Project Report

Early Detection of Chronic Kidney Disease Using Machine Learning

Team ID: PNT2022TMID08664

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Project Report

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1. INTRODUCTION

1.1 Project Overview

Chronic kidney disease, also called chronic kidney failure, involves a gradual loss of kidney function. Advanced chronic kidney disease can cause dangerous levels of fluid, electrolytes and wastes to build up in your body. Chronic Kidney Disease is one of the most critical illness nowadays and proper diagnosis is required as soon as possible. Machine learning technique has become reliable for medical treatment. So using this machine learning algorithms and strategies we should detect whether the person has a chronic kidney disease or not.

1.2 Purpose

The purpose of early detection are to prevent the progression of chronic kidney disease and its associated complications, with subsequent improvements in patient outcomes and reductions in the impact of chronic kidney disease on healthcare resources.

2. LITERATURE SURVEY

2.1 Existing problem

End-stage kidney disease (ESKD) is the last stage of long-term (chronic) kidney disease. This is when your kidneys can no longer support your body's needs. Kidney disease also increases the risk of having heart and blood vessel disease. These problems may happen slowly over a long time. Early detection and treatment can often keep chronic kidney disease from getting worse. When kidney disease progresses, it may eventually lead to kidney failure, which requires dialysis or a kidney transplant to maintain life. Earlier ckd detection could improve patient outcomes and delay the need for dialysis . Potentially reducing the cost. This is made possible by this application. This application aim at saving people from the severe symptoms of CKD by detecting CKD at earlier stages.

2.2 References

1. A Deep Neural Network for Early Detection and Prediction of Chronic Kidney Disease[Vijendra Singh, Vijayan K Asari and Rajkumar Rajasekaran].

2. Detection of Chronic Kidney Disease using Machine Learning Algorithms with Least Number of Predictors[Marwa Almasound,Tomas E Ward],Information System Department | College of Computer and Information Science |(IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 10, No. 8, 2019.

3. A Literature Review on Kidney Disease Prediction using Data Mining Classification Technique[Suman Bala, Krishan Kumar], Department of Computer Science& Engineering, JNTU Hyderabad, India | IJCSMC, Vol. 3, Issue. 7, July 2014.

4. A Hybrid Parallel Classification Model for the Diagnosis of Chronic Kidney Disease [Vijendra Singh, Divya Jain] , School of Computer Science, University of Petroleum and Energy Studies, Dehradun|Computer Science and Engineering, The NorthCap University, Gurugram.

5. Development of a Graphical User Interface Software for The Prediction of Chronic Kidney Disease[S.C. Nwaneri1, H.C. Ugo],Nigerian Journal of Technology (NIJOTECH) Vol. 41, No. 1, January, 2022.

6. Analysis and Prediction of Chronic Kidney Disease using Machine Learning Classification approaches [Abhimanyu Agarwala , Asfar Sharief,Faaiz Ahmed] ,Department of Computer science and Engineering CMR Institute of Technology,Bangalore-37.

7. Data Mining Performance in Identifying the Risk Factors of Early Arteriovenous Fistula Failure in Haemodialysis Patients[Morteza Khavanin Zadeh; Mohammad Rezapour; Mohammad Mehdi Sepehri], Volume 2, Issue 1, March 2013.

2.3 Problem Statement Definition

Chronic kidney disease (CKD) is increasingly recognized as a global public health problem. There is now convincing evidence that CKD can be detected using simple laboratory tests, and that treatment can prevent or delay complications of decreased kidney function, slow the progression of kidney disease, and reduce the risk of cardiovascular disease (CVD). Translating these advances to simple and applicable public health measures must be adopted as a goal worldwide. Understanding the relationship between CKD and other chronic diseases is important to developing a public health policyto improve outcomes.So taking all these into account we are creating a chronic kidney disease detector which is very user friendly and easy to be used by everyone.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes.

It is a useful tool to helps teams better understand their users.

Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.

Early Detection of Chronic Kidney Disease using Machine Learning

What do they THINK AND FEEL?
what really counts
major preoccupations
worries & aspirations

- How much fast does it shows the prediction?
- Is the system user friendly?
- Does the system shows values and annuals results?
- If it is an prediction for medical professionals
- Is this like a regular test?
- Can it be trusted?

What do they HEAR?
what friends say
what boss say
what influencers say

- Consult best Nephrologist
- Reduce the intake of potassium foods
- Helps to predict outcomes
- Don't get stressed by the process

What do they SEE?
environment
friends
what the market offers

- Machine Learning model incorporate risk factors
- Visiting the best centre for medication
- Life Threatening disease
- Fluid Retention

What do they SAY AND DO?
attitude in public
appearance
behaviour towards others

- Can you help me?
- Everything will be fine one day
- Be strong to face the challenges
- Optimistic and perseverant
- Expressing self improvement through positive behaviour
- Ask how to overcome the pain and challenges

PAIN
fears
frustrations
obstacles

- Dealing with loneliness and fear of death
- Insecurity
- Ambiguity in results
- Delay in reports

GAIN
"wants" / needs
measures of success
obstacles

- Reduces the risk factor of a disease due to early prediction
- Create awareness about the chronic real challenges
- Limiting the bias tendency
- Self-control and self-esteem

3.2 Ideation & Brainstorming

Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

- 10 minutes to prepare
- 1 hour to collaborate
- 2-8 people recommended

Title:Early Detection of Chronic Kidney Disease using Machine Learning

Team ID:PNT2022TMID08664

Share template feedback

Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

⏱ 10 minutes

A — Team gathering
Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

B — Set the goal
Think about the problem you'll be focusing on solving in the brainstorming session.

C — Learn how to use the facilitation tools
Use the Facilitation Superpowers to run a happy and productive session.

Open article →

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1 Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

⏱ 5 minutes

> PROBLEM
> How might we construct a model to predict whether the patient is likely to have disease or not?

Key rules of brainstorming
To run a smooth and productive session

- Stay in topic.
- Encourage wild ideas.
- Defer judgment.
- Listen to others.
- Go for volume.
- If possible, be visual.

2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

🕐 **10 minutes**

Santhosh Kumar

Identify the most common cause of kidney disease	Collection of proper data related data	Collecting the past records and family records of an patient
Investigating the major contributor to the disease	Developing user friendly user interface to enter informations	Developing the model that helps predicties and lower the risks

Nimalan

Checking the scope of the model	Continuing education programmes by controlling awareness about disease	Displaying the treatment by the screen about the risks that adverts the issue
Presence of healthcare kidney disease patients for hospital and testing	Providing proper essential medicines and drugs which in services can prevent CKD	Delivering the user interface in multi-compatible

Gowtham

Conservative treatment strategies	Suggesting best diet and exercise plans for kidney disease patients	Discover the trends and patterns in a dataset
Maintaining the integrity of data	Checking the stage of kidney disease in a patient	Building a virtual model of the patient connection along with the relationships

Nishanth Bhoopathy

Asking the facility to remind future treatments like dialysis	Explore different algorithms for model creation	Check whether the model will run for long run
Choose the model which yields best accuracy	Getting rid of high-error susceptability	Setting threshold values

3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

⏱ 20 minutes

Identification

Collection and Maintaineance

Sugessting strategies and awareness

Model Process

Validation and Scope

Important Features Associated

Facilities

Testimonial

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

⏱ 20 minutes

Importance

If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?

TIP

Participants can use their cursors to point at where sticky notes should go on the grid. The facilitator can confirm the spot by using the laser pointer holding the H key on the keyboard.

Feasibility

Regardless of their importance, which tasks are more feasible than others? (Cost, time, effort, complexity, etc.)

→

After you collaborate

You can export the mural as an image or pdf to share with members of your company who might find it helpful.

Quick add-ons

A   **Share the mural**
Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session

B   **Export the mural**
Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save in your drive.

Keep moving forward

Strategy blueprint
Define the components of a new idea or strategy.
Open the template →

Customer experience journey map
Understand customer needs, motivations, and obstacles for an experience
Open the template →

Strengths, weaknesses, opportunities & threats
Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.
Open the template →

🗐 Share template feedback

3.3 Proposed Solution

S. No	Parameter	Description
1.	Problem statement	Chronic Kidney Disease is an asymptomatic in its early stages and cannot be noticeable until the condition is advanced. Early prediction can lower the risk factor and prevent the loss of life. To solve this problem, we develop a proposed and effective system by gathering the data and train the model using different machine learning algorithms to predict at the earliest.
2.	Idea / Solution description	Dataset is gathered consisting of user's information. It is then moved to stages like pre-processing, constructing a model and training the data and testing it. Evaluation is done on it to choose the best algorithm which yields maximum accuracy. The final output allows to check whether the user has chronic kidney disease or not.

3.	Novelty / Uniqueness	The suggested solution uses ensemble techniques for analysis and can avoid bias or variance in the model. It is accomplished to downstage (increase the percentage of CKD recognised at an early stage). Traditional testing takes more time to detect the disease. With the model developed here, it will be easier to understand the analysis done at the background.
4.	Social Impact/Customer Satisfaction	The propose help the user to safely enter the medical data without any fear of them. The final system helps to reduce the anxiety and can further improves the users to be aware of the disease. Following the prediction, users will be able to take doctor's advice and prescription.
5.	Business Model (Revenue Model)	Make money from direct users and can work with the healthcare industry to make money from their users.
6.	Scalability	The proposed system is scalable because as the number of features get added and number of users also get increased, it can predict efficiently.

3.4 Problem Solution fit

Project Title: **Early Detection of Chronic Kidney Disease using Machine Learning**   Team ID: **PNT2022TMID08664**

1. CUSTOMER SEGMENTS CS

- Diabetic Patients.
- Person who has issues related to kidney disease.
- Medical Professionals.

6. CUSTOMER CONSTRAINTS CC

- Not getting 100% accuracy which creates fear or agitation.
- Lack of awareness of how to use the technologies.
- Network connectivity.
- Delay in getting results.

5. AVAILABLE SOLUTIONS AS

- Avoid products with added salt. Lower the amount of sodium intake in the foods.
- Control the blood pressure level.
- Adapt to new lifestyle.

2. JOBS-TO-BE-DONE / PROBLEMS J&P

- Creation of simple user interface for the customers.
- Provide a virtual room to allow patients communicate with the medical professionals.
- Ensuring the website is responsive in the long run.

9. PROBLEM ROOT CAUSE RC

- Diabetes and High Blood pressure are the main cause of chronic kidney disease.
- Being lethargic to take regular checkup on their health.

7. BEHAVIOUR BE

- The proposed final system will take test results as the parameters (or) features for prediction. It is then trained using machine learning algorithms which predicts whether the patient has disease or not.
- Easier and faster access of system.

3. TRIGGERS TR

- Some people will experience nausea, vomiting, loss of appetite, fatigue and decreased mental sharpness. This insists them to go to hospital.
- Prolonged back pain and itchy skin.

4. EMOTIONS: BEFORE / AFTER EM

- Before : Anxiety, Depressed, Frustration
- After : Peace and Self-Awareness

10. OUR SOLUTION SL

- Identify chronic kidney disease using machine learning techniques which would help in facilitating the whole process than taking manual tests. The cost of the treatment would be reduced and also prevent the loss of life.
- Ensuring the true rate of prediction.
- Providing preventive measures for those who are prone to kidney disease.

8. CHANNELS of BEHAVIOUR CH

8.1 ONLINE

- Patients providing appropriate test results to be entered in the web application.

8.2 OFFLINE

- Patients visit the laboratories where their details would be entered in the web application to display the accurate results of prediction.

Define CS, fit into CC · Explore AS, differentiate · Focus on J&P, tap into BE, understand RC · Identify Strong TR & EM

4. REQUIREMENT ANALYSIS

4.1 Functional requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	**User Registration**	Registration through Gmail
FR-2	**User Confirmation**	Confirmation via Email
FR-3	**User Authentication**	Authentication via Password
FR-4	**User Input**	The test vitals result is entered as input further detects the possibility of patient having disease or not
FR-5	**Data Inputs**	Application allowing the patients/users to enter the data and it detects within a short span of time. Feasible and enhance the trustworthy of patients/user's data
FR-6	**Print Result**	Model after got trained displays whether the patient has chronic kidney disease or not

4.2 Non-functional Requirements:.

NFR No	Non Functional Requirement (Epic)	Sub Requirement (Story/Sub-Task)
NFR-1	**Usability**	The user interface will be developed in a simple and understandable way. Provides proper accuracy
NFR-2	**Security**	Permits the users who has proper identity credentials to access the application
NFR-3	**Reliability**	Accurate and Flawless Information
NFR-4	**Perfomance**	Able to respond within a minute
NFR-5	**Availability**	Free to use and can be accessible at any period of time if the credentials got verified
NFR-6	**Scalability**	Capacity to handle large number of traffic users

5. PROJECT DESIGN

5.1 Data Flow Diagrams

Example: (Simplified)
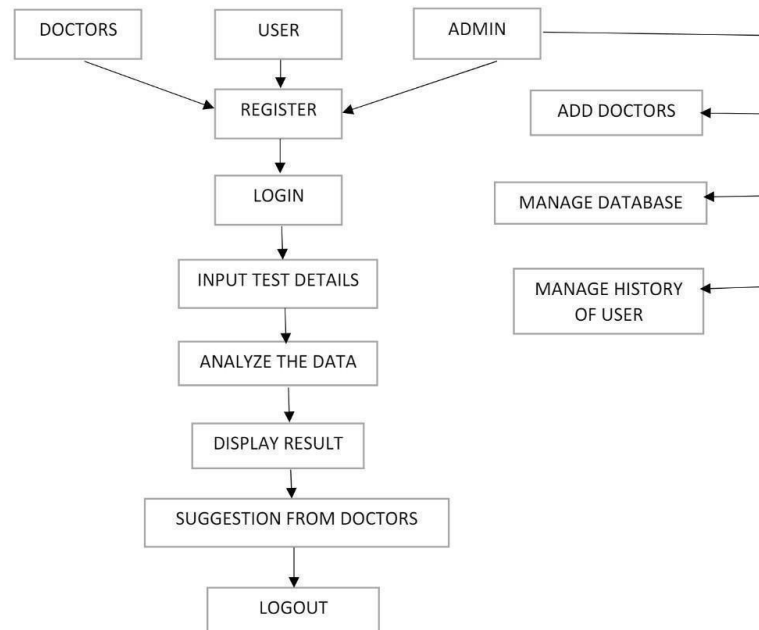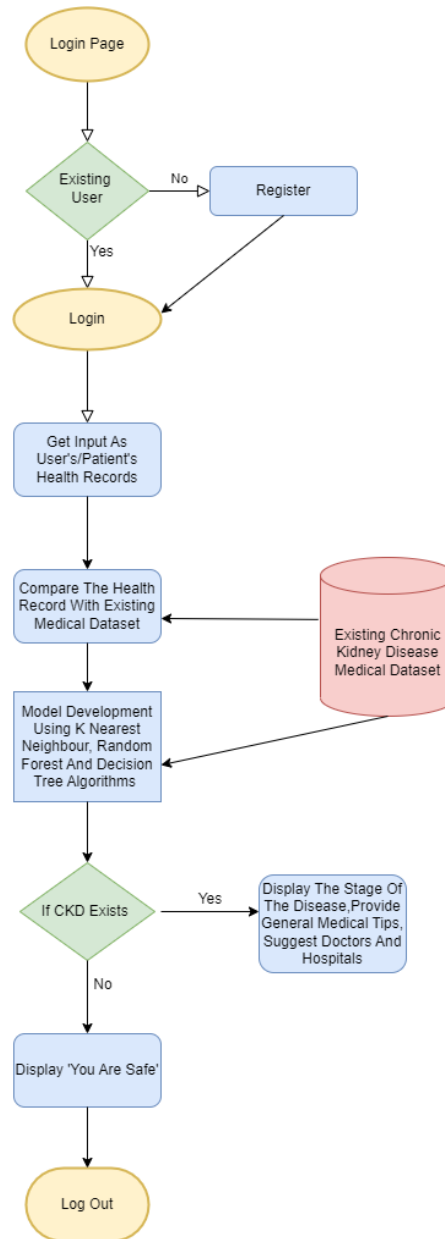
5.2 Solution & Technical Architecture

Technical Architecture:
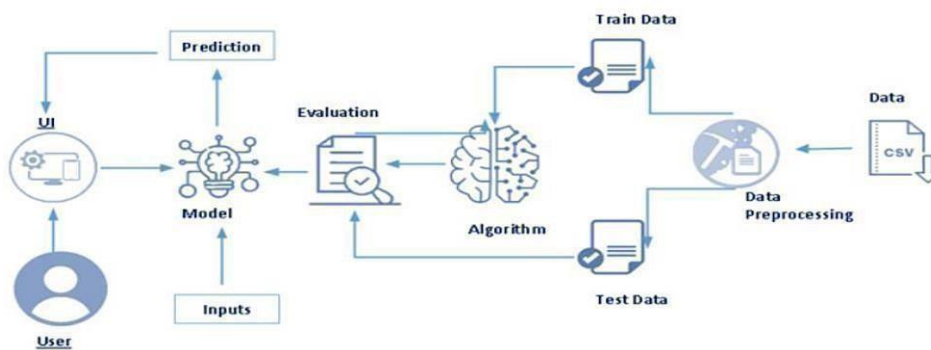
Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	Import Data	Data Import lets you upload data from external sources and combine it with data you collect via Analytics.	HTML, CSS, Javascript
2.	Application Logic-1	Clicking on the register button will direct to registration page where they will enter their details to get registered	HTML, CSS, Flask
3.	Application Logic-2	Clicking on the login button will direct to login page where they can enter the login credentials if registered already	HTML, CSS, Flask
4.	Application Logic-3	After successful login, the form will get the vital details from the user for predicting the disease	HTML, CSS, Flask
5.	Data	Data Type	Comma Separated Values
6.	Cloud Database	Database service on cloud	IBM DB2, IBM Cloudant
7.	File Storage	File Storage Requirements	Local File System
8.	External API 1	Purpose of External API used in the application	NIL
9.	External API 2	Purpose of External API used in the application	NIL
10.	Machine Learning Model	Model is developed to find the patterns or make decisions. It will predict whether the user has disease or not	Supervised Machine Learning Algorithms
11.	Infrastructure (Server / Cloud)	Cloud Deployment	IBM Cloud

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Open-source frameworks used for data preprocessing, application development and deployment	Visual Studio Code, Anaconda Navigator and IBM Cloud etc.
2.	Security Implementations	User profile and test result details will be secured	Encryptions and OWASP
3.	Scalable Architecture	Accurate details will be displayed	Supervised Machine Learning Algorithms such as Random Forest Classifier, K-Nearest Neighbor and Decision Tree etc
4.	Availability	Availability at any cost of time	IBM Load Balancer
5.	Performance	User will be able to know in-depth information about the disease and its severity. Capable of performing faster classification	Supervised Machine Learning Algorithms such as Random Forest Classifier, K-Nearest Neighbor and Decision Tree etc.

5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer(Web User)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account/dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm/verify through OTP	High	Sprint-1
	Login	USN-3	As a user, I can log into the application by entering the email and password	Gain the access to view the dashboard	High	Sprint-1
	Dashboard	USN-4	As a user, I can view the past activities	Access the history of user's activities	Low	Sprint-2
	Input Data	USN-5	User can enter the vital test results as an input to view the output	Giving input in the website	High	Sprint-2
	Report	USN-6	User can able to see the final report generated by the application	Able to view test results after diagnosis	High	Sprint-3
Customer Care Executive	Queries	USN-7	As a customer care executive, I can assist the problem faced by the user through Q/A	Rectifying the user's problem within a short span of time	Medium	Sprint-4
	Clarification	USN-8	User should need clarification on how to use some features in the application	Application gives detailed explanation and provide 24/7 assistance	Medium	Sprint-4
Administrator	Feature Extraction	USN-9	As an administrator, I should find the significant features required to make decision on the dataset	Identify the most important feature	High	Sprint-2
	Model Construction	USN-10	As an administrator, I should identify the best model that can yield maximum accuracy for detection of disease	Training the ML model	High	Sprint-2

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Collection of Dataset	USN-1	I need to collect dataset from IBM resource	3	High	Santhosh Kumar Nishanth Bhoopathy Nimalan Gowtham
Sprint-1	Data Pre-Processing	USN-2	I need to take raw data and transform it into a format that can be understood and analysed by machine learning algorithms	6	High	Santhosh Kumar Nishanth Bhoopathy Nimalan Gowtham
Sprint-2	Exploratory Data Analysis (EDA)	USN-3	I need to do Exploratory Data Analysis to obtain the main characteristics	8	Medium	Santhosh Kumar Nishanth Bhoopathy Nimalan Gowtham
Sprint-2	Model Building	USN-4	I need to explore the type of algorithms which can be used to train and test the model for providing the best accurate results	13	High	Santhosh Kumar Nishanth Bhoopathy Nimalan Gowtham
Sprint-3	UI Designing	USN-5	As a developer, I need to design a simple and understandable UI	3	Medium	Santhosh Kumar Nishanth Bhoopathy Nimalan Gowtham
Sprint-3	UI Integration	USN-7	As a developer, I need to integrate the user interface and the model developed using machine learning algorithms	5	Medium	Santhosh Kumar Nishanth Bhoopathy Nimalan Gowtham
Sprint-4	Dashboard	USN-8	As a user, I will be able to enter my test results as input which will be used for prediction	5	High	Santhosh Kumar Nishanth Bhoopathy Nimalan Gowtham
Sprint-4	Result	USN-9	As a user, I will receive whether chronic kidney disease is there or not	5	High	Santhosh Kumar Nishanth Bhoopathy Nimalan Gowtham

6.2 Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	9	6 Days	24 Oct 2022	29 Oct 2022	9	31 Oct 2022
Sprint-2	21	6 Days	31 Oct 2022	05 Nov 2022	21	05 Nov 2022
Sprint-3	8	6 Days	07 Nov 2022	12 Nov 2022	8	12 Nov 2022
Sprint-4	10	6 Days	14 Nov 2022	19 Nov 2022	10	19 Nov 2022

6.3 Reports from JIRA

Sprint 1

Roadmap Chart
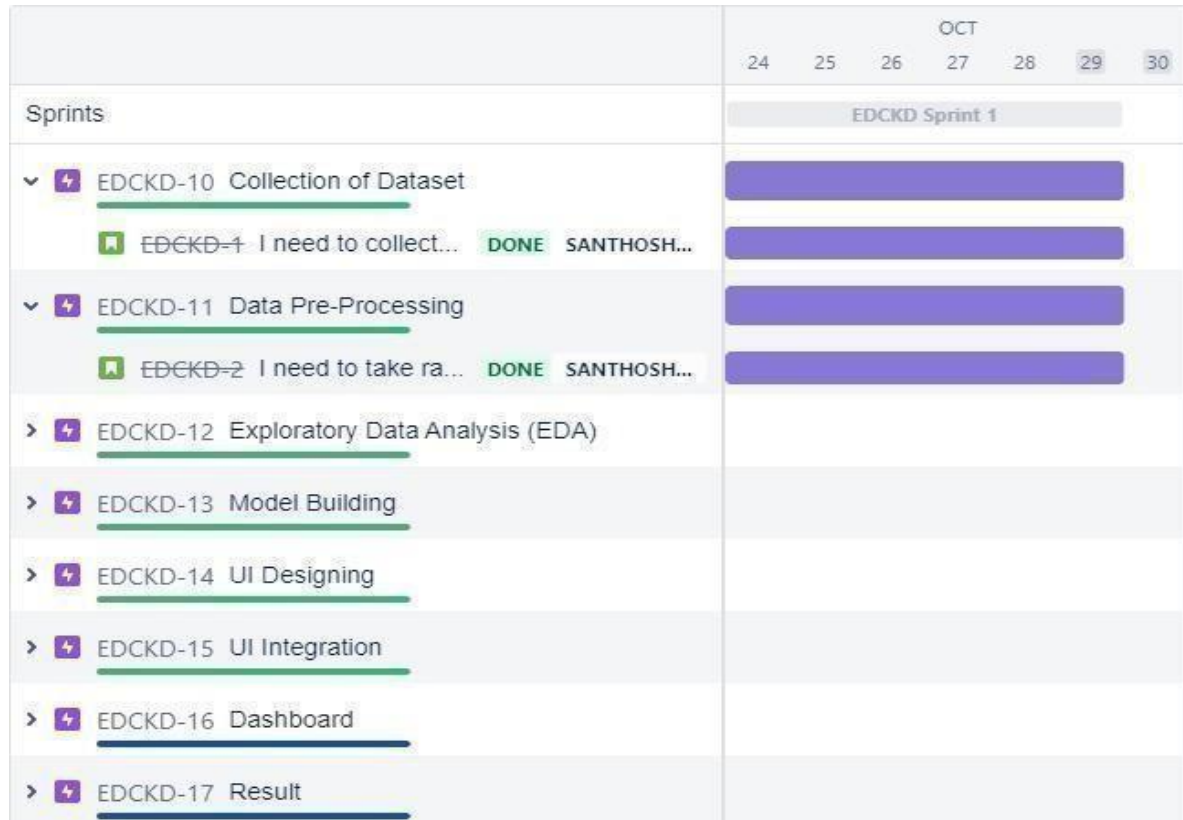
Burndown Chart
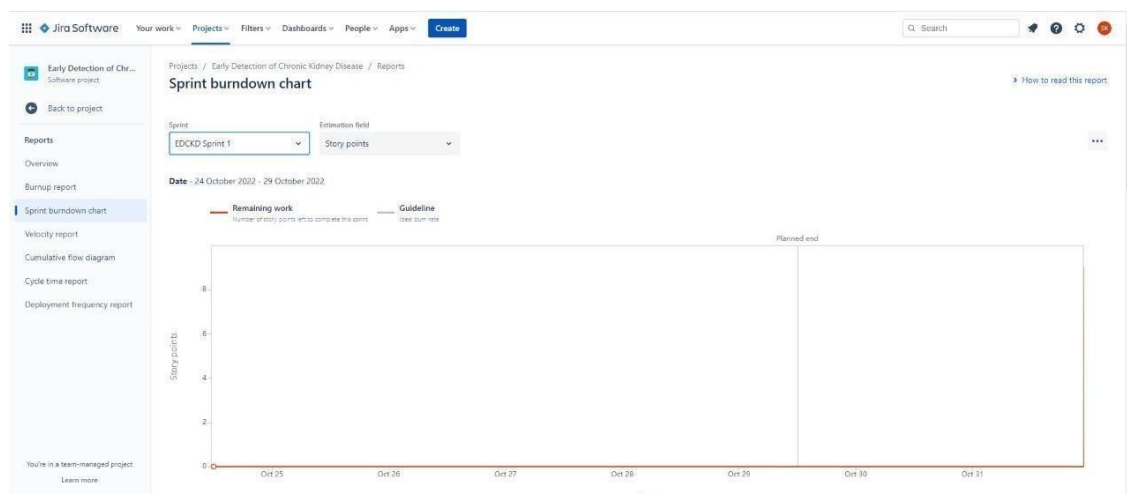
Sprint 2

Roadmap Chart
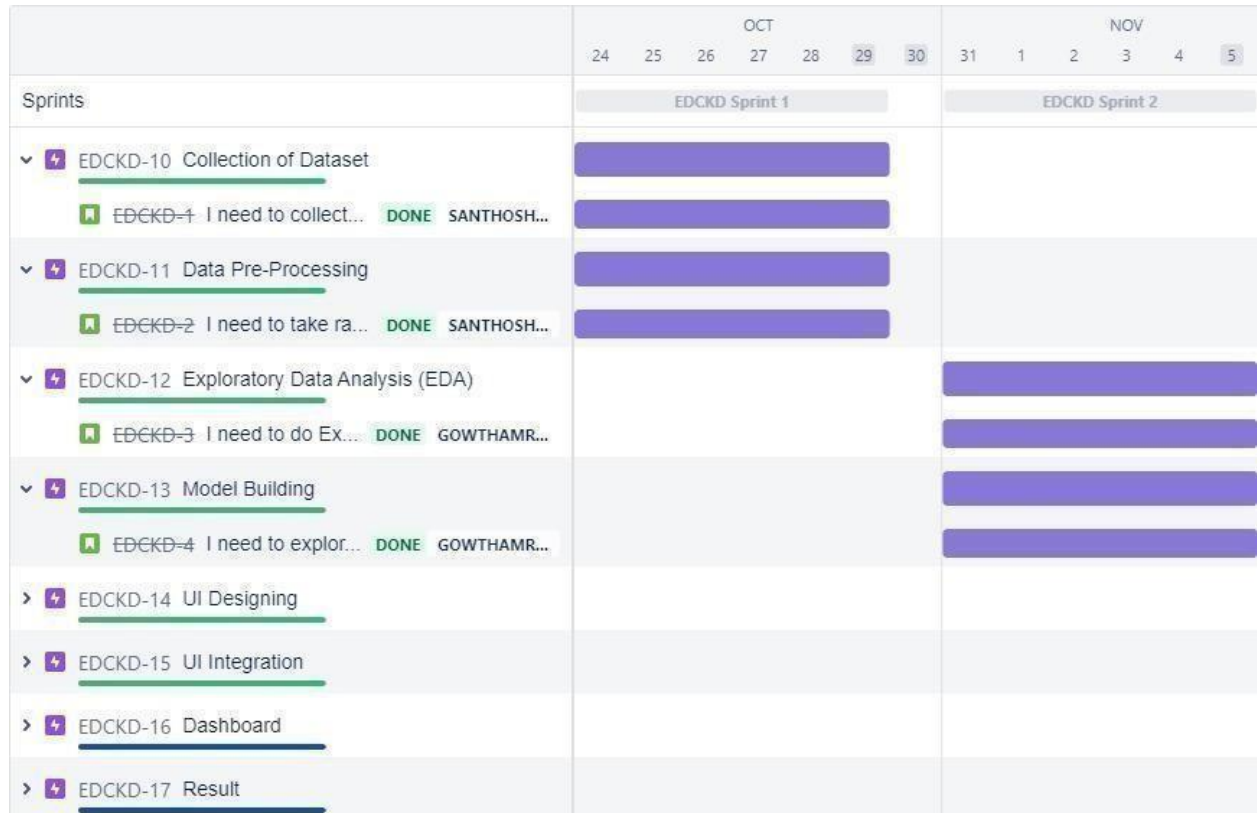
Burndown Chart
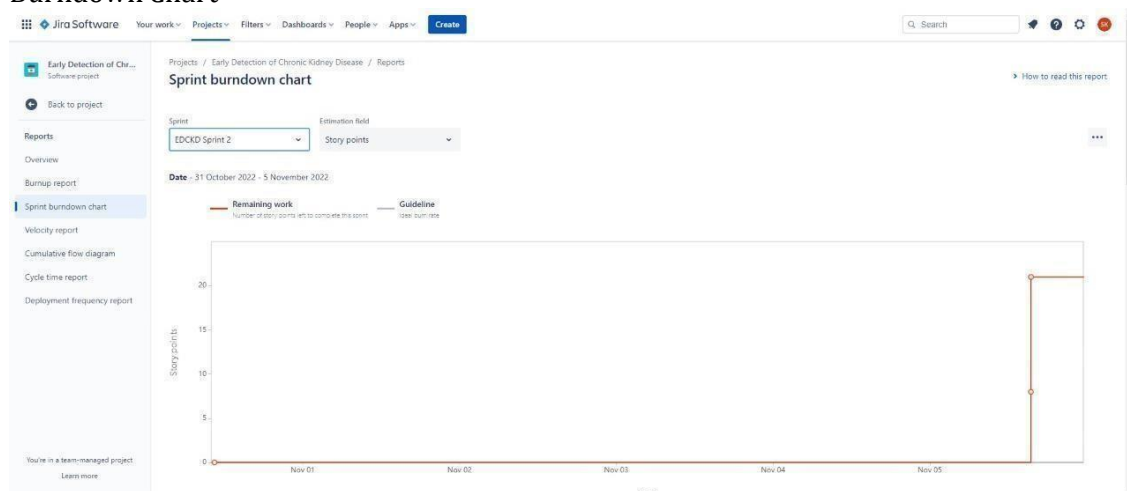
Sprint 3

Roadmap Chart
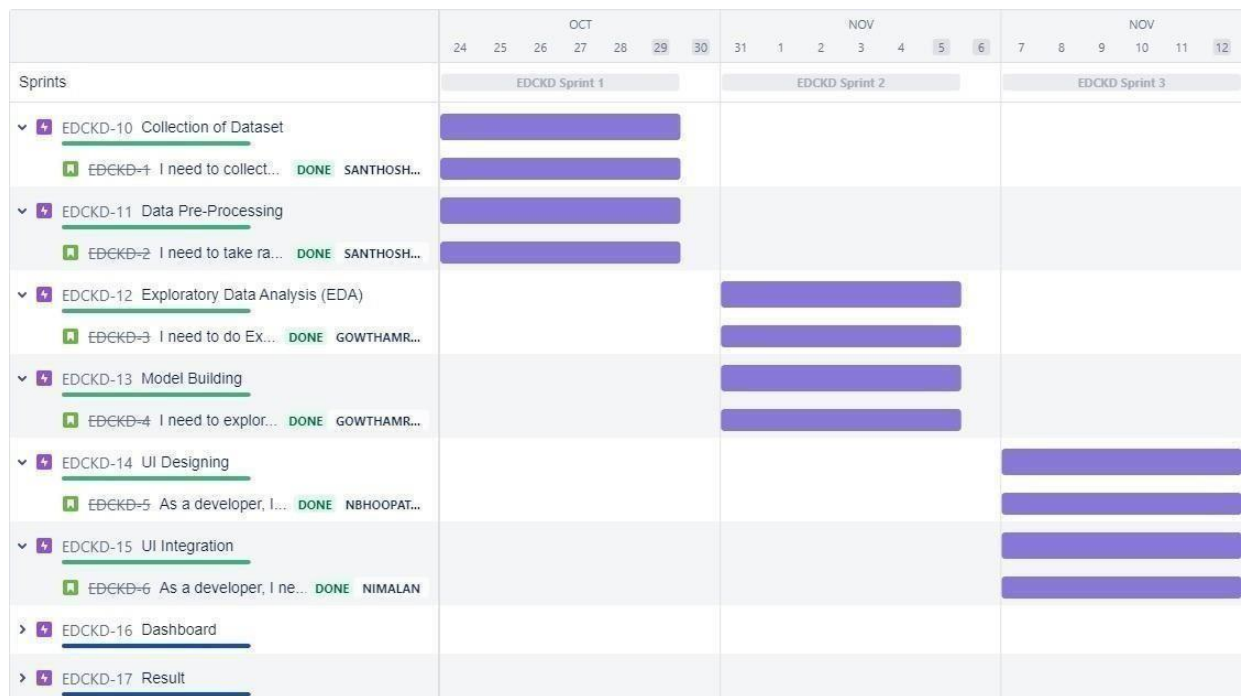
Burndown Chart
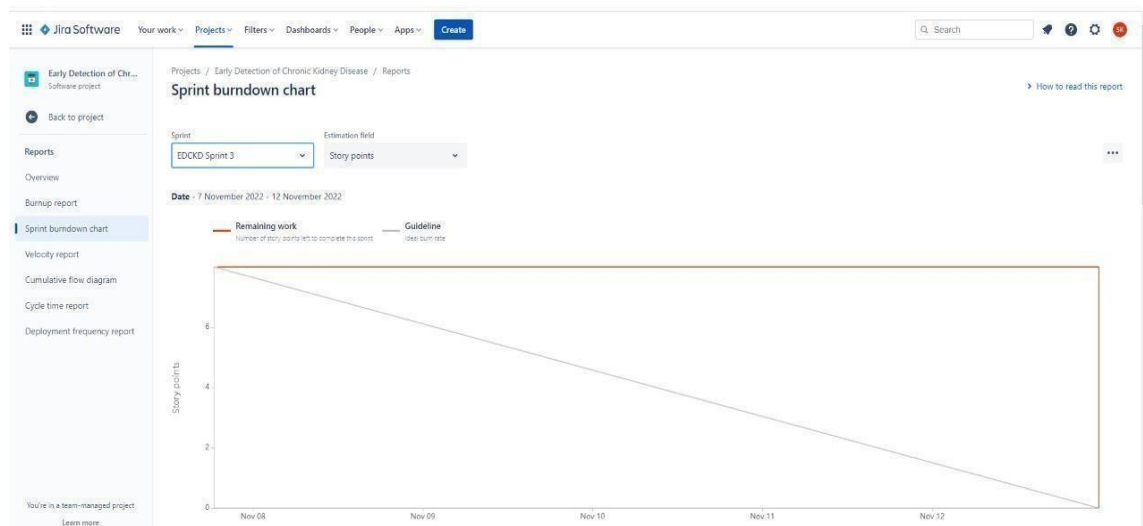
Sprint 4

Roadmap Chart
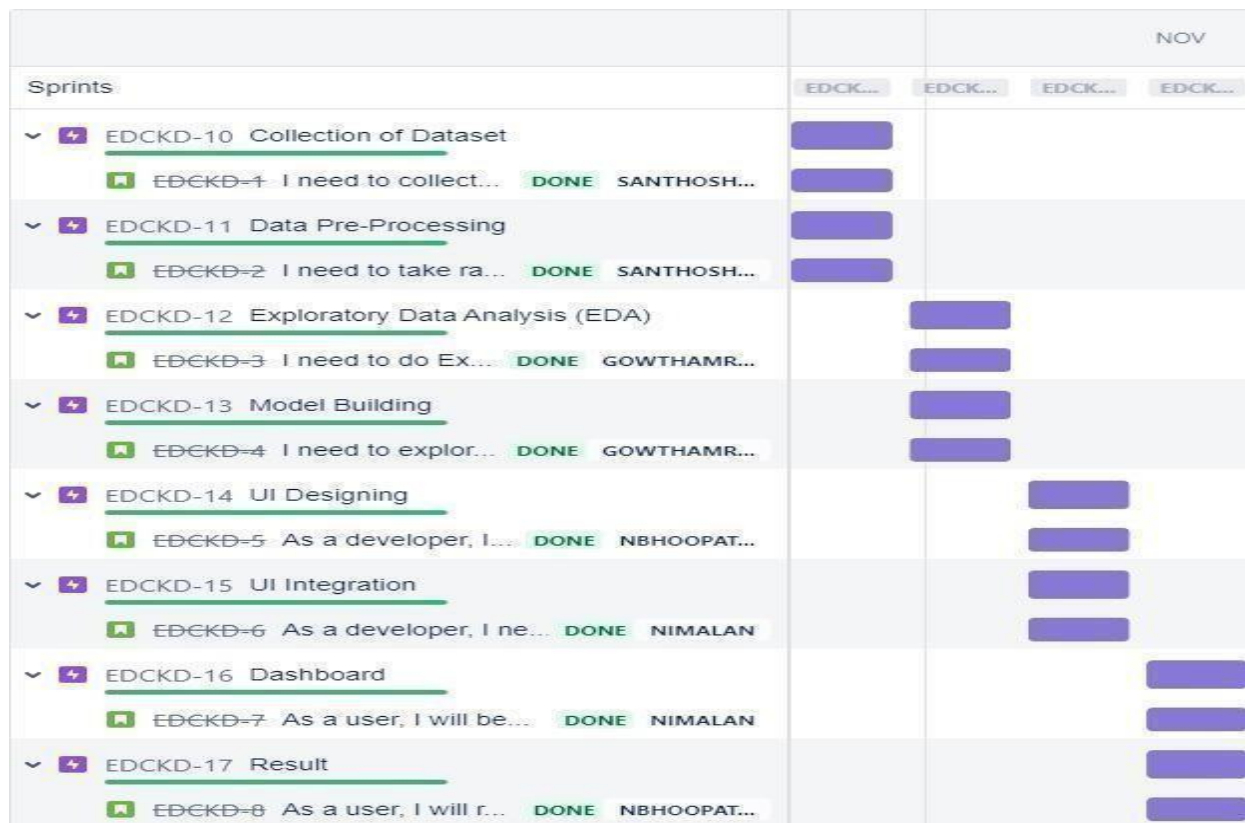
Burndown Chart
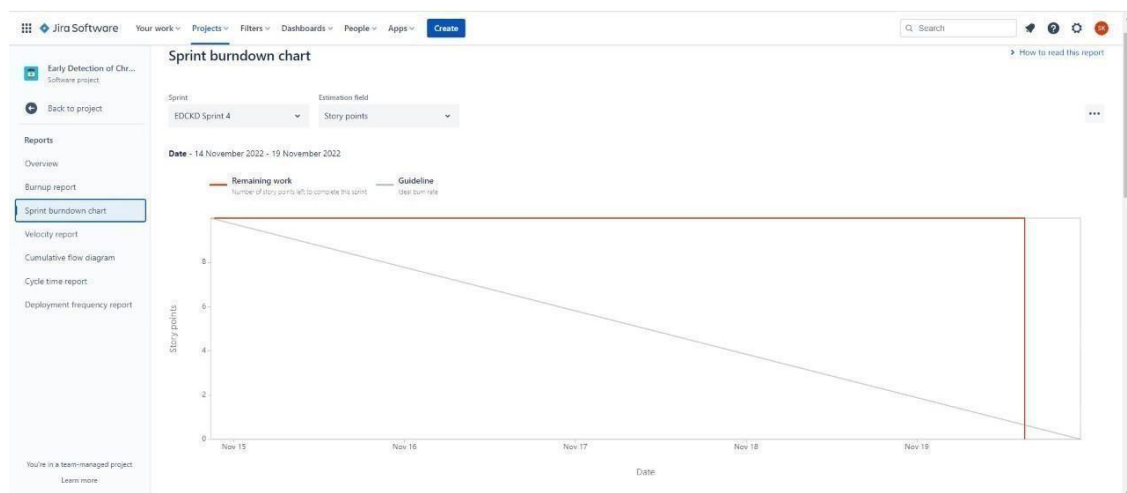
Velocity Chart
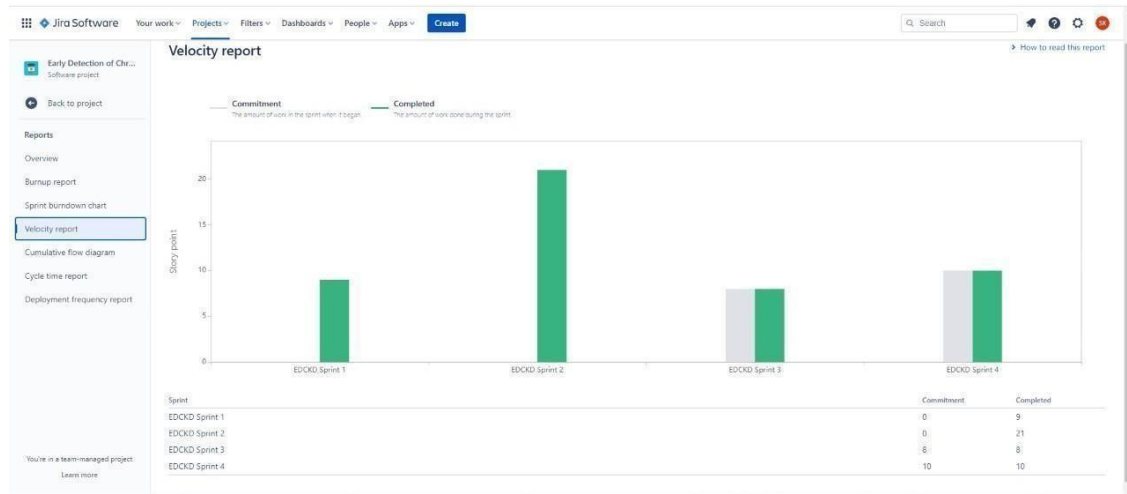
7. CODING & SOLUTIONING (Explain the features added in the project along with Code)

7.1 Feature 1 - Flask App

The flask is the micro web framework written in python. It is the one which integrates model created and user interface.

app.py

```python
from flask import Flask, render_template, request, redirect, url_for
import numpy,pickle

app = Flask(__name__)

@app.route('/')
def index():
    return render_template("home.html")
@app.route('/home')
def home():
    return render_template("home.html")

@app.route('/predict')
def predict():
    return render_template("prediction.html")
@app.route('/result',methods=['POST','GET'])
def result():
    age = float(request.form['age'])
    haemoglobin = float(request.form['haemoglobin'])
    redbloodcells = int(request.form['redbloodcells'])
    specificgravity = float(request.form['specificgravity'])
    albumin = float(request.form['albumin'])
    serumcreatinine = float(request.form['serumcreatinine'])
    hypertension = int(request.form['hypertension'])
    sodium= float(request.form['sodium'])
    bloodpressure = float(request.form['bloodpressure'])
    whitebloodcellcount = float(request.form['whitebloodcellcount'])


    x = numpy.array([age,haemoglobin, redbloodcells, specificgravity,
        albumin, serumcreatinine, hypertension, sodium, bloodpressure,
        whitebloodcellcount]).reshape(1, -1)
```

```
model = pickle.load(open(r'F:\ML Kidney Disease\Chronic Kidney
    Disease\models\EDCKDML.pkl', 'rb'))
Y_pred = model.predict(x)


return render_template("result.html", y=Y_pred)




if __name__ == '__main__':
 app.run(debug=True)
```

7.2 Feature 2 – User Interface

HOME PAGE:

When the user logs on to our website this homepage will be displayed to them which has information about chronic kidney disease and also the navigation button to the detectionor prediction page.

CODE:

```html
<!DOCTYPE html>
<html lang="en" dir="ltr">
 <head>
      <meta charset="utf-8">
      <title>Early Detection of Chronic Kidney Disease using Machine Learning</title>
      <link href="{{ url_for('static', filename='css/style1.css') }}" rel="stylesheet" />
      <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-
awesome/5.15.2/css/all.min.css"/>
      <meta name="viewport" content="width=device-width, initial-scale=1.0">
 </head>
 <body>
      <nav>
      <div class="logo">CHRONIC KIDNEY DISEASE DETECTION</div>
      <ul>
      <li><a class="active" href="{{url_for('home')}}">Home</a></li>
      <li><a class="active"href="{{url_for('predict')}}">Predictor</a></li>
      </ul>
      </nav>
      <br>
      <div class="kidneyd"><image src="{{url_for('static',
filename='images/image1.jpeg')}}" style="height:240px;margin-left:38%"
class="center"/></div>
      <h1 style="margin-left:97px; font-size:18px">ABOUT THE DISEASE</h1>
      <p style="margin-left:97px; font-size:18px">
      <br>
      Chronic kidney disease (CKD) is a type of kidney disease in which there is gradual
loss of kidney function over a period of months to years.
      Initially there are generally no symptoms. Later, symptoms may include leg swelling,
feeling tired, vomiting, loss of appetite, and confusion.
      Complications can relate to hormonal dysfunction of the kidneys and include (in
```

chronological order) high blood pressure (often related to activation of the Renin-Angiotensin-Aldosterone system), bone disease, and anemia.

Additionally CKD patients have markedly increased cardiovascular complications with increased risks of death and hospitalization.

Causes of chronic kidney disease include diabetes, high blood pressure, glomerulonephritis, and polycystic kidney disease.Risk factors include a family history of chronic kidney disease.Diagnosis is by blood tests to measure the estimated glomerular filtration rate (eGFR), and a urine test to measure albumin.

Ultrasound or kidney biopsy may be performed to determine the underlying cause.Several severity-based staging systems are in use.

Treatments for anemia and bone disease may also be required.Severe disease requires hemodialysis, peritoneal dialysis, or a kidney transplant for survival.

```
            </p>
<br>
<h1 style="margin-left:97px; font-size:18px">SIGNS AND SYMPTOMS</h1>
<p style="margin-left:97px; font-size:18px">
<br>
```

Signs and symptoms of chronic kidney disease develop over time if kidney damage progresses slowly. Loss of kidney function can cause a buildup of fluid or body waste or electrolyte problems.

```
<ul style="margin-left:120px; font-size:18px">
<li>Nausea</li>
<li>Vomiting</li>
<li>Loss of appetite</li>
<li>Fatigue and weakness</li>
<li>Sleep problems</li>
<li>Urinating more or less</li>
<li>Muscle cramps</li>
<li>Decreased mental sharpness</li>
<li>Swelling of feet and ankles</li>
<li>Dry, itchy skin</li>
<li>High blood pressure (hypertension) that's difficult to control</li>
<li>Shortness of breath, if fluid builds up in the lungs</li>
<li>Chest pain, if fluid builds up around the lining of the heart</li>
</ul>

</p>
<br>

<h1 style="margin-left:97px; font-size:18px">HOW TO KEEP KIDNEY
HEALTHY</h1>
<br>
<p style="margin-left:97px; font-size:18px">
<ul style="margin-left:120px; font-size:18px">
<li>Be Fit and Active</li>
<li>Stop smoking</li>
<li>Avoid carbonated soft drinks</li>
<li>Drink plenty of water</li>
<li>Certain other medications, toxins, pesticides and illegal drugs (such as heroin
and cocaine) can also cause kidney damage</li>
<li>Take medications as directed</li>
<li>Keep your blood pressure in the target range</li>
<li>Stay in your target cholesterol range</li>
<li>Eat foods lower in salt</li>
<li>Eat more fruits and vegetables</li>
<li>Keep your weight in target range</li>
```

```
        </ul>

        </p>

  </body>
</html>
```

PREDICTION PAGE:

This page is used to check whether there is chronic kidney disease or not by getting the required input values from the user in the required field.

CODE:

```html
<html>
<head>
        <meta charset="utf-8">
        <title>Early Detection of Chronic Kidney Disease using Machine Learning</title>
        <meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no">
        <script src="https://code.jquery.com/jquery-3.3.1.slim.min.js" integrity="sha384-q8i/X+965DzO0rT7abK41JStQIAqVgRVzpbzo5smXKp4YfRvH+8abtTE1Pi6jizo"
```

```html
crossorigin="anonymous"></script>
        <script
src="https://cdn.jsdelivr.net/npm/popper.js@1.14.7/dist/umd/popper.min.js"
integrity="sha384-
UO2eT0CpHqdSJQ6hJty5KVphtPhzWj9WO1clHTMGa3JDZwrnQq4sF86dIHNDz0W1"
crossorigin="anonymous"></script>
        <script
src="https://cdn.jsdelivr.net/npm/bootstrap@4.3.1/dist/js/bootstrap.min.js"
integrity="sha384-
JjSmVgyd0p3pXB1rRibZUAYoIIy6OrQ6VrjIEaFf/nJGzIxFDsf4x0xIM+B07jRM"
crossorigin="anonymous"></script>
        <link rel="stylesheet"
href="https://cdn.jsdelivr.net/npm/bootstrap@4.3.1/dist/css/bootstrap.min.css"
integrity="sha384-
ggOyR0iXCbMQv3Xipma34MD+dH/1fQ784/j6cY/iJTQUOhcWr7x9JvoRxT2MZw1T"
crossorigin="anonymous">
</head>
<style>
  .card{
        margin-left: 45%;
        width:100%
}
#pred
{
margin-left:39%;
}
select {
        width: 100%;
        margin: 0px;
        height: 32px;
        }
        option
        {
        color:#8e8e8e;
        }




</style>
<body background="{{ url_for('static', filename='images/kidney.jpg') }} "
style="background-repeat:no-repeat; background-size:cover;">
<div class="card-title border-10" id="pred">
        <h3>Chronic Kidney Disease Predictor</h3>
</div>
<div class="container">
<div class="row">
        <div class="col-lg-6">
        <div class="card shadow-none p-4 mb-4 bg-light" style="width: 40rem;">
        <form action="{{ url_for('result') }}" method="post">
  <div class="form-group">
        <label for="age" style="margin-left:44%">Age</label>
        <input type="text" class="form-control" id="age" name="age" aria-describedby=""
placeholder="Enter your age" style="width: 100%;" required>
  </div>
        <div class="form-group">
        <label for="haemoglobin" style="margin-left:44%">Haemoglobin</label>
```

```html
        <input type="text" class="form-control" id="haemoglobin" name="haemoglobin"
aria-describedby="" placeholder="Enter the value of your Haemoglobin" style="width:
100%;" required>
        </div>

  <div class="form-group">
        <label for="haemoglobin" style="margin-left:44%">Red Blood Cells</label>
        <br>
  <select class="form-select form-select-lg mb-2" aria-label="Default select example"
id="redbloodcells" name="redbloodcells" required>
  <option value="0">Normal</option>
  <option value="1">Abnormal</option>
  </select>
        </div>
  <div class="form-group">
        <label for="specificgravity" style="margin-left:44%">Specific Gravity</label>
        <input type="text" class="form-control" id="specificgravity" name="specificgravity"
aria-describedby="" placeholder="Enter the value of specific gravity" style="width: 100%;"
required>

  </div>
  <div class="form-group">
        <label for="albumin" style="margin-left:44%">Albumin</label>
        <input type="text" class="form-control" id="albumin" name="albumin" aria-
describedby="" placeholder="Enter the value of your albumin" style="width: 100%;"
required>

  </div>
  <div class="form-group">
        <label for="serumcreatinine" style="margin-left:44%">Serum Creatinine</label>
        <input type="text" class="form-control" id="serumcreatinine"
name="serumcreatinine" aria-describedby="" placeholder="Enter the value of your serum
creatinine" style="width: 100%;" required>

  </div>
        <div class="form-group">
        <label for="serumcreatinine" style="margin-left:44%;">Hypertension</label>
  <select class="form-select" aria-label="Default select example" id="hypertension"
name="hypertension">
  <option value="0">No</option>
  <option value="1">Yes</option>
  </select>
        </div>
  <div class="form-group">
        <label for="sodium" style="margin-left:44%">Sodium</label>
        <input type="text" class="form-control" id="sodium" name="sodium" aria-
describedby="" placeholder="Enter the value of your sodium" style="width: 100%;"
required>

  </div>
  <div class="form-group">
        <label for="bloodpressure" style="margin-left:44%">Blood Pressure</label>
        <input type="text" class="form-control" id="bloodpressure" name="bloodpressure"
aria-describedby="" placeholder="Enter the value of your blood pressure" style="width:
100%;" required>
```

```
      </div>
  <div class="form-group">
          <label for="whitebloodcellcount" style="margin-left:44%">WBC Count</label>
          <input type="text" class="form-control" id="whitebloodcellcount"
name="whitebloodcellcount" aria-describedby="" placeholder="Enter the value of your
white blood cell count" style="width: 100%;" required>
  </div>


          <br>
  <center><button class="btn btn-success" style="margin-
right:0%">Predict</button></center>
          <br>
          </form>
          </div>
</div>
</div>
</div>
</body>
</html>
```


RESULT PAGE:

This page will display the results that whether you have a chronic kidney disease or not.

CODE:

```
<html>
<head>
<title>Early Detection of Chronic Kidney Disease using Machine Learning</title>
<link rel="stylesheet" href="style.css">
<link
href="https://fonts.googleapis.com/css?family=Poppins:100,200,300,400,600,700&display
=swap" rel="stylesheet">
<link rel="stylesheet" href="https://stackpath.bootstrapcdn.com/font-
```

```html
awesome/4.7.0/css/font-awesome.min.css">
</head>
<style>
*{font-family: 'Poppins', sans-serif;}
</style>

<body style="text-align: center;">
        <div>
        <h1 style="font-family: 'Poppins', sans-serif; background-color:black;
color:white">Chronic Kidney Disease Detection</h1>
        </div>
        <br/>
        <br/>


        {% if y==0%}

        <div >
        <image src="{{url_for('static', filename='images/ckdisnotthere.jpg')}}"
style="height:200px;width:300px;"/>
        <h2 style="font-size:45px"><b>Medical Result</b></h2>
        <blockquote style="font-size:35px;"><b>NORMAL</b></blockquote>
        <blockquote style="font-size:35px;"><b>YOU ARE NOT HAVING CHRONIC KIDNEY
DISEASE</b></blockquote>
        <p></p>

        </div>
        {%else%}
        <div >
        <image src="{{url_for('static', filename='images/ckdisthere.jpg')}}"
style="height:200px;width:300px;"/>
        <h2 style="font-size:45px"><b>Medical Result</b></h2>
        <blockquote style="font-size:35px;"><b>ABNORMAL</b></blockquote>
        <blockquote style="font-size:35px;"><b>YOU ARE DIAGNOSED WITH CHRONIC
KIDNEY DISEASE</b></blockquote>
        <p></p>

        </div>
        {% endif %}

</body>
</html>
```

Medical Result

ABNORMAL

YOU ARE DIAGNOSED WITH CHRONIC KIDNEY DISEASE

Medical Result

NORMAL

YOU ARE NOT HAVING CHRONIC KIDNEY DISEASE

8. TESTING

8.1 Test Cases

Date	19th Nov 2022
Team ID	PNT2022TMID08664
Project Name	Early Detection of Chronic Kidney disease using Machine Learning
Maximum Marks	4 marks

Test case ID	Feature Type	Compone nt	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets	TC for Automation(Y/N)	BUG ID	Executed By
InitialScreen_TC_001	Functional	Home Page	Verify user able to see the Prediction page		1.Enter URL 2.Click on Predictor Button	https://localhost:5000	Entering into data input page	Working as expected	Pass	Normal test case			Nimalan
Input_data_TC_002	Functional	Prediction value input page UI	Verify user able to enter input value		1.Check entering into predictor page 2.Check if user can enter value	https://localhost:5000	Application should show below UI elements to enter **numeric values**	Should allow entering numeric values	Pass	Normal test case			
Input_data_TC_003	Functional	Prediction value input page UI	Verify user able to enter input value		1.Check entering into prediction page 2.Check if user can select option from drop down box	https://localhost:5000	Application should select from drop down menu:	should allow selection from drop	Pass	Normal test case			Santhosh Kumar
Input data TC_004	Functional	Prediction value input page UI	Verify user able to enter input value		1.Check entering into prediction page 2.Check if user can select option from drop down box	https://localhost:5000	Application should show below UI elements to enter **categorical values** drop down	Should not allow entering alphabetic values	Pass	Robustness test case			Gowtham
Result_data_TC_005	Functional	Prediction Result Page	Verify Chronic Kidney Disease (CKD) test values		1.Enter predict button after entering values 2.Redirect to result page and display correct result	a.Age-60 b.Haemoglobin-8.4 c.Red Blood Cells-Normal d.Specific Gravity-1.051 e.Albumin-1 f.Serum Creatinine-3 g.Hypertension-Yes h.Sodium-100 i.Blood Pressure-100 j.White Blood Cell Count-7000	Application should show Chronic Kidney Disease	Showed CKD	Pass	Normal test case			Nimalan
Result_data_TC_006	Functional	Prediction Result Page	Verify No Chronic Kidney Disease (No CKD) test values		1.Enter predict button after entering values 2.Redirect to result page	a.Age-20 b.Haemoglobin-15.0 c.Red Blood Cells-Normal d.Specific Gravity-1.03 e.Albumin-2 f.Serum Creatinine-2 g.Hypertension-No h.Sodium-70 i.Blood Pressure-110 j.White Blood Cell Count-9980	Application should show No Chronic Kidney Disease	Showed No CKD	Pass	Normal test case			Santhosh Kumar
Result_data_TC_007	Functional	Prediction Result Page	Verify Chronic Kidney Disease (CKD) test values		1.Enter predict button after entering values 2.Redirect to result page and display correct result	a.Age-90 b.Haemoglobin-5.0 c.Red Blood Cells-Abnormal d.Specific Gravity-1.501 e.Albumin-1 f.Serum Creatinine-2 g.Hypertension-Yes h.Sodium-100 i.Blood Pressure-80 j.White Blood Cell Count-7500	Application should show Chronic Kidney Disease	Showed CKD	Pass	Normal test case			Nishanth Bhoopathy

8.2 User Acceptance Testing

Purpose of Document
The purpose of this document is to briefly explain the test coverage and open issues of the Early Detection of Chronic Kidney Disease project at the time of the release to User Acceptance Testing (UAT).

Defect Analysis
This report shows the number of resolved or closed bugs at each severity level, and how they were resolved.

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	3	1	1	1	6
Duplicate	4	0	2	0	6
External	2	2	0	1	5
Fixed	1	1	1	1	4
Not Reproduced	0	0	0	0	0
Skipped	0	0	0	0	0
Won't Fix	0	4	0	0	0
Totals	10	4	4	3	21

Test Case Analysis
This report shows the number of test cases that have passed and failed.

Section	Total Cases	Not Tested	Fail	Pass
Home Page	1	0	0	1
User Input	5	0	1	4
Chronic Kidney Disease testing	2	0	0	2
No Chronic Kidney Disease testing	5	0	1	4

9. RESULTS

9.1 PERFORMANCE METRICS

S.No.	Parameter	Values	Screenshot

1.	Metrics	**Classification Model:**
		Confusion Matrix –
		[[54,4],
		  [0,62]]),
		Accuracy Score- 96.6666%
		Classification Report –
		
		             precision recall f1-score support
		
		    0 1.00 0.93 0.96 58
		    1 0.94 1.00 0.97 62
		
		  accuracy 0.97 120
		  macro avg 0.97 0.97 0.97 120
		weighted avg 0.97 0.97 0.97 120
			See Below

2.	Tune the Model	Hyperparameter Tuning - Validation Method -	See Below

```
[ ] print(accuracy_score(y_pred,y_test))
    0.9666666666666667
```

AS WE MOVED WITH RANDOM FOREST CLASSIFIER, WE GOT ACCURACY OF 96.66666%

▾ CONFUSION MATRIX

```
[ ] conf_mat=confusion_matrix(y_test,y_pred)
    conf_mat

    array([[54,  4],
           [ 0, 62]])
```

▾ CLASSIFICATION REPORT

```
[ ] print(classification_report(y_test,y_pred))
                 precision    recall  f1-score   support

             0       1.00      0.93      0.96        58
             1       0.94      1.00      0.97        62

      accuracy                           0.97       120
     macro avg       0.97      0.97      0.97       120
  weighted avg       0.97      0.97      0.97       120
```

▾ MODEL BUILDING AND FINDING BEST MODEL ACCURACY AMONG FOUR MODELS

HYPERPARAMATER TUNING

```
from sklearn.model_selection import ShuffleSplit,GridSearchCV,StratifiedKFold
from sklearn.linear_model import LogisticRegression
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.svm import SVC
def find_best_model(x,y):
    models={'Logistic_regression':{'model':LogisticRegression(solver='liblinear',penalty='l2',multi_class='auto'),'parameter':{'C':[1,4,8]}},
            'decision_tree':{'model':DecisionTreeClassifier(splitter='best'),'parameter':{'criterion':['gini','entropy'],'max_depth':[5,7,13,15]}},
            'svm':{'model':SVC(gamma='auto'),'parameter':{'kernel':['sigmoid','linear'],'C':[1,5,10,15]}},
            'random_forest':{'model':RandomForestClassifier(criterion='gini'),'parameter':{'max_depth':[5,10,15],'n_estimators':[1,3,5]}}}
    scores=[]
    cv_shuffle=StratifiedKFold(n_splits=10)

    for model_name,model_params in models.items():
        gs=GridSearchCV(model_params['model'],model_params['parameter'],cv=cv_shuffle,return_train_score=False)
        gs.fit(x,y)
        scores.append({'model':model_name,'best_parameters':gs.best_params_,'score':gs.best_score_})
    return pd.DataFrame(scores,columns=['model','best_parameters','score'])
find_best_model(X_train,y_train)
```

	model	best_parameters	score
0	Logistic_regression	{'C': 1}	0.985714
1	decision_tree	{'criterion': 'gini', 'max_depth': 15}	0.985714
2	svm	{'C': 1, 'kernel': 'linear'}	0.978571
3	random_forest	{'max_depth': 10, 'n_estimators': 5}	0.996429

10. ADVANTAGES & DISADVANTAGES

Advantages:

1.The user can make use of this application to detect the disease easily from their place.
2.As the application provides an accurate result which improves users trustworthiness.
3.It's an cost efficient method for the users to get an prediction result.

Disadvantages:

1. Continuous Network connection is required for this application to work which is not affordable for some class of people.

2. Unwanted error due to numerical value.

3. Delay in getting the result due to poor network connection.

11. CONCLUSION

Chronic kidney disease affects 8% to 16% of the population worldwide and is a leading cause of death. Optimal management of CKD includes cardiovascular risk reduction, treatment of albuminuria, avoidance of potential nephrotoxins, and adjustments to drug dosing. Patients also require monitoring for complications of CKD, such as hyperkalemia,

metabolic acidosis, anemia, and other metabolic abnormalities. Diagnosis, staging, and appropriate referral of CKD by primary care clinicians are important in reducing the burden of CKD worldwide.

The application helps in easy detection of the disease which is of high accuracy and prediction which helps a user to detect the disease. This application is of high user friendly to users.The user can make use of this application to detect the disease easily from their place .

12. FUTURE SCOPE

CKD is a condition in which the kidneys are damaged and cannot filter blood because of this, excess fluid and waste from blood remain in the body and may cause other health problems, such as heart disease and stroke. Some other health consequences of CKD include:

Anemia or low number of red blood cells

Increased occurrence of infections

Low calcium levels, high potassium levels, and high phosphorus level in the blood

Loss of appetite or eating less

Depression or lower quality of life

Considering these conditions, this application can be a stepping stone for discovering certain other diseases which are caused by CKD.

Secondly, this application can be integrated with other applications which will be able to find different other diseases such as Heart diseases, Lung diseases , so that it would be a complete package and it would be very helpful for the Health care industries.

Finally, this particular application , when integrated with other working disease detection applications would provide free medical check-up for the poor community. This would provide great support for the Government to implement free health check-ups.

13. APPENDIX

SOURCE CODE:

scoring_app.py

```python
from flask import Flask, render_template,request
import numpy,pickle

import requests

API_KEY = "QhoFbRSt_fE2DqkxtoBpww_NplmFAOS11vcwayKLx38h"
token_response = requests.post('https://iam.cloud.ibm.com/identity/token', data={"apikey":
 API_KEY, "grant_type": 'urn:ibm:params:oauth:grant-type:apikey'})
mltoken = token_response.json()["access_token"]

header = {'Content-Type': 'application/json', 'Authorization': 'Bearer ' + mltoken}

app = Flask(_name_)


@app.route('/')
def index():
    return render_template("home.html")
@app.route('/home')
def home():
    return render_template("home.html")

@app.route('/predict')
def predict():
    return render_template("prediction.html")
@app.route('/result',methods=['POST','GET'])
def result():
    age = float(request.form['age'])
    haemoglobin = float(request.form['haemoglobin'])
    redbloodcells = int(request.form['redbloodcells'])
    specificgravity = float(request.form['specificgravity'])
    albumin = float(request.form['albumin'])
    serumcreatinine = float(request.form['serumcreatinine'])
    hypertension = int(request.form['hypertension'])
    sodium= float(request.form['sodium'])
    bloodpressure = float(request.form['bloodpressure'])
    whitebloodcellcount = float(request.form['whitebloodcellcount'])


    A=[[age,haemoglobin, redbloodcells, specificgravity, albumin, serumcreatinine, hypertension,
sodium, bloodpressure, whitebloodcellcount]]

    payload_scoring = {
        "input_data": [{"field":
```

```python
[['age','haemoglobin','redbloodcells','specificgravity','albumin','serumcreatinine','hypertension','sodium','bloodpressure','whitebloodcellcount']], "values": A}]}

    response_scoring = requests.post(
        'https://us-south.ml.cloud.ibm.com/ml/v4/deployments/6ce12547-4be9-450c-af6b-9cefc9b58465/predictions?version=2022-11-17',
        json=payload_scoring,
        headers={'Authorization': 'Bearer ' + mltoken})

    print("Scoring response") print(response_scoring.json())

    predictions = response_scoring.json()
    pred = predictions['predictions'][0]['values'][0][0]print(pred)

     return render_template("result.html", y=pred)




  if __name__ == '__main__':
    app.run(debug=True)
```

home.html

```
<!DOCTYPE html>
<html lang="en" dir="ltr">
 <head>
        <meta charset="utf-8">
        <title>Early Detection of Chronic Kidney Disease using Machine Learning</title>
        <link href="{{ url_for('static', filename='css/style1.css') }}" rel="stylesheet" />
        <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-
awesome/5.15.2/css/all.min.css"/>
        <meta name="viewport" content="width=device-width, initial-scale=1.0">
 </head>
 <body>
        <nav>
        <div class="logo">CHRONIC KIDNEY DISEASE DETECTION</div>
        <ul>
        <li><a class="active" href="{{url_for('home')}}">Home</a></li>
        <li><a class="active"href="{{url_for('predict')}}">Predictor</a></li>
        </ul>
        </nav>
        <br>
        <div class="kidneyd"><image src="{{url_for('static', filename='images/image1.jpeg')}}"
style="height:240px;margin-left:38%" class="center"/></div>
        <h1 style="margin-left:97px; font-size:18px">ABOUT THE DISEASE</h1>
        <p style="margin-left:97px; font-size:18px">
        <br>
        Chronic kidney disease (CKD) is a type of kidney disease in which there is gradual loss of
kidney function over a period of months to years.
        Initially there are generally no symptoms. Later, symptoms may include leg swelling,
feeling tired, vomiting, loss of appetite, and confusion.
        Complications can relate to hormonal dysfunction of the kidneys and include (in
chronological order) high blood pressure (often related to activation of the Renin-Angiotensin-
Aldosterone system), bone disease, and anemia.
        Additionally CKD patients have markedly increased cardiovascular complications with
increased risks of death and hospitalization.
        Causes of chronic kidney disease include diabetes, high blood pressure, glomerulonephritis,
and polycystic kidney disease.Risk factors include a family history of chronic kidney
disease.Diagnosis is by blood tests to measure the estimated glomerular filtration rate (eGFR), and
```

a urine test to measure albumin.

Ultrasound or kidney biopsy may be performed to determine the underlying cause.Several severity-based staging systems are in use.

Treatments for anemia and bone disease may also be required.Severe disease requires hemodialysis, peritoneal dialysis, or a kidney transplant for survival.

```
</p>
<br>
<h1 style="margin-left:97px; font-size:18px">SIGNS AND SYMPTOMS</h1>
<p style="margin-left:97px; font-size:18px">
<br>
```
Signs and symptoms of chronic kidney disease develop over time if kidney damage progresses slowly. Loss of kidney function can cause a buildup of fluid or body waste or electrolyte problems.
```
<ul style="margin-left:120px; font-size:18px">
<li>Nausea</li>
<li>Vomiting</li>
<li>Loss of appetite</li>
<li>Fatigue and weakness</li>
<li>Sleep problems</li>
<li>Urinating more or less</li>
<li>Muscle cramps</li>
<li>Decreased mental sharpness</li>
<li>Swelling of feet and ankles</li>
<li>Dry, itchy skin</li>
<li>High blood pressure (hypertension) that's difficult to control</li>
<li>Shortness of breath, if fluid builds up in the lungs</li>
<li>Chest pain, if fluid builds up around the lining of the heart</li>
</ul>

</p>
<br>

<h1 style="margin-left:97px; font-size:18px">HOW TO KEEP KIDNEY HEALTHY</h1>
<br>
<p style="margin-left:97px; font-size:18px">
<ul style="margin-left:120px; font-size:18px">
<li>Be Fit and Active</li>
<li>Stop smoking</li>
<li>Avoid carbonated soft drinks</li>
<li>Drink plenty of water</li>
<li>Certain other medications, toxins, pesticides and illegal drugs (such as heroin and
```
cocaine) can also cause kidney damage
```
<li>Take medications as directed</li>
<li>Keep your blood pressure in the target range</li>
<li>Stay in your target cholesterol range</li>
<li>Eat foods lower in salt</li>
<li>Eat more fruits and vegetables</li>
<li>Keep your weight in target range</li>
</ul>

</p>

</body>
```

</html>

prediction.html

```html
<html>
<head>
        <meta charset="utf-8">
        <title>Early Detection of Chronic Kidney Disease using Machine Learning</title>
        <meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no">
        <script src="https://code.jquery.com/jquery-3.3.1.slim.min.js" integrity="sha384-q8i/X+965DzO0rT7abK41JStQIAqVgRVzpbzo5smXKp4YfRvH+8abtTE1Pi6jizo" crossorigin="anonymous"></script>
        <script src="https://cdn.jsdelivr.net/npm/popper.js@1.14.7/dist/umd/popper.min.js" integrity="sha384-UO2eT0CpHqdSJQ6hJty5KVphtPhzWj9WO1clHTMGa3JDZwrnQq4sF86dIHNDz0W1" crossorigin="anonymous"></script>
        <script src="https://cdn.jsdelivr.net/npm/bootstrap@4.3.1/dist/js/bootstrap.min.js" integrity="sha384-JjSmVgyd0p3pXB1rRibZUAYoIIy6OrQ6VrjIEaFf/nJGzIxFDsf4x0xIM+B07jRM" crossorigin="anonymous"></script>
        <link rel="stylesheet" href="https://cdn.jsdelivr.net/npm/bootstrap@4.3.1/dist/css/bootstrap.min.css" integrity="sha384-ggOyR0iXCbMQv3Xipma34MD+dH/1fQ784/j6cY/iJTQUOhcWr7x9JvoRxT2MZw1T" crossorigin="anonymous">
 </head>
 <style>
   .card{
        margin-left: 45%;
        width:100%
}
#pred
{


margin-left:39%;
}
select {
        width: 100%;
        margin: 0px;
        height: 32px;
        }
        option
        {
        color:#8e8e8e;
        }



</style>
<body background="{{ url_for('static', filename='images/kidney.jpg') }} " style="background-repeat:no-repeat; background-size:cover;">
<div class="card-title border-10" id="pred">
        <h3>Chronic Kidney Disease Predictor</h3>
</div>
```

```html
<div class="container">
<div class="row">
        <div class="col-lg-6">
        <div class="card shadow-none p-4 mb-4 bg-light" style="width: 40rem;">
        <form action="{{ url_for('result') }}" method="post">
  <div class="form-group">
        <label for="age" style="margin-left:44%">Age</label>
        <input type="text" class="form-control" id="age" name="age" aria-describedby=""
placeholder="Enter your age" style="width: 100%;" required>
  </div>
        <div class="form-group">
        <label for="haemoglobin" style="margin-left:44%">Haemoglobin</label>
        <input type="text" class="form-control" id="haemoglobin" name="haemoglobin" aria-
describedby="" placeholder="Enter the value of your Haemoglobin" style="width: 100%;"
required>
        </div>

  <div class="form-group">
        <label for="haemoglobin" style="margin-left:44%">Red Blood Cells</label>
        <br>
  <select class="form-select form-select-lg mb-2" aria-label="Default select example"
id="redbloodcells" name="redbloodcells" required>
  <option value="0">Normal</option>
  <option value="1">Abnormal</option>
  </select>
        </div>
  <div class="form-group">
        <label for="specificgravity" style="margin-left:44%">Specific Gravity</label>
        <input type="text" class="form-control" id="specificgravity" name="specificgravity" aria-
describedby="" placeholder="Enter the value of specific gravity" style="width: 100%;" required>

  </div>
  <div class="form-group">
        <label for="albumin" style="margin-left:44%">Albumin</label>
        <input type="text" class="form-control" id="albumin" name="albumin" aria-
describedby="" placeholder="Enter the value of your albumin" style="width: 100%;" required>

  </div>
  <div class="form-group">
        <label for="serumcreatinine" style="margin-left:44%">Serum Creatinine</label>
        <input type="text" class="form-control" id="serumcreatinine" name="serumcreatinine"
aria-describedby="" placeholder="Enter the value of your serum creatinine" style="width: 100%;"
required>

  </div>
        <div class="form-group">
        <label for="serumcreatinine" style="margin-left:44%;">Hypertension</label>
  <select class="form-select" aria-label="Default select example" id="hypertension"
name="hypertension">
  <option value="0">No</option>
  <option value="1">Yes</option>
  </select>
        </div>
  <div class="form-group">
        <label for="sodium" style="margin-left:44%">Sodium</label>
```

```html
<input type="text" class="form-control" id="sodium" name="sodium" aria-describedby=""
 placeholder="Enter the value of your sodium" style="width: 100%;" required>

  </div>
  <div class="form-group">
        <label for="bloodpressure" style="margin-left:44%">Blood Pressure</label>
        <input type="text" class="form-control" id="bloodpressure" name="bloodpressure" aria-
describedby="" placeholder="Enter the value of your blood pressure" style="width: 100%;"
required>

  </div>
  <div class="form-group">
        <labelfor="whitebloodcellcount" style="margin-left:44%">WBC Count</label>
        <input type="text" class="form-control" id="whitebloodcellcount"
name="whitebloodcellcount" aria-describedby="" placeholder="Enter the value of your white
blood cell count" style="width: 100%;" required>
  </div>

        <br>
  <center><button class="btn btn-success" style="margin-right:0%">Predict</button></center>
        <br>
        </form>
        </div>
</div>
</div>
</div>
</body>
</html>
```

result.html

```html
<html>
<head>
<title>Early Detection of Chronic Kidney Disease using Machine Learning</title>
<link rel="stylesheet" href="style.css">
<link
href="https://fonts.googleapis.com/css?family=Poppins:100,200,300,400,600,700&display=swap"
rel="stylesheet">
<link rel="stylesheet" href="https://stackpath.bootstrapcdn.com/font-awesome/4.7.0/css/font-
awesome.min.css">
</head>
<style>
*{font-family: 'Poppins', sans-serif;}
</style>

<body style="text-align: center;">
        <div>
        <h1 style="font-family: 'Poppins', sans-serif; background-color:black; color:white">Chronic
Kidney Disease Detection</h1>
        </div>
        <br/>
        <br/>
```

```
{% if y==0%}

<div >
<image src="{{url_for('static', filename='images/ckdisnotthere.jpg')}}"
style="height:200px;width:300px;"/>
<h2 style="font-size:45px"><b>Medical Result</b></h2>
<blockquote style="font-size:35px;"><b>NORMAL</b></blockquote>
<blockquote style="font-size:35px;"><b>YOU ARE NOT HAVING CHRONIC KIDNEY
DISEASE</b></blockquote>
<p></p>

</div>
{%else%}
<div >
<image src="{{url_for('static', filename='images/ckdisthere.jpg')}}"
style="height:200px;width:300px;"/>
<h2 style="font-size:45px"><b>Medical Result</b></h2>
<blockquote style="font-size:35px;"><b>ABNORMAL</b></blockquote>
<blockquote style="font-size:35px;"><b>YOU ARE DIAGNOSED WITH CHRONIC KIDNEY
DISEASE</b></blockquote>
<p></p>

</div>
{% endif %}

</body>
</html>
```

GitHub & Project Demo Link

Github link:
https://github.com/IBM-EPBL/IBM-Project-3300-1658515539

DemoLink:
https://drive.google.com/file/d/1ohfucRdSSEvqoSZm3QvgG1MoLNPVt_xt/view