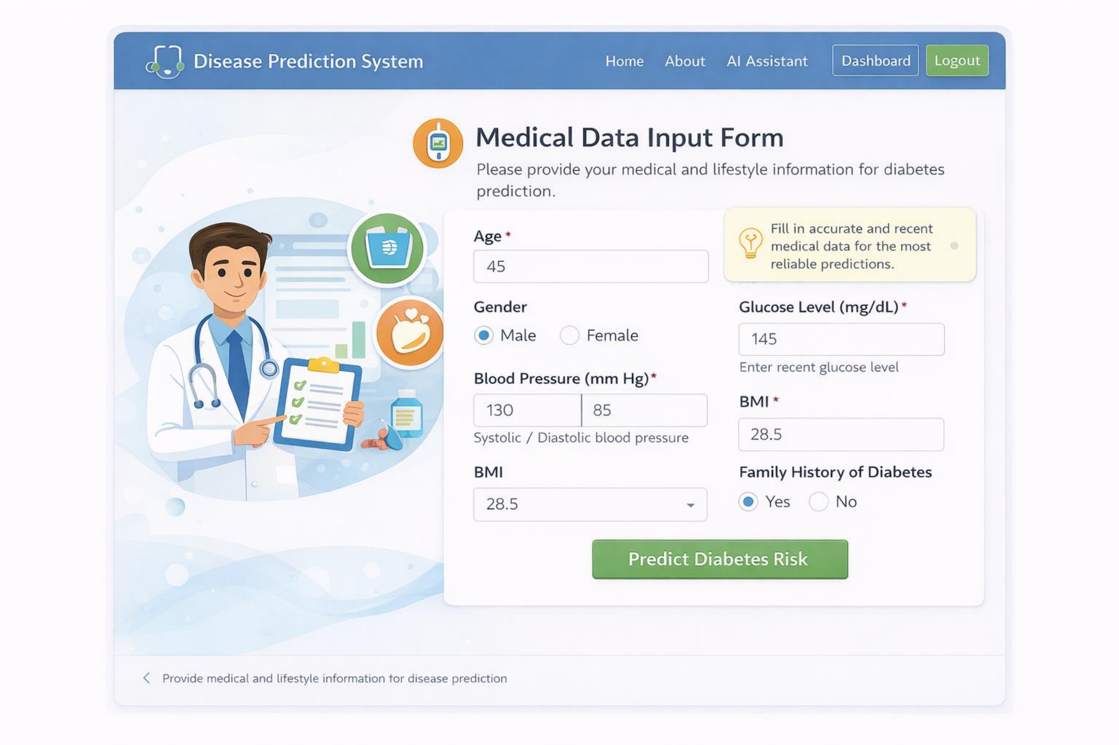
Numeric and categorical inputs

Validation messages

Purpose:

Gather accurate data for prediction

Reduce user input errors



Medical Data Input Form

Please provide your medical and lifestyle information for diabetes prediction.

Fill in accurate and recent medical data for the most reliable predictions.

Age * 45

Gender ● Male ○ Female

Glucose Level (mg/dL) * 145

Enter recent glucose level

Blood Pressure (mm Hg)* 130 85

Systolic / Diastolic blood pressure

BMI * 28.5

BMI 28.5

Family History of Diabetes ● Yes ○ No

Provide medical and lifestyle information for disease prediction

3.4.6 Prediction Result Page

This page displays the prediction outcome.

Displayed Information:

Predicted disease risk

Confidence level

Advisory message (non-diagnostic)

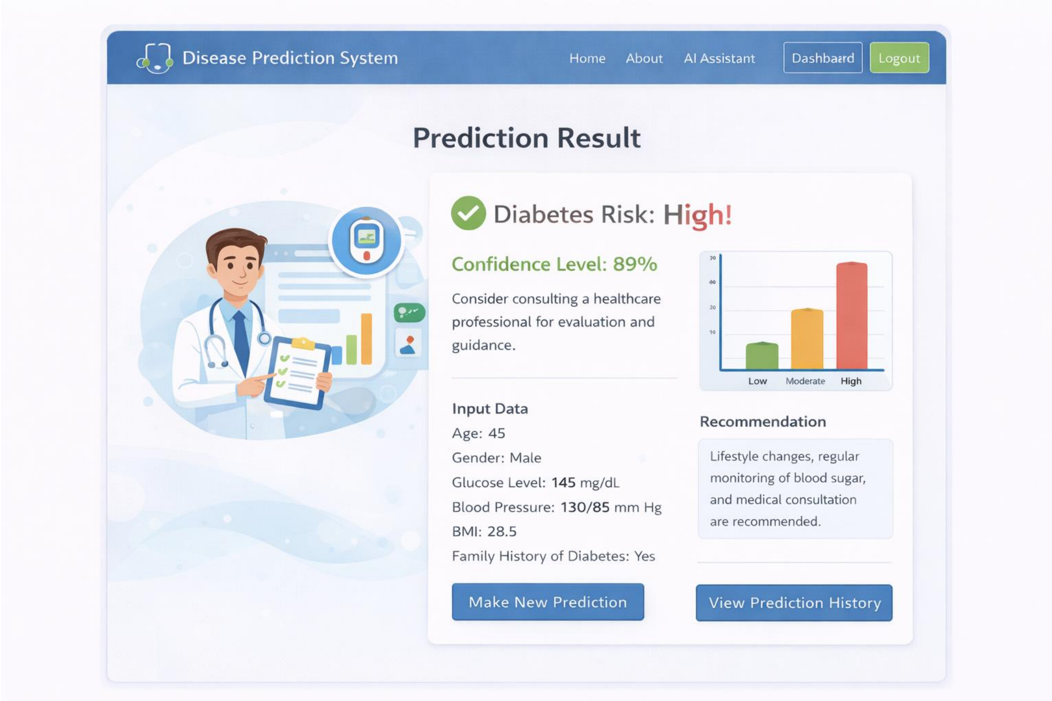
Visualization:

Graphs or charts

Color-coded indicators

Purpose:

Present results clearly and responsibly



Prediction Result

✓ Diabetes Risk: High!

Confidence Level: 89%

Consider consulting a healthcare professional for evaluation and guidance.

Input Data
Age: 45
Gender: Male
Glucose Level: 145 mg/dL
Blood Pressure: 130/85 mm Hg
BMI: 28.5
Family History of Diabetes: Yes

Recommendation

Lifestyle changes, regular monitoring of blood sugar, and medical consultation are recommended.

3.10 Conclusion

The User Interface design of the Disease Prediction System prioritizes usability, clarity, and accessibility. By providing intuitive navigation, clear input forms, and meaningful visual feedback, the interface enhances user experience while supporting responsible health awareness. This design ensures that users can interact with the system efficiently and confidently.