Project Report: Chronic Kidney Disease Detection Using Machine Learning

Project Description

Title: Chronic Kidney Disease Detection Using Machine Learning

Objective: The primary objective of this project is to develop a machine learning-based system for the early detection and prediction of Chronic Kidney Disease (CKD). By leveraging data from patient records, the system aims to provide an accurate diagnosis that can assist healthcare professionals in making informed decisions.

Project Idea and Community Impact

Project Idea: Chronic Kidney Disease (CKD) is a significant health concern that often goes undiagnosed until it reaches an advanced stage. This project uses machine learning techniques to analyze patient data and predict the likelihood of CKD, thus facilitating early detection and treatment. By integrating this system into a user-friendly web interface, healthcare providers can quickly and accurately assess patients' kidney health.

Community Impact: In Somalia, where healthcare resources are limited, particularly in rural areas, this project can have a profound impact by:

- Enabling early detection and treatment of CKD, potentially reducing morbidity and mortality rates.
- Reducing the burden on healthcare facilities by enabling remote diagnosis and monitoring.
- Empowering healthcare providers with data-driven tools to improve patient care and outcomes.
- Raising awareness about CKD and encouraging regular health screenings.

Project Purpose

The purpose of this project is to:

- Develop a machine learning model that can predict CKD based on patient data.
- Create a user-friendly web application that integrates this model for use by healthcare providers.
- Enhance the capacity of the Somali healthcare system to diagnose and treat CKD effectively.

How the Project Works

The project consists of two main components: a machine learning model and a web application.

Machine Learning Model:

- **Data Source:** The model uses a dataset obtained from Kaggle, which includes patient information and medical records.
- **Algorithm:** A Random Forest Classifier is used to predict CKD. This model has been chosen for its accuracy and ability to handle complex datasets.
- **Training and Testing:** The dataset is split into training and testing sets to evaluate the model's performance. Key metrics such as accuracy, precision, recall, and F1 score are used to measure its effectiveness.

Web Application:

- **Framework:** The application is built using PHP for the front end and Flask for the back end. The Flask API handles predictions using the trained machine learning model.
- **Functionality:** Users can register, log in, add and manage patient information, and view CKD prediction results.
- **Deployment:** The application is deployed on a subdomain (http://cdk.great-site.net), making it accessible to healthcare providers.

Significance to the Community

The project offers several benefits to the Somali community:

- **Early Detection:** By identifying CKD in its early stages, patients can receive timely treatment, potentially slowing the progression of the disease.
- **Accessibility:** The web application is accessible from any device with an internet connection, making it usable in both urban and rural areas.
- **Efficiency:** Automating the diagnosis process saves time for healthcare providers, allowing them to focus on patient care.
- **Education:** The project raises awareness about CKD, encouraging regular check-ups and preventive measures.

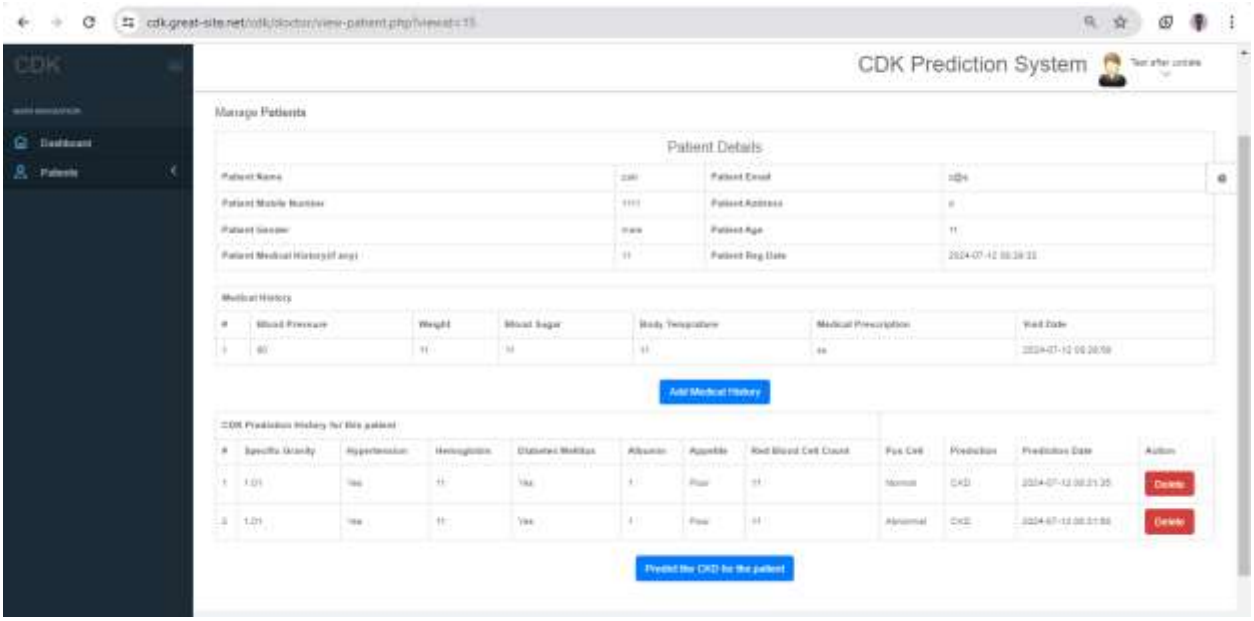
Use Cases

1. **Hospitals:** Utilize the system for early detection and continuous monitoring of CKD in patients.
2. **Clinics:** Implement the tool for quick and reliable CKD screening during outpatient visits.
3. **Pharmacies:** Assist pharmacists in understanding patients' conditions to provide better medication management.
4. **Doctors:** Provide nephrologists and general practitioners with a decision support tool to enhance diagnosis accuracy.

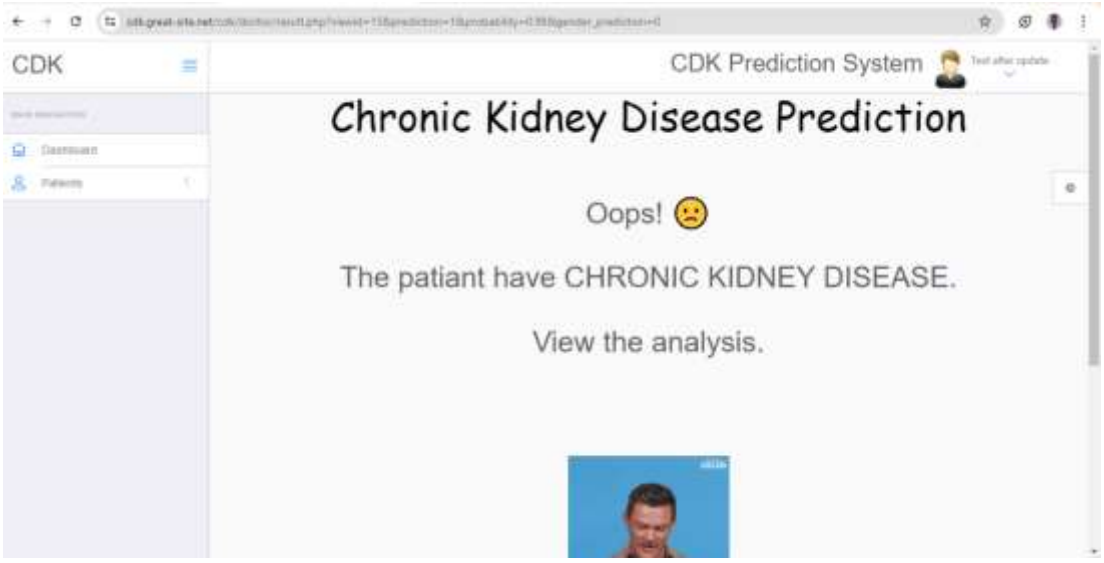
Pages Descriptions, Navigations, and Significance

1. **Index Page (Landing Page):**
    - **Description:** Introduction to the project with sections explaining its purpose, features, and benefits.
    - **Navigations:** Links to Registration and Login pages.
    - **Significance:** Educates visitors about CKD and the system, encouraging them to use the tool.
2. **Registration Page:**
    - **Description:** Allows new users to create an account.
    - **Input Fields:** Name, email, password, user type (Doctor, Hospital, etc.).
    - **Navigations:** Link to the Login page.
    - **Significance:** Ensures that only authorized users access the system, improving data security.
3. **Login Page:**
    - **Description:** Authenticates existing users.
    - **Input Fields:** Email, password.
    - **Navigations:** Links to Dashboard, Forgot Password, and Registration pages.
    - **Significance:** Provides secure access to user-specific data and functionalities.
4. **Dashboard Page:**
    - **Description:** User's main workspace after logging in.
    - **Features:** Profile management, Patient management.
    - **Navigations:** Links to Update Profile, Change Password, Add Patient, Manage Patients.
    - **Significance:** Central hub for managing user and patient information.
5. **Add Patient Page:**
    - **Description:** Form to enroll new patients.
    - **Input Fields:** Patient name, age, gender, medical history, etc.
    - **Significance:** Simplifies patient onboarding and ensures complete data collection.
6. **Manage Patients Page:**
    - **Description:** Displays a table of all patients with actions to edit, delete, or view detailed information.
    - **Significance:** Facilitates efficient patient data management.

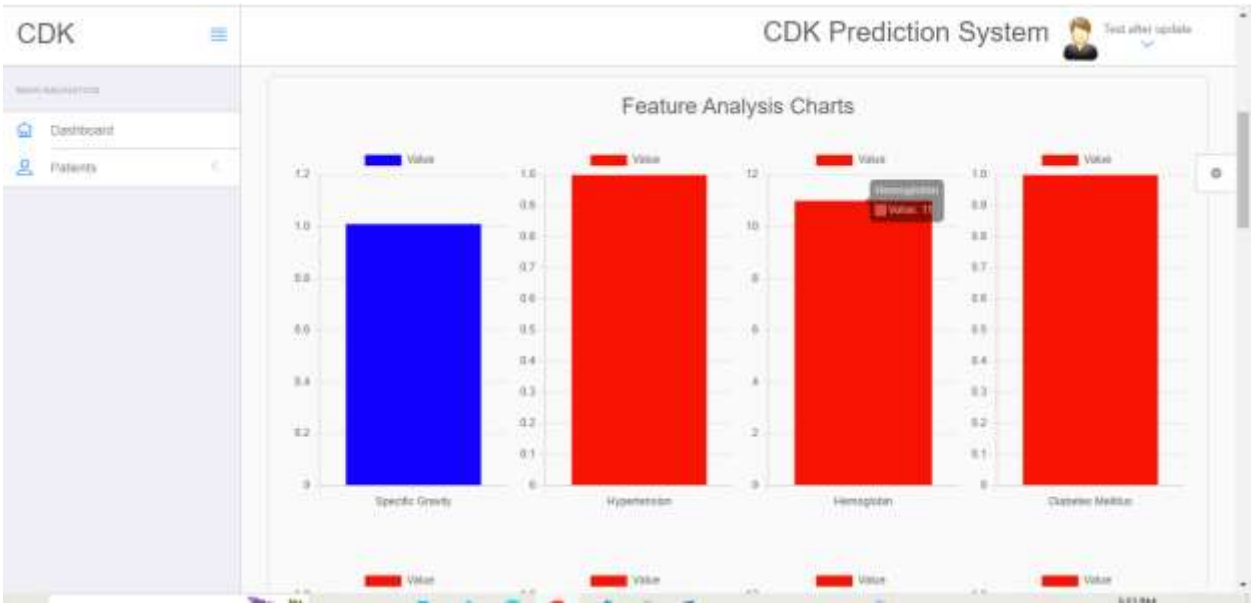
7. **View Patient Page:**
    - **Sections:**
        - **Patient Info:** Basic patient details.
        - **Medical History:** Records of past medical data.
        - **CKD Prediction History:** Displays past CKD predictions and allows new predictions.
    - **Significance:** Core feature for tracking and predicting CKD, providing comprehensive patient insights.

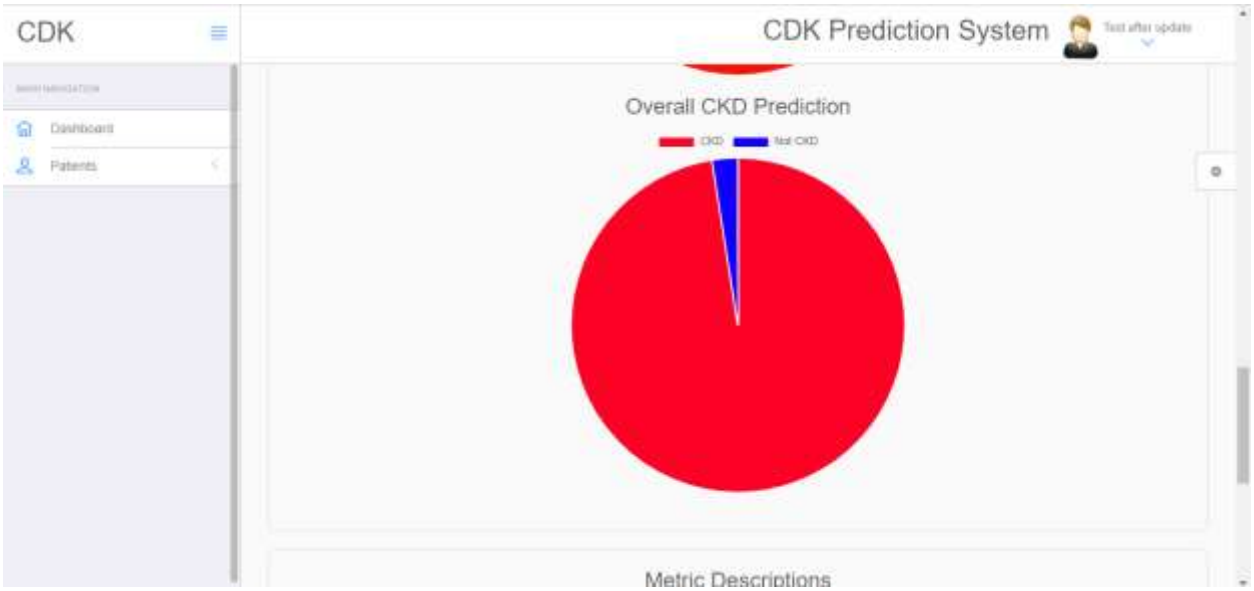


8. **Result Page:**
    - Shows the result of the prediction



9. **Analysis Page:**
    - **Description:** Detailed analysis of CKD predictions with visual charts.
    - **Significance:** Helps in understanding the prediction data and making informed medical decisions.





How Users Can Access and Use the System

1. **Accessing the System:**
    - **URL:** Users can access the system via the provided subdomain URL (http://cdk.great-site.net).
    - **Registration/Login:** New users must register, and existing users can log in.
2. **Using the System:**
    - **Registration/Login:** Fill out the registration form with the required details and select the user type. For login, enter the email and password.
    - **Dashboard Navigation:** Use the sidebar to navigate to different pages like Add Patient, Manage Patients, and View Patient.
    - **Adding Patients:** Enter the patient details in the provided form and submit.
    - **Managing Patients:** Use the actions in the Manage Patients table to edit, delete, or view detailed patient information.
    - **Predicting CKD:** On the View Patient page, fill out the CKD prediction form and submit to get the results.
    - **Analysis:** Navigate to the Analysis page to view detailed charts and insights about the CKD predictions.

Conclusion

The "Chronic Kidney Disease Detection Using Machine Learning" project stands to make a significant impact on the healthcare landscape in Somalia. By providing a robust, accessible tool for early detection of CKD, it empowers healthcare providers and patients alike, contributing to better health outcomes and a stronger healthcare system.